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Albany Museum.

VOL. II.

PART I CONTAINING:

PLATES I-IX AND 10 FIGURES IN THE TEXT.

Issued March 28th, 1907.

Price 6s.

Printed for the
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BY
JOSIAH SLATER, GRAHAMSTOWN, SOUTH AFRICA

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Dr. S. SCHÖNLAND,
Director of the Albany Museum,
Grahamstown,
Cape Colony.

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JOHN HEWITT, B.A. (Cantab.)
Director of the Albany Museum,
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ERRATA.

Page 50, line 29, for *Capeniss* read *Capensis.*
P. 51, l. 14, for *Stend* read *Steud.*
P. 57, l. 30, „ *Thaumochortus* read *Thamnochortus.*
P. 100, l. 16, „ *Aprica* „ *Apicra.*
P. 231, l. 11, „ *Therebintaceae* „ *Terebintaceae.*
P. 256, l. 28, „ *perigonii* „ *perigonium.*
P. 256, l. 29, „ *longi* „ *longum.*
P. 279, l. 8, „ *Bitus* „ *Bilis*
P. 306, remove *known* from line 29 to commencement of line 30.
P. 312, l. 1, for *Solpugidae* read *Solifugae.*
P. 318, l. 27, „ *occuring* „ *occurring.*
P. 319, l. 19, „ *Carteunian* „ *Cartennian.*
P. 319, l. 27, „ *Bartonion* „ *Bartonian.*
P. 321, l. 29, „ *occured* „ *occurred.*
P. 327, l. 8, „ *Venernois* „ *Venerupis.*
P. 327, l. 29, „ *Lamark* „ *Lamarck.*
P. 334, l. 4, „ *occuring* „ *occurring.*
P. 336, l. 20, „ *Saccs.* „ *Sacco.*
P. 338, l. 19, „ *ligamenta* „ *ligamental.*
P. 339, l. 19, „ *Corolina* „ *Carolina.*
P. 342, l. 14, „ *occurence* „ *occurrence.*
P. 345, l. 13, „ *spinal* „ *spiral.*
P. 345, l. 25, „ *spine* „ *spire.*
P. 347, l. 9, „ *ornamental* „ *ornamented.*
P. 349, l. 32, „ *intermittant* „ *intermittent.*
P. 351, l. 29, „ *spinal* „ *spiral.*
P. 352, l. 12, „ *fasciola* „ *fasciole.*
P. 360, l. 2, „ *Ova-Mbanduru* read *Ova-Mbandieru.*
P. 360, l. 17, „ *Waterburg* „ *Waterberg.*
P. 363, l. 19, „ *Barotse* „ *Ba Rotse.*
P. 367, l. 14, „ *Kanwana* „ *Kunwana.*
P. 368, l. 31, „ *Kokwani* „ *Lokwani.*
P. 368, l. 32, „ *Chiefs Nocwasele* „ *Chief Mocwasele.*
P. 368, l. 32, „ *Molelele* „ *Molepolele.*
P. 369, l. 24, „ *Eland sand* „ *Elands and.*
P. 369, l. 25, „ *were* read *was.*

P. 369, l. 29, delete *the eponymous* read *Not only Tulare, but Diale and Le Lellating were called Moperi a word corresponding to isiXosa UmVela (see. im-Vela-ngangi the first-born.—Kropf.)*

P. 371, l. 23, for *BaKwebo* read *BaKebo*.

P. 371, l. 25, ,, *call Bakgalaka* read *call Bokgalaka*.

P. 371, l. 28, ,, *Malemba or Malepa* read *MaLemba or MaLepa*.

P. 372, l. 17, after *p.* insert *361*.

P. 376, l. 19, ,, *Vambe* insert *were*.

P. 376, l. 20, for *Manibe* read *Mambe*.

P. 379, l. 26, ,, *Bovanaland* read *Bomvanaland*.

P. 379, l. 30, ,, *Uminim* ,, *Umnini*.

P. 382, l. 29, ,, *1886* ,, *1876*.

P. 385, l. 15, } for *Amaponda* and *Amamponda* read *AmaMpondo*.
P. 385, l. 20, }

P. 385, footnote †, for *as the Magossebe* read *of the Magossebe*.

P. 386, l. 34 and 31 } for *Imidange* read *ImiDange*.
P. 387, l. 29 }

P. 387, l. 16, for *Barabe* read *Rarabe*.

P. 398, l. 30, ,, *Scylacognathus* read *Scylacognathus*.

P. 406, l. 24 and p. 407, l. 4, for *Kamacks* read *Kamachs*.

The Rock Channel of the Buffalo River, East London.

BY E. H. L. SCHWARZ, A.R.C.S., F.G.S.

(Plate I).

The question of the emergence and submergence of land areas, to use Sir A. Geikie's nomenclature, has been lately the subject of much speculation. When geological knowledge was confined to the results of the partial exploration of Europe, the question seemed fairly simple, but lately the enormous volume of facts that have accumulated with reference to every part of the globe, has rendered many of the older explanations only partially true. In every problem concerning the geology of the earth as a whole, we must turn for inspiration to Prof. Suess' "Antlitz der Erde," now available to English students through Prof. Sollas' translation, or in the better illustrated edition in French by M. de Margerie. Prof. Suess stoutly denies the possibility that large areas of land can be uplifted, and supports his argument with an immense mass of evidence ; subsidence he grants, and elevation in limited areas, but the main factor in the retreat or advance of the shore line is, he contends, the oscillation of the level of the sea. This heterodox doctrine has called forth a wealth of accurate observations on the shores and sea-bottom from European and American geologists, and some definite ideas are being evolved as to true relations of land to sea, most of them, however, strengthening the theory of movements of land with a more or less stable sea-level. In South Africa evidence of such emergence of the land occurs in levels of peneplanation at heights of 700, 1,500, 2,500, 4,000 and 6,000 feet, that is to say, at certain epochs relatively recent, the sub-continent stood submerged to such an amount, and the rivers at those times having no fall and consequently no opportunity for deepening their channels, cut sideways and levelled the land into what was more or less a level plain.

I endeavoured to put forth the facts for this general aspect of the question in a recent paper (Quart. Journ. Geol. Soc., Vol. LXIII., pp. 70-87), but there is a sub-section of the larger question which also is at the present moment subject of controversy, namely the question of the formation of coral reefs.

Darwin maintained that as coral-building animals cannot live at depths greater than 20 fathoms (lately extended to 45 fathoms) their existence in reefs bordering islands rising from greater depths in the Indian and Pacific Oceans must be due to the islands having sunk, and thus having allowed the living coral reef to grow upwards and outwards. Examination of coral islands, however, revealed the fact that many, if not most of them, show evidence of elevation. To a geologist elevation and subsidence are successive movements, and any land area shows unmistakable signs of having undergone changes due to repeated retreat and and advance of the shore-line. Prof. Davis in his Physical Geography puts the facts very clearly, illustrating by means of diagrams how the coral reefs are formed by submergence of the rock-cores of the islands and the denudation of the reefs when there has been a temporary emergence.

In South Africa we have the same facts very clearly demonstrated. As referred to above, the evidences for the general emergence of the land are overwhelming, yet north of the Natal coast our sub-continent is bordered by fringing and barrier reefs of coral. We have then further south the basis on which the coral animals built their reefs unobscured by the heavy covering which exists in the tropics.

Off the southern extremity of the land, there is a continental platform whose edge is known as the Agulhas Bank. It is a tract of rock cut level in terraces, those near the shore running to 30 fathoms or so, and the outermost lying at 90 fathoms ; beyond the last there is a rapid drop to deep water. These are not ledges cut by currents, for wasting of the rock does not extend much below the action of the breakers at low water. Currents may move masses of sand over the deeper terraces, and may also wash them free of debris, but the erosive action of sand suspended in water is hardly greater than that of hail-stones on land. The presence of large rounded boulders on terraces far out near the edge of the Agulhas plateau points unmistakably to that portion having been actual beach at some former age. This then provides a case for submergence in an area subject to general emergence, and similar cases are abundantly recorded from the continental plateaus of Europe and America.

Coming now to the special detail which is the subject of this paper, we have in the bed of the Buffalo River as clear a case of the submergence of the land which as clearly has at no very distant date been subjected to emergence, as witness the beach-covered flats at elevations of 200 to 400 feet above sea level. The diagram I have reduced from the working sections of bore-holes put down under the direction of Mr. J. J. Godfrey for the purpose of testing the foundations for a railway bridge. The river channel is seen to be cut in rock which consists apparently of shales and sandstones belonging to the Beaufort series; this has then been submerged 122 feet, and the rock channel has been filled in with sand and mud. In three bore-holes gas was struck in the clay, which in two cases escaped with explosive violence; this point is interesting in view of the mud island that rose off Walfish Bay, which was described and illustrated by Mr. Waldron in the Trans. S. A. Phil. Soc., Vol. 11, p. 185. The gas was analysed, and is doubtless due to the decomposition of organic matter held in the clay. In some cases the explosions were very violent and lasted for some minutes, shells and gravel being forced up through the pipes from a depth of 100 feet below low water, followed by a stream of water completely filling the $3\frac{3}{4}$ inch pipes, and reaching to a height of some 50 feet above water level. The gas was composed of

Methane	53.4
Carbon dioxide ...	28.6
Carbon monoxide ...	1.0
Nitrogen	14.8
Oxygen	2.2
	100

Three lines of bore-holes were put down showing little difference in the configuration of the rock channel ; the greatest depths at which the rock was struck in the three are respectively 118 ft. 6 in. ; 122 ft. 6 in. ; 124 ft. 3 in.

The samples submitted to me from the bore-hole which struck rock at 116 feet 3 inches, and is marked H_5 were as follows :—

Feet.	
15—26	Yellow sand with fragments of shale, *Nassa kraussiana* and barnacle shells (*Balanus*).
26	Rounded pebbles of Karroo sandstone.
26—32	Grey plastic clay with a few fragments of shale.
32—34	Fine black and yellow sand with shell fragments, calcareous worm tubes.
34—42	Plastic clay with fragments of *Balanus* shells.
42—43½	Broken *Balanus* shells, oyster shells, *Nassa kraussiana*, worm tubes much rolled.
43½—46	Grey plastic clay with fragments of shells.
46—48	Yellow sand with charred fragments of twigs ; worm tubes, young bivalve shells and small gastropoda.
48—54	Plastic clay with unbroken shells of *Ostrea cucullata*.
54—56	Loose quartz sand with fragments of shale and sandstone ; quartz grains partly pellucid, partly red with iron oxide.
56—62	Sandy plastic clay with shale fragments.
62—65	Moderately fine yellow sand.
65—69	Grey plastic clay.
69—71	Large fragments of Karroo sandstone, a few oyster and *Balanus* shells with *Nassa kraussiana* lying in a coarse shale sand.
71—74	Plastic clay with fragments of shells and bits of shale.
74—76	*Balanus* shells, *Nassa kraussiana*, *Littorina* and worm tubes.
76—81	Plastic greenish grey clay, with fragments of small shells and *Nassa kraussiana*.
81—84	Fine yellow sand.

Feet.	
84 – 88	Grey plastic clay.
88—90	Fragments of *Balanus* and oyster shells, *Nassa kraussiana*, worm tubes, with a good deal of sand.
90—98	Plastic clay with yellow ochreous patches, fragments of shells, worm tubes and *Nassa kraussiana.*
98—103	Sand with twigs of bushes, *Ostrea cucullata*, *Nassa kraussiana*, *Balanus*, worm tubes and shale fragments.
103—109	Plastic clay with *Nassa kraussiana* and shale fragments, some covered with lime.
109—116	3 inches *Balanus*, some entire *Nassa kraussiana* and shale fragments.

On examination, many of the samples were seen to contain microzoa, which have been little studied in South Africa. I therefore sent them to Mr. Chapman, of the Melbourne National Museum, who has already described the microzoa of the cretaceous deposits of Pondoland (Annals of the S. A. Museum, Cape Town, 1904, vol. iv., pt. v.)

Report on Pleistocene Microzoa from a Boring in the Bed of the Buffalo River, East London.

By Frederick Chapman, A.L.S., F.R.M.S.

With one text figure.

Preliminary Remarks.

At Prof. E. H. L. Schwarz's request, I have examined for Ostracoda and Foraminifera, a series of samples of sands and clays obtained at intervals from a boring down to 117 feet below the bed of the Buffalo River. The results are highly interesting in that they extend the area of distribution of some of the species, especially of the Ostracoda.

The general aspect of the microzoal fauna is such as would be met with under estuarine, brackish, or littoral marine conditions. The exceptions which offer adverse evidence are very few, and their presence may be accounted for either by the agency of currents by which the shells must have been carried into a littoral area; or by reason of our imperfect knowledge concerning the bathymetrical distribution of certain species. Some of the Foraminifera show such unmistakeable signs of depauperation of the test, that it may be safely assumed that changes of a distinct and severe character occurred during the course of their existence and propagation.

OSTRACODA.

Family CYPRIDÆ.

Genus MACROCYPRIS, G. S. Brady.

Macrocypris decora, G. S. Brady sp.

Cytherideis decora, G. S. Brady, 1865, Trans. Zool. Soc., Lond., vol. v., p. 366, pl. lvii., figs. 13*a-c*.

Macrocypris decora, G. S. Brady, 1880, Rep. Chall. Zool., pt. iii, p. 44, pl. 1., figs 3*a-d* ; pl. vi., figs. 8*a-b*.

Our specimen has the dorsal margin less strongly arched than usual, but otherwise it is typical.

M. decora is widely distributed in the Southern hemisphere, and occurs in soundings from shallow to moderately deep water.

In the boring this species was found at 15-26 ft; one specimen.

FAMILY BAIRDIIDÆ.

BAIRDIA ? OVATA, Bosquet.

Bairdia ovata, Bosquet, 1853, Crustacés fossiles du Limbourg. p. 63, pl. v., figs. 6*a-d*.

B. ? ovata, Bosquet, G. S. Brady, 1880, Rep. Chall. Zool., pt. iii, p. 53, pl. vii., figs. 3*a-d*.

Our specimen is comparable with those figured by Dr. Brady from Simon's Bay, S. Africa, 15 to 20 fathoms, and off New Zealand 150 fathoms.

From the boring at 15-26 feet; one specimen.

FAMILY CYTHERIDÆ.

GENUS CYTHERE, Muller.

CYTHERE CONVEXA, Baird.

Cythere convexa, Baird, 1850, Brit. Entom., p. 174, table xxi, fig. 3. G. S. Brady, 1868, Trans. Linn. Soc., Lond., vol. xxvi., p. 401, pl. xxix., figs. 19-27; pl. xxxix., fig. 4.

It is extremely interesting to find this well-known British species in the Southern hemisphere. The present examples are quite typical, as I find on comparing them with specimens in my own collection from Bembridge, Isle of Wight, from material supplied me by my friend, H. A. Hinton, Esq., F.G.S. A closely allied form is *Cythere speyeri*, G. S. Brady[1], but differing in the unequal convexity of the right and left valves; it is also much more tumid than *C. convexa*.

Found in the boring at 15-26 feet; one complete carapace and right valve.

---

[1] Ann and Mag. Nat. Hist., ser. 4, Vol. II., 1868, p. 222, pl. XV., figs. 8—11. Rep. Chall., Zool., pt. III., 1880, p. 79 pl. XX., figs. 2 *a-f*.

CYTHERE FUSCATA, G. S. Brady.

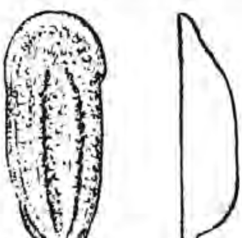
Cythere fuscata, G. S. Brady, 1869, Ann. Mag. Nat. Hist., ser. 4, vol. iii, p. 47, pl. vii., figs. 5-8. Idem, 1889, Trans. R. Dublin Soc., N.S., vol. iv., pt. ii, p. 148, pl. xv., figs. 9-11.

A complete carapace of this interesting species was found in the present material. It has hitherto been found only in estuarine and brackish or sub-brackish areas in Holland and the east of England. It is closely allied to *Cythere acupunctata*, as already remarked by Dr. G. S. Brady[a], but there are certain minor distinctions which serve to separate the forms, such as the habitual shortness of the valves and their tumidity in the posterior region.

Found in the boring at 15-26 ft ; a carapace with the valves in opposition.

CYTHERE SCHWARZI, sp. nov.

Description.—Valve elongate-ovate, obliquely rounded in front, sloping away to the hinge-line, which is nearly straight Ventral border sinuous. Posterior extremely prolonged, bluntly acuminate. Surface somewhat tumid, highest in the median area and towards the posterior third, sloping gently towards the front, and steeply towards the hinder margin, where it ends in a flanged border. Ornamentation consisting of four folds or ridges, two in the median area and two marginal ; the sides of the plicæ and intercostal areas pitted with numerous deep, circular areolæ, and a single series of the same below the anterior marginal rim.



CYTHERE SCHWARZI, sp. nov.
Pleistocene : Bed of the Buffalo River, East London, at a depth of 15-26 feet.

[a] Rep. Chall., Zool. part iii, 1880, p. 68.

Measurements.—Length, 2 mm.; height, ·5 mm; thickness of carapace, ·8 mm.

Affinities.—This species most nearly resembles *C. plicatula*, Reuss sp.[3], but differs from it in the greater attenuation of the posterior extremity, the regular plication of the median area, and the greatly elongated carapace.

Found in the boring at 15-26 ft.; one valve.

Order FORAMINIFERA.

FAMILY MILIOLIDÆ.

GENUS SPIROLOCULINA, d'Orbigny.

SPIROLOCULINA PLANULATA, Lamarck sp.

Miliolites planulata, Lamarck, 1805, Ann. du Muséum, vol. v., p. 352, No. 4.—1822, Anim. sans Vert., vol. vii., p. 613, No. 4.

Spiroloculina planulata, Lam. sp., H.B., Brady, 1884, Rep. Chall., vol. ix., p. 148, pl. ix., figs. 11*a-b*. Rupert Jones, 1895, Pal. Soc. Mon.—Crag Foram., p. 103, pl. iii. figs. 37, 38; woodcut fig. 1.

This species is usually found in shallow water sands in temperate regions.

Rare in the boring, at 15-26 feet.

SPIROLOCULINA EXCAVATA, d'Orb.

Spiroloculina excavata, d'Orbigny, 1846, Foram. Foss. Vien., p. 271, pl. xvi., figs. 19-21. H.B. Brady, 1884, Rep. Chall., vol. ix., p. 151, pl. ix., figs. 5, 6. Rupert Jones, 1895, Pal. Soc. Mon., Crag Foram., p. 106, pl. v., fig. 2; woodcuts figs. 2*a-b*.

This is also a shallow water form, usually found in depths less than 100 fathoms. The examples before us are well-grown and typical.

In the boring, common at 15-26.

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[3] *Cypridina plicatula*, Reuss, "Die fossilen Entomostr., etc.," in Haidinger's Abhandl., 1850, p. 44, pl. x, figs. 23*a-b*.

Cythere plicatula, Reuss, sp., G. S Brady, "Ostrac. Antwerp Crag." Trans. Zool. Soc., vol. x, pt. viii, No. 1, 1878, p. 387, pl. lxiv., figs. 6*a-b*.

Genus MILIOLINA, Williamson.

Miliolina subrotunda, Montagu sp.

Vermiculum subrotundum, Montagu, 1803, Test. Brit., pt. 2, p. 251.

Miliolina subrotunda, Montagu sp., H. B. Brady, 1884, Rep. Chall. vol. ix., p. 168, pl. v. figs. 10, 11. Millett, 1898, Journ. Roy. Micr. Soc., p. 502.

Most typical in littoral or shallow water deposits.

In the boring it was found at 15-26 feet, rare; 90-98 feet, common and very small.

Miliolina seminulum, Linné sp.

Serpula seminulum, Linné, 1767, Syst. Nat., 12th ed., p. 1264, No. 791;—1788, 13th (Gmelin's) ed., p. 3739, No. 2.

Miliolina seminulum, Linné sp., H. B. Brady, 1884, Rep. Chall. vol. ix., p. 157, pl. v., figs. 6 *a-c*. Millett, 1898, Journ. Roy, Micr. Soc., p. 505.

In the boring this species occurred at 42-43 ft., very rare and small; at 48-54 ft., frequent and very small; and at 56-62 ft. frequent and very small.

Miliolina trigonula, Lamarck sp.

Miliolites trigonula; Lamarck, 1804, Ann. du Muséum, vol. v., p. 351, No. 3;—1822, Anim. sans Vert., vol. vii., p. 612, No. 3.

Miliolina trigonula, Lam. sp., H.B. Brady, 1884, Rep. Chall., vol. ix., p. 164, pl. iii., figs. 14-16. Millett, 1898, Journ. Roy. Micr. Soc., p. 503.

This is most typical as a shallow water form.

In the boring it was found at 42-43 ft., very rare and small.

FAMILY LITUOLIDÆ.

GENUS HAPLOPHRAGMIUM, Reuss.

HAPLOPHRAGMIUM cf. CANARIENSE, d'Orb. sp.

Nonionina canariensis, d'Orbigny, 1839, Foram. Canaries, p. 128, pl. ii., figs. 33, 34.

Haplophragmium canariense, d'Orb. sp., H.B. Brady, 1884, Rep. Chall. vol. ix., p. 310, pl. xxxv., figs. 1-5.

This is better known as a shallow water form. Our specimens are not quite typical, but compare more nearly with Brady's Challenger specimen (*loc. supra cit.)*, fig. 3, excepting that the lateral faces are flat.

In the boring at 15-26., rare and small.

FAMILY GLOBIGERINIDÆ.

GENUS GLOBIGERINA, d'Orbigny.

GLOBIGERINA BULLOIDES, d'Orbigny, var. TRILOBA, Reuss.

Globigerina triloba, Reuss., 1849, Denkschr. d. k. Akad. Wiss. Wien., vol. 1, p. 374, pl. xlvii., figs. 11 *a-e*.

G. bulloides d'Orb., var. *triloba*, Reuss, H.B. Brady, 1884, Rep. Chall. vol. ix., p. 595, pl. lxxix., figs. 1, 2; pl. lxxxi., figs. 2, 3.

In the boring this variety was found at 15-26 ft., very rare and very small.

GLOBIGERINA CONGLOBATA, Brady.

Globigerina conglobata, H. B. Brady, 1879, Quart. Journ. Micr. Sci., vol. xix., N.S., p. 72.—1884, Rep. Chall., vol. ix., p. 603, pl. lxxx., figs. 1-5; pl. lxxxii., fig. 5. Millett, 1903, Journ. R. Micr. Soc., p. 688.

In the boring at 15-26 feet, very rare and small.

FAMILY ROTALIIDÆ.

GENUS TRUNCATULINA, d'Orbigny.

TRUNCATULINA LOBATULA, Walker and Jacob sp.

Nautilus lobatulus, Walker and Jacob, 1798, Adams' Essays, Kaumacher's ed., p. 642, pl. xiv., fig. 36.

Truncatulina lobatula, W. and J. sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 660, pl. xcii., fig. 10; pl. xciii., figs. 1, 4, 5; pl. cxv.. figs. 4. 5.

This widely distributed form is not limited to depth. It is abundant in most shallow water deposits.

In the boring it occurred at 15-26 feet, very rare, very small and malformed; also at 71-74 feet, very rare, and very small and maltormed.

TRUNCATULINA REFULGENS, Montfort sp.

Cibicides refulgens, Montfort, 1808, Conchyl. Systém.; vol. 1. p. 122, 31^e genre.

Truncatulina refulgens, Montf. sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 659, pl. xcii., figs. 7-9. Millett, 1904, Journ. Roy. Micr. Soc., p. 491.

This species has previously been found off the Cape of Good Hope, amongst other localities, at a depth of 150 fathoms.

In the boring it occurred at 15-25 ft., very rare and typical; 48-54 ft., very rare, very small and deeply stained.

TRUNCATULINA UNGERIANA, d'Orbigny sp.

Rotalina ungeriana, d'Orbigny, 1846, Foram. Foss. Vien., p. 157, pl. viii, figs. 16-18.

Truncatulina ungeriana, d'Orb., sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 664, pl. xciv., figs. 9*a-c*.

This species has been found off the Cape of Good Hope.

In the boring it was found at 15-26 ft., very rare and rather small.

TRUNCATULINA HAIDINGERI, d'Orbigny sp.

Rotalina haidingeri, d'Orbigny. 1846, Foram. Foss. Vien., p. 154, pl. vii., figs. 7-9.

Truncatulina haidingeri, d'Orb., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 663, pl. xcv., figs. 7 *a-c*. Millett, 1904, Journ. Roy. Micr. Soc., p. 493.

This species appears to be more at home under moderately deep water conditions.

In the boring *T. haidingeri* was found at 42-43 ft., rare, not quite typical, and very small.

TRUNCATULINA PYGMÆA, Hautken.

Truncatulina pygmæa, Hautken, 1875, Mittheil. Jahrb. d. k. ung. Geol. Anstalt, vol. iv., p. 78, pl. x., fig. 8. H. B. Brady, 1884, Rep. Chall., vol. ix., p. 666, pl. xcv., figs. 9, 10.

The above species is usually found in deep water deposits.

In the boring it occurred at 46-48 feet, rare, the specimens rather worn.

GENUS PULVINULINA, Parker and Jones.

PULVINULINA KARSTENI, Reuss sp.

Rotalia karsteni, Reuss, 1855, Zeitschr. d. deutsch. Gesellsch., vol. vii., p. 273, pl. ix., fig, 6.

Pulvinulina karsteni, Reuss sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 698, pl. cv., figs. 8, 9.

This is a characteristic form in Arctic soundings, and has also been recorded in a few localities in the southern hemisphere.

In the boring it was found at 15-26 feet, very rare, small but typical.

PULVINULINA ELEGANS, d'Orbigny sp.

Rotalia (Turbinulina) elegans, d'Orbigny, 1826, Ann. Sci. Nat., vol. vii., p. 276, No. 54.

Pulvinulina elegans, d'Orb. sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 699, pl. cv., figs. 4, 5, 6. Flint, 1899, Rep. U. S. Nat. Mus. for 1897, p. 331, pl. lxxv., fig. 1.

In the boring this species (the deep water variety), occurred at 15-26 feet., frequent ; at 42-43 ft., rare, small but typical ; and at 84-88 ft., very rare and very small.

GENUS ROTALIA, Lamarck.

ROTALIA BECCARII, Linné sp.

Nautilus beccarii, Linné 1767, Syst. Nat., 12th ed., p. 1162 ; 1788, Ibid. 13th (Gmelin's) ed. p. 3370, No. 4.

Rotalia beccarii, Linné sp., H. B. Brady, 1884, Rep. Chall., vol. ix.,

p. 704, pl. cvii., figs. 2, 3. Millett, 1904, Journ. Roy. Micr. Soc., p. 502.

This species is typically a shallow water form. The test in some of the specimens appears to be stained by the sarcode, of a deep reddish brown, a character sometimes shown in examples from shallow water.

In the boring *R. beccarii* occurred at 15-26 feet, very common and typical; 32-34 feet, common; 42-43 feet, common and typical; 46-48 feet, frequent; 48-54 feet, frequent, and stained deeply; 56-62 feet, common and tyyical; 71-74 feet, very rare and small; 84-88 feet, rare; 90-98 feet, very common, small and dark-coloured; 103-109 feet, common and rather small.

ROTALIA ORBICULARIS, d'Orbigny.

Rotalia (Gyroidina) orbicularis, d'Orbigny, 1826, Ann. Sci. Nat., vol vii., p. 278, No. 1;—Modèle, No 13.

Rotalia orbicularis, d'Orb., H. B. Brady, 1884, Rep. Chall., vol. ix, p. 706, pl. cvii., fig. 5; pl. cxv., fig. 6.

The specimens of the above in the present series are very variable, and exhibit characters which link them with the preceding form. At 46-48 feet the examples met with were like the passage form figured by Dr. Brady on pl. cvii., fig. 5, of the Challenger Report.

In the boring *R. orbicularis* occurred at 42-43 feet, rare; 46-48 feet, very common; 56-62 feet, very rare; 103-109 feet, very common and small.

ROTALIA DENTATA, Parker and Jones.

Rotalia dentata, Parker and Jones, 1865, Phil. Trans., vol. civ., p. 387, pl. xix, figs. 13*a-c*. Brady, 1884, Rep. Chall., vol. ix., pl. cviii., fig. 4.

This species was originally recorded by Parker and Jones from anchor mud at Bombay Harbour.

In the boring *R. dentata* occurred at 15-26 feet, very rare.

FAMILY NUMMULINIDÆ.

GENUS POLYSTOMELLA, Lamarck.

POLYSTOMELLA CRISPA, Linné sp.

Nautilus crispus, Linné, 1767, Syst. Nat., 12th ed., p. 1162.

Polystomella crispa, Linné sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 736, pl. cx., figs. 6-7. Millett, 1904, Journ. Roy. Micr. Soc., p. 603, pl. xi., fig. 2.

This species is a typically shallow water form.

In the boring it occurred at 15-26 feet, rare; 42-43 feet, very rare; 90-98 feet, rare and rather small.

POLYSTOMELLA MACELLA, Fichtel and Moll sp.

Nautilus macellus, var. a, Fichtel and Moll, 1798, Test. Micr., p. 66, pl. x., figs. e-g.

Polystomella macella, F. & M. sp., H. B. Brady, 1884, Rep. Chall., vol. ix., p. 737, pl. cx., figs. 8, 9, 11; ? 10.

This species is typically a shallow water form, and has been recorded, amongst other places, off the Cape of Good Hope.

In the boring it was found at 15-26 feet, very rare.

SUMMARY OF RESULTS.

The depths of the samples with their contents in descending order are as follows:—

15-26 feet. Ostracoda frequent; 5 species, viz:

Macrocypris, G. S. Brady sp.
Bairdia ? ovata, Bosquet.
Cythere convexa, Baird.
C. fuscata, G. S. Brady.
C. schwarzi, sp. nov.

Foraminifera very abundant, 15 species, viz:—

Spiroloculina planulata, Lam. sp.
S. excavata, d'Orb.
Miliolina subrotunda, Mont. sp.
Haplophragmium cf. *canariense*, d'Orb. sp.
Globigerina bulloides, d'Orb. var. *triloba*, Rss.
G. conglobata, Brady.
Truncatulina lobatula, W. & J. sp.

T. refulgens, Montf. sp.
T. ungeriana, d'Orb sp.
Pulvinulina karsteni, Reuss.
P. elegans, d'Orb. sp. (deep water var.)
Rotalia beccarii, Linné sp.
R. dentata, Parker and Jones.
Polystomella crispa, Linné sp.
P. macella, Fichtel & Moll sp,

Also globate and triradiate sponge spicules.

32-34 FEET. No Ostracoda.

Foraminifera rare. One species, viz :—
Rotalia beccarii. L. sp.

42-43 FEET. No Ostracoda.

Foraminifera moderately common. 7 species, viz :—
Miliolina seminulum, L. sp.
M. trigonula, Lam. sp.
Truncatulina haidingeri, d'Orb. sp.
Pulvinulina elegans, d'Orb. sp.
Rotalia beccarii, L. sp.
R. orbicularis, d'Orb.
Polystomella crispa, L. sp.

46-48 FEET. No Ostracoda.

Foraminifera moderately common. 3 species, viz. :—
Truncatulina pygmæa, Hautken.
Rotalia beccarii, L. sp.
R. orbicularis, d'Orb.

48-54 FEET. No Ostracoda.

Foraminifera rather rare. 3 species, viz. :—
Miliolina seminulum, L. sp.
Truncatulina refulgens, Montf. sp.
Rotalia beccarii, L. sp.

Also fragments of shells of pelecypoda and worm tubes.

56-62 FEET. No Ostracoda.

Foraminifera moderately common. 3 species, viz :—
Miliolina seminulum, L. sp.
Rotalia beccarii, L. sp.
R. orbicularis, d'Orb.

71-74 **Feet.** No Ostracoda.

Foraminifera very rare. 2 species, viz :—

Truncatulina lobatula, W. & J. sp.
Rotalia beccarii, L. sp.

84-88 **Feet.** No Ostracoda.

Foraminifera very rare. 2 species, viz :—

Pulvinulina elegans, d'Orb. sp.
Rotalia beccarii, L. sp.

90-98 **Feet.** No Ostracoda.

Foraminifera common. 3 species, viz :—

Miliolina subrotunda, Mont. sp.
Rotalia beccarii, L. sp.
Polystomella crispa, L. sp.

103-109 **Feet.** No Ostracoda.

Foraminifera fairly common. 2 species, viz :—

Rotalia beccarii, L. sp.
R. orbicularis, d'Orb.

On Some Implements and Ornaments of South African Native Races made of Stone and Bone.

By S. Schönland, Ph.D., Hon. M.A., Oxon.

[Plates II—IV.]

At the first meeting of the South African Association for the Advancement of Science held at Capetown in 1903, I exhibited some stone implements from the collection of the Albany Museum. A short account of them was published in the Report of the Association. It was suggested to me that it would be desirable to publish figures of some of these implements, and the present paper is the outcome of this suggestion. I have confined myself almost entirely here to short descriptions of the specimens in the order in which they are figured. Since this meeting was held, several very interesting specimens have been added to the collection.

The figures on Plates 2-4 are reproductions of my own photographs. The majority of these figures show the means by which the specimens are fastened to their supports, and it is scarcely necessary to point out that this is the reason why lines and cirles appear on several of them. It was thought best not to re-touch them at all. On Plate 4, Fig. 4, have been reproduced the photos of a number of bone implements. Such bone implements have, as far as I know, scarcely ever been referred to, except in the recently published book by George W. Stow, "The Native Races of South Africa," ed. by George McCall Theal (London, 1905), p. 72-73, and yet they must have been in fairly common use for various purposes, apart from the fact that arrow tips were even until recently very commonly made of bone.

Unfortunately none of the specimens which I have figured throw any light on the supposed sequence in the art of making stone implements. Not one of them was found under such conditions that one could with any degree of certainty hazard a guess as to its age, or at all events such conditions were not carefully enough noted at the time they were found; but several of them evidently fill a gap which was pointed out by Mr. J. P. Johnson in the Trans. S. A. Geol. Soc. vol. 6, 1904, p. 66.

I would especially call attention to the finely wrought axe-head represented on Plate 4, Fig. 1 and 2. It is of a distinctly neolithic type, and it is curious that it was found only two years after Mr. Johnson had pointed out that it is quite likely that further research would reveal the presence of such axe-heads in South Africa. Perhaps a further search in the place where this specimen was found will reveal some evidence to strengthen Mr. Johnson's view, which had already been formulated by Mr. Peringuey, that we had in South Africa, as in Europe, an eolithic, neolithic, and palæolithic stone-age.

A bibliography of the subject will be found compiled by Mr. J. P. Johnson in the Report of the South African Association for 1904, page 197-199.

PLATE II, FIG. 1.

Muller, made of diorite, length 8½"=21 cm. (A 78 of the Museum register).

Found in the mud of the Gats River, Sneeuwberg. Pres. by Mr. Murray.

Owing to the extreme hardness of the material of which this implement is made, and the beautiful polish given to it, this is in some respects the most remarkable stone implement in the collection.

PLATE II, FIG. 2.

Saw, made of surface quartzite, almost natural size (A 1538). Found in a Bushman "cave," King's Quarry, Grahamstown.

PLATE II, FIG. 3.

Saw, made of surface quartzite, almost natural size (A 826) Bushmanland. Presented by Dr. Howard.

Mr. E. J. Dunn pointed out in 1880 (Trans. S. A. Phil. Soc., II, p. 12), that "flakes similar in form to those used as knives, but having one or more of the edges systematically serrated, were widely distributed" He figures one specimen from Salt River, Cape flats. In the 2 specimens figured by me on Plate II, each tooth has been carefully filed out. There is another specimen made of quartz from a Kitchenmidden, near Port Alfred, in the collection of the Albany Museum. The cutting edge of this specimen is, however, very coarsely made. There are quite a number of stone-saws represented on photos of several hundred flakes and knives (chiefly from Mossel Bay) which the late Mr. G. Leith sent me about 12 years ago. The originals will probably be found in the Pretoria Museum.

PLATE II, FIG. 4.

Implement of unknown use, made of coarse sandstone, length 21" = 53·2 cm. (A 45).

Ploughed up at Berkleys, Kareiga, Lower Albany. Pres. by Mr. J. B. Baines (1891).

It has been suggested that this implement was originally used as part of a trap for small game. The part pointing upwards in the illustration, although exhibiting a sharp edge, does not show any evident sign of human workmanship, the remaining part (about two thirds of the whole) has been rounded off at the corners.

PLATE II, fig. 5.

"Arrow-straightener," nearly egg-shaped, with 8 grooves, made of tufa, length $3\frac{5}{8}$" = 9·2 cm. (A 875).

Found at Upington, Cape Colony. Pres. by the Hon. Mr. Justice Jones.

PLATE II, FIG. 6.

"Arrow-straightener," with 3 groves, made of laterite, length $5\frac{1}{2}$" = 14 cm. (A 1351).

Found in the diamondiferous Vaal River gravels near Fourteen Streams. Pres. by Mr. Moir (1903).

The first of these implements (fig. 5), agrees with the description given by Stow (lc., p. 66) of the implement used by Bushmen for forming the round bone-shafts of their arrows, and also for rounding the edges of their ostrich egg-shell beads. The nature of the material altogether refutes Dunn's idea (Trans. S. Afr. Phil. Soc. II, p. 20), that these grooved stones were heated in the fire before the fresh-cut reed was rubbed along the groove.

The suggestion thrown out by me in the Report of the S. Afr. Association for the Advancement of Science, 1903 (p. 306) that the implement represented on fig. 5 was used for roap-making should also be considered.

Plate III, Fig. 1.

Ring, made of slate, outer diameter $4\frac{1}{2}''$ = 11·4 cm. (A 828).

Found about 15 feet underground in a forest in Galeckaland. Pres. by the Rev. Canon Woodrooffe (1897).

This is the flattest of the 3 rings figured on Plate III. In all of them the outer edge is rather thin, a pecularity which is also found in the brass neck-rings worn until recently by women of the reigning house and the chief fighting men in Basutoland.

Plate III, Fig. 2.

Ring, made of a slaty conglomerate, outer diameter $4\frac{3}{4}''$ = 12 cm. (A 22).

Found near the junction of the Vaal and Orange Rivers. Pres. by Mr. P. Nightingale (1894).

Plate III, Fig. 3.

Ring, made of slaty sandstone, outer diameter $3\frac{1}{4}''$ = 8·2 cm. (A 62).

Found in the Peddie district. Pres. by Mr. S. Bell.

Plate III, Fig 4.

Disk, made of soapstone, greatest outer diameter $4\frac{3}{64}''$ = 10·5 cm. (A 21).

Found near the junction of the Vaal and Orange Rivers. Pres. by Mr. P. Nightingale (1894).

I have suggested that this disk may have been used as a spindle-whorl.

Plate III, Fig. 5.

Ornament made of Quartzite, about one-half natural size. (A 873).

Found near Grahamstown. Pres. by Mr. S. Juby (1898).

Plate III, Fig. 6.

Ornament made of shale, about one half natural size.

Found on the Peddie Coast. Pres. by Mr. Corn. Cock.

Plate IV, Fig. 1.

Axe-head made of green jasper, natural size. (A 1354).

Found by Miss Ethel Currie at Vaal Krantz, near Grahamstown, in 1906. Pres. by Mrs. J. Currie.

Plate IV. Fig. 2.

Side-view of the upper portion of the same slightly enlarged.

This very fine implement was discovered amongst some stones which had been excavated some considerable time ago in making a water-furrow. It is made of a small boulder of green jasper from the Dwyka Conglomerate. Advantage has to a large extent been taken of the natural shape of the boulder, and its natural surface has not been disturbed except within 12 mm. of the cutting edge, but the portion which has been worked has been most carefully ground. The parallel striæ on this axe-head are evidently ice-scratches.

Plate IV, Fig. 3.

Cigar-shaped implement, made of fine-grained sandstone, length 19½ " =49·4 cm. (A 61).

Ploughed up at Tharfield, near Port Alfred. Pres. by the late Dr. W. G. Atherstone.

This implement may have been used for braiding skins. Various other uses have been suggested for it, but so far nothing definite can be said of it.

Plate IV, Fig. 4.

Collection of bone-implements, about one half natural size.

Found in a "cave" at King's Quarry, close to Grahamstown, from which came also the saw represented on Plate II, fig. 2, and the pot figured in these Records, Vol. 1, Plate II, fig. 3. Numerous stone-implements (arrow-heads, knives, &c.), were found at the same place. Until recently there were to be seen traces of Bushman paintings on the walls of this cave.

The implements on figs. 4, R, E, and G are very carefully finished. Those represented on fig. 4, F and H, are simply thick splinters of bone which have been used as boring implements, and have been somewhat rounded off when in use. There are also rough bone implements from Kitchenmiddens at the Rufanes River, Port Alfred, in our collection. These are larger specimens of bone with pointed ends. the edges of which have also been rounded off.

Petrographical Notes on the Older Rocks in the Diamond Mines of Kimberley.

By Ernest H. L. Schwarz, A.R.C.S, F.G.S.

The following notes refer to the rocks encountered in the shafts outside the pipes. Their interest lies in the evidence of replacement of the minerals by alteration products; for all the rocks, though far below the reach of surface weathering, show unmistakeable evi lence of having been altered by water percolating through the minute pores and cracks. The materials for the study were collected by myself through the courtesy of the De Beers' Company, and are now deposited in the Albany Museum.

The pipes themselves are vertical chimneys filled in with blue-ground. There are altogether five pipes which are at present being worked, namely, the great Kimberley Mine, the De Beers, the Wesselton (formerly known as the Premier), the Dutoitspan and the Bultfontein Mines. All of them have been originally worked as open mines; the blue-ground has simply been quarried and hauled to the surface, leaving the outline of the rock walls visible. Where the depth has made this mode of mining the blue-ground inconvenient, rock-shafts have been put down at some distance from the pipes, and tunnels have been driven from the shaft to the pipe; the blue-ground is then worked out in chambers, the roofs of which are driven upwards till they come near to the rubble at the bottom of the open mine, and they are then abandoned; in a short while, all timbering and supports having been meanwhile removed, the roofs of the chambers collapse. When all the chambers on the hauling level have crushed in, the rock-shaft is deepened, and a new tunnel at a lower level is driven and a new set of chambers excavated. In the Kimberley Mine this process has gone on till the depth of the open mine is very great; the surface rubble always sinking as each level is abandoned, has left exposed to view the original hole blown through the solid rock by the volcano. The boundaries thus presented to us show that the chimney was not excavated by one explosion, but was widened to its final size by successive outbursts; in the south-east corner there is a smalle rounded chimney attached to the main pipe. In the case of the Du Toit's Pan mine, there are two pipes quite distinct attached by a neck, while a portion in the eastern neck is so poor in diamonds that it does not pay to work the blue-ground, showing that there is a difference in the nature of the blue-ground, and this difference is maintained in depth.

The sections of the various mines are given in the 18th Annual Report of the De Beers' Company, which, with the addition of my own observations, may be summarized thus:—

KIMBERLEY.	DE BEERS.	BULTFONTEIN.	DU TOIT'S PAN.	WESSELTON.
Debris.		Debris.	Debris.	Limestone.
Dolerite.	Dolerite.	Shale.	Dolerite	Dolerite.
Ecca Shale.	Ecca Shale.	Dolerite.	Ecca Shale.	Ecca Shale.
		Ecca Shale.		
DWYKA CONGLOMERALE.			DWYKA CONGLOMERATE.	
Melaphyre.	Melaphyre.	Melaphyre.	Quartzite	Melaphyre.
Quartzite.		Quartzite.	Melaphyre.	Quartzite.
	Quartzite.	Melaphyre.		
Rhyolite.	Rhyolite			
Quartzite.	Quartzite.			
Rhyolite.				
Sandstones, Shales & Breccias.	Gneiss.			

These sections reveal the existence of late Palæozoic beds resting unconformably on more ancient ones. The age of the latter is quite uncertain, and they have not been correlated with any degree of certainty with any of the rocks appearing at the surface in the country. Dr. Molengraaff included the whole series in what he called the Vaal River System, the Ventersdorp System of Drs. Hatch and Corstorphine. In Prieska, however, we have the amygdaloidal melaphyre intrusive or lying upon the quarzites under the Dolomite series, and also on the Matsap beds (Waterberg Sandstone.) The former quartzites are undoubtedly equivalent to the Black Reef Series of the Transvaal, and also in all probability to the Keis series of Stow, though this author separated the two quartzites by an unconformity. In the Bultfontein and Du Toit's Pan sections the melaphyre is also seen to be intrusive in the quartzite or perhaps contemporaneous with the upper beds, and this latter rests on rhyolites and felsites underlain by shales and breccias. In the Transvaal the Black Reef series rests unconformably on volcanic beds (the Vaal River or Ventersdorp system), and any lavas of the same age or later than the Black Reef series cannot be included in these.

The quartzite in the De Beers' shaft is 722 feet thick, and in the Kimberley shaft is underlain by shales 260 feet thick; it thus indicates a fairly extensive period of steady deposition. This formation resting on a volcanic series and followed, after a very long interval, by a further display of volcanic activity, as shown in the diabase or melaphyre, indidates too great a lapse of time for the whole three members to be classed under one general heading. It seems more in keeping with what we know of the surrounding country to correlate the undoubtedly volcanic series at the base of the quartzites with Beer Vley Volcanic Series, the Quartzites with the Keis or Black Reef Series, and the amygdaloids with the Prieska amygdaloids, noting that the one volcanic series is considerably later than the other, and leaving in abeyance the question as to whether the lowermost is equivalent or not to the Vaal River (Ventersdorp) beds.

The following are the chief references to the volcanic rocks :—

1871, Hübner, A., Peterman's Mittheilungen, XVII, p. 81; "Quartz-porphyry."

1873, Cohen, E., Brief aus Klipdrift, Neues Jahrbuch, p. 52; "Vaalgestein."

1874, Stow, G. W., Quart. Journ. Geol. Soc., p. 662, "Volcanic rocks of Pniel and Ongeluk."

1887, Dunn, E. J., Geological Sketch Map of S. Africa; "Diabase later than the Lydenburg beds."

1890, Cohen, E., Neues Jahrbuch, Beil. Bd. V., p. 210.

1900, Rogers, A. W., and Schwarz, E. H. L., Ann. Rept. Geol. Comm., 1899, p. 86; "Beer Vlei Volcanic Series."

1903, Molengraaff, G. A. F., Trans., Geol. Soc. S.A., Vol. VI., p. 68; "An unrecognized Formation underlying the Black Reef Series."

1903, Hatch, F. H., Trans. Geol. Soc. S.A., Vol. VI., p. 69; "An unusual basal development of the Black Reef Series."

1904, Hatch, F. H., Trans. Geol. Soc. S.A., Vol. VI., p. 95; "Ventersdorp Beds," unites the Klipriversberg amygdaloid with the boulder beds of Ventersdorp.

1904, Molengraaff, G. A. F., Geology of the Transvaal, p. 19; "Vaal River System."

1905, Rogers, A. W., Geology of Cape Colony, p. 68; "Beer Vley Volcanic Series."

1905, Schwarz, E. H. L., Trans. Geol. Soc. S.A., Vol. VIII., p. 102; "Amygdaloid; felsitic lavas and volcanic breccias."

1905, Hatch, F. H., and Corstorphine, G. S., Geology of South Africa, p. 148; "Ventersdorp System."

1906, Rogers, A. W., Trans. Geol. Soc. S.A., Vol. IX., p. 2; "Ongeluk Volcanic Series; Pniel Volcanic Series."

Since the above was written, the 10th Annual Report of the Geological Commission has appeared, in which Mr. Rogers correlates the Pniel Volcanic Series of Barkly West with the Ventersdorp beds (p. 149). He also states that he is of opinion that the Prieska amygdaloids are of the same age, indicating, however, that a re-survey of the district will be necessary to establish this, as our present knowledge makes such a correlation impossible (p. 146). Mr. du Toit also brings the main volcanic beds of Vryburg and Mafeking under the heading of Ventersdorp beds, but the acid lavas and breccias are separated by a marked unconformity from the overlying diabase (p. 238), and hence there is here also a very wide time difference between the two. On p. 247 the latter author also describes diabase sheets contemporaneous in the Black Reef Series in Vryburg. The above facts, therefore, cannot affect what I have already said in reference to the Kimberley rhyolites and breccias and the diabase, though the conclusions of Messrs. Rogers and du Toit are adverse to my interpretation.

The terms "Vaal River" and "Klipriversberg" amygdaloid have been used throughout the geological literature of South Africa.

Local names for the older rocks in the Kimberley mines are "Quartz porphyry" for the felsites and "Vaal River conglomerate" for the breccias composed of fragments of granite.

GNEISS AND GRANITE: De Beer's Mine, 2040 ft. level.

The gneiss is a hornblende, biotite rock with quartz, microcline and orthoclase felspars; accessory minerals are apatite in great abundance, zircon and topaz; alteration minerals are rutile, anatase, epidote and calcite. The rock is well foliated in places, especially in those where biotite is abundant, this mineral being aggregated in planes, leaving the rest of the rock fairly free. Veins of calcite and chalcedony occur showing shrinkage in the mass, and also large branching veins of coarse pegmatite with plagioclase.

Hornblende; dark green mineral showing no alteration, often with some quartz and fairly large apatites included in it.

Biotite; mostly bleached to a green lustrous mineral. The original biotite, pleochroic from yellow to almost black, occurs; by the leaching of the iron the colour is reduced, and it appears like chlorite, only that the mineral shows more definite boundaries, while the high interference colours show it to be still a mica. Occasionally the biotite is bleached almost entirely, and one might mistake it for muscovite did not the faint brown tinge appear when the cleavage planes lie parallel to the axial plane of the lower nicol. A further alteration shows itself in the form of minute granules of epidote wedged in between the cleavage laminæ; the formation of epidote is effected by the addition of lime derived from the plagioclase felspars in the pegmatite dykes. Some of the micas become attacked in the centre or at one end, and the substance becomes converted into a clear transparent base full of minute epidote granules. The clear base is like quartz, but is sometimes biaxial, and although it does not show fibres or felting, it is then probably serpentine or some allied hydrous magnesium silicate. Where there has been a plentiful supply of lime the whole end of a mica flake is converted into a single large granule of epidote, transparent, and beautifully pleochroic from siskin-green to brownish yellow. A simple hydration entirely changes the nature of the mica; it becomes a vermiculite. This change, as far as I have observed it, only occurs near the pegmatite veins, and then only on one or two mica-flakes. The vermiculite is at once noticeable owing to its beautiful dark sky-blue colour, like that of riebeckite, but it is pleochroic to shades of honey brown. The absorption, also, is directly opposite to that of the micas, like that of tourmaline, being light brown parallel to the axial plane of the nicol, and dark blue at right angles to it. There can be no doubt that the mineral is simply a hydrated mica, as in some cases one half on the centre of the mica flake is altered, leaving the remainder in its original state, yet at the same time its behaviour in polarised light shows it to be as definite a mineral as, say, epidote. The flakes are too minute to isolate, but the absorption is in the same direction as in the well-known Kimberley vermiculite "Vaalite." I have not found in my own preparations of blue ground the blue vaalite, yet the mineral is described by Messrs. Maskelyne and Flight as being of a beautiful blue colour in patches.[1]

The biotite was a fairly early crystallization product, and has been partly re-absorbed, as the ends are rounded concavely, and other minerals, quartz and felspar, fill in the notch.

Microcline is very common, showing the "gitter" structure; the perfection of this is usually referred to by those who have investigated the ancient granites of Africa, so that it seems to be a constant characteristic of the basement rock of the whole continent. Microcline is usually undecomposed, and was an early crystallization product, being included as grains in the plagioclase; in the pegmatite veins it is of a reddish colour, contrasting with the greenish white of the plagioclases.

[1] Q.J.G.S., Vol. XXX, 1874, p. 406.—I am indebted to Prof. Miers, of Oxford, for pointing out that Tschermak (Ber. Akad. Wien, Vol. C., 1891, p. 3), regards Vaalite simply as a decomposition product of biotite, and not as a distinct species. The Vaalite in my own preparations, however, is entirely separated from any other mineral, and I hope in the near future to publish the constants of this, and some other micaceous minerals from South Africa.

Orthoclase, occurring as a milk white, or even transparent, colourless mineral, is fairly abundant, and is intimately mixed with plagioclase. Cleavage fragments of both are readily obtained, and whereas the extinction and plane of the optic axes in the former are clearly shown, in the latter they vary within such wide limits that I do not feel justified in yet drawing a conclusion from my examination. With the naked eye the plagioclase is often greenish and shows the twin lamellae very distinctly. In the felspars there are often seen portions traversed with quartz in irregular vermicular tubules, which sometimes, however, have developed along definite planes and show as crossing pegs. I regard this quartz as having been deposited in cavities eaten out by solvent water, and therefore secondary in origin. According to Holmquist,[a] this *quartz vermiculé*, or myrmekite, never occurs in granite that has not undergone metamorphism.

Quartz occurs as round grains of the primary consolidation which are included in all the other minerals, and also as a later product of solidification, when it fills in the gaps between other minerals, irregularly. The larger grains are usually cracked, moderately strained, and with an insignificant amount of liquid inclusions showing as trails of dust across the grains. Secondary quartz has just been alluded to, and there is also a considerable amount of chalcedony occurring as veins traversing the rock.

Apatite is often of quite large size; the hexagonal sections and stumpy laths with basal cleavage enable one easily to pick it out.

Zircon occurs frequently as inclusions, showing long pointed forms with characteristic deep margins; they are always of microscopic size.

Topaz occurs exceptionally in one section in the pegmatite near the contact with the gneiss. It is the only mineral I have found which suggests pneumatolitic action. The cleavage, high relief, low double refraction and biaxial figure leave no doubt as to its nature.

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[a]Studien über die Granite von Schweden; Bull Geol. Inst., Upsala, VII., 1906, p. 116; Pl. 17., fig. 10.

Of the alteration products anatase is very common. Sometimes in clear crystals with adamantine lustre, strong single refraction and very high interference colours usually appearing as white light; in convergent light it gives a cross with several closely set concentric rings, showing easily the negative character with the ¼ undulation mica plate. In other crystals there is a brownish dusty coat of leucoxene or sphene, when the cross sections appear much like sphene, but they have strong cleavage. Although I have put down most of the crystals to anatase, some showing pleochroism from colourless to fox red, are rutile; the geniculate twins are sometimes obscurely shown, but the little grains have not the appearance of an original constituent. Both anatase and rutile, I believe, are due to the alteration of the micas in which titanium frequently replaces part of the iron.

Epidote is often in fairly large grains, and appears like the anatase as constituting one of the original minerals of the rock, but the mineral in other cases is clearly secondary. The larger grains give clear biaxial figures showing negative character, the high interference colours and yellowish colour which usually shows marked change when the lower nicol is revolved distinguish the mineral very clearly.

It is difficult to explain the amount of lime that exists in the slides either in the form of calcite, shown by the rising of bubbles when the section is covered with acid, and also combined in the epidote. Large veins of calcite occur quite separately from the pegmatites as well. I do not think this calcite has been derived from solutions percolating through the rocks contemporarily with the volcanic activity which produced the pipes of blue-ground, nor are the cracks to be attributed to these explosions. The veins, though subsequent to the pegmatite dykes, bear some sort of relation to them, and none at all to the walls of the pipe. My impression is that the production of the cracks filled with calcite, and the influx of lime throughout the gneiss which rendered the material for altering the micas to epidote, was an effect of the extrusion of the amygdaloidal melaphyre, probably during the solfataric stage in the eruption, of which the outpouring of lava was the effusive stage.

THE EARLIER VOLCANIC SERIES.—Clastic igneous rocks (Vaal River conglomerate). Through the basement of gneiss there broke out a number of vents which at first simply shattered the older rocks and strewed the fragments over a large area. These fragmental volcanic rocks now exist as fine sediments and coarse grits made up of large quartz and felspar grains imbedded in a dark matrix; bands of coarser material alternate with fine shales, and occasionally breccias occur in which rounded and angular fragments of the same microcline-plagioclase granite such as we find in the 2040 ft. level at De Beers; sometimes the plagioclase predominates when the rock-fragment appears greenish white, at others the microcline predominates when the pebble appears pink in colour. The finer materials are lustrous with chlorite flakes, and are dark-coloured. At one place they are strongly ripple marked, and little lumps scattered over the surface may be interpreted as the casts of large worms. At other places the shales have been epidotized, and are light cream colour with a greenish tinge.

Petrographically the finer materials appear under the microscope strikingly like the Desmoisites and Adinoles of Europe, sedimentary rocks which have been metamorphozed by contact with basic-igneous rocks, and have perhaps absorbed their strange minerals from the molten magma. Here, however, the fragmental rocks indicate that the chlorite, epidote, etc., have been derived from ferromagnesian minerals scattered by the explosions, together with the quartz and felspars, as has been suggested is the origin of the chlorite in the green schists of the Scottish Highlands. Some sections show that the rock has been derived from the shattering of granite, the consolidated dust including all the granite constituents very little altered, sometimes separated from one another and re-arranged, or occasionally, less thoroughly pulverised, with little groups of grains still showing their original position of consolidation. It is noteworthy that no heating effect is apparent on the grains, that is, that they were erupted cold. I have, however, a section from the same petrographical region in the north-west of the Colony, in which the grains of quartz and felspar distinctly show a certain degree of fusion round the edge;

for instance, a quartz grain, full of rutile needles is cleared of the inclusions round the margins, and the smaller rounded quartz grains are pressed into the borders of the large plagioclase crystals, indicating that they were soft at the time of deposition.

In almost every bed the minerals are differently arranged, but the following descriptions of the constituents of the sediments will give some idea of the nature of the rocks.

Quartz in fine splinters with many fluid inclusions, showing a bubble and an oily liquid within the bubble; sometimes the cavities are bi-pyramidal with prism interposed. Larger grains show strain, and are frequently cracked when the matrix wedges in between the dissevered portions, or they are eaten into by the quartzose, chalcedonic, or calcareous matrix. Still coarser fragments have grains of microcline still adherent in the position in which they were originally consolidated in the granite.

Inclusions of apatite and zircon are frequent.

Of the felspars, microcline is usually fairly fresh, but the others are cloudy with sometimes white mica flakes developed in them.

Mica is either biotite, almost entirely bleached or altered to green chlorite; the latter is strongly pleochroic, and shows under crossed nicols the peculiar dark blue colour of pennine. In finer aggregates the chlorite is new formed, either as granules or in small rosettes which present the revolving dark cross on turning the nicols. The less altered biotites are sometimes full of minute needles arranged in definite relation to the crystallographic boundaries, and are usually ascribed to rutile. Epidote exists as an alteration product in the form of granules between the fibres of the chlorite, but sometimes where the lime has been in excess, the fibres have been separated by interposition of calcite.

Epidote is very common, showing either as minute grains or in relately quite large columnar crystals projecting into clear spaces of felspar or of the matrix. It always appears to be an alteration product *in situ*, and was not erupted as epidote, so that one is led to conclude that at the time of the volcanic activity the original gneiss had not undergone the alteration which we now see in it.

In the darker sediments turbid granules of higher refraction than epidote, both single and double, may be put down to anatase.

Zircon is present as occasional crystals apart from that included in the quartz grains.

Sphene is found in one slide. One crystal shows the margin deeply eaten into, but the form is still apparent, namely, that of the pyramid (2/3 P. 3), while the prismatic cleavage is markedly not parallel to the boundaries. The colour is yellow, and lets very little light through, so that the inference colours cannot be seen.

One crystal fragment, of a faint mauve tint, I have identified as Axinite. It is clear, highly refractive, with interference colours high, and biaxial. There are many fluid inclusions, and the cleavage is represented by irregular cracks. The mauve changes to yellow on revolving the lower nicol. Remembering the topaz in the pegmatite dykes in the gneiss, this boron compound, together with the florine one, indicates that there was a pneumatotized area in the neighbourhood—one which in all probability carried tin as well.

Pyrites, magnetite and ilmenite occur in fair abundance.

Granules of high refractive index, isotropic and colourless, may be identified as colourless garnet.

The amount of actual mud in the sections is remarkably little, though it occasionally is noticed as irregular specks or as films separating two layers of the ordinary material. In one slide it forms kernels to the calcite.

Matrix is usually a mixture of fine mosaic quartz and calcite, but chalcedony is frequently present.

FELSITE AND RHYOLITE (QUARTZ PORPHYRY).—The rocks described above may be regarded as the initial clearing of the throats of the volcanoes, and represent the same stage as the Cave Sandstone of a later period in the Drakensberg. In the latter case basic lavas were erupted from some deep-seated source; the granite which was shattered to form the Cave Sandstone being traversed by the pipes. In the old Kimberley volcanoes the breccia formation was succeeded by an acid lava flow. These felsites and rhyolites, or quartz porphyries, as they are called locally, naturally vary considerably in the enormous mass which is exposed in the mines; in the Kimberley shaft it is 1072 feet thick. At places the rock is dense and fine grained, or actually glassy; elsewhere it is amygdaloidal, showing that it was a surface flow to some extent, and occasionally in the De Beers' tunnels, where I saw most of it. it becomes brecciated, as if half consolidated during flow, and the fragments carried along with the still molten rock. The last featnre is well seen in the Beer Vley volcanic rocks in Hopetown, which are of the same composition as the Kimberley felsites and rhyolites The amygdaloids appear much like the later melaphyres, but their colour is lighter, and the specific gravity is 2·5 against the 2.9 for the melaphyres. Stress, however, must not be laid on the basicity of lavas, as in most cases where they are followed over large areas wide ranges can be recognized in their composition; for instance, the basic lavas of the Drakensberg and the rhyolites of the Lebombo Mountains are probably equivalent, and the typical Klipriversberg amygdaloid around the Vredefort granite boss alternates with quite acid felsites.

Petrographically the rhyolites and felsites consist of a vitreous, devitrified or microcrystalline ground mass, in which are embedded blebs of quartz, crystals of felspar, apatite and ilmenite.

The ground mass is, when vitreous, marked by very finely developed perlitic structure; the centres between the cracks become chloritized or assume a reddish turbid colour. The actual glass has long ago been replaced by quartz, chlorite and calcite, leaving the original structure untouched. Little threads and strings of haematite dots run through the glass.

The quartz blebs are strongly corroded; the larger grains have been divided by the matrix, and the angular points rounded by re-fusion. The grains are traversed by more or less parallel rows of fluid inclusions. The felspars are entirely altered to a base of quartz in which there are innumerable brilliant flakes of sericite; sometimes chlorite has also developed. The outer margin of the felspars is either sharp and clear, or it has been rounded by re-fusion; in the latter case the matrix has usually penetrated along planes of easy solution, and riddled the crystals with a crossing network of tubules filled in with ground mass.

Ilmenite exists in fair quantity, showing strong cleavage planes from which one infers that the variety is "crichtonite," containing 30 per cent. of titanium. The boundaries and cracks are converted into leucoxene.

Pyrites occur plentifully in the neighbourhood of a calcite vein that traverses the rock in De Beers.

Where the matrix is fine crystalline, it consists of minute laths of felspar, altered, especially in the centre, and often consisting of little hollow crystals with chlorite or some opaque black substance filling in the cavity. Epidote is present in considerable quantity in the form of yellow granules. Apatite needles are fairly abundant. Between the recognizable crystals there are spaces filled in with chlorite and opaque substances, evidently altered glass. I could detect no patches which might indicate augite or other ferro-magnesian mineral.

The amygdules are made up of concentric layers of chlorite and chalcedony alternating with each other, sometimes the one, sometimes the other, forming the outside. The colour of the chlorite is dark green, with a greasy lustre; it is pleochroic to yellowish green, and under crossed nicols shows the dark blue of pennine.

BASIC DYKES.—In the 2,520 ft. level in Kimberley, there are two dykes from which I collected specimens, one actually at the junction of the slates with the pipe and another midway in the 2,520 ft. tunnel. The latter apparently runs through to the 2,160 ft. tunnel, in felsite. It has all the appearance of a dolerite, yet the amount of quartz in it raises it petrographically to a diorite, although its specific gravity is 3·0.

Macroscopically it is a dark greenish crystalline rock with patches of pink felspar; on the north side it has a selvage half-an-inch thick of black or very dark green serpentine with granular quartz. The serpentine frequently forms patches filling in cracks in the rock, and is accompanied by a good deal of iron pyrites; on the south side the dyke is very fine grained with large rosettes and crystals of pyrites.

Under the microscope the typical coarse-grained rock is seen to be composed of augite and decomposed felspar, some quartz, magnetite, pyrites and apatite, and as alteration products, biotite, uralite, serpentine, delessite, epidote and calcite.

The augite is partly quite fresh and unaltered, partly entirely paramorphosed, with varying degrees of alteration, leading one to infer that the augite constituted the sole original ferro-magnesian silicate. The unaltered augite is wine-red in colour, and sharply crystalline in form. Some crystals have a fibrous alteration taking place in the centre, the fibres running normal to the clinopinacoid, and at a later stage being replaced by green fibres parallel to that face. Usually there is a brown pleochroic mineral developed round the outside. This last effect can be studied from stages where the augite has turned darker and strongly pleochroic, to where regular biotite crystals project into the surrounding minerals. Finally there are crystals that have entirely altered to a mixture of green uralite and biotite flakes. This alteration ot augite to mica is not, as far as I know, at all common, though if has frequently been recorded in teschenites and similar rocks. The biotite again is itself altered by hydration at places, especially in the centres of the flakes; the absorption of light is directly opposite to the usual one, and though the cleavage planes pass uninterrupted from end to end, the central portion becomes colourless, when the ends are almost black, and on turning the nicol at right angles, the biotite part of the flake is light brown and the central portion dark brown. Elsewhere the alteration is apparently to the vermiculite vaalite, at any rate portions of the flakes are strongly pleochroic from blue to orange; where these flakes lie surrounded by uralite, so that the light passes partly through the uralite and partly through the vaalite, the resulting colours on rotating the lower nicol are brilliant in the extreme, resembling the interference colours of zircon. The colours and absorption at first led me to think of riebeckite, an amphibole that has often led investigators astray. Bonney[3] first described it as tourmaline from the Island of Socotra, although the absorption is

[3]Miner. Mag. VIII., 1888; p. 103.

the same as in the other amphiboles. Harker[4] and Cole[5] originally described it from Wales with absorption a light brown. Since then, however, it has been found that a lies nearest to the vertical axis C, not to A, as in other amphiboles; therefore, Harker's and Grenville Cole's statement of its optical properties, as it stands, indicates an absorption similar to tourmaline and the vaalite, whereas actually it is the same as that of biotite and ordinary hornblende. I have stated this difficulty as Cross has described brown hornblende with terminal alteration to riebeckite.[6]

Secondary glaucophane has also been recorded in rocks similar to the one under description,[7] but the pleochroism of glaucophane never brings up the honey colour of the vaalite.

Uralite is sometimes developed side by side with biotite, and one would at first suppose that the latter had originally existed in the augite. Intergrowths of biotite and augite are well known, the basal plane of the biotite being arranged parallel to the prism faces of the augite, but in the Kimberley sections the unaltered augites have no such intergrowths, and the biotite can be seen to be undoubtedly an alteration product of the augite. Uralite is grass green in colour pleochroic to yellowing green, and is usually in parallel columns; the bright interference colours differentiate it from serpentine, and the low extinction angle from diopside and malacolite. The original derivative structure of the uralite is often lost, and definite crystals of amphibole result.

Another alteration of the augites, and perhaps simply a final stage of the process which begins with mica, uralite coming next in order, is its conversion into an aggregate of green fibres with epidote granules between. Some of this is undoubtedly chlorite, with marked pleochroism and low interference colours, but generally the pleochroism is very faint, from grass or blue green

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[4]Geol. Mag. 1888, pp. 221 and 455; in the latter the true absorption is given as determined by Sauer, Zeitsch. d deutsch. geol. Gesell., XL., p. 138, 1888.

[5]Miner. Mag. IX., 1891; p. 222.

[6]Am. Journ. cience, XXXIX., May, 189 .

[7]Bergeron and Michel Levy, Comptes rendus, 15th March, 1886.

to a lighter or more yellow green, and the interference colours are high in patches; the latter mineral we must identify as serpentine. The typical "window" structure of serpentine resulting from alteration of augite is never shown in any definite form, and I am therefore inclined to think that the serpentine has not formed directly from the augite. Green fibres are present in the quartz, which seem to point to the secondry origin of the latter, while the liquid inclusions point to its primary nature; the same feature and the same difficulty are noticed in the Uralite porphyrite of the South Tyrol.[8]

In a replacement cavity filled with calcite, a projecting biotite flake is covered with a fibrous coat of light green colour, pleochroic to colourless when the light is vibrating at right angles to the axis of the fibres. Little vermicular bands of this fibrous substance also occur in the calcite. Interference colours and index of refraction are low. The mineral can be safely put down to delessite

Epidote is only seen in the form of very small granules in the chlorite and serpentine.

The felspar is entirely kaolinized; it is stained with hæmatite, giving it a reddish colour in the rock. Under the microscope all that can be seen are patches of turbid, opaque substance sometimes showing the chrystalline boundaries of felspar.

Quartz occurs usually in irregular grains whose boundaries are quite irregular and determined by the minerals which surround them. A few grains, however, are rounded or show sharp crystalline faces, so that the mineral appears to be certainly a primary constituent of the rock, an appearance, however, which is delusive. Inclusions of apatite are frequent; cavities filled in with a pinkish liquid contain also bubbles which are often in rapid motion, a feature which I did not notice in the gneiss sections; the cavities are either rounded or bi-pyramidal. Another form in which quartz occurs is in intimate intergrowth with the felspar, forming a micro-granophyric structure.

[8] Verhandl. geol. R. Anst. Vienna, 1887, p. 215.

Magnetite occurs abundantly in sharply bounded crystalline forms, sometimes in compact crystals, at other times these are elongated or branched; when included in the augites, it forms centres for alteration into biotite.

Pyrites is probably secondary, and has been introduced from outside.

Apatite occurs plentifully in long needles.

The fine-grained portion on the south side consists of a microcrystalline base of opaque greenish material and felspar laths. In this lie large rosettes of pyrites and pseudomorphs of serpentine after augite. The latter consist partly of green, very slightly pleochroic fibres, and partly of colourless fibres with many groups of epidote granules.

The rock is a quartz diabase, and finds its nearest parallel in the quartz diabase, described by Barrois as occurring in dykes and submarine flows in the Silurian rocks of Menez Hom, Department of Finistère. Another rock with which we can compare it is the "Andendiorite" of Stelzner. In the French rock we find the same sharply bounded quartz crystals, even bi-pyramidal in form, with the same mineral intergrown in a micrographic manner with oligoclase.[9] The presence of quartz in basic rocks has long been known, and theories have been advanced to explain the anomaly.[10] In South Africa we find the same feature in the Karroo dolerites and in dykes piercing the Malmesbury slates at Kapockberg, Malmesbury Division. While the larger quartz grains may be derived by deposition from solution, the space being produced by contraction in the surrounding minerals due to alteration, the smaller aggregates intergrown with the felspar may be explained by replacement. The vermicular quartz in the felspars in the gneiss would represent a first stage, and on subsequent metamorphism of the rock under pressure, a slight re-adjustment of the crystalline substances would obscure the original nature and produce the appearance of primary structure. The

[9] Bull. des serv. de la Carte geol. de la France, 889, No. 7.

[10] Iddings, Am. Journ. Sci., XXXVII, 1888, p. 208; Harker, Geol. Mag., IX., 1892, p. 199.

presence of liquid cavities simply means that the formation of the crystals has gone on at a considerable pressure, while the presence of flakes of secondary minerals like chlorite in the quartz is, to my mind, proof that the quartz is subsequent not only to the consolidation but to the alteration of the rock.

GREY CONTACT OF PIPE.—A very fine aggregate of felspar laths, augite and magnetite, with some larger crystals of augite.

Under the microscope the felspar laths are much altered to kaolin and sericite flakes. The augite of the ground mass is rendered turbid by hydration; some biotite and uralite have resulted in a further alteration. The larger crystals are altered to chlorite, which appear as green fibres with marked pleochroism and low interference colours; epidote granules are plentiful, and some flakes of white mica traverse the chlorite fibres.

The magnetite is mostly in the form of minute octahedra, which are joined in strings; sometimes it appears as delicate bars which are placed parallel to one another.

The ground mass partly exists as an aggregate of quartz, but some of what appears to be quartz, having the same relief and interference colours is, however, biaxial, and may be identified with the zeolite laumontite. Little bunches of needles are probably stilbite.

The rock occurs obscurely bounded at the very junction of the sedimentary rocks and the blue ground. It belongs to the same group as the quartz diabase, and can be called simply a quartz melaphyre.

LATER VOLCANIC ROCKS.—The amygdaloidal melaphyres. These have been described by Cohen, and require no further notes. My own preparations show an exceedingly fine aggregate of altered felspar laths with a dark interstitial matter, which, under high power, resolves itself into a chlorite mass with opaque earthy matter.

Large porphyritic crystals, with well defined borders, are altered to a mixture of chalcedony and calcite, or pure calcite and chlorite, sericite and quartz. Little cubes of isotropic substance in the chlorite are probably chabazite. The alteration has often taken place along planes of easy solution.

The amygdules are of chalcedony or quartz, chlorite showing the blue interference colours of pennine, and calcite. Sometimes little furry balls of black substance with spherulitic chlorite occur in the quartz.

In one section from Du Toit's Pan mine, a large rounded grain of quartz occurs containing large bipyramidal and rounded cavities filled with liquid; incipent solution is shown by planes of turbid quartz that traverse the grain. This is clearly a case of a foreign grain either derived from the rhyolite or more probably from the gneiss.

In the Du Toit's Pan Mine there used to be marked in the Company's sections a layer of diorite on top of the melaphyre. I went to some trouble to secure specimens of this, as it is only exposed now in the ladder way; the rock to my mind is simply a more altered portion of the melaphyre.

The rock is greenish yellow in colour, showing no structure. Under the microscope there are porphyritic crystals lying in a ground mass in which the pseudomorphs of felspar are apparent. Some ilmenite and fine granular iron ores are also recognized. The whole is changed to a mixture of quartz and calcite, with a small amount of chlorite. The calcite occurs either as a very fine granular material or in definitely bounded clear crystals. Some of it is probably dolomite and magnesite, for not all portions of the rock effervesce with weak acid when cold, but decompose readily on heating.

EXPLANATION OF PLATE V.

Fig 1. Slide 29. Vaal River (Ventersdorp) conglomerate 2520 feet, Kimberley. 1 inch objective: crossed nicols.

On the left is a fragment of microcline, on the right a large fragment of quartz brecciated by pressure. In the upper portion of the latter is a crystal of sphene. Matrix moderately coarse.

Fig. 2. Slide 8. Pegmatite dyke, 2040 feet, De Beers.. 1 inch objective: crossed nicols.

The central portion of the slide is shown occupied by a crystal of orthoclase enclosing a crystal of plagioclase (light) in the lower portion; both are riddled with vermicular tubules filled with quartz. A large quartz bleb (dark) is shown in the lower portion.

Fig. 3. Slide 5. Pegmatite, contact with gneiss, 2040 feet, De Beers. 1 inch objective: ordinary light.

Topaz in centre surrounded by green mica and quartz.

Fig 4. Slide 2. Gneiss, 2040 feet, De Beers. $\frac{1}{4}$ inch objective: ordinary light.

A crystal of biotite in which bright yellow epidote (dark) has crystallized in between the fibres. The clear space on the lower side is secondary quartz similarly formed. At either end are quartz grains, and on either side zeolitised felspar.

Fig 5. Slide 7. Dyke of quartz diabase. 2520 feet, Kimberley. 1 inch objective: ordinary light.

In the centre is seen a stumpy crystal of wine-red augite, surrounded by an alteration border of brown (biotite). The upper end protudes into a crystal of quartz with sharp crystalline borders, surrounded by light green alteration products. On the right another crystal of augite is seen, but above the central one, and to the left of it, there are augite crystals entirely changed to green alteration minerals. The opaque substances are magnetite. The rest of the slide is composed of cloudy felspar, biotite flakes, and green alteration minerals.

Fig. 6. Slide 44. Vaal River (Ventersdorp) conglomerate, 2520 feet, Kimberley. 1 inch objective: ordinary light.

Clear quartz grains, pennine with magnetite and grey matrix.

List of the Flowering Plants found in the Districts of Albany and Bathurst, Cape Colony.

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The list of flowering plants, of which the first instalment (dealing with about 275 species) is herewith offered, will, I hope, supply a long felt want of students of Botany in these parts, whose numbers are slowly but steadily increasing, and will, I expect, also be of value in phytogeographical studies. The plants enumerated belong to the Gymnosperms and Monocotyledons (excl. Liliaceae, Amaryllidaceae and Iridaceae). It will be noticed that, as far as we know, the following orders represented in South Africa are not found within our boundaries: Hydrocharidaceae, Pontederiaceae, Xyridaceae, Flagellariaceae, Lemnaceae, Eriocaulaceae. Of these one or more representatives of the Lemnaceae are almost sure to be found. I have almost the whole list (which will probably contain about 1,800 species) drawn up already, only a number of critical species have to be revised yet, and there should, therefore, be no unreasonable delay in continuing its publication. The districts of Albany and Bathurst include, roughly, the country bounded in the East and North by the Fish River, in the West by the Bushman's River, and in the South by the Indian Ocean. A general discussion of the special features of the vegetation dealt with will be supplied when the complete list has been published, a few words of introduction may suffice for the present.

The country is mostly composed of rolling grass-plains, which on the whole are not very rich in species. A narrow fringe of maritime plants is found along the ocean. The valleys of the Fish and Bushman Rivers, as also of their tributaries, have on the whole a xerophytic vegetation, rich in interesting species, but the bulk of the species are found in the kloofs and on the slopes (especially those facing the sea) of the outliers of the Zuurberg range, which runs south of Grahamstown at an average attitude of about 2300′. About 30 miles separates this range from the sea.

Albany and Bathurst are already within the region of summer rains, but it would be best to describe them as being in a region of uncertain rains.

In preparing this list I have of course made use, as much as possible, of the Literature on the subject. The newly-published volumes of the Flora Capensis have especially been of value. I have, however, wherever possible, based it on the specimens in the Albany Museum, which fortunately include most of Prof. MacOwan's Eastern Province collections. In addition to other well-known collectors whose names are recorded in the Flora Capensis, Mr. J. Glass, Mr. B. South, Mrs. G. White, and one of my assistants, Miss M. Daly, have in recent years made valuable additions to our knowledge of the distribution of the plants of Albany and Bathurst. Lastly I may mention that the majority of the species have been collected by myself and their distribution noted. It will be shown that a number of species have only been collected by Prof. MacOwan on or near the Bothasberg, and in the valley of the New Year's River. A number of species found in these localities occupy only a restricted area, and are not so accessible now as they used to be 40 years ago. This is due to the fact that so much wire-fencing has been erected in all directions, which makes travelling by cart or on horseback impossible except on main roads. Whatever changes may have taken place here and there, especially as a result of overstocking farms, there is evidence, as far as I can judge, that the number of species has in this neighbourhood not been materially altered in recent years.

The country within a 10 miles radius of Grahamstown can be looked upon as pretty thoroughly explored as far as flowering plants and ferns are concerned. Owing to the uncertain seasons some species do not turn up sometimes for years, yet, on the other hand, almost every year lately, one or two species not previously recorded, have been found. Beyond the ten miles radius there are still large tracts of country which are practically unexplored botanically, and it is quite certain that a thorough exploration of what is known as Lower Albany will yield a good many additional species, especially of herbaceous plants with inconspicuous flowers, and of many trees and shrubs in the Kowie and Fish River Bush.

Cultivated plants are not included, except the few which have become naturalised, and may be looked upon as permanent additions to the Flora.

The term "Lower Albany" will be used, as generally understood, to denote the portion of the division of Albany south of the Zuurberg range and the Bathurst division. Gt. denotes Grahamstown.

GYMNOSPERMÆ.

CYCADACEÆ.

STANGERIA, Moore.

1. **St. paradoxa,** Moore.—Tharfield (about 8 miles east of Port Alfred). Only the forest form is known from this locality. This may be a distinct species. See Pearson in Trans. S. A. Phil. Soc., xvi., p. 350.

ENCEPHALARTOS, Lehm.

1. **E. Altensteinii,** Lehm.—On the hills south of Gt. (now very rare), Lower Albany to within a short distance of the sea-shore vegetation. Usually in open bush.

E. Altensteinii, var. **Vroomii.**—This striking variety occurs at Clumber, and is also said to have formerly been found on Stone's Hill, near Gt.

2. **Lehmanni,** Lehm.—Fish River Bush in open, sunny situations.

3. **E. cycadifolius,** Lehm.—This species must be fairly common in the bush in Lower Albany, as, according to Mr. Tidmarsh, it used to be frequently offered for sale by Kafirs. In the Grahamstown Botanic Gardens it goes under the name of E. bracteata, but I cannot find a reference to this name.

4. **E. caffer,** Miq.—The specimens in the Gt. Botanic Gardens are said to come from Lower Albany, but the exact locality is not known.

5. **E. latifrons,** Lehm.—Clumber.—In view of the protean nature of the species of Encephalartos, especially of their foliage, the above determinations must be accepted with some reserve.

CONIFERÆ.

PODOCARPUS, L'Hérit.

1. **P. elongatus,** L'Hérit.—Very common in woods.

? **P. Thunbergii,** Hook.—I have not made a note of the occurrence of this species, but I am pretty sure to have seen it within our boundaries.

PINUS, Linn.

1. **P. Pinaster,** Soland.—Very extensively planted on the hills round Gt., and, unlike other species, it sows itself and spreads in many places.

ANGIOSPERMÆ.

MONOCOTYLEDONES.

CYPERACEÆ.

KYLLINGA, Rottb., pr. p.

1. **K. alba Nees,** var. b. **alata.** C.B. Cl.—Near the mouth of the Kasouga River, and at Port Alfred.

2. **K. erecta,** Schum.—Not uncommon near Gt. (Oatlands, &c.), Trapp's Valley.

3. **K. melanosperma,** Nees.—Brookhuizen's Poort.

? **K. pulchella,** Kth.—MacOwan's No. 1351 from the Bothasberg, in the Herb. Alb. Mus., belongs to K. erecta, Schum., and not to K. pulchella, Kth., under which this species is quoted by C. B. Clarke in Flora Cap. vii., p. 154. As no other collector has found K. pulchella in our neighbourhood, its occurrence becomes doubtful.

PYCREUS, Beauv.

1. **P. polystachyus,** Beauv.—In moist places near Gt. (Grey Reservoir), &c.

2. **P. umbrosus,** Nees.—Gt. (in moist places behind Fort England).

CYPERUS, Linn.

1. **C. tenellus,** Linn.—Common along river courses in damp sandy places (Howison's Poort, &c.)

2. **C. compactus,** Linn.—On the flats near Gt. in wet places.

3. **C. semitrifidus,** Schrad.—Sandy places near Botha's Hill and Trapp's Valley.

4. **C. difformis,** Linn.—In wet places near Gt.

5. **C. pulcher,** Thunb.—Along river courses and in pools, Gt., common.

6. ? **C. sphærospermus,** Schrad.—Trapp's Valley (Miss Daly, 662, flowers undeveloped).

7. **C. denudatus,** Linn. f.—Along river courses, Gt., and at Trapp's Valley.

8. **C. textilis,** Thunb.—Bathurst division, near Theopolis (Burchell). Not collected during recent years.

9. **C. albostriatus,** Schrad.—Port Alfred and Trapp's Valley.

10. **C. usitatus,** Burch.—Port Alfred.

11. **C. fastigiatus,** Rottb.—Bushman's River and Brak Kloof.

MARISCUS, Vahl.

1. **M. pseudo-vestitus.** C.B. Cl. in Schinz's Beiträge, xix., p. 709.—Trapp's Valley.

2. **M. capensis,** Schrad.—Trapp's Valley and Fort Brown.

3. **M. congestus,** Vahl.—Gt.—Fairly common in moist places.

4. **M. riparius,** Schrad.—Near Port Alfred (Burchell). Not collected during recent years.

5. **M. Owani,** C.B. Cl.—Near the Kowie River and at the Kleinemond.

6. **M. tabularis,** C.B. Cl.—Port Alfred, Gt. flats and Brak Kloof.

7. **M. durus,** C.B. Cl.—Between Sidbury and the Kasouga River. Not collected during recent years.

ELEOCHARIS, R. Br.

1. **E. limosa,** Schultes.—Wet places near Gt. (Oatlands).

FIMBRISTYLIS, Vahl.

1. **F. ferruginea.** Vahl.—Only found by Drège in the Bathurst Division.

2. **F. complanata,** Link, var. ε. **consanguinea,** C.B. Cl.—Howison's Poort (MacOwan).

3. **F. monostachya,** Hassk.—Featherstone's Kloof, Howison's Poort, Sidbury.—Amongst grass.

BULBOSTYLIS, Kunth.

1. **B. humilis,** Kth.—Common amongst grass near Gt., also at Trapp's Valley and elsewhere.

SCIRPUS, Linn.

1. **Sc. fluitans** Linn.—Very common in standing water and damp places near Trapp's Valley and elsewhere.

2. **Sc. Ludwigii,** Boeck.—In damp places near Gt., not uncommon.

3. **Sc costatus.** Boeck.—Trapp's Valley.

4. **Sc. cernuus,** Vahl.—Botha's Hill and Sidbury.

5. **Sc. rivularis,** Boeck.—Howison's Poort.

6. **Sc. antarcticus,** Linn.—Howison's Poort, Trapp's Valley, &c.

7. **Sc. nodosus,** Rottb.—In damp places near Gt. (MacOwan).

8. **Sc. prolifer,** Rottb.—Howison's Poort, Bushman's River, and elsewhere.

9. **Sc. Holoschœnus,** Linn. var. **Thunbergii,** C.B. Cl.—Only found by Burchell near Theopolis.

10. **Sc. paludicola,** Kth.—Near Gt. (Schlechter, 2611). Bathurst (Drège).

11. **Sc. maritimus,** Linn.—At the mouth of the Kowie River.

FICINIA, Schrad.

1. **F. tristachya,** Nees.—Trapp's Valley (M. Daly, 664= Zeyher, 4986).

2. **F. gracilis,** Schrad.—Common on dry hillsides round Gt.

3. **F. bracteata,** Boeck.—Common on the hills round Gt.

4. **F. fascicularis,** Nees.—In damp woods near Gt.

5. **F. lithosperma,** Boeck.—Port Alfred.

6 **F. ramosissima,** Kth.—Signal Hill, Gt., and Port Alfred.

7. **F. sp.**—Riet River, near Port Alfred (Mrs. G. White, 50).

8. **F. sp.**—Botha's Hill, near Gt. (MacOwan, 490). The last 2 species are distinct from the other species mentioned, but cannot at present be determined satisfactorily.

FUIRENA, Rottb.

1. **F. pubescens,** Kth.—On the hills south of Gt.

2. **F. hirta,** Vahl.—On the hills near Gt., and in Lower Albany (Trapp's Valley).

RHYNCHOSPORA, Vahl.

1. **Rh. glauca,** Vahl. — Howison's Poort (MacOwan, 1354, p.p.)

CARPHA, R. Br., p.p.

1. **C. glomerata,** R. Br.—Common along river courses in Howison's Poort and elsewhere.

2. **C. capitellata,** Boeck.—In damp places on the mountains near Brookhuizen's Poort (MacOwan, 351).

TETRARIA, Beauv.

1. **T. cuspidata,** C.B. Cl.—Coldstream, Goodwin's Kloof, Sidbury, and Port Alfred.

CAREX, Linn.

1. **C. glomerata,** Thunb.—In damp places amongst grass in Featherstone's Kloof and at Sidbury.

2. **C. Bolusi,** C.B. Cl.—Port Alfred and near Fort Brown.

3. **C. dregeana,** Kth.—Gt., and between Port Alfred and Kaffir Drift (C. B. Clarke in Flora Capeniss, vii., p. 303). Not collected recently.

4. **C. esenbeckiana,** Boeck.—Common in woods near Gt., also at Trapp's Valley.

5. **C. æthiopica,** Schkuhr.—In damp shady places, fairly common from near sea-level to the highest points.

GRAMINACEÆ.

ERIANTHUS, Mchx.

1. **E. capensis,** Nees.—Howison's Poort and Botha's Hill.

POLLINIA, Trin.

1. **P. villosa,** Spreng.—Common on dry hillsides.

TRACHYPOGON, Trin.

1. **T. polymorphus,** Hack, var. **capensis,** Hack.—Hillsides near Gt., Port Alfred, and the Kasouga.

ELIONURUS, Kth.

1. **E. argenteus,** Nees.—Hillsides near Gt., and Trapp's Valley.

ANDROPOGON. Linn.

1. **A. eucomus,** Nees.—Howison's Poort and Sidbury.
2. **A. appendiculatus,** Nees.—Moist places near Gt.
3. **A. filifolius,** Stend.—From Gt. to the sea.
4. **A. contortus,** L. var. **Allionii,** Hack.—Belmont Valley, near Gt.
5. **A. Nardus,** L. var. **marginatus,** Hack.—Widely distributed, Gt., Kowie, Brak Kloof, &c.
6. **A. hirtus,** L.—Gt.

ANTHISTIRIA, Linn.

1. **A. imberbis,** Retz., var. **mollicoma,** Stapf.—Widely distributed on pastureland from near sea-level to the highest points.

PASPALUM, Linn.

1. **P. scrobiculatum,** L.—Gt. and Trumpeter's drift.

DIGITARIA, Rich.

1. **D. monodactyla,** Stapf.—Gt., common.
2. **D. Parlatorii,** Steud (= D. eriantha, Steud).—Fairly common everywhere.
3. **D. setifolia,** Stapf.—Mountain slopes near Gt.
4. **D. sanguinalis,** Scop.—Common in cultivated ground.
5. **D. diagonalis,** Stapf.—Found by Dr. MacOwan near Gt. (see Fl. Cap., vii., p. 381), but no specimen from Albany or Bathurst seen by me. Represented in Herb. Alb. Mus. by several specimens from the Eastern region.

PANICUM, Linn.

1. **P. serratum,** Spreng.—Gt. and Port Alfred.

2. **P. arrectum,** Hack.—"Between Assegai Bush and Botram," Drege (Fl. Cap., vii., p. 393). Not found by any other collector in Albany and Bathurst districts.

3. **P. Crus Galli,** L.—In cultivated ground, Gt., Kowie, &c.

4. **P. perlaxum,** Stapf.—Fairly common near Gt.

5. **P. deustum,** Thunb.—Widely distributed within our boundaries.

6. **P. maximum,** Jacq.—Widely distributed within our boundaries.

7. **P. proliferum,** Lam.—Coldspring and Brak Kloof.

8. **P. minus,** Stapf.—Widely distributed within our boundaries.

9. **P. Ecklonii,** Nees.—Gt. (MacOwan).

OPLISMENUS, Linn.

1. **O. africanns,** Beauv., var. **capensis,** Stapf.—Very common in damp woods.

AXONOPUS, Hook. f.

1. **A. semialatus,** Hook. f., var. **Ecklonii,** Stapf.—Very common all over.

SETARIA, Beauv.

1. **S. lindenbergiana,** Stapf.—Very common from near sea-level to the highest points.

2. **S. perennis,** Hack.—Near the Kowie and Trapp's Valley.

3. **S. flabellata,** Stapf.—Fairly common from near sea-level to the highest points.

4. **S. aurea,** A. Braun.—Kowie (Hutton).

5. **S. imberbis,** Roem. et Schultes.—Coldspring (Galpin); Kowie (Hutton).

6. **S. verticillata,** Beauv.—Very common on the edges of cultivated ground.

PENNISETUM, Pers.

1. **P. macrourum,** Trin.—Wet places near Gt.

STENOTAPHRUM, Trin.

1. **S. glabrum,** Trin.—Common at the sea-side, but also found further inland as far as Gt.

TRICHOLAENA, Schrad.

1. **T. setifolia,** Stapf.—Fairly common near Gt.

2. **T. rosea,** Nees.—Albany division, without precise locality, Williamson (Fl. Cap., vii., p. 443). Not found by any other collector in Albany and Bathurst districts.

TRISTACHYA, Nees.

1. **T. leucothrix,** Trin.—Very common all over.

ACHNERIA, Munro.

1. **A. hirsuta,** Stapf, var. **glabrata.**—Gt. (MacOwan).

AIRA. Linn.

1. **A. caryophyllea,** L.—Botha's Hill (MacOwan).

KOELERIA, Pers.

1. **K. cristata,** Pers.—Gt. and Port Alfred.

AVENASTRUM, Juss.

1. **A. antarcticum,** Stapf.—From near sea-level to Gt.

AVENA, L.

1. **A. sativa,** L.– An occasional weed in cultivated ground.

PENTASCHISTIS, Stapf.

1. **P. heptamera,** Stapf.—Sea-shore, Port Alfred West (Galpin).

2. **P. viscidula,** Stapf.—Mountains near Gt. (MacOwan).

3. **P. eriostoma,** Stapf.—Botha's Hill (Ecklon). Not found recently.

4. **P. fibrosa,** Stapf.—Steep mountain slopes near Gt. (MacOwan).

5. **P. curvifolia,** Stapf.—Common from Port Alfred to Gt.

6. **P. angustifolia,** Stapf.—From Port Alfred to Gt.

7. **P. airoides,** Stapf.— Botha's Hill (MacOwan).

8. **P. longipes,** Stapf.—Albany plains (Bowie). Not recently collected.

DANTHONIA, DC.

1. **D. cincta,** Nees.—Wet places on the mountains round Howison's Poort.

2. **D. stricta,** Schr.—Coldstream (Glass).

3. **D. disticha,** Nees.—Fairly common from near sea-level to the highest points.

4. **D. curva,** Nees.—Mountains near Gt.

PHRAGMITES, Trin. (p.p.)

1. **P. communis,** Trin. Near streams (Gt).

POLYPOGON, Desp.

1. **P. monspeliensis,** Desf.—From near sea-level (Kleinemond) to Gt. (Brand Kraal).

AGROSTIS, Linn.

1. **A. bergiana,** Trin.—Botha's Hill (MacOwan).

2. **A lachnantha,** Nees.—Frequent on the banks of streams.

ARISTIDA, Linn.

1. **A. congesta,** Roem. et. Schult.—Kowie and Brak Kloof.

2. **A. barbicollis,** Trin.—Port Alfred.

3. **A. capensis,** Thunb.—Port Alfred.

STIPA, Linn.

1. **St. dregeana,** Steud.—Burnt Kraal, near Gt. (Prof. Hackel has pointed out to me that this species should be called St. elongata, Steud, this being the older name).

St. dregeana, var. **elongata,** Stapf. Port Alfred.

TRAGUS, Hall.

1. **T. koelerioides,** Aschers. (= T. major, Stapf).—Port Alfred and Brak Kloof.

2. **T. racemosus,** All.—Common in cultivated ground (Port Alfred and Gt.)

SPOROBOLUS, R. Br.

1. **S. fimbriatus,** Nees.—Port Alfred and Gt.

2. **S. indicus,** R. Br.—Widely spread : Port Alfred, Kasouga, and Gt.

3. **S. pungens,** Kunth.—Mouth of the Kasouga and Kowie rivers in salt-marshes.

DIPLACHNE, Beauv.

1. **D. fusca**, Beauv.—Along river beds from Port Alfred to Gt.

ERAGROSTIS, Beauv.

1. **E. curvula**, Nees, var. **conferta**, Nees.—Common everywhere.

2. **E. plana**, Nees.—Trapp's Valley.

3. **E. chalcantha**, Trin.—On hills round Gt., common.

4 **E. major**, Host.– Port Alfred and Gt.

5. **E. brizoides**, Nees.– Common everywhere from Port Alfred to Gt.

6. **E. obtusa**, Munro.—Port Alfred, Gt. and Botha's Hill.

7. **E. gummiflua**, Nees.—Riet River (east of Port Alfred).

SPARTINA, Schreb.

1. **S. stricta**, Roth.—River edge, Port Alfred West.

CYNODON, Pers.

1. **C. Dactylon**, Pers.—Common everywhere.

? 2. **C. incompletus**, Nees.—I am not sure of the occurrence of this species within our boundaries.

MICROCHLOA, R. Br.

1. **M. caffra**, Nees.—Port Alfred and Burnt Kraal, near Gt.

HARPECHLOA, Kth.

1. **H. capensis**, Kth.—Hills round Gt. and Sidbury.

CHLORIS, Sw.

1. **C. virgata**, Sw.—Fairly common in cultivated ground (Port Alfred, Gt., &c.).

2. **C. petraea**, Thunb.—Fairly common everywhere from Port Alfred to Gt. and Brak Kloof.

ELEUSINE, Gaertn.

1. **E. indica** Gaertn.—Port Alfred, Gt., &c., in cultivated ground.

DACTYLOCTENIUM, Willd.

1. **D. ægyptiacum**, Willd.—Port Alfred.

EHRHARTA, Thunb.

1. **E. longifolia**, Schrad.—In rocky places near Gt.

2. **E. erecta**, Lam.—Trapp's Valley.

3. **E. calycina,** Sw.—Port Alfred, Trapp's Valley, and Belmont Valley near Gt.

PHALARIS, Linn.

1. **Ph. minor,** Retz.—Common in cultivated ground.

MELICA, Linn.

1. **M. racemosa,** Thunb.—Common everywhere in woods from Port Alfred to Gt.

FINGERHUTHIA, Nees.

1. **F. sesleriæformis,** Nees.—In swampy places: Kasouga, Gt., &c.

LASIOCHLOA, Kth.

1. **L. longifolia,** Kth.—Common from Port Alfred to Gt.

BRIZA, Linn.

1. **B. maxima,** Linn.—Not uncommon: Port Alfred, Gt., &c.

2. **B. minor,** Linn.—Gt., Coldspring, &c., chiefly on waste land.

POA, Linn.

1. **P. binata,** Nees.—Common near Gt., Howison's Poort, &c.

2. **P. annua,** Linn.—Everywhere in gardens, &c.

FESTUCA, Linn.

1. **F caprina,** Nees.—Howison's Poort (Flanagan 94). Not found by any other collector, and not represented in Herb. Alb. Mus.

2. **F. costata,** Nees.—Albany division (Ecklon and Zegher). Not found by any other collector.

3. **F. longipes,** Stapf.—Rocky slopes near Gt. and Trapp's Valley.

4. **F. scabra,** Vahl.—Stony ledges on Botha's Hill (MacOwan), Albany plains (Bowie).

VULPIA, Gmel.

1. **V. bromoides,** S. T. Gray.—Burnt Kraal, near Gt. (MacOwan).

BROMUS, Linn.

1. **B. patulus**, Mert. et Koch. —Port Alfred and Gt., amongst shrubs. Both the typical form and the var. **vestitus** Stapf are found.

2. **B. unioloides**, HBK.—Common in cultivated ground: Port Alfred, Gt., &c.

LOLIUM.

1. **L. temulentum**, Linn.—In cornfields, Lower Albany.

2. **L. perenne**, Linn.—In cornfields, Lower Albany.

3. **L. multiflorum**, Lam. (= L. italicum, A. Br). — In cornfields, Lower Albany.

This grass, which seems to be quite a recent introduction, is locally known as "Australian drabok," the other two species being also called "drabok."

HORDEUM, Linn.

H. murinum, Linn.—Roadsides near Gt. and elsewhere.

RESTIACEÆ.

RESTIO, Linn.

1. **R. triticeus**, Rottb.—Hills near Gt. (MacOwan, 1361), but this number is not in Herb. Alb. Mus., nor is it quoted in the Flora Capensis.

2. **R. Rhodocoma**, Mast. - Riebeck (Burchell). Not collected recently.

3. **R. sp.**—Common near Gt. (Daly, 36, &c.)

4. **R. sp.**—Coldstream (Daly, 254), Round Hill, Lower Albany (Bolus, 10660).

LEPTOCARPUS, R. Br.

1. **L. modestus**, Mast.—Gt. (Ecklon) and near Riebeck (Burch). Not collected recently.

THANMOCHORTUS, Berg.

1. **Th. fruticosus**, Berg.—Amongst grass in Brookhuizen's Poort.

ELEGIA, Linn.

1. **E. parviflora**, Kunth.—Hills near Gt. According to MacOwan's Ms. list, his number 1359 is this species, but this

number is not in Herb. Alb. Mus., nor is it quoted in the Flora Capensis.

2. **E. asperiflora,** Kunth.—Near Port Alfred (Burchell). Not collected recently.

HYPODISCUS, Nees.

1. **H. Willdenovia,** Mast.—Coldspring.

CANNAMOIS, Beauv.

1. **C. cephalotes,** Beauv.—Monstrous form (teste Miss Kensit).—Coldspring.

PALMÆ.

PHŒNIX, Linn.

1. **P. reclinata,** Jacq.—Common in some of the valleys near the sea (Lushington Valley, Tharfield, &c).

TYPHACEÆ.

TYPHA, Linn.

1. **T. capensis,** Rohrb.—In stagnant water near Gt., and in Lower Albany.

AROIDACEÆ.

RICHARDIA, Kunth.

1. **R. africana,** Kunth.—Very common in moist places.

NAJADACEŒ.

TRIGLOCHIN, Linn.

T. striatum, Ruiz et Pavon.—Along the lagoon, Port Alfred.

APOPONOGETON, Thunb.

1. **A. kraussianum,** Hochst.—Common in wet places all over.

POTAMOGETON, Linn.

1. **P. pusillus,** L.—Common in stagnant water round Gt.

MUSACEÆ.

STRELITZIA, Banks.

St. Reginæ, Banks.—Very common in Lower Albany, also on the Queen's Road, but not found in the immediate neighbourhood of Gt.

ORCHIDACEÆ.

LIPARIS, Rich.

1. **L. Bowkeri**, Harv.—March.—Coldspring and Signal Hill. In sandy places amongst rocks.

EULOPHIA, R. Br.

1. **E. capensis** (L.) Bol. (E. aculeata, Spreng).—Dec.—Coldspring.

2. **E. æmula,** Schltr.—Feb.—Coldspring.

3. **E. aequalis,** Sond.—Nov.—Coldspring.

4. **E. Buchanani** (Rchb. f.) Dur. et Schinz.—Dec.—Coldspring, Howison's Poort, and Featherstone's Kloof.

5. **E. dregeana,** Lindl.—Nov., Dec.—Port Alfred, mouth of the Fish River, Bathurst, and Trapp's Valley.

6. **E. ensata,** Lindl.—Dec., Jan.—Between Bathurst and Port Alfred, Sevenfountains, &c.

7. **E. hians,** Spreng.—Oct., Nov.—Common near Gt. (top of mountain drive), and Dixon's Bush.

8. **E. nutans,** Sond.—Jan.—Coldspring.

9. **E. streptopetala.** Dec.—Tharfield, flats between Port Alfred and Bathurst.

10. **E. platypetala,** Lindl. (E. tuberculata, Bol.)—Nov.—Fairly common on rocky ground on the hills south of Gt.

ACROLOPHIA, Bol. et Schltr.

1. **A. micrantha,** Bol. et Schltr.—Nov., Dec.—Fairly common on rocky mountain-sides south of Gt., also at Port Alfred.

2. **A. tristis,** Bol. et Schltr.—Nov., Dec.—Common at Woest Hill, Coldspring, and other damp places on the hills south of Gt., and at Sidbury.

LISSOCHILUS, R. Br.

1. **L. speciosus,** R. Br.—April.—Common near Port Alfred and the Fish River Mouth; rare in woods south of Gt. (MacOwan).

POLYSTACHYA, Hook.

1. **P. Ottoniana,** Reichb. f.—Nov., Dec.—Common in woods south of Gt.

2. **P. pubescens,** Reichb. f.—Sept., Dec., April.—Fairly common in woods south of Gt.

ANGRÆCUM, Bory.

1. **A. sacciferum,** Lindl.—Nov., Dec.—Fairly common in woods south of Gt.

2. **A pusillum,** Lindl.—July, Sep.—In woods south of Gt.

3. **A. bicaudatum,** Lindl.—Dec.—Trapp's Valley and Gt. (rare).

LISTROSTACHYS, Reichb. f.

1. **L. arcuata,** Reichb. f.—Common in woods south of Gt.

MYSTACIDIUM, Lindl.

1. **M. longicornu** (Thunb.) Dur. et Schinz (M. filicorne, Lindl). - Nov., Jan.—Not uncommon in woods south of Gt.

STENOGLOTTIS, Lindl.

1. **S. fimbriata,** Lindl.—April.—On rocks in shady places at Signal Hill, near Gt.

BARTHOLINA, R. Br.

1. **B. Burmanniana** (L.) Ker. (B. pectinata, Lindl).—Sep.—Not uncommon on the top of the Mountain Drive, Gt.

HOLOTHRIX, Rich.

1. **H. exilis,** Lindl. (H. brachylabris, Sond.) — Feb. —Coldspring (Glass).

2. **H. Schlechteriana,** Krzl.—Nov., Dec.—Common near Gt., Signal Hill, Howison's Poort, Port Alfred, &c.

3. **H. orthoceras,** Reichb. f.—March, April.—Amongst rocks in damp shady places at Dassie Krantz and Fern Kloof.

4. **H. MacOwaniana,** Reichb. f.—Sep.—Similar situations as the preceding species in Howison's Poort.

5. **H. villosa,** Lindl.—Oct., Nov.—Stone's Hill and Atherstone Station.

6. **H. Lindleyana,** Reichb. f.—Sep.—In damp shady places amongst rocks at Signal Hill, Dassie Krantz, &c.

7. **H. Burchelli,** Reichb. f.—Nov., Dec.—Fairly common amongst grass near Gt. and in Lower Albany.

BRACHYCORYTHIS, Lindl.

1. **B. MacOwaniana,** Reichb. f. (Habenaria MacOwaniana Gymnadenia MacOwaniania, Schltr.) — Nov., Dec. — Brook huizen's Poort and Howison's Poort.

PTERYGODIUM, Sw.

1. **P. magnum,** Reichb. f.—Feb.—Coldspring.

2. **P. cleistogamum,** Schltr.—Nov.—Coldspring (J. Glass).

3. **P nigrescens,** Schltr. (Corycium nigrescens, Sond).—Jan.—Coldspring and Howison's Poort.

CERATANDRA, Eckl.

1. **C. grandiflora,** Lindl.—Nov. - Coldspring.

DISPERIS, Sw.

1. **D. capensis.** Sw.—Sep.—Coldspring.

2. **D. lindleyana,** Reichb. f.—Jan.—In a kloof just beyond Stone's Hill.

3. **D. micrantha,** Lindl.—April—Fern Kloof.

4. **D. disæformis,** Schltr.—Aug.—Oatlands Park (A. Galpin). Evidently coming up rarely and then in profusion.

5. **D. MacOwanii,** Bol.—May.—Fern Kloof.

SATYRIUM, Sw.

1. **S. acuminatum,** Lindl.—Oct.—Fairly common in Howison's Poort, Featherstone's Kloof.

2. **S. membranaceum,** Sw.—Oct., Nov.—Very common on grassy slopes all round Gt.

3. **S. maculatum,** Burch.—Nov., Dec.—Fairly common on grassy slopes round Gt.

4. **S. princeps,** Bol.—Oct.—Port Alfred.

5. **S. ligulatum,** Lindl.—Dec.—Howison's Poort and Featherstone's Kloof.

6. **S. sphaerocarpum,** Lindl.—Nov.—Sandhills at the Kleinemond, Port Alfred, and at Coldspring.

7. **S. parviflorum,** Sw.—Oct., Nov., Feb. - Common on grassy slopes round Gt. and near Port Alfred.

DISA, Berg.

1. **D. (Monadenia) brevicornis,** Lindl.—Oct.—Coldspring and Howison's Poort, fairly common; Tharfield, near Port Alfred.

2. **D. chrysostachya,** Sw.—Nov.—Kleinemond flats, in swampy places, Howison's Poort (MacOwan, sine no. in Herb. Alb. Mus.). The last locality is probably incorrectly given.

3. **D. polygonoides,** Lindl. Dec., May.—Near the railway tunnel and in Howison's Poort in damp grassy spots.

4. **D. racemosa,** Linn. f.—Nov., Dec.—Along river courses in Howison's Poort and near Trumpeter's Drift (Mr. F. Barber's farm).

5. **D. sagittalis,** Sw.—Nov.—In fissures of rocks, Howison's Poort and Woest Hill.

6. **D. aconitoides,** Sond.—Oct., Nov.—Coldspring.

7. **D. cornuta,** Sw.—Oct., Nov.—Near top of Woest Hill and at Sidbury.

8. **D. nervosa,** Lindl. Dec.—Featherstone's Kloof and Howison's Poort.

9.? **D. lacera,** Sw.—On rocky hills near Gt. (fide Schlechter in "Monographie der Diseæ," p. 288.)

10. **D. lugens,** Bol.—Nov., Dec.—On damp grassy slopes, fairly common near Gt. (Stone's Hill, Howison's Poort, Slaai Kraal, &c.)

11. **D. porrecta,** Sw.—March.—Brookhuizen's Poort.

BROWNLEA, Harv.

1. **B. coerulea,** Lindl.—Nov., April.—In shady places, rather rare (Coldspring, &c.)

2. **B. recurvata,** Sond.—Feb., April.—Coldspring.

3. **B. parviflora,** Harv.—April.—Coldspring.

HABENARIA, Willd.

1. **H. anguiceps,** Bol.—Jan.—Coldspring.

2. **H. arenaria,** Lindl.—Sep.—Common in shady places near Gt.

4. **H. Bonatea,** Rchb. f. (including **H. Boltoni,** Harv.).—Nov.—Widely spread on the hills round Gt. and in Lower Albany,

5. **H. dregeana,** Lindl.—Tops of hills in Howison's Poort, rare.

6. **H. laevigata,** Lindl.—Feb.—Gt. Flats.

7. **H. tetrapetala,** Lindl.—Feb., March.—Howison's Poort. Woest Hill and near Port Alfred.

8. **H. foliosa,** Sw.—Dec.—Kasouga.

HÆMODORACEÆ.

LANARIA, Ait.

1. **L. plumosa,** Ait.—Kleinemond (Mrs. G. White).

SANSEVIERIA, Thunb.

1. **S. thyrsiflora,** Thunb.—Very common in dry bush all over.

?2. **S. zeylanica,** Willd.—Found in the Albany division by Cooper, according to the Flora Capensis, but I have not seen it within our boundaries.

CYANELLA, Linn.

1. **C. capensis,** Linn.—Fish River Randt, near Fort Brown.

2. **C. lutea,** Linn. fil., var. **rosea,** Bak.—Gt. and at Port Alfred, where it is fairly common.

DIOSCOREACEÆ.

TESTUDINARIA, Salisb.

1. **T. elephantipes,** Burch.—In subcarroid localities (Brak Kloof, &c.), also at Port Alfred.

2. **T. sylvatica,** Kunth.—In bush near Gt. (Howison's Poort, Currie's Kloof, &c.), also at the Riet River, near Port Alfred.—In the Flora Capensis (vol. vi., p. 253), it is stated that the rootstock and habit are as in the preceding species. The "rootstock" in T. sylvatica is, however, a **flat** disk, the diameter of which I have never seen to exceed 12 inches. The surface is divided into irregular areas by shallow furrows, not deeply areolated as in T. elephantipes.

COMMELINACEÆ.

COMMELINA, Linn., p.p.

1. **C. benghalensis,** Linn.—Common near Gt. and at Trapp's Valley.

2. **C. africana,** Linn.—Common near Gt.

CYANOTIS, D. Don.

1. **C. nodiflora,** Kunth.—Very common amongst grass all over.

JUNCACEÆ.

JUNCUS, Linn.

1. **J. diaphanus,** Buchen.– Albany (Bolus, 188).– Not found by any other collector.

2. **J. capensis,** Thunb.– Fairly common in Howison's Poort and in Lower Albany. The var. **flaccidus** is the commonest form in our region. A form intermediate between var. **flaccidus** and **delicatulus** grows at Stone's Hill, near Gt. (M. Daly and M. Sole, 547, Nov., 1903).

3. **J. lomatophyllus,** Spreng.—Common along mountain streams and in Lower Albany.

4. **J. dregeanus,** Kth. - Gt. and through Lower Albany.

PRIONIUM, E. Mey.

1. **P. Palmita,** E. Mey.—In streams in Lower Albany.

(To be continued.)

Genetics of the Colour Pattern in Tortoises of the Genus Homopus and its Allies.

BY J. E. DUERDEN, M.Sc., Ph.D., A.R.C.Sc.

(Plates VI, VII, VIII [Figs. 1-12] and nine figures in the text).

CONTENTS.

The genus *Homopus* represents a very distinct group of South African tortoises, comprising the five species[1] : *boulengeri*, Duerden, 1906 ; *femoralis*, Boulenger, 1888 ; *areolatus*, Thunberg, 1787 ; *darlingi*, Boulenger, 1902 ; and *signatus*, Walbaum, 1782. It is closely allied to the better known genus *Testudo*, differing from it in that the alveolar surface of the upper jaw is without a median ridge, such a structure being present in *Testudo* ; it is separated from two other allied genera, *Cinixys* and *Pyxis*, in which the upper jaw is also without a median ridge, owing to the

[1]Siebenrock (1903, p. 442) has shown that the *Homopus nogueyi* of Lataste, obtained from Senegal, has an imperfect hinge to the hinder part of the carapace, and must therefore be placed in the genus *Cinixys*. Lindholm (1906) has described a new species, *Homopus bergeri*, founded upon an imperfect specimen, obtained from German South-West Africa, and doubtfully referred to the genus.

fact that both the carapace and plastron are hingeless, *Cinixys* having a hinged carapace and *Pyxis* a hinged plastron. The study of a large number of specimens has shown that the species of the genus *Homopus* are clearly separable from one another by combinations of such characters as the number of claws to the fore-limb, the relative size of the inguinal shield, the presence or absence of a large femoral tubercle, the arrangement of the scales on the forehead, and by details of coloration.

In a paper recently published (1906), a brief comparison was given of the different members of the genus, founded largely upon specimens of the three first species mentioned above. At the time only a single example of *H. signatus* was available, and only the type specimen of *H. darlingi*, obtained from Rhodesia, and now in the British Museum, is yet known. Recently I have received from Namaqualand a series of 34 specimens of *H. signatus*. Most of these I owe to the kindness of Mr. W. B. Magennis, C.C. & R.M. of Springbokfontein, and a few to Mr. J. B. Cunningham, formerly Principal of the High School at O'okiep. At first sight the coloration of *H. signatus* differs so greatly from that of the other species as to suggest for it an independent origin, but a close study reveals that it is possible to establish within the genus an almost continuous series of stages from the simplest to the most complex colour pattern; moreover, the very important fact is disclosed that in the colour varieties of *Homopus* we have the explanation to the colour patterns of all the other species of South African tortoises, so that, despite great apparent differences, they can all be understood in terms of one another.

The colour pattern of the shell of the *Homopus* tortoises is throughout dependent upon two sources of colour: 1. The general ground colour, which is that of the horny material of the shields, and is nearly always a light yellow; 2. A superadded pigment, nearly always dark brown or black. The actual colour pattern arrived at in any specimen is determined by the relative proportions of these two and their distribution as regards one another. Within limits the ground colour varies considerably. Usually it is a light straw colour, but may be different shades of yellow, brown, or olive; these are generally uniform in any one specimen, and therefore never produce any pattern. The melanic pigment is always conspicuous compared with the lighter ground colour, and varies in intensity from reddish or dark brown to black. The ground colour may be regarded as the natural colour of the horny material modified by the bony plates which it overlies, while the black or dark brown is derived from pigment formed in the Malpighian layer, and masks the ground colour where it diffuses into the horny shields. A certain fading of the colours is observable in most museum specimens when compared with those of fresh or living shells; also, owing to the fraying of the superficial layers of the horny material, the shields of old specimens rarely show the characteristic pattern of the species.

1. Colour Patterns of the Species of Homopus.

H. boulengeri.—In this recently described species the shields of the carapace and plastron are sometimes coloured uniformly, the tint varying from a dark reddish or yellowish brown to a straw colour. This represents the ground colour, the dark pigment being altogether wanting. Frequently, however, the anterior and lateral margins of the first three or four neural shields have a narrow, well-defined black border, which may be termed the *marginal zone* (Fig. 1), and the plastral shields may have a similar black anterior border which shades off into the ground colour.

H. femoralis.—The ground colour is here a pale or dark brown on the carapace, and pale yellow on the plastron. Each shield of the carapace has usually a black or dark brown border, often better developed on the front margin (Fig. 2). The black border varies much in the extent of its development in different individuals, being altogether absent from some examples and 5 or 6 mm. wide in others. The front and lateral margins of each plastral shield have likewise a black border encroaching upon the pale ground colour for a distance which varies much in different specimens, but is always more extensive than in *H. boulengeri* (Fig. 9).

Thus in the extent of its development on all the shields the melanic pigmentation of *H. femoralis* shows a considerable advance on that of *H. boulengeri*, though evidently representing the same inherent tendencies. Further, instead of the marginal zone being continuous, it is sometimes interrupted or broken up here and there, as it were, by the intrusion of incipient yellow rays. This condition is somewhat imperfectly seen in the specimen represented in Fig. 2.

H. areolatus.—Usually the shields of the carapace in *H. areolatus*, the padlooper of the Dutch, have a dark brown or black border extending all the way round, and passing gradually into the ground colour which is yellow or olive (Fig. 3). Here, for the first time, the areola is distinguished from the general ground colour by being reddish brown, dark brown, or nearly black like the margin; moreover, the dark pigment often extends as irregular blotches into the ground colour beyond the limits of the areola. Specimens from around Cape Town are usually darker than those in the Eastern Province, owing to the greater development of the marginal and areolar pigmentation. On the plastral shields the dark colour extends beyond the anterior border to such a degree as to occupy the whole of the middle of the plastron, the sides only retaining the yellow ground colour (cf. Fig. 10). The middle dark patch is usually more intense towards the anterior border of each shield than towards the posterior border. *H. areolatus* thus shows a considerable advance on the degree and distribution of the pigmentation of *H. femoralis*. Rarely the black pigment is entirely wanting from the plastron.

H. darlingi.—This species, obtained from Mashonaland, seems to be closely related to *areolatus* as regards its coloration. The single specimen is thus described by Boulenger (1902, p. 16): "Carapace black, each shield with a yellow-brown areola; plastron black and yellow, with a median yellowish marking with dentate borders and speckled with olive grey." Judging from the accompanying lithographic figures there would appear to be in *H. darlingi* a narrow black marginal zone to each carapace shield, followed by a zone of light ground colour, and then a darker yellowish-brown areola, very likely comparable with the reddish-brown areola in *H. areolatus*. The plastral shields, however, have a dark margin all round and a lighter areola, more like those to be described in *H. signatus*. The median yellow markings on the plastron undoubtedly represent an incipient breaking up of the black margin to produce a rayed pattern, such a condition being very usual in some other South African tortoises (cf. Fig. 11). The details of this ray production usually vary greatly in individual specimens, and not much can be gathered from a single specimen.

In its colour pattern *H. darlingi*, therefore, offers no features which do not occur in other members of the genus, but their full genetic value can scarcely be determined without a number of specimens for comparison.

H. signatus.—The marked feature of the coloration of this species is the intense degree to which the black pigmentation is developed, and the great variation in its inter-relationships with the ground colour (Figs. 5 and 6). On the shields of the carapace the marginal black zone is usually distinct, and is everywhere very broad, extending almost as far as the areola. Usually, however, a narrow zone of ground colour intervenes between the black border and the areola, though broken up by irregular spots of pigment derived from both the border and the areola. The areola is occupied by a black patch generally broken up into irregular blotches or nearly circular spots, and proliferations from it pass into the ground colour beyond. The black outer border of the shields is rarely continuous, but is interrupted or broken up by invasions of the ground colour. In the most marked instances the breaking up takes place by the introduction of the yellow ground colour either in the form of narrow, continuous, wedge-shaped areas, or of irregular patches of yellow. In the first case a rayed arrangement is produced, and in the second a blotchy or spotted appearance (cf. Figs. 5 and 6). Between the typical examples of each are many intermediate stages in which neither the one feature nor the other is specially pronounced.

Whether the general appearance of the shell is light or dark is very much determined by the extent to which the zones of melanin are broken up by the light ground colour, and, according to the manner in which this takes place, the resulting pattern is rayed or spotted.

The black pigmentation is also strongly developed all round the shields of the plastron, sometimes to such a degree that scarcely any of the ground colour is visible. The areolæ, however, usually show a little of the latter. Furthermore, in many instances the black colour reveals the early stages in the breaking up to form either rays or irregular spots, though never with such definiteness as to produce a regular pattern.

Thus in its coloration *H. signatus* differs from the other species of *Homopus* in that the black pigmentation is very strongly developed, but this proceeds along lines already indicated in the less pigmented forms; and further, the pigmentation has been much broken up by the intrusion of the ground colour, so as to give rise to rays or spots.

Comparing all the species of *Homopus* they reveal a very distinct gradational series as regards the extent to which the melanic pigmentation is developed, a series extending from forms in which the pigment is altogether wanting to others in which it occupies nearly the whole shell; moreover, we pass from species in which the ground colour and pigment are in continuous concentric zones to others in which the two are so inter-related as to produce a radiate or spotted pattern. These stages will be more clearly understood from the text-figures on page 79 and their explanation.

2. The Constituent Elements of the Colour Patterns.

The origin and nature of the various colour patterns can be best understood by resolving them into their fundamental constituents and noting the changes which these undergo.

Marginal zone of pigment.—Starting with *H. boulengeri*, we find the carapace shields are either devoid of any dark pigmentation or only three or four of the neural shields have a very narrow black border on their front and lateral margins (Fig. 1). In *H. femoralis* specimens are very rare in which the dark colour is altogether wanting; usually it is present as a dark border of varying width on all the shields (Fig. 2). The same marginal zone is present on all the shields in *H. areolatus* (Fig. 3), while in *H. darlingi* it has evidently become somewhat broader.

In *H. signatus* the marginal zone is nearly as wide as the entire shield with the exception of the areola, and usually preserves its identity even when more or less broken up into rays or blotches (Figs. 5 and 6).

Thus as regards the marginal zone of pigmentation a complete gradational series can be established among the species of *Homopus*. First a narrow border occurs on only a few of the shields, better developed on the front margin; then it is present on all the shields, and, at the same time, a little wider; and ultimately it becomes so broad as to occupy practically the whole shield with the exception of the areola.

In its typical condition the marginal zone is continuous, but everywhere we find a tendency for it to be interrupted transversely by the intrusion of the yellow ground colour[1], either in the form of definite rays or irregular patches: even where the border is very narrow, as in *H. femoralis* (Fig. 2), interruptions are occasionally seen, and they become a conspicuous feature in *H. signatus* (Fig. 6). The definite breaking up of the continuous marginal zone into rays or spots is to be regarded in the light of a further differentiation of the colour pattern. Both ontogenetically and phylogenetically it bears this significance.

Areolar patch.—On its first appearance the areolar pigmentation is fully developed, and is altogether distinct from the marginal zone. It is wholly wanting in *H. boulengeri* and *H. femoralis*, but appears as a single well-developed patch in *H. areolatus* (Fig. 3), a little larger or smaller than the areola itself; this is probably also its condition in *H. darlingi*. In *H. signatus* the single patch is nearly always broken up into several rounded or irregular spots by the presence of the yellow ground colour, exactly as takes place in the marginal zone (Figs. 5 and 6).

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[1]Though the interruptions are spoken of as an intrusion of the yellow ground colour it is obvious that it is only an absence of the black pigment which admits of the yellow rays or spots appearing. The pigment is produced at intervals instead of continuously. These may possibly represent original centres of proliferation, but the evidence seems to favour the continuous zone as being more original.

Intermediate zone of ground colour.—Between the marginal zone and the areolar patch there occurs everywhere a zone of ground colour, which in some species remains altogether free from black pigment, but in *H. signatus* is invaded by irregular spots. These are evidently of a double origin, being continuations of the marginal zone and of the areolar patch. In specimens of *H. areolatus* irregular proliferations from the areolar patch are frequently seen, and from their appearance it can readily be understood how they become detached and then appear as circular or irregular independent spots; similar offshoots, as it were, are found in *H. signatus* extending from the marginal zone and exhibiting all stages in detachment.

When closely analysed the varieties in the colour pattern of the shields ot the plastron are found to be of the same nature as those of the carapace shields, but are somewhat obscured owing to the excentric position of the areola. From the position of the areola the gular, humeral, femoral, and anal shields represent morphologically little more than a quadrant of the neural and costal shields, and the pectoral and abdominal shields a little more than half of those shields in which the areola is in the middle. In making a comparison of the colour pattern of the plastron allowance must be made for this structural difference in the value of the shields.

As regards the black pigmentation of the plastron we start with a stage in which it may be altogether wanting (some *H. boulengeri* and *H. femoralis*), and pass to others in which it occurs only as an anterior dark border to the shields, varying much in width (some *H. boulengeri* and *H. femoralis*, Fig. 9); in some *H. femoralis* it may be present over both the anterior and outer borders of the shield. Next the pigmentation extends from the anterior border to such a degree as to occupy the whole of the middle part of the plastron, the ground colour showing only along the outer border (*H. areolatus*, cf. Fig. 10); finally the chromatophores form a broad black zone all round the shields and begin to break up into rays or spots (*H. darlingi*, *H. signatus*).

Stages similar to those on the carapace and plastral shields occur on the marginal shields, the dorsal half of which corresponds with somewhat more than a quadrant of a neural or costal shield, and the ventral half with another such quadrant. The dorsal half of the marginals follows approximately the colour transformations of the carapace shields and the ventral half those of the plastral shields.

3. Comparison of Colour Patterns in Homopus with those of other South African Tortoises.

In addition to the *Homopus* series of tortoises, South Africa possesses a remarkable group of rayed tortoises, known as the *geometrica*-group, from its first described member, *Testudo geometrica*, 1766. The group at present includes ten described species, though the standing of some of these is very doubtful, five having been founded on single specimens. Besides the *geometrica* tortoises, two very different forms, *Testudo angulata*, Schweigg. 1814, and *T. pardalis*, Bell, 1828, are also very common. While each species of *Homopus* and of the *geometrica*-group respectively has a very restricted distribution over South Africa, with scarcely any overlapping, *T. angulata* and *T. pardalis* are very widely distributed, and to a large extent occupy the same areas. The interpretation of the colour pattern elaborated above from a study of the *Homopus* tortoises serves as the key to the coloration of these other forms, and it will be found that the tendencies exhibited by the most differentiated of the *Homopus* species reach their fulfilment and are still further emphasized in certain of these other species. As before, we are concerned with a light ground colour characterised by various shades of yellow to which is superadded a dark brown or black pigment.

Testudo angulata.—The colour pattern of *T. angulata* is of a comparatively simple type, and is subject to only slight variations. The neural and costal shields have a broad black marginal zone all round, followed by a zone of yellow ground colour, while the areola is largely occupied by an irregular black patch (Fig. 4). The outer melanic border manifestly corresponds with the pigmented marginal zone developed to a greater or less degree in all the species of *Homopus*, and the black areolar patch with that in *H. areolatus* (cf. Text-fig. 3, p. 73). Indeed, analysed in this way the colour pattern of *T. angulata* is closely comparable with that of *H. areolatus*, the great difference being in the broader marginal zone of the former. Likewise, as in the various species of *Homopus*, the black marginal zone in *T. angulata*, instead of being continuous, is in places broken up by yellow rays. A few of these are clearly shown in Fig. 4, and in other specimens they are frequently wider and more numerous. The yellow rays occur on only a few of the shields, and are never constant in character nor very plentiful on any one shield; they represent the same incipient tendency to a rayed condition better seen in *Homopus* (Fig. 6), and which, as will be shown, becomes a highly characteristic feature of the tortoises included in the *geometrica*-group (Fig. 8). In *T. angulata* the marginal zone and the areolar patch never show any spotted tendency like that found in some *H. signatus* (Fig. 5).

The plastron in *T. angulata* is usually black along the middle and yellow at the sides, exactly as in *H. areolatus* and *T. tentoria* (cf. Fig. 10), and a tendency to a rayed condition is feebly manifest in some examples.

Thus no new type of colour pattern is introduced in *T. angulata*. Its concentric plan of coloration admits of the closest comparison with one or other of the stages occurring in *Homopus*. The presence of rays here and there, both on the carapace and plastron, reveals an incipient innate tendency to the formation of the rayed type of coloration, which, however never proceeds so far as in *H. signatus*. In specimens from the Western Province of Cape Colony the ground colour of the plastron is often diffusely reddish.

Testudo pardalis.—The leopard tortoise, or berg schildpad, extends over practically the whole of the continent of Africa, as Siebenrock (1906a) has lately shown, and is everywhere very uniform as regards its colour pattern. On the carapace this consists of a yellowish ground colour with irregular black patches or spots, having a faint tendency to a zonary and rayed disposition, especially in young specimens; a black continuous marginal zone is sometimes seen in half-grown specimens, though frayed in an irregular manner (Fig. 7). The plastron is of the same spotted character as the carapace, but not infrequently the black pigmentation is wholly or largely wanting. Siebenrock (l.c., p. 7) finds that specimens north of the equator are a brighter colour than those south of it, fewer black spots being present on the former than on the latter.

The stages in the differentation of the colour pattern represented in many specimens of *H. signatus* accurately illustrate how the spotted type of *T. pardalis* has been evolved (cf. Figs. 5 & 7). The black margin and areola of *H. signatus* and others have been completely broken up in *T. pardalis*, and in such a manner as to produce irregular patches. All stages in this breaking up are represented in *H. signatus* from a continuous black margin to one with irregular spots; similarly in some specimens of *T. pardalis* the rayed arrangement is still manifest (Fig. 7), while in others it is practically obliterated. Thus the adults of the latter species have reached a permanently spotted condition such as is represented in a less perfect condition in many of the specimens of *H. signatus*; the various stages in the differentation of the latter give us the explanation of the usual condition of the former.

That such is the phylogenetic value of the spotted pattern in *T. pardalis* is further borne out by its early stages of growth. Very young specimens (3-6 cm. long) have a black margin, without any trace of discontinuity, followed by the intermediate zone of light ground colour; the areolar ridge is also bounded by a very narrow black border, enclosing one or two large well-defined areolar spots, the border and the spots perhaps representing the entire areolar patch. This zonary type of colour pattern has been found to be characteristic of the less differentiated species of *Homopus*, and also of *T. angulata*, and we now find it appearing in the early stages of growth of *T. pardalis* whereas older specimens are almost uniformly spotted. Similarly the shields of the plastron in very young shells have a black marginal zone, though the plastron of the adult is spotted. Siebenrock (l.c., p. 8) gives a figure of the carapace of a young shell (54 mm.) at this stage, showing very distinctly the zonary type of pigmentation, but wanting the areolar spots of the South African specimens. These and many other details characteristic of the young shell are shown in Fig. 7, taken from a specimen 9 cm. long.

Thus in the ontogeny of its colour pattern *T. pardalis* closely reproduces its phylogeny as here elaborated; it begins with a zonary pattern which becomes transformed into a spotted pattern. Young specimens of *H. signatus* exhibit the same changes though to a less degree. In the early stages of their colour pattern one can scarcely distinguish between specimens of *H. signatus* and *T. pardalis* though so highly distinctive in the adult.

Geometrica-group.—The *geometrica*-group of South African tortoises includes a highly characteristic series of closely allied species, the carapace shields of which are black or dark brown and provided with numerous yellow rays (Fig. 8). The rays usually extend all the way from the margin of the shield to the central areola, and vary greatly in number and general arrangement. From the ten different species of the group a continuous series can be formed showing how from an irregular disposition of the rays, all of equal value, we reach a complicated geometrical pattern with the rays divisible into primaries, secondaries, and sometimes tertiaries. In the most highly differentiated colour patterns the rays of one shield are arranged so as to correspond with those of adjacent shields, and thereby give rise to a more definite pattern for the shell as a whole. The irregular series of rays is found in *T. tentoria* (Fig. 8), and they reach their highest elaboration in *T. oculifera* (cf. Text-figs. 5 and 6).

Similarly with the plastron. In *T. tentoria* (Fig. 10) the middle is occupied by a continuous black patch and the sides are of the yellow ground colour just as in *H. areolatus* and *T. angulata*; from this we can pass through a complete series of stages in which the middle black patch breaks up into rays, new rays appear on the yellow sides (Fig. 11), and all ultimately become arranged in a complex geometrical pattern over the whole plastron, as in *T. oculifera* (Fig. 12). In the plastron, as in the carapace of the more differentiated *geometrica* tortoises, the rays of one shield come into correspondence with those of adjacent shields, and thereby tend to produce a more perfect symmetrical pattern like that shown in Fig. 12.

The whole question of the transformation of the colour pattern in the *geometrica*-group, from irregular rays to a definite pattern, has been worked out in detail in a paper shortly to be published, but written before the supplementary significance of the colour patterns in the *Homopus*-group was understood. The object at present is to show how the completely rayed pattern of the *geometrica*-group has been derived from the concentric pattern of the *Homopus*-group.

In the *geometrica* tortoises the black marginal zone of *Homopus* has increased in width to such a degree that it now occupies the whole extent of each shield, with the exception of a small area of ground colour in the middle of the areola. The breaking up of the black border into rays, found to be incipient in most species of *Homopus* and in *T. angulata*, has likewise extended over the whole width of the shield, and has become a fixed characteristic feature of *geometrica* and its allies. The rays are, however, constituted on exactly the same plan as those imperfectly indicated on certain specimens of *H. signatus* and *T. angulata*. Conditions like those represented in Figures 2, 4, 6, and 8 afford the clearest clue to the constitution of the rayed pattern of the *geometrica* type, and demonstrate there can be no question that we are correct in interpreting the rayed shields of the *geometrica* tortoises as foreshadowed by the incipient rays in various forms of *Homopus* and in *T. angulata*.

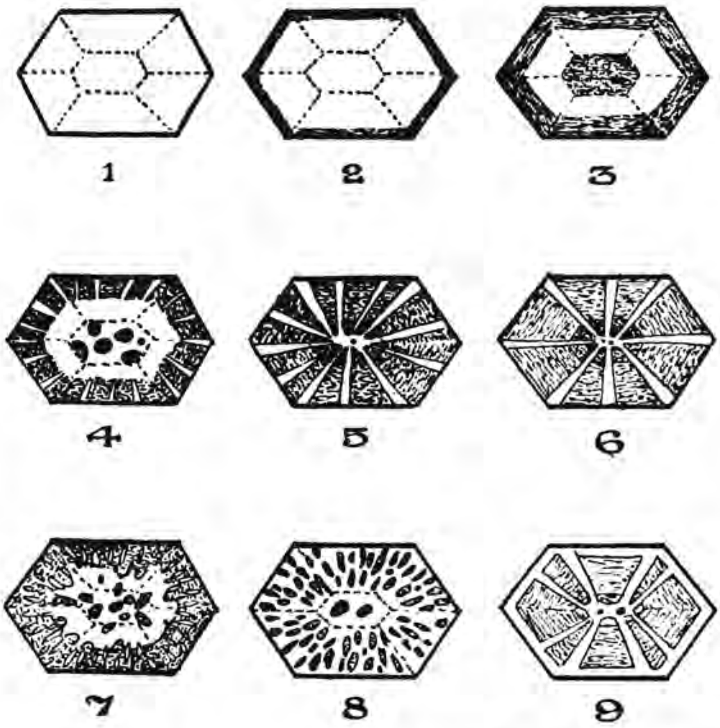
One of the characteristic features of the less differentiated forms of the *geometrica*-group is the strongly knobbed carapace, each of the neural and costal shields forming a well-developed conical upgrowth, as shown in *T. tentoria* (Fig. 8). This knobbed character is also suggested by many of the more differentiated specimens of *H. signatus* (Fig. 6), which thereby afford a clue to the origin of a feature hardly otherwise explicable.

Pyxis arachnoides and Testudo radiata.—In a recently issued paper, "Schildkröten von Ostafrika und Madagaskar," Professor F. Siebenrock (1906) has described and given numerous photographic illustrations of colour pattern variations met with in *Pyxis arachnoides*, Bell (Figs. 1 to 11), and *Testudo radiata*, Shaw (Figs. 12 to 16). Both of these belong to the rayed type of tortoises, and present some extremely interesting stages in the evolution of the colour pattern, all of which can be understood on the explanation here advanced. In these two species the rayed character has evidently not become so fixed and constant as in the *geometrica* allies. The specimens of *Testudo radiata* represented in Siebenrock's figures 12 and 13 have but few more rays that are occasionally met with in the South African *T. angulata* (Fig. 4), while in the others (Figs. 14 to 16) they are very numerous, but show little regularity in arrangement compared with the fixed disposition of the rays of the more differentiated members of the *geometrica*-group. They are evidently at about the same indefinite stage as are the rays in *T. tentoria*.

The specimens of *Pyxis arachnoides* are further interesting as revealing all stages in the development of a yellow border of ground colour at the outer margin of the shields, especially pronounced on the border of the costal shields adjacent to the marginals (Text-fig. 9). This is a character which is rarely represented in any of the South African forms available, but occasionally appears in *T. angulata*; it is probably to be associated with the previous observation of Siebenrock that the more northern forms of some African tortoises are usually less pigmented than those further south. The other details in *P. arachnoides* present no new features.

4. Types of Colour Pattern.

Comparing all the forms hitherto noticed, four chief types of colour pattern are distinguishable, connected however by intermediate stages. 1. *Uniform coloration*: In this the shell shows only the ground colour, the melanic pigmentation being wholly absent. Examples are certain specimens of *H. boulengeri* and *H. femoralis*. No South African species of tortoise is known in which the reverse condition takes place, that is, where the ground colour becomes wholly masked by the black pigment. 2. *The*



SINGLE SHIELDS OF THE CARAPACE SHOWING IN A SCHEMATIC MANNER THE VARIOUS TYPES OF COLOUR PATTERN.

1. The entire shield, including the central areola, shows the ground colour without any melanic pigmentation. Occurs in the costal shields of *H. boulengeri*, and one or two of the posterior neural shields.

2. A marginal zone of pigment of varying width, which may be continuous, as here represented, or interrupted transversely by the ground colour. Found in *H. femoralis*, and in most of the neural shields of *H. boulengeri*.

3. The marginal pigmentation is broader, and the areola is also pigmented, leaving an intermediate zone of ground colour between. Characteristic of *H. areolatus*, *T. angulata*, and probably *H. darlingi*. The continuity of the marginal zone may be interrupted transversely by the ground colour, and the areolar patch may be smaller or larger than the areola.

zonary or concentric pattern : In this type a black marginal zone is followed by a zone of lighter ground colour, and this may or may not be followed by a dark areolar patch. The zonary pattern is found in most *H. boulengeri* and *H. femoralis*, *H. areolatus* and *H. darlingi*, some *H. signatus*, *T. angulata*, and the young of *T. pardalis*. 3. *The rayed pattern* : The black pigmentation is here broken up by rays of ground colour. It is incipient in *H. femoralis*, *H. signatus*, and *T. angulata*, fully developed in *Pyxis arachnoides* and *T. radiata*, and throughout the *geometrica*-group. In the extreme members of the last group the rays of different shields correspond so as to give rise to a more or less definite pattern for the carapace or plastron as a whole. 4. *The spotted pattern* : This occurs in some *H. signatus*, and in all mature *T. pardalis*. While each species in the main conforms to one of the above types it usually shows an incipient tendency towards the others ; in the zonary type, for example, we have suggestions of the radiate and the spotted conditions.

4. The marginal zone is broken up into rays by the ground colour, and the areolar patch into round or irregular spots. Certain specimens of *H. signatus* (Fig. 6).

5. The marginal zone is rayed, and has enlarged so as to occupy the whole shield, its rays extending to the areolar There is no regularity in the disposition of the yellow and black rays. Occurs in certain members of the *geometrica*-group, e.g. *T. tentoria*.

6. Same as 5, but the rays of ground colour are arranged in a definite manner, four primaries at the principle angles, and four secondaries alternating; rays of a lower order, tertiaries, may also be present. Characteristic of the more differentiated members of the *geometrica*-group, e.g. *T. fiskii*, *T. oculifera*.

7. The marginal zone and areolar patch are broken up into irregular spots or patches by the ground colour. The intermediate zone of ground colour is also invaded in an irregular manner. Found in certain specimens of *H. signatus*.

8. The shield is now more or less uniformly spotted, and all indications of the marginal zone and areolar patch have disappeared. Found in mature specimens of *T. pardalis* and certain species of *H. signatus*, (cf. Fig. 5).

9. A stage much like 6, but having a marginal zone of ground colour. Occurs in *Pyxis arachnoides* and rarely in *T. angulata*.

The four different types of pattern differentiation receive their explanation in the various stages occurring within the *Homopus*-group. In the genus we have revealed the elements which enter into the production of the different patterns, and how they may give rise to the zonary, spotted, or radiate condition. In the single species, *H. signatus*, we have suggestions which help us to understand how the extremes—the zonary type of *T. angulata*, the spotted type of *T. pardalis*, and the radiate type of *T. geometrica* —are produced. All the South African species of tortoises represent one or another stage in the evolution of these colour patterns, showing that they are genetically connected. No new type of pattern differentiation is anywhere introduced, but all indicate responses to a common internal directive tendency or force, continued further in some than in others.

5. Phylogeny and Ontogeny of the Colour Patterns.

Dr. H. H. Newman (1906), in a paper on "Abnormalities" in the scutes and plates of Chelonia, has given a brief consideration to the colour patterns in certain fresh-water tortoises (*Chelydra*, *Graptemys*), and has attempted to show that the patterns are intimately associated with the scutes (shields) and throw much light on their phylogeny. Going back to primitive conditions in the evolution of the Chelonia he states : "Evidence is not lacking that points to an original striped condition of the chelonian carapace. The neck and tail of most tortoises show characteristic stripes, which on careful examination may be analyzed into rows of scales with similar coloration. When the scales are large enough, it will be seen that each has a centre of pigmentation coinciding with its centre of growth. Now the coloration of the carapace and plastron is nothing more than a series of scales or scutes, each with its pigmental centre. The stripe effect is lost through the great increase in the size of the scute and the consequent separation of the centres of pigmentation.

The pigmentation of scutes is typically concentric in character."

According to Newman, the coloration in embryos of *Chelydra* consists of a distinct patch of melanin pigment at the tip of the tubercular processes of the keels of the carapace shields, and the marginals are marked with small black spots at the posterior edge of each shield, while specimens a year or two old have a radiating pattern with the centre of pigment proliferation at the keel. Older embryos of *Graptemys* have, at first, one dark spot at the median posterior margin of each shield. Later on two or more other spots are produced in very definite positions on the various scutes, and all develop into concentric ocellated markings, the ring being formed by repeated splittings of the innermost ring of pigment. Newman then proceeds to show that the primary ocellated spots denote centres of dermal ossification, and therefore they may be assumed to represent the location of scutes which formerly occupied the position now occupied by the pigment spots. Each plastral shield has also its ocellated spot.

For the present paper the interest in Newman's results lies in the fact that he finds the pigmentation to commence at a single spot for each shield, and that this spot is situated towards the posterior border of the shield. These results do not admit of application to the series of South African tortoises here studied, and it will no doubt become a very important question to determine how far the phylogeny of the coloration of a species is represented in the individual development.

Two young specimens of *H. femoralis*, 33 mm. and 37 mm. in length respectively, show no melanic pigmentation whatever on the carapace, but the larger shell has a dark anterior area on the plastral shields. Thus the dark marginal zone characteristic of the carapace shields of the species does not necessarily appear until somewhat late in growth, though the plastral pigmentation appears early, and further, there is no hint of any pigmentation which disappears during the early stages in ontogeny, such as might well have been expected in a form so deficient in pigment in the adult had the phylogenetic loss been recent.

In a newly-hatched specimen of *T. angulata*, only 33 mm. long, the areolar boundary ridge is alone pigmented, continuous in some shields and interrupted in others, and the central areolar patch is wanting. The plastral pigmentation is developed almost as in the adult. In a specimen a little older (50 mm.) the pigment has almost disappeared from the areolar boundary, but assumes a continuous black margin beyond, that is, on the first growth ridge; the middle of the areola is faintly melanic, and the plastron is pigmented as in an adult. In a third example (57 mm.) the pigment has practically disappeared from the areolar border, and largely so from the next growth ridge, and to a certain extent from the third, the rest being black. The middle areolar patch is feebly developed.

Thus the pigmentation in the carapace shields of *T. angulata* begins with a black areolar margin, and the new growth ridges as formed are also pigmented. With the increase in size of the shields the pigmentation disappears from within outwards, until the areolar boundary and the first two or three growth ridges show little more than the yellow ground colour. The areolar patch appears late, and is not always developed. At its earliest stage the marginal zone may be interrupted by a few yellow rays such as occur in the adult (Fig. 4).

Young specimens of the leopard tortoise, *T. pardalis*, exhibit very considerable differences in their colour pattern when compared with the adult. In a shell only 50 mm. long, each shield has developed a narrow, continuous, extra-areolar black border, representing about a year's growth. The areola proper is mostly of the yellow ground colour, but on the inner surface of the areolar ridge is a thin black band independent of the black margin beyond, also one or more well-defined, nearly circular pigment spots occur, usually detached from the narrow black band, but in other cases continuous with it; the costal plates have generally one to three central spots, while the neural have two, rarely more. Siebenrock (1906, p. 8) gives a figure representing this stage, but in his specimen the areolar spots are altogether wanting. The specimen here represented in Fig. 7 is 9 cm. long, but still retains the central areolar spots and the areolar black band. The areolar pigment band and spots both persist for some time, but disappear later, and the extra-areolar marginal zone becomes broken up into irregular patches and spots, which, however, give evidence of their zonary origin until the shells are 10 cm. or more in length (Fig. 7). The shields of the plastron have also a faintly pigmented areolar boundary and a strongly pigmented outer border, denser on the anterior border as in the adult forms of other species already described; later these continuous pigmented boundaries also become broken up into the irregular patches of the adult.

Thus in the early stages of its growth *T. pardalis* presents a wholly different type of colour pattern from the adult. The young shell exhibits the zonary or concentric plan, while the adult is spotted, thereby indicating that the spotted type is a later differentiation both phylogenetically and ontogenetically. The areolar spots do not represent proliferating centres of pigmentation, for they are seen to be derived from the marginal band, and moreover, are frequently wanting and disappear early. Here, as elsewhere, the marginal zone is the most important element of the colour pattern.

In their fundamental plan the early growth stages of *Homopus signatus* very closely compare with those of *T. pardalis*, but the pigmentation is everywhere better developed, and might tend to obscure the real conditions were it not for simpler conditions elsewhere. In one specimen of *H. signatus*, 38 mm. long, the areola of each shield has four or five more or less distinct circular spots, recalling those of *T. pardalis*, and, as in that species, the areolar ridge has a narrow continuous pigmented band on its inner border. Then follows the light, but spotted, middle and outer part of the areolar ridge passing into a more or less continuous dark zone beyond, in this specimen hardly yet represented by a definite growth ridge. Mature specimens of *H. signatus* differ from the young mainly in losing the areolar band and in the greater width of the marginal zone; the latter may remain a continuous zone, but is more frequently broken up into spots or rays in a somewhat irregular manner as in Fig. 5.

As regards the different members of the *geometrica*-group, a number of young specimens, about 40 mm. long, are available, giving the early stages in the differentiation of the colour pattern. Without going into minute details and differences, in may be said that the young shells reveal in an incipient manner what the pattern of the adult will become. In none is the black marginal zone continuous, but is already intersected by the yellow rays which are such a marked feature of the adult; moreover, the pigmentation of the marginal zone extends radiately in a continuous manner as far as the areola, and even for some distance over it. Thus the long black rays of the adult throughout their length are to be considered as continuations of the marginal zone, not as a combination of the marginal and areolar pigmentation as may have been supposed. The middle of the areola reveals the yellow ground colour to a much larger proportion than does the adult, but shows no independent black spots; the areolar margin is invaded by the pigmentation of the marginal zone except where crossed by the yellow rays. In the adults of certain of the *geometrica* tortoises the middle of the areola has one or more small black spots, which have often been regarded as of specific value. The early stages show that these spots merely represent parts of the original black zone which have been cut off, as it were, by the yellow rays meeting one another in the areola; hence they do not indicate separate centres of pigmentation such as are found elsewhere, and vary much on the different shields, even of the same individual.

Young specimens of the *geometrica*-group therefore do not represent phylogenetic stages in the colour pattern to any marked degree; the earliest pigmentation displays the general plan which will be represented by the adult. Fundamentally, however, this early plan is practically the same as that found in other South African tortoises, namely, a black margin broken up by yellow rays; the only difference is that the yellow rays are more numerous and constant, and the rays of the black marginal zone produced thereby extend continuously on to the areola. The tendency to the production of rays, though often incipient, is evidently a very deep-seated character in all South African tortoises, occurring in practically all the species, and from the earliest stages. In *H. femoralis* (Fig. 2) a few yellow or black rays are present, but do not extend beyond a very narrow marginal zone; in *H. signatus* (Fig. 6) they are inconstant and extend over a rather wide marginal zone; in *T. angulata* (Fig. 4) they are few in number, and extend nearly to the areola; while in the *geometrica*-group they pass on to the areola and give the characteristic rayed pattern (Fig. 8).

From the foregoing it will be seen that the earliest stages of the melanic pigmentation reveal very little which can be considered as throwing light upon the phylogeny of the colour pattern. In every case we start with a black marginal zone, either uniformly developed all round the shield or more prominent on the anterior border, and, from the beginning, the marginal zone is either continuous or broken up into rays, indicating whether the dominant colour pattern of the adult will be zonary or rayed. *T. pardalis* is the only species which in the ontogeny of its colour pattern passes through well-defined phylogenetic stages, for here the early stages conform to the primary zonary type, and only later become transformed into the spotted type; the zonary or concentric type and the rayed type retain their own plan from the beginning, the growth changes being of comparatively small amount. The areolar patch is evidently not a very fundamental part of the colour pattern of the South African tortoises. It occurs at its maximum in *H. areolatus*, but very early stages are not available showing its manner of development; it is much broken up by the ground colour in *H. signatus* and in some *T. pardalis*, and is altogether absent from *H. boulengeri*, some *T. pardalis* and *T. angulata*, and all the *geometrica* allies. The general plan of the pigmentation has reached a certain degree of fixedness in all the species from whatever locality they may be obtained, but in *H. signatus* from the one district are to be found examples of the zonary, radiate, and spotted patterns, providing the material for new and distinct types should favourable isolation step in.

The early ontogeny unquestionably indicates a community of origin of the colour pattern for all the South African tortoises, a result which was also arrived at from a comparison of the mature characters. In no way apparently do the early stages admit of comparison with those which Newman has found in the American fresh-water tortoises *Chelydra* and *Graptemys*, for here the earliest stages were represented by a single pigment patch on the posterior border of the shields, whereas in the South African forms we have a zonary disposition of the pigment, frequently best developed upon the anterior border, and either continuous or interrupted.

Similar studies on other forms will be necessary ere we can say how far the results admit of general application to the Chelonia as a whole.

6. Colour Pattern and Environment.

All the species of *Homopus* are to-day very distinct types, separated from one another by various combinations of characters other than those of coloration. The same can be affirmed of the better defined members of the *geometrica*-group, and also of *T. angulata* and *T. pardalis*. Further, the respective members of the *Homopus* and *geometrica* groups have a well-defined geographical distribution, rarely overlapping; but, on the other hand different members of the *Homopus*-group overlap different members of the *geometrica*-group, and all are completely overlapped by *T. pardalis* and *T. angulata*, both of which are practically ubiquitous in South Africa.

The foregoing sections have served to establish the common genetic nature of the coloration of all the forms considered, and it might be worth while to consider whether their later differentiations are in any way determined by the environment. Were only the *Homopus*-group to be taken into consideration it might readily be surmised that the different colour patterns were in some way adaptations to the enviroment, since, in a general way, each species occupies a restricted area with physiographic conditions different from the others. Similarly with the members of the *geometrica*-group. I have shown elsewhere that each well-marked species or sub-group, usually with a very distinctive stage in the elaboration of the colour pattern, occupies a restricted area without any overlapping, and hence the colour differentiation here also may perhaps be a response to a difference of environment. While it cannot be said that the distribution of any one species in the one group very closely corresponds with that of any one species in the other group, yet I think it may be admitted that we have the representatives of two very closely related groups, with the colour pattern built on the same fundamental type, becoming very divergent under practically the same environmental conditions. Thus *H. areolatus* and *H. boulengeri* are found along with *T. tentoria*; *H. femoralis* occurs in the same localities as *T. fiskii* and *T. oculifera*, and *H. signatus* along with a sub-species of *T. fiskii*. It would be very difficult to find tortoises with more divergent colour patterns than those here contrasted and yet existing side by side. Moreover *T. angulata* and *T. pardalis*, the adults of which are fairly divergent from all the others and also from one another, are found practically everywhere. Hence from almost every district in South Africa we get four or five species of tortoises—usually a member of the *Homopus*-group, one of the *geometrica*-group, and *T. angulata* and *T. pardalis*—all representing different colour patterns in the adult.

With such marked divergencies from a common type of coloration occurring in practically the same area, it may well be doubted whether the environment has much influence upon the pattern assumed, or whether the variations have any selective value. Were there any such selective influences at work, we should scarcely expect to get from the same fundamental conditions and under the same environment a non-pigmented type as in some forms of *Homopus*, a strongly concentric type as in *T. angulata*, a conspicuously radiate type as in the *geometrica* series, or a spotted type, transforming from a zonary type, as in *T. pardalis*. Rather, I am prepared to believe that the many divergencies represent responses to directive forces inherent in the organism itself, and are to a large extent uninfluenced by external forces.

If the species is the result of the interaction of its hereditary tendencies and its environmental forces, as is most generally assumed, these two must play very disproportionate parts in the various forms of tortoises here considered. *T. pardalis* and *T. angulata* show remarkably little variation over the whole subcontinent of South Africa; in both species practically perfect uniformity persists in spite of great diversity of environment. We may say that the inherent forces have here the same result though acting under very varied conditions or, to put it the other way, that the enviromental forces have little or no influence upon the organism. The members of the *Homopus* and *geometrica* groups on the other hand may be supposed to be much moulded by their environment, seeing that the species of each have restricted distributions which correspond in a measure with physiographic differences. But even among some of these great differences are manifest in the constancy of the specific characters. The individuals of *H. signatus*, for instance (cf. Figs. 5 & 6), even when coming from the same neighbourhood, show great differences in nearly all their characters, in addition to the marked variations in coloration ; here much diversity appears in spite of uniformity of conditions. Have we to suppose that these variations represent the inconstancy of the hereditary tendencies, or are they the result of the interaction of the minor differences in the environmental forces ? With the present data it is impossible to say, but this we can affirm that other species under exactly the same conditions show but little variation. Zoologists are prepared to admit great differences in the intensity of the hereditary tendencies in animals, and also great differences in the response of the organism to its environmental forces, and the South African tortoises afford remarkable instances of both.

7. Summary.

1. The paper contains a discussion of the colour patterns in the various species of tortoises of the genus *Homopus*, and compares these with the colour patterns of other South African tortoises. It is shown that the pattern arrived at is dependent upon the relationships of the horny ground colour of the shields and a superadded melanic pigmentation.

2. Certain members of the genus *Homopus* are devoid of the melanin; in some it occurs as a narrow marginal zone; in others as a wider marginal zone and areolar patch; and yet in others the pigmentation is broken up into irregular patches or into regular rays, thereby producing a spotted or rayed pattern. All intermediate stages are available between the various extreme conditions, showing them to have arisen by gradual modification, not by sudden transformation.

3. Several species of tortoises belonging to the genus *Testudo* show one or other of the stages represented in the genus *Homopus*. In one the zonary type is dominant, in another the spotted arrangement is presented, and in one large group the rayed type is highly characteristic, well-defined geometrical patterns occurring in the extreme members. The interpretation of the more differentiated patterns is found within the *Homopus* series, indicating a community of origin for the colour patterns of the whole of the South African tortoises.

4. The early ontogenetic stages of certain species serve to explain the phylogeny of the colour pattern, but in others the characteristics of the adult are assumed from the beginning. The spotted type is derived from the breaking up of an originally zonary pigmentation, and the radiate type from a zonary condition interrupted by rays of ground colour.

5. The studies afford little support in favour of the influence of the environment upon the colour pattern, either directly or by selection. Zonary, spotted, and radiate types are found together in almost every region, usually as distinct species, but sometimes as fluctuations of a single species. Minor modifications of a type have frequently a restricted distribution, but in the same districts are other types with different modifications.

6. Different forms differ greatly in their degree of variability of pattern, pointing either to differences in their responsiveness to changed conditions, or, more likely, to inconstancy in the hereditary tendencies. The variations indicate directive responses inherent in the organism itself rather than responses to environmental forces.

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EXPLANATION OF FIGURES.

PLATE VI.

Four stages in the zonary type of colour pattern of the carapace shields.

Fig. 1. *Homopus boulengeri.*—The carapace is uniformly coloured, with the exception of the anterior and lateral borders of the first four neural shields which have a very narrow black border, the marginal zone.

Fig. 2. *Homopus femoralis.*—The black marginal zone occurs on all the shields of the carapace, but is still narrow. The discontinuity of the marginal zone on the outer border of the costal shields is rather imperfectly shown. The number of neural and costal plates is irregular in the specimen represented.

Fig. 3. *Homopus areolatus.*—The marginal zone on all the shields of the carapace is now somewhat broader and an irregular areolar patch occurs. Between the areolar patch and the marginal zone is the intermediate zone of light ground colour.

Fig. 4. *Testudo angulata.*—The plan of coloration is much the same as in *H. areolatus*, but the marginal zone is much broader and several yellow rays are seen crossing the black zone of the costal plates.

PLATES VII.

Stages in the spotted and rayed types of colour patterns of the carapace shields.

Fig. 5. *Homopus signatus.*—The colour pattern is spotted as a result of the irregular breaking up of the black marginal zone and the areolar patch and the invasion by pigment of the intermediate zone of ground colour.

Fig. 6. *Homopus signatus.*—The colour pattern is here rayed, from the more regular breaking up of the marginal zone by wedge-shaped rays of ground colour. Many intermediate stages are available between those of Figs. 5 and 6.

Fig. 7. *Testudo pardalis.*—A young specimen, 9 cm. long. The specimen still preserves much of the zonary arrangement of the pigment of the early stages, but in places is beginning to show the spotted character of older shells The areolar spots, inter-areolar zone, extra-areolar zone, and marginal zone of pigment are clearly shown.

Fig. 8. *Testudo tentoria.*—As in other representatives of the *geometrica*-group the black marginal zone is here continued as far as the areola, and is much broken up by yellow rays which however are not as regular in number and arrangement as in some other members of the *geometrica*-group (e.g., *T. oculifera*).

PLATE VIII

Four stages of the colour pattern of the plastron.

Fig. 9. *Homopus femoralis.*—The black pigmentation occurs only along the anterior border of the plastral shields. The anal shields extend posteriorly a little beyond the underlying bony part of the plastron, and the horny substance appears more transparent.

Fig. 10. *Testudo tentoria.*—The black anterior border of each shield has extended so as to occupy the whole of the middle part of the plastron, the sides only showing the yellow ground colour. This is also the condition in most *Homopus femoralis* and in *Testudo angulata.* Many intermediate stages occur between the condition in Fig. 9 and that in Fig. 10.

Fig. 11. *Testudo tentoria var. fiskii.*—The black central patch is beginning to break up into rays, and rays have also appeared on the sides.

Fig 12. *Testudo oculifera.*—The central patch has become completely broken up into rays, those of opposite shields corresponding somewhat so as to produce a definite geometrical pattern. In a series of intermediate stages between Figs. 10 and 12, it is possible to show that the rays of Fig. 12 correspond, ray for ray, with those appearing in the breaking up of the central patch of Fig. 10.

A Giraffe from British East Africa.

BY J. E. DUERDEN, M.Sc., Ph.D., A.R.C.Sc.

(Plate IX.)

Dr. J. B. Greathead recently presented to the Albany Museum the skin of the neck and head of a female giraffe shot by him on the South bank of the Tana River in British East Africa, about 40 miles south of the Equator. The specimen has since been mounted, and is now placed on exhibition.

The identification of the species or sub-species of giraffe is a matter of no small difficulty. At one time they were all grouped together under a single species, *Giraffa camelopardalis*, and then the southern form was separated from the northern as *G. capensis*. With the acquisition of more specimens and closer study other varieties have since been described, until in a paper contributed to the Proceedings of the Zoological Society in 1904, Mr. R. Lydekker, of the British Museum, enumerates ten distinct forms, each with a separate geographical distribution, and all of which he regards as sub-species of *G. camelopardalis*. An additional form, *G. reticulata*, from Somali and Northern British East Africa, has been regarded by Mr. Oldfield Thomas as a distinct species, and, with reserve, Mr. Lydekker accepts this.

The distinctions between typical northern and typical southern forms of the giraffe are strongly marked, and are summarised by Sclater in "The Fauna of South Africa," Vol. I, p. 260. In the northern form the dark body markings are polygonal with very well-defined edges, the pale intervals becoming narrower and more defined as age advances; the legs below the knees and hocks are white; the third horn is well developed in the male. In the southern form the body markings are more blotchy, the middle being darker than the edges, and these are never really well-defined; the legs are spotted to the hoofs; the third horn merely consists of a slight hump or prominence in the males. Lydekker adds the further distinction that some of the northern forms of giraffe have the front of the face more or less feebly spotted, whereas in the southern forms it is always uniformly coloured. The southern giraffe, *Giraffa capensis*, was formerly found throughout the country north of the Orange River as far as the Zambesi, and is absent immediately north of the Zambesi, becoming fairly abundant in German and British East Africa as far as the Tana River, north of which it is replaced by the Nubian form, *Giraffa camelopardalis*. According to Mr. A. H. Neumann, in "The Great and Small Game of Africa," the Tana River is in all probability the dividing line between the northern and the southern forms.

Dr. Greathead's specimen, coming from the southern bank of the Tana River, combines in an interesting manner many of the characteristic features of both the northern and southern giraffes. Thus it has the dark, well-defined polygonal markings of the northern and the spotted legs of the southern; both the front and sides of the head are strongly spotted, a feature more usually associated with the northern form. Being a female, and in what Dr. Greathead considers to be early prime, one would not expect the third horn to be present. The peculiar feature of the individual is its very dark colour. Not only are the patches a dark chocolate brown, but the reticular spaces between, usually either white or cream, are also brown, though much paler than the patches. In fact it was the conspicuously dark colour of the animal in the distance compared with the lighter shade of its companions in the herd which induced Dr. Greathead to secure the creature, his experience as a hunter suggesting that the type was different from that usually encountered. Mr. Lydekker (p. 212) records that Sir Harry Johnson informs him that males and females of the Baringo giraffe are often so dark that at a distance they appear to be nearly black, with white bellies and legs, while one aged female appeared a uniform sepia tint.

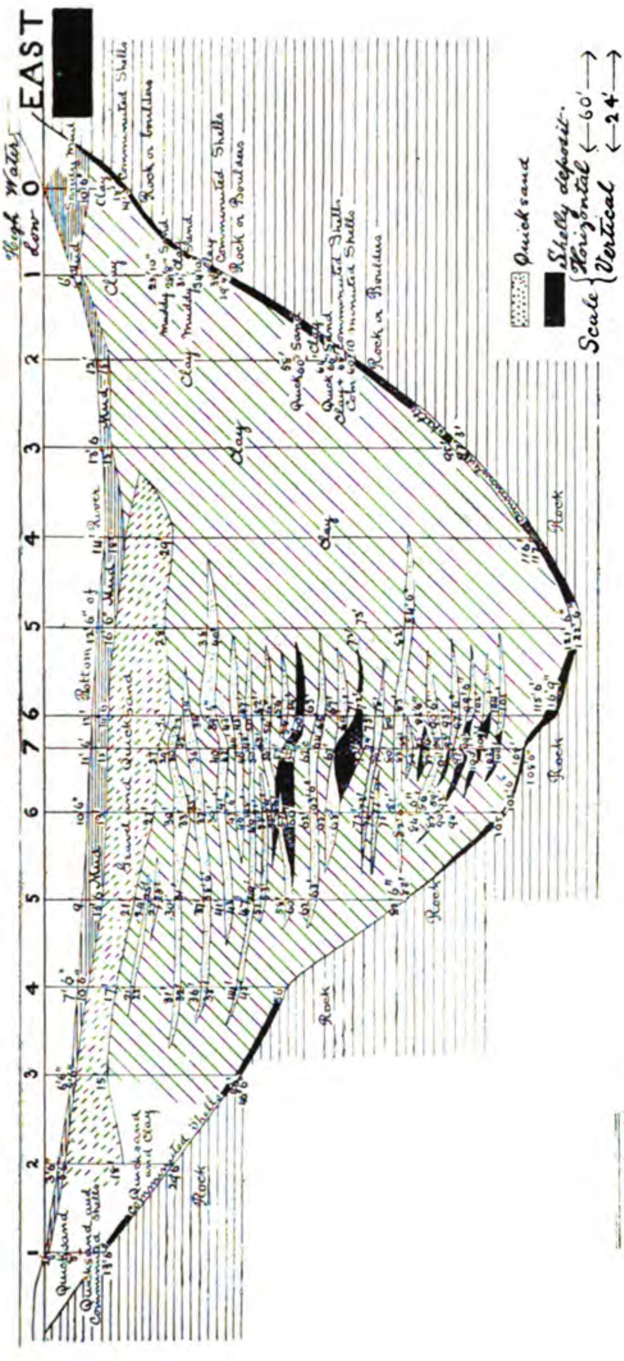
When we attempt to identify the present specimen with any of the ten sub-species recognised by Mr. Lydekker we find several differences of importance. Geographically it is most nearly related to the sub-species *Giraffa camelopardalis rothschildi*, from around Lake Baringo and Mount Elgon and *G. c. tippelskirchi* from Lake Eyassi, to the south-west of the Victoria Nyanza and westward to Mount Kilimanjaro. The Baringo giraffe is characterised by having three horns, and the sexes generally different in colour, at least in the early adult condition; the lower part of the legs is pure white and unspotted; the interspaces between the spots are yellowish fawn. In the female the spots are irregular, jagged, and star-like, reddish chestnut in colour upon a light orange-fawn ground; the light areas on the neck are wide, and the spots on the legs very small; the sides of the face are sparsely spotted. In all these details of coloration *rothschildi* differs conspicuously from the Tana River specimen.

The Kilimanjaro giraffe, *G. c. tippelskirchi*, including also the *Giraffa schillingsi* of Matschie, 1888, is described by Lydekker as a three-horned giraffe, lighter coloured than the Baringo variety, with the lower part of the legs (at least generally) more or less spotted and either whitish or olive-coloured. The spots in both sexes are very irregular and jagged in contour, often displaying a distinctly star-like shape. These characters separate the typical *tippelskirchi* from the present specimen, but the figure which Lydekker gives (Text-fig. 31) of a female Kilimanjaro giraffe mounted in the Museum at Karlsruhe, and identified by Dr. Matschie as *schillingsi*, suggests very closely the Tana River specimen. In a foot-note it is remarked that in the figure the spots on the neck appear larger and less jagged than those on the opposite side of the neck, so that these characters, considered to be of some diagnostic importance, are shown to vary even on the two sides of the same individual.

There is evidently much diversity among the individuals which Lydekker includes under the term Kilimanjaro Giraffe, as might well be expected in an area which constitutes a dividing line between at least two well-marked sub-species. It is impossible to regard the present specimen as belonging to either the southern or northern variety, but rather as combining certain of the characters of each. In the present state of our knowledge it may well be included under the sub-species, *Giraffa camelopardalis tippelskirchi*, as understood by Lydekker, with a greater tendency towards melanism than usual.

There is evidently much yet to be learned from a comparative study of the African Giraffe. If large numbers of individuals from various districts were available for study, it would undoubtedly be possible to show that the many sub-species pass into one another. Specimens from the extreme limits of range differ widely from one another, but from intermediate localities they grade into one another, as in the present instance. There are fairly definite tendencies manifest in passing from the southern to northern areas as regards details of coloration and cranial characters, affording what seem to be good instances of continuous or orthogenetic variation. The evolution of the giraffes as we know them to-day has certainly not taken place by mutation.

A thoroughly satisfactory study of the giraffe from an evolutionary or genetical point of view can only be carried out by someone on the spot, someone empowered to examine the specimens shot by the numerous hunting parties over various parts of Africa. The comparatively few specimens available in Museums little more than serve to indicate so many existent variations, not how the variations have come about. Now that the wasteful destruction of hundreds of giraffes annually is almost everywhere prohibited, and nearly all the shooting of those remaining is under Government regulation, it should not be impossible to devise means for such an investigation. In many directions Africa is proving itself most favourable for the evolutionary study of the larger forms of life.



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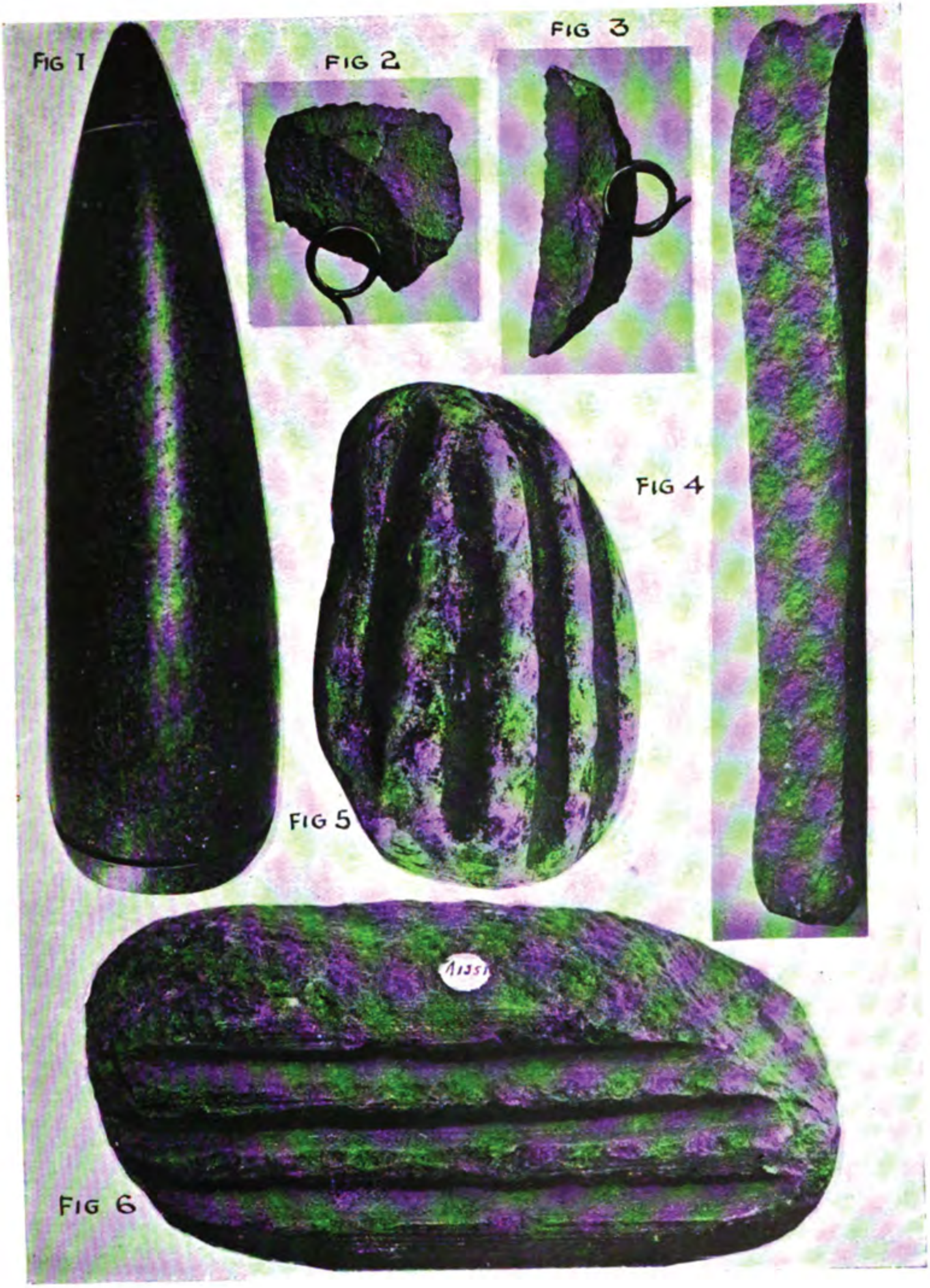
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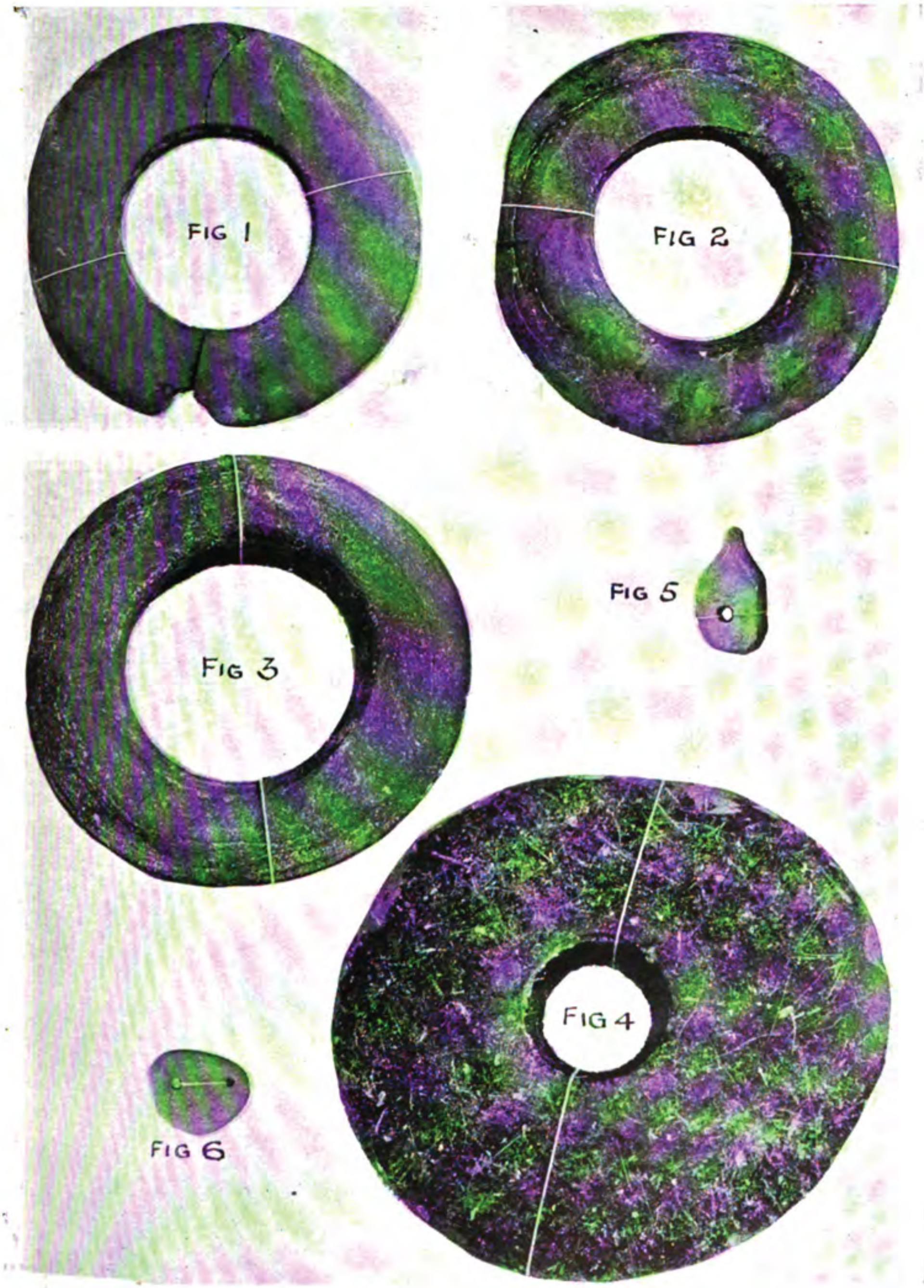
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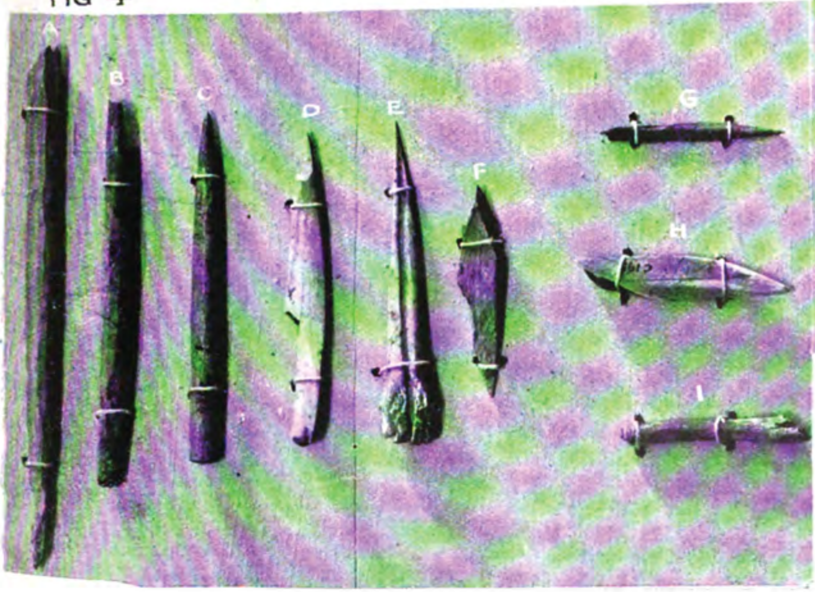

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Fig. 10.

Fig. 11.

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List of the Flowering Plants found in the Districts of Albany and Bathurst, Cape Colony.

II.

By S. SCHÖNLAND, Ph.D., Hon. M.A., Oxon.

In offering herewith the second instalment of the list of flowering plants of Albany and Bathurst I wish to acknowlege gratefully the assistance I have received (especially with many of the Monocotyledons dealt with in this instalment) from Dr. Bolus, F.L.S., and Miss Kensit, who not only revised many names in a number of difficult genera, but also named some species which I could not name at all.

In the arrangement of the Dicotyledons I am following on the whole Bentham & Hooker's system as adopted by Dr. Bolus and Major Wolley-Dod in their "List of Flowering Plants and Ferns of the Cape Peninsula" (Trans. S.A. Phil. Soc. XIV p. 207), in order to facilitate comparison both with this list and many other important publications on the Flora of South Africa.

To the first instalment have to be added on p. 47 (p. 4 of offprint): *Widdringtonia cupressoides*, Endl.—Howison's Poort and about five miles beyond Stone's Hill (on the southern slopes of the mountain). Now rather rare.

On p. 61 (p. 18 of offprint). *Disa (Monadenia) micrantha*, Bol.—Nov.—Waainek and Coldstream near Grt.

MONOCOTYLEDONES (*Continued*).

LILIACEAE.

ASPARAGUS, Linn.

1. **A. plumosus**, Bak.—Ap.—Common near Grt. and in Lower Albany.

2. **A. MacOwani,** Bak.—Albany Division, Zeyher (fide Baker in Flora Cap. VI, p. 261). Not known to me.

3. **A. subulatus,** Thunb.—Belmont Valley near Grt. (Miss M. Daly 70).

4. **A. capensis,** Linn.—Ap.—Common near Grt.

5. **A. africanus,** Lam.—Albany division, Cooper (fide Baker in Flora Cap. VI, p. 266). According to Zahlbruckner, Penther found A. *africanus*, var. *dependens*, Bak. between Grt. and Uitenhage (" Plantae Pentherianae " I. p. 14).

6. **A. retrofractus,** Linn. In a wooded kloof west of Grt. Burchell (fide Baker in Flora Cap. VI. p. 267).

7. **A. striatus,** Thunb.—Belmont Valley near Grt.

8. **A. racemoses,** Willd. var. *tetragonus*, Bak.—July—Pt. Alfred.—I have also referred to this species a plant from Grt. which is much more robust than the type (M. Daly and M. Sole 216). The cladodes are in this plant trigonous and about 3/4" long. Fruiting in July.

9. **A. sarmentosus,**Linn.—Feb.—Highlands.

10. **A. oxyacanthus,** Bak.—Fish River Valley.

11. **A. Kraussii.** Bak.—Bathurst division near Kafir Drift. Burchell (fide Baker in Flora Cap. VI, p. 272).

12. **A. medeoloides,** Thunb.—Common in bush from Grt. to Port Alfred.

BEHNIA, Didr.

1. **B. reticulata,** Didr.—Lower Albany.

DRACAENA, Vand.

1. **D. hookeriana,** K. Koch —Jan.—Common in dense bush from Grt. (Signal Hill, etc.), to Port Alfred.

KNIPHOFIA, Moench.

1. **K. alooides,** Moench.—Common on damp hillsides near Grt.

2. **K. citrina,** Bak.—Albany division; mountains north of Grt. (Baker in Flora Cap. VI, p. 278). I suspect a mistake here. There are no mountains north of Grt. in the Albany division.

(*K. Northiae*, Bak. mentioned in the Flora Capensis as coming from near Grt., does not occur here; it comes from near Queenstown.)

GASTERIA, Duval.

1. **G. nigricans,** Haw.—Sep. to Nov.—Brakkloof, Sidbury.

2. **G. variolosa,** Bak.—Sep. to Nov.—Howison's Poort, Assegai Bush, Brak Kloof.

3. **G. Beckeri,** Schönl., n. sp.—Jan., Feb.—Neighbourhood of Clumber, Lower Albany (Dr. H. Becker, F.L.S., F.S.A.). The description of this species will be found in a subsequent article in this number of the "Records."

4. **G. acinacifolia,** Haw.—Sep. to Nov.—Sandhills, Port Alfred.

ALOE, Linn.

1. **A. Grahami,** Schönl. (Rec. Alb. Mus., vol. 1, 1903).—Sep.—Probably from the neighbourhood of Grt.

2. **A. micracantha,** Haw.—Nov.—Marshy places, Howison's Poort.

3. **A. myriacantha,** R. et S.—March, Ap.—Amongst grass: Kleinemonde near Port Alfred, Grt., Highlands.

4. **A. humilis,** Mill., var *echinata*, Bak.—Aug.—Brak Kloof.

5. **A. pratensis,** Bak.—Sep., Oct.—Common in stony ground on the flats above Currie's Kloof, also above the Grt. Botanic Gardens.

6. **A. Ecklonis,** Salm-Dyck.—Jan.—Sandhills near the Kasouga.

7. **A. lineata,** Haw.—Jan. to March.—Locally common near Grt. (Grey Reservoir, above Currie's Kloof, etc).

8. **A. striata.** Haw.—July to Oct.—Near Grt. (Howison's Poort, etc).

9. **A. latifolia,** Haw. (incl. *A. Saponaria*, Haw).—Jan., Feb.—Not uncommon near Grt.

10. **A. tenuior,** Haw.—Flowers the greater part of the

year.—West Hill, Hell Poort, Fort Brown, near Martindale (Lower Albany).

11. **A. obscura,** Mill.—Nov.—A specimen in the Grt. Botanic Gardens is probably from this neighbourhood (Zeyher found it between Coega and the Sunday's River).

12. **A. ciliaris,** Haw.—Nov.—In fairly open bush near Grt. and in Lower Albany.

A. ciliaris, Haw, var. *Tidmarshi*, Schönl. (Rec. Alb. Mus. I, 1903).—Nov.—Fairly common near Grt. and at Port Alfred.

13. **A. succotrina,** Lam.—(= A. *pluridens*, Haw).—May to July.—Grt. flats and in Lower Albany.

14. **A. speciosa,** Bak.—Sep.—Hell Poort and Kowie Bush.

15. **A. ferox,** Mill.—May to Sep.—Common near Grt.

16. **A. africana,** Mill.—May to Nov.—Common near Grt. and through Lower Albany to near sea-level.

APRICRA, Willd.

1. **A. deltoidea,** Bak.—Hell Poort (Bolus 2687, fide Baker in Flora Cap. VI., p. 331). Not seen by me and not represented in Herb. Alb. Mus.

2. **A. spiralis,** Bak.—Oct.—Fish River Randt.

HAWORTHIA, Duval.

1. **H. Reinwardti,** Haw.—Oct. Common on dry hillsides near Grt.

2. **H. translucens,** Haw.—Fish River Randt, Howison's Poort.

3. **H. cymbiformis,** Haw., var.—Jan.—Near Grt. (amongst rocks, Howison's Poort, &c).

4. **H. angustifolia,** Haw. March.—Fern Kloof near Grt. (Miss M. Daly).

Miss Daly's specimens are really intermediate between H. *angustifolia* and H. *chlorocantha*, Haw., which can scarcely be kept up as distinct species.

BULBINE, Linn.

1. **B. caulescens,** L.—Aug. to Jan, April.—Common near Grt., Brak Kloof, Port Alfred.

2. **B. filifolia,** Bak.—Dec., Jan.—Grt. (behind Fort England and on hill behind Botanic Gardens).

3. **B. asphodeloides,** R. et Sch.—Nov., Dec., Feb.—Common near Grt. especially towards the Fish River.

4. **B. longiscapa,** Willd.—Dec.—Grt. (Drostdy grounds, etc), Port Alfred.

5. **B. narcissifolia,** Salm-Dyck.—May.—Grt. (Farm Beaconsfield, etc.), Brak Kloof.

6. **B. mesembrianthemoides,** Haw.—Albany division, Bowker (fide Baker in Flora Cap. VI, p. 365). Not collected recently in our districts.

7. **B. alooides,** Willd.—Sep. to Nov.—Common near Grt.

8. **B. latifolia,** R. et Sch.—Sep. to Nov.—Fairly common near Grt.

ERIOSPERMUM, Jacq.

1. **E. dissitiflorum,** Bak.—March.—Common amongst grass near Grt.

ANTHERICUM, Linn.

1. **A. pachyphyllum,** Bak.—Grt. (fide Baker in Flora Cap. VI, p. 381).

2. **A. pulchellum,** Bak., var.—Nov.—Sidbury (Miss Daly 816). The perianth in this specimen is 5–5½ lines long. Dr. Bolus, to whom the specimen was submitted, sends the following note. "*A. angulicaule* and *A. Cooperi* seem to be hardly distinguishable from each other, and Miss Daly's 816, except for the scabrous filaments and larger corolla, might be *A. angulicaule.* It goes better into the subgenus *Dilanthes* where it might either be regarded as *A. triflorum* var. B. (in the typical *A. triflorum* the leaves are weaker) or *A. pulchellum* with a larger perianth. These four species—*angulicaule*, *Cooperi*, *triflorum*, var. B.—together with *Schlechterii*,

patulum, and *Saundersii* are all very closely allied and confusing to separate."

3. **A. elongatum**, Willd.—Sep.—Sandhills, Port Alfred; common.

4. **A. affine**, Bak. (Journ. Bot. X (1872) p. 138).—Nov., Ap., May. Grt. (Coldstream). This species is not mentioned in the Flora Capensis. It seems to have been re-described by Baker in Journ. Linn. Soc. XV (1877) p. 309 as *A. MacOwani*.

5. **A. pubescens**, Bak.—Fish River heights, Hutton (fide Baker in Flora Cap. VI, p. 309). Not seen by me.

6. **A. falcatum**, Linn. fil.—Near Theopolis, Burchell (fide Baker in Flora Cap. VI, p. 394). Not seen by me.

7. **A. longifolium**, Jacq.—Dec.—Trapp's Valley.

A. longifolium, Jacq. var.—Port Alfred (H. Hutton). This may be the variety described by Baker as var. *Burchellii*. It has an oblong capsule and should perhaps be separated as a distinct species.

8. **A. hirsutum**, Thunb.—Near Theopolis, Burchell (fide Baker in Flora Cap. VI, p. 395). Not seen by me.

9. **A. pilosum**, Bak.—Oct.—Grt.; fairly common.

10. **A. Gerrardi**, Bak.—Nov., Dec.—Grt. and Trapp's Valley.

CHLOROPHYTUM, Ker.

1. **Chl. elatum**, R. Br.—Oct. to Feb.—Fairly common near Grt.

Chl. elatum *var. Burchellii*, Bak.—Oct.—Grt. and Blaauwkrantz.

2. **Chl. comosum**, Bak.—Nov.—Grt. (Howison's Poort).

AGAPANTHUS, L'Herit.

1. **A. umbellatus**, L'Herit.—Sep. to March.—Common on damp mountain sides near Grt.

TULBAGHIA, Linn.

1. **T. acutiloba**, Haw.—Brak Kloof.

2. **T. alliacea,** Linn. f.—Nov.—Common amongst grass: Grt., Sidbury.

T. alliacea, Linn. f., var. *ludwigiana*, Bak.—Port Alfred, Trapp's Valley.

3. **T. violacea,** Kunth.—Nov., Dec.—Brakkloof, in damp places near Grt. (along the Bothas River), Trapp's Valley.

ALLIUM, Linn.

1. **A. dregeanum,** Kunth.—On the sheet bearing Bolus' No. 648 from Graff-Reinet in Herb. Alb. Mus. there is a note by MacOwan: "Idem legi LXIV prope Grahamstown sed specimina omnia amissa."—No other collector has found it here.

MASSONIA.

1. **M. Huttoni,** Bak.—Albany, Hutton (fide Baker in Flora Cap. VI, p. 413). The type of this species seems to be lost. We have a specimen from the Fish River Randt collected by Mr. H. Hutton, which appears to belong to this species though it differs slightly from the description. On the other hand it comes so close to the specimens of *M. versicolor*, Bak., collected by MacOwan near Somerst East and quoted in the Flora Capensis, that it seems to me most likely that the two species cannot be separated.

2. **M. latifolia,** Linn.—Sep.—Grt. (Ft. England), Brakkloof.

POLYXENA, Kth

1. **P. pygmaea,** Kth.—May.—Grt. (West Hill).

LACHENALIA.

1. **L. orchioides,** Ait.—Oct.—Grt. Flats, Brakkloof.

2. **L. convallarioides,** Bak., var. *robusta*, Bak.—Sep.—Featherstone's Kloof near Grt. (rare).

DRIMIA, Jacq.

1. **D. haworthioides,** Bak.—Jan. Port Alfred (Rev. F. A. Rogers). The occurrence at Port Alfred of this extraordinary plant, previously only known from Graaff-Reinet, is somewhat remarkable.

2. **D. elata,** Jacq.—Jan. to March.—Near Grt. (Howlson's Poort).

3. **D. anomala,** Benth.—Dec., Jan.—Grt. (Currie's Kloof, etc.).

RHADAMANTHUS, Salisb.

1. **Rh. hyacinthoides** (Bak.) (= *Drimia? hyancinthoides*, Bak.)—Nov.—In a shady kloof, Woest Hill (MacOwan).

LITANTHUS, Harv.

1. **L. pusillus,** Harv.—Sep. to Jan.—Amongst damp rocks near Blaauw Krantz Bridge.

DIPCADI, Medic.

1. **D. ciliare,** Bak.—Oct. to Dec.—Fairly common near Grt. amongst grass, Brakkloof, Trapp's Valley.

2. **D. viride,** Moench.—Jan.—Sidbury.

3. **D. megalanthum,** Zahlbr. (in "Plantae Pentherianae" I, p. 21).—Dec., Jan.—Near Grt. (Penther No. 511; type not seen by me).—Brakkloof (Mrs. Geo. White.)

ALBUCA, Linn. (Compare "The genus Albuca in the Herbarium of the Albany Museum" by J. G. Baker, F.R.S. in Rec. Alb. Mus. I, p. 89). All species are found amongst grass in rather dry situations.

1. **A. altissima,** Dryand.—Oct.—Grt. (Oatlands Park).

2. **A. minor,** L.—Sep., Nov.—Grt., Port Alfred.

3. **A. trichophylla,** Bak.—Oct.—Grt. flats.

4. **A. bifolia,** Bak.—Oct.—Grt. (Currie's Kloof).

5. **A. Dalyae,** Bak.—Oct.—Grt. (near brickkilns and in Belmont Valley).

6. **A. Schönlandi,** Bak.—Oct.—Rare.

7. **A. fastigiata,** Dryand.—Oct.—Grt. (not very common).

8. **A. caudata,** Jacq.—Sep., Oct.—Very common near Grt.

9. **A. tortuosa,** Bak., Sep., Oct.—Grt. (not common), Brakkloof.

10. **A. setosa,** Jacq.—Oct.—Grt. (near brickkilns).

11. **A. longifolia,** Bak.—Sep.—Coldstream near Grt.

12. **A. circinata,** Bak.—Aug., Sep.—Port Alfred West (common on the north side of the sandhills).

13. **A tenuifolia,** Bak.—Feb.—Brakkloof.

URGINEA, Steinh.

1. **U. exuviata,** Steinh.—Nov.—Sidbury.

VELTHEIMIA, Gleditsch.

1. **V. viridifolia,** Jacq.—Sep. and Oct.—Common in damp shady places near Grt., Port Alfred, etc.

EUCOMIS, L'Herit.

1. **E. punctata,** L'Herit.—Nov., Feb. to Ap.—Grt. (near Brickfields, Hamilton Reservoir, Slaai Kraal, etc.) MacOwan's specimens (No. 1921) quoted under this species in the Flora Capensis, were collected in a shady locality. Other specimens grown in the shade, which I have seen, are similar to them, but when growing in the open, what appears to me to be the same species agrees in its characters with *E. undulata*, Ait. or sometimes with *E. pallidiflora*, Bak. Specimens collected near Grt. in March 1907, agreed in every particular with others collected at the end of February at Bloemfontein, except that the leaves of the Grt. specimens were not so decidedly undulate, so that ours were even more like *E. pallidiflora* than those from the O.R.C. I believe these 3 supposed species cannot even be sharply divided into three varieties.

SCILLA, L.

1. **S. hypoxidioides,** Schönl. (Rec. Alb. Mus. I, p. 48)—Jan.—Amongst grass and in rocky places round Grt.

2. **Sc. firmifolia,** Bak.—Feb.—Amongst rocks near the New Year's Rixer. (MacOwan 461 and 471 in Herb. Alb. Mus.)

3. **Sc. versicolor,** Bak.—Jan.—Grt. (hills on the right going to Stone's Hill, locally common).

4. **Sc. rigidifolia,** Kth.—Nov. to Jan.—Grt. flats above Currie's Kloof, Goodwin's Kloof, Brakkloof, amongst grass.

5. **Sc. revoluta,** Bak.—Jan.—"Mayor's Seat" near Grt.

(Miss M. Daly 846). This specimen agrees fairly with Bot. Mag. t. 1380. The flowers are, however, somewhat smaller, the petals are dark green with lighter margins on both surfaces, the base of the leaves is white passing into dark green, unspotted above on the lower surface, but blotched with red to about the middle of the lamina, the blotches being arranged in a few irregular transverse lines. The ovary is somewhat flatter than in Bot. Mag. t. 1380. It should be noted that the lower part of the leaves is folded in; they thus become "subpetiolate."

6. **Sc. MacOwani,** Bak. — Dec. — Damp ground, Trapp's Valley (Miss M. Daly 582). Miss Daly's specimens are much more robust than the type. I have made the following notes from the live specimens, from which it will be seen that they also come very close to *Sc. subglauca*, Bak.

Bulb subglobose, c. 1¼" (3 cm.) in diam., tunics rather firm, white. Produced leaves 4 to 5, c. 6" (15 cm.) long, 5/8" (c. 15 mm.) broad in the broadest part, oblanceolate subplicate, slightly cucullate and apiculate, on upper surface almost white at the base without spots, upper 2/3 green with dark brown irregular spots, on lower surface indistinctly ribbed longitudinally, with mauve irregular transverse bands on white background, in the lower fourth passing into similar bands on green background, upper half green and unspotted. Peduncle about the length of the leaves, curved, terete, white, spotted with mauve below, dirty greenish and finely mottled with brownish higher up. Bracts very small, deltoid. Lower pedicels cernuous, bright green, upper white, nearly 1/2" (12 mm.) long. Corolla c. ¼" (6 mm.) long, petals purplish-green with light margins, inner cucullate, outer slightly so, free lobes longer than pseudotube, decidedly reflexed. Lower third of filaments nearly white, upper bright mauve, anthers versatile, mauve, pollen pale yellow. Ovary shortly stipitate, disk-shaped, 6-lobed, style white, mauve near apex, stigma minute.

7. **Sc. Cooperi,** Hook. fil.—Dec.—Stone's Hill near Grt. A single specimen gathered by me seems to be this species.

8. **Sc lanceaefolia,** Bak.—Oct., Nov.—Common near Grt.

9. **Sc. prasina,** Bak.—Oct.—Fairly common near Grt.

10. **Sc. paucifolia,** Bak —Sep., Nov.—Port Alfred.—The leaves in our specimens were mottled with dark green on a glaucous background as stated in the description to Saund. Refug. Bot. t. 181. They are not spotted as represented on the plate.

11. **Sc. linearifolia,** Bak.—Nov.—A specimen gathered by me (146) near the Grey Reservoir, Grt., seems to belong to this species.

12. **Sc. sp.** Fish River Randt (H. Hutton). Miss Kensit suggests that these specimens come nearest *Sc. saturata*, Bak. and *Sc. pusilla*, Bak., but I am unable to come to any decision.

ORNITHOGALUM, L.

1. **O. thyrsoides,** Jacq.—Oct., Nov. Common in damp places near Grt. and in Lower Albany. One of the yellowish varieties grows near Carlisle Bridge.

2. ? **O gracile,** Bak.—Nov.—A plant collected by Miss Daly at Sidbury (796*a*) comes nearest this species and *O. graminifolium*, Thunb.

3. **O. monophyllum,** Bak.—Sep. to Nov.—Queen's Road near Grt., kloofs near Sidbury, etc. The plants from our neighbourhood have broader leaves than the type.

4. **O. Zeyheri,** Bak.—Oct., Dec.—Swampy places, Grt. flats, Trapp's Valley.

5. **O. inandense,** Bak.—Dec.—Trapp's Valley (Miss Daly 606). Judging from the description, Miss Daly's specimens are close to this species and may be identical with it.

6. **O. tenellum,** Jacq.—Oct., Nov.—In damp places amongst grass, Grt.

7. **O. coarctatum,** Jacq.—In marshy ravines around Grt. (Galpin 312). Not in the Herb. of the Albany Museum.

8. **O. pubescens,** Bak.—Albany division, Williamson (fide Baker in Flora Cap. VI p. 501). Not recently found. This species species should be compared with *O. bolusianum*, Bak. with which it will probably be fouud to be identical.

9. **O. elatum,** Bak.—Albany division, Cooper 3280 (Baker in Flora Cap. VI p. 508). Not found by any other collector.

10. **O. bolusianum,** Bak.—Oct.—Under trees in Currie's Kloof Grt. (Miss Daly and Miss Sole 345).

11. **O. subulatum,** Bak.—Dec., Jan.—Trapp's Valley, Grt., Brakkloof, Howison's Poort.

12. **O. tenuipes,** C. H. Wright (Kew Bulletin 1901, p. 136). This species was grown at Kew from a bulb which I sent from this neighbourhood. It is not represented in Herb. Alb. Mus., unless, as I suspect, it is identical with *O. subulatum.*

13. **O. comptum,** Bak.—Nov.—Grt.—In addition to the normal form, there occurs near Grt. a very robust form (Stone's Hill, Miss Daly and Miss Sole, 534) which has much larger bulb, leaves, and peduncle than the type. The raceme also is much longer (7") and the flowers are somewhat larger.

14. **O. Eckloni,** Schlecht.—Dec.—Farm Beaconsfield near Grt.

15. **O. longebracteatum,** Jacq.—Oct., Nov.—Common near Grt.

ANDROCYMBIUM, Willd.

1. **A. melanthioides,** Willd, var. *acaule,* Bak.—Aug.—Grt. (MacOwan), Brak Kloof.

2. **A. longipes,** Bak.—Aug.—Drostdy grounds, Grt. (See Rec. Alb. Mus. I, p. 124).

3. **A. albanense,** Schönl. (Rec. Alb. Mus. I, p. 123).—Aug. —Brickfields near Grt.

GLORIOSA, Linn.

1. **G. virescens,** Lindl.—Sandhills east of Port Alfred.

AMARYLLIDACEAE.

CURCULIGO, Gaertn.

1. **C. plicata,** Ait.—Port Alfred (H. Hutton in Herb. Alb. Mus.)

HYPOXIS, Linn.

1. **H. alba,** Linn. var. *gracilis*, Bak.—March to Nov.—Very common near Grt., especially on the flats. Its petals are yellow. I doubt whether it can be looked upon as conspecific with *H. alba*.

2. ? **H. stellata,** Linn. f. — May.—Brak Kloof (Mrs. G. White). I suspect that this is a cultivated specimen.

3. **H. Kraussiana,** Burch. — Bathurst division, Burchell (fide Baker in Flora Cap. VI, p. 180).

4. **H. Zeyheri,** Bak.—Oct. to Dec.—Grt., Trapp's Valley.

5 **H. argentea,** var. *sericea*, Bak.—April to Nov.—Grt. (common on the flats), Sidbury, Round Hill.

6. **H. setosa,** Bak.—Grt. (MacOwan 72); Brak Kloof.

7. **H. villosa,** Linn. f.—Aug, to Nov.—The typical form is very common throughout the districts.

8. **H. longifolia,** Bak.—Ap. to Dec.—Kleinemonde, Sidbury, Trapp's Valley.

9. **H. Ludwigii,** Bak ?—Nov.—Sidbury (Miss Daly 767, 818).

10. **H. rigidula,** Bak.—Nov.—Lower Albany (Trapp's Valley, Sidbury, etc.)

11. **H. multiceps,** Buch.—Dec.—Grt.

12. **H. stellipilis**, Ker.—Jan.—Brakkloof.

13. **H. Rooperii,** Moore.—Oct.—Coldstream near Grt.; Albany div., Bushman River below 1,000, Drege (fide Baker in Flora Cap. VI. p. 189).

CRINUM, Linn.

1. **Cr. campanulatum,** Herb.—Oct. to Jan. —.Standing pools, Grt. flats and in Lower Albany.

2. **Cr. sp.**— A species of *Crinum*, collected by Mr. H. Hutton on the Fish River Randt near Fort Brown, and represented in Herb. Alb. Mus. by 2 flowers with their stalks, may be an undescribed species.

AMMOCHARIS, Herb.

1. **A. falcata**, Herb.—Jan.—Brakkloof.

BRUNSVIGIA, Heist.

1. **B. minor**, Lindl.—Feb.—Grt. flats, common.

NERINE, Herb.

1. **N. undulata**, Herb.—May.—Dassie Klip, Port Alfred.

2. **N. humilis**, Herb.—June.—Botha's Hill (Zeyher), Fish River Randt. Banks of the Fish River near Fort Brown (H. Hutton).

3. **N. flexuosa**, Herb. var ? — Sep. — Port Alfred (H. Hutton). "Smaller in every part than Bolus 2202 and MacOwan 1549 (quoted in Flora Cap.)" (H. Bolus in litt.)

CYRTANTHUS, Ait.

1. **C. obliquus**, Ait.—Nov.—Common in Currie's Kloof near Grt., Lower Albany.

2. **C. collinus**, Gawl.—Nov., Jan.—Driver's Bush. Said also to occur along the ridge beyond Stone's Hill.

3. **C. angustifolius**, Ait.—Oct.—Fairly common in Currie's Kloof and similar places round Grt.

4. **C. uniflorus**, Gawl.—Jan.—Fairly common near Grt., Howison's Poort and sandhills near Port Alfred.

5. **C. helictus**, Lehm.—Nov.—Sidbury and dry hillsides round Grt. common.

CLIVIA, Lindl.

1. **Cl. nobilis**, Lindl.—Oct.—Common in open bush south of Grt. to near sea-level.

HAEMANTHUS, Linn.

1. **H. puniceus**, Linn. — Ap. — Kleinemonde (teste MacOwan).

2. **H. magnificus**, Herb.—Jan.—Port Alfred West (in a bush half-way to Salt River); Bushman's River heights on the road from Grt. to Alexandria. I doubt whether this species can be satisfactorily distinguished from *H. puniceus*.

3. **H. amarylloides,** Jacq.—Jan.—Grt. flats (3 miles beyond Cradock dam). The leaves appear after the flowers. Those collected from our specimens are suborbicular, but Miss Kensit is probably right in suggesting that they had not developed properly when preserved.

4. **H. montanus,** Bak. ?—March ?—Brak Kloof. Cannot be named with any certainty, but distinct from all our other species.

5. **H. albiflos,** Linn. — May. — Grt. (Hamilton Reservoir, Coldspring); Pt. Alfred, Riet River, Brak Kloof.

BUPHANE, Herb.

1. **B. disticha,** Herb.—Jan.—Grt. flats.

VELLOZIA, Vand.

1. **V. viscosa,** Bak.—March.—Brak Kloof.

IRIDACEÆ.

MORAEA, Linn.

1. **M. spathacea,** Ker.—Sep.—Coldstream near Grt.

2. **M. polyanthos,** Thunb.—Albany div (Cooper 1529 in Flora Cap. VI, p 17). Not found by any other collector.

3. **M. polystachya,** Ker. — March, April. — Common amongst grass near Grt. Known as the "Tulp."

4. **M. ramosa,** Ker.—In damp places near Howison's Poort, rare (MacOwan 399). Not seen by me.

5. **M. setacea,** Ker.—Aug, Sep.—Common near Grt. (Oatlands, etc).

6. **M. unguiculata,** Ker.—Oct.—Brickfields near Grt.

7. **M. iridioides,** Linn.-Oct.—Not uncommon in shady places in the kloofs round Grt.

8. **M. bicolor,** Spae.—Oct.—At Blaauwkrantz, near the spot where the main road to Bathurst crosses the valley.

HOMERIA, Vent.

1. **H. collina,** Vent.—Dec.—Only a form with pale yellow petals has been observed since the year 1900, when it first came up

in the grounds of the Albany Museum, and has since been seen in large numbers along the railway line in Oatlands and a few other places in waste ground.

SYRINGODEA, Hook. f.

1. **S. bicolor,** Bak.—Nov.—On the Grt. flats (MacOwan 827). Evidently a rare plant with us.

ROMULEA, Maratti.

1. **R. chloroleuca,** Bak.—Nov.—Between the mouths of the Fish River and Kleinemonde (MacOwan 416), Port Alfred (E. E. Galpin, in Herb. Alb. Mus.)

2. **R. rosea,** Eckl.—May, Oct.—Common near Grt., Kleinemonde, Brak Kloof, etc. Several varieties approaching the type, which shade into one another, are found. The var. *parviflora* is also fairly common.

BOBARTIA, Ker.

1. **B. sp.**—Oct.—Stone's Hill and Woest Hill near Grt. (Schönland 1674). Dr. Bolus considers that this plant is either new or a form of *B. Burchellii* (= Pegler 816, Kentani).

2. **B. aphylla,** Ker.—Dec.—Coldspring near Grt.

3. **B. spathacea,** Ker.—Flowers almost throughout the year.—Very common near Grt. and other parts within our limits

ARISTEA, Soland.

1. **A. anceps,** Eckl.—Dec.—Trapp's Valley, Grt., Riebeck and Zwartwaterpoort.

2. **A. schizolaena,** Harv.—Nov., Dec.—Fairly common in swampy places (Howison's Poort, etc.)

3. **A. pusilla,** Ker.—Aug. to Feb.—Very common amongst grass near Grt.

HESPERANTHA, Ker.

1. **H. falcata,** Ker.—Sep.—Not uncommon near Grt. (on the flats, Coldstream, etc.)

2. **H. radiata,** Ker.—Aug. to Nov.—Not uncommon near Grt.

3. **H. angusta,** Ker.—Sep.—Botha's Hill near Grt (MacOwan 345).

GEISSORHIZA, Ker.

1. **G setacea,** Bak.—"Along the rivulet at Grt." Burchell (fide Baker in Flora Cap. VI, p. 74). Not known to me.

2. **G. sp.**—Sep.—Amongst grass near Southwell (Schönland 781). "Seems to be nearest *G. foliosa* Klatt." (Miss Kensit in litt.)

DIERAMA, K. Koch.

1. **D. pendula,** Bak.—Oct. Nov.—Common on the southern slopes of the mountains near Grt. and in Lower Albany.

2. ? **D pulcherrima,** Bak.—Albany division, Cooper (fide Baker in Flora Cap. VI p. 88). Not seen by me from within our boundaries.

LAPEYROUSIA, Pourr

1. **L. cruenta,** Bak.—Nov., Dec.—Shady places at Port Alfred, Trapp's Valley, Sidbury, etc.; also said to occur in Howison's Poort.

FREESIA, Klatt.

1. **F. refracta,** Klatt.—Oct., Nov.—Common near Grt. and in Lower Albany. Both the typical form and the var. *odorata*, Klatt, occur within our limits.

WATSONIA, Mill.

1. **W. angusta,** Ker.—Jan.—Kleinemonde.

2. **W. Meriana,** Mill.—Oct., Dec.—Very common, especially on the hills south of Grt. and in Lower Albany. The flowers are rarely red in our neighbourhood; they are usually mauve-coloured and frequently white.

BABIANA, Ker.

1. **B. disticha,** Ker.—Lower Albany, Hutton (fide Baker in Flora Cap. VI, p. 113). No specimens from within our boundaries seen by me.

TRITONIA, Ker.

1. **T. lineata,** Ker.—June to Oct.—Fairly common round about Grt., Brak Kloof, Highlands, etc.

2. **T. laxifolia,** Benth.—Bathurst div., between Blaauw Krantz and Kafir drift, Burchell (fide Baker in Fora Cap. VI, p 127). Not found by any other collector within our boundaries.

GLADIOLUS, Linn.

1. **Gl. tristis,** Linn.—Ap., May.—Not uncommon near Grt.

2. **Gl. recurvus,** Linn.—Nov.—Not uncommon near Grt.

3. **Gl brevifolius,** Jacq.—Between Blaauw Krantz and Kafir Drift, Burchell (fide Baker in Flora Cap. VI, p. 144). Not found by any other collector within our boundaries.

(*Gl. blandus*, Ait —Stated in the Flora Cap. VI, p 155 to have been collected by Baur near Grt. This is a mistake. The label with MacOwan's specimen in Herb. Alb. Mus. clearly shows that it is a cultivated specimen grown from a corm received from Kaffraria).

4. **Gl. Milleri,** Ker.—Port Alfred (H. Hutton).

5. **Gl. MacOwani,** Bak.—Nov. to Feb.—Common near Grt. ; also at the Kleinemonde.

6. **Gl. undulatus,** Jacq.—Bathurst div. between Rietfontein and the sea-shore, Burchell (fide Baker in Flora Cap. VI, p. 155).

7. **Gl. edulis,** Burch. ?—Nov.—Howison's Poort near Grt.

8. **Gl. permeabilis,** De la Roche.—Oct., Nov. Common near Grt., Sidbury.

9. ? **Gl. arenarius,** Bak.—Sand-dunes at the mouth of the Bushmans River, Zeyher (only recorded so far from the Alexandria side).

ANTHOLYZA, Linn.

1. **A. caffra,** Ker.—Aug. to Nov., April.—Common near Grt. (Dassie Krantz, etc.), Kleinemonde.

2. **A. aethiopica,** Linn.—Ap.—In somewhat shady places near Grt., and on the Kowie sandhills.

3. **A. revoluta,** Burm. — Nov. — Near Grt. (Atherstone, Highlands, etc.)

DICOTYLEDONES.

RANUNCULACEÆ.

CLEMATIS, Linn.

1. **Cl. brachiata,** Thunb.—March.—Common on the edges of bush near Grt. and in Lower Albany. The distinctions between this species and *Cl. Thunbergii*, Steud. appear to me to break down when large series of specimens are examined. Forms which might be put under the latter species are found in Lower Albany.

ANEMONE, Hall.

1. **A. alchemillaefolia,** E. Mey., var. *grandiflora*, Huth (*A. caffra*, E. & Z.)—June, July.—Near the top of the hills south of Grt.—rather local.

KNOWLTONIA, Salisb.

1. **K. capensis** (L.) Huth (*K. rigida*, Salisb.), var. *ternata*, Harv.—Nov.—Near the tops of the hills south of Grt. (Howison's Poort, etc.)

2. **K. vesicatoria,** Sims.—Sep.—Port Alfred.

RANUNCULUS.

1. **R. pinnatus,** Poir.—Dec.—Fairly common in dampish places amongst grass near Grt. Specimens collected at Trapp's Valley by Miss Daly (551) are much smaller in all parts and have less divided leaves than the type, but can hardly be separated specifically.

MENISPERMACEÆ.

CISSAMPELOS, Linn.

1. **C. torulosa,** E. Mey.—Dec.—Queen's Road near Grt.

2. **C. capensis,** Thunb.—April.—Queen's Road and Hell Poort near Grt.

NYMPHAEACEÆ.

NYMPHAEA, Linn.

1. **N. capensis,** Thunb. (see Kew Bulletin 1906, No. 5, p. 183).—Nov.—Lower Albany.

PAPAVERACEÆ.

PAPAVER, Linn.

1. **P. aculeatum,** Thunb.—On the Cowie, Albany, T. Williamson (fide Flora Cap. I, p. 15). Seems to be very scarce within our limits.

ARGEMONE, Tourn.

1. **A. mexicana,** Linn.—Jan.—A weed in the Grt. location along the railway line; along the banks of the Fish River, etc.

FUMARIACEÆ.

FUMARIA, Linn.

1. **F. officinalis,** L.—Nov. to March. Fairly common on and near cultivated ground at Grt. and in Lower Albany.

CORYDALIS, DC.

1. **C. Cracca,** Ch. et. Schlecht.—Nov. In shady places at Coldspring near Grt., also near Blaauw Krantz.

2. **C. pruinosa,** E. Mey.—Currie's Kloof near Grt. (fide MacOwan); not seen by me from this neighbourhood.

CRUCIFERÆ.

NASTURTIUM, Linn.

1. **N. fluviatilis,** E. Mey.—Sep. to March.—Common in rivers and stagnant water near Grt.

2. **N. officinale,** R. Br.—Sep. to Nov.—In river-beds, Grt.

CARDAMINE, Linn.

1. **C. africana,** L.—Nov.—In shady places, Howison's Poort and Brookhuizen's Poort.

SISYMBRIUM, Linn.

1. **S. capense,** Thunb, var. *latifolium*, Sond.—Nov.—In shady places north of Grt. (Burnt Kraal, Hell Poort).

S. capense, Thunb, var. *angustifolium*, Sond.—Nov.—Botha's Hill (MacOwan).

2. **S. lyratum,** Burm., var. ?—Sep.—Margins of woods. Port Alfred (near sea-level).

3. **S officinale,** Scop.—Oct., Nov.—Grt., Port Alfred.—A fairly common weed.

4 **S. Burchellii,** DC.—Sep. to Dec.—Grt., a fairly common weed.

HELIOPHILA, Linn.

1. **H. pendula,** Willd.—July.—In shady places amongst rocks near Grt. (MacOwan 999).

2. **H stricta,** Sond.—Brandkraal amongst low bushes near Grt. (MacOwan 1427).

3. **H. abrotanifolia,** Herb. Banks., is stated by Sonder to have been found by Ecklon and Zeyher at Grt. and Fish River (Flora Cap. I, p. 47).

4. **H. suavissima,** Burch.—Ap. to July.—Common in Lower Albany, also found at Botha's Hill and Sidbury.

5. ? **H. succulenta,** Herb. Banks - Dec.—A specimen doubtfully referred to this species was found by Miss L. Britten on the east road from Grt. to Port Alfred.

6. **H. subulata,** Burch.—Fish River Flats near mouth (Dr. W. G. Atherstone in Herb. Alb. Mus.)

7. **H. rigidiuscula**, Sond.—Dec.—Near Grt.; rare (Brand Kraal, MacOwan 1421.)

8. **H. stylosa,** Burch.—May, Nov.—Very common near Grt.; both the type and the var. *lobata* are found here.

9. **H virgata,** Burch.—Dec.—Trapp's Valley and on the sand-dunes along the sea (Kasouga, Kowie, Fish River Mouth).

10. **H. florulenta,** Sond. ?—Sep., Oct.—Near Grt. (Featherstone's Kloof), Botha's Hill, Queen's Road.—MacOwan's specimens (845) were named *H. florulenta*, Sond. by Prof. Oliver at Kew. It seems to me, however, that they do not belong to this species. The pods are quite different from those of Ecklon and Zeyher's Uitenhage plants. They are broadly oblong, sharply divided from

the style, not attenuated into it. The young branches and leaves are pubescent. The plant is very common along the Queen's Road. It may be the incompletely known *H. brachycarpa*, Meissn, of which I have not seen a specimen.

BRASSICA, Linn.

1. **B. Napus,** Linn.—Oct.—A common weed in cultivated ground at Grt. and elsewhere.

2. **B. strigosa,** DC.—Along the Botha's River (MacOwan 993, 1022).

3. **B. retrorsa** (Burch.).—Aug., Nov.—A common weed in cultivated ground near Grt.

CAPSELLA.

1. **C. Bursa Pastoris,** Moench.—Aug. to Nov.—A common weed in and near cultivated ground.

SENEBIERA, DC.

1. **S. pinnatifida,** DC. (*S. didyma,* Pers.). A weed in cultivated ground, Grt. (MacOwan 824). I have not seen a specimen from our neighbourhood.

LEPIDIUM, Linn.

1. **L. capense,** Thunb.—Sep. to Dec.—A common weed on and near cultivated ground at Grt. and elsewhere.

CAPPARIDACEÆ.

CLEOME, Linn.

1. **Cl maculata,** Hk. fil. et Bth. (*Tetrateleia maculata,* Sond.)—Grt., Dr. Atherstone (fide Sonder in Fl. Cap. I, p. 58). Not found by any other collector within our limits.

NIEBUHRIA, DC.

1. **N. triphylla,** Wendl.—Sep. to Jan.—Very common throughout our limits.

BOSCIA, Lam.

1. **B. caffra,** Sond.—Apr.—Common in wooded kloofs south of Grt. and in Lower Albany.

CADABA, Forsk.

1. **C. juncea,** DC.—Nov., Dec.—In carroid places north of Grt. (Bothas Hill, Thornkloof, Fish River Valley).

CAPPARIS.

1. **C. oleoides,** DC.—Hell Poort (MacOwan 640). Not seen by me from this neighbourhood.

2. **C. Zeyheri,** Turcz.—Feb.—Po t Alfred and Kasouga.

3. **C. citrifolia,** Lam.—Sep. to Jan.—Abundant in semi-carroid scrub, almost everywhere from near sea level almost to the highest points. The var. *sylvatica*, Sond. is chiefly found close to the sea.

RESEDACEÆ.

OLIGOMERIS, Camb.

1. **O. Dregeana,** Presl.—Fish River Randt, near Fort Brown.

VIOLACEÆ.

IONIDIUM, Vent.

1. **I. capense,** Roem. et Schult.—Nov.—Grt. (Stone's Hill), Kasouga.

BIXACEÆ.

SCOLOPIA, Schreb. (= *Phoberos*, Lour.)

1. **S. Zeyheri,** Arn.—Sep.—Near Grt. in semi-carroid places, not common. (MacOwan 808). Port Alfred (Schlechter 2733, May).

2. **S. Mundtii,** Arn.—Aug.—In woods near Grt.

(**S. Ecklonii,** Arn.—In woods near Grt. T. R. Sim in his "Forest-flora of Cape Colony, 1907, p. 127, includes this species in *S. Zeyheri*).

DOVYALIS, E. Mey.

1. **D. zizyphoides,** E. Mey. (*D. rhamnoides*, Harv).—Sep. to Nov.—Brookhuizens Poort (MacOwan 1267). "Frequent

within 10 miles of the sea, and occasionally found 20 or more miles inland." (Sim l. c. p. 131).

2. **D. rotundifolia** (Thunb.) Harv.—"Frequent amongst scrub on the coast sand-dunes and for a few miles inland from Gamtoos River to Natal." (Sim, l. c. p. 132). Mrs. Barber's specimens mentioned in Flora Cap. I, p. 70 were probably collected at Tharfield.

3. **D. caffra,** Sim (*Aberia caffra*, Sond.)—Naturalised here and there near Grt. and in Lower Albany.

TRIMERIA, Harv.

1. **T. trinervis,** Harv.—May.—Fairly common near Grt., abundant near Atherstone station.

2. ? **T. alnifolia,** Planch.—"Frequent in forest-districts from Knysna to Natal." (Sim, l. c. p. 132). Not seen by me from our districts.

KIGGELARIA, Linn.

1. **K. ferruginea,** E. & Z. Sep.—Along shady river courses near Grt., Currie's Kloof, etc. Sim, l. c. p. 129, places this species under *K. africana*, Linn., which, I think, is not admissible.

PITTOSPORACEÆ

PITTOSPORUM, Banks.

1. **P. viridiflorum,** Sims. Oct., Nov.—Fairly common in wooded kloofs near Grt. and in Lower Albany.

POLYGALACEÆ.

POLYGALA, Linn.

1. **P. oppositifolia,** Linn.—Oct.—Very common in open bush, especially the var. *cordata*, Harv., but forms approaching var. *trigonoides*, Harv. are also found (*e.g.* at Dixon's Bush).

2. **P. myrtifolia,** Linn.—Aug., Sep.—Very common near Grt. (especially north of the town, but also found in Howison's Poort).

3. **P. virgata,** Thunb.—Sep., Oct.—Very common near Grt. in several varieties.

4. **P. ericaefolia,** DC.—Nov., April.—Very common near Grt., also at Sidbury, etc.

5. **P. tenuifolia,** Link.—Nov., Jan.—Grt., Brakkloof, Port Alfred.

6. **P. refracta,** DC.—Sep.—Grt. (Stone's Hill, etc.)

7. **P. hispida,** Burch.—Nov.—Fairly common amongst grass on rocky mountain slopes.

8. **P. Ohlendorfiana,** E. & Z.—Grt. (MacOwan 666); not seen by me from our districts.

9. **P. asbestina,** Burch.—Port Alfred (H. Hutton in Herb. Alb. Mus.)

10. **P. illepida,** E. Mey.—July to Dec.—Grt., Trapp's Valley, etc.

MUNDTIA, Kth.

1. **M. spinosa,** DC.—May.—Along the coast.

MURALTIA, DC.

1. **M. squarrosa,** DC.—July.—Fairly common on the hills south of Grt., Brak Kloof.

2. **M. ononidifolia,** E. & Z.—Grt., T. Williamson (fide Harvey in Flora Capensis I, p. 100). Not recently collected, and not known to me.

3. **M. laricifolia,** E. & Z.—July.—Fairly common near Grt. (Woest Hill, Stone's Hill, &c.); also at Riebeck East.

4. **M. alopecuroides,** DC.—Sep.—Very common on rocky hill sides south of Grt.

5. **M. ciliaris,** DC.—Grt., C. J. F. Bunbury (fide Harvey in Flora Cap. I, p. 108). Not recently collected.

CARYOPHYLLACEÆ.

DIANTHUS, Linn.

1. **D. scaber,** Thunb, var. *glabratus*, Sond.—Jan., Feb.—Common near Grt. (on the flats and elsewhere.)

2. **D. incurvus,** Thunb.—Nov., Dec. Trapp's Valley, Alicedale.

3. **D. holopetalus,** Turcz.—Dec.—Port Elizabeth to Grt. (Penther 2387, fide Zahlbruckner in "Plantae Pentherianae" I, p. 378). The exact locality not being stated, it is doubtful whether this species occurs within our limits.

4. **D. crenatus,** Thunb. Nov., Dec.—Grt., E. & Z. (fide Sonder in Flora Cap. I, p. 123); Brookhuizen's Poort (MacOwan 701). I have not seen a specimen from within our limits.

SILENE, Linn.

1. **S. capensis,** Otth.—Oct., April.—Grt. (Oatlands Park), Port Alfred.

2. **S. gallica,** Link.—Oct.—A common weed at Grt. and elsewhere.

3. **S. Burchelli,** Otth.—Aug. to Dec.—A common weed at Grt., Trapp's Valley and elsewhere.

4. **S. primulaefolia,** E. & Z.—Jan. Along the sea-shore (Kasouga, Port Alfred, Tharfield.)

CERASTIUM, Linn.

1. **C. viscosum,** L.—"At the foot of Botha's Hill and elsewhere" (MacOwan 773).

2. **C. capense,** Sond.—Sep.—Common near Grt. and at Port Alfred.

STELLARIA, Linn.

1. **S. media,** Vill.—A common weed in cultivated ground.

SPERGULA, Linn.

1. **S. arvensis,** Linn.—Sep. to May.—A common weed in cultivated ground.

SPERGULARIA, Pers.

1. **S. media,** Presl.—Sep.—Grt. and Port Alfred.

POLYCARPON, Linn.

1. **P. tetraphyllum,** L. fil.—Nov.—A common weed on and near cultivated ground.

PORTULACEÆ.

PORTULACA, Linn.

1. **P. oleracea,** Linn.—Oct.—A weed in gardens at Grt.

PORTULACARIA, Jacq.

1. **P. afra,** Jacq—July to Sep.—Very common in carroid places especially north of Grt.

ANACAMPSEROS, Linn.

1. **A. arachnoides,** Sims.—Feb.—Fish River Randt.

HYPERICACEÆ.

HYPERICUM, Linn.

1. **H. aethiopicum,** Thunb. — Dec. — Howison's Poort (MacOwan).

2. **H. Lalandii,** Chois.—Dec. to Feb.—Very common. All varieties indicated in the Flora Capensis I p. 118, are found within our boundaries.

MALVACEÆ.

MALVA, Linn.

1. **M. parviflora,** Linn.—A common road-side weed at Grt. and elsewhere.

MALVASTRUM, A. Gray.

1. **M. capense,** Gray et Harv.—Sep. to Nov.—Common near Grt.

SIDA, Linn.

1. **S. triloba,** Cav.—Oct. to April.—Frequent in open woods near Grt. and in Lower Albany.

2. **S. longipes,** E. Mey.—Amongst shrubs at Botha's Hill (MacOwan 328). Not seen by me from our districts.

ABUTILON, Tourn.

1. **A. Sonneratianum,** DC.—Oct. to May.—Common in shady places near Grt. and Port Alfred.

2. **A. indicum,** G. Don.—Oct. to Jan.—Penrock and Queen's Road near Grt.

PAVONIA, Cav.

1. **P. mollis,** E. Mey.—Albany, Mrs. F. W. Barber (fide Flora Cap. I, p. 170). Not seen by me from our districts.

2. **P. praemorsa,** Willd.—April to Dec.—Common on the edges of thickets near Grt., Trapp's Valley, Port Alfred.

HIBISCUS, Linn.

1. **H. calycinus,** Willd.—Nov. to Jan.—Near sea-level at Port Alfred.

2. **H. Ludwigii,** E. & Z.—Dec., Jan.—Kasouga and Port Alfred.

3. **H. pedunculatus,** DC.—Nov.—In damp woods near Waai Plaats (MacOwan 267) and near "Carlisle," Grt. (MacOwan in Herb. Alb. Mus.)

4. **H. aethiopicus,** Linn.—Sep. to Nov.—Found in numerous forms all through our districts from near sea-level to Brakkloof.

5. **H. trionum,** Linn.—Dec. to April.—Widely spread in our districts (Trapp's Valley, Grt., Brakkloof, etc.)

STERCULIACEÆ.

DOMBEYA, Cav.

1. **D. elegans,** K. Schum. in "Sterculiaceæ africanae" (Engler's Monographien afrikanischer Pflanzenfamilien und-gattungen) p. 31 (1900).—Oct.—Open woods at Port Alfred and the Kasouga.

MELHANIA, Forsk.

1. **M. didyma,** E. & Z.—May.—Grt., rather rare (hill behind hospital and Featherstone's Kloof).

HERMANNIA, Linn.

1. **H. althaeifolia,** Linn.—Nov.—Amongst shrubs Burnt Kraal near Grt. (MacOwan 1327).

2. **H. candicans,** Ait.—May to Dec.—Very common near Grt., Port Alfred, Trapp's Valley, Brakkloof, etc.

3. **H. holosericea,** Jacq. July to Sep.—In rocky places near Grt.

4. **H. pallens,** E. & Z.—Oct.—In carroid places not far from Grt., not common (MacOwan 936).

5. **H. salvifolia,** L., var *grandistipula*, Harv.—Aug.—Amongst rocks, Grt. flats (MacOwan 360).

6. **H. conglomerata,** E. & Z.—Dec. to April. In carroid places near Grt. (near Fort Brown, Assegaibush, etc.)

7. **H. filifolia,** (Linn ?).—Near Grt. (fide Harvey in Flora Cap. 1, p. 195). Not seen by me from our districts.

8. **H. flammea,** Jacq.—Dec. to May.—Very common all over our districts.

9. **H. hyssopifolia,** Linn.—Sep.—Fairly common along river courses near Grt.

10. **H. velutina,** DC.—Aug. to May.—Very common on dry ground near Grt.

11. **H. gracilis,** E. & Z. — May. — Hell Poort near Grt. (MacOwan 935).

12. **H. pulverata,** Andr.—Albany, Mrs. F. W. Barber (fide Harvey in Flora Cap. I, p. 203).—I have not seen a specimen from our districts.

13.—**H.** (**Mahernia**) **pinnata,** Linn. (*Mahernia bipinnata*, DC.)—Albany, Mrs. F. W. Barber (fide Harvey in Flora Cap. I, p. 212). Mrs. Barber's specimens in Herb. Alb. Museum are without locality.

14.—**H.** (**Mah.**) **coccocarpa** (E. & Z.), var. *ustulata*, Harv.—Assegaibush, Burke (fide Harvey in Flora Cap. I, p. 213). Not seen by me from our districts.

15. **H. (Mah.) linnaeoides** (Burch.) K. Schum.—Bothasberg, near Grt. (fide Harvey in Flora Cap. I, p. 215). Not seen by me from our districts.

16. **H. (Mah.) depressa,** N.E. Br.—Albany, on chalk hills E. & Z. 392 (fide K. Schuman in "Sterculiaceae africanae," p. 71). I have doubtfully referred to this species my No. 595 collected in Oct. 1892, on the Queen's Road near Grt.

17. **H. (Mah.) veronicaefolia** (E. & Z).—Oct., Nov.—Near Grt. (Douglas Reservoir), Bothashill, Blaauwkrantz, Bathurst.

18. **H. (Mah.) stellulata** (Harv.) K. Schum.—Near Grt., Herb. Hooker (fide Harvey in Flora Cap. I, p. 217). Not seen by me.

19. **H. (Mah.) geniculata** (E & Z.) (*Mahernia chrysantha* Turcz)—Jan.—Grt. (Hospital Hill).

TILIACEÆ.

CORCHORUS, Linn.

1. ? **C. asplenifolius,** Burch.—Near Grt., Dr. Atherstone (fide Harvey in Flora Capensis I, p. 229) I suspect a mistake here, as no other collector has found it in our districts.

GREWIA, Linn.

1. **G. occidentalis,** Linn.—Sep., Oct.—Very common in open bush near Grt., Port Alfred, etc. (*G. flava*, DC., which Sim (Forest Flora p. 148) considers to be conspecific with *G. occidentalis*, is stated by him to be abundant on the semi-carroid scrub on the shale-formation from Keiskama to Uitenhage).

LINACEÆ.

LINUM, Linn.

1. **L. africanum,** Linn.—Oct.—Near Grt. (not very common).

2. **L. Thunbergii,** E. & Z.—Nov.—Fairly common amongst grass near Grt. (Woest Hill, etc.)

ERYTHROXYLON, Linn.

1. **E. monogynum,** Roxb. (*E. pictum*, E. Mey).—Albany, Mrs. F. W. Barber (fide Sonder in Flora Cap. I, p. 234). Not seen by me from our districts.

ZYGOPHYLLACEÆ.

ZYGOPHYLLUM, Linn.

1. **Z. uitenhagense,** Sond.—Jan. to April.—Port Alfred, Grt. (West Hill).

2. **Z. debile,** Cham. et Schlecht.—Albany, E. & Z. (fide Sonder in Flora Cap. I, p. 361). Not known to me.

3. **Z. Lichensteinianum,** Cham. et Schlecht. — Sep.— Amongst rocks, hillsides near Grt. (MacOwan 966). Not known to me.

4. **Z. foetidum,** Schrad. et Wendl. — Oct. — Bottom of Queen's Road near Grt., climbing amongst prickly pear.

GERANIACEÆ.

OXALIS, Linn.

1. **O. convexula,** Jacq.—March, April, Oct.—Very common near Grt.; Atherstone Station, etc.

2. **O. punctata,** Linn. f.—April.—Near Atherstone Station (Miss Daly 451).

3. **O. Uitenhagensis,** Sond.—March.—Beaconsfield near Grt.

4. **O. imbricata,** E. & Z. var ? —Sep.—Road from Grt. to Table Farm.

5. **O. aganophila,** Sond.—Grassy hills at Kareiga River, Zeyher 2137 (fide Sonder in Fl. Cap. I, p. 339). Not seen by me.

6. **O. bifurca,** Lodd. — March, April — Very common amongst grass near Grt., and throughout Lower Albany in several varieties.

7. **O. Smithii,** Sond.—Aug., Sep., March.—Very common amongst grass throughout our districts in several varieties.

8. **O. cernua,** Linn.—May.—An occasional weed in gardens at Grt., etc.

9. **O. purpurata,** Jacq.—March, April.—Common in shady places near Grt.

10. **O. stellata,** E. & Z.—April.—Port Alfred.

11. **O. corniculata,** Linn.—Ap. to June.—A common garden weed in Grt. and elsewhere.

MONSONIA, Linn.

1. **M. ovata,** Cav.—Feb. to May, Nov.—Very common on dry hills near Grt.

SARCOCAULON, DC.

1. **S. Patersoni,** DC.—Brak Kloof.

GERANIUM, Linn.

1. **G. incanum.** Linn. Sep.—Common in Lower Albany (between Southwell and Port Alfred, etc.)

2. **G. ornithopodum,** Linn.—Oct.—In damp shady places near Grt.

3. **G. caffrum,** E. & Z.—Nov.—Common in damp shady places near Grt.

ERODIUM, L'Her.

1. **E. moschatum,** L'Her. — Sep. — Common on waste ground at Grt.

PELARGONIUM, L'Her.

1. **P. pulverulentum,** Colv.—Oct. to Dec.—Common on the Grt. flats; Port Alfred.

2. **P. radulaefolium,** E. & Z.—Albany, Mrs. F. W. Barber (fide Harvey in Flora Cap. I, p. 273). Not known to me.

3. **P. caffrum,** E. and Z.—Dec.—Damp places, Howison's Poort, etc.

4. **P. carnosum,** Ait.—Oct. to Dec.—In semi-carroid places north of Grt.

5. **P. dissectum,** E. & Z.—Sep.—Botha's Hill (MacOwan 1025).

6. **P. ionidiflorum,** E. & Z.—Sep.—Botha's Hill (MacOwan 636).

7. **P. tetragonum,** L'Her.—Nov.—Hell Poort, Alicedale.

8. **P. myrrhifolium,** Ait.—Jan.—Port Alfred (F. A. Rogers 990).

9. **P. multicaule,** Jacq.—In semi-carroid places north of Grt.

10. **P. grossularioides,** Ait.—Sep. to Dec.—Common in moist places near Grt. and at Trapp's Valley. Very variable with us as in other localities.

11. **P. ovale**, Burm.—Albany, Dr. Stanger (fide Harvey in Flora Cap. I, p. 292). Not seen by me from our districts.

12. **P. peltatum**, Ait.—June to Dec.—Common near Grt., Port Alfred, etc., climbing over bushes.

13. **P. alchemilloides**, Willd.—Oct. to Dec.—In damp places throughout our districts.

14. **P. inquinans**, Ait.—Feb.—Hell Poort, Sidbury.

15. **P. zonale**, Willd.—Aug., Sep.—In woods near Grt. (Woest Hill, etc.)

16. **P. reniforme**, Bot. Mag.—Sep.—Common on dry pastures near Grt., Port Alfred, etc.

17. **P. odoratissimum**, Ait.—May, Oct.—In shady places near Grt.

18. **P. vitifolium**, Ait.—Nov.—Hillsides near Grt., rare (Featherstone's Kloof, MacOwan 677).

19. **P. scabrum**, Ait.—Oct.—Slaay Kraal near Grt., Burke and Zeyher (fide Harvey in Flora Cap. I, p. 405). I have not seen this species from our districts.

20. **P. ribifolium**, Jacq.—Aug. to Nov.—Common in damp shady places near Grt.

21. **P. graveolens**, Ait.—Sep., Oct.—Common in damp shady places near Grt.

22. **P. Radula**, Ait.—Oct., Feb.—Amongst rocks near Grt. and at Highlands.

RUTACEÆ.

CALODENDRON, Thunb.

1. **C. capense**, Thunb.—Scattered in woods (Woest Hill, Howison's Poort, Belmont Valley, etc.)

BAROSMA, Willd.

1. **B. pulchella**, B. et W.—Sep. to Nov.—Near Grt. (Howison's Poort, Coldstream, Brockhuizens Poort); Sidbury.

2. **B. venusta**, E. & Z.—Aug.—Common on the hills south of Grt.

3. **B. scoparia,** E. & Z.—July., Aug , Sep.—Grt. (behind Bot. Gardens, Cradock Road, etc.)

4. **B. lanceolata,** E. & Z.—Aug.—Not uncommon near Grt. (Howison's Poort, etc).

AGATHOSMA, Willd.

1. **A. Owanii,** Sond.—Nov.—On the hills not far from the Fish River Mouth (MacOwan 373), and on the hills above the Bushmans River, near Salem.

2. **A. apiculata,** G. F. W. Mey.—Sep.—Amongst shrubs, Port Alfred, near sea-level.

3. **A. gnidioides,** Schlecht.—July.—On the hills round Grt.

4. **A. thymifolia,** Schlecht.—July.—Bothas Hill near Grt. (MacOwan 560).

5. **A. ericoides,** Schlecht.—Nov.—In the valleys south of Grt.

XANTHOXYLON, Linn.

1. **X. capense,** Harv.—May.—Fairly common in woods throughout our districts.

CLAUSENA, Burm.

I. **C. inaequalis,** Benth.—Oct., Nov.—Fairly common in woods throughout our districts, especially towards the sea.

TODDALIA, Juss.

1. **T. lanceolata,** Lam.—Woods near Grt. and Port Alfred

2. **T. natalensis,** Sond.—" Frontier of Albany, Mrs. F. W. Barber (fide Harvey in Flora Cap. I, p. 447); frequent in the coast forests of the Eastern Conservancy (Sim l. c. p. 157).

OLACINACEÆ.

APODYTES, E. Mey.

1. **A. dimidiata,** E. Mey.- Sep.—Fairly common in open bush near Grt. (Prince Alfred Road, Howison's Poort, etc.)

CASSINOPSIS.

1. **C. capensis,** Sond.—At the edges of bush near Grt.

ILICINEÆ.

ILEX, Linn.

1. **I. capensis**, Sond. et Harvey.—Oct., Nov.—Near Grt (Featherstone's Kloof, Brookhuizen's Poort).

OCHNACEÆ.

OCHNA, Schreb.

1. **O. atropurpurea**, DC.—Sep.—Common in open bush throughout our districts.

2. **O. arborea**, Burch.—Aug.—Fairly common in the bush near Grt. (Woest Hill).

MELIACEÆ.

TURRAEA, Linn.

1. **T. obtusifolia**, Hochst.—Jan. to July.—In open bush, Port Alfred.

EKEBERGIA, Sparrm.

1. **E. capensis**, Sparrm.—Sep. to Jan.—In woods in Brookhuizen's Poort near Grt.; Bathurst.

CELASTRACEÆ.

CASSINE, Linn.

1. **C. albanensis**, Sond.—Albany, Mrs. F. W. Barber (fide Sonder in Flora Cap. 1, p. 467). Not known to me.

2. **C. scandens**, E. & Z. var.—Grt. (MacOwan 242).

LAURIDIA, E. & Z.

1. **L. reticulata**, E. & Z.—Botha's Hill and Featherstone's Kloof near Grt.

GYMNOSPORIA, W. & A.

1. **G. peduncularis**, Sond. — In woods near Grt., "abundant throughout the Eastern Conservancy, etc." (Sim l. c., p. 184).

2. **G. acuminata,** Linn.—Sep. to Nov.—Grt. (slopes of Mountain drive), Blaauwkrantz; "occurs in all conservancies from the coast to 6,000" (Sim l. c. p. 185).

3. **G. linearis,** Linn.—Sep.—Bothas Hill.

4. **G. polyacantha,** Sond. — Nov. — Brakkloof; Burnt Kraal (MacOwan 778).

5. **G. procumbens,** Linn. — On the sand hills at the Kleinemonde (MacOwan 1403). Not seen by me.

6. **G. undata,** Thunb. — "Frequent in the Eastern Conservancy" (Sim l. c. 186); Port Alfred (Schlechter 2738); Botha's Hill E. & Z. (fide Sonder in Flora Cap. 1. p. 457).

7. **G. capitata,** E. Mey. — May. — "Bushman's Riverhoogde," E. & Z. 947. Not found by any other collector within our districts.

8. **G. heterophylla,** E. & Z.—Aug.—Grt., Ecklon and Zeyler. (Represented in Herb. Alb. Mus. by E. & Z.'s specimens, but not found by any other colloctor within our districts).

9. **G. buxifolia,** Linn.—Aug, Sep.—Very common near Grt.

10. **G. nemorosa,** E. & Z.—June.—In woods near Grt. (MacOwan 295).

11. **G. angularis,** Sond.—Aug., Sep.—Very common near Grt.

12. **G. maritima,** Bol. Sand-dunes, Port Alfred and Kleinemonde

13. **G. apiculata,** Sond.- Kleinemonde (MacOwan 1402). "On the coast dunes from Port Elizabeth to Pondoland." (Sim l. c., p. 187).

14. **G. angustifolia,** Sond.—"Albany, Mrs. F. W. Barber" (fide Sonder in Flora Cap. 1., p. 472). (MacOwan's no. 1171 from the Bothasberg named *G. angustifolia* does not seem to belong to this species).

PTEROCELASTRUS, Meissn.

1. **P. variabilis,** Sond.—Nov.—Common near Grt., Trapp's Valley, etc., especially on stony hillsides.

PUTTERLICHIA, Endl.

1. **P. pyracantha,** Linn.—Nov., Dec.—In open bush near Grt.

ELAEODENDRON, Jacq.

1. **E. croceum,** DC.—"Primitive woods of Fish River" (fide Sonder in Flora Cap. I, p. 468). "Distributed throughout the Eastern Conservancy, etc." (Sim l. c. p. 190).

2. **E. capense,** E. & Z.—"Frequent, especially in the coast-forests of the Eastern Conservancy, etc." (Sim l. c. p. 190).

3. **E. Kraussianum,** Bernh. (*Cassine capensis*, Linn.)—May.—Woods near Grt. "Frequent in the forestral districts throughout the Colony usually forming part of the forest-fringe" (Sim l. c., p. 190).

4. **E. aethiopicum,** Oliv. (*Mystroxylon confertiflorum*, Tul.)—Jan.—Port Alfred and Kasouga, in the bush on the sand hills. "Frequent throughout the Eastern Province, especially on the shale-formation" (Sim l. c., p. 191).

5. **E. sphaerophyllum,** Presl.—Apr.—Port Alfred. "Frequent throughout the Eastern Province, especially on the shale-formation" (Sim l c.. p. 191).

6. **E. n. sp.?**—Sandhills, Kasouga (MacOwan 751).—This seems to be an undescribed species, but the material is scarcely sufficient for a full description.

RHAMNACEÆ.

SCUTIA, Comm.

1. **S. indica,** Brongn. (= *Sc. Commersoni*, Brongn.)—Jan. —Common in woods at Grt., Port Alfred, etc.

RHAMNUS, Linn.

1. **Rh. prinoides,** L'Herit.—"Occurs in all forest districts of Cape Colony" (Sim l. c. p. 179). I have not seen specimens from our districts, but it is sure to occur in them.

PHYLICA, Linn.

1. **paniculata,** Willd.—March to May.—Common on stony hillsides near Grt.

2. **Ph. lutescens**, Sond.—Aug. to Nov.—Common on the hills near Grt.

3. **Ph. gnidioides**, E. & Z.—March to Nov.—Coldspring, Atherstone.

NOLTEA, Reichb.

1. **N. africana**, Reichb.—Nov.—On the banks of the Kowie River at Blaauwkrantz.

HELINUS, E. Mey.

1. **H. ovata**, E. Mey.—"Common throughout the Eastern Province" (Sim l. c., p. 180). Not found near Grt., but sure to occur in our districts.

AMPELIDACEÆ.

CISSUS, Linn.

1. **C. capensis**, Willd.—Hillside near Hamilton Reservoir, Grt., and generally found in our districts.

2. **C. Thunbergii**, E. & Z.—Fairly common in woods near Grt. and in Lower Albany.

3. **C. semiglabra**, Sond. ?—I have doubtfully referred to this species a specimen collected near Grt. by Mr. R. Ivy in Nov. 1902.

4. **C. pauciflora**, Burch.—Woods in Albany, common (fide Kuntz in Flora Cap I, p. 251). Var. *tridentata*, Kunth.—Feb.—Brickmaker's Kloof near Grt.

5. **C. dimidiata**, E. & Z.—Featherstone's Kloof and Botha's Hill near Grt.

6. **C. cuneifolia**, E. & Z.—Featherstone's Kloof near Grt.

7. **C. rhomboidea**, E. Mey.—In woods near Grt. (Howison's Poort, etc.)

8. **C. cirrhosa**, Pers.—Hell Poort near Grt. (MacOwan 606).

SAPINDACEÆ.

PAPPEA, E. & Z.

1. **P. capensis**, E. & Z.—In carroid scrub near Botha's Hill.

SCHMIDELIA,

1. **S. erosa,** Arn. (= *S. natalensis*, Sond.)—Ap., May.—Riet River and Kleinemonde, east of Port Alfred.

2. **S. decipiens,** Arn. -Dec.—Port Alfred and Bathurst (MacOwan 406). "Abundant throughout the Eastern Province from the coast to 5000′." (Sim l. c., p. 170).

HIPPOBROMUS, E. & Z.

1. **H. alata,** E. & Z.—July to Nov.—Frequent in woods near Grt. and in Lower Albany.

DODONAEA, Linn.

1. **D. Thunbergiana,** E. & Z.—In carroid scrub near Botha's Hill.

PTAEROXYLON, E. & Z.

1. **P. utile,** E. & Z.—Jan.—Abundant throughout our districts.

AITONIA, Linn. f.

1. **A. capensis,** L. f.—In carroid scrub of the Fish River Valley. Not seen by me from our districts.

MELIANTHUS, Linn.

1. **M. comosus,** Vahl.—Oct.—Coldspring and Brookhuizens Poort near Grt.

ANACARDIACEÆ.

HARPEPHYLLUM, Bernh.

1. **H. caffrum,** Bernh.—March.—Fairly common in woods near Grt, and in Lower Albany.

ANAPHRENIUM, E. Mey.

1. **A. abyssinicum,** Hochst., var *mucronifolium*, Engl.—Jan.—Botha's Hill, Brak Kloof, and Hell Poort.

LOXOSTYLIS, Spreng.

1. **L. alata,** Spreng.—Sep.—In damp woods near Grt.

RHUS, Linn.

1. **Rh. obovata,** Sond.—Jul., Aug.—Grt. (Currie's Kloof, etc.), Assegai Bush.

2. **Rh. tomentosa,** Linn.—Aug.—In open bush, hillsides near Grt.

3. **Rh. undulata,** Jacq.—Botha's Hill, E. & Z. (fide Sonder in Flora Cap. I, p. 518).

4. **Rh. excisa,** Thunb., var *pallens*, Sond.—Jan.—In bush near Grt. (MacOwan 501).

5. **Rh. scytophylla,** E. & Z.—Aug.—Woest Hill near Grt.; between Port Alfred and the Kasouga.

6. **Rh. albomarginata,** Sond.—Nov.—Sand hills near Kasouga River (MacOwan 1303); Slaay Kraal, Burke; Kowie River, Zeyler (fide Sonder in Flora Cap. I, p. 519).

7. **Rh. lucida,** Linn.—Howison's Poort near Grt.

8. ? **Rh. longispina,** E. & Z.—Found at Sandflats and probably extends into the Albany District.

9. **Rh. crenata,** Thunb.—Port Alfred.

10. **Rh. villosa,** Linn. f.—Currie's Kloof near Grt.

11. **Rh. puberula,** E. & Z.—In woods near Grt. (Howison's Poort, Assegai Bush, etc.)

12. **Rh. pyroides,** Burch.—Albany, E. & Z.

13. **Rh. mucronata,** Thunb., var *Jacquini*, Sond.—Grt. (MacOwan 977). A narrow leaved form was collected near Grt. by Miss Daly and Miss Gane (No. 747).

14. **Rh. dentata,** Thunb.—April, May.—Near Collingham, Assegai Bush, etc.

15. **Rh. laevigata,** Linn.—Dec.—Common near Grt.

16. **Rh. lancea,** Linn. fil.—Grt., Fish River. Not seen by me from our districts.

17. **Rh. Eckloniana,** Sond. — Oct. — Howison's Poort, Botha's Hill.

(To be continued.)

On some new and some little known species of South African Plants belonging to the genera Aloe, Gasteria, Crassula, Cotyledon and Kalanchoe.

By S. SCHÖNLAND, Ph.D., Hon. M.A., Oxon.

Aloe Broomii, Schönl., n. sp.

Caulescens. Truncus erectus vel adscendens. Folia ad apicem trunci dense rosulata, glauca vel rubescentia, immaculata, ovato-lanceolata, mucronata, indistincte lineata, apice dorso carinata et 4-5 aculeis instructa, marginibus linea cartilaginea cincta, aculeis deltoideis pungentibus instructa. Inflorescentia terminalis, simplex. Scapus brevis, crassus, bracteis vacuis ovato-acuminatis numerosis tectus. Racemus elongatus dense multiflorus, bracteis cuneato-ovatis. Pedicelli breves. Perianthium leviter curvatum, petalis subliberis staminis stylisque exsertis.

Caulescent; leaves up to 25 cm. long, unspotted, rosulate, crowded, ovate lanceolate, tapering into a pungent horny apex, rather firm, carinate on the back near the apex and with spines on the keel, younger ones almost straight, older curved in, younger glaucous, older reddish, on both surfaces indistinctly lineate, slightly convex on the outer surface, slightly concave on the inner, margin with a narrow horny border on which there are spines between fairly regular straight inter-spaces of 8-12 mm. Spines at right angles to the margin or slightly pointing downwards, very sharp from a broad base, brown at the base, lighter-coloured at the apex.

Inflorescence unbranched. Scape thick, densely covered with ovate-acuminate sterile bracts which are 3.5 cm. long. Raceme very dense, multiflowered, c. 33 to 80 cm. long, 5 cm. broad in the smaller inflorescences. Bracts ovate, cuneate at base, acute at apex, nearly 3 cm. long. Pedicels short, perianth 2 cm.

long, slightly curved. Petals almost free, outer very pale yellow becoming brownish towards the apex, inner very pale yellow, with a green median line—the three petals on the concave side of the perianth with a dark brown spot at the apex. Flowers proterandrous, eventually stamens and style in turn projecting c. 8 mm. beyond the perianth. Filaments slightly flattened, thinner at the base, pale yellowish at the base, pale red in the upper portion, anthers oblong, very pale brick-coloured. Ovary and style pale yellow, stigma very small.

Young rosettes of this species look exactly like the rosettes of *A. longistyla*, Bak., which, however, never has the large leaves of *A. Broomii*. Besides the flowers are quite different. *A Broomii* is evidently allied to *A Peglerae*, Schönl. which, however is acaulescent. Large plants of *A. Broomii* have stems 60 cm. in height, but they do not grow higher usually. Very old plants are usually lying down, and the stem only exceptionally reaches a length of 120 cm. Frequently the old stem shows branching.

Pampoonpoort. Dr. R. Broom. Oct., 1907.

I have pleasure in naming this species in honour of my friend Dr. Broom, to whom I owe many interesting succulents. *A. Schlechteri*, Schönl., was found growing by him at the foot of the hill at Pampoon-poort while *A. Broomii* grew on the top.

Aloe castanea, Schönl., n. sp.

Subaucalis. Folia lanceolata e basi sensim attenuata, apice leviter recurvata, intus sulcata, glaucescentia, immaculata, marginibus parvis aculeis instructis. Inflorescentia simplex. Scapus viridibrunnea, compressa, bracteis vacuis brunneis numerosis instructus. Racemus elongatus dense multiflorus, bracteis ovati-cuspidatis, floribus breviter pedicellatis, petalis subiberis, staminis stylisque paullo exsertis.

Leaf c. 43 cm. long, c. 8 cm. broad at the base, tapering very regularly towards the pointed slightly recurved apex; deeply channelled above and consequently very concave on the under surface; glaucous, unspotted; marginal spines brown on a green base, small (c. 1. 5 mm. long), slightly curved forward, separated by nearly straight fairly regular interspaces which are 8–11 mm. long. Scape greenish-brown, laterally compressed, provided with numerous ovate-cuspidate, dry, brownish, empty bracts. Raceme c. 43 cm. long, very densely multiflowered. Bracts ovate-cuspidate, brownish, c. 12 mm. long. Flowers shortly pedicellate, pedicels c. 2.5 mm. long, rather thick. Flower-buds brown at the tip, irregularly marked with reddish brown on the convex side, yellowish green on the concave side. Flowers upright or spreading; very decidedly proterandrous. Perianth c. 19 mm. long; lobes (both inner and outer) practically free; outer slightly narrower than inner and slightly asymmetrical Ground-colour yellow, outer with much chestnut-colour, especially along the median line and at the tips, inner yellow, outer stamens decidedly shorter than the inner, and with broader anthers. Ovary rather angular; style eventually exceeding the corolla by about 3 mm ; stigma small, capitate.

Origstad valley, near Lydenburg (Burtt-Davy 2856, vii. 06); also common in the Smit Drift valley, near Haenertzburg.

Aloe parvibracteata, Schönl. n. sp.

Acaulis. Folia lanceolata, supra leviter sulcata, obscure viridia, nitida, maculis prasinis irregularibus fasciatim dispositis lineisque concoloribus numerosis striato-nervata, infra prasina secundum margines obscure viridia, maculis irregularibus obscure viridibus substriato-nervata, marginibus aculeis parvis instructis. Inflorescentia paniculata, scapo sine bracteiis vacuis, racemis laxiusculis, multifloris, bracteis ovatis cuspidatis, floribus pedicellatis pendulis, perianthio elongato, petalis basi connatis, staminibus stylisque vix exsertis.

Leaf lanceolate, c. 32 cm. long, 6.5 cm. broad at the base, slightly channelled above, slightly convex below. Upper surface dark green with numerous elongated bright green blotches which are united in irregular transverse bands and with numerous indistinct longitudinal parallel bright green lines. Under surface bright green with dark green margin and elongated narrow dark green blotches, which form interrupted longitudinal parallel lines.

Margin with small horn-coloured spines on dark green bases, separated by nearly straight or rounded interspaces which are 8-10 mm. long. Inflorescence a panicle. Scape brownish, without empty bracts; racemes about 20 cm. long, floriferous portion about 15 cm. long, very laxly multiflowered; flowers patent; bracts ovate cuspidate, membranous, lowest about 4 mm. long, upper gradually smaller, sometimes absent. Lowest pedicels 10–12 mm. long, upper gradually smaller. Flowers slender, dark red, slightly swollen at the base. Tube of perianth 1.9 cm. long, lobes 7 mm. Margins of outer lobes narrowly edged with yellowish white, inner broadly edged with whitish. Filaments rather broad towards the base, slender above; anthers brick red, pollen pale brick red. Ovary rather long (9 mm.). Stamens and style do not seem to exceed the perianth.

From the cliffs at Lourenço Marques (Burtt-Davy 2853, vii. 06). Allied to *A. transvaalensis*, O.K. "A particularly slender form which retains its character under cultivation in Pretoria" (Burtt-Davy in litt.).

Gasteria Beckeri, Schönl., n.p.

Acaulis. Folia 6-8, dense rosulata, lanceolato-deltoidea, e basi sensim attenuata, in spinam corneam exeuntia, lateraliter dorso carinata, viridia, tuberculis parvis vix elevatis separatis vel confluentibus transversaliter fasciatim irregulariter dispositis ornata. Inflorescentia terminalis, simplex vel ramosa, racemis laxis, bracteis albis lanceolatis acutis, pedicellis pendulis. Perianthium basi oblonge ampliatum.

Acaulescent; leaves 6-8 in a dense multifarious rosette, moderately thick, c. 5 cm. wide at the base, c. 12 cm. long, gradually narrowed to the acute apex, provided with a horny, short and very pointed mucro, laterally carinate, both upper and lower surface green with a large number of small, scarcely raised, greenish white, more or less confluent tubercles, which are disposed in irregular transverse bands, margins with very slightly raised elongated tubercles. Peduncle terminal, usually simple, laterally compressed, c. 30 cm. long. Raceme rather loose, c. 14 cm. long. Bracts white, lanceolate, acute, 4-6 mm. long. Pedicels red, pendulous, c. 8 mm. long. Perianth c. 18 mm. long, ball narrow oblong, c. 3 mm. wide, red, upper portion of perianth greenish.

Near Ciumber, Lower Albany, leg. Dr. H. Becker, F.L.S., F.S.A. Flowers in January and February. The flowers become larger under cultivation and reach 3 cm. in length. This species is evidently allied to *G. parvifolia*, Bak.

Crassula connivens, Schönl. n. sp.

Suffruticosa, erecta, glaberrima, e basi ramosissima, c. 14 cm. alta, ramis teretibus, basi efoliatis, sursum dense foliatis. Internodia c. 5 mm. longa, apicem versus sensim minora. Folia sub-connata, leviter incurvata, tereti-subulata, subacuta, carnosa. inferiora c. 1 cm. longa, superiora sensim minora. Inflorescentia terminalis, pedunculata, pauciflora, cymoso-corymbosa, pedunculo 4 bracteis vacuis parvis munito, c. 2 cm. longo, floribus pedicellatis, bracteis parvis. Calyx breviter gamosepalus, lobis ovatis. Petala oblonga, quam sepala subtriplo longiora, erecta, conniventias, infra apicem dorso mucronata. Stamina petalis basi adnata, filamentis subulatis, antheris ovatis. Carpella margine ventrali breviter ciliata, stylis ovariis subaequilongis recurvatis. Squamae subcarnosae, subquadratae, apice rotundatae leviter emarginatae, pallide virides.

Matjesfontein, Dr. F. W. Purcell, 1905. Flowered in Grahamstown, April 1906.

This species has no doubt often been mixed up with *C. acutifolia*, Lam. In fact I belelieve that Harvey's *Cr. acutifolia* in the Flora Cap. represents at least two more species. The following table will show the essential difference of *Cr. connivens* and *Cr. acutifolia* (the latter as found near Grahamstown):

Crassula acutifolia, Lam.	*Cr. connivens*, Schönl.
Leaves tereti-subulate, acute. Petals pure white, not mucronate, recurved, 2 mm. long.	Leaves teriti-subulate, subacute.
Anthers brownish-red, pollen whitish.	Petals greenish white, mucronate, upright and connivent, 3 mm. long (all other floral parts also larger in proportion than in *C. acutifolia*). Anthers
Carpels not ciliate along the inner suture.	

Squamae broader than long, cuneate, deeply emarginate, red.

dark red, pollen yellow.

Carpels along inner suture minutely ciliate.

Squamae sub-quadrangular, rounded and very slightly emarginate, pale green.

Crassula planifolia, Schönl. n.sp.

Suffruticosa, glaberrima, ramosa, decumbens vel adscendens, ramis teretiusculis basi efoliatis, annulatis, sursum dense foliosis. Folia lanceolata decussata sublibera carnosa subplana, supra leviter concava, (in sicco) multis maculis parvis albis ornata, infra leviter convexa maculis parvis albis sparsim ornata. Inflorescentia et flores illis *Cr. acutifoliae* valde similes.

Nobengubo hill-side near Columbo mission; trailing over rocks. Miss Alice Pegler, 1451, Sep. 20th, 1907. Alt. 1000 ped

Resembling in almost all respects the larger forms of *C. acutifolia.* The leaves are, however, though fleshy, practically flat, being only very slightly convex at the back and slightly concave on the upper side and longer. They have small white spots, especially on the upper surfaces. These were, however, not noticed by me in the fresh specimens. The flowers in my specimens were a little too much advanced for a minute description, but they showed clearly the following differences from *C. acutifolia:*

Calyx-lobes blunter and tube of calyx slightly longer.

Style shorter as compared with the ovary.

Squamae white, somewhat longer, and not so deeply emarginate.

Crassula Peglerae, Schönl., n.sp.

Herbacea, perennis, e basi ramosissima ramis erectis simplicibus vel ramulosis, teretibus, retrorse hirsutis, foliosis. Folia remota, internodiis subaequilongis, ovata acuta sessilia, subconnata, infra convexa, supra plana an leviter concava, impresso-punctata, supra glabra, infra sparsim hirsuta. marginibus minute sed dense retrorse papilloso-ciliatis. Inflorescentia terminalis, cymosa, contracta, sub-corymbosa. Flores breviter pedicellati, campanulati. Sepala lanceolata sublibera, dorso papillosa convexa, margine versus apicem papilloso-ciliata. Petala oblongo-spathulata, infra apicem dorso minute mucronulata. Stamina sublibera filamentis subulatis, antheris oblongis. Carpella margine ventrali breviter ciliata, stylis elongatis quam ovaria subaequilongis, stigmatis minutis capitatis. Squamae minutissimae, latiores quam longae, apice rotundatae et leviter emarginatae.

Kentani, Miss A. Pegler, 1181, alt. 1000 ped., Mart. 1905.

Stem herbaceous, richly branched from the base, branches more or less upright, usually simple, terete, red, restrorsely hirsute with white hairs, internodes about the same length throughout (10-13 mm.). Leaves sessile, subconnate, ovate, acute, c. 18 mm. long, c. 8 mm. broad in the middle, upper only slightly smaller than the lower, strongly convex below, flat or slightly concave above, impresso-punctate above and below, glabrous above, slightly retrorsely hirsute below, the hairs increasing in numbers towards the base, margin minutely but densely retrorsely papilloso-ciliate. Inflorescence terminal, cymose, contracted, subcorymbose. First bracts leaf-like, younger ones gradually much smaller; flowers shortly pedicellate, campanulate.

Sepals green, lanceolate, nearly free, convex and papillate on the back, margin minutely papilloso-ciliate in the upper part only, 3.5 mm. long.

Petals white, oblongo-spathulate, spreading in the upper third, 5 to 5.5 mm. long, on the back just below the apex minutely mucronulate with a subulate mucro.

Stamens c. 4 mm. long; filaments subulate white, anthers red.

Styles about the length of the ovaries and gradually passing into them, subulate, stigmata minute, capitate. Squamae very minute, broader than long, emarginate. Inner margin of carpels sparingly ciliate.

This species is closely allied to *Cr. ramuliflora*, Link. (*Cr. stachyera* E. & Z.) and also to *Cr. Meyeri*. I have ventured to describe Miss Pegler's specimens under a new name as I have been able to stu ly them alive, and they are certainly very distinct from the typical *Cr. ramuliflora.* I hope to give before long a more detailed account of this very variable species, when several forms which have hitherto been united to it, will probably have to be separated.

Crassula Cooperi, Rgl., var. *robusta*, Schönl., n. var.

Hanover, Cape Colony, Dr. F. W. Purcell, flowered in Grahamstown, Feb. '06.

Besides being more robust in all parts than the type, this variety has ciliated sepals, while in the type the margins of the sepals are smooth. The lowest leaves as received from Dr. Purcell in Nov. '06 were c. 4 cm. long and 2 cm. broad, the spots on the upper surface of the leaves were larger and more pronounced. The inflorescence has more flowers, and is more richly branched.

This variety comes close to *Crassula Schmidti*, Reg. (Gartenflora 1886, p. 345 t. 1225) (= *Cr. impressa*, N.E.Br.) On the other hand I have specimens of *Cr. Cooperi*, which can hardly be distinguished from *Cr. curta*, N.E.Br. It seems, therefore, likely that all these species will have to be united.

Crassula setulosa, Harv., var.

This species is exceedingly variable. I know at least five different forms, which, however, run into one another. I have only, so far, examined one in the living state, and give the notes which I jotted down from it.—A low herb, richly branched from the base in a pseudo-dichotomous manner and this pseudo-dichotomous branching is continued right up to the inflorescence. Height about 8 cm. Stem and branches terete, almost white, covered with soft pubescence. Internodes nearly of equal length (c. 14 mm.) throughout, only shortened below the inflorescence. Leaves flat, but somewhat fleshy, ovate, subconnate, subglabrous on both surfaces, ciliate on the margin, lowest about 15 mm. long, 7–8 mm. broad, upper gradually smaller. Inflorescence terminal, a pseudo-corymb, many-flowered, bracts and bracteoles similar to the foliage leaves but much smaller. Flowers shortly pedicellate. Calyx green with a slight tinge of red, perfectly glabrous. Sepals connate at the base, lobes lanceolate, mucronate, thin, convex on the back, about half the length of the petals. Petals white, recurved, obovate-spathulate, c. 4 mm. long, free, with a vey minute dorsal mucro. Stamens free from the petals, filaments white, rather broad, anthers dark red, pollen yellow, c. 3 mm. long. Carpels white, 2.5 mm. long, style about the length of the ovary, slender. Squamae *very* minute, yellow, broadly cuneate, rounded and emarginate above.

As in *Cr. Galpini*, the anthers discharge their pollen successively, but all stamens stand upright and look ripe at one and the same time.

Magaliesberg, J. Burtt-Davy, 3068, Feb. 1905.

Crassula Gillii, Schönl., n.sp.

Herbacea, perennis. Caulis brevis, foliis rosulatis faciebus glabris, margine dense ciliatis, obovatis acutis vel obtusis. Inflorescentia terminalis vel lateralis, dense cymoso-corymbosa vel capitata, pedunculata, pedunculo tenui, bracteis 4 vacuis munito. Bracteae parvae, margine ciliatae. Flores subsessiles. Sepala sublibera lanceolata obtusa, margine ciliata, apice breviter mucronata, dorso subcarinata. Petala leviter recurvata, oblonga, quam sepala sub-duplo longiora. Filamenta filiformia, antherae parvae late oblonga. Carpella oblique ovata, stylis brevibus. Squamae membranaceae, late cuneatae, apice rotundatae leviter emarginatae.

"In rupestribus pr. Somerset East pr. Visch River, alt. 3000 ped., flor. Oct., Nov." P. MacOwan 1586. There are six specimens which were received with the Gill College Herbarium presented to the Albany Museum a few years ago by the Gill College Trustees. They were named *Cr. orbicularis*, Linn., but the capitate inflorescence, the broader leaves, the absence of runners, the form of the squamae (which in *Cr. orbicularis* are spathulate) distinguish *Cr. Gillii* sufficiently from this species. It comes close to *Cr. swaziensis*, Schönl. (Journ. Linn. Soc. XXXI, 1897) which I placed originally under *Perfilatae*, while it should be amongst *Rosulares*, but this is a pubescent, distinctly fruticose species.

Height of plant (incl. inflorescence) c. 10 cm.; lowest leaves c. 3 cm. long, c. 2 cm broad; upper leaves of the rosette gradually smaller; peduncle 5-6 cm. long; lobes of sepals c. 2.5 mm. long; petals c. 4 mm. long; stamens c. 3.5 mm. long; carpels c. 1.5 mm. long.

Crassula Engleri, Schönl., n. sp.

Herbacea. Caulis brevis adscendens. Folia subrosulata, connata, ovata, subacuta, margine dense ciliata. Inflorescentia elongata, thrysoidea, breviter pedunculata. bracteis foliis similibus sed minoribus. Flores masculini subsessiles. Sepala ovata glabra, petala lutea, erecta, oblonga, quam sepala duplo longiora, stamina brevissima, filamentis filiformibis, antheris late ovatis. Flores femini ignoti.

Van Rhynsdorp; Western slope of the Bokkeveld.

Shady places in crevices of rocks, 600 m., Sep. 12, 1900. L. Diels.

Lowest leaves c. 2.5 cm. long, c. 1.6 cm. broad; inflorescence c. 9 cm. long, peduncle c. 1 cm. long; length of sepals 2 mm., of petals 4 mm., of stamens c. 1 mm., of the anthers 0.6 mm.

This is one of the most extraordinary species of *Crassula* known to me. Some years ago Dr. Diels sent me a specimen in which I thought the flowers were undeveloped, as I could not find any carpels and the stamens were very small. I have now, through the kindness of Prof. Engler, had a chance of examining the material in the Berlin Herbarium, and found to my astonishment that, as before, each flower, which I dissected, was without female organs, and that the stamens are very short as compared with the other floral organs. The pollen in the flowers, which I examined, was ripe and normally developed, but no discharge of it had taken place. I must, therefore, come to the conclusion that *Cr. Engleri* is a **dioecious species**, and, if so, it is the only one in the genus *Crassula* known so far.

Crassula Broomii, Schönl., n.sp.

Herbacea, perennis, rhizomate breve tuberoso. Folia radicalia, patentia, imbricata, rosulata, spathulato-suborbicularia, carnosa, subplana, supra minute papillosa, margine ciliata. Inflorescentia terminalis erecta, elongata, thyrsoidea, pedunculata, bracteis ovatis, ciliatis Calyx extus papillosus, gamosepalus, lobis ovatis, obtusis, dorso convexis. Petala basi connata, suberecta, ovato-spathulata, infra apicem dorso mucronulata. Stamina libera quam petala subaequilonga, filamentis subulatis, antheris oblongis. Ovaria oblique oblonga, stylis subulatis, stigmatis ad apicem dorsalibus, elongatis. Squamae minutae, duplo latiores quam longae, apice rotundatae, leviter emarginatae.

Pampoonpoort near Victoria West, Oct. 1907. Dr. R. Broom.

The leaves in this species are very soft, their lower surface is smooth and reddish, the upper subglaucous with numerous brown irregular depressions. The flowering stem is c. 12 cm. long, bearing in the lower third four pairs of small leaves without flowers and a number of gradually smaller leaves bearing in their axils dense cymes of flowers which form a slightly interrupted thyrsus. The leaves on the flowering stem are sheathing, the lowest c. 2 cm. long, the uppermost 2 mm., calyx c. 3.5 mm. long, its lobes 2 mm. Petals c. 5 mm. long, pink with white margin and a brownish dorsal mucro. The stamens are quite free from the corolla and about equalling it in length, the anthers are brick-coloured, the pollen pale yellow. The carpels are c. 3 mm. long, the style is about half the length of the ovary.

Crassula barklyana, Schönl., n.sp.

Suffruticosa, pygmaea, e basi ramosissima, ramis dense foliatis, in regione florifero dichotome ramulosis, caulibus pubescentibus. Folia sub-carnosa, subplana, oblanceolata obtusa, connata, vaginantia, marginibus tenuiter ciliata versus apicem glaberrima. Flores inter ramificationes terminales, solitarii vel gemini, pedicellati. Sepala basi connata ovato-lanceolata glaberrima. Petala alba, basi connata, ovata. Stamina petalis basi adnata, filamentis filiformibus, antheris oblongis. Overia oblique ovata, stylis subulatis quam ovaria vix brevioribus. Squamae carnosae, late cuneatae, apice rotundatae leviter emarginatae.

Wittebergen; damp places, mt. Ben McDhui, distr. Barkly East, alt. c. 9150′. E. E. Galpin 6626, March 1904.

This is a regular alpine plant. Its height is only about 4 cm. Its usually solitary flowers place it near sect. *Filipedes*, but it is quite distinct from any other species. The lowest leaves are c. 1.3 cm. long, the upper gradually smaller. The pedicels are somewhat fleshy and c. 4 mm. long. The petals are white (or rosy ?) some with a darker coloured spot about the middle. Length of sepals c. 2 mm., of petals c. 2.5 mm., of stamens c. 2 mm., of carpels c. 1.75 mm.

Crassula (§ Sphaeritis) Purcellii, Schönl., n. sp.

Suffruticosa, ramosa. Rami pubescentes, subtetragoni, laxe foliosi. Folia pubescentia, glauca, connata, carnosa, subteretia vel subovata dorso convexa, supra subplana apicem versus convexa, leviter incurvata, apice subcuspidata vel obtusa. Inflorescentia terminalis subpedunculata corymbosa, floribus subsessilibus in cymos densos stipitatos confertis. Sepala basi connata dorso pubescentia, lobis oblongis dorso convexis, margine ciliatis. Petala alba, sepalis paullo superantia, forma ut in subgenero. Filamenta linearia, antheris luteis oblongis Carpella quam stamina duplo breviora, oblique oblonga, stylis brevissimis crassis, stigmatis subdorsalibus. Squamae membranaceae, pallide luteae, subrectangulares apice rotundatae emarginatae, longiores quam latae, quam carpella duplo breviores.

Matjesfontein, Dr. F. W. Purcell. Flowered in Grahamstown, Dec., 1906.

The mode of growth and the shape of the leaves, which somewhat resemble those of *Cotyledon decussata*, Sims, distinguish this species from all other known species of the subgenus *Sphaeritis*.

Height of plant, c. 50 cm., lower internodes c. 1.6 cm. long, upper gradually longer. Lowest leaves c. 4 cm. long c. 6 mm. broad, upper gradually smaller and more pointed, passing gradually into the floriferous bracts. The floral structure does not differ materially from that of most other species of C. § *Sphaeritis*. The petals are white, stamens yellow, the squamae pale yellow.

Crassula (§ Sphaeritis) serpentaria, Schönl., n. sp.

Suffruticosa. Caulis simplex, teres, foliosus, adscendens. Folia sub-connata, pubescentia, margine ciliata, ovato-lanceolata, carnosa, supra sulcata, infra convexa, basi cordata. Inflorescentia terminalis, in specimine meo valde ramosa, paniculata, bracteis foliis similibus sed minoribus, floribus sessilibus in cymos pauciflores sessiles vel breviter pedunculatos confertis. Calycis lobi ovati, dorso convexi, pubescentes, petalorum forma ut in subgenero. Stamina petalis basi adnata, antheris oblongis luteis, quam petala subtriplo minores. Carpella oblique oblonga, stylis brevibus, stigmatis, subcapitatis subdorsalibus, rubris. Squamae membranaceae, quam carpella subtriplo breviores, luteae, subquadratae apice rotundatae, leviter emarginatae.

Springbokfontein, Namaqualand. Mr. W. Magennis, 1905. Flowered in Grahamstown, Sep. 1906.

Length of stem, in the specimen described, to the beginning of the inflorescence, 40 cm.; length of inflorescence, 25 cm.; length of lower leaves c. 5 cm.; greatest breadth 1.3 to 1.4 cm., upper leaves only a little smaller; length of internodes 1 to 2 cm.; thickness of stem c. 3 mm. (very even throughout); length of calyx 3 mm., of the calyx lobes 2 mm., of the petals 3.5 mm.

This species struck me as remarkable on account of its long, unbranched, comparatively thin stem. It has not only retained this character under cultivation but showed it even in a more pronounced manner. The richly branched inflorescence is also remarkable, but this was probably due to an early injury of the top.

Crassula (§ Globulea) Rogersii, Schönl., n.sp.

Suffruticosa, ramosa, laxe foliosa, ramis pubescentibus. Folia subpetiolata, obovata, carnosa, pubescentia. Inflorescentia terminalis, thyrsoidea. Scapus pubescens, 2-4 foliis reductis munitus. Flores pedicellati, calyce tomentoso, tubo calycis breve, lobis lanceolatis obtusis, petalis quam calycem duplo longioribus, squamis cuneatis substipitatis, apice rotundatis profunde emarginatis.

Port Alfred, Rev. F. A. Rogers, Jan. 1907.

A straggling subshrub, branches, leaves, scape, peduncles, bracts, pedicels and calyx softly pubescent, the pubescence on the calyx and pedicels rather longer than on the other parts. Branches with about four pairs of foliage leaves which are subpetiolate, obovate, soft and fleshy, subconnate, lowest internodes c. 12 mm. long,upper gradually shorter,lowest leaves (incl. the narrowed base) c. 2 cm. long, 6 mm. broad, upper gradually smaller. Scape about 5 cm. long, provided with two pairs of reduced leaves. Bracts and bracteoles small, lanceolate, obtuse, pedicels short. Flowers in an interrupted thyrsus, cymules rather dense, few flowered. Calyx-tube very short, lobes about 2 mm. long, lanceolate. Petals creamy white, about twice the length of the calyx. Shape of petals, stamens and carpels about the same as in allied species. Squamae about 1/3 the length of the carpels, cuneate, substipitate, rounded and deeply emarginate at the apex.

This is a very distinct species of the subgenus *Globulea*, the species of which are generally very ill defined and extremely variable. It seems to come near *Globulea mollis*, Haw, which is one of the many species of *Crassula* known only from unsatisfactory descriptions; the shape of the leaves in our species is, however, quite different.

Cotyledon heterophylla, Schönl., n.sp.

Fruticosa, ramosissima, ramis basi efoliatis lignosis, sursum carnosa, tomentosa, foliis c. 8 decussatis munitis. Folia oblonga subpetiolata crassa carnosa, tomentosa, dorso convexa, supra leviter convexa, inferiora obtusa vel glanduloso-apiculata, apicem versus 2 dentibus obtusis munitis, superiora integerrima sessilia. Inflorescentia terminalis pseudo - paniculata, pedunculo pubescente, floribus pendulis, pedicellis pubescentibus. Tubus calycis brevissimus, lobis deltoideis extus pubescentibus. Corolla extus sparse pubescens, tubo pentagono, lobis ovatis acutis quam tubum duplo brevioribus. Stamina corollam leviter superantia. Filamenta corollae basi adnata, infra lanuginosa, antherae oblongae. Carpella gracilia, squamis marginibus lateralibus carpellis adnatis, margine apicale breviter emarginatis.

"Forming a bush about a foot high and much branched" (N. S. Pillans in litt.) Lower portion of branches bare and woody, upper portion fleshy, tomentose, with about 4 pairs of decussate leaves, lowest internodes c. 12 mm. long. Leaves oblong, subpetiolate, thick and fleshy, tomentose, strongly convex on the back, slightly so on the inner surface, lower blunt or glanduloso-apiculate, further with 2 glandular (?) blunt teeth near the apex, 6 cm. long, upper sessile and quite entire, 5 cm. long. Peduncle terminal, rather thick and fleshy, pubescent, without reduced leaves, 9 cm. long. Flowers pseudo-paniculate, pendulous, pedicels c. 12 mm. long, pubescent. Calyx tube very short, lobes deltoid, separated by rounded interspaces, c. 2 mm. long, pubescent on the outside. Corolla reddish, with short pubescence on the outside, tube pentagonous, c. 1 cm. long, lobes ovate, acute, c. 5 mm. long. Stamens slightly exceeding the corolla in the open flower. Filaments adnate to the tube near the base, hairy near the point of attachment, anthers oblong. Carpels slender, squamae small, forming a shallow cup, slightly emarginate on the outer rim.

Along the road between Ladismith and Laingsburg, Eustace Pillans, 1906 (N. S. Pillans, No. 968).

This is a more robust plant than *C. tomentosa*, Harv. to which it is probably nearly allied. Besides the differences in habit, the relative proportions of corolla-tube, lobes and calyx are different in the two species. However, these relative characters have in the genus *Cotyledon* to be used with great caution as they are frequently inconstant. The heterophylly of this species will repay further examination in fresh specimens. The lateral projections and the apex of the lowest leaves have a most peculiar glandular appearance which is otherwise unknown to me amongst Crassulaceæ. The branch from which the above description was taken had about 10 flowers.

Cotyledon ventricosa, Lam.—The following notes taken from live specimens supplement the description in the Flora Capensis II (p. 375): Peduncles and pedicels glanduloso-pubescent. Sepals almost free, lanceolate, acute, spreading and recurved at the apex, almost flat, green, glanduloso-pubescent on the back, 6–12 mm. long. Corolla green, both inside and outside finely pencilled with red in the upper portion, usually slightl, ventricose, very slightly curved, on the outside glanduloso-pubescent, on the inside towards the base sparsely tomentose, tube 14–20 mm. long, lobes lorato-lanceolate, acuminate, slightly recurved, slightly twisted near the apex, 7–10 mm. long. Epipetalous stamens reaching about 3 mm. beyond the episepalous ones. All stamens included. Filaments slender, very thin in the upper half, lower half, with the exception of the base, lanuginose, anthers small, broad, apiculate. Carpels slender, squamae yellow, tongue-shaped, slightly emarginate above, c. 2.3 mm. long.

Cotyledon caralinoides, Linn.—Th·s species was found by Mr. Eustace Pillans at the Kenko River, Oudtshoorn division (in flower March 1907). To the description in the Flora Capensis I may add that the squamae are small, green, submembranous, subquadrate.

Cotyledon Wallichii, Harv.—I have identified with this species a plant which Dr. Broom sent some years ago from Prince Albert, and which seems to have a pretty wide distribution in the Karroo. Cultivated specimens in Grahamstown flower in December. The following notes may supplement the description in the Flora Capensis II, p. 374: The plant forms a fleshy, branched stem which reaches about a foot in height. The tereti-filiform, glabrous, glaucous leaves are crowded at the end of the branches and reach about 5–8 cm. in length. As in allied species they appear in spring and drop off before the flowers appear, their somewhat prominent scars thickly covering the branches. Sepals nearly free, lobes ovate, acute, c. 7 mm. long, rounded on the back, glaucous with a faint yellow tint. Corolla greenish-yellow, tube 11 mm. long, lobes obliquely ovate, acute, recurved, c. 8 mm. long. Stamens projecting beyond the corolla in the open flower, filaments slender, very thin in the upper two thirds, base broadened and hairy, anthers oblong, pale yellow. Carpels slender, squamae small, greenish yellow, submembranous sharply emarginate above.

Cotyledon Pillansi, Schönl. (= *C. cuneata*, Harv., non.

Thunb.). I have no doubt that a specimen collected by Mr. N. Pillians in Sep. 1906 (no. 883) at Biesjespoort, Victoria West district, belongs to the species described by Harvey inFlora Cap. II, p. 373, as *C. cuneata*. Judging from the descriptions I cannot imagine that Thunberg's and Harvey's species are the same, and a new name is, therefore, required. The same species was found in Nov. 1906 at Oudtshoorn by Miss A. Taylor, and in 1907 by Dr. Broom at Pampoonpoort near Victoria West. Mr. Pillans wrote when sending his specimen: "My plant is not more than a foot high, with a stem 3/4" thick, and is now sending out branches from its base. The leaves are suberect." My own specimens are growing in the same manner.–Stem subligneous, branched at the base, glabrous. Leaves in a few decussate pairs, crowded, ovate-oblong, cuneate at the base, hispid or subglabrous, glaucous or green with a dark red cartilaginous border, slightly concave above, slightly convex below, obtuse or mucronate, lowest c. 12 cm. long, c. 10 cm. broad, upper gradually shorter and narrower. Inflorescence terminal, cymose, subcorymbose. Peduncle c. 30 cm. long, with usually 4 reduced leaves, glanduloso-pubescent (especially in the upper portion). Flowers pedicelled, patent or pendulous. Pedicels, bracts (which are small and sometimes absent), calyx, and outer part of corolla glanduloso-pubescent. Calyx-lobes somewhat fleshy, ovate, acute, separated by rounded interspaces, c. 4 mm. long. Corolla yellowish-green, tube pentagonal, usually 6 mm. long, sometimes longer, lobes spreading, recurved, lanceolate, plicate at the apex, usually 11 mm. long, sometimes shorter. Stamens inserted just below the throat of the corolla, with scanty hairs at the point of insertion, anthers oblong, pink, minutely apiculate. Carpels slender, coloured like the corolla. Squamae almost white, with slightly emarginate apex, forming a shallow cup.

Cotyledon cuneata Thunb.—In the "Journal of Botany," 1902, p. 89, Mr. E. G. Baker and myself gave a short description of a plant collected by Mr. R. Schlechter at Vuurdood, Western Region. We referred it very doubtfully to *C. tomentosa*, Harv. With a fuller knowledge of the South African species of Cotyledon I am now inclined to refer it to *C. cuneata*, Thunb., though the absence of leaves in our specimens makes the determination still somewhat doubtful. I must again point out that the plant described by Harvey in Flora Cap. II, p. 373 as *C. cuneata* can hardly be Thunberg's plant.

Kalanchoe pyramidalis, Schönl., n. sp.

Glaberrima, herbacea, 100-150 cm. alta. Caulis carnoso-herbaceus, foliosus, glauco-viridis, internodia inferiora c. 4 cm. longa, sursum gradatim longiora summa breviora. Folia cruciatim opposita, pallide viridia, sessilia, inferiora 35-45 cm. longa, medio 8-9 cm. lata, superiora gradatim minora, carnosa, plana, plicata basi semi-amplexicaulia, apice cucullata, margine irregulariter crenato-sinuata. Inflorescentiae multiflorae cymoso-corymbosae, terminales and laterales. Bracteae foliis similes sed minores. Pedicelli et calyx griseo-pulverulenti. Tubus calycis 1.25 mm. longus; lobi calycis 2.5 mm. longi, ovato-lanceolati, dorso convexi. Tubus corollæ 1.5 cm. longus, basi c. 4 mm. diam., subhypocrateriformis, tetragonus, pallide virido-flavescens. Lobi corollae recurvato-patentes, subcordiformes, subplicati, intus pallide flavescentes, extus pallide virido-flavescentes, 2 mm. longi et lati. Filamenta tubo adnata, quatuor faucem adaequantia, quatuor breviora, antherae parvae, luteae. Ovaria subtrigona, externe convexa, viridia, erecta, approximata, in styles parvos elongata, stigmatis parvis capitatis. Squamae lineatae, tenues, pallide virido-pallescentes, c. 2.5 mm. longae.

Whole plant glabrous, 100 to 150 cm. high. Stem fleshy, herbaceous, leafy, glaucous, lowest internodes c. 4 cm. long, gradually longer upwards, but uppermost again shorter. Leaves decussate, pale green, sessile, lower 35 to 45 cm. long, in the middle 8-9 cm. broad, upper gradually smaller, fleshy, plicate, semi-amplexicaul at the base, cucullate at the apex, margin irregularly crenato-sinuate. Inflorescences multiflowered, cymoso-corymbose, terminal and lateral. Peduncles 20 to 30 cm. long. Bracts similar to the foliage-leaves but much smaller. Pedicels and calyx greyish pulverulent. Calyx-tube 1.25 mm. long; calyx-lobes 2.5 mm. long, ovate-lanceolate, convex on the back. Corolla-tube 1.5 cm. long, at the base c. 4 mm. in diam., tetragonous, pale greenish-yellow. Corolla-lobes patent and recurved at the apex, subcordiform, subplicate, on the inside pale yellowish, on the outside greenish yellow, 2 mm. long and broad. Filaments adnate to the corolla-tube, the epipetalous ones slightly exceeding the tube, the episepalous ones shorter, anthers small, yellow. Ovaries subtrigonous, externally convex, green, erect, passing into short styles, stigmata small, capitate, squamae linear, delicate, pale greenish-yellow c. 2.5 mm. long.

I collected this handsome plant, which appears to be quite distinct, in Sep. 1903 at Serowe, N.E. Kalahari. It flowered in Grahamstown in May 1904, and the following year, but the living plants are now lost. Its leaves form with the upright stem a handsome pyramid. In floral structure it comes nearest to *K. paniculata*, Harv. (which, I may mention, I found to be common on the hills near Norval's Pont, and which has also recently been collected at Bloemfontein by Dr. Bolus and Dr. Potts).

On the Geological Horizons of the Vertebrate Genera of the Karroo Formation.

By R. Broom, M.D., D.Sc., Victoria College, Stellenbosch.

At the South African meeting of the British Association I read a paper "On the classification of the Karroo system of South Africa," in which I endeavoured to subdivide the system into different Zones by means of the vertebrate fossils, and to give as far as possible the European equivalents. During the past two years a considerable number of new forms have been discovered; and as a Committee appointed by the British Association in 1905 is still considering the question of the age of the South African beds, it seems advisable to further review the question in the light of more recent finds. The previous paper was written mainly from a geological stand point, but the Karroo faunas are perhaps even more interesting when considered from the Zoological point of view.

The additional new genera discovered in the last two years have in no way altered the conclusions arrived at in 1905. The Dwyka is still believed to be Lower Permian and the Stormberg Lower Jurassic. The Beaufort beds form a continuous series, of which the lowest are Lower Permian and the highest beds Upper Triassic.

In the following tables I have given the geological horizons of all the satisfactorily known S. African genera. In one or two cases a "?" is put down indicating what is believed to be the zone, but concerning which there is some doubt.

SOUTH AFRICAN FORMATIONS.	Dwyka	Beaufort.							Stormberg.		
European Equivalents.	Permian L.	Permian M.		Permian U.		Trias. L.	Trias. M.	Trias. U.	Rhaetic	L. Jurassic.	
South African Zones.	Dwyka Beds.	Ecca Beds.	Pareiasaurus Beds.	Endothiodon Beds.	Cistecephalus Beds.	Lystrosaurus Beds.	Procolophon Beds.	Cynognathus Beds. (= Burghersdorp Beds.)	Molteno Beds.	Red Beds.	Cave Sandstone.
PISCES											
Selachii											
Order PLAGIOSTOMI											
Hybodus, Agassiz								x			
Dipnoi											
Order SIRENOIDEI											
Ceratodus, Agassiz								x			
Ganoidei											
Order CROSSOPTERYGII											
Coelacanthus, Agassiz								x			
Order HETEROCERCI											
Helichthys, Broom								x			
Elonichthys, Giebel	x	?	?								
Atherstonia, [S. Woodward						x					
Oxygnathus, Egerton								x			
Dictyopyge, Egerton								x			
Order LEPIDOSTEI											
Semionotus, Agassiz								?			x
Cleithrolepis, Egerton								x			
Hydropessum, Broom								x			
Pholidophorus, Agassiz								x			

South African Formations.	Dwyka	Beaufort.							Stormberg.		
European Equivalents.	Permian L.	Permian L.	Permian M.	Permian U.		Trias. L.	Trias. M.	Trias. U.	Rhaetic	L. Jurassic.	
South African Zones.	Dwyka Beds.	Ecca Beds.	Pareiasaurus Beds.	Endothiodon Beds.	Cistecephalus Beds.	Lystrosaurus Beds.	Procolophon Beds.	Cynognathus Beds. (= Burghersdorp Beds.)	Molteno Beds.	Red Beds.	Cave Sandstone.
AMPHIBIA											
Order STEGOCEPHALIA											
Rhinostoma, Broom			x								
Cyclotosaurus, Fraas								x			
Rhytidosteus, Owen								?			
Batrachosuchus, Br.								x			
Bothriceps, Huxley							?				
Micropholis, Huxley							x				
REPTILIA											
Synapsida											
Order PAREIASAURIA											
Pareiasaurus, Owen			x								
Propappus, Lydekker				x							
Order DINOCEPHALIA											
Titanosuchus, Owen			x								
Archæosuchus, Broom		x									
Scapanodon, Broom			x								
Delphinognathus, [Seeley			x								
Order THEROCEPHALIA											
Galechirus, Broom						x					
Alopecodon, Broom			x								
Pristerognathus, Seel.			x								
Lycosuchus, Broom			x								
Glanosuchus, Broom			x								
Hyaenasuchus, Broom			x								

South African Formations.	Dwyka	Beaufort.							Storm-berg.		
European Equivalents.		Permian L. M. U.				Trias. L. M. U			Rhaetic	L.Jur-assic.	
South African Zones.	Dwyka Beds.	Ecca Beds.	Pareiasaurus Beds.	Endothiodon Beds.	Cistecephalus Beds.	Lystrosaurus Beds.	Procolophon Beds.	Cynognathus Beds. (= Burghersdorp Beds.)	Molteno Beds.	Red Beds.	Cave Sandstone.
Trochosaurus, Broom			x								
Pardosuchus, Broom			x								
Cynodraco, Owen				x	?						
Aelurosaurus, Owen				x							
Ictidosaurus, Broom				x							
Scylacosaurus, Broom				?							
Scymnosaurus, Broom				?							
Gorgonops, Owen			?								
Cynochampsa, Owen					?						
Cynosuchus, Owen					?						
Scaloposaurus, Owen					?						
Ictidosuchus, Broom				x							
Arnognathus, Broom						x					
Order ANOMODONTIA											
Dicynodon, Owen			x	x	x	x		x			
Oudenodon, Owen			x	x	x	x		x			
Lystrosaurus, Cope						x					
Cistecephalus, Owen					x						
Prodicynodon, Broom				x							
Endothiodon, Owen				x							
Esoterodon, Seeley				x							
Cryptocynodon, Seeley				x							
Chelyoposaurus, [Broom				?							
Pristerodon, Huxley				x							
Opisthoctenodon, [Broom				x							

South African Formations.	Dwyka	Beaufort.							Stormberg.		
European Equivalents.	Permian L. M. U.					Trias. L. M. U.			Rhaetic	L. Jurassic.	
South African Zones.	Dwyka Beds.	Ecca Beds.	Pareiasaurus Beds.	Endothiodon Beds.	Cistecephalus Beds.	Lystrosaurus Beds.	Procolophon Beds.	Cynognathus Beds. (= Burghersdorp Beds.)	Molteno Beds.	Red Beds.	Cave Sandstone.
Order CYNODONTIA											
Cynognathus, Seeley								x			
Aelurosuchus, Broom								x			
Galesaurus, Owen							?				
Bauria, Broom								x			
Gomphognathus, Seeley								x			
Trirachodon, Seeley								x			
Microgomphodon, Seeley								x			
Diademodon, Seeley								x			
Sesamodon, Broom								x			
Melinodon, Broom								x			
Diapsida											
Order MESOSAURIA											
Mesosaurus, Gervais	x										
Heleosaurus, Broom						x					
Order PROCOLOPHONIA											
Procolophon, Owen							x				
Thelegnathus, Broom								x			
Saurosternum, Huxley				x							
Incert. sed.											
Eunotosaurus, Seeley			x								
Pelosuchus, Broom			x								
Order RHYNCHOCEPHALIA											
Palacrodon, Broom								x			

South African Formations.	Dwyka	Beaufort.							Stormberg.		
European Equivalents.	Permian L.	Permian M.		Permian U.		Trias. L.	Trias. M.	Trias. U.	Rhaetic	Liassie.	L.Jurassie.
South African Zones.	Dwyka Beds.	Ecca Beds.	Pareiasaurus Beds.	Endothiodon Beds.	Cistecephalus Beds.	Lystrosaurus Beds.	Procolophon Beds.	Cynognathus Beds. (= Burghersdorp Beds.)	Molteno Beds.	Red Beds.	Cave Sandstone.
Order PROTEROSUCHIA											
Proterosuchus, Broom							x				
Order GNATHODONTIA											
Howesia, Broom								x			
Order PHYTOSAURIA											
Erythrosuchus, Broom								x			
Order LACERTILIA											
Paliguana, Broom							x				
Order DINOSAURIA											
Massospondylus, Owen										x	
Thecodontosaurus, [Riley & Stutch										x	
Euskelesaurus, Huxley										x	
Order CROCODILIA											
Notochampsa, Broom										x	x
MAMMALIA											
Order MULTITUBERCULATA											
Tritylodon, Owen										?	
Incert. sed.											
Karoomys, Broom								x			

The fishes of the Karroo Beds are still rather imperfectly known. Those of the upper beds I have recently had an opportunity of working out, and have been fortunate in obtaining a number of new forms. As Smith Woodward had previously pointed out there is a distinct resemblance to the fish fauna of the Hawkesbury Beds of New South Wales. Of the ten genera known from South African Upper Karroo beds, five are also found in the Hawkesbury beds, and two others are represented by allied genera. But seven of the genera are found in Europe, and only two are, so far as known, confined to South Africa, and not improbably these may yet turn up elsewhere.

The Labyrinthodonts, like the fishes, are very similar to the Permian and Triassic forms of other parts of the world. *Rhinostoma* is found in European Permian beds, *Cyclotosaurus* in those of Triassic age. Perhaps they both point to a land connection between Africa and Europe in early Permian times.

When we look at the Reptilian faunas, the most striking feature is the marked dissimilarity from the faunas of the north. Of the genera found in the Permian beds only 3 out of 37 are certainly known in Europe, viz., *Pareiasaurus*, *Dicynodon*, and *Oudenodon*, and it is highly probable that these have migrated by a land connection to the north-west of India, from their being associated with *Glossopteris*. One other genus, *Scymnosaurus* is very similar to the European *Inostranseria*. With these exceptions the South African fauna is unlike that of the Permian of any part of the world. The Pelycosaurs and Cotylosaurs so characteristic of the American Permian are quite unknown in Africa, and no Therocephalians, Dinocephalians, Anomodonts or Pareiasaurians are certainly known from America. Some limb bones have been discovered in the American Triassic beds which may be Anomodont and Therocephalian, but if they prove to be so they most likely, judging from their late appearance, came from Africa by way of Europe.

The Triassic fauna is quite as distinctive as the Permian. It is characterised by the appearance of *Cynodonts*—extremely mammal-like reptiles which are unknown from any other part of the world. They first appear apparently in beds which are middle or upper Trias, and are almost entirely confined to the uppermost beds of the Trias. The large majority of the other Triassic genera are also very unlike those of other regions. *Proterosuchus*, *Howesia*, *Erythrosuchus*, *Paliguana*, and *Heleosaurus* are each so different from their nearest known allies in other parts that they must each be regarded as the type of at least a distinct family.

Though four of the five Triassic genera are confined to S. Africa the differences from European and American forms is much less than between the Permian and Triassic faunas.

It will be many years before the African strata can be at all fully explored, and many hundreds of new reptiles almost certainly remain to be discovered. Further research will probably enable us to connect up fully the Therocephalians with the Dinocephalians, the Anomodonts and the Cynodonts, and most probably the Cynodonts with the mammals.

The Andalusite Schist of George.

By E. H. L. SCHWARZ, A.R.C.S., F.G.S.

In the George division in the South-west of Cape Colony there are two large outcrops of granite separated by a zone of old slates, phyllites and mica-schists. The easternmost of the two is the last of the granite outcrops that form a chain from the Cape Peninsula to this point, and I have shown reason to believe that it is different from the other granite masses in that it is a horizontal arm and not a true batholith.[1] This point, however, does not concern us here except that it in a way accounts for the metamorphism that the slates have experienced; this is greater than would have been produced were the two outcrops the tops of two great domes of granite with a deep tract of slate between; it can be far better accounted for on the supposition that the igneous rock is continuous beneath the surface and that it has affected the slates between the two exposures by contact metamorphism. Several small dykes are shown in the road cuttings and deep river gorges, and these have superinduced an added metamorphism of their own, usually by altering mica-schists to andalusite schists. The whole area is one of intense interest, and is well worth a close investigation, but the present article is restricted to a study of specimens obtained from the east bank of the Kat (Zwart) River, about five miles from George Town, along the post-cart road.

The specimens were presented to the Albany Museum by the Geological Commission, through the Director, Mr. A. W. Rogers, and are catalogued as R. 39.

In the granite area of the south-west of Cape Colony the

[1] Ann. Rept. Geol. Comm., 1905, Cape Town, 1906, pp. 55-56; Geol. Mag., London, 1905, pp. 369-379.

metamorphic influence of the injections is very slight; on Signal Hill at Cape Town the clay slates are only moderately spotted near the contact, and the highest form of new mineral development is that of brown mica. In the great Malmesbury batholith although there is a large development of dykes, nothing remarkable has been noticed in the surrounding slates. At Stellenbosch Mr. Rogers records a certain amount of transference of felspar from the granite into the schist, and the development of augen gneiss with large orthoclase crystals; also, to a certain extent the alteration of the slates at the immediate contact into hornfels[2]. At Robertson augen gneiss is developed on a grand scale, with Carlsbad twins of orthoclase as big as one's thumb between the micaceous foliae; on the south-eastern side of the batholith there has been a *lit par lit* injection of the granite substance, so that between the sedimentary and igneous rocks there is a zone which belongs to both categories[3]. These are the main notices of metamorphic action that I know of in the south-west of Cape Colony other than that to be described in the following account; and it should be noticed that the main type of metamorphic action is that of the transference of the granite substance into the schists either by actual injection, or by the imbibition of the more mobile compounds in the granite by the sedimentary rocks, clearly proved by the formation of orthoclase felspar in the latter. In the George contact zone, however, the metamorphic effect is shown in the development of minerals not found in granite, and therefore usually supposed to have been formed by re-arrangement of the substances in the schists; I shall show, however, that the difference is only apparent, for in the case of the development of felspar the injected granite is a biotite granite and could spare the potash for transference as an aluminium silicate to the schists, whereas in George the granite is a muscovite granite, and required all the potash for itself; under the same conditions of contact metamorphism, the aluminium silicate was imbibed by the schists without potash, and therefore instead of orthoclase the andalusite was formed.

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[2]Ann. Rept. Geol. Comm., 1897, Cape Town 1898, p. 48.

[3]ib. p. 54.

Besides the references given above, the occurrence is noticed in Mr. Rogers' "Geology of Cape Colony," p. 45, and in Drs. Hatch and Corstophine's "Geology of South Africa," pp. 36 and 47; the former refers to the andalusite as chiastolite, but so far as I have seen the carbonaceous particles are not arranged as in that variety.

Throughout the George slate area there are many instances of the development of andalusite in the slates, but in most cases the crystals are small and are only partially developed. I have noticed only the one instance where the prisms are bounded by sharp terminal faces. The peculiarity of this development of new minerals is that it occurs between the dykes and not at the actual contact. I at first thought that the zones where we found andalusite marked the places where dykes existed further in the earth, remembering in this connection that contact metamorphism affects rocks to a far greater extent in the direction of foliation or bedding than against it, but the repeated occurrence of the andalusite schist within a few yards of the dykes and the comparatively unaltered condition of the sedimentary rocks between, negative this supposition; at any rate all geologists who have examined the exposures are satisfied that the andalusitisation is an instance of the action of contact metamorphism at a distance. Such occurrences are by no means uncommon, but as far as I can find there is usually some differences to be noticed in the original rocks, for instance, if a coarse-grained greywacke lies next to the granite, and a finer grained one a little away from it, then it will be the latter that will be affected by alteration far more than the former. Then again Brögger has described instances in Norway of one and the same bed being differently altered along the length of the contact. In the George exposures, however, the original rock seems to have been the same both close to and away from the granite, yet the rock near the contact is invariably unaffected. The nearest analagous case that I can find is that described by Grenville Cole from Aughrim in Ireland, where there has been an imbibition of felspar by the slates, but the felspar crystals first make their appearance at a distance of 1 to 2 feet from the contact.[a]

[a] Trans. roy. Irish Acad., 1891, p. 481.

The granite dyke in the Kat River section is a small one with an eliptical section, the major axis lying parallel to the foliation of the schist and inclined 45° to the south-east. On the under side there are a number of small dykes an inch to three inches in diameter. There is no attempt on the part of the granite to follow the foliation planes of the schists in their laminae; on the contrary, the small dykes are rounded in section and appear to riddle the slates without respect to the guiding planes of weakness. On the upper side of the main dyke the contact is quite abrupt and there are no offshoots. The andalusite forms only on the south side of the dyke; the beds are well exposed on the north, up the river, but there is no signs of contact metamorphism on the larger scale. This difference on the two sides of the dyke is in accord with the classical example of Huelgoat in Brittany, described by Barrois, where granite is intrusive in Silurian and Devonian slates; on the east side of the intrusion the rocks have suffered metamorphism to a distance of 3 kilometres from the contact, whereas on the west side there has been no alteration at all, proving that heat alone cannot be the cause of the new mineral development in the sedimentary rocks.

The small dykes have hardened the mica-schist at the immediate contact into a black hornfels or cornubianite, but the effect reaches only to a quarter of an inch from the granite. The cornubianite is largely made up of microscopic crystals of andalusite averaging ·7 mm. in length and ·15 m. breadth; they are arranged scale-fashion one over the other, occasionally running counter to the foliation of the schist. The mineral is colourless and has traces of distinct prismatic cleavage, and is usually terminated by frayed out ends or a single dome-face. Eye-shaped patches of the same substance occur, and both the crystals and the "eyes" contain quantities of pellucid, egg-shaped grains of quartz and a little red-brown mica. Occasionally a mica flake of the schist ends abruptly at the margin of the andalusite, and in the latter there is the continuation of the flake rounded off in the usual manner of these inclusions; the flake has the appearance of having had its end melted and a portion incorporated in the new crystal of andalusite. When the prisms of andalusite have sharp ends these are inclined to the vertical axis as if the prism was a simple monoclinic form; these terminations are parallel to the sides of the "eye-shaped" patches, and in the larger crystals to be presently described, this domal termination persists as a fairly regular parting.

Next to the granite margin there is a little muscovite and the quartz has the mosaic appearance of that in the granite; the biotite flakes are densly packed and cemented together.

The granite is a muscovite-oligoclase rock and at the contact the quartz and felspar are arranged prismatically. The ends of the larger crystals are rounded and project somewhat, causing the contact line, and the foliation of the schist external to it, to be wavy; between the rounded ends of the crystals there is a mosaic of quartz with a little muscovite, which passes in a thin layer over the ends of the larger crystals. This latter feature I think points to movement in the rocks after crystallisation, but before the granite had time to cool much below the temperature at which that was effected, possibly a subsidence of the superincumbent rocks consequent on the contraction of the granite on passing from the molten to the crystalline condition.

The mica-schist consists of greenish and reddish-brown biotite and subordinate quartz, with very little muscovite. The biotite is almost certainly derived from original chlorite. The brown biotite contains little needles probably of rutile arranged parallel to the gliding planes of the mineral, that is, along the rays of the pressure figure; the axial angle is very small but can be made out with a $\frac{1}{12}$ inch objective and the axial plane lies between the intersecting rutile needles, that is to say, the biotite is meroxene. Besides the new mineral andalusite in the schist there are small columns of a honey-yellow mineral with frayed out terminations; they are 2·5 mm. in length and about 1 mm. in diameter and are staurolite not yet perfectly formed.

The andalusite crystals even in the one section are very variable in the state of development, some being well formed crystals with basal planes with only a little rounding on the edges, others are terminated with irregularly formed rounded ends. The crystals are always covered with a scaly coaling of mica so that the prismatic angle cannot be accurately measured, but at a glance one notices that in most instances the transverse section is not so rectangular as the normal prism angle of 90° 48′ should give; measured with the contact goniomet r the angle is 92°-93°, but cleavage fragments measured with the reflecting goniometer give the normal prism angle. The obtuse angle of the prism is rounded in most crystals, as if there were present the macropinacoid and a second prism, but the covering of mica flakes prevents the faces from being recognised. The size of the crystals averages 4 centimetres in length by 1·5 centimetres in diameter. So far as my preparations go, we can divide the crystals into perfectly developed ones and irregular ones.

The former when hammered split readily parallel to the prism face and show on the fresh face a dark grey mineral with resinous lustre. The substance is divided into roughly rectangular blocks by the prismatic cleavage and by a number of planes of parting inclined to the vertical. These planes are almost cleavage planes and allow the crystal to split along them, giving faces which are nearly flat; they differ, however, from cleavage planes in that only a certain number are developed in a given crystal and the substance between the planes has not this property of parting. The more strongly marked planes of parting lie parallel to the macrodomes meeting the vertical at an angle of 60°. The majority of these parting planes lie parallel to one of the macrodomes. A second set of parting planes cross each other at an angle of 90° over the vertical axis ; these are more regular than the first set and allow sharp cleavage splinters to be knocked off, which show the emergence of one optic axis, only a little out of the normal to the face. The second set are developed more plentifully parallel to the dome face opposite to that to which the larger cracks are mostly parallel. These dome-partings are unrecorded as far as I can find in andalusite from other localities. The rough basal parting is also present.

A thin section parallel to the prism shows the body colours to be a beautiful rose-red which changes to a very pale greenish-blue when the light vibrates parallel to the horizontal axis, Trains of rounded black dots and stout, short rods of rutile follow more or less the direction of the parting planes. The former are graphite, showing in reflected light an adamantine lustre with white faces, and are probably carbonaceous matter which has aggregated in the andalusite substance from the minute flocculent material in the schists; the rutile needles also appear to have been enlarged from the inclusions in the biotite flakes. Rounded flecks of red-brown biotite occur throughout the substance of the andalusite, as well as pellucid, egg-shaped grains of quartz. None of the inclusions have induced pleochroic halos in the andalusite.

The inclusions are arranged in no sort of agreement with the present foliation of the schists, but if not scattered irregularly, follow more or less closely the lines of parting; on the outside of the crystals, however, there are flakes of mica which occasionally penetrate some distance into the andalusite, parallel to the trains of true inclusions; these flakes are of the greenish variety which represents the original mica before being, as it were, digested in the andalusite substance; we shall see that in the irregular crystals, these flakes from the matrix sometimes extend right across the crystals. In the better developed ones, however, the undigested biotite in the more central portions of the crystal is aggregated in small rounded spots, often surrounded by a zone of andalusite substance free from inclusions. It certainly appears as if during the building up of the andalusite crystal, the molecular movement was sufficient to push on one side those particles which the andalusite was unable to incorporate. These specks are much larger than the other inclusions, ranging up to 1 millimetre in diameter, and in other respects are quite different; for instance, the biotite flakes can be picked out with a fine point whereas the biotite in the other kind of inclusions are, as it were, melted into the substance of the andalusite. I will defer raising the question of the meaning of these inclusions till I have described the less well-developed crystals of andalusite. The margins of the perfect andalusite crystals are borded with a thin white zone ·4 mm. thick. Under the microscope this is resolved into a mass of very minute fibres standing vertically to the edge and arranged with a slight tendency to a radiating structure, the centres of the spherules being internal. A second layer is sometimes present outside the fibrous one, which is apparently composed of the same substance, but in which no structure, or at any rate only a very fine granular structure, can be detected. The indices of refraction and double refraction are low, and the material is in all probability one of the hydrated forms of aluminium silicate; the ordinary product of the alteration of andalusite is usually stated to be kaolin, but there are such a number of minerals of the same composition differing only in the amount of combined water, that it would be unwise to definitely call the present substance kaolin, because it occurs in a form quite unusual for that mineral. The other usual alteration products, talc, gibbsite and muscovite have too high double refraction to be mistaken. Sometimes the external alteration zone dips into the andalusite substance, which, as usual, is strongly cleaved near the edge and cuts off a portion of the andalusite. The planes of parting pass into the hydration zone and show conclusively that this is not a deposit on the surface of the original crystal.

Lying in the fibrous zone, and often between it and the granular portion, there are long bladed crystals with fairly strong single refraction and double refraction about the same as the andalusite. They are very faintly coloured blue when the long axis lies parallel to the vibration plane of the lower nicol and colourless at right angles; they also have strong basal parting and a cleavage running lengthwise through the crystals. They are very like cyanite in some respects, but the extinction is straight, and they are the rarer form of aluminium silicate, dumortierite, $10\ Al_2\ O_3,\ 7\ SiO_2$. In other parts of the hydration zone the mineral occurs as little granules, and in this form, also, it occurs in the fibrous zone which develops along the cracks in the interior of the andalusite crystal.

The hydration zone represents an alteration of the andalusite substance with increase of bulk, and this to my mind accounts for the biotite and muscovite flakes adhering to the outside of the crystals. Whether the Dumortierite inclusions are bits of the andalusite surrounded by the products of hydration, and converted by compression into the new mineral is a speculative point of no immediate importance.

The irregular crystals are terminated with rounded ends projecting on one side of the crystal end more than on the other, in fact in some examples the crystals appear to be capped by a macrodome of which one side is more developed than the other. On slicing the crystal lengthwise, parallel to the prism face or one of the pinacoids, the partings cutting the vertical axis at an angle of 60° are very strongly marked and intense alteration has gone on along them. The alteration is due to hydration, and the increase of bulk has in some instances closed the crack and formed a band of light coloured material traversing the crystal. In some cases, near the end, the original matrix separates the terminal portion of the crystal from the rest, and still beyond that, the matrix has the form of a further segment of the andalusite column, but the biotite and quartz have not yet been replaced, but have merely been slightly cemented together by the andalusite substance.

The section shows a network of grey branches usually aggregated in a central trunk; these in thin sections can be resolved by high powers of the microscope into an aggregation of fibres and granules, quite similar to those in the alteration zone on the outside of the crystals. The ill-formed segments at the end are particularly strongly attacked by this alteration, and although the minerals by their optical and other properties are shown to be kaolin and dumortierite, yet the form of the aggregate is like that of talc and epidote in altered magnesian silicates. The irregular crystals are also indented along the prism sides by bunches of biotite flakes and small pockets of matrix.

The nature of the imperfectly developed andalusite crystals confirms the conclusion derived from that of the "eyes" and small crystals in the cornubianite. In these latter the deposition of the new mineral was first in lenticular patches, of which the long sides parallel with the foliation of the schist became ultimately the prism faces, while the up-turned ends of the "eyes" became, first the termination, and in the large crystals, ultimately the strongly marked parting planes. This mode of origin explains why the strongly marked parting planes, those which cross the vertical axis at 60°, do not develop in two directions. In the perfect crystals one notices in picking them out of the schist that one side of the basal plane has a little heel of mica flakes parallel to the base; the orientation of these would be the result of the final energy of the crystalline substance in levelling up the basal plane from the inclined parting plane, and is another line of argument in favour of the view that the bending of the foliae of the schist is due not to movement in the mass, but to the molecular activity of the crystal.

Summarising these observations on andalusite, we see in the microscopic crystals in the cornubianite alongside the small dykes, that the andalusite substance collects in small eye-shaped kinks in the schist, first surrounding the grains in the matrix and gradually dissolving these and passing their substance out into the surrounding rock. Presently the patch grows and the crystalline substance has sufficient molecular activity to push the matrix aside and build up definite crystals; the prism zones are more active in this respect than the terminal planes, hence the ends of the crystals grade into the matrix. In the larger crystals the molecular activity is sufficient in some instances to clear a space for itself in the rock, both by dissolving out the constituent minerals till they are small enough not to hinder the development, or by actually pushing aside the matrix and forcing the laminae to pass round the columns; the foliae of the schist, however, stop abruptly at the terminal planes, with perhaps only a few flakes orientated along the basal plane, showing that the bending of the foliation planes round the crystals is not due to compressional movement after the formation. Besides this an inspection of the orientation of the crystals in the face of the rock (Plate X, fig. 2) shows that many of the columns do not lie with their long axes parallel to the foliation, as would have been the case had there been subsequent movement in the schist. A small amount of matrix, which the andalusite has been unable to pass out, is left in small dots in the substance of the crystal and is surrounded by material free from incorporated inclusions. These last seem to be necessary for the development of the andalusite and certain of the varieties, for instance graphite and rutile have actually been enlarged as a result of their being selected for inclusion. The biotite and quartz inclusions have been digested till they have all become rounded and more or less of the same size. In some instances, owing to want of heat or pressure or both, the molecular activity of the andalusite has not been able to form well-shaped crystals, and when this is the case, the mineral shows that it was weakness inherent in the crystal substance itself which caused this defect, by the fact that such irregular forms far more readily succumb to alteration by hydration than the perfect crystals. The latter expose the solid substance to the attack of circulating water, and alteration goes on only on the outside and along the cracks,—never within the crystal substance.

As to the origin of the andalusite, the usual theory is that it is derived from the substances in the slates, kaolin, muscovite and such like aluminium silicates. The matter is perfectly simple if the matrix happens to be a fairly pure aluminium silicate, but in the present instance it is highly charged with iron and magnesium, in fact the biotite largely preponderates over all other constituent minerals. If a rock of this kind were subjected to metamorphism the natural development of new minerals would be that of staurolite 6 (Fe Mg) 0, 12 $Al_2 0_3$ 11 $Si0_2$, 2 $H_2 0$, and where the substance of the slate runs together, this mineral does actually form. The iron and magnesium being soluble as compared to the aluminium, these may pass off in solution, and the simple aluminium silicate be left behind, so that there is nothing inherently improbable in the andalusite ($Al_2 0_3$, $Si0_2$) forming in this way. The large well-defined crystals in the Kat River section, however, are so similar in their mode of occurrence to the large felspar crystals in the schists round the Robertson granite mass, and in respect, also, to the varied inclination of the crystals to the foliation, the slight bending of the foliae round the inclusions and the abrupt ending of them where they impinge on the basal planes, and their development at a distance from the actual contact, they so alike, that I am strongly inclined to think that the large andalusite crystals have been formed in the same way. Everyone seems to be in accord in regard to the felspar, $K_2 O, Al_2 O_3 6SiO_2$, being derived from the granite: well, in the case of the Robertson granite the rock is a biotite granite, so that the igneous magma could spare the potash for transferrence to the schists, as it was not wanted to form any of the constituent minerals of the granite; in the case of the George dyke, the rock is a muscovite granite and all the potash was required to form the white mica, muscovite $K_2 O, 3 Al_2O_3, 6 SiO_2, 2 H_2 O$, and it seems reasonable to suppose, therefore, that under such circumstances the silicate transferred from the igneous to the sedimentary rock should be as nearly the same in composition as that of the orthoclase, but wanting in potash, and as a result the andalusite, $Al_2 O_3, SiO_2$, was the mineral that became developed. I do not wish to imply that the formation of andalusite in schists is as a general rule the result of imbibition of substance from the igneous magma, but that it is in all probability it is so in this particular instance. We can say that the granite masses of the south-west of Cape Colony form a more or less well defined petrographical province; the igneous rocks were formed under similar conditions of pressure and heat, and were injected right through into the same series of rocks, therefore the development of new minerals in the contact areoles should all conform more or less to the same general rules.

Description of Plate X.

Fig 1.—View of the granite dyke on the east bank of the Kat (Zwart) River, 5 miles from George Town along the Knysna Road. The main dyke is eliptical in section and on the lower portion a number of small dykes are seen riddling the mica schist. The schist is deeply eaten into by the weather, owing to the cleavage planes allowing the entrance of moisture. Five yards from the granite the andalusite schist begins.

Fig 2. -Near view of the andalusite schist showing the direction of the foliation of the schist, the more or less spaced arrangement of the andalusite crystals and the relation of their long axes to the foliation of the schist.

Descriptions of two new Species of South African Cicadidæ.

By W. L. DISTANT.

Sub-family TIBICININÆ.

Division *Tettigomyiaria.*

Xosopsaltria Schönlandi sp.n.

Male. Head, pronotum, mesonotum, metanotum and basal segment of abdomen obscure brownish-green; pronotum with the margins and a central longitudinal fascia fuscous; mesonotum with the lateral margins and a large discal patch in front of the cruciform elevation, which anteriorly encloses two pale obconical spots, fuscous; abdomen pale virescent, above more or less distinctly transversely fasciated with pale fuscous; head beneath, sternum and legs, brownish-green; tibiæ pale testaceous; face with two central longitudinal lines and the transverse striations fuscous; base of abdomen beneath dark fuscous; opercula pale virescent; tegmina and wings hyaline, talc-like, the venation brownish-green, tegmina with the costal area and the margins of the veins infuscate; vertex centrally longitudinally sulcate on its basal area; rostrum reaching the intermediate coxæ, opercula short, transverse, not meeting internally.

Long. excl. tegm., male, 15 mm. Exp. tegm. 26 to 27 mm.

Habitat, Transkei, Buntingville, near Umtata (Miss Barrett—Albany and British Museums).

Pauropsalta mimica sp.n.

Male. Head, pronotum and mesonotum black; lateral margins of front and a small spot at apex, a central fascia to vertex from the ocelli to base, margins of pronotum and a central longitudenal fascia which is ampliated posteriorly and contains a small black spot, lateral margins of mesonotum, and two discal longitudinal fascia which are inwardly angulated behind middle, the cruciform elevation and margins of metanotum, pale ochraceous; a black spot on lateral margins of pronotum at the posterior angles; abdomen above sanguineous, basal margin and a longitudinal series of transverse segmental spots, black; body beneath and legs pale ochraceous; head beneath black, margins of the face and a central spot at its base pale ochraceous; coxal spots, and some central abdominal spots (inconstant in number) black or piceous; tegmina and wings hyaline, the venation ochraceous on basal and darker in apical areas; vertex centrally longitudinally sulcate from vertex to base; rostrum reaching the intermediate coxæ; opercula short, transverse, well separated medially; wings with five apical areas, in some specimens only four.

Long. excl. tegm. 15 mm. Exp. tegm. 33 mm.

Habitat, Grahamstown (F. Pym--Albany and British Museums).

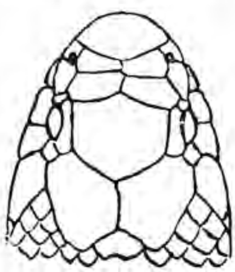
This is another addition to those species belonging to distinct genera which have a strongly simulative appearance. A comparison of *Melampsaltera leucoptera*, *Quintilia maculiventris*, *Taipinga consobrina*, and *Psilotympana signifera* with *Pauropsalta mimica*, all found in South Africa, will readily emphasise this suggestion

Description of a new species of Atractaspis, collected at Serowe, North Eastern Kalahari.

By LEWIS HENRY GOUGH, Ph.D. Assistant in the Transvaal Museum, Pretoria.

During the examination of the collection of South African snakes belonging to the Albany Museum, which had kindly been placed at my disposal by Dr. Schönland and Dr. Duerden, a new species of *Atractaspis* was found.

The specimen was collected at Serowe, in the north-eastern Kalahari, by Mrs. S. Blackbeard, on May 3rd, 1904. It appears to be closely related to *A. bibroni*, Smith, and to *A. rostrata*, Günther, but differs in sufficiently important characters to justify its being considered the type of a new species. In general appearance it differs greatly from *A. bibroni*, Smith, being much stouter and the colour of the specimen is also quite dissimilar from that of either of the species mentioned.



Head of Atractaspis duerdeni, n.sp.

I propose to give it the name *Atractaspis duerdeni*, n.sp., and describe it as follows:—

Snout prominent, subcuneiform. Rostral with a rounded horizontal edge, the portion visible from above a little longer than its distance from the frontal. Internasals and praefrontals much broader than long. Suture between the internasals shorter than that between the praefrontals.

Frontal broader than long, shield-shaped, longer than its distance from the end to the snout, and longer than the parietal; an azygous enlarged shield is present behind the parietals.

One prae- and one post-occular ; a large temporal wedged in between the fourth and fifth upper labials; five upper labials, first very small, third and fourth entering the eye, fourth largest. Posterior nasal much larger than the anterior.

First lower labial in contact with its fellow behind the symphysal; three lower labials in contact with the chin-shields, third very large, corresponding with the second, third and fourth upper labials.

Two pairs of chin-shields, first pair very large and broad, second pair two-thirds the length of the first and much narrower, wedged in between the first chin-shields and the third labial, their posterior tips separated by three scales, of which the middle one is slightly enlarged.

Scales in 21 rows; ventrals 199, anal entire, subcaudals 22, all except the first entire.

Cream coloured above and below.

A new Species of Parazoanthus.

By J. E. DUERDEN, M.Sc., Ph.D., A.R.C.S.

(PLATE XI.)

The genus *Parazoanthus* includes a number of species of small colonial actinians usually found encrusting or growing over sponges, hydroids, or shells of molluscs. They are widely distributed in both tropical and temperate seas, being found in shallow water and to depths of many fathoms. In the waters of False Bay, near Cape Town, a sponge-encrusting *Parazoanthus* is sometimes found, and lives freely in the tanks of the marine aquarium at St. James. I am indebted to Dr. J. D. F. Gilchrist for directing my attention to the form, and for supplying me with the material upon which the description is based.

Parazoanthus capensis, n.sp.

(Pl. XI.)

The colonies are very irregular in form, usually somewhat longer than broad. They appear as so many thickened superficial patches on the sponge, producing a slight depression wherever they occur. The individual polyps of a colony are closely arranged, and therefore the amount of intervening coenosarc is very small. On fullest retraction the polyps scarcely project beyond the general level of the coenosarc; on expansion they extend vertically from the surface of the coenosarc and hence grow in all directions, showing their independence of any geotropic influence.

The polyps expand freely in the laboratory, when the column measures about 4 mm. in height; in the partly retracted condition they extend 2.5 mm. beyond the general surface of the coenosarc and are about 2 mm. in diameter. The column is erect, cylindrical; somewhat enlarged below and above; on partial expansion 12 to 14 capitular serrations can be seen.

The tentacles on full expansion are long, overhanging, acute and colourless, and are arranged in two cycles, 12 to 14 in each cycle.

The coenosarc is thin and of the same character as the retracted polypal wall. Examined with a lens, minute white incrustations can be seen in both the coenosarc and lower part of the polypal wall. A very feeble effervescence takes place on the addition of hydrochloric acid, proving that the incrustations are calcareous.

The colour of the coenosarc and polyps is pale yellow, which contrasts strongly against the reddish brown sponge which the colonies encrust. On full expansion the tentacles are colourless and also the upper parts of the polyp.

In microscopic preparations the external walls, including both the ectoderm and mesogloea, are seen to be thickly impregnated with various forms and sizes of siliceous sponge spicules. Very few of these resemble those of the sponge on which the colonies are growing; evidentiy, therefore, the incrusting spicules are such as incidently fall upon the polyps and are not in any special way derived from the commensal sponge.

The endodermal cells are devoid of zooxanthellae, but yellow granules take their place, some, also, occurring in the inner part of the ectoderm. These yellow granules give the charateristic coloration to the living colonies. The ectoderm of the column is a continuous layer and contains numbers of large oval nematocysts in addition to the usual narrow kind. The mesogloea is very narrow in the upper part of the column and contains but few cell-islets; it thickens considerably below where it becomes continuous with the coenosarc.

As in several other members of the genus only a feeble endodermal sphincter muscle is developed. Even on retraction it is scarcely folded or pleated and the muscle layer is continued, almost as well developed, over the disc and down the stomodaeum.

The mesenteries present the macrocnemic arrangement characteristic of the genus, six or seven pairs occurring on each side.

The mesenterial filaments are apparently devoid of any ciliated bands or flimmerstreifen, as in other very small species of the genus.

The coenosarc is constituted mainly of mesogloea in which are abundant incrustations, cell-islets, and communicating canals.

In its general appearance the present species most closely resembles *Parazoanthus Swiftii* (Duch. & Michl) Duerd., found in West Indian waters. Both encrust branching sponges, form small irregular colonies, and their bright colours cause them to stand out very conspicuously against the sponge. In the Cape species the actinian is pale yellow against a reddish brown sponge while in the older species the colonies are bright orange yellow against a blackish green sponge. The colour contrast between the actinian and sponge is so great in each case as to suggest a warning significance, perhaps beneficial alike to the sponge and the actinian. In *P. Swiftii* the colonies are narrower and the polyps more linear in their arrangement than in *P. capensis*. In anatomical details the two species differ greatly, particularly in the thicker wall and much greater abundance of the yellow pigment granules in *P. Swiftii* than in *P. capensis*. The capitular serrations are almost invariably twelve in the former, while they are frequently fourteen in the latter, the tentacles and mesentaries having also a corresponding variation. No other species has yet been described with which *P. capensis* can be closely compared.

Sapphire-Cyanite Rock from the Jagersfontein Mine.

By E. H. L. SCHWARZ, A.R.C.S., F.G.S.

When the Jagersfontein Mine was first opened up, a large number of lumps of hard blue were found in the yellow ground. One of these containing sapphires was sent by Mr. W. Wagner to the Albany Museum in 1892, and forms the subject of the present note. A great deal of interest has recently been evoked with reference to the cyanite rock of the Roberts Victor (Damplaats) mine,[1] and on examining some of the detached "sapphires" accompanying the little nodule of rock, I found they were the same mineral as the Roberts Victor cyanite. The specific gravity of the granules, however, was intermediate between that of sapphire and cyanite, and the hardness ranged from 4 to considerably over 7. On slicing the nodule the reason of the discrepancy was explained, for both sapphire and cyanite were found to be present.

Sapphires have been recorded from the Jagersfontein mine by Gardner Williams[2] and Harger[3]; the latter also records them from the Frank Smith Mine, while rubies are said by Gardner Williams to occur in the same mine. Rubies occur in the Seta gravels on the Limpopo, with pebbles of green jade; some of them show the tabular hexagonal form but little worn[4]. A rock almost composed of rubies has been described by Tweddill from Leydsdorp in the Transvaal[5]. Outside South Africa, the Jagers-

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[1] R. Beck, Proc. Geol. Soc. S. Africa, vol. IX, Johannesburg, 1907, p xlviii.

[2] The Diamond Mines of S. Africa, London, 1902, p. 483.

[3] The Diamond Pipes of S. Africa; Trans. Geol Soc. S.A., vol. VIII., Johannesburg, 1906, p. 130.

[4] Specimens in the Albany Museum, presented by C. Hall of Durban.

[5] Ann. Rept. Geol. Survey, Pretoria, 1906, p. 107.

fontein rock is most nearly approached by the corundum eclogites of Cowee-creek, North Carolina[6]. In the garnet-cyanite rock of Damplaats, Beck records a few dark-blue grains of corundum with small green spinels; allowing for the small size of the lump, and the consequent impossibility of judging what the original rock was like in bulk, I believe the Damplaats rock is practically one and the same as that now described, for in the slices taken from the Jagersfontein lump only one shows the sapphires in any quantity; it also is of the same nature and belongs to the same category as the various eclogites now known from so many of the diamond mines.

The interest centering in these hard lumps in the blue ground is that geologists look to them to decide whether the diamond originated in a siliceous magma, or was crystallised in a metallic substance, such as titaniferous iron, the oxide of which occurs so plentifully in all the South African pipes, whether they contain diamonds or not. If the latter theory is correct, and the diamonds were freed by the burning away of the metal surrounding them when they were hurled in a state of incandescence into the air, then the hard lumps in the blue must have been formed subsequently as concretions.

Beck, however, received a lump 8 cm. by 15-18 cm. from the Newlands Mine, now abandoned on account of the hardness of the ground and the small body of diamondiferous material; this lump contained hundreds of small octahedra of diamond intergrown in diopside, or crystallised in between the diopside and garnet. These Newlands boulders, of which countless numbers have been found, were already consolidated in the depths of the earth and were dragged to the surface by the eruption; their formation in the pipe is out of the question. Beck goes further and states (*loc. cit.*, p. 301) that the Newlands boulders stand in the same relation to the blue ground as the olivine bombs do to

[6] J W. Judd & W. E. Hidden, Mineral Mag. 1899, vol. XII., p 139 et seq; J. H. Pratt, Am. Journ. Sci., 1898, p. 49.

[7] Untersuchungen über einige Sud-Afrik. diamantenlagerstätten Zeitschr. d. deutsh. geol. Gesell., Berlin, 1907, p. 303.

the basalts and basalt tuffs, that is to say, the eclogite is an igneous rock, and it follows that the diamonds, cyanites, sapphires, garnets and so forth were crystallised from a molten magma. The eclogite, then, would be an igneous rock of the same mineralogical composition as the usually known metamorphic one, and Beck proposes to call it Griquaïte to distinguish its mode of origin. My examination of the Jagersfontein rock and the comparison of the South African eclogites with cyanite-eclogites from Saxony and Bavaria, leaves me with the impression that the two are similar in regard to their origin; the presence of diamonds in some of them would be due to recrystallisation of the original carbonaceous matter in the crystalline schist, a view which is strengthened by the fact that in some instances the recrystallisation has only produced graphite. This assumption that the eclogites are portions of deeply buried schists brought to the surface does not in any way prejudice the question of the general origin of diamonds in the blue, for besides the many well known theories, there is that of the impregnation by vapours of carbon, either combined with hydrogen or oxygen, which could have built up the diamond crystals in the same manner as tin-stone crystals are formed in granite, that is to say, by pneumatolitic action. The gases contained in the blue ground have not to my knowledge been investigated, but it might lead to some further light being thrown on this vexed question if they were; it is certainly a fact that a wound from a block of falling blue ground is extremely dangerous, though the rocks from the walls of the pipe have not these poisonous qualities, the presumption being, therefore, that some noxious gas is present in the blue ground.

The Jagersfontein lump shows in section under the microscope a number of grains of sapphire and cyanite both feebly tinged blue, enclosed in mashed-up grains of garnet, much decomposed, and containing a little biotite and green spinel among the decomposition products.

The cyanite is very light Berlin blue, distinctly pleochroic to yellow in some sections. The grains have usually straight borders, more rarely rounded; they are of rhombic section and are frequently arranged in radial aggregates. The crystals are frequently cut in two by the interposition of matrix, but there is no displacement of the fragments. The most noticeable feature about the crystals is the strong parting, not cleavage, parallel to the basal plane, which is often accentuated by presence of matrix in the cracks. Single refraction high; double refraction varying from low to high. Under crossed nicols the polysynthetic twinning parallel to the gliding plane is extraordinarily developed, like in plagioclase and serebendite; the twinning parallel to the macropinacoid is often also present and is equally developed polysynthetically. In convergent light the mineral gives a negative biaxial figure with the axes widely divergent, but in my preparations there are no sections showing the emergence of an axis, so the crossed dispersion could not be seen; in cleavage fragments parallel to the macropinacoid, the body colour obscures the interference colours. Around the edge the mineral is altered to an isotropic mineral, probably spinel, coloured from bluish green to deep amethystine mauve; the same mineral can be seen under very high powers to penetrate the whole substance of the cyanite in irregular plates of extreme tenuity. Sometimes the spinel occurs as a definite layer bordering the cyanite, and from it portions have been detached which project into the matrix; other crystals have little pegs of spinel dipping into the margins of the cyanite grains. An indefinite talc-like substance has developed in one of the cyanite grains.

The sapphire is also light-blue in sections, very feebly pleochroic to a sea-green tint of blue; in form the grains are very similar to the cyanite crystals but are traversed by irregular branching cracks. Single refraction very high, double refraction low. Isotropic sections parallel to the basal plane give in convergent light a cross but no rings. Gliding planes parallel to the sides of the rhombohedron giving polysynthetic twinning like in calcite; in convergent light where the focus traverses a twin lamella the cross distinctly becomes a biaxial figure on revolving the nicols, but this can never be confused with the cyanite interference figure. The sapphire alters round the edge to the same spinel-like mineral as surrounds the cyanites, but the border is always sharp and clear.

Garnets are very much mashed up, some fairly fresh, others decomposed to a brown indefinite mass; they enclose grains of cyanite and corundum, and occupy subordinate positions between the grains of the other minerals. In the Cowee-creek eclogite it is the sapphire which encloses the garnet.

Matrix practically absent, or rather it is impossible to separate the alteration products of the garnet from what might have been matrix. Crystals of sea-green spinel are sparingly distributed through the mass, and a reddy brown mica, clearly secondary, calcite and greenish brown secondary minerals make up an indefinite felted mass.

The sections show in the development of gliding planes without cleavage, that the fragment has been subjected to steady pressure, without much distortional movement; it was probably the nucleus of a large block of which the outer portions have disintegrated and have mixed with the yellow ground. There is nothing to show that it is not of the normal eclogite type, and its presence in the blue-ground is best explained by considering it a portion of a deeply buried crystalline schist brought to the surface during the progress of the eruption.

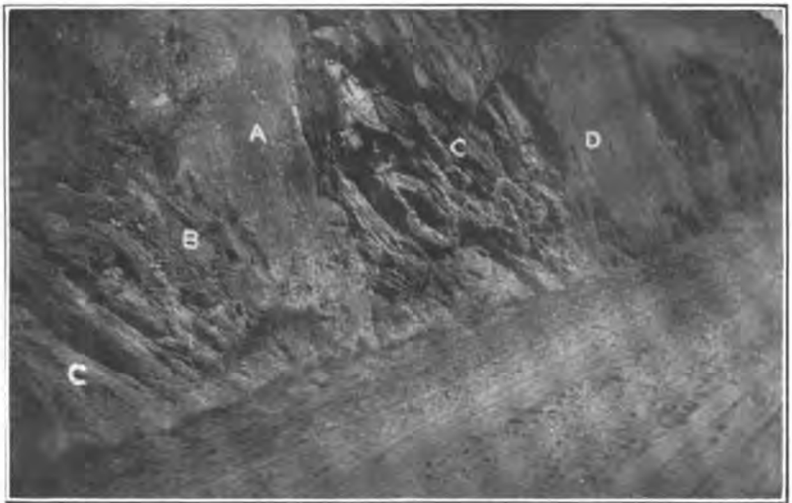


Fig 1.—Granite dyke in mica schist, Kat River, George.

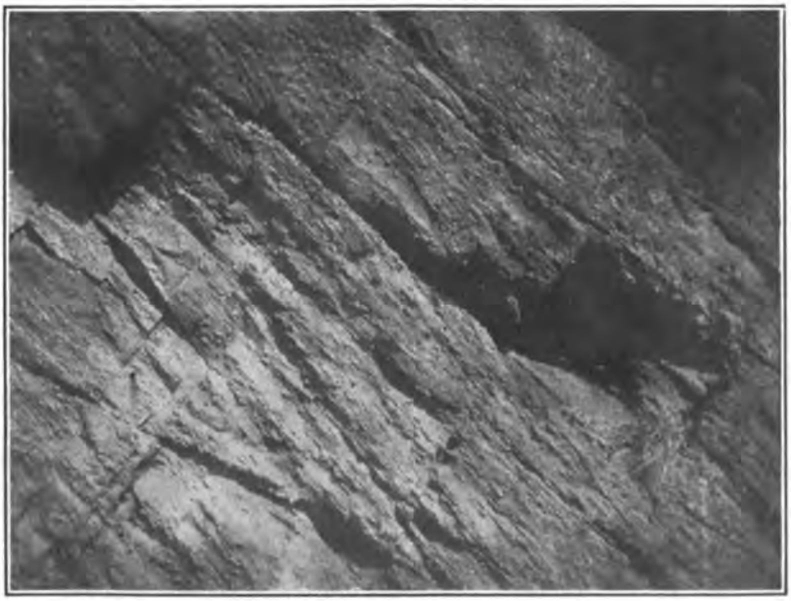
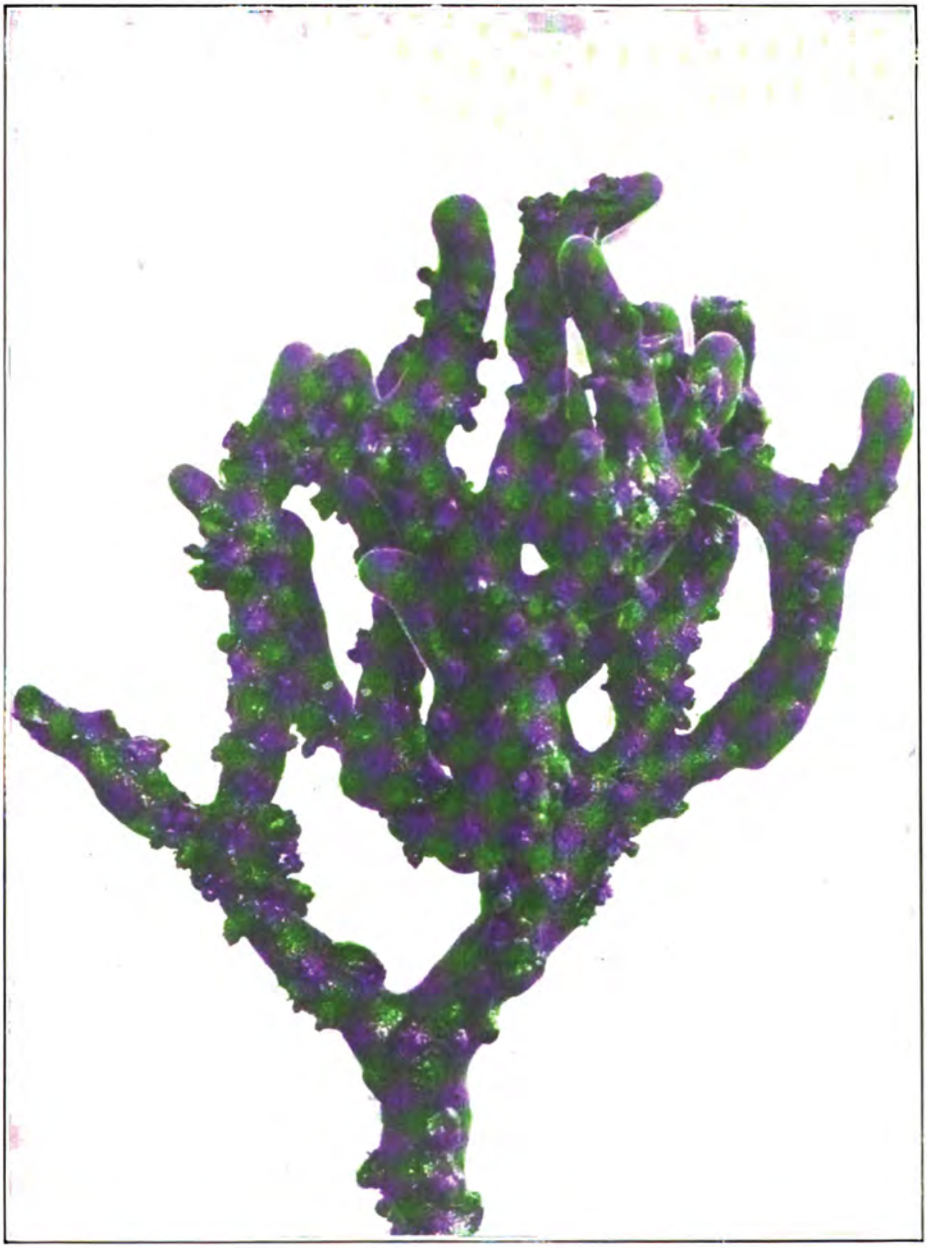


Fig. 2.—Andalusite schist, Kat River, George.



A Key to the species of the South African Batrachia together with some notes on the specific characters and a Synopsis of the known facts of their distribution.

BY JOHN HEWITT.

THIS paper was commenced eighteen months ago when it fell to my lot to work through the large and comprehensive collection of the Transvaal Museum. Since that time much additional material from various parts of the country has passed through my hands, thanks to the kindly co-operation of the authorities of most of the other S. African museums; one of the most widely representative of such collections is that of the Kimberley Museum, comprising as it does some fine series of frogs from Mochudi (Mr. W. A. H. Harbor), from Fort Richmond (Mr. W. H. Wayland), from Marandellas (Mr. A. O. Kidwell) and from Strand (Bro. J. H. Power). I am also indebted to several private gentlemen for much material and helpful information, especially to Bro. J. H. Power of Kimberley, to Mr. P. D. Morris of Victoria West and recently in Grahamstown to Masters K. and R. Graham. Nevertheless, although I have been able to examine probably more S. African material than has ever before been at the disposal of any single worker, this little paper has no claim to completeness or infallibility as the synonomy of our species is still far from satisfactory and there is much uncertainty regarding the facts of distribution.

Apart from the British Museum Catalogue and the valuable pioneer works of Andrew Smith and of Peters, the literature consists mainly of papers by Mr. Boulenger in the Proceedings of the Zoological Society, the Annals and Magazine of Natural History and elsewhere; there are also a few odd papers by Bocage, Boettger, Werner and Matschie. The northern boundary of our area is the Zambesi on the east, and the Cunene River on the west; but this is not a natural boundary, nor is the area thus defined entitled even to subregional rank, its fauna being in unbroken continuity with that of East Africa and Angola.

Key to the genera.

1. Tongue absent; toes broadly webbed, the first three with a sharply pointed nail. *Xenopus.*

   Tongue present. 2.

2. Upper jaw toothed; diapophyses of sacral vertebrae not, or only very slightly, dilated. 3.

   Upper jaw toothless; diapophyses of sacral vertebrae dilated, often considerably so. 11.

   Upper jaw with very small teeth; diapophyses of sacral vertebrae considerably dilated; adults of unusually small size; tympanum not visible; no vomerine teeth; a distinct curved fold on either side stretching from the eye to the shoulder. *Cacosternum.*

3. Tympanum hidden or indistinct; pupil vertical; tongue not free behind; toes webbed; fingers free; the digits, especially fingers, ending in broad flat triangular discs. **Heleophryne.*

   Tympanum usually distinct; digits pointed, or terminating in rounded discs. 4

4. A small intercalary bone between the two last phalanges of the digits; tips of toes dilated (except in Cassina). 5.

   No intercalary bone between the last two phalanges of the digits; pupil horizontal; fingers free; tips of toes not dilated. 9.

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*Signifies an arciferous condition of the sternum.

5. Metatarsals separated distally by the swimming membrane; vomerine teeth present; pupil horizontal; fingers and toes webbed, the two inner fingers opposable with the two outer ones (somewhat as in a Chamaeleon). *Chiromantis.*

   Metatarsals not separated distally by swimming membrane. 6.

6. Vomerine teeth present; fingers free, or only slightly webbed; pupil vertical; tympanum more or less distinct. 7.

   No vomerine teeth; fingers and toes more or less webbed, and the tips dilated into discs; tympanum hidden. 8.

7. Toes not webbed, and their tips not dilated into discs. *Cassina.*

   Toes webbed and their tips dilated, the terminal phalanges claw-shaped, swollen at the base. *Hylambates.*

8 Pupil horizontal. *Rappia.*

   Pupil vertical. *Megalixalus.*

9. Vomerine teeth present. *Rana.*

   No vomerine teeth. 10.

10. Toes webbed; outer metatarsals separated by web. *Phrynobatrachus.*

   Toes nearly free; outer metatarsals united. *Arthroleptis.*

11. Tympanum distinct; a pair of prominent parotoid glands situated dorsolaterally in the neck region (sometimes one but not both together of these two characters may be absent); the skin usually wtih warts or tubercles. **Bufo.*

   Tympanum hidden, and no parotoid glands. 12.

12. Tips of digits dilated into discs, terminal phalanges T-shaped; the toes not webbed; pupil erect. *Phrynomantis.*

   Tips of digits not dilated into discs. 13.

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*Signifies an arciferous condition of the sternum.

13. Habit extremely stout; snout very obtuse, scarcely distinct; limbs very short; palate papillose. *Breviceps.*

Habit stout; snout strongly projecting and pointed; mouth small; limbs short; a cutaneous ridge across the palate between the choanae. *Hemisus.*

In addition to the above we may also have to add to our list the genus Phrynopsis founded on a single species *P. boulengeri* taken in Mozambique. The characters of the genus are given in Dr. Jean Roux's paper on the genera of Ranidae (Zool. Anz. Bd. 28 no 24 25) and are as follows: pupil horizontal; tongue thick, free and feebly cut behind; vomerine teeth present; tympanum visible; fingers free, toes feebly webbed; metatarsals united; omosternum and sternum cartilaginous. The original description by Pfeffer is given in Jahresber. Hamburg. Anst. x 1893, p. 101, but this is inaccessible to me. It appears to be in agreement with the *pyxicephalus* section of *Rana* but for the sternal character. As the characters of the sternum have been utilised in distinguishing between genera, it should be noted that there is a discrepancy in the British Museum Catalogue as regards the sternum of the following genera: *Rappia*, *Megalixalus*, *Cassina* and *Hylambates*. In these genera the sternum is cartilaginous and has no bony style at any rate in the species which were investigated by Peters in the Reise nach Mozambique; I have been able to confirm this in Rappia marmorata and in Cassina senegalensis. Unfortunately the same error is contained in Dr. Jean Roux's table of genera of Ranidae.

KEY TO THE SPECIES.

RANA Linn.

Along with the typical members of this genus we include a few species which were referred by the early systematists to a distinct genus *Pyxicephalus*, the validity of which, however, was not admitted by Mr. Boulenger in the British Museum Catalogue. Lately Dr. Nieden (Zool. Anz. 1908 p. 651) asserts that the *pyxicephalus* section is worthy of generic separation from *Rana*, and he proposes to separate the two genera by the character of the outer metatarsals which in *Rana* are separated by web and in *Pyxicephalus* are united: also *Pyxicephalus* has large shovel-shaped metatarsal tubercles, and the head is usually blunt and and rounded. (cp. adspersa and delalandi). His reasons for uniting the two genera were clearly stated by Mr. Boulenger in the British Mus. Catalogue. It is possible that the differences between *Rana* and *Pyxicephalus* are as considerable as those which separate certain other genera of Ranidae (e.g. *Phrynobatrachus* and *Arthroleptis*), but that such differences are of generic importance appears to me doubtful.

1. Inner metatarsal tubercle moderate or small, cylindrical 2
   Inner metatarsal tubercle large, compressed, shovel-shaped. 11
2. Toes completely webbed or practically so (end phalanx of 4th toe may be free.) 3
   Toes two-thirds webbed or less (at least the two end joints of 4th toe free of web.) 4
3. Snout unusually long and pointed: vomerine teeth in two straight series, the outer edge touching the inner front edge of the choanae: tympanum about as large as the eye: back with 6-8 longitudinal folds: tibio-tarsal joint of adpressed hind limb reaching beyond the end of the snout. *R. oxyrhynchus*, Sund.
   Snout rounded: vomerine teeth in two slightly oblique oval groups between the choanae, or on a level with their hinder edges: back smooth or with elongate warts, no definite skin-folds: tibio-tarsal joint of adpressed hind-limb reaching between the eye and tip of snout. *R. fuscigula*, D.B.
4. A narrow dorsolateral fold, or skin quite smooth. 5
   Numerous dorsal skin folds. 6
5. Snout obtusely acuminate: no distinct dorsolateral fold: two small metatarsal protuberances, the outer one indistinct: toes two-thirds webbed: vomerine teeth in two slightly oblique oval groups close together just behind the level of the choanae. *R. darlingi*, Boul.

A narrow glandular dorsolateral fold : one metatarsal protuberance : toes almost half webbed : vomerine teeth in two oblique series between the choanae. *R. galamensis*, D.B.

6. Toes one-third webbed or less : vomerine teeth in two long series transversely on a level with front edge of choanae. 7

Toes one-half to three-fourths webbed. 8

7. Tibio-tarsal joint of adpressed hind limb reaching the end of snout : first finger slightly longer than the second : snout rather short and rounded. *R. grayi*, Smith.

Tibio-tarsal joint of adpressed limb reaching far beyond the end of the snout : first and second fingers equal : snout long, rather pointed : fourth toe as long as the distance from tympanum to vent. *R. fasciata*, Boie.

8. Six or eight skin folds stretching over the whole back : a strong glandular fold from beneath the eye to the arm : toes two-thirds webbed : tympanum two-thirds the width of the eye : vomerine teeth in two short oblique series commencing from the inner front edge of the choanae. *R. mascareniensis*, D.B.

Dorsal skin folds short, interrupted. 9

9. Tibio-tarsal joint of adpressed hind limb reaching only to the nostril : vomerine teeth in two short transverse series between the choanae : toes two-thirds webbed : tympanum a little smaller than the eye. *R. queketti*, Boul.

Tibio-tarsal joint of adpressed hind limb going beyond the end of snout. 10

10. Many interrupted glandular longitudinal skin folds dorsally : vomerine teeth in two short oblique series commencing from inner front edge of the choanae : toes broadly webbed, leaving only two phalanges of the fourth toe free. *R. aequiplicata*, Werner.

A few narrow interrupted glandular lines along the back : vomerine teeth in two transverse series between the choanae : toes two-thirds webbed or a trifle more so : tibio-tarsal joint of adpressed hind-limb usually reaching beyond the tip of snout : snout rather long and pointed. *R. angolensis*, Boc.

Apparently very like *angolensis*, Boc., but differing thus :— vomerine teeth in two rather extensive transverse groups arising from anterior angle of choanae, and leaving only a very narrow interval in the mid line. *R. theileri*, Mocq.

11. Skin with folds or warts dorsally. 12

Skin smooth dorsally : snout moderate : vomerine teeth in two scarcely oblique groups between the choanae : toes half-webbed : metatarsal tubercle of adpressed hind limb nearly reaches tip of snout : no outer metatarsal tubercle. *R. natalensis*, Smith.

12. Dorsally with symmetrically arranged warts and streaks or with a dorsolateral fold. 13

Dorsally with numerous, longitudinal, glandular folds : of very stout habit and large size : toes short, half webbed: lower jaw wtih two large bony prominences in front. *R. adspersa*, Bibr.

13. Dorsally with smooth rounded warts but no folds ; habit stout ; snout rounded ; fingers moderate, the first a little longer than the second ; toes half-webbed ; a small rather indistinct outer metatarsal tubercle ; vomerine teeth in two oblique groups extending a little beyond hinder edge of choanae ; tympanum half the size of eye. *R. delalandi*, Bibr.

Dorsally with flat smooth warts and dorsolateral folds which are very indistinct; snout rounded; head as long as broad; fingers very short, the first extending as far as the second; toes one-third webbed ; vomerine teeth in two small groups close to the inner borders of choanae; tympanum a little smaller than the eye. *R. ruddi*, Boul.

CHIROMANTIS, Pet.

Inner fingers webbed at the base, outer ones half webbed; toes entirely webbed; subarticular tubercles well developed, a small inner metatarsal tubercle; vomerine teeth in two short oblique groups between the choanae; ventral surfaces granular. Above pale-grey or brownish-grey with some darker stripes or network; reaching a length of about 60 or 70 mm.

C. xerampelina, Pet.

PHRYNOBATRACHUS Günth.

Tympanum rather indistinct, half as large as the eye; first finger not extending quite so far as the second; tarsometatarsal articulation of adpressed hind limb reaching the tip of snout; two small tubercles on the metatarsus and another on the middle of the inner edge of the tarsus; skin often with warty tubercles above. Olive above, indistinctly marked with darker, a dark cross bar between the eyes; legs with dark cross bars; lower parts whitish, the throat spotted in female, blackish in males, the lips with dark spots. *P. natalensis*, Smith.

Tympanum distinct, two-thirds the size of eye; first finger as long as the second; tarso-metatarsal articulation going far beyond the end of snout. Markings as in *natalensis*.

P. ranoides, Boul.

ARTHROLEPTIS, Smith.

Skin smooth above; tympanum half the width of eye; toes without web; one rather small metatarsal tubercle; tibio-tarsal articulation of adpressed hind limb reaching the eye.

Dorsal surfaces brownish or rusty ash-gray.

A. wahlbergii, Smith.

Tympanum two-thirds the size of eye; a very large, compressed, crescentic, sharp-edged inner metatarsal tubercle; tongue with a conical median papilla.

Pale above, sometimes with a dark festooned mid-dorsal band, or a fine light vertebral band; a blackish-brown band on the rostral canthus and temple; lips with small black and white spots; a small dark brown lumbar spot may be present.

A. whytii, Boul.

RAPPIA, Günth.

(A) SNOUT ROUNDED OR OBTUSE.

(a) UPPER PARTS WITH SMALL SCATTERED TUBERCLES OR WARTS.

Belly granular, throat tubercular; a more or less distinct fold surrounding the median abdominal region; male with an adhesive disc on throat.

Yellowish above; thighs, under surface of limbs and sides of belly brown or black. *R. cinctiventris*, Cope.

Distinct from *cinctiventris* by the very small head; throat and ventral surface paved with large granules; a very strong fold across the throat; male without gular disc. Above marked by an undulating dorsolateral line forming a hook posteriorly.

R. undulata, Boul.

(b) UPPER PARTS SMOOTH.

Belly paved with large granules; no strong fold across the chest; male with a subgular vocal sac and an adhesive disc covering the throat; fingers half-webbed.

A dark, above light-edged band from tip of snout passing through the eye and continued along each side of the body; or a light dorsolateral band edged with black. *R. horstocki*, Schleg.

Belly granular; no strong fold across the chest; fingers webbed at the base; snout subtriangular.

Uniform greenish above; thighs colourless except for a narrow white vitta along the upper surface. *R. concolor*, Hallow.

Skin transversely areolate on the belly. Fingers one-fourth, toes three-fourths webbed. Snout short, truncate.

Male with large vocal sac prolonged posteriorly and bound by a median frenum, on each side of which a plicate pouch projects deeply into the vesicular cavity.

Pale-straw colour: a faint brown line on the rostral canthus.

R. pusilla, Cope.*

*See note under distribution.

Central portion of belly not definitely granular, but very distinctly so at the sides especially posterolaterally : a strong fold across the chest in the female : male with subgular vocal sac and an adhesive disc on the throat : toes entirely webbed.

Above finely or coarsely spotted, or reticulated, or with three dark parallel bands longitudinally. *R. marmorata*, Rapp.

Belly slightly granular : a strong fold across the chest : male with a subgular vocal sac and an adhesive disc on the throat ; toes two-thirds webbed.

A white black-margined line along the canthus rostralis, continued behind the eye along the anterior half of the body or reaching as far as the vent. *R. microps*, Gunth.

Tongue with two conical papillae in front.

Toes two thirds webbed.

Above immaculate. *R. tuberilinguis*, Sund.

(B) SNOUT ACUTELY POINTED.

Snout produced, longer than diameter of eye : tympanum hidden : fingers one-third, toes half-webbed. Brownish with small blackish dots on the head and back. *R. nasuta*, Günth.

MEGALIXALUS, Günth.

Skin with very small scattered tubercles above : tongue heart-shaped : fingers one-third webbed, toes nearly entirely webbed. Brown above, with two white bands along the back confluent on the snout, narrowing and converging towards the vent. *M. fornasinii*, Bianc.

Skin of upper surfaces smooth except on upper surface of head and muzzle which is studded with acute tubercles : tongue elliptic, deeply nicked : fingers slightly webbed. A dark-brown lateral band, pale-bordered anteriorly, between the eye and the groin ; also a median band which commences between the eyes and becomes wider and more indistinct posteriorly.

M. spinifrons, Cope.

CASSINA, Gir.

Fingers and toes short, quite free : an oval inner, and a very small rounded outer metatarsal tubercle : male with a large adhesive disc on the throat, and two introverted external subgular vocal sacs, the throat strongly plaited behind and at the sides of the disc.

Dorsally with three or more dark stripes along the back, or with large elongated spots. *C. senegalensis*, D.B.

Similar to *senegalensis*, but differing in that the toes are slightly webbed at the base, and there are two metatarsal tubercles of almost equal size. *C. wealii*, Boul.*

HYLAMBATES, A. Dum.

Fingers free, toes half-webbed; tibio-tarsal articulation not reaching the eye; tympanum half the size of eye, or nearly so; inner metatarsal tubercle very small, blunt.

Dorsally with large insuliform dark-brown light-edged spots. *H. maculatus*, A. Dum.

Fingers one-third webbed, toes half-webbed; tibio-tarsal articulation reaching the eye; tympanum three-fourths the size of eye; a rather small oval inner metatarsal tubercle.

Brown or olive above with a green, or dark-brown, black-edged stripe from tip of snout through the eye to the shoulder; large insuliform spots on the sides. *H. natalensis*, Smith.

Fingers very slightly webbed, toes about half-webbed; tibio-tarsal articulation reaching the tympanum or eye; tympanum a half to two thirds the diameter of eye; inner metatarsal tubercle large, compressed, crescentic and prominent. Uniformly coloured above; a white streak borders the upper lip, the outer side of forearm and hand, the anal region, the heel and outer side of foot. *H. johnstoni*, Boul.

PHRYNOMANTIS, Pet.

Head small, snout round; a cutaneous fold across the palate between the choanae; hind limb very short, the tip of the longest toe only extends as far as the end of snout. Dark above, with light (red when alive) spots usually in the form of a triangular patch on the coccygeal region and a dorsolateral streak on each side. *P. bifasciata*, Smith.

*See Notes

BREVICEPS, Merr.

Snout indistinct; eyes rather small, directed forwards; upper surfaces with small warts; belly granulate; a very large shovel-shaped inner metatarsal tubercle; subarticular tubercles distinct; outer toe not longer than inner one. *B. gibbosus*, Lin.

Snout more or less distinct; body entirely covered with distinctly porous granular glands. *B. verrucosus*, Rapp.

Snout distinct; skin quite smooth or indistinctly glandular on head and front part of back. *B. mossambicus*, Pet.

Snout distinct; eye rather large, about equal to length of snout; extremities not particularly short; outer and inner toe equally long; inner metatarsal tubercle large, shovel-shaped, and a smaller rounded outer one; sub-articular tubercles distinct; dorsal surfaces warty and strongly porous; ventrally with wrinkled crossfolds, but not granular. *B. pentheri*, Wern.

Head comparatively larger, and body less gibbose than in gibbosus and allies, eyes much larger, their diameter 6½ to 8 times in the length of head and body; belly smooth, dorsal surface with small warts; toes extremely short, the first rudimentary, shorter than the fifth; two large feebly prominent metatarsal tubercles; sub-articular tubercles absent from the toes.

B. macrops, Boul.

HEMISUS, Günth.

Lower jaw with three prominences in front; toes not webbed, a small inner metatarsal tubercle, no sub-articular tubercles. Brown above with round whitish spots. *H. guttatum*, Rapp.

Toes with distinct rudiment of web, subarticular tubercles more or less distinct; metatarsal tubercle large, shovel shaped. Brown above, marbled with blackish. *H. marmoratum*, Pet.

CACOSTERNUM, Boul.

See later notes.

HELEOPHRYNE, Sclater.

Toes completely webbed; snout obtuse; interorbital space a little broader than upper eyelid; skin smooth above, granular on the belly; tongue rounded behind.

Above purplish with darker, round, faintly white-edged spots, hind limbs with darker cross bars. *H. purcelli*, Sclat.

Toes only about half webbed, the first toe practically free; interorbital space a trifle narrower than upper eyelid; snout rounded.

Purplish above with irregular dark spots, the limbs with indistinct cross bands. *H. regis*, Hewitt.

BUFO, Laur.

PAROTOID GLANDS INDISTINCT.

A tarsal fold present; subarticular tubercles simple; first finger a trifle longer than the second; tympanum as large as the eye, circular; interorbital space rather broader than the upper eyelid. Reddish above; of moderate to large size.

B. carens, Smith.

No tarsal fold; subarticular tubercles double; tympanum three-fourths the size of eye. Dorsally with a white rhomboidal or triangular spot on the vertebral line anteriorly; belly with black spots. Of small size, the female about 35 mm., the male about 27 mm. from snout to vent. *B. vertebralis*, Smith.

PAROTOIDS DISTINCT.

Tympanum vertically oval, as large as the eye or nearly so; first finger appreciably longer than the second; toes one-third webbed, with simple subarticular tubercles; parotoids elliptic and elongate.

Dorsally with large well defined, regularly arranged dark spots. Of large size, reaching about 140 mm. from snout to vent.

B. regularis, Reuss.

Tympanum a little less than half the upper eyelid; parotoids elliptic, twice as long as broad; subarticular tubercles simple and prominent; first finger a trifle longer than the second; external metatarsal tubercle conical, inner one narrow and elongated.

Dorsal skin with granulations and rounded tubercles which on the sides and hinder portion of the back enlarge and elongate considerably.

Pale ashy-olive above with small brown spots on the parotoids, and transverse brown spots on the limbs. *B. tuberculosus*, Boc.

Tympanum one-half to three-fourths the size of the eye; parotoids elliptic, broader in front; first finger extending only very little beyond the second, or not exceeding the latter; sub-articular tubercles of toes all single, or some may be double; toes webbed at the base; tarso-metatarsal joint of the adpressed hind limb reaching axil, shoulder, or between shoulder or tympanum; belly granular at any rate posteriorly.

Greyish or pale-olive above, with large brown or dark olive spots or marblings. Male 75 mm., female 90 mm. from snout to vent. *B. granti*, Boul.

Tympanum one-third the size of the eye; first finger not extending beyond the second; parotoids generally small, elliptic or suboval; toes webbed at the base, the subarticular tubercles single, but there may be two between the last phalanges of the fourth toe; tarso-metatarsal joint of adpressed hind limb reaching the eye in males, hardly the tympanum in females; belly almost entirely smooth.

Generally a yellowish vertebral line, marbled or with brown or olive spots above. *B. angusticeps*, Smith.

No tympanum; parotoids very large, well defined, only a little longer than broad; snout pointed, projecting beyond the mouth, the loreal region nearly vertical, concave. Either entirely blackish above, or upper parts brown, the sides of head and body blackish; lower parts bright yellow, speckled with black on the breast. *B. anotis*, Boul.

No tympanum; parotoids of moderate size, flat and elongate; no tarsal fold; the snout more rounded, and loreal region more oblique than in *anotis*.

Dark-yellowish brown with irregular longitudinal and transverse black spots; belly marbled and spotted with black.

B. taitanus, Pet.

XENOPUS, Wagl.

Skin smooth with more or less distinct tube-like lines round the body; subocular tentacle short, less than one-third the diameter of the eye; no vomerine teeth; inner metatarsal tubercle very blunt and feebly prominent. *X. laevis*, Daud.

Subocular tentacle more than half as long as the eye; vomerine teeth often present; metatarsal tubercle more conical.

X. muelleri, Pet.

NOTES ON CERTAIN SPECIES.

RANA.

R. natalensis, Smith.—Somewhat resembles *delalandi* in the dorsal pattern. It differs from that species, however, in the more pointed snout, the smaller metatarsal tubercle and the entirely smooth skin. It is of small size.

R. adspersa, Bib.—At once distinguished by its large size: the bull-frog of S. Africa.

R. delalandi, Bibr.—The British Mus. Cat. description reads, "olive or brown above, often with one or three light dorsal lines." But in our specimens such light dorsal lines are only occasionally present, and the dorsal surface usually has dark marblings, in places edged with black, more or less regularly disposed; just behind the head is a fairly large pale space almost semi-hexagonal in shape, the longest side in front, the four corners rounded off and thickly blackened. Sometimes the dorsal skin appears to be quite smooth: in a beautifully marmorated specimen from Marandellas (Kimberley Museum) this is the case except for some small and very flat warts on the head and others less distinct on the darker margins of the marbled areas. The largest specimen I have seen, from King William's Town (Mr. F. A. O. Pym), measures 59 mm. from snout to vent.

R. ruddi, Boul.—"Dark brown above with light yellowish streaks on the head and body, viz. a narrow vertebral line, a broader band from the end of the snout along the canthus rostralis and the outer border of the upper eyelid to above the tympanum where it bifurcates, the upper branch extending to above the vent, the lower running obliquely to the groin: a yellowish streak along the upper lip: a white oblique line in front of the eye and and a white circle round the tympanum: throat and breast dark brown or marbled with dark brown, with a Y-shaped white marking on each side. From snout to vent 48 mm. Male with two external vocal sacs opening by a pair of slits, one on either side of the lower jaw."

This species is included in the *pyxicephalus* section apparently, but the head is more pointed than in *delalandi* or *adspersa*, and the paired external vocal sacs of the male is a very distinct character.

R. theileri, Mocq.—This species is described as having longitudinal skin-folds in the living specimen, but the folds disappeared in the spirit-preserved animal. The colour markings and general characters appear to be much the same as in *angolensis*.

R. oxyrhynchus, Sund.—This species and its ally *mascareniensis*, together with *galamensis* and *ruddi* are the only S. African species whose males possess external vocal sacs opening by two slits below the lower jaw. *R. oxyrhynchus* has a longer snout, the toes are more webbed and the tympanum is larger than in *mascareniensis*. In a Shilowane specimen (Transvaal Museum) the dorsolateral pair of skin-folds are especially distinct, stretching almost to the base of the hind limbs: dorsally it is greyish olive, with numerous irregular dark blotches of varying size, there is a dark cross-band in the inter-orbital region and in front of this up to the end of the snout is a pale space triangular in shape, the sides sharply defined: the tympanum is surrounded by a whitish raised border. This specimen has a length of 52 mm. from snout to vent.

A specimen from Marandellas, N. Rhodesia (Kimberley Museum) is almost uniformly reddish brown on the dorsal surface, and the dorsolateral skin fold is not so strongly marked out: the limbs are indistinctly banded.

R. mascareniensis, D. and B.—Zululand specimens have a light vertebral stripe and a light line along the tibia (Mr. Boulenger). The light line along the tibia is present in all the Woodbush specimens (Transvaal Museum), but the vertebral stripe is variable in width and development. The Kimberley Museum has three specimens from Marandellas: the largest of these has very pronounced dorsolateral skin-folds which are whitish in colour, and this is also the case in the Woodbush examples: there is a light line along the tibia but no distinct vertebral stripe: the snout is long and acutely pointed; the vomerine series has much the same position as in *oxyrhynchus* but is perhaps shorter than in that species: the tibio-tarsal joint of the adpressed hind-limb does reach so far as the end of the snout. In a smaller example the snout is less elongated, the tibio-tarsal joint of the adpressed hind limb reaches considerably beyond the tip of snout, and the vomerine series is long and obliquely disposed; the other small specimen is very similar, but differs in possessing the pale vertebral streak. In this species the legs are distinctly cross barred.

The specimen figured by Peters (Reise nach Mossambique) is 46 mm. long, and dorsally, a broad white band stretches from snout to vent; the largest Woodbush specimen measures 45 mm. and the Marandellas specimen reaches 42 mm. from snout to vent.

R. darlingi, Boul.—"Pale-grey above, black on the sides, the limit between the two shades sharply defined; a white labial streak from tip of snout to the arm; belly marbled with grey brown. From snout to vent 53 mm."

R. galamensis, D.B.—According to Mr. Boulenger this species has a large flat gland on the front side of the humerus; the male has an external vocal sac on each side of the throat.

R. grayi, Smith.—In this species an oblique dark blotch with curved upper margin and bordered below by a pale narrow skin fold, stretches from the eye to the base of the fore limb and anteriorly a thin dark stripe passes from the eye to the nostril; the dorsal surface of the body often has a pale median streak which is sometimes very broad and occasionally is absent; on either side of this mid-dorsal band the dark blotches may be arranged transversely or obliquely or even longitudinally, in which latter case the dorsal pattern sometimes approaches that of *fasciata*. The fourth toe varies somewhat in length and is sometimes almost as long as in *fasciata*, but the two species are easily distinguished by the shape of the snout as well as by the colour markings. It is rather a small species; the largest specimen I have seen, from Avontuur (Transvaal Museum), reaches a length of 46 mm. from snout to vent.

R. fasciata, Boie.—Light brown above with four or six dark longitudinal stripes; there is sometimes a broad pale or whitish mid-dorsal band much as in immature examples of *grayi*; the sharply defined white streak under the eye appears to be fairly constant.

R. queketti, Boul.—"Olive above with black spots and a yellow vertebral stripe; a blackish canthal streak and a brown temporal spot; limbs with blackish cross bars; length from snout to vent 48 mm." Apparently this is only distinguishable from *angolensis* through the character of the relative length of hind limb and body; it may be only a variety of that species.

R. angolensis, Boc. and *R. fuscigula*, D.B. These two species are very closely allied and some difficulty may arise in distinguishing between them. The points of difference are as follows:—

ANGOLENSIS.	FUSCIGULA.
1. Snout pointed.	Snout rounded.
2. Toes two-thirds webbed or a little more.	Toes nearly entirely webbed.
3. Skin with narrow interrupted lines along the back.	Dorsal skin smooth or with elongate warts along the back.
4. Vomerine teeth in two transverse series between the choanae, the series rather longer than in *fuscigula*.	Vomerine teeth in two slightly oblique oval groups on a level with hinder edge of choanae.
5. Tibio-tarsal joint of adpressed hind-limb reaching beyond the tip of the snout.	Tibio-tarsal joint of adpressed hind-limb reaching between the eye and tip of snout.

The colour characters afford some guide in the determination, for in *fuscigula* the dorsal skin is usually brown with or without darker blotches, and the whole ventral surface, or the throat and breast only, is covered with black reticulations : in *angolensis* the dorsal colour is paler and has a green tinge, the large dark spots are always present and the ventral surfaces are either immaculate or there may be dark reticulations on the throat and breast, rarely extending to the belly. *R. angolensis* has usually a rather sharply defined broad white line extending from below the eye to the angle of the mouth : in *fuscigula* this line is either absent or is ill defined and blurred.

Most of the above-mentioned structural characters are variable in *angolensis* at any rate : the most reliable character is the form of the snout and next in importance is the relative lengths of the hind-limb and body. The Grahamstown form of *angolensis* is quite typical, and is at once distinguished by a number of characters from the equally characteristic *fuscigula* as found at Victoria West, but a series of *angolensis* from Potchefstroom (W. Moore) shews some features in common with *fuscigula*, and on the other hand I have seen specimens of *fuscigula* from Kimberley which might easily be mistaken for *angolensis*.

In Mr. Moore's series from Potchefstroom, all the specimens of moderate size are typically *angolensis* so far as the shape of the snout, the dorsal skin and the colour characters are concerned, but the femora are rather short ; in the largest specimens, some of which reach a length of 100 mm. from snout to vent, the snout is more rounded, the webbing of the foot is nearly complete, and the folds of the dorsal skin are hardly to be seen ; moreover, the ventral surface of the greater part of the body is covered with blackish reticulations, the dorsal skin is dark, sometimes with a pale mid-dorsal band and the clearly defined and regularly disposed dark spots of the smaller examples give place to ill defined dark blotches, and lastly the subocular oblique white streak becomes in these largest specimens a broad ill-defined pale band or is absent altogether ; the tibio-tarsal joint of the adpressed hind limb does not reach the end of the snout, scarcely exceeding the nostril. Comparing these with very large specimens of *fuscigula* from Victoria West (Mr. P. D. Morris), of length 90 mm. from snout to vent, the resemblance is very striking and the only obvious difference is that the snout of the Potchefstroom frog is relatively longer : moderate sized frogs from Victoria West are however quite like the larger specimens of that locality, and thus different from Potchefstroom specimens of similar size.

It is possible that the Potchefstroom series includes two species, but I am referring them all to *angolensis*, this local form being characterised by unusually short femora.

In one or two Kimberley specimens of *fuscigula* (Bro. J. H. Power) the tibio-tarsal joint of the adpressed hind-limb reaches as far as the tip of the snout and the dorsal skin has short irregular longitudinal folds : such folds occasionally occur in quite typical specimens of *fuscigula* from Victoria West, but more usually they are better described as elongated warts. These skin folds vary to some extent according to the method of preservation of the material, and sometimes *angolensis* appears to be almost without folds or only a single pair dorsolaterally situated may be present.

The colouration and markings of *fuscigula* from Kimberley is in many specimens very like that of *angolensis*, but they all have rounded snouts and short femora and the feet are practically entirely webbed.

Our Grahamstown form of *angolensis*, which is fairly typical in structural characters, often has a pale mid-dorsal band which apparently does not usually occur in Pretoria specimens of this species, though it is a common feature in *fuscigula*, and the oblique subocular streak is relatively broad and is not very sharply defined.

Some small examples from Port Elizabeth (Port Elizabeth Museum) which are typically *angolensis*, except that the femora are rather short, also have the subocular line broad and not sharply defined : the toes are more than three-fourths webbed, but not quite entirely webbed. In most of them the tibio-tarsal joint of the adpressed hind-limb does not go beyond the end of the snout.

From Strand, Bro. J. H. Power has taken specimens of *fuscigula* which are fairly typical in their structural characters, differing chiefly from Karroo specimens in that they are considerably paler in colour. The Transvaal Museum has an immature example from Knysna which agrees in most respects with the Strand forms.

A very large specimen from Avontuur (Transvaal Museum) is very like the larger individuals from Potchefstroom, on which account I am provisionally calling it *angolensis*. The toes are nearly entirely webbed but not broadly so, the tibio-tarsal joint of the adpressed hind-limb reaches the nostril on the one side and nearly reaches the tip of the snout on the other side, the dorsal skin has a number of short linear folds, the head is very broad behind, but not broadly rounded in front, though it is not pointed: dorsally the skin is so dark that the darker blotches and bars are almost indistinguishable, the throat and the anterior part of the belly has dark reticulations and the subocular streak is merely a vague broad band of irregular outline. The length from snout to vent is 98 mm. and the breadth of the gape is 40 mm.

The Karroo specimens of *fuscigula* seem to be more constant in their structural characters than *angolensis*: nevertheless young specimens sometimes resemble *angolensis* in the form of the snout, and if the ventral surfaces happen to be entirely without black markings, it may have a strong resemblance to the immature form of *angolensis*, though the femora are as a rule short in this species.

It will be understood from the above that in order to properly understand the mutual relations of these two species we shall require large series from many localities, especially from those parts where the characteristic fauna of south-west Cape Colony meets with the tropical fauna coming from the north. For the present, I regard the two species as the extreme forms of one common stock.

PHRYNOBATRACHUS.

The common *P. natalensis* reaches a length of about 30 mm. from snout to vent. It has the habit of a young *Rana angolensis* but is easily distinguished from that species by the character of the vomerine teeth and by the presence of the three foot tubercles.

On either side of the lower jaw of the male there is a long shallow groove, but this does not lead into an introverted vocal sac. The tympanum is always present but is more or less distinct according to the method of preservation. *P. ranoides* founded on a specimen only 22 mm. long will probably prove to be an immature form of *natalensis*.

ARTHROLEPTIS WAHLBERGII, Smith.

This is a small species reaching only about an inch from tip of snout to vent. Smith's description of the colour characters is as follows: upper surfaces "rusty ash-gray or a tint intermediate between yellowish-brown and ash-gray, and variegated with liver-brown; a brown stripe on each side of the nose, another behind the eyes on the side of neck, and one more or less distinct, immediately over the base of the fore legs; an irregular transverse stripe or two blotches between the eyes; a diamond shaped mark on the middle of the back between the fore legs, in some individuals only in outline; two spots towards hinder part of back, one a little before each hinder extremity; limbs with one transverse bar to each joint and a few small dark freckles." The only specimens I have seen, from Richmond (Natal Govt. Museum), do not exhibit the above-mentioned markings very definitely except for the thin cross-striping on the legs, and the curved line stretching from the nostril and continued behind the eye almost to the base of the fore-limb. But for the foot characters, this species might easily be confused with half-grown specimens of *Phrynobatrachus*. In the sternal apparatus the coracoids are strong and stout, the clavicles are very slender, the bony sternum is short and rather stout and the bony omosternum is long and slender, ending in front in a rounded expansion.

RAPPIA.

The commonest species in S. Africa are *marmorata*, *horstocki* and *cinctiventris*. *R. tuberilinguis* wants rediscovering as nothing has nothing has been heard of this species since the original description: *pusilla* and *microps* may not occur within our area. The three common species above mentioned are easily distinguished by the character of the dorsal skin and the granularity of the belly: also the colour markings appear to be fairly constant except in *marmorata.* The degree of webbing of the digits and the proportions of the hind-limbs seem to be unavailable characters being subject to some variation. Transvaal, Rhodesian and Zululand specimens of *marmorata* are usually ornamented with three dark longitudinal bands dorsally, whilst Eastern Cape Colony examples are generally spotted—in fresh specimens whitish grey wtth yellow spots, the ventral surfaces, especially the legs, pink—and have no bands, but specimens from the same locality may shew much variation in this respect. A male *marmorata* from Shilowane and another from Hectorspruit (Transvaal Museum) are uniformly fuscous above with numerous pale spots so small as to be scarcely or not at all visible to the naked eye : from the eye a broad dark band passes along the side of the body becoming indistinguishable behind, this band bordered below by a pale streak between the eye and the angle of the jaw, and edged above by a very thin pale streak : the outer lateral surfaces of the tibia and tarsus are darker than the upper surfaces, a thin pale streak marking the dividing line. I have seen one specimen of *marmorata* (Port Elizabeth Museum) which had the dorsal skin slightly but distinctly warty, the minute excrescenses being localised over its numerous small spots.

R. horstocki seems to be very constant in its colour markings. The head is triangular in shape, there is sometimes a very loosely defined fold across the chest, the dorsal skin may be puckered, but is not granular, and in Eastern Cape Province specimens the fingers are not so much as half-webbed : the ornamentation of these latter is a white dorsolateral band commencing on the tip of the snout as a thin streak and gradually widening as it passes posteriorly.

A single specimen, only 22 mm. long, from Marandellas (Kimberley Museum), agrees fairly well with the description of *nasuta* as given in the British Museum Catalogue, but differs in the following respects : there is a strong fold across the chest : the central portion of the belly is crumpled and not granular, though at the sides there is a more definite granulation : the dorsal surfaces are not quite smooth, being beset with innumerable closely packed and very minute flattened warts, giving it a finely granular appearance to the naked eye. Dorsally it is light brown with numerous very minute black dots which under a lens appear as radiating stars: the pigmentation is densest on the snout and top of the head.

Another specimen, from the same locality and same collection, appears to be referable to *microps*, though it differs but slightly from *horstocki*. The dorsal colour is grey and there is a thin white dorsolateral streak commencing on the upper eyelid, curving inwards a little posteriorly and ending in the sacral region. The belly is granular but not quite so strongly so as in our specimens of *horstocki*, and there is a strong fold across the chest. The specimen is only 22 mm. long.

MEGALIXALUS SPINIFRONS, Cope.

The specimen in the S. African Museum from Rondebosch Flats has pale dorsolateral bands almost fusing on the snout and there is a median pale band in the posterior dorsal region. The other species *M. fornasinii* is well figured by Peters in the Reise nach Mossambique under the name of *Hyperolius bivittatus*, the specimen having a total length of 35 mm.

BREVICEPS.

Typical examples of the several species appear to be quite distinct. *B. verrucosus* as found at Knysna (Transvaal Museum) has the following characters: uniformly blackish brown on the upper surfaces, the skin not warty but granular above and pitted all over, the granularity most distinct on the top of the head, especially over the eyes and on the throat; the belly is smooth but has numerous small whitish glands; the eyes are rather small. We have a specimen from Qacu Forest, near Tois River (T. Liefeldt), which is covered with porous granules excepting on the belly where the skin is broken up into a close network; dorsally there is an almost uniform colouration with black and yellow intermingled, and an indication of a broad mid-dorsal area where the yellow predominates, and there is also a trace of a dark oblique streak passing from the eye to the shoulder; the metatarsal tubercle in this specimen is divided into two. A juvenile specimen from Haenertsburg (Transvaal Museum) agrees well with *verrucosus* but in colouration it resembles *mossambicus*, and for example the oblique dark streak under the eye is sharply defined.

Breviceps mossambicus as illustrated by specimens from Hunyain, Rhodesia (Transvaal Museum), has smooth dorsal surfaces without warts or granules, though the skin is pitted all over excepting on the snout; at the sides of the body are some pale granular glands, but these do not extend on to the belly. The size of the eye varies appreciably but it is usually bigger than in *verrucosus*, and the metatarsal tubercle is bigger and longer than that of *verrucosus* and is crossed by a furrow proximally. In a juvenile specimen from Marandellas (Kimberley Museum) probably referable to this species, the dorsal surface is not quite smooth being indistinctly corrugated though not definitely warty. Specimens of the same species from Komati Poort (Transvaal Museum) have a rough dorsal skin; the colouration of the upper surface is dull-brown with yellow blotches symmetrically arranged.

In his description of *mossambicus*, Peters (Reise nach Mossambique) states that *gibbosus* has a broader head, the eyes are further apart, and the snout is shorter than in *mossambicus*; and the broad light dorsal band with dentated margins is fairly characteristic of *gibbosus*. He appears to distinguish between *verrucosus* and *gibbosus* merely by the skin characters. Under the specific name of *adspersus* he mentions some Damaraland and Transvaal specimens which have scattered granules on the back and sides of the body, the belly being smooth; also there is a broad irregular triangular dark spot under and behind the eye as in *gibbosus*; it does not appear however that a definite description of *adspersus* was ever published.

A rather large specimen from Kimberley (Kimberley Museum) agrees fairly well with the description of *gibbosus* but for one or two characters, one of which is usually considered important, viz. the snout. This example has the snout quite distinct, the dorsal skin is warty, ventrally quite smooth, the lateral surfaces with numerous whitish granular glands, the eyes of moderate size, the metatarsal tubercle large and long and crossed by a slight furrow proximally. The dorsal surface might be described as yellowish, with brown reticulately arranged variegations with the following somewhat indistinct pattern: a pale band between the eyes anteriorly, a rather broad paler mid-dorsal area edged with brown, a pale lateral band, ill defined and broken into spots, and an oblique black patch stretching from the eye to the shoulder. So in the form of the snout, the size of the eye and the smoothness of the belly, it differs from the description of *gibbosus*, agreeing rather with *pentheri*, but in general colour pattern it is in agreement with *gibbosus* I must provisionally refer this specimen to *pentheri*, leaving subjudice the question of the relationship of *pentheri* to *gibbosus*.

The Grahamstown Breviceps has rather indistinct warts on the dorsal surface, the ventral surfaces are wrinkled but not granular, and laterally there are some pale glands which also occur on the throat but they are not so conspicuous, nor so densely disposed, as in *verrucosus*; the snout is indistinct, the eyes are of moderate size and the metatarsal tubercle is fairly large. There are some irregular, ill-defined pale blotches above, arranged in four longitudinal bands, the median pair sometimes absent and at other times almost fusing together; there is a dark oblique patch below the eye and a pale band between the eyes anteriorly. According to the description it is possible that the type of *pentheri* came from Grahamstown, but our specimens, which, however, are only half-grown, do not agree with that species in the form of the snout. The most typical specimen of *gibbosus* that I have seen comes from King William's Town (Mr. F. A. O. Pym); it is of moderately large size, the dorsal surface is warty, the snout is indistinct and the eyes are small. It differs from the Kimberley specimen, especially in the form of the snout; it differs only from the description of *gibbosus*, in that the belly is comparatively smooth, not granular.

B. macrops is a very distinct species characterised by the much larger eyes and the particularly short toes; the two metatarsal tubercles are of more equal size and are quite separated from each other, the inner one being smaller than in *gibbosus* and allies. One of our specimens from Port Nolloth (Dr. R. W. Howard) has the dorsal surface corrugated, not warty, and in the other individual it is quite smooth. The upper surfaces are a very pale flesh colour with dark markings and lines more or less regularly arranged.

CACOSTERNUM BOETTGERI, Boul.

This frog was originally described as species of Arthroleptis (Ranidae), but afterwards (Ann. Mag. Nat. Hist. 7, 17, p. 321) the author of the species has referred it to the genus Cacosternum (Engystomatidae).

I have recently had the opportunity of examining a large series of this frog, presented to the Kimberley Museum by Bro. J. H. Power and kindly forwarded to me by Miss M. Wilman for examination. The following are some of the more important characters of the frog: firmisternous, diapophyses of sacral vertebrae rather strongly dilated, maxillary and premaxillary teeth present, pupil horizontal, tongue heart-shaped, free behind, no vomerine teeth and palate without dermal ridges, tympanum hidden, fingers and toes free, their tips not dilated, terminal phalanges simple, and no phalangeal intercalary bone, outer metatarsals united, sternum bony of moderate size, terminating posteriorly in a laterally expanded ziphisternum, precoracoids absent, and no omosternum: in the skull a frontoparietal fontanelle is present and the frontoparietals themselves are but feebly ossified.

Judged from these characters, its place in the system is nearest to that section (Dyscophinae of Gadow) of the Engystomatidae which have teeth in the upper jaw; the Dyscophinae include but a few genera, and they are mostly from Madagascar. Two species of Cacosternum are described, viz.: *nanum* from Kaffraria (Ann. Mag. Nat. Hist. 5. 20., p. 52) and *boettgeri* first described (B.M. Cat. Batrachia p. 118) from Kaffraria, since recorded from Natal (Natal Govt. Museum), and known to me from Kimberley, Madibi, Bloemfontein, Lions River (Natal) (Rev. N. Roberts), King William's Town (F. A. O. Pym), and from Grahamstown. If these two species are really distinct—and this I think is improbable—the difference is to be based on the length of the hind-limb; in *nanum* the tarso-metatarsal joint of the adpressed hind-limb reaches the end of the snout, whereas in *boettgeri* this joint reaches only as far as the eye or between the eye and tip of snout.

The specimens in *C. boettgeri* shew very considerable colour variation; often, but not always, there is a distinct whitish mid-dorsal streak, usually narrow but occasionally broad, commencing from the snout, and laterally starting from the shoulder fold is another whitish streak, with curved outline; there are few or many, large or small, black patches of varying shape on the dorsal surface, over each eye is a dark streak directed obliquely backwards, and there are transverse black patches on the thighs and legs; the belly is either spotted with black or uniformly pale and the under side of the thighs is black-marbled; the shoulder fold, sometimes indistinct, especially in the females, is marked below by a whitish streak; sometimes there is a dark streak on each side of the head, commencing on the snout, passing through the eye, and continued along the shoulder fold. The specimen from Lions River (Natal), collected by Rev. N. Roberts, is very fuscous; the upper surfaces are entirely dark, the lower surfaces of the thighs and the throat have deep black blotches forming a reticulation in which the white is scarcely seen; the belly has a few black spots and the hinder surface of thighs is wrinkled almost into tubercles. The tarso-metatarsal articulation reaches just beyond the end of snout, but the specimen is probably only half grown. The species has two metatarsal tubercles, the inner one largest and the outer one occasionally indistinct or represented only by a pale spot. The largest specimens of this frog only reach about 25 mm.

BUFO.

The three examples of *B. vertebralis* from Kimberley (Bro. J. H. Power) have blackish spots and vermiculations on the belly, and also on the under surfaces of the legs. The white spot on the dorsal surface is present, but only the anterior angle of this spot is well defined, being bordered in front by a Λ-shaped dark mark. The parotoid glands are certainly present, though considerably compressed; they are completely divided into two by a transverse interval which, in one specimen, is nearly half as wide as the hinder division is long; they are capped with spinose tubercles like the other, much smaller, skin protuberances of the dorsal surface. The inferior inner surface of the tarsus is beset with a number of a relatively large tubercles and the under surface of the foot is also much tubercled. The greater portion of the belly has almost a smooth surface, though it is much wrinkled transversely; posteriorly it becomes more rugose and indefinitely tubercled, but nowhere is it definitely granular.

We have seven examples of *B. granti* from Victoria West (Mr. P. D. Morris), and these, coming from the same district as the types of *granti*, may be regarded as typical of this species. In all of them the first finger extends beyond the second; the tympanum is rounded, or pearshaped, being pointed towards the parotoids; the subarticular tubercles under the toes are mostly single, but sometimes double; the central portions of the belly are in most cases quite smooth, but in one or two examples it is roughened, though not definitely granular; the dorsal skin has a blistered appearance being raised into smooth rounded warts, often hemispherical though varying considerably in development and shape, each wart usually beset with numerous minute spines; most of them are ornamented with large brown spots dorsally, but there is considerable asymmetry in their arrangement, and one specimen, which is very warty, is almost uniformly pale brown dorsally. It is to be distinguished from *regularis* by the shorter hind limbs, the smaller tympanum, the less degree of webbing between the toes, and the asymmetrical arrangement of the dorsal pattern. From *angusticeps* it is said to be distinct in general size —*granti* goes up to 90 mm., whereas *angusticeps* only reaches about 46 mm. (2 inches according to Smith) from snout to vent—in the larger tympanum, the proportions of the first and second fingers, and perhaps the dorsal pattern which in *angusticeps* usually has a yellowish vertebral line not present in *granti*. Whether these three forms *regularis*, *angusticeps* and *granti* really represent so many distinct species can only be determined by examination of more material, but there is some reason for supposing that such is not the case. The fact that the tympanum of *granti* varies much in relative size, and that the length of the hind limbs of *angusticeps* is also variable, often being as relatively short as in *granti*, and further that both these species were taken by Mr. Grant at Durban Road, may mean that these are one and the same thing. On the other hand, that Smith's species *gariepensis* from the Orange River, is the same as *angusticeps* (*sensu strictiori*), as reduced in the British Museum Catalogue, is very doubtful; and it is just as probable that *granti* is synonymous with that species. According to Smith's description and figure, *gariepensis*, the type of which only reached 1½ inches and was probably juvenile, had the following characters: belly smooth, the middle of the back studded with rather large oblong somewhat depressed tubercles, the hinder portion of the back and sides rough from closely set small hemispherical ones, parotoids broadly oval, subcircular and large, posterior limbs moderate, tympanum small and circular, lower parts sparingly freckled with minute dark spots, but dorsally there is no median pale streak.

Smith's description of *angusticeps* includes the following points: parotoids rather long and narrow, belly mostly smooth, back and sides thinly sprinkled with large oval or circular tubercles. The author of these species attached more importance to the shape of the parotoids than is admissable now, but there certainly is a tendency in *granti* for the parotoids to assume an ovoid shape, the wider portion anterior.

It is a significant fact that in no less than three genera of *Anura*, the Western Cape representatives have reduced the length of the hind limbs, cp. *Rana fuscigula*, *Bufo granti* and *Breviceps macrops*.

Bufo carens, the red toad of the Transvaal, easily distinguished by its much depressed parotoids, has a characteristic colour marking in the form of a reddish brown streak starting from the upper eyelid, margining the tympanum above and passing along the sides of the body to the thighs.

HELEOPHRYNE.

In my original description of *H. regis* the tympanum was described as hidden, but in further specimens which are somewhat shrivelled, the tympanum is fairly distinct being a little more than one-third the width of the eye. The tongue is attached behind. The skull has a large frontoparietal fontanelle. The pupil though vertical does not contract into a narrow slit but is lozenge-shaped in most specimens. The sacral diapophyses are a little dilated but not strongly so. In one specimen the vertebral column had the following abnormalities: the first vetebra bears well developed diapophyses, the eighth vertebra constitutes the sacrum, and the ninth vertebra, which is postsacral, is well developed, excepting that on one side there is no diapophysis; the urostyle has two concave surfaces for articulation with the ninth vertebra.

DISTRIBUTION OF THE SPECIES.

RANIDAE.

RANA, Linn.

R. natalensis, Smith : B. M. Cat. p. 30. Described from Natal and since recorded from Pondoland; the Transvaal Museum has it from Irene (Rev. Roberts), from Kameel Drift, Pretoria dist. (C. J. Swierstra), from Hectorspruit, and from Haenertsburg. The Brit. Mus. Cat. cites also Madagascar, but this is not recognised by Mocquard and is probably incorrect.

R. adspersa, Bibr. : B. M. Cat. p. 33. Apparently common throughout the Transvaal (Transvaal Museum), and recorded from German East Africa, S. Angola, Mozambique, Mashonaland, Matabeleland and Zululand: we have it from from Grahamstown, the King William's Town Museum from King William's Town, and the Port Elizàbeth Museum has it from the Port Elizabeth neighbourhood. It occurs also at Kimberley (Mr. F. C. Graham).

R. delalandi, Bibr. : B. M Cat. p. 31. Distributed throughout South Africa and extending northwards into Angola, German East Africa and Abyssinia.

R. ruddi, Boul. : P. Z. S. 1907, 2. 480. Described from Beira.

R. angolensis, Boc. B.M. Cat. p. 50.—This species occurs in German East Africa and in Angola extending southwards into every province of S. Africa. It is the common water frog of the Transvaal, and Smith stated " the whole of Southern Africa and abundant near Cape Town" ; but as in the appendix of his book he states that *R. fuscigula* is very common in the Cape Town neighbourhood, I suspect that he had previously confused together the two species and the true *angolensis* does not occur along with *fuscigula* in the western portion of the Cape Province. The only Cape Province records known to me are Grahamstown, Port Elizabeth (Port Elizabeth Museum), King William's Town (King William's Town Museum), and the Transvaal Museum has a single specimen which I refer with some doubt to this species from Avontuur. Mr. Boulenger has recorded it from Deelfontein in the Richmond district, but the record requires further confirmation as this locality is well within the area of *fuscigula*, and for example, all the Ranas from Victoria West (Mr. P. D. Morris), which is not far from Deelfontein, certainly belong to *fuscigula* and so also do the Kimberley frogs.

R. theileri, Mocq. Bull. Mus. Hist. Nat. Paris, 1906, p. 252.—Described from the Barberton district. Possibly a synonym of *angolensis*.

R. fuscigula, D.B. B.M. Cat., p. 50.—Smith said " common throughout the whole of southern Africa, abundant near Capetown." It is known to me from Strand (Bro. J. H. Power), Victoria West (Mr. P. D. Morris), Tafelberg in the Middleburg district (E. Gadd), Fort Richmond and Kimberley (Kimberley Museum); Mr. Boulenger recorded it from Klipfontein in British Namaqualand, and the South African Museum has it from Stellenbosch, Caledon, Paarl, Clanwilliam, Worcester, Robertson, Tulbagh and Prince Albert Divisions. It appears, therefore, that this is the common water frog of Western Cape Province. The Transvaal Museum has a single specimen which probably belongs to this species from Knysna. Matschie recorded it from Haenertsburg (Zoutpansberg Dist.), but I doubt this record. It is recorded from North Nyassaland and the British Museum Catalogue cites Sierra Leone and West Africa.

R. oxyrhynchus, Sundew. B.M. Cat., p. 51.—Recorded from Angola, from German East Africa, from Nyassaland, from Beira and Coguno, from Zululand, from Zoutpansberg district and from Natal. Smith's specimens came from Kafirland and the country about Port Natal. The Transvaal Museum has it from Shilowane (Zoutpansberg Dist.) and from Waterval Onder, the South African Museum from Salisbury (Mashonaland), and the Kimberley Museum from Marandellas (Rhodesia).

R. darlingi, Boul. P.Z.S. 1902, 2, p. 15.—Described from Mashonaland, and Chubb records it from the Victoria Falls.

R. galamensis, D.B. : B. M. Cat. p. 61. Recorded from Beira (P. Z. S. 1907, 2. 481). Known from East and West Soudan, West Africa from Senegal to Congo, Central and East Africa.

R. grayi, Smith, B. M. Cat. p. 53. According to Smith, found in the western districts of Cape Colony, and near Capetown. Recorded by Mr. Boulenger from Durban Road (near Capetown), Klipfontein (British Namaqualand), Sibudeni and Ngoye Hills (Zululand). Known to me from Strand (Bro. J. H. Power), from Robben Island (A. Jones), from Knysna (Transvaal Museum), and recorded from Kaffraria, Pondoland and Pietermaritzburg. The Transvaal Museum has it from Woodbush, Zoutpansberg dist. (Hon. P. A. Methuen). The South African Museum has it from Caledon division, Paarl division, Clanwilliam, Touws River, Ceres and Port St. John's ; the Port Elizabeth Museum has it from Port Elizabeth. Apparently not extending to the high central plateau of S. Africa.

R. fasciata, Boie. B. M. Cat. p. 54. According to Smith, widely spread over Southern Africa. We have it from Grahamstown, the Port Elizabeth Museum has it from Port Elizabeth, the Transvaal Museum has it from Pretoria, from Wilge River and from Avontuur, and the South African Museum from several localities in the Cape Division. Other records are Kaffraria, Pondolaud, Natal, Rydal Mt. (O.F.S.) and Haenertsberg (Zoutpansberg district). Mr. Boulenger records it from Sibudeni (Zululand). This species is known locally as the grass frog, its habits being terrestrial rather than aquatic.

R. mascareniensis, D.B. B. M. Cat., p. 52.—Widely distributed from Barbary and Egypt throughout Tropical Africa, southwards into Rhodesia (Gwamayaya River, Chubb), Mozambique, to Zululand (Mseleni and Sibudeni). The Kimberley Museum has the species from Marandellas (Rhodesia), and the Transvaal Museum from Woodbush, Zoutpansberg Dist. (P. Methuen).

R. aequiplicata, Werner. This species was recorded from the Barberton Dist., Transvaal, by Mocquard in Bull. Mus. d'Hist. Nat. Paris, 1906, p. 252. Probably the record should be *R. mascareniensis*, D.B.

R. queketti, Boul. P. Z. S., 1894, p. 643.—Only known from Natal (Pietermaritzburg).

CHIROMANTIS, Pet.

C. xerampelina, Pet. B. M. Cat., p. 93.—Recorded from British and German East Africa, Mozambique, and from Victoria Falls (E. Chubb); known to me from Komati Poort and Hectorspruit (Barberton District) and Selati (Zoutpansberg District) (Transvaal Museum), Palapye Road (Albany Museum), and Lydenburg District (S. A. Museum).

According to Peters it was taken in Damaraland by Wahlberg.

PHRYNOBATRACHUS, Günth.

P. natalensis, Smith. B. M. Cat., p. 112.—Known from Angola, German East Africa, Mashonaland, Matabeleland, Transvaal, Beira and Coguno, Zululand, Natal and Eastern Cape Colony. The Transvaal Museum has it from Pretoria, Potchefstroom, Woodbush and Middelburg (Transvaal). We have it from Grahamstown, Mr. F. Pym has taken it at Kingwilliamstown and Bro. J. H. Power, has it from Christiania.

P. ranoides, Boul. P. Z. S. 1894, p. 644.—Described from Pietermaritzburg. Perhaps a synonym of *P. natalensis*, Smith.

ARTHROLEPTIS, Smith.

A. wahlbergi, Smith. B. M. Cat., p. 117.—Recorded from Pietermaritzburg and from Zululand (Sibudeni and Hluhluwe

Stream) by Boulenger, and the Natal Govt. Museum has this species from Natal (Richmond) and from Zululand (Hlabisa).

A. whytii, Boul. P. Z. S. 1897, p. 802.—Described from North Nyassaland and since recorded from Beira.

RAPPIA, Günth.

R. concolor, Hallow. B. M. Cat., p. 124.—Recorded from Gold Coast, N. and S. Angola, Shiré Valley, Zambesi, Quellimane and Zululand (Lower Umzimkulu).

R. horstocki, Schleg. B. M. Cat., p. 120.—The Brit. Mus. Cat. cites S. Africa and Madagascar: the latter record is not admitted by Mocquard, and is probably incorrect. The S. African records are Pirie Bush (B. M. Cat.), Capetown, Rhondebosch and Knysna (South African Museum), Port Elizabeth (Port Elizabeth Museum) and King William's Town (King William's Town Museum).

R. undulata, Boul. Annals Mus. Congo. Zool. serv. 1, tom. 1, fasc. 1.—Described from the Congo and since recorded from Pietermaritzburg by Mr. Boulenger.

R. marmorata, Rapp. B. M. Cat., p. 121.—Known from West Africa, Congo, Angola, Abyssinia, East Africa and on the eastern side extending southwards as far as Eastern Cape Colony) We have it from Alice, from Brak Kloof (near Grahamstown. and from Kowie; Mr. Pym has it from Pirie bush and the Port Elizabeth Museum has it from the Port Elizabeth neighbourhood. The Transvaal Museum has it from the Zoutpansberg and Barberton districts.

R. tuberilinguis, Sundew. B. M. Cat., p. 125.—Described from Kaffraria.

R. cinctiventris, Cope. B. M. Cat., p. 126.—Recorded from Senegal, Congo, N. and S. Angola, Zambesi, Beira, Zululand and Natal: also known from Kingwilliamstown and the Albany Museum has it from Grahamstown (Dr. Harrison).

R. pusilla, Cope. B. M. Cat., p. 127.—I know of no S. African record for this species, but have included it here on the authority of Mr. Sclater's list (Annals S. African Mus., Vol. 1. p. 108.—The B. M. Cat. cites Umvoti, West Africa.

R. microps, Günth. B. M. Cat., p. 127.—According to Peters (Reise nach Mossambique, p. 163) this is a synonym of his *R. flavoviridis*, Pet. (=*R. tettensis*, Pet.). An East African species recorded by Peters from Boror and from Tette, which latter is the only S. African record known to me apart from a doubtful juvenile specimen from Marandellas (Kimberley Museum).

R. nasuta, Günth. B. M. Cat., p. 127.—Described from Angola. The Kimberley Museum has what appears to be this species from Marandellas (Rhodesia).

MEGALIXALUS, Günth.

M. fornasinii, Bianc. B. M. Cat., p. 130.—Recorded from Gold Coast, Congo and Nyassaland, and East Africa from Zanzibar coast to Delagoa Bay.

M. spinifrons, Cope. B. M. Cat., p. 130.—The locality of the describer is Umvoti, W. Africa; the South African Museum has a specimen from Rhondebosch agreeing with the description of this species, which seems to be the only record from South Africa.

CASSINA, Gir.

C. senegalensis, D. B. B. M. Cat., p. 131.—Known from Senaar (Egypt), occurring throughout tropical Africa, extending southwards into Rhodesia, Zululand, Transvaal, O.F.S., Natal and South East Cape Colony; the Transvaal Museum has it from Knysna (J. H. Rex), Wakkerstroom (A. Roberts), Kameel Drift, Pretoria (C. J. Swierstra), Great Letaba River (Dr. Breyer), the Port Elizabeth Museum has it from Kroonstat, O. F. S., and we have it from Grahamstown (K. and R. Graham).

C. wealii, Boul. B. M. Cat., p. 131.—Apparently a synonym of *C. senegalensis*, D. B. (see P. Z. S. 1907, 2, 482.) Described from Kaffraria.

HYLAMBATES, A. Dum.

H. maculatus, A. Dum. B. M. Cat., p. 134.—Known from German East Africa, Zanzibar, Shiré valley and Mozambique. Perhaps not occurring within our limits.

H. natalensis, Smith. B. M. Cat., p. 135.—Only known from Natal (Port Natal).

H. johnstoni, Boul. P. Z. S. 1897, p. 803.—Described from Northern Nyassaland; the Transvaal Museum has this species from Shilowane (Zoutpansberg Dist.).

ENGYSTOMATIDAE.

PHRYNOMANTIS, Pet.

P. bifasciata, Smith. B. M. Cat., p. 172.—Known from South Angola, German East Africa, N. Nyassaland, Shiré valley, Beira, Matabeleland, Komati Poort; Palapye (Albany Museum); Vryburg (Port Elizabeth Museum); Waterberg Dist. and Pienaar's River, Pretoria Dist. (Transvaal Museum); Kimberley and Madibi (Kimberley Museum).

BREVICEPS, Merr.

B. gibbosus, Lin. B. M. Cat., p. 176.—This species, or its allies *verrucosus* and *mossambicus*, occurs throughout the whole of South Africa. The typical form apparently occurs in the Cape division, and the King William's Town and Grahamstown forms should also be referred to *gibbosus*, but I have not had sufficient material to enable me to determine the precise area of distribution of this species as distinct from *mossambicus*; however it seems likely that *mossambicus* will prove to be merely a geographical variety connected by all grades of intermediates with *gibbosus*. The species *gibbosus* was known to Smith only from the Cape Town neighbourhood.

B. verrucosus, Rapp. B. M. Cat., p. 177.—We have it from Qacu Forest (T. Liefeldt), and the Transvaal Museum has this species from Knysna and from Haenertsburg. Also it is recorded from German East Africa, Natal and Kaffraria. Smith said "inhabits the whole of Southern Africa."

B. mossambicus, Pet. B. M. Cat., p. 177.—Known to me from Woodbush, Shilowane, Komati Poort, Hectorspruit, Pretoria, Doornkop near Belfast, De Kroon Crocodile River (Transvaal Museum). Recorded from German East Africa, S. Angola, Mozambique, North Nyassaland, Mashonaland, N. Matabeleland and Zululand.

B. pentheri, Wern. Zool. Anz. 22, 1899, p. 116.—Locality doubtful; "perhaps Grahamstown." A specimen from Kimberley (Kimberley Museum) agrees with the description of this species.

B. macrops, Boul. A. M. N. H. 7, 20, p. 46.—Described from Namaqualand; presumably this is British Namaqualand. We have it from Port Nolloth (Dr. R. W. Howard).

HEMISUS, Günth.

H. guttatum, Rapp. B. M. Cat., p. 178.—South-Eastern coast of Africa towards Port Natal (A. Smith); in addition to the Natal record there is one from Indukuduku, Zululand (Natal Govt Mus.), and Bocage records it from S. Angola.

H. marmoratum, Pet. (=Sudanense Steind). B. M. Cat., p. 178.—East and West Africa; recorded from Beira (P. Z. S. 1907, 2, p. 480).

CACOSTERNUM, Boul.

C. boettgeri, Boul. (=*Arthroleptis boettgeri*). B. M. Cat., p. 118.—See previous note.

C. nanum, Boul. A. M. N. H. 5, 20, p. 52 (1887).—Probably a synonym of *C. boettgeri*, Boul. Described from Kaffraria, and since recorded from West Somaliland. (P. Z. S. 1895).

CYSTIGNATHIDAE.

HELEOPHRYNE, Sclat.

H. purcelli, Sclat. Ann. S. African Mus., Vol. I., p. 110.—Only known from the neighbourhood of Stellenbosch.

H. regis, Hewitt. Ann. Transvaal Mus., Vol II., p. 45.—Described from Knysna.

BUFONIDAE.

BUFO, Laur.

B. carens, Smith. B. M. Cat., p. 301.—Distributed from German East Africa southwards through Rhodesia, Transvaal, Mozambique and Natal, but absent from the greater part of Cape Colony. It occurs at Kimberley (J. H. Power); probably also throughout Orange Free State, and it is common apparently in every part of the Transvaal. Mr. Boulenger (P. Z. S. 1907, 2, 480) remarks on some specimens from Port Elizabeth, but no doubt the locality record is an error.

B. vertebralis, Smith. Zoology of S. Africa, Pl. 68, see also P. Z. S. 1905, 2, p. 250.—Known from the Orange Free State (Vredefort Road), and taken recently at Kimberley by Bro. J. H. Power.

B. anotis, Boul. A. M. N. H. 7, 20, 48.—Described from South East Mashonaland.

B. regularis, Reuss. B. M. Cat., p. 298.-According to Mr. Boulenger, distributed throughout Africa with the exception of Barbary. It is abundant throughout the Transvaal and extends southwards, at any rate as far as Kimberley (McGregor Museum), King William's Town (King William's Town Museum), and Grahamstown (Albany Museum), but presumably it does not occur in the same localities as *angusticeps* and *granti*, though Smith stated that it is abundant throughout Southern Africa and common near Cape Town.

B. angusticeps, Smith. B. M. Cat., p. 300. A Cape Colony species of limited distribution. Mr. Boulenger records it from Durban Road (Capetown), and the South African Museum has it from Wynberg, Diep River, Laingsburg and Worcester. It appears to be absent from Eastern Cape Colony though the British Museum Catalogue cites "vleis. Kaffraria." Boettger recorded it from Linokana (Transvaal), but this is an error I believe; also in the Reise nach Mossambique, Peters recorded this species from Tette but apparently he was not at that time quite convinced of the essential difference of this species from *regularis*, so that this record is in my opinion very doubtful. Smith's species *gariepensis*, which came from the banks of the Orange River, is placed in the British Museum Catalogue as a synonym of this species.

B. granti, Boul. A. M. N. H. 1903, 7, 12, p 215.—A Cape Colony species described from Deelfontein in the Richmond district and since recorded by Mr. Boulenger from Matjesfontein, from Durban Road (near Capetown), and Klipfontein (British Namaqualand); we have it from Victoria West (Mr. P. D. Morris) and the South African Museum has it from Hanover and Graaff-Reinet.

B. tuberculosus, Boc. Jorn. Sci. Math. Phys. Nat. Lisboa 2, 4, 1896.—Described from Linokana in Western Transvaal.

B. taitanus, Pet. B. M. Cat., p. 305.—Recorded from Beira (P. Z. S. 1907, 2, 480); previously known from Somaliland, Taita, and the East Coast of Lake Tanganyika.

DACTYLETHRIDAE.

XENOPUS, Wagl.

X. laevis, Daud. B. M. Cat., p. 456.—Known from all parts of South Africa and occurring also in Angola, Uganda and Abyssinia.

X. muelleri, Pet. B. M. Cat., p. 457.—An East African species found in Mozambique, Nyassaland and Zanzibar. Peters recorded it from Tette, the only S. African record known to me.

ADDENDUM.

The following records were received after the paper had been prepared for press:—

BUFO REGULARIS, Reuss. Diep River, near Capetown (Dr. W. F. Purcell).

Smith's general statement on the distribution of this species was no doubt correct. Dr. Purcell's specimen has the tympanum rather small, but it is typically regularis in the proportions of the first two fingers and in the marked granularity of the whole ventral surfaces.

BREVICEPS GIBBOSUS, Lin. Diep River, near Capetown (Dr. W. F. Purcell).

The specimens are of large size and agree entirely with the description, excepting that the ventral surfaces are not definitely granular and the outer toe is longer than the inner one.

A new species of Aloe from Namaqualand

By S. SCHÖNLAND.

Aloe Pearsoni, Schönl., n.sp.

E basi ramosa, caules elongati erecti ca. 1.5 cm. diam., 0.6-1.2 m. longi dense foliati. Folia deflexa laxe imbricata vaginantia; vaginis albis distincte rubro-striatis ca. 2 cm. longis; laminis crassis coriaceis ovatis vel ovato-lanceolatis acutis pungentibus supra viridibus vel rubescentibus irregulariter albo-maculatis subplanis vel apicem versus canaliculatis subtus convexis viridibus interdum rubro-vel viridi-striatis, ca. 9 cm. longis ca. 3-5 cm. latis, ca. 1 cm. crassis, interdum summo apice 1-2 dentibus armatis, margine subcartilagineo denticulato summo apice integro cinctis, dentibus ca. 1.5 mm. longis basi deltoideis apice aculeatis incurvatis ca. 3 mm. distantibus primum albis demum flavescentibus. Inflorescentia subterminalis 30-35 cm. alta; scapus simplex vel sub medio furcatus basi complanatus uno latere canaliculatus, superne bracteatus, bracteis vacuis membranaceis ovatis longe acuminatis 6–10 mm. longis; racemo multifloro elongato ca. 15 cm. longo, bracteis floriferis lanceolatis acuminatis ca. 1 cm. longis, pedicellis gracilibus ca. 2 cm. longis arcuatis erecto-patentibus apice nutantibus. Perigonium ca. 2 cm. longum subcylindraceum supra ovarium haud constrictum sed leviter decurvatum pallide luteum interdum testaceum, segmentis ultra medium connatis. Stamina breviter exserta. Ovarium 7 mm. longum, stylus demum breviter exsertus.

H. H. W. Pearson 6091 (Percy Sladen Expedition 1910–11). Common on upper West, North West and South West slopes, Numies mine, Brakwater pools and Kuboos.

A. Pearsoni belongs to Berger's section *Prolongatae* (A. Berger in Engler's „Pflanzenreich," Heft 33, p. 162) and may further be placed near the group *Stantes* of his series *Mitriformes*. Except the very youngest, the leaves are all strongly deflexed which gives the plant a characteristic appearance. From *Aloe sororia*, A. Berg. (l.c. p. 280) it is distinguished by much smaller spines on the margin of the leaves and the perigonium in this species is twice the length as compared with *A. Pearsoni*. *A. Browni*, Bak. (Journ. of Bot. [1889] p. 44) has also longer spines and larger flowers and in Berger's and Baker's species the filaments are exserted and the style is eventually considerably exserted, whereas in *A. Pearsoni* only the anthers are slightly exserted and the style also protudes only slightly. *A. parvispina*, Schönl., the only other species which has to be considered, has much larger leaves and smaller flowers, besides there are other differences.

South African Anacardiaceae in the Herbarium of the Albany Museum

By S. SCHÖNLAND.

Having consented to determine the Anacardiaceae collected by Prof. Pearson on the Percy Sladen Memorial Expeditions, it became necessary first of all to carefully work through the rich material of the Albany Museum in which many specimens were undetermined, while others were obviously wrongly named. The following report on these specimens was, therefore, prepared with a key to all known S. A. species of Rhus. This key has been largely based on Sonder's and Engler's keys. It is, however, not meant to express always natural relationships. Sonder (in the Flora Capensis, Vol. I, p. 502) placed the Anacardiaceae (his Anacardieae and Spondieae) with the Bursereae amongst the Therebintaceae, Juss. As usually done now I follow Lindley (Veg. Kingdom, p. 465) in the limitation of the order Since the publication of Sonder's account two very important works on South African Anacardiaceae have appeared. Engler monographed the whole order (Anacardiaceae in Monographiae Phanerogamarum ed. Alph. et Cas. de Candolle, Vol. IV, 1888, p. 171) and Diels dealt with the phylogeny of the vegetative organs of Rhus. L. § Gerontogeae Engl. (Engler's Botanische Jahrbücher Vol. XXIV, 1898, p. 568). Diels contributed a large number of facts which are of great value in delimitating the S. A. species of Rhus and made also an attempt to divide them into natural groups. He stated (p. 593) that, with the increase of material the delimitation of the species which seemed on the whole comparatively easy at the time when Engler wrote his monograph, has become more and more difficult. He has pointed out that several of Engler's species cannot stand and shows how elusive some of the other species are. A number of new species of Rhus have been described since the publication of Engler's monograph. Reference to these will be made later on, it may suffice here to mention that very few of them can be retained. But even with the large material now available, a thorough critical revision of ihe genus Rhus is not possible at present, as collectors have generally only picked small pieces of each plant. For a future revision the vegetative organs of young and adult plants in addition to flowers and fruits will be required. I have on the whole contented myself with the co-ordination of our material (as far as it did not consist of types) with other types in this country. I have had the advantage of consulting the Herbaria of Dr. Bolus, F.L.S, and Mr. E. E. Galpin, F.L.S and the Cape Government Herbarium. In some cases, however, my determinations were taken from the published descriptions. In cases of doubt I have duly indicated that the specimens did not fit the descriptions accurately; a few specimens only were left out altogether as I did not venture to put a name to them.

KEY TO THE GENERA:

A. Fruit winged. Leaves simple. BOTRYCERAS, Willd.

B. Fruit winged. Leaves trifoliate. SMODINGIUM, E. Mey.

C. Fruit not winged.

a. Leaves simple.

‡. Ovary 2-3-locular, 2-3 ovules in each chamber. PROTORHUS, Engl.

‡‡. Ovary 1-locular, 1-ovular. HEERIA Meissn. (ANAPHRENIUM, E. Mey.).

b. Leaves (in S. African species) 3-foliate, rarely 5-foliate. RHUS, L.

c. Leaves imparipinnate.

‡. Calyx of female flowers enlarging, enclosing the drupe. LOXOSTYLIS, Spreng. f.

‡‡. Calyx not enlarging after flowering.

I. Flowers tetramerous. Male flowers with 12-15 stamens. SCLEROCARYA, Hochst.

II. Flowers tetramerous or pentamerous, rarely hexamerous. Male flowers with 8-10 stamens. ODINA, Roxb. (incl. HARPEPHYLLUM, Bernh.).

SCLEROCARYA, Hochst.

S. caffra, Sond.

J. M. Wood 8644, Durban; Leendertz 316, Wonderboompoort near Pretoria.

ODINA, Roxb.

O. edulis, Sond.

Rehmann 4735, Pretoria; Leendertz 269, Wonderboompoort near Pretoria; E. E. Galpin 633, Barberton; F. A. Rogers 239a, Waterval Boven.

O. discolor, Sond.

Rehmann 4737, Pretoria.

O. caffra (*Harpephyllum caffrum*, Bernh.) Sim, Forest Flora, t. 50.

MacOwan, Grahamstown; T. R. Sim 1994, Dohne Hill; H. G. Flanagan 586 (and in Herb. Austr. Afr. 1707), Komgha.

PROTORHUS, Engl,

P. longifolia, Engl. (*Rhus longifolia*, Sond. Fl. Cap., I, p. 522.) Wood, Natal Plants t. 69 and 383. Sim, Forest Flora, t. 47.

Flanagan 158, Keimouth and in Herb. Norm. Austr. Afr. 1432, Komgha; Miss A. Pegler 778, Kentani.

P. sp. nova ?

T. R. Sim 2433, Egossa, Pondoland.

LOXOSTYLIS, Spreng. fil.

L. alata, Spreng. fil. Sim, Forest Flora, t. 33, fig. 2.

Schlechter 6065, Van Staadens river; Ecklon and Zeyher 1137, Winterhoeksberg and Elandskloof near Uitenhage; MacOwan 1170, Howison's Poort near Grahamstown; Dr. Exton, Hospital Hill, Grahamstown.

BOTRYCERAS, Willd.

B. laurinum, Willd. Sim, Forest Flora, t. 33 fig. 1.

MacOwan 1068, Zeyher 299, 2241, Van Staadens mountains; Burchell 4690, without locality; Ecklon 1, Berg River.

SMODINGIUM, E. Mey.

S. argutum, E. Mey.

J. M. Wood, Polela; Miss A. Pegler 899. Kentani. Schlechter 6533, Mt. Ayliff, may also belong here. It only bears flower-buds. *Rhus montana* Diels (Engl. Bot. Jahrb. 40, 1907, p. 86) is in appearance also similar to *S. argutum.* Whether it should be removed to the genus Smodingium cannot be decided either by the original description or by means of the material which I have seen.

HEERIA, Meissn. (ANAPHRENIUM, E. Mey.).

H. abyssinica, (Hochst.), § *mucronifolia*, Engl. (*Rhus mucronifolia*, Sond.). Sim, Forest Flora, t. 48, fig. 2.

MacOwan 1171, Hell Poort and Botha's Hill, near Grahamstown; Mrs. G. White, Brakkloof; Zeyher, on the banks of the Fish River, district of Albany, and between the Koonap and Kat Rivers; Schlechter 6967, Van Reenen.

H. paniculosa, (Engl.) (*Rhus paniculosa*, Sond.)

Schlechter 4297, Batsloop, Transvaal; Bolus 11758, Warmbath, district Waterberg; Zeyher 250, Magalisberg; F. A. Rogers 337, and Leendertz 1433, Potgietersrust; Miss A. Pegler 1903, Rustenburg.

H. dispar, (E. Mey.). (*Rhus dispar*, Presl.)

Schlechter 11093. Stinkfontein, S. W. Cape Colony; Zeyher, Lislap.

H. argentea, (E. Mey.). (*Rhus Thunbergii*, Hook.)

Zeyher 328, Tulbagh Kloof; Bolus 4031, Bain's Kloof; Schlechter 7484, Nieuwekloof; Ecklon and Zeyher and P. A. Mader, Clanwilliam; Burchell 7811 and 8046.

H. crassinervia, (Engl.) Bot. Jahrb. Vol. X. (1889) p. 37.

Marloth 5019, Aus, Namaqualand.

The only other species which is found in extratropical South Africa is

H. namaensis, Schinz et Dinter in Bull. de l'herb. Boiss. II., 3, p. 823.

RHUS. L.

Key, to the extratropical South African species with an enumeration of the specimens in the Herb. of the Albany Museum:

In view of the great variability of so many species of Rhus, it is indispensible to refer in many cases to the original description and, if possible, to authentic material before a determination can be accepted as final. *Rhus knysniaca*, Schinz (Vierteljahrschr. der naturf. Ges., Zürich, Vol. 55, 1910, p. 238) is excluded, as it belongs to *Schmidelia decipiens*, Arn.

A. Drupes tomentose or puberulous.

a. Leaflets linear or linear-lanceolate, on the underside more or less tomentose.

‡ Leaflets very narrow, margin distinctly revolute.

I. Leaflets narrow linear, acute or mucronate, panicle glabrous.

1. *Rh. rosmarinifolia*, Vahl.

Ecklon and Zeyher 1088, Table Mountain; Rehmann 1346, Stinkwater, Capetown.

II. Leaflets linear-lanceolate acute, panicle pilose.

2. *Rh. stenophylla*, E. et Z.

MacOwan 1030, Vanstaaden's Mountain; W. Kemsley 167 and J. L. Drege, Port Elizabeth; R. Schlechter 1227, Houtsbay.

Both Sonder (Fl. Cap. 1. p. 507) and Diels (l. c. p. 571) have already pointed out that these first two species are not sharply separated.

‡‡ Leaflets linear lanceolate shortly petiolulate, margin not revolute.

3. *Rh angustifolia*, L.

Zeyher 4832, Capetown; Rehmann 2817, Hex River Valley; Schlechter 5617, Rivierzonderend; Schlechter 9133, Bain's Kloof.

b. Leaflets ovate, obovate or elliptical, margin entire, dentate or crenate.

‡ Leaflets obovate, cuneate at the base, frequently obtuse or emarginate, margin entire or near the apex crenato-dentate.

4. *Rh. obovata*, Sond. Diels, l.c. p. 621, fig. 5 E. Sim, Forest Flora t. 104, fig. 4.

Schlechter 5095, Western Region, 11438 Wolveton, Western Region; MacOwan 34 and 625, Grahamstown; Ecklon and Zeyher 1111, Assegay Bush, Albany; Miss Daly 303 and Schönland 574, Grahamstown.

‡‡ Leaflets obovate or elliptical, at base and apex obtuse, margin crenato-dentate.

5. *Rh. populifolia*, E. Mey.

‡‡‡ Leaflets obovate, cuneate at the base, acuminate or mucronulate at the apex, margin entire or more or less (especially in the upper half) crenato-dentate or dentate.

6. *Rh. steingroeveri*, Engl. (Bot. Jahrb. XXIV. p. 500; Diels, l. c. p. 621, fig. 5 A).

As far as I can judge, without having seen authentic material, this species cannot be separated from *Rh. obovata*, Sond. Schlechter's numbers quoted under *Rh. obovata* might be placed here, but also some branches from Grahamstown.

‡‡‡‡ Leaflets obovate, oblong-ovate or elliptical, at base and apex acute, margin entire or towards the apex serrate.

7. *Rh. tomentosa*, L. Sim, Forest Flora, t. 104, fig. 3.

MacOwan, Capetown; Ecklon and Zeyher, Stellenbosch; Schlechter 8634, Packhuisberg; Ecklon and Zeyher 1109, Vanstaaden's mountain; T. R. Sim 262, Fort Cunynghame.

* Leaflets with long petiolules, elliptical-oblong, acute or acuminate.

var. *petiolaris*, Sond.

MacOwan 296, Grahamstown and Boschberg; Miss M. Daly 469, Grahamstown.

** Leaflets oblongo-elliptical or lanceolate, mucronulate, quite entire.

var. *swellendamensis*, E. et. Z. (connects *Rh. tomentosa*, L. with *Rh. angustifolia*, L.)

MacOwan, Table Mountain.

c. Leaflets pinnatifid, lobes obtuse with revolute margin.

8. *Rh. incisa* L. f. Diels, l.c. p. 621, fig. 5, P-H.

Schlechter 4991, Olifant River; Schlechter 7854 and 8720, Koudeberg; Ecklon and Zeyher, Simonstown; Rehmann 2518, Worcester.

This species is connected with *Rh. obovata*, Sond. by intermediate forms.

B. Drupes glabrous, verrucose. Leaflets cuneate at base, margin slightly revolute with mucronulate teeth or pinnatifid.

9. *Rh. dissecta*, Thunb. Diels, l.c., p. 621, fig. 5, B-D.

Schlechter 5027, Olifant River; Ecklon and Zeyher, Clanwilliam; Zeyher 332, Clanwilliam, P. A. Mader, Clanwilliam; Rehmann 2821, Worcester, 9a. *Rh. rosmarinifolia* × *dissecta*.

Schlechter 7872, Saron.

C. Drupes quite smooth and glabrous.

a. Petiole with narrow wings, leaflets usually more or less coriaceous.

I. Leaflets glabrous or subglabrous, obovate, oblong-obovate or oblong, frequently towards the base cuneately narrowed.

+ Leaves on long or moderate petioles.

* Leaflets oblong, at the apex slightly emarginate or mucronulate, veins minutely reticulate, prominent on both surfaces.

10. *Rh. Krebsiana*, Presl.

Schlechter 2521, Uitenhage, is probably this species of which no type is in South Africa.

** Leaflets "varnished," obovate cuneate, obovate lanceolate or lanceolate, obtuse, emarginate or acute, quite entire or margin undulate or undulate-dentate or incised-dentate, veins rather prominent.

11. *Rh. undulata*, Jacq.

Rehmann 2517, Worcester; Rehmann 2912, Maggisfontein, Witteberge, Karroo; ? Schlechter 11434, J'us, Western Region; ? Schlechter 7882, Saron; ? Schlechter 10331, Genadendal.

I am unable to distinguish this species satisfactorily from the following:

*** Leaflets „varnished," obovate-oblong or obovate-lanceolate, apex obtuse, emarginate, acute or mucronulate.

12. *Rh. excisa*, Thunb. Diels, l.c. p. 634, fig. 7, H-K.

Schlechter 5725, Mosselbay; MacOwan 504, Grahamstown; Bolus 88, Graaff Reinet; F. A. Rogers, Queenstown; Schlechter 6128, Kingwilliamstown; Sim 2185, Fort Cunynghame; Flanagan 701, Kabousie.

**** Leaflets not „varnished," ovate or obovate lanceolate entire or crenato-dentate. Young branches terete pubescent.

13. *Rh. Pentheri*, A. Zahlb. in Ann. Hofmus. Wien XV., p. 52.

***** Leaflets more or less „varnished," obovate, sometimes deeply emarginate, margin not revolute or only slightly so in the lower portion.

14. *Rh. lucida*, L.

MacOwan in Herb. in Austr. Afr. 1827, Constantia; Schlechter 1333, Lionshead; Ecklon and Zeyher, Caledon; Schlechter 5737, Gr. Braakriver; Schlechter 5199, Piquetberg; Schlechter 9208, Paarl; Schlechter 5845, without locality; MacOwan, Howison's Poort; Schönland 182, Grahamstown; ? Zeyher 39, Uitenhage.

This species shades into *Rh. undulate*, Jacq and *Rh. excisa*, Thunb., and cannot be satisfactorily distinguished from the following:

Rh. outeniquensis, Szysz. (Plantae Rehmannianae Cracoviae 1888, p. 52).

****** Leaflets more or less „varnished," obovate-cuneate obtuse, emarginate or mucronulate, margin distinctly revolute; lateral veins more distinctly raised than in the preceding.

15. *Rh. scytophylla*, E. et Z. Diels, l.c. p. 537 fig. 8 D.

Zeyher 2247, Hottentotsholland mts.; Ecklon and Zeyher, Stellenbosch.

******* Leaflets obovate-oblong or oblong, slightly „varnished" on the upper surface, with white revolute margin and somewhat conspicuous reticulate venation.

16. *Rh. albomarginata*, Sond.

MacOwan 1303, Kasouga; F. A. Rogers 3032, above Camps Bay Capetown.

******** Leaflets ovate, subacute or emarginate, shortly mucronulate, sometimes at the apex crenato-dentate, with prominent veins and revolute margin. Drupe oblique.

17. *Rh. africana*, Mill.

Zeyher, Heerelogment.

********* Leaflets small obcordate-crenate or cuneate.

18 *Rh. Burchelli*, Sond.

Flanagan 1532, Burghersdorp.

var. *tricrenata*, Engl. Leaflets tricrenate at the apex.

Rehmann 3887, Bloemfontein.

This was named *Rhus excisa*, Thunb., var. *pallens*, Engl. by Szyszylowicz but seems to agree with the variety of *Rh. Burchelli* to which I have referred it. It may be a transition-form between the two species.

+ + Leaves sessile or on short petioles.

* Leaflets obcordate-cuneate, rarely obovate, 1-1.5 cm. long.

19. *Rh. glauca*, Desf. Diels, l.c. p. 634, fig. 7 D and F.
Burchell 4522; Ecklon and Zeyher 1120, near Capetown.

** Leaflets obovate-cuneate, or obcordate-cuneate, 2-2.5 cm. long.

20. *Rh. scoparia*, E. et Z.
Schlechter 10332, Genadendal; Mrs. T. V. Paterson, Walmer near Port Elizabeth; S. Schönland 615, Howison's Port.

I fail to see a sharp distinction between 19 and 20. The length of the petiole and the shape of the leaves vary in both. Typical *Rh. glauca* has thicker leaves, but this may be due to local circumstances. The following species, which I have not seen, seems also not sufficiently distinct to be kept up.

*** Leaflets obovate, obtuse or emarginate.

21. *Rh. Schlechteri,* Diels in Engl. Bot. Jahrb. XXIV, p. 501 and l.c. p. 634, fig. 7 E.

II. Leaves glauco-pulverulent, leaflets less than 1 cm. long, oblanceolate, obtuse. Young branches reddish. Spiny shrub.

22. *Rh. horrida*, E. et Z. Diels, l.c. p. 634 fig. 7 M.
Zeyher 348, Ecklon and Zeyher 1135, Springbokkeel; Schlechter 1179, Rietkloof, Western Region.

III. Young leaves, branches and inflorescence usually covered with reddish glands. Leaflets obovate 1-2 cm. long. Spiny shrub.

23. *Rh. longispina*, E. et Z.
Zeyher 1048, Uitenhage; Ecklon and Zeyher 1116, near Uitenhage and Fort Beaufort; Bolus 660, Graaff-Reinet; F. A. Rogers 191, Sandflats.

IV. Leaflets linear-lanceolate or lanceolate, narrower at base and apex, sometimes dentate.

+ Leaflets glabrous.

* Leaflets broadly linear-cuneate acuminate, rather thick, 4-5 cm. long.

24. *Rh. rigida*, Mill.
Schlechter 10798, Packhuisberg, Western Region.

** Leaflets lanceolate to oblong, margin undulate, 4-5 cm. long.

25. *Rh. Burkeana*, Sond.
Schlechter 4081, Batsabelo.

*** Leaflets narrow lanceolate acuminate, margin undulate, 1.5-2 cm. long.

26. *Rh. celastroides*, Sond.
Zeyher 333, Kamos, Bechuanaland; Schlechter 8196, Kareebergen.

+ + Leaflets puberulous, not ciliate on the margin, 3-5 cm. long.

27. *Rh. coriacea*, Engl.
Schlechter 3773, Olifant-River.

Diels, l.c. p. 576, is of opinion that this species should be placed under *Rh. Burkeana*, Sond. Engler in his monograph does not refer to *Rh. magalismontana*, Sond. (Flora Cap. I, p. 510). I have seen an imperfect specimen of Zeyher 341, the original number of Zeyher's on which the species is based and think it is closely allied to *Rh. coriacea*, Engl. It may be looked upon as a broad-leaved form of this species.

+ + + Leaflets puberulous, ciliate on the margin, 2-2.5 cm. long.

28. *Rh. ciliata*, Licht.
Bolus 6404, near Mafeking.

b. Petiole not winged.

I. Leaflets cuneate, rather thick, upper margin crenato-dentate, teeth mucronate. Leaves almost sessile.

29. *Rh. cuneifolia*, Thunb. Diels, l.c. p. 637, fig. 8, A, B, C.
MacOwan 2795, Clanwilliam; Schlechter 4824, Sir Lowry's Pass.

This species is allied to *Rh. scytophylla*, E. et Z. and, according to Diels, intermediate forms are found.

II. Leaflets subcoriaceous or membranous.

+ Anterior margin of leaflets usually crenate or dentate.

* Leaflets crenate, but sometimes entire on the same branch.

✓ Lateral nerves not very prominent. Leaflets 1-2 cm. long.

31. *Rh. crenata*, Thunb. Sim, Forest Flora t. 48, fig. 1. I cannot distinguish *Rh. cuneata* N. E. Br. in Kew Bull. 1906, p. 17 from this species.

Burchell 5331; Schlechter 10394, Onrust river; Schlechter 5738, Gr. Braak river; Mrs. T. V. Paterson 1108, and W. G. Kemsley 316, Port Elizabeth; Ecklon and Zeyher, Uitenhage; Mrs. G. White 61 and Mrs. H. Hutton 988, Port Alfred; Rattray 35, East London; Flanagan 846, Keimouth; Schlechter 6301, Bashee river; Rehmann 7054, Biggarsberg, Drakensberge; Rehmann 8072, between Pinetown and Umbilo, Natal; J. M. Wood 4706, near Ladismith, Natal (type of *Rh. cuneata* N. E. Br.).

32. *Rh. Marlothii*, Engl. in Engl. Bot. Jahrb., Vol. 10, p. 37, differs from *Rh. crenata* by larger petioles, more elongated leaflets, slightly longer fruit-stalks and more compressed fruits.

Marloth 1394, Otyimbingue, Hereroland. Flanagan 1531, Burghersdorp; Schlechter 6690, Umkomanzi, Natal are very close to this.

✓✓ Lateral nerves of leaflets prominent, leaflets 2-4 cm. long, frequently entire.

Rh. Rehmanniana, Engl. This species should be sunk in *Rh. incana*, Mill. (*Rh. villosa*, L.f.).

** Leaflets with a few crenato-dentate mucronate teeth, sometimes obovate with a single mucronate tooth at the apex or entire mucronate (*Rh. rupicola*, Wood et Evans in Journ. of Bot. 1897, p. 350), 1.5-3 cm. long.

33. *Rh acutidens*, Engl. I have not seen a type of this species. The first two specimens agree well with the description except that young leaves on Schlechter 6882 are tomentose. Schinz has called Schlechter 6465 *Rh. truncata*, Schinz. I do not know whether this name has been published.

Schlechter 6465, Insiswa mountain; Schlechter 6882, Colenso; Wood 3932, Liddesdale, Maritzburg county (type of *Rh. rupicola*, Wood et Evans).

+ + Leaflets inciso-crenato-dentate, teeth usually going as far as the middle of the leaflets, glabrous, pubescent or more or less villous, obovate.

34. *Rh. dentata*, Thunb. Sim, Forest Flora t. 49, fig. 2. This may be quite glabrous or the young leaves are at all events villous or again the older leaves, the branches and inflorescence may be covered with either short or longish hairs. As moreover the form of the teeth varies immensely, I am unable to separate *Rh. Sonderi*, Engl. (which includes *Rh. parvifolia*, Harv. and *Rh. dentata*, var. *puberula*, Sond.).

Schlechter 6057, Gamtoos river; Zeyher 2231, 368, between Assegai bush and Grahamstown; Schönland, Douglass Reservoir, Grahamstown; Rattray 169, East London; Schlechter 6168, Komgha; Miss Pegler 900, Kentani; Schlechter 3345, 3348, Mooi river, Natal; F. A. Rogers 546, Howick falls; F. A. Rogers 694, Ladysmith, Natal; Schlechter 6525, Insiswa; Schlechter 6311, Ingungo; Schlechter 6990, Van Reenen; F. A. Rogers 791, Ladybrand; Schlechter 3642, Magalisbergen; Rehmann 4743; ? Schlechter 3890, Elandsspruitberg, Transvaal.

+++ Leaflets oblanceolate, 2-3 cm. long, dentate except at the cuneate base.

35. *Rh. Bolusii*, Engl.

Bolus 737, Cave mountain near Graaff-Reinet.

++++ Leaflets entire or crenate, with longish hairs or glabrescent..

* Branches with very short thorns and often thorny at the apex, main axis of inflorescence flexuous.

36. *Rh. flexuosa*, Diels in Engl. Bot. Jahrb. Vol. 40, p. 86.

Schlechter 3609, Aapjes river and Leendertz 34 and 508, Pretoria, may belong to this species. They have rather a flexuous inflorescence, but, as far as the specimens go, they have no thorns.

** Branches without thorns, main axis of inflorescence straight or not decidedly flexuous; leaflets usually 3-4 cm. long.

37. *Rh. incana*, Mill. Gard. Dict. ed. VIII no. 8, 1768 (= *Rh. villosa*, L.f., fide J. Britten in Journ. of Bot. XXXVIII, 1900, p. 316). Diels l.c. p. 579, fig. 1, A—D.

I have failed to find any satisfactory distinction between *Rh. pyroides*, Burch., and this species. Already Sonder in the Flora Cap. I, p. 511, had pointed out that the former may only be a variety of the latter. Again Diels, l.c. p. 580, enlarges on the extraordinary variability of *Rh. villosa*, L.f. in the shape of the leaflets and the amount of hairiness. I have already mentioned above that *Rh. Rehmanniana*, Engl., should be sunk in this species. I am confirmed in this opinion by the fact that Cooper 1171 (which is represented in Herb. Bolus), quoted by Engler under *Rh. villosa*, L.f., is undoubtedly identical with the types of *Rh. Rehmanniana*, Engl. which I have seen. Specimens which have leaflets crenate at the apex and otherwise practically indistinguishable from these types occur along the Southern Cape Coast districts. They are common near Grahamstown (e.g. near the Douglass Reservoir) and extend at least as far as Prince Alfred.

Ecklon and Zeyher, Table Mountain; Rehmann 1350, Stinkwater, Capetown; Schlechter 2127, Zuurbraak; Pappe, Swellendam; Schlechter 9979, Prince Alfred; Ecklon and Zeyher, Krakakamma; W. Kemsley 260, Port Elizabeth; Ecklon and Zeyher 1100, 1102, Uitenhage; MacOwan 505, Grahamstown; F. A. Rogers 4461, Debe Nek; Flanagan 789, Komgha; Schlechter 6359, Umtata; Rehmann 5560, 5561, Houtbosch, Transvaal; ? Galpin 1016, Barberton (an nova sp.?).

Rh. tridentata, Sond., of which I have not seen a type, can hardly be separated from *Rh. incana*, Mill. According to Diels, l.c. p. 580, the difference, consisting in „ the cuneate trilobed or tridentate terminal leaflet" is not constant.

*** Branches sometimes thorny, leaflets obovate, margin entire or more or less crenate, 1-1.5 cm. long, lateral nerves not distinctly reticulate.

38. *Rh. refracta*, E. et Z.

Zeyher 17, Uitenhage; Schlechter 6584, Zuurbergen; Schönland, Roversground, Grahamstown.

+ + + + + Leaflets with short clinging hairs, obovate to lanceolate, mucronulate, rarely obtuse, margin entire, 1.5-2 cm. long.

39. *Rh. puberula*, E. et Z.

Ecklon and Zeyher 1108, Addo; Zeyher 887, between Assegaibush and Grahamstown; Zeyher 2239, Grahamstown; MacOwan 265, 766, Grahamstown; MacOwan 862, Katberg; Schlechter 6164, Komgha; Flanagan 800, Komgha; Marloth 835, Kimberley.

+ + + + + + Leaflets on the under surface, more or less tomentose (but see also some forms of *Rh. villosa*, L.f.)

* Leaves shortly petiolate. Leaflets obtuse, rarely acute or emarginate, margin entire, undulate or with a few teeth, slightly revolute, under surface greyish tomentose. Frequently thorny.

40. *Rh. Engleri*, Britt. in Journ. of Bot. XXXVIII, 1900, p. 316 (*Rh. incana*, Engl.).

** Leaves with longer petioles. Leaflets oblong or oblong-cuneate, margin entire, undulate or with a few teeth, sometimes slightly revolute, underside densely covered with rufous tomentum, 1-5—2 cm. long.

41. *Rh. divaricata*, E. et Z.

In the var. *fulvescens*, Engl., which Diels, l.c. p. 512, evidently rightly separates as a species under the name of

42. *Rh. fulvescens* (Engl.) Diels, the leaflets are somewhat larger, broadly oblong, mucronate, with pale fulvous tomentum. To this belongs probably

Bolus 11021, Potgietersrust, Transvaal.

+ + + + + + + Branchlets and leaves glabrous; leaflets entire, except in *Rh. laevigata*, var. *dentata* and occasionally in *Rh. mucronata.*

* Leaflets subcoriaceous, paler green on the under surface, lanceolate or obovate-oblong, cuneate, obtuse or subacute, mucronulate with slightly revolute margin; petiole slender about equal in length with the lateral leaflets.

43. *Rh. mucronata*, Thunb.

Schlechter 9471, Hawston, Western Province; Ecklon and Zeyher 1102, Table Mountain; Mrs. T. V. Paterson 1020, Schoenmaker's Kop, Port Elizabeth; Mrs. T. V. Paterson 523, Redhouse; ? G. Rattray 178, East London.

** Leaflets membranous, below paler, 5-10 cm. long, ovate or ovate-lanceolate, acuminate, petiole slender, about equal in length with the lateral leaflets.

44. *Rh. laevigata*, L. Diels, l.c. p. 579 fig. E. Sim, Forest Flora t. 45.

Schlechter 5912, Knysna; Zeyher 314, near Uitenhage; MacOwan 294, Grahamstown; Sim 1990, Fort Cunynghame; Tyson 2951, Perie Forest;

Flanagan 766, Komgha; Schlechter 6176, Komgha; W. G. Bennie 392, Nqamakwe, Transkei.

Leaves with very coarse teeth, irregularly arranged.

var. *dentata*, E. Mey.

Schönland, Grahamstown (common near Douglass Reservoir); Rattray 170, East London; F. A. Rogers 4569, Komgha; Schlechter 6212, Kei mouth; Miss Pegler 225, Kentani.

*** Leaflets 1.5-2 cm. long, elliptic lanceolate acute, with thickened margin.

45. *Rh. Ecklониana*, Sond.

F. A. Rogers 3108, and M. Daly 747, Grahamstown; ? Schlechter 3439, Elsburg; ? F. A. Rogers, 1040, Parys, Orange Free State.

**** Leaflets glaucous, obovate or obovate-lanceolate apiculate or obtuse.

46. *Rh. Zeyheri*, Sond. (*Rh. glaucovirens*, Engl.). Diels, l.c. p. 584, has already pointed out that Engler's species can only with difficulty be separated from *Rh. Zeyheri*, Sond. I think they are identical.

Rehmann 4740, Leendertz 324, Pretoria; ?Schlechter 3626, Magalisberg. Leendertz 83, Pretoria may also belong here, though many of the leaves are much larger than in the type; Schlechter 7895, Piquetberg, is very doubtfully referred by me to this species.

***** Leaflets more than 4 times longer than broad, linear-lanceolate or lanceolate, rarely oblong or oblong-elliptical or obovate oblong, usually at base and apex equally narrowed.

✓ Leaflets more or less irregularly serrate, rarely subentire, 6-12 cm. long, 3-5 mm. broad, frequently falcate.

47. *Rh. erosa*, Thunb. Diels, l.c. p. 625, fig. 6, A—C. Sim, Forest Flora t. 48, fig. 3.

Burchell 2697; Bolus 535, Graaff-Reinet; Zeyher, Cradock div.; Ecklon and Zeyher, Silo; T. W. Pocock 114, Burghersdorp; Rehmann 3832, Bloemfontein.

✓✓ Leaflets 3-3.5 cm. long, 3-4 mm. broad with a few large teeth.

48. *Rh. grandidens*, Harv. Not known to me.

√√√ Leaflets usually quite entire or slightly crenate or undulate, rarely conspicuously dentate (e.g. *Rh. Gerrardi*, Harv. and *Rh. montana*, Diels).

† Leaflets glabrous or rarely sparsely pilose, never tomentose.

§ Young branches densely pilose, leaflets glabrous, oblong-elliptical, at base and apex equally narrowed, acute, mucronulate.

49. *Rh. transvaalensis*, Engl. This species which is not known to me is, according to Diels l.c. p. 589, hardly distinguishable from *Rh. laevigata*, L.

§§ Branches pilose, leaflets linear, 4-8 cm. long, midrib and lateral veins sparsely pilose.

50. *Rh. gracillima*, Engl. (*Rh. filiformis*, Schinz in Vierteljahrschrift der Naturforsch. Ges. in Zürich, Vol. 55 (1910) p. 239.

Rehmann 4882, Boshveld, Transvaal; Schlechter 3746, Wilge River, Transvaal.

§§§ Leaves, usually also branches, quite glabrous.

o Leaflets linear, usually distinctly falcate, 5-7 cm. long.

51. *Rh. Dregeana*, Sond. Diels, l.c. p. 625, fig. 6 D. Sim, Forest Flora t. 48, fig. 4.

Bolus 43, Sneuwberg; Flanagan 1530, Burghersdorp; Galpin 6599, Buffelsriver-waterfall, Basutoland.

oo Leaflets linear, 3-4 cm. long.

52. *Rh. tridactyla*, Burch.

? J. B. Davy 1614, Christiana, Transvaal.

Burtt Davy's specimen is thorny, otherwise agrees fairly well with the description.

ooo Leaflets oblanceolate or ovate lanceolate or oblong, frequently glaucous, usually obtuse subentire or with short crenate teeth.

∓ Unarmed.

53. ***Rh. glaucescens***, Rich. (incl. ***Rh. natalensis***, Bernh. See Diels in Engl. Bot. Jahrb. Vol. 40, p. 87).

T. R. Sim 2127, 2128, Toise River; Flanagan 797, Komgha.

∓∓ Thorny.

54. *Rh. spinescens*, Diels in Engl. Bot. Jahrb. Vol. 40, p. 87.

Schlechter 11791, Komatipoort.

oooo Leaflets lanceolate, slightly obtuse, mucronate, remotely denticulate.

55. *Rh. Gueinzii*, Sond.

Rehmann 5144, Boshveld, Transvaal, between Elands river and Klippan Schlechter 4305, Naboomfontein, Transvaal; Leendertz 54 and 174, Pretoria.

Margin of leaflets undulate and crisped, but not mucronate (?) *var. crispa*, Engl. This is probably a distinct species.

Miss A. Pegler 1446, Kentani.

ooooo Leaflets lanceolate, usually coarsely dentate (but sometimes entire on the same branch), mucronate.

56. *Rh. Gerrardi*, Harv. (*Rh. viminalis*, Vahl γ *Gerrardi*, Engl.).

Schlechter 3771, Olifant River; Schlechter 3963, Lydenburg.

oooooo Leaves frequently 5-foliate. Leaflets oblanceolate or obovate-oblong, coarsely serrate, teeth mucronulate.

57. *Rh. montana*, Diels in Engl. Bot. Jahrb. Vol 40, p. 87.

Bolus 8837, Engcobo, Tembuland.

Diels places this species next to *Rh. Sonderi*, Engl. I do not think, however, that they are nearly allied, in fact I have my doubts, whether it is a species of *Rhus*. It may belong to *Smodingium*.

ooooooo Leaflets lanceolate entire, acute or acuminate or sometimes emarginate.

∓ Panicle pubescent. Leaflets 5-8 cm. long, c. 1 cm. broad, both above and below the middle narrower.

58. *Rh. viminalis*, Vahl. Sim states in his Forest Flora that, from the description in the Flora Capensis, he cannot distinguish this species from *Rh. lancea*, L.f., but the two

species are perfectly distinct and not even closely allied *Rh. viminalis* being more nearly allied to *Rh. puberula*, E. et Z., but *Rh. lancea*, L.f. has frequently been taken for it. There are typical specimens of both in the Cape Government Herbarium and in Dr. Bolus' Herbarium. The following specimens belong to it, though they have somewhat broader leaves than the type.

Bolus 134, Graaff-Reinet; F. A. Rogers 151, Sheldon; Baur 856, Shiloh.

The following are very close to it, but may represent a distinct species.

Mrs. T. V. Paterson 736, Van Staadens; Schlechter 258, near Durban.

∓∓ Panicle glabrous, leaflets 8-12 cm. long, 0·8-1 cm. broad, linear-lanceolate.

59. *Rh. lancea*, L. f. Sim, Forest Flora t. 46.

Reference to this species has been made under *Rh. viminalis*. The illustrations in Marloth, Das Kapland pflanzengeographisch dargestellt, Jena 1908 (p. 240, fig. 97, p. 243, fig. 101 and p. 215) represent *Rh. lancea* though named *Rh. viminalis*.

H. Hutton, Rondebosch (cultivated specimens ?); Marloth 1150, on the Vaal River, Griqualand West; Burchell 2728, without locality; Schlechter 10923, Matjesfontein; Leendertz 188, Derde Poort, Transvaal.

60. *Rh. Wilmsii*, Diels in Engl. Bot. Jahrb. Vol. 24, p. 501, a very much branched shrub with thin fragile terminal branches, reminds one, according to the author, of *Rh. lancea*, L.f., but has almost isolateral leaf-structure and has, therefore, neither the pale underside nor the shining upper side of the leaflets of the latter. It also approaches *Rh. Dregeana*, Sond, which has smaller leaves. The petiole is broadly margined. It occurs near Lydenburg. I have not seen it.

†† Leaflets lanceolate, at least on the underside tomentose.

o Leaflets 2.5-2 cm. long.

61. *Rh. macrocarpa*, Engl.

Only known from the Caledon div., collected by Burchell. According to Diels, l.c. p. 591, it comes close to *Rh. stenophylla*, E. and Z., and *Rh. angustifolia*, L.

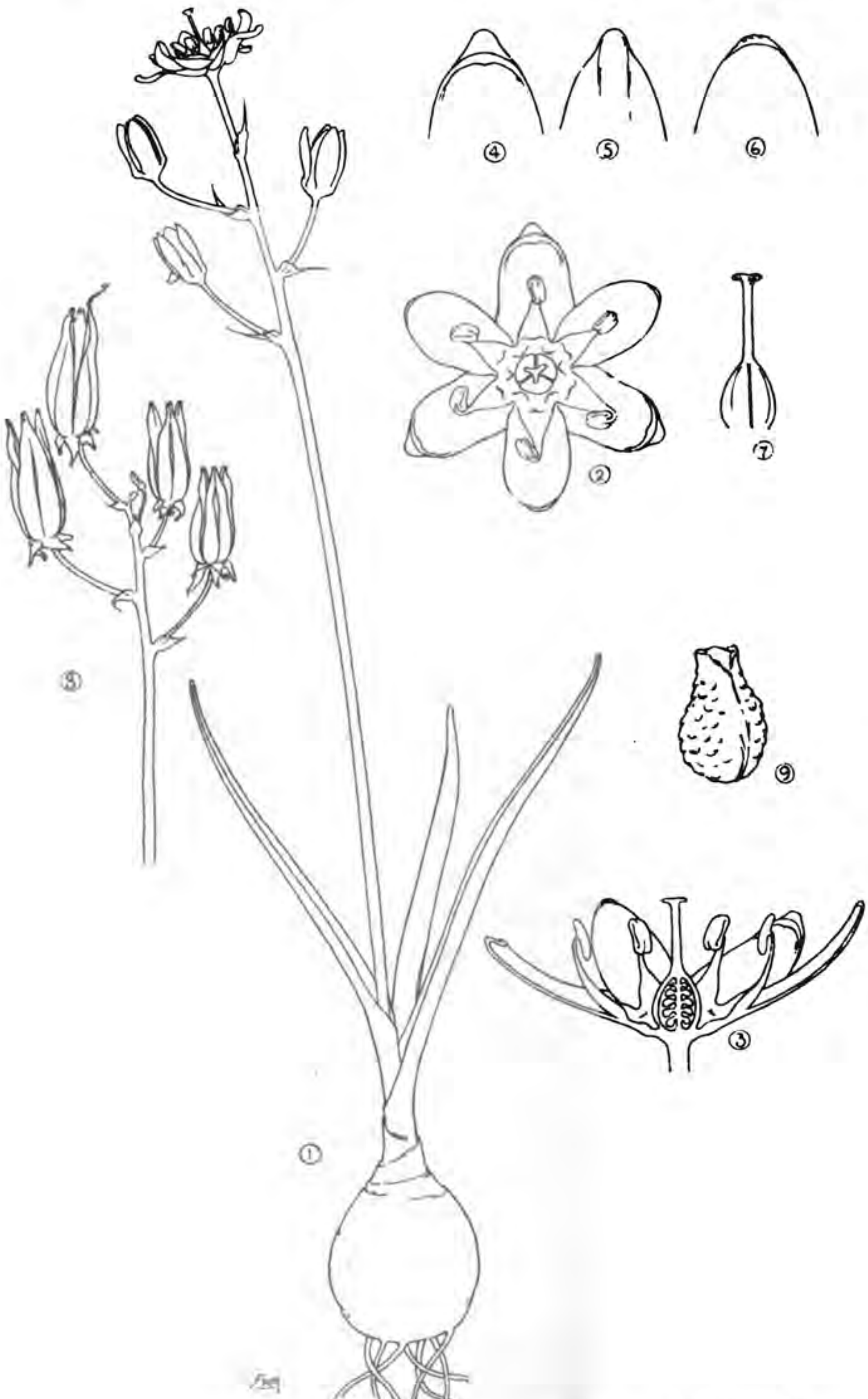
oo Leaflets on an average 5-7 cm. long, usually 1-1.5 cm. broad.

62. ***Rh. discolor***, E. Mey.

This is a very variable species. According to Diels, l.c. p. 590, *Rh. villosissima*, Engl. (Rehmann 5557) cannot be satisfactorily distinguished from it. *Rh. grandifolia*, Engl., is distinguished by larger and broader leaflets than the type; moreover, the leaflets are coarsely dentate, but Schlechter 3737 has both entire and coarsely toothed leaves. Bolus 8138 has some obovate slightly crenate-dentate leaves while other leaves are typically lanceolate. It seems, therefore, desirable to join this species also to *Rh. discolor*, E. Mey.

MacOwan 864, Katberg; J. M. Wood, 849, Ladysmith, Natal; F. A. Rogers 53, Majuba; Bolus 8138, Harrismith, O.F.S.; Leendertz 1693, Johannesburg; Rehmann 5557, Houtbosch; F. A. Rogers 360, Potgietersrust.

LIST OF SPECIES OF RHUS MENTIONED.



NEOPATERSONIA UITENHAGENSIS SCHÖNL.

Neopatersonia, a new genus of Liliaceae.

(Plate XII.)

By S. SCHÖNLAND.

Perigonium marcescens gamophyllum tubo breve. Segmenta oblonga subaequalia patentia. Stamina subuniseriata fauci affixa. Filamenta basi deltoidea, leviter incrassata intus excavata, connata, apicem versus gradatim subulata. Antherae late oblongae dorsifixae introrsae. Ovarium sessile subovoideum trisulcatum multiovulatum. Stylus filiformis. Stigmata 3 brevia patentia apice deflexa. Capsula subconica apice acuta, trisulcata, membranacea, loculicide dehiscens. Semina numerosa lageniformia; testa atra verruculosa.

This is the second new genus of Liliaceae which the neighbourhood of Port Elizabeth has yielded during recent years. (See *Neodregea*, C. H. Wright in Kew Bulletin, 1909, p. 308.)

I have pleasure in associating its name with the discoverer, Mrs. T. V. Paterson, to whom I owe an enormous number of plants from the rich flora of the Uitenhage district, which had not been thoroughly explored since Zeyher's time.

Neopatersonia belongs to the tribe *Scilleae* of the *Lilioideae* with which it shares the possession of a bulb, racemose inflorescence, introrse anthers and loculicidal capsules. It is closely allied to the monotypic genus *Whiteheadia*, Haw. from Namaqualand, in which, however, the stigma is capitate, the capsule acutely triquetrous and which moreover has 2 broad flat leaves which are lying flat on the ground, while in the only species of *Neopatersonia* the leaves are linear and erect. The subspicate inflorescence of *Whiteheadia* with very large bracts also assists in conferring upon it a very different habit as compared with *Neopatersonia*. The two genera share a gamophyllous persistent corolla, connate stamens and flask-shaped seeds with black testa besides other characters common to *Scilleae*.

Neopatersonia also approaches some species of *Ornithogalum* e.g. *O. caudatum*, Bak.*, which is similar in floral structure, even to the extent that the petals are slightly gamophyllous, but its stamens, the filaments of which are more or less broadened at the base, are quite free from one another as in other species of *Ornithogalum*, and the shape of its seeds is different.

Neopatersonia uitenhagensis Schönl., n. sp.

Herba perennis bulbosa. Radices fibrosi. Bulbus ovoideus circ. 2 cm. longus, circ. 1.5 cm. latus, tunicatus, tunicis exterioribus membranaceis. Folia 1, 2 vel 3 anguste linearia acuta parum carnosa, intus valde concava marginibus inflexis, extus convexa, pallide viridia circ. 9 cm. longa, circ. 4 mm. lata. Inflorescentia racemosa terminalis pauciflora laxa, pedunculata. Pedunculus gracilis teres nudus. Bracteae membranaceae basi late ovatae trinerves, margine laceratae, apice cuspidata, circ. 6 mm. longae. Pedicelli graciles adscendenti-patentes, inferiores circ. 1.5 cm. longi, superiores sensim minores. Corolla gamophylla tubo breve. Segmenta subaequalia patentia oblonga, marginibus basin versus reflexa, rubescentia margine et apice alba, exteriora infra apicem dorso mucronata, mucrone globoso, interiora apice mucronata, mucrone breve obtuso, 6 mm. longa. Filamenta partibus basilaribus deltoideis basi connata petalis adnata apicem versus gradatim subulata cernua, 4 mm. longa. Antherae late oblongae dorsifixae lutescentes circ. 1 mm. longae. Ovarium sessile ovoideum circ. 2 mm. longum, stylus filiformis albus circ. 3 mm. longus, stigmata

*This species is very common near Grahamstown. It has hitherto been unrecorded from any definite locality, most likely owing to the fact that MacOwan no. 1839, as represented in the Herbarium of the Albany Museum and probably in other Herbaria, which is undoubtedly *O. caudatum*, Ait., has been placed by Baker under *O. Ecklonis*, Schlecht. in the Flora Cap. VI. p. 513. As I find, however, that the shapes of the stamens and the leaves vary considerably in *O. caudatum*, Ait., it may be necessary to sink *O. Ecklonis* Schlecht. in it.

3 brevia patentia apice reflexa. Capsula subconica apice acuta trisulcata membranacea loculicide dehiscens. Semina numerosa lageniformia testa atra verruculosa.

Top of Picnic Reach Hill, Redhouse, near Port Elizabeth. Mrs. T. V. Paterson, No. 2151, Oct. 1911.

DESCRIPTION OF PLATE XII.

NEOPATERSONIA UITENHAGENSIS Schönl., n. sp.

Fig. 1.—Whole plant (nat. size).
Fig. 2.—Flower seen from above (enlarged).
Fig. 3.—Section of flower (enlarged).
Fig. 4.—Apex of outer petal, front view (enlarged).
Fig. 5.—Apex of outer petal, back view (enlarged).
Fig. 6.—Apex of inner petal, front view (enlarged).
Fig. 7.—Gynaecium (enlarged).
Fig. 8.—Fruiting inflorescence (natural size).
Fig. 9.—Seed (enlarged).

I am indebted to Mr. F. W. Armstrong, A.R.C.A., Principal of the Grahamstown School of Art, for the drawings on Plate XII.

The species of Haworthia Duval in the Herbarium of the Albany Museum (with a description of a new species).

By S. SCHÖNLAND.

As the localities of so very few species of *Haworthia* are known, I hope the following list, though not very large, will be acceptable to students of the plant geography of South Africa. Berger in his lately published monograph in "Das Pflanzenreich" IV., 38, III., 2) has excluded *Haworthia tenuifolia* Engl. and allied species from the genus and has included them in the new genus *Chortolirion*. I have, therefore, not mentioned these species here.

H. viscosa (L.) Haw. var. *torquata* (Haw.) Bak. Berger l.c.p. 79.

Oudtshoorn, Mr. F. Holland (flowered in Grahamstown Oct. and Nov., 1910); Steytlerville, Mrs. T. V. Paterson, No. 30.

H. Reinwardtii Haw. Berger l.c.p. 83.

Very common in rocky ground near Grahamstown. Flowers in summer from October onwards. Besides the typical form, another form is common which has narrower and spreading leaves.

H. coarctata (Salm) Haw. Berger l.c.p. 86.

Received from Dr. H. Becker, F.L.S., F.S.A. Grows, accord- to Mr. N. S. Pillans, near Conway Station.

H. papillosa (Salm) Bak. Berger l.c.p. 90.

Common close to Worcester, Cape Colony (north of the town), S. Schönland (flowered in Grahamstown, January, 1911).

H. subfasciata (Salm) Bak. Berger l.c.p. 90.

Despatch, near Uitenhage, Mr. F. Holland (flowered in Grahamstown, November, 1908).

H. fasciata (Willd) Haw. Berger l.c p. 90.

Uitenhage division, Mrs. T. V. Paterson, no. 1172, in flower Aug., 1910 and Jan., 1911 ; Uitenhage division, various localities, Ecklon and Zeyher no. 1055, Zeyher no. 4187, Burke (?) no. 29, in flower in December (this was distributed by Ecklon and Zeyher under the name of *Aloe rigidu* [DC.]) ; Blaauwkrantz, near Grahamstown, Mr. Brink.

H. attenuata Haw. Berger l.c.p. 93.

Port Elizabeth, March 1896, W. Kemsley, no. 299.

H. radula (Jacq.) Haw. Berger l.c.p. 94.

Kingwilliamstown, Dr. H. Becker, F.L.S., F.S.A, (flowered in Grahamstown, Nov., 1899 and Oct 1900).

H. truncata, Schönl. Trans. Roy. Soc. S. Afr. I. p. 391.

Oudtshoorn, April, 1909, Miss L. Britten, B.A.

H. tesselata Haw. var. *parva* (Roem. et. Schult.) Bak. Berger l.c.p. 97.

Hanover, Cape Colony, Dr. Purcell (flowered in Grahamstown, Dec., 1907) ; Naauwpoort, Dec. 1907, T. R. Sim, no. 14.

H. planifolia Haw. Berger l.c.p. 102.

Willowmore, Mr. D. de Smit (flowered in Grahamstown, Nov., 1911 ; Port Elizabeth, Mrs. T. V. Paterson, no. 1141 ; Signal Hill Grahamstown, Dec., 1907, Miss M. Daly. The leaves of this species vary considerably in breadth and thickness.

H. reticulata Haw. Berger l.c.p. 103.

Carroid hills on the Zwartkops River, Sep. (in fruit), Zeyher no. 4189, Burke (?) no. 25 ; Stony hills, Sidbury, April, Zeyher no. 4189; Sheldon, Nov., 1902, Mrs. H. Hutton, no. 488; Redhouse, Jan., 1911, Mrs. T. V. Paterson, no. 431 ; (?) bare rocks on Nahoon banks, East London, Nov., 1908, Dr. G. Rattray, no. 235. I have also placed here a specimen from Willowmore collected by Mr. D. de Smit, which flowered in Grahamstown, Feb., 1911. It has larger cilia on the margin of the leaves as compared with the others. Dr. Rattray's specimen has broadly ovate acuminate leaves, but seems not to differ specifically from *H. reticulata.*

H. altilinea Haw. Berger l.c.p. 104.

Neighbourhood of Grahamstown, November, 1911, Rev. F. A. Rogers.

H. Cooperi Bak. Berger l.c.p. 108.

Sterkstroom, Rev. F. A. Rogers; Fish River Randt.

H. vittata Bak. Berger l.c.p. 108.

Hankey, near Port Elizabeth, Mrs. T. V. Paterson, no. 24 (flowered at Redhouse, Nov., 1911); Fish River Randt. This species has its leaves often largely underground.

H. angustifolia Haw. Berger l.c.p. 109.

Steytlerville, Mrs. T. V. Paterson (flowered in Grahamstown, Jan. and Nov., 1911).

H. albanensis, Schönl. n. sp. (Sect. Loratae Salm).

Caespitosa. Rosulae 8—20-foliatae et 2—3 cm. latae, parce e basi proliferae. Folia oblique lanceolata acuminata circ. 3.5—4 cm, longa et 1 cm. basi lata, erecta, superne incurvata vel. recurvata. subrigida basi laevia viridia indistincte lineata apicem versus rubro-brunnea minutissime aspera, supra subplana, subtus triangulari convexa, superne acute carinata and in setam brevem terminantia, ad margines carinamque minutissime denticulata. Pedunculus simplex filiformis, e basi vacue bracteatus, incl. racemo laxo paucifloro circ. 25 cm. longus; flores subsessiles, bracteis deltoideis acutis albis circ. 4 mm. longis suffulti; perigonii circ. 13 mm. longi, tubus leviter curvatus albus roseo-striatus, segmenta obtusa alba, roseo-striata, inferiora leviter revoluta. Stylus ovario brevior.

Fernkloof, near Grahamstown, March, 1907, Miss M. Daly.

This species is closely allied to *H. chloracantha* Haw. and *H. angustifolia* Haw. From both it is distinguished by much shorter teeth on the leaves and slightly shorter flowers, from the former also by the shape of the leaves, from the latter by the obtuse segments of the petals.

H. arachnoides Haw. Berger l.c.p. 112.

Steytlerville, Jan., 1911, Mrs. T. V. Paterson, no. 27.

H. setata, Haw. Berger l.c.p. 111.

Oudtshoorn, Nov. 1910, Miss L. Britten, B.A., no. 181.

H. pellucens Haw. (*H. translucens* Haw.) Berger l.c.p. 113.

Top of hill, Redhouse, Jan. 1911, Mrs. T. V. Paterson, no. 1893.

H. Bolusii, Bak. Berger l.c.p. 114.

Rocky places near Graaff-Reinet, H. Bolus ; Laingsburg, Mr. D. de Smit (flowered in Grahamstown, Jan. 1911).

A new species of Gasteria.

By S. SCHÖNLAND.

Gasteria Armstrongii Schönl., n. sp.

Acaulis vel ex superpositione foliorum vix 4 cm. alta. Folia 2—4, stricte disticha juniora erecto-patentia, seniora horizontalia 3 5 cm. longa et 3 cm. lata crassa, linguiformia apice rotundata abrupte mucronata, supra basi vaginantia excavata superne convexiuscula punctis albis hemisphericis subfasciatis verrucosa marginibus sublaevibus, subtus sublaevia apicem versus subverruculosa. Pedunculus simplex, incl. racemo elongata laxo circ. 32 cm. longus, superne bracteis vacuis paucis deltoideis cuspidatis albis instructus; pedicelli rosei circ. 8 mm. longi bracteas lanceolatas duplo majores; perigonium gracile roseum circ. 2 cm. longum, basi parum angustatum in ventrem anguste oblongo-ovatum inflatum, curvatum, parte tubulosa ventre subaequilonga, segmenta obtusa viridi-nervata.

Kabeljauw River, near Humansdorp, amongs grass, Mr. W. Armstrong. Flowered in Mr. J. L. Drege's garden, Port Elizabeth, Jan. 1912. This species has been known to me for several years, but I had not seen the flowers until I received them from Mr. J. L. Drege. It is allied to *G. brevifolia* Haw., from which it can easily be distinguished by the small number of leaves, most of the general characters of the leaves and the shorter bracts. The last pair of fully developed leaves lies almost flush with the ground.

The Species of Albuca found in the neighbourhood of Port Elizabeth (with descriptions of 2 new species).

By S. Schönland.

Subgenus Eu-Albuca.

A. Patersoniae Schönl., n. sp.

Glaberrima. Bulbus subglobosus vel supra applanatus, 4-5 cm diam. tunicis exterioribus albis setis copiosis brunneis coronatis. Folia 3-4 linearia firmula intus canaliculata involuta circ. 25 cm. longa, basi vaginantia. Pedunculus teres 8-12 cm. longus. Racemus pauciflorus interdum subcorymbosus. Bracteae basi late ovatae cuspidatae membranaceae circ. 10 mm. longae. Pedicelli graciles adscendenti-patentes, inferiores circ. 15 mm. longi., superiores sensim minores. Petala exteriora circ. 8-13 mm. longa medio viridi-striata apice leviter cucullata, interiora exterioribus similia sed breviora. Stamina exteriora filamentis applanatis lineari-lanceolatis antheris minutissimis sterilibus, interiora fertilia filamentis applanatis parte basali subquadrata circ. 2 mm. longa, parte superiori angustata circ. 9 mm. longa. Ovarium subovoideum, stylus triquetrus obpyramidalis.

Redhouse, Feb. 1909, Mrs. T. V. Paterson no. 460.

This species is closely allied to *A. Dalyae* Bak. (Rec. Alb. Mus. 1. p. 90), which was originally found near Grahamstown, but has also been collected near Coerney by Mrs. T. V. Paterson, (no. 66, Oct. 1911). *A. Dalyae* has the bristles on the bulb fairly regularly connected by stout cross bands which are quite absent in *A. Patersoniae*, and further the leaves are broader in *A. Patersoniae* as compared with *A. Dalyae*.

A. Cooperi Bak. in Journ. of Botany 1874, 366. Fl. Cap. VI, p. 455.

Port Elizabeth, Aug. 1905, Oct. 1902, Mr. J. L. Drege, no. 72.

A. trichophylla Bak. in Gard. Chron. VI. 94. Fl. Cap. VI, p. 455.

Redhouse, Oct.—Dec., Mrs. T. V. Paterson, no. 386, 464 and 913.

This must probably be considered as only a more or less hairy variety of *A. minor* L. with which it agrees very closely in floral structure. I doubt whether *A. viridiflora*, Jacq. is distinct from it. I think too much reliance has been placed on the shades of colouring in the flowers of Albuca. I have seen specimens of *A. minor* L. and *A. trichophylla* Bak. which had flowers in colour almost exactly like those of *A. viridiflora* Jacq. *A. minima* Bak seems to be another species not sufficiently distinct from *A. trichophylla* Bak.

The following is a description taken from a specimen received from Mrs. Paterson, Nov. 1911:—

Bulb depresso-globose circ. 3 cm. broad, circ. 2.2 cm. high ; outer tunics membranous dirty whitish, not splitting into fibres at the tip; leaves about 10, semiterete, channelled above, linear acute, finely hairy, 3-5 cm. long, circ. 2 cm. wide, sheathing at the base; peduncle glabrous terete circ. 11 cm. long; flowers few, arranged in a lax raceme, 3-6 cm. long ; pedicels ascending cernuous at tip, the lowest 2.5 cm. long, the upper gradually smaller ; bracts membranous brownish with a white margin in the sheathing lower part, lanceolate acute, the lowest circ. 2 cm. long, the upper gradually smaller. Outer petals oblong, erecto-patent dirty yellowish green slightly thickened and inflexed at the apex, circ. 2.2 cm. long. inner petals boat-shaped more decidedly green with lighter margin, apex transversely oblong, green with yellow margin, strongly thickened and sharply deflexed, without the inflexed part circ. 1.9 cm. long ; outer stamens without anthers circ. 1.8 cm. long, filaments flat white narrow lanceolate cernuous at the very tip, inner stamens circ. 1.4 cm. long, filaments with a subquadrate basal portion which has inflexed margins at its apex and a sublanceolate longer upper portion which has inflexed margins at the base and is cernuous at the finely pointed tip, anthers oblong c. 4 mm. long. Ovary subtriquetrous circ. 7 mm. long, style triquetrous gradually broader upwards and with a short acute conical tip.

A. juncifolia Bak. in Gard. Chron. 1876, V, 534. Fl. Cap. VI, p. 456.

Walmer near Port Elizabeth, Oct 1909, Mrs. T. V. Paterson, no. 771. This agrees well with the published figure and description of *A. juncifolia* Bak., but I think that again the differences between this species and *A. minor* L., seem to be too slight to warrant its being kept up as a different species.

A. exuviata Bak. in Fl. Cap. VI, p. 456.

We have MacOwan, no. 1830, on which the species is founded. If it was not for the colour of the flowers which is distinctly yellow and green in this species, I would have no hesitation in sinking *A. Dalyae* Bak. (with white and green flower) in this species, and this may have to be done by the future monographer of the genus.—In the following specimens the bases of the leaves are covered by raised bars which are, however, not quite parallel as in the type and are otherwise more irregular, and further are not always retained when they split into bristles: Redhouse, Aug. to Oct., Mrs. T. V. Paterson, no. 83., Rev. F. A. Rogers, no. 2130.

A. corymbosa Bak. in Gard. Chron. 1886, XXVI, p. 38. Fl. Cap. VI, p. 457.

This is only recorded from Port Elizabeth, but I have not come across any specimen which fits the description.

Subgenus Falconera.

A. Schönlandi Bak. in Rec. Alb. Mus. 1. p. 90.

This species was erroneously placed by Mr. Baker under Subgenus Eu-Albuca. It is closely allied to *A. fastigiata*, Dryand. from which it is distinguished by the leaves having a narrow white border which is finely ciliate. Redhouse, Oct. 1911, Mrs. T. V. Paterson, no. 1188a.

A. longifolia Bak. in Rec. Alb. Mus. 1. p. 91.

This is hardly anything but a form with narrower and longer leaves of *A. fastigiata* Dryand. Redhouse, Oct. 1908, Mrs. T. V. Paterson, no. 237.

A. caudata Jacq. Collect. IV p. 203 ; Jc. II, 20, t. 442. Baker in Fl. Cap. VI, p. 458.

Redhouse, Oct. 1908, Mrs. T. V. Paterson, no. 277.

A. polyphylla Bak. in Gard. Chron. 1874, I, p. 471 ; Fl. Cap. VI, p. 459.

Redhouse, Sep. 1908, Mrs. T. V. Paterson, no. 211. The specimens received under this number agree well with the description of *A. polyphylla* Bak. except that in some the leaves are up to nine inches long. I have not seen the type. They also agree thoroughly with specimens collected by Mr. A. E. Murray at the Kabousie at an altitude of 3,500', except that I could not satisfy myself whether in the latter the style is cylindrical or prismatic. Murray, no. 54, from the same locality is quoted by Baker (Fl. Cap. VI, p. 462) under *A. Shawi* Bak. As the two species appear to be otherwise very similar, a re-examination of Murray, no. 54, seems desirable.

A. tenuifolia Bak. in Saund. Ref. Bot. t. 335 ; Fl. Cap. VI, p. 461.

Hankey, Oct. 1911, Mrs. T. V. Paterson, no. 25.

A. nana Schönl. n. sp.

Bulbus subglobosus circ. 1.8 diam. tunicis exterioribus membranaceis. Folia 2-3, ovato-lanceolata marginibus involutis venis prominentibus minutissime puberula circ. 2 cm. longa. Pedunculus teres 1.9-4.5 cm. longus 2-3 florus. Bracteae ovato-lanceolatae basi vaginantes membranaceae sordide luteae vel rubescentes albo-alatae, circ. 1 cm. longae. Pedicelli circ. 1.5 cm. longi erecto-patentes. Petala pallide viridia albo-alata, exteriora anguste oblonga, apice incurvata and leviter incrassata erecto-patentia 1.6-1.8 cm. longa, interiora erecta ovata navicularia infra apicem leviter contracta apice incurvata crassa, 1.4 cm. longa. Stamina exteriora fertilia filamentis applanatis lineari-lanceolatis circ. 1.1 cm. longis antheris 2 mm. longis, interiora filamentis applanatis, parte basali subquadrata circ. 2 mm longa, parte superiori sublineata basi contracta circ. 9 mm. longa, antheris 4.5 mm. longis. Ovarium subovoideum circ. 5 mm. longum, stylus triquetrus obpyramidalis circ. 7 mm. longus.

Redhouse, Nov. 1911, Mrs. T. V. Paterson, no. 2180. The absence of fibres on the outer tunics, the ovate-lanceolate leaves with prominent nerves, and the small size of this species are a combination of characters by which it can easily be distinguished.

Notes on the specific characters and distribution of some South African Ophidia and Batrachia.

By J. HEWITT.

Within recent years much has been written on the systematics of our reptiles and amphibia, but so much has been based on insufficient material and incorrect locality data that there is still a most important field of enquiry to those who are able to critically examine the range of variation and distribution of the species. In the following paper I have attempted to clear up the synonymy and to indicate the distribution of some of the rarer and little-known species as well as to give new records for species with which I have previously dealt (Annals Transvaal Mus. and Records Albany Mus.)

Boodon infernalis, Günth and *Lamprophis inornatus*, D.B.

The differences between the two genera *Boodon* and *Lamprophis* are expressed by Mr. Boulenger as follows: *Boodon* has scales in 23 to 33 rows, with apical pits, and the anterior maxillary teeth are strongly enlarged, whereas *Lamprophis* has scales in 19 to 23 rows, the frontal is broad and short, and the posterior maxillary teeth are shortest (Annals S. A. Mus. vol. 5 p. 501) ; *Boodon* has 18 to 24 maxillary teeth, the 5 or 6 anterior ones enlarged and forming a slightly interrupted series with the remainder, whereas *Lamprophis* has 15 to 18 maxillary teeth, the anterior ones longest, but arranged in a continuous series with the others (B. M. Cat. 1. p. 320). Such distinctions (apical pits, shape of frontal, maxillary dentition) certainly hold good for the typical species *Boodon lineatus* and *Lamprophis aurora*, but *Boodon infernalis* combines the characters of the two genera. This latter species has about 18 maxillary teeth arranged in a continuous series, and without any such pronounced enlargement of the anterior teeth as occurs in *lineatus*: the frontal varies in shape, but is usually subtri angular, being relatively broader in front than is the case in *lineatus*, in this respect also approaching the *Lamprophis* condition; the scales have apical pits. Only in a single juvenile specimen have I found definite indication of the discontinuity of the maxillary dentition. Judged by its dentition, *infernalis* is certainly as near to *Lamprophis* as to *Boodon* and only on account of the presence of apical pits can it be definitely assigned to the former genus. This apical pit character is not however very definite, for whilst in *Boodon lineatus* and *guttatus* each scale has a single apical pit, in *infernalis* there is a pair of pits at the apex of the scale; but for this trivial character there could be no reason whatever for the separation of *Boodon* from *Lamprophis*. I think it is very probable that the little-known species, *Lamprophis inornatus*, will prove to be the same as *Boodon infernalis* for the latter species has a fairly wide range of variation, enough to include all the specific characters assigned to *inornatus*.

At any rate the specimens in the Albany Museum which were assigned to *inornatus* by Dr. Gough (Annals Trans. Mus. 1, p. 22) are certainly the same as *infernalis*. In our series of *Boodon infernalis* there are always two post oculars, and usually three suboculars, but in one large specimen only two labials enter the the eye on either side, and in several specimens there are two suboculars on the one side and three on the other; a Port Elizabeth specimen has only two suboculars on either side, and a Robben Island specimen has three suboculars on either side, whilst another from that locality has only two on one side. The relationship of the length to the breadth of the frontal varies somewhat, and so does the length and shape of the loreal though this scute is always elongated, especially so at its infero-posterior angle. *Lamprophis inornatus* is described as having the loreal nearly thrice as long as deep, which at once distinguishes it from *aurora*, and only two upper labials enter the eye: it is worthy of note that in *aurora* either two or three of the upper labials may be suboculars. So far as one may judge from the description, if *inornatus* has been correctly referred to *Lamprophis*, it is only to be distinguished from *Boodon infernalis* by the character of the apical pits and by colour, the latter being of no specific importance. *Boodon infernalis* is known from the coastal districts of the Cape, Grahamstown and Robben Island (Albany Mus.), Port Elizabeth (Pt. Elizabeth Mus.), Capetown, Knysna, Kingwilliamstown and Port St Johns (S. A. Museum). It is recorded from Kimberley in Annals South African Museum, but according to Bro. Power this record must be viewed with suspicion. Neither Werner nor Sternfeld have seen the species from German S. W. Africa, but there is solitary Damaraland record (B. M. Cat.) which awaits confirmation. It is known to me from Doornkop, near Belfast (R. Gerhardt), and the Natal Government Museum has it from Zwartkop, Natal. According to Dr. Werner it extends in East Africa as far north as Zanzibar.

Boodon guttatus, Smith.

This is a comparatively rare species known to me from Grahamstown, O'okiep (Dr. R. W. Howard), and Doornkop, near Belfast (R. Gerhardt) ; the S. A. Mus. records include also Capetown and Burghersdorp.

In the key to the species of *Boodon* given in Annals S. A. Mus. 5, p. 504, both *infernalis* and *guttatus* are included in a section wherein three upper labials enter the eye, whereas I find that in both species two or three of the upper labials may be suboculars. Also the two species are contrasted according to the number of postoculars, two in *infernalis* and three in *guttatus*, but in the latter species there may be either two or three postoculars. The two species are distinct enough however, and may be distinguished by the preocular condition (Brit. Mus. Cat.), by the shape of the loreal which is more elongated in *infernalis*, and by the apical pits which are paired in *infernalis* but single in *guttatus*. This species is more closely allied to *lineatus* than to *infernalis*, but is distinct therefrom in the number of scales round the body, 21 or 23 in *guttatus*, but 25 or more in *lineatus* ; also the eye is larger in *lineatus*. Both *guttatus* and *lineatus* may have the upper preocular in contact with the frontal, though these two scutes are usually separated. The most characteristic feature of the species is its blotched pattern on the body.

Tropidonotus laevissimus, Günth.

This snake is frequently confused with *Ablabophis rufulus* and most of the snakes in this Museum attributed by Dr. Gough to that species (Ann. Trans. Mus. 1. p. 21) really belong to *Tropidonotus laevissimus.* The differences are as follows: *T. laevissimus* has a round pupil, the first labial is in contact with the loreal or is separated therefrom by a granular shield, and the dark colouration characteristic of the upper surfaces extends along the middle portion of the ventral surface : *A. rufulus* has a vertically elliptic pupil, the first labial is quite separated from the loreal and the ventral surfaces are yellow or pink. Moreover *T. laevissimus* is a much larger snake than *A. rufulus*. The characters which separate the monotypic *Ablabophis* of South Africa from the very large and world wide genus *Tropidonotus* are the shape of the pupil and the dentition but the latter character shews rather wide variation within the genus *Tropidonotus* as understood by Mr. Boulenger. According to the Brit. Mus. Catalogue, *T. laevissimus* is included in that section of its genus which has not more than 30 maxillary teeth, the hinder ones gradually enlarged, and the mandibular teeth are sub-equal whereas *Ablabophis* is stated to have 20 to 25 equal maxillary teeth and its anterior mandibular teeth are longest. In a specimen of *T. laevissimus* I find only 25 maxillary teeth and they are subequal throughout, the hindermost ones very slightly reduced rather than enlarged in which respect, and also in the mandibular dentition, it resembles *A. rufulus*; in neither species is there marked enlargement of any portion of the dental series. Indeed so far as the maxillary dentition is concerned *T. laevissimus* is nearer to *A. rufulus* than to *T. natrix* (as figured in the B. M. Cat.) and Dr. Günther in his original description of *laevissimus* considered it to be generically distinct from *Tropidonotus*. *T. laevissimus* and *A. rufulus* also resemble each other and differ from all other South African colubrines know to me in having a great number of pterygoid teeth *T. laevissimus* having about 30 whilst *A. rufulus* has about 34. In this respect also these two snakes agree with each other more than does *laevissimus* with *natrix* for the latter species appears to have only about 16 pterygoid teeth. From these facts it will be seen that the two species *laevissimus* and *rufulus* cannot be generically separated by dentition characters, and it may be doubted if the pupil character is sufficient to justify the association of *laevissimus* with *natrix* to the exclusion of *rufulus*. According to the maxillary and pterygoid dentition, *laevissimus* is more primitive than *natrix* and we may regard its ally *Ablabophis rufulus* as a slightly modified offshoot from the primitive *Tropidonotus* stock. *Tropidonotus laevissimus* is known to me from the following localities, Grahamstown, Alicedale (F. Cruden), Kingwilliamstown (F. A. O. Pym), Pirie (Rev. R. Godfrey), Tsomo, and from Natal. Mr. W. L. Sclater gave a good figure in Annals S. African Mus. 1, pl. 5, under the name of *Grayia lubrica*.

Psammophis.

This genus is sometimes confused with *Trimerorhinus*, but is easily distinguished by its characteristic maxillary dentition. In *Psammophis* besides the posteriorly situated fangs there are one or two enlarged teeth, often mistaken for fangs, in the middle of the maxillary series ; the nostril is situated between the nasals, not at the junction of the internasal and the nasals as in *Trimerorhinus* ; and lastly the anterior chin shields of *Psammophis* are shorter than the posterior ones, which relations are reversed in *Trimerorhinus*. The determination of the species often presents a little difficulty, for there is much variability in respect to every character ordinarily employed for specific distinction ; on this account, as well as by reason of the fact that the species are limited to particular distributional areas, the species of *Psammophis* are of special interest to South African systematists.

P. notostictus, Pet.

Out of fifteen specimens in our collection the following variations were found : in one case a divided anal scute, one specimen has a single preocular and another has a single preocular shewing the commencement of division, usually the upper preocular is just in contact with the frontal or forms a short suture with it, but in three specimens these two scutes are separated, and lastly the posterior nasal is usually divided, but in three cases the division is incomplete, and one specimen has a complete division on the one side but only an indication of division on the other. A very constant character is found in the posterior nasal, its upper portion having a backward prolongation directed slightly upwards towards the prefrontal. This species occurs in the western portions of Southern Africa from the Lower Congo southwards. It is common in German S. W. Africa, and Werner has a Kalahari record (Konya), but it is unknown from Bechuanaland. In Cape Colony it is specially characteristic of, and perhaps strictly limited to, the karroid and subkarroid areas. It does not occur at Grahamstown which has a humid climate, but is abundant at Brak Kloof, only 10 miles away, where the climate is much drier and the vegetation subkarroid. We also have it from O'okiep (Dr. Howard), Victoria West (Mr. P. D. Morris), Tafelberg (Mr. E. G. Gadd) Cradock and Alicedale (Mr. F. Cruden). According to the records of the several museums it does not occur at Kimberley, Port Elizabeth nor Kingwilliamstown. Mr. Boulenger gave a list of localities in Annals S. African Museum, Vol. 5, Pt. 9, but one of those records (Port S. Johns) requires verification.

P. furcatus, Pet.

This snake, which was regarded as a variety of *sibilans* by Peters and quite recently by Sternfeld, is no doubt quite distinct therefrom as stated by Boulenger. In fact it more closely resembles *notostictus* with which it agrees in possessing a backward prolongation of the upper portion of the posterior nasal. This posterior nasal is longitudinally divided so that the nostril lies between three shields (not two as in the Brit. Mus. Cat.) Usually the preocular is broadly in contact with the frontal, but in a Kimberley specimen (Kimberley Mus.) these two scutes are only just in contact, whilst another specimen from that locality and one from Pretoria (Transvaal Museum) shew wide separation of the two scutes. As a general rule the preocular is single, but not infrequently it has the commencement of a division, and we have an example from Great Namaqualand which shews two preoculars on one side and an incompletely divided preocular on the other. It will be seen therefore that no single character above mentioned is sufficient to distinguish the species from *notostictus* a fact which was pointed out by Dr. Werner (Schultze. Forschungsreise in Südafrika IV), who also records aberrations of furcatus with an entire anal scute and a divided preocular, and of *notostictus* with a divided anal scute: and he adds that in cases where the characteristic colour markings of the species happen to be wanting it may be a matter of great difficulty to decide between the two species. Nevertheless in my opinion the two species are perfectly distinct, a good distinguishing character being found in the shape of the prefrontal scutes these being in proportion to their length broader in *notostictus* than in *furcatus*: so that *notostictus* has the internasals usually but not always rather more than half the length of the prefrontals whereas *furcatus* has the internasals scarcely half as long as the prefrontals. The deep grooving of the forehead of *furcatus* is also a good character, but the species shews some variation in this respect. The form described by Mr. Boulenger as *leightoni*, and since reduced by himself as a synonym of *furcatus* (Ann. S. African Mus. Vol. 5. pt. 9), differs considerably in its colour characters from a typical *furcatus*, and may perhaps rank as a distinct colour variety characteristic of the Cape peninsula. It is remarkable that several Cape peninsula forms of widely distributed reptiles and amphibia are frequently of peculiar colour characters. P. *furcatus* occurs throughout German S.W. Africa and the Kalahari; recorded by Boulenger from southern Rhodesia; known to me from Kimberley and Madibi (Kimberley Museum), Pretoria (Transvaal Mus.) and Capetown (Albany Mus): other records given by Boulenger are Little Namaqualand, Ograbies and Burghersdorp. There is a single record from the immediate neighbourhood of Port Elizabeth (Mr. F. W. Fitzsimons): it is otherwise unknown to me from the more eastern portions of the subcontinent.

P. crucifer Daud.

One of our examples has 17 rows of scales round the body, though the normal number is 15: one out of five specimens from Kingwilliamstown (Kingwilliamstown Museum) has the upper preocular in short contact with the frontal. This species differs from *furcatus* and *notostictus*, and agrees with *sibilans* and all other S. African members of the genus, in the absence of a definite backward prolongation of the upper part of the posterior nasal. Examples which have 17 rows of body scales may be very like the brevirostris form of *sibilans* and hardly distinguishable but for the colour markings. In such cases the shape of the prefrontal scute affords a fairly good test this being relatively longer in *sibilans*, in which species the frontal scute is about equal in length to its distance from the end of the snout, whereas in *crucifer* the length of the frontal is much greater. It should be added, however, that the relative length of the prefrontal scutes is by no means a constant feature in *sibilans*, and shews a wide range from the form described as *thomasi* by Dr. Gough to the short-snouted brevirostris. The subcaudal scales are fewer in *crucifer* than in *sibilans*, but no doubt the two series overlap. *P. crucifer* is specially abundant in the coastal regions of Cape Colony, Natal and Transvaal. According to Werner it is unknown in German S.W. Africa, but we have it from Steinkopf (G.H. Zerf), and Mr. Boulenger also recorded it from Little Namaqualand. In Cape Colony it does not seem to extend far inland, though it is unknown to me from any part of the Karroo or karroid area, but Mr. Boulenger cites a Beaufort West record. It is common in Natal and is known from the Barberton and Lydenburg districts of the Transvaal : it extends also to the high veld, being known to me from Doornkop, near Belfast (R. Gerhardt) and from Johannesburg (Transvaal Mus.), but apparently is absent from the Pretoria neighbourhood. The Bloemfontein Museum has a specimen without locality, and according to Mr. Boulenger (S. African Mus. collection) it occurs at Beaconsfield and at Burghersdorp : from the latter locality indeed he records also *furcatus* and *notostictus*, but it is highly improbable that these three records are all correct : as regards the Beaconsfield record, the Kimberley Museum has not received this species from the Kimberley neighbourhood nor has it been taken there by Bro. J. H. Power, who is well acquainted with the local reptile fauna.

P. sibilans, Lin.

The South African form of this species, as known to me from Pretoria and from Natal, is inconspicuous and sombre coloured agreeing well with the variety F. of the British Museum Catalogue. A series of thirteen specimens in the Transvaal Museum shews the following variations: two examples have the frontal and preocular scutes in contact, and in a number of cases these two scutes are widely separated though usually they are only slightly apart: the subcaudals vary in number from 86 to 104 and the ventrals from 153 to 169, the largest individual (from Louw's Creek) having at the same time the maximum number of ventrals and of subcaudals: the frontal is usually about equal in length to the parietals but may be a little longer or shorter and may equal or appreciably exceed its distance from the end of the snout. The frontal in the middle of its length is narrower than the supraocular: the third upper labial is deeper than either the second or the fourth. In the Brit. Mus. Cat. Mr. Boulenger recorded a snake from Pretoria under the name of *P. brevirostris*, Pet. but the same specimen he had previously referred to sibilans in Mr. Distant's "Naturalist in the Transvaal". Dr. Gough (Annals Transvaal Mus. Vol. 1 p. 29) has also referred the Pretoria snakes to two species *sibilans* and *brevirostris* but after careful examination of a long series of Pretoria specimens I am unable to distinguish between them. The alleged differences between the two species are: in *sibilans* the frontal is obviously narrower in the middle than the supraocular whereas in *brevirostris* the frontal is as broad as or only a little narrower than the supraocular: in sibilans the snout is once and a half to twice as long as the eye, but in *brevirostris* only once and a half to once and two-thirds as long as the eye. There are certainly a few specimens from Pretoria and from Rustenburg (Transvaal Mus.) which agree well with the description of *brevirostris*, but they are juvenile or immature examples and are connected by all grades of inter-mediates with typical *sibilans*. This type with the short snout, wide frontal and short loreal has its opposite extreme in *thomasi* (Gough in Ann. Trans. Mus. 1. p. 30), recently reduced by Boulenger as a synonym of *sibilans*: the type of *thomasi* is a large speciman with unusually long prefrontal scutes and the temporal shields are 1+1 and 2+1 but in another example of this variety from Empandeni (Rev. J. O'Neil) the prefrontals are not quite so long and the temporals are 2+2 on both sides. These varieties of *sibilans* shew only a trace of a backward prolongation of the posterior nasal, which scute as a rule is single : in this species only two upper labials enter the orbit.

P. sibilans according to the Brit. Mus. Catalogue occurs as various colour varieties throughout Egypt and tropical Africa as far South as Natal. The form found in S. Africa appears to extend far into tropical Africa but not into Egypt. In this sub-continent it is unknown from German S. W. Africa (Dr. R. Sternfeld in Mitt. aus d Zool. Mus. Berlin V. 1. 1910 wrongly places *furcatus* under this heading in his list of German S. W. snakes), and known to me only from Rhodesia, Transvaal (Rustenburg, Pretoria, Zoutpansberg and Lydenburg districts) and Natal as far south as Durban at any rate : it is absent from the Grahamstown, Port Elizabeth and Kingwilliamstown districts and apparently also from the Kimberley neighbourhood but Boulenger records it from Cape division, Tulbagh (*brevirostris*) and Little Namaqualand (*sibilans*).

P. subtaeniatus Pet.

(synonyms : *P. bocagii*, Boul. and *P. transvaalensis*, Gough). I have examined five specimens which agree precisely with the type of *transvaalensis* in general characters and in colour, but exhibit a little structural variation. One example is entirely similar to the type excepting that only two upper labials enter the eye : an example from the Matoppos has the preocular incompletely divided and just in contact with the frontal, and on one side two, on the other side three, upper labials enter the eye : an example from M'moove (42 miles North of Serowe) shews only an indication of division in the preocular which is just in contact with the frontal, but another specimen from the same locality has the preocular completely divided and appreciably separated from the frontal. These variations are comparatively slight and they shew no constancy in the same locality : such being the case it is impossible to maintain *transvaalensis* as specifically distinct from *subtaeniatus*. As regards *P. bocagii*, Boul., it is distinguished from *transvaalensis* according to Mr. Boulenger's key in that the former has 9 upper labials and the latter only 8 but a glance at the figure accompanying the description of *transvaalensis* shews that the upper labials might be variously numbered as either 8 or 9, and according to Mr. Boulenger's description (Brit. Mus. Cat.) *subtaeniatus* may have either 8 or 9 upper labials ; moreover, Mr. Boulenger now records *bocagii* from Victoria Falls, which is well within the area of *subtaeniatus*. These snakes which have been assigned to the three species above mentioned agree together in respect to a very characteristic colour pattern which is much like that ascribed to the varieties D and E of *sibilans* in the British Museum Catalogue, and as a matter of fact *subtaeniatus* and *bocagii* were both originally referred to by Peters and by Bocage respectively as varieties of *sibilans* : Mr. Boulenger however has separated the species of *Psammophis* into two classes according to the shape of the rostral, *sibilans* and *bocagii* being referred to the deep rostral section (Brit. Mus. Cat.)—but in Annals S. African Mus. he places *bocagii* in the broad rostral section—whilst *subtaeniatus* and *transvaalensis* have both been assigned to the broad rostral section. On the whole this rostral character appears to be a fairly good one, but is not an absolutely safe guide as may be judged from the fact that *thomasi*, which is merely a form of *sibilans*, is described as having the rostral broader than deep. What may be the relationship of *subtaeniatus*, as I understand the species, to the varieties D. and E. of *sibilans*, which are inaccessible to me, must be deferred for the present, but it is quite distinct from the S. African form of *sibilans* as represented in Natal and at Pretoria. This species is known to me from Louw's Creek and Nelspruit (Transvaal Mus.), M'moove, 42 miles north of Serowe (Albany Mus.), Matoppos and Bulawayo (E. C. Chubb), Francistown (Kimberley Mus.) ; Mr. Boulenger records *bocagii* originally from Angola and now from Victoria Falls, and *subtaeniatus*, according to the B. M. Cat., ranges through East Africa from Zanzibar to Mozambique. Dr. Werner does not know the species from German S. W. Africa, but Dr. Sternfeld records *bocagii* from three localities in that region (Gobabis, Grootfontein and Outgo).

P. trigrammus, Gunth.

Originally described from "R. san Nicolao, Little Fish Bay" it has since been recorded by Sternfeld from Rehbock. Dr. Werner does not however, include the species in his list of snakes from German S.W. Africa and suggests that its real home is Angola. It seems to be very near subtaeniatus and perhaps identical therewith.

P. angolensis Boc

Mr. Boulenger includes Orange River Colony in his list of localities for this species. This species is not otherwise known from S. Africa, and the record certainly requires confirmation.

P. jallae Peracca (Boll. Mus. Torin. 1896 no 255.)

The body scales are in 15 rows : preocular broadly in contact with the frontal : posterior nasal divided but its upper portion, judging from the figure, has no such backward prolongation as occurs in *furcatus* and *notostictus* : anal scute divided : 7 upper labials of which 2 are suboculars : loreal about twice as long as deep. I have not seen this species : the figure shews a head scutellation very like that of *furcatus* but for the upper posterior nasal, whilst it differs from *sibilans* in the broad suture between the preocular and frontal scutes. It was described from Kazungula (Rhodesia).

The following key will serve as a guide to the species which occur in South Africa :

1 Posterior nasal usually divided, the upper portion with a distinct backward prolongation 2

Posterior nasal usually entire, the upper portion without a distinct backward prolongation 3

2 Anal scute usually entire, internasals rather more than half the length of prefrontals. *P. notostictus,*

Anal scute usually divided, internasals hardly half as long as the prefrontals, forehead rather deeply grooved. *P. furcatus,*

3 body scales in 15 rows 4

body scales in 17 rows 5

4 preocular broadly in contact with the frontal, seven upper upper labials *P. jallae,* Per.

preocular separated from the frontal or only narrowly in contact *P. crucifer,*

5 2 upper labials entering the eye. 6

3 upper labials entering the eye. 8

6 rostral as deep as broad or only slightly broader than deep. 7

rostral appreciably broader than deep, head somewhat depressed. 8

7 Frontal scute equal to or slightly longer than its distance from end of snout. *P. sibilans.*

Frontal scute appreciably longer than its distance from end of snout. *P. crucifer.*

8 temporals 2+2 or 3. *P. subtaeniatus.*

temporals 1+1 or 2+1. *P. trigrammus.*

Amplorhinus multimaculatus, Smith.

Strand (Bro J. H. Power), Doornkop, Belfast (R. Gerhardt). This species appears to have a very disconnected distribution, being known only from the Cape Peninsula and from the high-veld Transvaal.

Aparallactus capensis, Smith.

Serowe (S. Blackbeard). 148 ventrals.

Calamelaps warreni, Boul.

Empandeni, Plumtree (S. Rhodesia), Rev. J. O'Neil. The specimen is quite typical, having 172 ventral scales and 19 rows round the body: the second upper labial is in contact with the nasal, not with the prefrontal.

Xenocalamus bicolor, Günth.

Rechtuit, Waterberg dist. (Transvaal Mus.). Typical colouration: ventrals 219; subcaudals 24.

Aspidelaps scutatus, Smith.

Philippolis, O.F.S. (Pt. Elizabeth Mus.), Newington, E. Transvaal (Dr. J. P. Fenoulhet).

Dendraspis angusticeps, Smith and *D. mamba*, Gough (Ann. Trans. Mus., 1, 37).

Dr. Jean Roux, in Zool. Jahrb. Syst. XXV, remarks that the scutellation of the head is very variable in angusticeps, three specimens from Illovo, Natal, shewing the following characters:

In front of eye.	Behind the eye.	Temporal shields in contact with outer edge of parietals.
A. 2+2 preoculars.	2+3 postoculars.	3+3
0+1 suboculars.	1+1 suboculars.	
B. 2+2 preoculars.	2+2 postoculars.	3+2
1+1 suboculars.	1+1 suboculars.	
C. 2+2 preoculars.	2+2 postoculars.	3+2
no suboculars.	no suboculars.	

A series of 5 examples examined by myself shew considerable differences in the shape and number of the temporal shields, though no definite approximation to the *mamba* condition was found. The points of difference between the two species are as follows: *angusticeps* has 19 to 23 scales round the body, whereas *mamba* has 25, a distinction of little importance in view of the known wide variation in *angusticeps*: the upper anterior temporal in *angusticeps* not longer than the lower anterior temporal, but in *mamba* twice as long: eight upper labials in *angusticeps* but nine in *mamba*. The number of upper labials is not a specific character for Dr. Peters in the Reise nach Mozambique, figures and describes a specimen of *angusticeps* with nine upper labials on either side: he remarks that this example has four postorbitals instead of three as in Smith's type. The long anterior temporal of *mamba* is the equivalent of three shields in *angusticeps*, viz: two upper temporals and one posterior lower temporal, and so far as this condition is concerned it seems likely that specimens B and C examined by Dr. Roux were *angusticeps* on one side of the head and *mamba* on the other side. The temporal condition of *mamba* is the same as that of *jamesonii* of West and Central Africa, but in this species the body scales are in 15 to 19 rows. It is evident that the whole genus is in a very plastic condition with regard to scutellation characters and that *mamba* does not possess any peculiar character but merely exhibits one amongst many possible combinations which grade into each other. Lastly the type of *mamba* is a juvenile example. I think it is not entitled to rank as a distinct species.

Bitis inornata, Smith.

The Kingwilliamstown Museum has a specimen of this rarity from the Twatwa River, Cathcart dist. (F. A. O. Pym), agreeing fairly well with the description as given in the British Museum Catalogue. It is near *cornuta* in general shape of the head and agrees therewith in that the chin shields are in contact with three lower labials: but the supraorbital region is not so much elevated as in *cornuta*. There are 11 and 12 supralabials, and 3 scales between the eye and the labials (according to the description there should be 14 supralabials and 4 scales between the eye and the labials.) The colour is pale brown with some illdefined darker spots mostly situated mid-dorsally. In the shape of the head it resembles Smith's figure of *atropoides* rather than his *inornata*, but the spots are not nearly so conspicuous nor so regularly arranged as in *atropoides*.

Bitis atropos, Lin.

From Doornkoop, near Belfast, Mr. Gerhardt has taken three specimens which are uniformly reddish brown much as in *inornata*: the scutellation of the head is however the same as in *atropos*. There are two series of scales between the eye and the labials, the the upper labials vary from 10 to 12, there are 4 lower labials in contact with the chin shields and the subcaudal scales are large and smooth. The eyebrows are only slightly elevated, one example having a decided depression between the eyes: this latter specimen also has a shorter head than the other two, which are long headed as in typical *atropos*. *B. inornata*, as figured and described by Smith also has an elongated head, but its scutellation, given in the Brit. Mus. Cat., places that species nearer to *cornuta* than to *atropos*. We have the typical form of *atropos* from Addo (E. Potgieter) and Coldspring (J. Glass).

Bitis caudalis, Smith, and *cornuta*, Daud.

According to the published records these two species occur together in northern localities; but the only locality from which we have both species is Steinkopf (J. H. Zerf). They are both recorded from Serowe by Mr. Boulenger, but all our species from that locality (S. Blackbeard) are *caudalis*. Dr. Werner places *caudalis* as one of the commonest of snakes in German S. W. Africa and the Kalahari, and records *cornuta* from Steinkopf, Luderitzbucht and Kubub; Dr. Sternfeld also records numerous examples of *caudalis* from German territory and from one locality (Gobabis) has 17 examples of that species, and 4 which he refers to *cornuta*, explaining however that to distinguish between the two species is very difficult as the colour characters are the same and the development of the erect supraorbital scales is subject to much variation. He adds moreover that the Cape examples of *cornuta* are strikingly different in colour from those in German territory. In view of these facts, and especially as *cornuta* is typically southern and *caudalis* northern, it seems to me not improbable that most of these northern records will prove to be referable to varieties of only one species. The Albany Museum has a single specimen of *cornuta* from Brak kloof, near Grahamstown (Mrs. G. White).

Atractaspis bibroni, Smith. Pretoria (Transvaal Museum).

BATRACHIA.

Rana grayi, Smith.

Kaaiman's River, George, and Oudtshoorn (Miss M. Wilman), Wakkerstroom (A. Roberts, fide P. Methuen).

Rana fasciata, Boie.

Kaaimans River, George (Miss M. Wilman).

Rana angolensis, Boc.

Kaaimans River, George (Miss M. Wilman), a half-grown example.

Rana fuscigula, D. B.

Knysna (J. H. Rex), immature specimen; Kaaiman's River, George (Miss M. Wilman), a young example. At this latter locality it seems as if the distribution areas of *fuscigula* and *angolensis* overlap; the case requires further investigation.

Rana natalensis, Smith. Somerville Mission, Tsolo (Miss F. Ross).

Rana mascareniensis, D.B.

Between Tsolo and Maclear (Miss F. Ross).

Megalixalus spinifrons, Cope.

It is rather doubtful if *Megalixalus spinifrons*, Cope, is specifically distinct from *M. fornasinii*, Bian. In the British Museum Catalogue the two are distinguished by the tubercled character of the dorsal surface, the head alone being studded with acute tubercles in *spinifrons*, whilst the skin of the whole upper surface is beset with very small tubercles in *fornasinii*; more recently (Annals S. A. Mus. 5.531) Mr. Boulenger distinguishes them according to the webbing of the hand, *fornasinii* having the hand ⅓ webbed, and *spinifrons* only a rudiment of a web. In November, 1911, Father Alexander Hanisch sent me from Mariannhill, Natal, two specimens of typical *spinifrons*, but his more recent captures (Jan., 1912) agree precisely with *fornasinii* as regards the tubercle character, the whole of the upper surface of body and limbs being beset with small scattered tubercles. The Mariannhill forms are almost certainly specifically identical, and, as the webbing of the hand is only slight, they may for the present be designated as *spinifrons*; the tubercle differences may be seasonal.

Cassina senegalensis, D. B.

Kaaimans Riv. George (Miss M. Wilman.)

Bufo gariepensis, Smith. (=*B. granti*, Boul.)

Modder River (Bro. J. H. Power), George Lakes (Miss M. Wilman), Groot Vlaate, Somerset East Dist. (B. Marais), Steinkopf (J. H. Zerf). There can be no doubt but that the juvenile specimens described by Smith from the Orange River and reduced by Günther and Boulenger as *angusticeps*, are really the same as *granti*; the former is quite unknown from northern parts of the colony, the latter, as Bro. Power's record shews, extends to the Orange River.

Bufo regularis, Reuss.

Modder River (Bro. Power), Knysna (J. H. Rex), Oudtshoorn and Kaaimans River, George (Miss Wilman).

From Mariannhill, Natal, Father A. Hanisch sends the following species; *Rana angolensis*, Boc., *R. oxyrhyncha*, Sund. *R. grayi*, Smith, *Phrynobatrachus natalensis*, Smith, *Megalixalus spinifrons*, Cope, *Breviceps mossambicus*, Pet., *Cacosternum boettgeri*, Boul., *Bufo carens*, Smith, *Bufo regularis*, Reuss., *Hylambates natalensis*, Smith, and *Xenopus laevis*, Daud.

Note on Two remarkable Implements presumably of Strandlooper Origin.

BY J. HEWITT.

[Plate XIII.]

Since the time when Dr. Schönland figured and described (page 18 et seq. of this vol.) the more interesting stone implements of our collection, one very remarkable specimen has been received, along with a Strandlooper skeleton, from a cave in Plettenberg bay. It is a hafted tool, consisting of a small, shaped and roughly trimmed piece of chalcedony embedded in a large lump of resin which is provided with a wooden handle. The stone, according to Prof. Schwarz, is precisely like those found in the river gravels of the Vaal and Orange rivers or in the Bushmans river; similar ones were left in the Oudtshoorn caves by their former occupants. An exact determination of the nature and origin of the resin could not be made without damage to the specimen, but Dr. Schönland informs me that the natives of S. Africa used for similar purposes the resin exuding from the roots of *Pterocelastrus variabilis* when heated. The stone is still quite securely fixed in the resin but the wooden haft is loose; the latter has a narrow tapering end for insertion into its socket, which is about an inch deep, the lump of resin being four inches long. The purpose of the handle is not obvious, but with the resinous lump held firmly in the hand this tool would prove very serviceable for cutting up skins and the like. There is nothing to suggest a great antiquity for this implement: indeed the shaping of the stone and the well preserved condition of the wood is against that view. In shaping the wood several clean cuts have been made and it seems to me possible that these have been made with a steel or iron blade. The total length is 9½ inches. Only one other example of this kind is recorded: it was described by Dr. L. Péringuey in Annals S. African Mus., Vol. VIII, p. 91, pl. 19.

IMPLEMENTS FROM A CAVE IN PLETTENBERG BAY.

Another object also from a cave in Plettenberg bay seems to be quite unique. It is a long bone of a bird ornamented very regularly by short clean-cut incised lines arranged as described below : at one end of the bone is a lump of resin which happens to cover over some of the ornamentation. The pattern is in five long rows of unequal length, two of which may be described as a continuous series of crosses (**X**) irregularly overlapping each other: another row is similar except that it is broken up into six small groups by unequal intervals which are greater than the length of a group; another row is made up twelve parallel tranverse lines arranged in six pairs as shewn in the plate, and the fifth row is likewise but for the fact that two of the groups include three lines each. No two adjacent rows are alike. This ornamentation is fundamentally the same as that figured by Dr. Péringuey in the publication above mentioned fig. 194, 2, which also came from Plettenberg bay. Mr. John Hemming and Prof. Schwarz have suggested that this is a tally, and the former gentleman regards the knob of resin as a convenient handle for an object which would doubtlessly be carried in a sheath on the person of its owner: each pair of transverse lines may perhaps represent a double moon. If this view is correct, the cross markings must be part of the tally, but their counterpart on Dr. Péringuey's specimen cannot readily be explained in this way and may be purely ornamental : at any rate this is a very common type of ornamentation on Kaffir implements and pottery.

[*Extracted from the* GEOLOGICAL MAGAZINE, Decade V, Vol. VIII, No. 565, pp. 298-99, July, 1911.]

A new Genus of Fossil Plants from the Stormberg Series of Cape Colony.

By A. C. SEWARD, F.R.S., Cambridge.

[Plate XIV.]

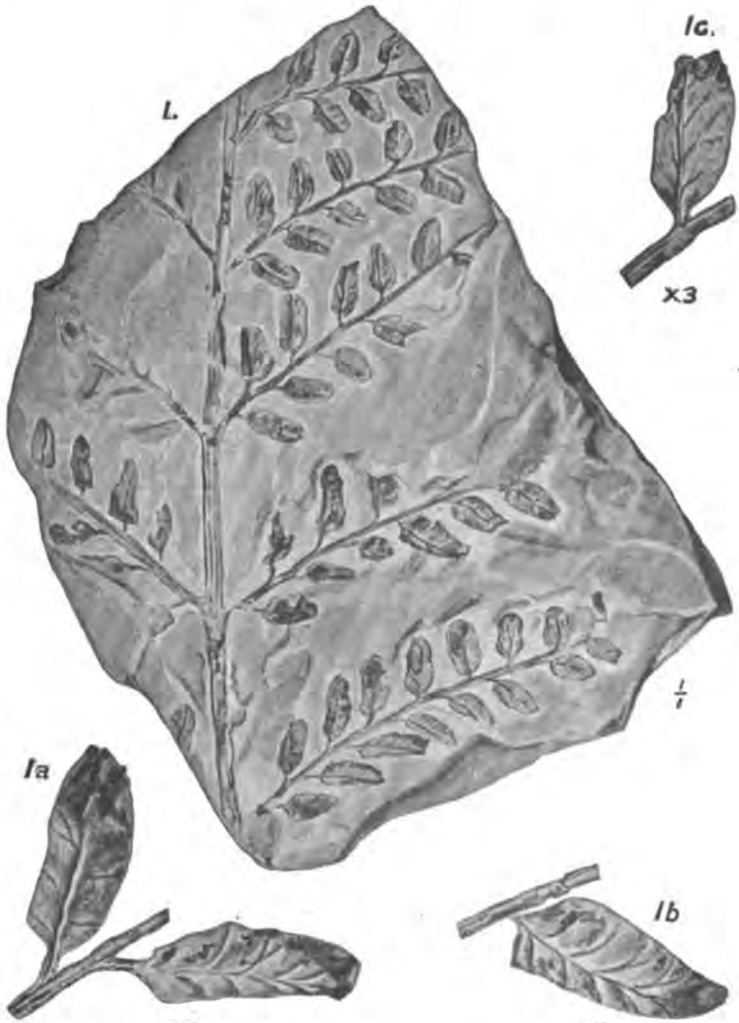
The single specimen which forms the subject of this note was sent to me for examination by Mr. Hewitt, of the Albany Museum, Grahamstown, Cape Colony; it was found at Cyphergat and presented to the Museum by Mr. S. R. Gardner. Fossil plants from Cyphergat in Cape Colony have been described by Feistmantel and, more recently, by myself[1] from beds containing the remains of a flora assigned to the Rhætic age. Our knowledge of this flora is based on material obtained from the Molteno Beds at the base of the Stormberg Series[2] at Molteno, Stormberg, Cyphergat, and other places.

The fossil shown natural size in Pl. XIV, Fig. 1, may be described as follows: A partially carbonized impression of a portion of a bipinnate frond 11 cm. long, consisting of a comparatively slender rachis not exceeding 3 mm. in breadth, which gives off sub-opposite linear pinnæ at an angle of approximately 45°. The pinnæ bear alternate broadly linear pinnules attached by a short stalk; the substance of the lamina is represented in places by a fairly thick carbonaceous layer. The apex of the pinnules is bluntly rounded, and at the proximal end the edge of the lamina bends inwards rather abruptly towards the stalk (Pl. XIV, Figs. 1, 1*a-c*). There is a well-defined midrib, from which a few simple or forked veins arise at a wide angle.

[1] Feistmantel, *Abh. kön. böhm. Ges. Wiss.* [vii], Bd. iii, 1889; Seward, Ann. S. African Mus., vol. iv, 1903.

[2] Rogers & Du Toit, *An Introduction to the Geology of Cape Colony*, London, 1909.

ALBANY MUSEUM RECORDS.



T. A. Brock del.

Stormbergia Gardneri, gen. et sp. nov. Stormberg Series, Cyphergat, Cape Colony.

To illustrate paper by Professor A. C. Seward, M.A., F.R.S., F.G.S., etc.

The preservation is far from satisfactory, but the thickness of the carbonaceous layer, as seen in some of the pinnules (e.g. Pl. XIV, Fig. 1*a*), indicates a thick lamina. A superficial examination of the specimen suggested comparison with *Bernoullia helvetica*, Heer, a species originally described by Heer[1] from the Upper Triassic beds of Switzerland, and more recently figured by Leuthardt[2] from the Keuper of Neuewelt near Basel. Professor Zeiller[3] has also described the same type from the Rhætic flora of Tonkin. The fertile pinnules of *Bernoullia* are in some cases contracted at the base, and in this respect approach the more definitely stalked segments of the Cyphergat plant; but a more careful examination of the published figures and of a Swiss specimen kindly given to me by Dr. Leuthardt convinced me that the fossils are generically distinct. They differ in the shape of the pinnules as in the venation; in *Bernoullia* the secondary veins are numerous, while in the South African plant they appear to be few and widely separated. Moreover, in the plant shown in Pl. XIV, Fig. 1, the stalked pinnules are sterile, and differ considerably from the sterile segments of *Bernoullia*. Among recent ferns stalked pinnules occur not infrequently, e.g. in species of *Adiantum*, *Pellæa*, *Llavea*, *Polybotrya*, *Osmunda*, *Didymochlæna*, and other genera, but it is noteworthy that among fossil Ferns and Pteridosperms stalked pinnules are very uncommon. One of the few examples known to me is *Neuropteris Grangeri*, a species originally described by Brongniart[4] from the Coal-measures of Ohio, and more recently figured by Zeiller[5] from France. In this Upper Carboniferous species the pinnules possess the venation and auriculate base characteristic of *Neuropteris*, and differ widely from those shown in Fig. 1.

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[1] Heer, *Flor. Foss. Helvetiæ*, p. 88, pl. xxxviii, figs. 1-6, Zürich, 1876.

[2] Leuthardt, *Abh. Schweiz. paläont. Ges.*, vol. xxxi, p. 38, pl. xix, figs, 1-4, pl. xx, figs. 1, 2, 1904.

[3] Zeiller, *Flor. Foss. Gîtes de Charbon du Tonkin*, p. 34, pl. i, figs. 14-16; Paris, 1903.

[4] Brongniart, *Hist. Vég. foss.*, p. 237, pl. lxviii, fig. 1, Paris, 1828.

[5] Zeiller, *Bassin Houill. et Perm. d'Autun et d'Epinac*, p. 145, pl. xi, figs. 6, 6*a*, Paris, 1890.

It is unfortunate that the South African plant is represented only by a single specimen, and that an imperfect one. While venturing to institute a new genus, I hope that additional material may be obtained which will lead to a more satisfactory knowledge of the affinity of the plant. In the absence of fertile specimens the question of taxonomic position cannot be definitely settled, though the presumption is that the frond is that of a fern.

STORMBERGIA, gen. nov. Plate XIV.

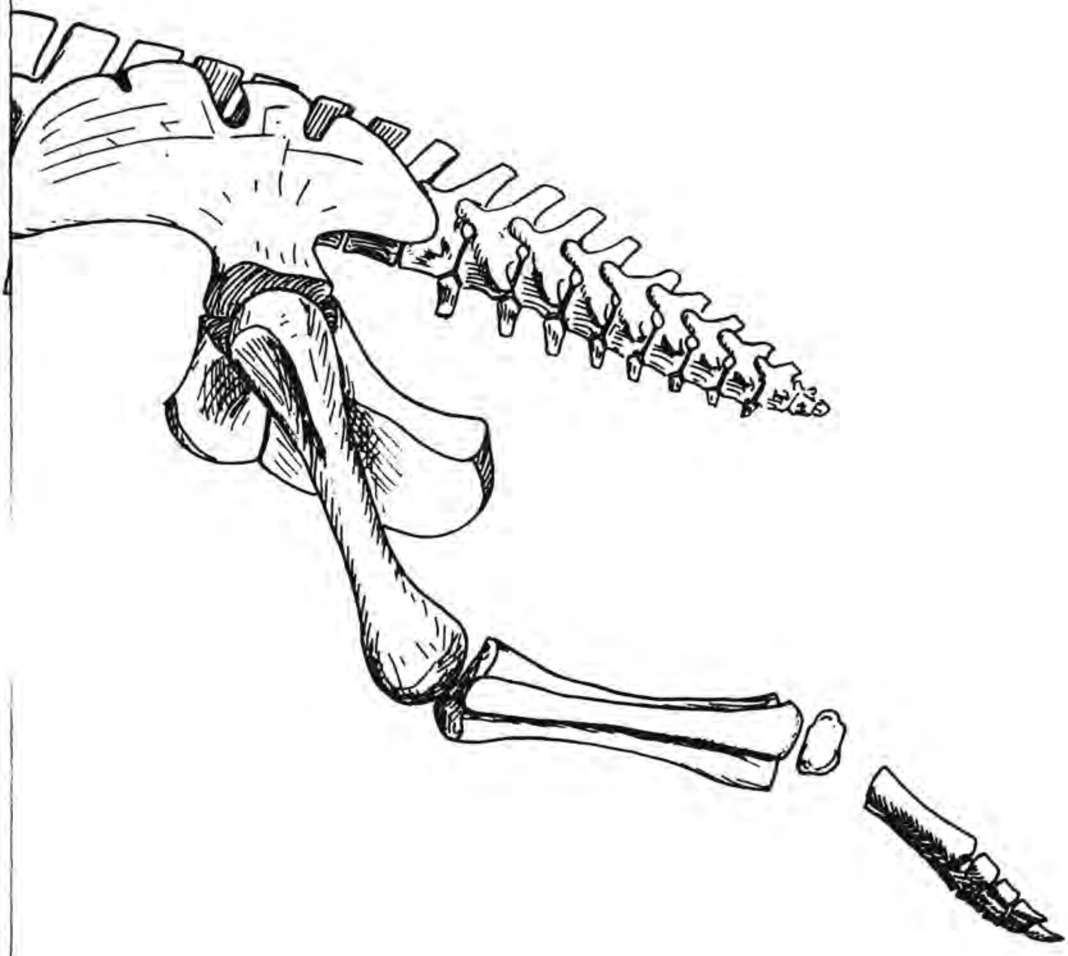
Fronds characterized by pinnules with the *Cladophlebis* type of venation, attached to the pinnæ by a short stalk. The lamina is suddenly contracted at the base and not auriculate.

Stormbergia Gardneri, gen. et sp. nov. Pl. XIV, Figs. 1, 1*a-c*.

The specific characters are enumerated in the description already given. The specimen was discovered by Mr. S. R. Gardner in the Stormberg Series at Cyphergat, Cape Colony.

LYSTROSAURUS LATIROSTRIS OWEN.

Plate XVI.



The Skeleton of Lystrosaurus.

By D. M. S. WATSON, M.Sc., Lecturer in Vertebrate Palaeontology in the Victoria University of Manchester.

[Plate XV and XVI.]

Lystrosaurus is one of the commonest fossil reptiles of South Africa and we have been acquainted with its skull and some other bones for many years. Only within the last few months, however, has a complete skeleton been found, the Albany Museum having recently secured two specimens through the generosity of Messrs. N. and D. Collett of Botmanskop, Conway. The finer of these specimens has been developed by myself and shews a magnificent skull, the entire vertebral column, limb girdles and the limbs complete except for the feet. The skull agrees exactly with the type of *Lystrosaurus latirostris* (Owen), and in its general construction agrees exactly with that of *L. McCaigi* figured by Broom. It shews, however, very clearly the presence of a large septo-maxillary, forming part of the border of the external naris and wedged in between the prefrontal, lachrymal, maxilla and premaxilla. The nostril lies at the bottom of a deep pit, the anterior walls of which are very steep, whilst the posterior side slopes gradually on to the outer surface of the side of the skull. *Lystrosaurus* is aquatic, and the whole appearance of the nostril suggests strongly to my mind the presence of a valve formed of a simple muscular flap fastened to the front rim of the narial pit and closing down so as to leave the side of the face smooth, whilst the animal was under water. The flap would be similar to that which protects the tympanic membrane of the crocodile. The columella cranii is well shewn in the specimen, and is a narrow rod whose base is much expanded and produced forward, and lies on the outer and upper side of the pterygoid. The "Quadrate" is inserted in the usual way on the anterior face of the descending process of the squamosal and is connected with the posterior ramus of the pterygoid, which passes on the inner side of it. The outer portion of the "quadrate" is very tightly applied to the squamosal, its upper edge being apparently bevelled off and wedged into a slit in the outer bone. The two parts are divided by a slit which widens below into a large foramen, but they appear to be quite continuous on the bottom edge, the pulley-like articulating surface of which belongs almost entirely to the outer portion. Dr. Broom very kindly shewed me a similar condition in *Oudenodon*, where however the division was continued to the bottom and the "quadrate" was composed of two bones identified by him with the quadrate and quadrato jugal. The lower jaw is a shortened modification of the ordinary anomodont type. The very powerful and heavy dentary overlaps the surangular and angular behind, leaving a large fenestra in the ordinary way, the articular appears to be fused with the surangular as in *plesiosaurs*, the outer face of the combined bones being largely covered by the much expanded angular, which is remarkable for being divided by a notch starting from the back of the bone and continued forward, until it terminates very near the large fenestra of the jaw. Details of the articulating surface of the articular cannot yet be given and the inner side of the jaw is unknown, but there is definite evidence of the presence of a splenial.

The whole vertebral column is beautifully shewn in this specimen, its formula being c + d 25, s. 6, c. 10.

The atlas is not completely preserved, but one half of the neural arch is shewn in an imperfect condition : it is a small flat bone provided with two processes, one for articulation with the prezygapophysis of the axis, the other having the facet for the tuberculum of the atlantal rib. The odontoid process is not fused with the centrum of the axis and has the curious trefoil shape which is so characteristic of the *Therapsids*. Another specimen shews the half-moon-shaped intercentrum of the atlas. There is no intercentrum between the odontoid process and the axis, and none between any of the subsequent vertebrae till the tail is reached. The axis has an expanded and very mammalian looking spine, the front edge of which bears a pair of small processes which represent the prezygapophyses and serve to articulate with the atlas.

The rib of the axis is double headed, the facet for the tuberculum being placed at the end of a short transverse process, and the capitulum articulating with a facet on the extreme anterior edge of the centrum quite at the bottom.

There is no distinction of cervical and dorsal vertebrae. Vertebrae 3–6 are very similar, they have narrow spines of moderate height, the transverse process is long and the zygapophyses long and broad. The 7th vertebra has a high, broad neural spine bent backwards and somewhat expanded at the top, and short zygapophyses. Vertebrae 8–19 shew several progressive changes: the neural spines gradually narrow and incline more and more backward, the zygapophyses, at first short, shew a gradual increase in length and amount of overlap. The transverse process shortens, but the facet for the rib becomes obliquely extended until it nearly meets the pit on the anterior edge of the centrum, which receives the capitulum and gradually and evenly rises throughout the entire series of presacral vertebrae. From the 17th–25th vertebrae, the neural spines gradually widen and become more upright, the zygapophyses become shorter, but the modifications of the rib articulation continue in the same sense as in the preceding vertebrae. In the 25th vertebra the capitular facet is upon the neurocentral suture. The sacrum consists of six vertebrae, the centra of which, though very closely articulated, are not fused. The neural spines are of moderate height, broad and nearly upright. The short but powerful zygapophyses are very closely applied to one another and between the 3–4, 4–5, 5–6 sacrals are actually fused. The rib facet is not shewn in the 1st sacral, in the 2nd it is shared equally by the centrum and arch, in the 3rd the facet is more extensively on the arch, and in the last three sacrals is entirely carried by the arch.

The first sacral rib is comparatively slender, and nearly 2 cm. long, its distal extremity is somewhat expanded in a vertical plane. The second sacral rib is a very massive bone, only 1.5 cm. long, and apparently of nearly circular section.

The third and fourth are very similar to the second, but much weaker, the last two are not shewn. None of the sacral ribs are fused with the sacrum. Judging from the characters of the rib articulation, the 1st sacral vertebrae is a sacrolumbar the next two are true sacrals and the last three sacro-caudals.

The caudals are not very well shewn, they have short back wardly inclined neural spines, large zygapophyses and in the anterior part of the tail, small non-fused ribs. It is improbable that there were more than 12 caudals; 10 are preserved, the last of which is very small.

It is of interest to examine the meaning of the changes in the vertebrae of different parts of the column which have been outlined above.

The characters of the 3–6 vertebrae seem to me to shew a good deal of flexibility, the zygapophyses with a long overlap allow of much vertical movement, and the comparatively narrow neural spines indicate that the interspinous ligaments were capable of some considerable elongation.

The seventh vertebra with its powerful spine marks the point of origin of the ligamentum nuchae, and is connected with the following two vertebrae by short zygapophyses which imply some rigidity in the back at this point.

The series of vertebrae which follow, 10—19, with their narrow spines and large zygapophyses form a very flexible region, the back beyond this point gradually becomes stiffer until the sacrum is reached.

The pectoral girdle of *Lystrosaurus* has been well described by Owen and Broom, and the present specimen adds nothing to our knowledge.

The humerus has been beautifully figured by Owen, but the bones of the forearm have not yet been described.

The ulna is a short stout bone much flattened throughout its length: there is no olecranon process but the head of the bone shews a facet for the humerus, which is obliquely placed and to ulnar side of which is a small surface indicating the former presence of a cartilaginous cap. The face of the bone which is presented to the radius shows at its upper end a slight recess for the head of the latter bone. The lower end of the ulna is somewhat expanded and its termination rounded and obviously formerly covered by a cartilaginous cap. The radius is a short flattened bone much constricted in the middle of its length and greatly expanded distally. The articular surface of the proximal end is concave and the other end is convex, but both were certainly covered with a cartilaginous cap. The whole forearm is remarkably similar to that of a seal in general build. The hand is not preserved in this specimen, but there is an incomplete example in an associated specimen. This shews that the metacarpals are very short and broad and quite flattened, only a few phalanges are preserved which are also flattened and considerably wider than long.

The pelvis presents an interesting modification of the ordinary anomodont type. The ilium is very much elongated, the preacetabular portion being much produced, its upper border is cut into by three notches, which also occur in another specimen. The whole ilium is low, very strikingly so when compared with that of *Oudenodon trigoniceps* or "*Platytodosaurus*."

The pubis is a very small bone joined very closely with the ischium by a long suture which is interrupted by the very small obturator foramen whose border is mainly in the pubis. The anterior edge of the bone is deflected and has had a cartilaginous extension. The head of the bone has three facets, that for articulation with the ischium being sharply separated from the other two which are only obscurely indicated. The ischium is a large bone, meeting its fellow of the opposite side in a short symphysis and then widely separated from it behind. The bone is greatly produced backward and its outer border is very much thickened.

The pelvis as a whole is very low, the subacetabular part though much produced backwards is not nearly so deep as in a *Dicynodon* or *Oudenodon* of analogous size.

There is no doubt that these are adaptations to swimming: the extended ischium gives rise to powerful ischio-femoral muscles which drive the femur backwards; and the shallowness of the lower part of the pelvis is possible in an aquatic animal which has not to support the weight of its body and consequently does not require strong adductors.

The notching of the upper border of the ilium and its great forward extension are somewhat mysterious, but they may be connected with a subdivision of the ilio-femoral muscles concerned with feathering the hind limb during its forward motion. The extremely long and powerful sacrum is also a surprise in an aquatic animal but it may have served as the insertion of strong longissimi dorsi, and sacrolumbar muscles.

The femur is a long bone flattened in the plane of the condyles. The head is rounded and its surface for cartilaginous attachment is directly connected with that of the great trochanter. From the trochanter a powerful ridge runs down the side of the bone, terminating at about $\frac{1}{3}$ of its length from the top. Below this point the bone contracts to a fairly narrow shaft from which it expands again to the distal end, which is obscurely divided into two condyles by shallow grooves on each face of the bone. The distal end has certainly been covered by a thick cartilaginous cap, but its shape suggests that during life the leg was never very much flexed.

The tibia is remarkable in that it is scarcely at all flattened. It is a bone with very few features; both ends are expanded and have been provided with cartilaginous caps. The proximal end has a faint division into two, shewing that both condyles of the femur articulated with it.

The fibula is a slender bone somewhat flattened at the upper end where it is applied to the tibia, it articulates rather on the side of the femur than on the end. Its lower end is expanded and closely connected with that of the tibia.

Of the tarsus only two proximal tarsals are preserved. These are rounded nodules of the bone, the tibiale being the largest.

The foot is not preserved, but a very large incomplete pes in the Albany Museum, referred to L. McCaigi, shews that the metatarsals were long, that some, at any rate, of the toes had four phalanges, all were very short and broad, and the last formed a broad blunt claw.

As Broom has pointed out, *Lystrosaurus* is an aquatic animal, and as all the departures from the ordinary anomodont type are dependent on its habits it is interesting to consider what they may have been.

The articular surface of the quadrate is very extensive, allowing the jaw to be opened to a right angle or more. The fact that the turning down of the snout is really arrived at by shortening the skull instead of by the bending down of the face on the cranium as in *Tapinocephalus* and *Halicore* is of interest because it results in the retention of exceedingly long temporal and masseter muscles, and, as a long muscle allows of greater extension than a short one, this implies the power of opening the mouth very widely.

The very few complete *Lystrosaurus* tusks which I have examined are worn smooth, and in at least one case the end truncated and worn down. The neck is flexible, particularly in a vertical direction, and the anterior ribs, best shewn in some of the British Museum specimens, are unusually strong. The only use of strong anterior ribs is to give attachment to strong intercostals and other muscles which serve to depress the head, and the only possible necessity for a powerful depression of the head arises if the animal uses its tusks for digging, a habit which would also account for the worn condition of the tusks. As the tusks only project slightly below the dentary it is most probable that *Lystrosaurus* dug with his mouth widely open, shovelling up the loosened food with the lower jaw.

It is natural to suppose that *Lystrosaurus* was a vegetable feeder, as the absence of teeth and the presence of a horny beak are more adapted to such a diet than to a carnivorous one.

The extraordinary massiveness of the jaws is however rather difficult to reconcile with the softness of most aquatic plants and suggests some additional food.

If *Palaeomutela* were found commonly with *Lystrosaurus*, which so far as I know is not the case, I should be inclined to regard that animal as living on mollusca, for crushing the shells of which its mouth seems excellently adapted.

The flexibility of the back suggests that the hinder end of the body was bent downward at the beginning of the backward stroke of the hind limb and was straightened during the stroke.

As a final conclusion we arrive at the conception of *Lystrosaurus* as an aquatic animal capable of swimming strongly, but more usually employed in moving slowly along the bottom, digging up plants and possibly also shells with its tusks.

Plate XVI (nearly ½ natural size).—Restoration of the skeleton of *Lystrosaurus latirostris* (Owen).

Considerable accuracy is claimed for the details of this restoration as it is a photographic reduction of a life size sketch, all the bones of which, with the exception of the feet, the top of the scapula, sternum, and some ribs, are carefully measured drawings of a single individual.

The size and number of phalanges in the feet are hypothetical but are based on incomplete non-associated remains.

The animal is represented in the position of swimming, the hand being carried forward, and the hind leg at the extreme end of its backward stroke.

Measurements of skeleton of *Lystrosaurus* No. 3731, Albany Museum.

Skull.	
Maximum width across squamosals	17 cm.
Maximum length between perpendiculars	20 cm.
Minimum width of parietal region	4.8 cm.
L. scapula.	
Maximum width of lower end	4.8 cm.
Width at acromium	4 cm.
L. humerus.	
Total length	12.2 cm.
Breadth of head	5.7 cm.
Minimum width of shaft	2.3 cm.
Maximum width of distal end	7.8 cm.
L. Radius.	
Total length	9 cm.
Maximum width of upper end	5 cm.
Minimum width of shaft	1.7 cm.
Maximum width of lower end	3.3 cm.

L. ulna.	
Total length	7.7 cm.
Maximum width of upper end	3.5 cm.
Minimum width of shaft	1.4 cm.
Maximum width of lower end	4.3 cm.
R. ilium.	
Total antero-posterior length	14 cm.
Greatest height	8.8 cm.
Width of acetabular end	4.7 cm.
Width of neck above acetabular end	3.2 cm.
R. pubis.	
Maximum width	6 cm.
Maximum length	3.8 cm.
Maximum width of head	2.8 cm.
R. ischium.	
Maximum breadth	7.7 cm.
Maximum length	8 cm.
R. femur.	
Total length	13.3 cm.
Width of head and Trochanter major	6 cm.
Minimum width of shaft	2 cm.
Width of lower end	5.5 cm.
R. Tibia.	
Total length	10.8 cm.
Width of head	4.5 cm.
Depth of head	3.4 cm.
Width of lower end	3 cm.
R. fibula.	
Total length	10 cm.
Minimum width of shaft	.9 cm.

Length of vertebral column measured on the top of the neural spines and round the curves.

Front of axis to back of no. 25	55 cm.
Sacrum	11.5 cm.
Tail as preserved	17 cm.

Mesosuchus Browni, gen. et spec. nov.

By D. M. S. Watson.

When I visited the wonderful collection made as a result of a lifetime's work by Alfred Brown, Esq., of Aliwal North, I saw the remains of several new reptiles the most important of which was a small crocodile-like animal represented by several incomplete skeletons.

A preliminary description of this reptile is given below; a full illustrated account will be published as soon as possible.

Skull, not perfectly preserved, the nasals, frontals, lachrymals, prefrontals, postfrontals, post-orbitals, jugals, quadrato-jugals, and squamosal being only represented by isolated bones. The rest of the skull is articulated and well preserved.

Skull with a preorbital region of moderate length, preorbital fenestra probably small, orbit large, two temporal arches, external naris apparently not divided by processes from the premaxillae meeting the nasals. Premaxillae short with two acrodont teeth. Maxilla with two irregular rows of short acrodont teeth. Maxilla with two irregular rows of short acrodont teeth. Jugal triradiate with short anterior limb, like that of *Erythrosuchus*. Quadrate large with articulating surface with two moderately distinct condyles and large deep pterygoid process. Pterygoid of remarkable shape with a deep posterior ramus applied to the inner side of the quadrate, small external ramus (not well exposed) and long anterior ramus which bears a closely set series of small pointed teeth. Vomer apparently narrow with a series of small pointed teeth, articulated with anterior end of pterygoid. Other bones of palate not shewn. Epipterygoid widened with a deep notch for the optic nerve, touching the top of the deep posterior ramus of the pterygoid. Parasphenoid very large and placed high up in the skull. Lower jaw completely crocodilian in construction, except for the coronoid which was not seen but probably of crocodial type. One row of teeth all in sockets. Vertebral column not well shewn, tail long. Cervical ribs hatchet shaped and ? double headed. Dorsal ribs double headed. Complete plastron of one median and several lateral series of abdominal ribs. Scapula very massive with strong acromial process. Coracoid very large with a foramen, and meeting or nearly meeting its fellow in the middle line. Interclavicle long with nearly parallel sides and an anterior end scarcely, if at all expanded. Clavicle not well shewn but feeble. Humerus short, expanded both proximally and distally, twisted, apparently no epicondylar foramen. Ulna with no olecranon process, head of radius lying in front of that of the ulna. Ilium like that of Belodon. Pubis not well preserved, articulating with the ilium and ischium, nearly square in shape with thick outer border directed inwards. Ischium long with a wide posterior extension and a deep depression on the ventral surface in the acetabular region. Femur stout, nearly straight and much longer than the humerus. Average length 6 cm. Tibia much stronger than the fibula. Two proximal tarsals, that articulating with the fibula the largest. Only two small distal tarsals and no centralia. Five digits, metatarsal 1–3 increasing in size, 4 the same length as 3, about half the length of tibia. Proximal ends of metatarsals overlapping as in crocodiles. Metatarsal V, short and broad, having only two very reduced phalanges. Dermal armour represented by a few scattered scutes, small thin, with a faintly pitted surface and a low knob on the posterior edge.

For the very remarkable reptile whose characters are outlined above, I propose the name of *Mesosuchus browni*.

I purpose to postpone a complete discussion of its affinities till I can issue a fuller description, but may here indicate, that the remarkable dentition and the structure of the palate shew it to be a near ally of *Proterosuchus fergusi*; the remarkable quadrate, the epipterygoid and the ilium are best matched by *Erythrosuchus*; that the loss of the two very small phalanges of the 5th toe and the shortening of the metatarsal would convert the hind leg into that of a typical crocodile. The animal is in fact a primitive member of that somewhat vague group including such forms as *Belodon* and *Ornithosuchus* for which I prefer Owen's term of *Thecodontia*. All the known specimens are in the collection of Alfred Brown, Esq., and were found near Aliwal North in the Cynognathus zone of the Karroo system.

Eosuchus Colletti, gen. et spec. nov.

By D. M. S. Watson.

The Albany Museum contains a split nodule, both sides of which are preserved, from the Karroo beds of Grass Ridge, Cradock. This contains the back, the perfect hind limbs, an incomplete forearm and manus, and the incomplete tail of a small reptile. The characters of the vertebrae are not well shewn but the dorsals have high spines and laterally compressed, biconcave centra. There are small intercentra between some of the posterior dorsals. The characters of the rib articulation are not shewn. There are two sacrals with powerful ribs expanded at their outer ends and strongly resembling in general form those of *Erythrosuchus*. The tail is very long and is wound round the outside of the nodule. The manus is incomplete but shews four digits, a fifth having almost certainly been present. The metacarpals are rather long and increase in length from the 1st to the 4th ; the phalangeal formula is 2. 3. 4. ? ?, the final phalanx is a claw. Six or seven displaced carpals are shewn. The ilium resembles that of *Erythrosuchus*, but has a much smaller pre-acetabular projection. The pubis and ischium exactly resemble those of *Mesosuchus*, they are well preserved and shew that there was no obturator foramen, the pelvis being of a modified plate-like type. The femur is a somewhat slender sigmoidally curved bone split down the middle. The tibia and fibula are nearly as long as the femur, the former being much the thicker. There are two proximal tarsals, the fibulare being apparently provided with a heel process. There are no centralia. Four distal tarsals are well shewn ; I, II and III are very small bones, the fourth is rather large. There are five digits. Metatarsals one to four increase gradually in size, the fourth and largest being about half the length of the tibia ; digit III is shewn to have had 4 phalanges. Metatarsal V is a short thick bone much expanded proximally. It bears two phalanges ; the first of these is quite long, but the second is much shorter and has apparently been the last.

For this reptile I propose the name *Eosuchus colletti*, after Mr. J. Collett who presented it to the Museum.

The characters of the pelvis shew it to be a near ally of *Mesosuchus*, and the whole animal is stamped with a resemblance to that reptile which is quite unmistakable, but difficult to put into words. It is distinctly more primitive in the presence of four distal tarsals and a less reduced fifth toe. It is in fact certainly a *Thecodont* and the oldest and most primitive member of that order. Certain characters both of this animal and of *Mesosuchus* seem to suggest some connection with *Proterosuchus*, a suggestion which can only be checked by a new examination of the remains of that interesting reptile. I propose to issue an illustrated and detailed account of the animal shortly. For permission to examine, develop, and describe the remains of *Mesosuchus* I am indebted to the courtesy of Alfred Brown, Esq. The skeletons of *Lystrosaurus* and *Eosuchus* were most kindly put at my disposal by the Committee of the Albany Museum, and Dr. Broom who had intended publishing a description of the *Eosuchus* remains most generously allowed me to do so. Finally, I am indebted to the Trustees of the Percy Sladen Memorial Fund whose grant assisted me to visit Cape Colony.

Records and Descriptions of some little known South African Scorpions.

By J. HEWITT.

In the Annals of the South African Museum, vols. 1 and 2, Dr. W. F. Purcell published a series of papers on the taxonomy and distribution of South African Scorpions, and thus laid an excellent foundation for all future workers on this subject. The following paper deals mainly with genera and species which were not worked by Dr. Purcell, but in a few cases I have been able to add new records for some of the species, the distribution of which was so well investigated by that authority. References are only given to those species which were described after the publication of Kraepelin's monograph in Das Tierreich.

Parabuthus flavidus, Pocock. (Ann. Mag. Nat. Hist. 7.3, 419 and 7.10, 367, also Proc. Zool. Soc., 1902, p. 222.)

Described from Taungs in Bechuanaland and known to me from Kimberley (Bro. J. H. Power), Waterberg Dist. (Jutrsencka), Magersfontein (F. A. O. Pym), Bothaville, O.F.S. (Dr. Purcell). The most characteristic feature is in the second caudal segment where the granulation of the upper surface is squamiform and ladder-like, being arranged in a series of transverse rows and confined to a narrow median channel. In some respects it approaches *planicauda*, Poc. the accessory crest of caudal segment 5 being composed of one or two low rounded granules, and the superior crest being well defined only in the first half of this segment. Dr. Kraepelin (L. Schultze, Zool. u. Anthrop, Ergebnisse e. Forschungsreise in Süd-Afrika) records *flavidus* from Gr. Windhuk (*Kraepelini*, Wern.), but his figure of the first two caudal segments seems to me to refer to some other species: on the other hand his figure of *mosambicensis* seems hardly distinguishable from the true *flavidus* so that quite possibly, as Mr. S. Hirst suggests (in litt.), the two are synonymous. The type of *mosambicensis* was said to come from Tette, and

Kraepelin records it from Severelela. Mr. Hirst has just described (Manchester Memoirs, vol. 56, no. 2) a closely related species, *truculentus*, from East bank of the Loangwa, Portuguese East Africa.

Parabuthus laevifrons, Sim.

A single specimen from Molopo north of Zwart Modder in the Western Kalahari (Miss M. Wilman). The middle lateral keel of the fourth caudal segment is distinct though weak throughout its length. It somewhat resembles *flavidus*, Poc., in the characters of the second caudal segment, but differs from that species in that the granulation on the middle of the last abdominal tergite is exceedingly fine, not coarsely granular : the first caudal segment is much more finely shagreened above than in *flavidus*. the inferior keels of the first caudal segment are quite smooth, the median eye tubercle is quite smooth and the tibia of the pedipalps is strongly prominent anteriorly. According to Kraepelin, the related species, *raudus*, Sim., the type of which is lost, has the granulated area of the first caudal segment extending to the posterior margin of that segment.

Parabuthus schlechteri, Purc. (Ann. S. A. Mus., 1, 434, and 2, 164).

Modder River (F. A. O. Pym). The specimen differs from *transvaalicus*, Purc., in that the caudal segments are less granular laterally and the accessory crest of the 5th segment is less strongly developed, and not sharply spinose as in *transvaalicus* ; it approaches *planicauda*, var., *frenchi*, Purc., in the granulation on the upper surface of the 2nd caudal segment, but differs from that species in that the hinder portion of the superior crest of the 5th caudal segment is stronger, whilst the sides of the tail are less granular than in *capensis*, and lastly the 4th caudal segment is markedly wider than the first, which is not decidedly the case in *capensis*. Miss Wilman has it from several localities in the western Kalahari, viz. Kyky, Nosop, and Molopo north of Zwart Modder : typical, except for a small specimen in which the tail was olive green, the legs and pedipalp yellow, and the accessory crest of the fifth caudal segment sharp and conical, as in *transvaalicus*.

Parabuthus transvaalicus, Purc. (Ann. S. A. Mus., 1, 434 and 2, 162).

Francistown (Bro. J. H. Power), Serowe (S. Blackbeard), Hectorspruit (Transvaal Mus.).

Parabuthus granulatus, H. and E.

Victoria West (P. D. Morris): Miss Wilman took it in the western Kalahari at Kyky, Molopo north of Zwart Modder, Lower Molopo and Nosop River.

Parabuthus capensis, H. and E. (*neglectus*, Purc.). (See Ann. S. African Mus., 2, 155 also Kraepelin in Schultze's collection.)

Victoria West (P. D. Morris).

Parabuthus planicauda, Poc.

Cathcart (F. A. O. Pym): the most eastern record known: common at Grahamstown but apparently not found at Kingwilliamstown.

Uroplectes planimanus, Karsch.

Serowe, Bechuanaland (S. Blackbeard).

Uroplectes vittatus, Thor.

Serowe (S. Blackbeard), Newington, E. Transvaal (Dr. J. P. Fenoulhet).

Uroplectes formosus, Poc.

Newington, E. Transvaal (Dr. J. P. Fenoulhet).

Uroplectes alstoni, Purc. (Ann. S. African Mus., 2, 180.)

Kimberley (Bro. J. H. Power). I am not absolutely certain regarding the identity of the material which belongs to the *carinatus* group, and may just possibly be *karroicus*. However

I am inclined to follow Kraepelin in regarding these several forms merely as varieties of *carinatus*: but in any case, though the differences between them are slight, it is quite possible that they will prove to be fairly constant.

Hadogenes whitei, Purc. (Ann. S. African Mus., 1, 436.)

Described from Brakkloof, near Grahamstown: we have other specimens from Fish River Rand (Mrs. G. White) and Alicedale (Mr. W. Austin).

Hadogenes, sp.

We have female specimens of what appears to be an undescribed species from Cradock (Mr. P. O'Connor) and from Tarkastad (Port Elizabeth Mus.).

Opisthopthalmus breviceps, Poc. (Ann. Mag. Nat. Hist., 6, 17, 244.)

This was described 15 years ago from two male examples labelled South Africa, and has not been recorded since. It proves to be an Eastern Province species, and is known to me from Grahamstown, Brak Kloof (Mrs. G. White), Kentucky Farm, Fish River (M. Fletcher), Dikkop Flats (Miss. J. Harris), Groote Vlakte, Somerset East Dist. (B. Marais), and the Port Elizabeth Museum has specimens which were probably taken near Port Elizabeth.

The female has the following characters: cephalothorax quite smooth except for a little fine granulation at the sides, no Y shaped fork of the median groove: terga smooth and polished with a little granularity on the posterolateral corners, the seventh tergum entirely granular in its hinder half: sterna smooth and polished, except the last one, which is obscurely rugulose throughout, and more faintly so on the binder portions of the two preceding segments: first caudal segment smoothly rugulose below, the median groove quite absent or almost so, the inferomedian keels merely indicated as the inner margin of the inferolateral groove: in succeeding segments the median groove is present, but the infero-median keels are weak in segment 2, but forming in segment 5 a single sharply defined row of granules: upper caudal crests granular, terminal tooth slightly enlarged in segment 3, the sides of the cauda sparsely granular in every segment (except the vesicle): vesicle smooth below except for a few coarse granules at the base: hands very broad, cordate at the base, the upper surface convex, thickly covered with small, low, rounded and smooth elevations which become more granular distally, the secondary keels only represented by dark lines, the finger keel strong, the outer surface of the hand coarsely granular without a secondary keel, the breadth of the hand much exceeding the length of the hand-back: superior lobe of tarsi shorter than the lateral lobes, 2 external spines below tarsi: pectinal teeth 12 to 15. A stridulating organ on the inner surface of the basal joint of each mandible is present. Measurements in millimetres: total length 95; cephalothorax length 13, breadth 12: tail, including vesicle 44: first two caudal segments 10.5: fifth caudal segment 9.5: breadth of hand 12: length of handback 7 Colour: abdomen and sides of cephalothorax deep reddish brown, the interocular area yellowish: legs yellowish: hands yellow in the expanded basal part, elsewhere brown. This species appears to be very near *nitidiceps*, Poc., which has been recorded by Purcell from Port Elizabeth and from Dunbrody and of which the adult male is unknown. The females seem to be distinct in that the vesicle is granular anteriorly below for a considerable extent in *nitidiceps*, and the infero-median keel of the first caudal segment is distinct in that species: also in *nitidiceps* the scape of the pectines is free of teeth at the base for a distance about equalling one-third of its length, but hardly so much so in *breviceps*, I have not seen any examples of *nitidiceps*.

Opisthopthalmus latimanus, C. L. Koch.

Fort Beaufort: Glen Lynden (Bedford Dtstrict). The Albany Museum has several male examples of this species which were labelled by Mr. Pocock as *pugnax*. No doubt Pocock's records of *pugnax* from Eastern Cape Colony were based on these incorrect identifications.

Opisthopthalmus austerus, Karsch.

Victoria West (P. D. Morris).

Opisthopthalmus pictus, Krpln.

Kimberley (Bro. J. H. Power), Modder River (F. A. O. Pym), It was originally recorded from the Free State (Reddersburg). The species is known to me from Redhouse (Mrs. T. V. Paterson) and is recorded by Dr. Purcell from Port Elizabeth and Dunbrody; it is not known to occur in the central parts of Cape Colony.

Opisthophthalmus wahlbergi, Thor.

Kyky and Lower Molopo in the Western Kalahari (Miss M. Wilman): agrees best with the colour variety *gariepensis*, Purc.

Opisthopthalmus carinatus, Pet.

Kimberley (Bro. J. H. Power): Miss Wilman took it in the Western Kalahari at Kyky and Lower Molopo.

Opisthacanthus validus, Thor.

This occurs on the south and east coasts and neighbouring districts. The species has various forms which were regarded by Kraepelin and originally by Pocock as of minor importance, but afterwards (Ann. Mag. Nat. Hist. 7. 3. 412) they were awarded specific rank by Pocock, who applies the name *validus* to the Natal form, *asiaticus* Keys. to the Port Elizabeth form, and *fulvipes*, Poc. to the Basutoland form. He separated *fulvipes* from *validus* by the following characters: the brachium and hand of *fulvipes* flatter and much less coarsely sculptured, the reticulation finer and more evidently punctured: the vesicle distinctly higher and the granulation much coarser: the pectines much longer as compared with their basal width: and whilst *fulvipes* has the tarsus of the fourth leg armed below with 4 spines behind and 3 in front, one of the spines being on the inferior distal angle, *validus* has 3 spines behind and 2 in front with a bristle on the inferior distal angle. He states that *asiaticus* is a distinct species but does not give the distinguishing characters. These distinctions do not appear to me to be of specific importance, and the last mentioned character I have found very variable in specimens from the same locality. The form (*asiaticus*) which occurs at East London, Pirie, Port Elizabeth and Grahamstown is structurally very like the variety which occurs on the high veld, Transvaal (Doornkop, near Belfast, Mr. R. Gerhardt), differing chiefly in its larger size and stouter proportions, though the hands of the Doornkop form are a trifle shorter relatively as well as absolutely: the low country form (*asiaticus*) usually has much paler legs, but examples of *asiaticus* from Pirie (Rev. R. Godfrey) have dark legs. The Natal form certainly differs from *asiaticus* in the coarser reticulated sculpturing of the hands and on this account may rank as a distinct variety, but it has very much in common with *asiaticus*: whether it is correct to reserve the name *validus* for this form does not seem certain seeing that Thorell's type of *validus* came from Caffraria and may have been *asiaticus*.

The variety *asiaticus* reaches a total length of 85 mm.; total length of hand 21 mm.; the small form from Doornkop may reach a length of 75 mm.; total length of hand 17 mm. This latter form is probably the same as *fulvipes*, but the legs are dark brown, not yellowish red as is described in *fulvipes*.

Opisthacanthus capensis, Thorell.

This species has long been overlooked as it was supposed to to be merely a form of *validus*, but in reality is quite distinct. Its distinctive characters are: vesicle with two strong rows of granules below on either side: external surface of tibia as well as femur of the walking legs granulated; cephalothorax finely granular in front as well as behind; superior prominence on anterior surface of brachium very strong: the tarsus of fourth leg inferiorly with 4 spines behind and 3 in front, in each case with a strong bristle in addition at the inferior distal angle: the upper and lower surfaces throughout are very dark almost blackish, the known vesicle being dark brown. Total length 67 mm. Only to me from Knysna (J. H. Rex).

Opisthacanthus rugulosus, Poc.

The type was described from Ishiromo, Nyasaland. Known to me from Serowe (S. Blackbeard), Makowe (F. Suter, Durban Mus.), E. Zululand (Natal Govt. Mus.), and there are some large examples in the old collection of the Transvaal Museum. These

South African specimens differ from the type described by Pocock (Ann. Mag. Nat. Hist. 6. 17. 314) as follows: there are usually 8 pectinal teeth (6 in the type), but the number varies from 7 to 9 : the supero-anterior crest on the humerus is weak, whereas in his key Pocock includes *rugulosus* under a heading "crest on humerus very strong": the 4th tarsus is usually armed below with 3 outer and 3 inner (4 in type) spines the inferior angles being occupied by bristles. Total length 85 mm. The South African form may be worthy of varietal rank ; but Pocock presumably refers to this form when he records *rugulosus* from Barberton (Ann. Mag. Nat. Hist. 7. 1. 309).

Opisthacanthus asper Pet. (*laevipes*, Poc.)

The type locality for *laevipes* is Sheba mine and it occurs at Barberton (Transvaal Mus.). Kraepelin places it as a synonym of the East African species *asper* which was recorded from Barberton by Mr. Pocock. This species and *validus* were both recorded from Pretoria (W. L. Distant's coll.) by Pocock, but the records may be doubted.

Opisthacanthus africanus, E. Sim.

A tropical species recorded from Durban (Das. Tierreich) : perhaps an error as this is the only known S. African record.

Cheloctonus crassimanus, Poc.

Described from East London and recorded by Pocock from Caffraria, Natal and Basutoland. Known to me only from Kingwilliamstown (F. A. O. Pym).

Cheloctonus anthracinus, Poc. (Ann. Mag. Nat. Hist. 7. 3. 413.)

Described from Griqualand West. The Durban Museum has a specimen from Entree Siding, Standerton (W. H. Bennett) and several other examples of unknown locality. The Transvaal Museum has a juvenile example from Pietermaritzburg (H. A. Wager). The supero-anterior crest on the brachium is ill defined and represented by a few scattered granules ; the vesicle is smooth below and rather globular. It may be that the Natal specimens which were originally referred by Pocock to *crassimanus* are really *anthracinus*, if indeed these two forms should be specifically separated.

Cheloctonus jonesi, Poc.

Hectorspruit, Woodbush, and Shilowane (Transvaal Mus.); Newington, E. Transvaal (J. P. Fenoulhet); type from the Murchison range. Recorded by Mr. Pocock (W. L. Distant's Coll.) from Pretoria, but this probably is an error.

Cheloctonus intermedius, sp. nov.

Very like the Doornkop form of *Opisthacanthus validus* in general appearance, but differing therefrom in the generic character, having only one row of granulation on the cutting edge of the movable claw. From *jonesii* and *crassimanus* it differs in that the upper surface of the hands is flattened rather than rounded, the supero-anterior crest on the humerus is much stronger, the vesicle has a double row of granules inferiorly and is rather more flattened laterally, the upper surface of the cephalothorax anteriorly is more flattened. It appears to be closely related to *glaber* from German S. West Africa, but I have seen no material of that species. According to the description *glaber* has the vesicle obsoletely granular, not punctured whereas in *intermedia* there are 2 (or 4) rows of granules inferiorly and the surfaces are finely punctured: also, in *glaber* the cephalothorax is almost smooth excepting near the eye tubercle and at the sides where it is finely granular, whereas in *intermedia* it is finely granular throughout, excepting anteriorly where it is punctured. The hands are about as broad as the length of the hand back, the upper surface slightly convex and rather coarsely sculptured, and the fingers are lobed: the femora of the walking legs are finely granular externally: the inferior distal angles of the tarsi are armed with bristles: sides of the 5th caudal segment punctured, not granular: pectinal teeth 5 or 6. The upper surfaces, legs included, are dark olive green or brown, the vesicle being pale brown. Total length

69 mm. Type from Lydenburg (F. Noomé); in the Transvaal Museum. In the same collection is an immature specimen labelled Pretoria, 1897, which is probably this same species. I regard this species as intermediate between the two genera *Cheloctonus* and *Opisthacanthus*, for though its claw character is like that of *crassimanus* or *jonesii*, in most other respects it resembles *validus*.

The various South African species of *Cheloctonus* and *Opisthacanthus* may be recognised by the following key:

Cheloctonus.

Movable claw with a single row of granular teeth along its cutting edge.

1 humerus of pedipalp with no upper crest on its anterior side; upper surface of hand rounded: vesicle not granular inferiorly: legs pale: total length 85 mm. *C. jonesi*, Poc.

2 superoanterior crest on humerus of pedipalp rather weak but distinct: upper surface of hand rounded and forming a very obtuse angle with the hand back: vesicle not granular: hand and brachium very densely punctured, reticulately marked, but almost smooth: inner portion of upper surface of hand distinctly granular: legs dark: total length 56 mm. *C. crassimanus*, Poc.

3 differs from *crassimanus* thus: "upper side of brachium and hand much more closely sculptured, ornamented with thick smooth ridges and scarcely visibly punctured: black all over except the vesicle which is ferrugineous:" total length 54 mm. *C. anthracinus*, Poc.

4 supero-anterior crest on humerus of pedipalp distinct: upper surface of hand flatter, forming an angle of about 110° with the hand back: vesicle not punctured, weakly granular as also is the side of the fifth caudal segment: total length 66 mm. *C. glaber*, Krpln.

5 supero-anterior crest on humerus of pedipalp strong: upper surface of hand only slightly convex: vesicle with a double

row of granules inferiorly, the surface punctured as also the sides of the fifth caudal segment : total length, 69 mm.
C. intermedia, sp. nov.

Opisthacanthus.

Movable claw with a double row of thick granules along its cutting edge.

1 Upper surfaces of pedipalp covered with isolated rugosities : supero-anterior crest on humerus rather weak : a bristle on the inferior distal angle of the tarsi : femora granular externally : cephalothorax rather coarsely granular throughout. *O. rugulosus*, Poc.

2 supero-anterior crest on humerus strong : femora externally punctured, not granular : a strong spine on the inferior distal angle of the tarsi : pectinal teeth 8–10 : total length, 105 mm. *O. asper*, Pet. (*laevipes*, Poc.).

3 supero-anterior crest on humerus strong : femora externally granular : pectinal teeth 5–7. *O. validus*, Thor.

a. hands large and rather coarsely sculptured ; height of vesicle less than carinate portion of lower surface of first caudal segment : inferior distal angle of fourth tarsus armed with a bristle. var. *typicus.*

b. hands less coarsely sculptured, only reaching a length of 17 mm. : height of vesicle equal to length of carinate portion of first caudal segment : inferior distal angle of fourth tarsus armed with a weak spine or strong btristle. var. *fulvipes*, Poc.

c. stouter and larger than *b*: upper surface of hand smooth, excepting on the inner side, and reaching 21 mm. in total length : inferior distal angle of fourth tarsus armed with a bristle. var. *asiaticus*, Keys.

4 supero-anterior crest on humerus strong : femora and tibiae granular externally : vesicle with 2 strong rows of granules inferiorly : tarsus of fourth leg inferiorly with 4 spines

behind and 3 in front, in addition to which both in front and behind, a strong bristle at the distal angle.

O. capensis, Thor.

5 differs from all the preceding, thus: cauda, smooth and glossy, inferiorly much less strongly crested, the inferior keels of segments 1–3 quite wanting, the superior crests in segments 1 and 2, smooth and without granules: abdomen and cauda densely punctured. Vesicle granular below: pectinal teeth 5–7. *O. africanus*, Sim.

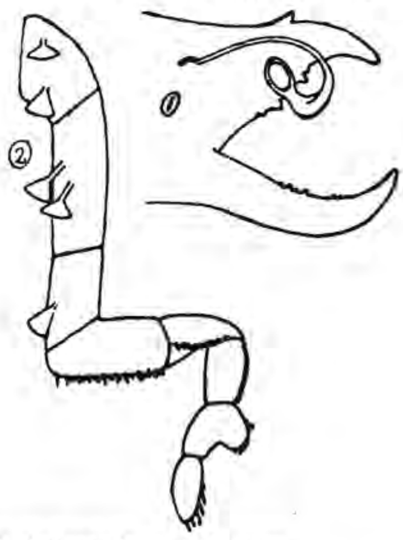
Description of a new species of Chelypus (Solpugidae).

By J. Hewitt.

Chelypus lennoxae, n. sp.

Along with a collection of scorpions obtained by Miss Wilman in the Kalahari, I find a single male specimen of a *solpugid* belonging to the family *Hexisopodidae*, which approaches in many respects *Chelypus barberi*, Purc. (Ann. S. A. Mus., 2, p. 223), and no doubt must be included in the same genus there-

CHELYPUS LENNOXAE, n. sp.



(1) Left chelicera from medial side.
(2) 4th left leg from below.

with, though it appears to be a very distinct species. The new species may be distinguished from *C. barberi*, Purc., as follows:

Chelicerae.

The dorsal surface of the upper finger with only one large black tubercle, and the terminal fang with no large basal tubercle on the inner side above. The large smooth area on the inner surface is marked with fine furrows, arranged more or less in continuous longitudinal lines but somewhat interrupted and obliquely disposed below.

Pedipalpi.

Sides and lower surfaces of tibia without stout spines, with the exception of one long one distally situated below: the upper surface of the tibia, hairy, with only a few abbreviated granuliform spinules.

Third leg.

Distal segment of claw less than half the total length of the claw ($\frac{1}{3}-\frac{2}{5}$) and distinctly marked off from the larger proximal segment: tibia dilated, but not so thick as the distal femoral segment, their posterior surfaces covered with short spinules.

Fourth leg.

The three distal segments are broad and flattened, but the tibia and tarsus are each longer than wide, the tibia being broader than the tarsus. The metatarsus has a large rounded lobe projecting externally and densely covered with short spinules.

Colour.

Reddish brown to dark brown: almost black on the lateral surfaces of the thoraco-abdomen.

Size.

Total length about 14 mm. Seeing that *C. barberi* has a total length of 30 mm, this specimen may be immature, but it has 5 malleoli on the hind leg, whereas, according Dr. Purcell, *Hexisopus* has only 3 malleoli in the young and 5 in the adult.

Locality.

Upington, Nov., 1911. Type in the Alexander McGregor Museum, Kimberley. The species is named in honour of Miss Hester Lennox, who accompanied Miss Wilman on the Kalahari expedition. *Hexisopus fodiens*, Sim., was described from the Kalahari, but the only known specimen, a female, though just about the same size as *lennoxae*, had only 3 malleoli on the hind limb, the metatarsus of which, moreover, is not modified in the same way.

*On Some Kainozoic Shells from South Africa.

By R. BULLEN NEWTON, F.G.S.
(Of the British Museum—Nat. Hist.—London)

[PLATES XVII.—XXIV.]

1. Introduction.

In the early part of the present year (1912), Mr. John Hewitt, Director of the Albany Museum, Grahamstown, South Africa, forwarded to the writer, at the British Museum (Natural History), a small collection of marine Kainozoic Mollusca, chiefly Pelecypoda, which had been obtained by Prof. Schwarz and his pupils from the limestones of Redhouse, situated in the Zwart Kops River district of South Africa and a few collected by the late Dr. W. G. Atherstone at Coerney, north of Redhouse, with a request that the specimens might be identified : more recently a further collection from Redhouse, presented to the Albany Museum by Mrs. T. V. Paterson, was also submitted for identification. As it was thought that bare determinations would be of little scientific value to the authorities of the Albany Museum, it seemed advisable to prepare a special report on the subject which might be utilized in the future for the encouragement of more systematic work towards correlating the various Kainozoic beds of South Africa than that hitherto attempted. From a study of the literature on these deposits as also of valuable material in the British Museum collected by Bain, Atherstone, &c. from the same, it is probable that such beds are divisible into two sections representing an older and a newer series. The newer or youngest beds appear to be those occurring at Knysna, Shark's River, Klein Brak River, Port Elizabeth, and Keurboom's River, which contain mollusca (according to Messrs. E. A. Smith, Crawford, Becker, and Farquhar) belonging entirely to recent species, and which may, therefore, be safely regarded as of Post-Pliocene age. In the same category might be included the deposits at Great Fish River, Kowie, Van Staaden's River, Mossel Bay, Cape Town (Lion's Head), which from Bain's account of 1856 were stated to be full

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of shells referable to species common to the Indian and Atlantic Oceans. From a study of Stow's report of 1871 it is possible that the Ferreira's River and Zwart Kops Bridge beds are of similar age, although no authentic determinations of the shells are at present available for systematic comparison. The older beds would appear to be those of the Zwart Kops region referred to by Stow in 1871 as "Pliocene limestone," and which are characterised by such genera as *Glycymeris* (= *Pectunculus*), *Melina* (=*Perna*), *Tivela*, *Cardium*, &c. A similar fauna may be present in the shelly limestones of Addo Hills mentioned by Dr. Rogers in 1906 which occur at a height of 1,300 feet although at present there is no molluscan evidence for this supposition. Such a fact is possible, however, because north of that locality at a place known as Coerney are certain shelly breccias rising to 600 feet which may represent the same beds as at Addo Hills, containing *Tivela baini* (n. sp.), and *Cardium edgari* (n. sp.), both forms likewise occurring in the Zwart Kops and Koega River limestones, as also in the rocks of Redhouse. There is evidence also, that the upper part of the Need's Camp formation near East London, represents the most easterly extension of these older Kainozoic deposits because of the occurrence of the large "*Perna* sp." described by Mr. H. Woods, which is identical with the *Melina cf. gaudichaudi* from Redhouse and intermediate localities as mentioned in the present paper.

There can be little doubt that the Redhouse limestones were of contemporaneous deposition with those of Bushman's River, Koega River, Zwart Kops River and Coerney as most of the species occur at Redhouse.

One of the more interesting Redhouse shells is *Melina cf. gaudichaudi*, which comes also from the limestones of Koega River and Bushman's River, while *Glycymeris pilosa*, *Tivela baini* and *Cardium edgari* are common to all three localities. The species of *Melina*, as explained later, resembles most strongly that known as *gaudichaudi* which is characteristic of the Miocene of Chili in South America. Again, *Glycymeris pilosa*, which is an abundant fossil of these beds and sometimes referred to in this particular literature as the "large *Pectunculus*," occurs in the Helvetian and

Tortonian stages of the Miocene, and the Pliocene of Europe, besides existing in the Mediterranean at the present day. The relationships of *Cardium edgari* are with the recent species, *Cardium maculatum* of the North Atlantic; with *Cardium grande* of the Miocene beds of South America (Chili); and with *Cardium Kubecki* found in the Austrian and German Miocene rocks. It is important to mention that the Redhouse and neighbouring rocks may be correlated with the "Alexandria Formation" of Professor Schwarz, which extends from near Port Elizabeth to the upper beds of Need's Camp, near East London, a distance of some one hundred and fifty miles. [This formation is again alluded to under *Melina cf. gaudichaudi.*]

TABLE SHOWING THE DISTRIBUTION OF THE SOUTH AFRICAN OLDER KAINOZOIC MOLLUSCA OF THE PRESENT COLLECTION.

Genera and Species.	Redhouse	Zwart Kops River	Koega River	Coerney	Bushman's River	Need's Camp (Upper Beds)	Recent Seas
OSTREA ATHERSTONEI	×	×					
OSTREA REDHOUSIENSIS	×						
MELINA CF. GAUDICHAUDI ...	×		×		×	×	
GLYCYMERIS PILOSA	×		×				×
CHAMELEA SCHWARZI	×	×					
CHAMELEA ROGERSI	×						
VENTRICOLA VERRUCOSA ...	×						×
TIVELA BAINI	×	×	×	×			
CARDIUM EDGARI	×	×	×				
MACOMA ORBICULARIS	×						×
TELLINA CF. PERNA	×						×
SCHIZODESMA SPENGLERI ...	×						×
VOLUTA AFRICANA	×						×
BULLIA ANNULATA	×						×
MELAPIUM PATERSONAE	×						
PIRENELLA STOWI	×						

The faunistic facies presented by this series of fossils, includes a part resemblance to the Mio-Pliocene species of South America and Europe, as well as a relationship to Atlantic or Mediterranean species. Therefore, the Redhouse and associated limestones would appear to belong to a somewhat late horizon of the Tertiary period, which might be referred to either the younger Miocence or the Pliocene system according to the European standard of geological nomenclature; or, in other words, these deposits might be recognised as of Mio-Pliocene age.

In support of this suggested geological age for the mollusca described in this paper, it may be of interest to examine briefly certain Kainozoic vertebrate evidence connected with South Africa, which seems to offer some confirmation as to the presence of a similar horizon in the Transvaal.

Some few years ago Prof. Dr. Beck of Freiberg called attention to the discovery of an authentic molar tooth of a mastodont animal in the diamantiferous gravels of the Vaal River, near Kimberley, which was determined by Dr. Johannes Felix as *Mastodon sp.* of the sub-division *Bunolophodon*, the age of the specimen being regarded by Dr. Beck as Pleistocene (*Geol. Mag.* 1906, p.p. 49, 50). The specimen was further studied by Dr. E. Fraas, who relegated it to the older deposits of that period (*Zeitsch. Deutsch. Geol. Ges.*, 1907, Vol. 59, p.p. 232–243). Now, although such river gravels as were here referred to, would undoubtedly belong to quaternary times, it need not follow that all the fossils found therein would be of similar horizon, because, speaking generally, organic remains occuring under such conditions would be of remanié character and, therefore, most probably of various ages. Hence, the gravels would be expected to contain both derived and contemporaneous material, a fact which is borne out by the association of some further organic remains with the Mastodont molar. These included relics of *Hippopotamus* and zebra (=*equus*) belonging to the present day fauna, as well as numerous examples of the well known Pelecypod genus, *Iridina*, now living in African fresh waters, all of which would be contemporaneous with the gravels themselves. The Mastodont fossil should be regarded, however, in a different category, as it cannot be mistaken for a part of the existing fauna; it must be treated as of considerably greater age than the *Hippopotamus*, the Zebra and the *Iridina*, and therefore its occurrence would suggest a derivation from older deposits than that of the gravels, representing in all probability a Miocene or Pliocene horizon. The beds from which the specimen was originally obtained may even form an extension of the same series of deposits which have yielded the mollusca described in this paper, and it is quite possible that at some future date Mastodont remains will be found *in situ* somewhere in this region of South Africa. Up to the time of this interesting discovery, Mastodonts were only known in Africa from the northern areas of the country. Gaudry referred to their occurrence in Tunisian rocks, which he regarded as equivalent in age to the Sansan Beds of France (*Mém. Soc. Geol. France*, 1891. Palæont. Mém., No. 8) and therefore that part of the Miocene Period which comes between the Burdigalian and the Helvetian. From a nearly similar horizon of the Miocene, viz.: the Carteunian (=Burdigalian), Professor Depéret (*Bull. Soc. Geol. France*, 1897, Ser. 3, Vol. 25, p. 518) recorded the occurrence in the Kabylie region of Algeria of *Mastodon angustidens*, a species representing the type of Cope's *Tetrabelodon*. Lastly, to Dr. C. W. Andrews, science is indebted for having recognised the same species in the Burdigalian beds of Moghara in Egypt (Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, 1906. Introduction, p. xi.), as also for his discoveries among the Upper Eocene deposits (Bartonion) of the Egyptian Fayum which have yielded the genus *Palæomastodon*, regarded as the ancestral representative of Mastodont animals. It would seem that European and Asiatic remains of Mastodonts are also found distributed throughout the Miocene and Pliocene formations, after which they became extinct. In North America, however, their distribution extended from Miocene to Post-Pliocene times, while South American forms appear to have been restricted to the late Pliocene and still younger deposits. From this, glance at the distribution of the Mastodonts, it is evident that the old world examples belong characteristically to Mio-Pliocene times, A further point of geological interest based upon vertebrate remains, was the record recently made by Dr. Andrews, concerning the discovery by Mr. C. W. Hobley of *Dinotherium* bones in some deposits at Karungu, Victoria Nyanza, which proved the existence in that region of rocks belonging to the Burdigalian stage of the Miocene period (*Proc. Zool. Soc.*, 1911, p.p. 943-945; *Journ. East Africa Uganda Nat. Hist. Soc.*, 1912, Vol. 2, No. 4, p. 112).

In concluding these general remarks, it is strongly urged that the greatest care should be exercised in field collecting. Every specimen requires to be properly marked as to its position in a bed or series of beds, and such marks should correspond with similar ones made on properly constructed plans or sections of each collecting area. In this manner the relationships of the various deposits would appeal to the palæontologist when studying the fossils, and so ensure a greater accuracy in his determinations. The collecting of fossils on a thoroughly scientific basis is probably of more importance among the numerous beds of the Kainozoic rocks than among some of the older deposits, but without strict attention to every detail, the work of systematic correlation will be impeded.

Finally, in the preparation of this account, the writer wishes to acknowledge with many thanks, the interest and assistance received from Professor E. H. L. Schwarz of South Africa, Mr. Henry Woods of Cambridge, and Mr. Edgar A. Smith of the British Museum.

2. Literature.

The Rev. W. B. Clarke was one of the first observers to recognise the presence of elevated beaches in South Africa containing marine shells belonging to existing species. He noted this phenomenon under the Lion's Head at Cobler's Hole, near Capetown, 400 feet above the level of the sea [Proc. Geol. Soc., London, 1841, Vol. 3. No. 76, pp. 418-423], but the paper included no determinations of the mollusca, The occurrence of a white calcareous rock in the Eastern Province and at Mossel Bay, was noted by A. G. Bain in 1856, containing "many specimens of mollusca at present inhabiting the neighbouring seas," but without determinations, which were regarded as probably of Pliocene age. Bain further alluded to the superficial deposits of South Africa represented by raised beaches varying from 20 to 300 feet above sea level, in which marine shells were found belonging to species common to the Indian and Atlantic Oceans (Trans. Geol. Soc., London, 1856, Ser. 2. Vol. 7, p. 185). Such deposits were found at Great Fish River, Kowie, Port Elizabeth, Van Staaden's River (25 miles W. of Port Elizabeth), Mossel Bay and Lion's Head, Cape Town.

During 1871, G. W. Stow published (Quart. Journ. Geol. Soc., 1871, Vol. 27, pp. 515-522 & 547) observations on the limestones covering the older rocks extending from the Zwart Kops to Port Elizabeth, which abounded with perfect and fragmentary shells, of which only a small percentage occurred in adjacent seas; some localities had yielded immense deposits of a large species of Oyster—such limestones were regarded as of Pliocene or Post-Pliocene age. The genera *Pectunculus* and *Perna* were mentioned (p. 547) as present in the "Pliocene limestone" of the Zwart Kops. The coastal Beds near Port Elizabeth with a profusion of *Akera* were scheduled as the oldest of the more recent formations; then came those at Ferreira's River with *Loripes*, *Tapes*, *Solen*, *Mactra*, *Cordium*, etc., succeeding which were the raised beach deposits, with broken shells, near the mouth of the Zwart Kops River; followed by the shell bank at Zwart Kops Bridge with "a large and characteristic *Panopoea*," *Tapes*, *Solen*, *Mactra*, etc.. on the top of which occured the "Red Clay" deposit, this being succeeded by the newest of the shell formations which contained mollusca belonging entirely to the South African coast.

In his account of an extinct ruminant cranium (*Bubalus Baini*) from the alluvial deposits of the Modder River, Transvaal, South Africa, at a depth of 40 feet below the surface, the late Professor H. G. Seeley referred to certain marine Tertiary limestones at Bathurst from 300 to 400 feet above sea level containing teeth of *Carcharodon* and *Lamna*, and shells of

Turritella, Ostrea, Donax, Lucina. These shells were stated to be preserved in the Albany Museum (*Geol. Mag.* 1891, p. 199).

Professor E. H. L. Schwarz reported on the district of "Knysna", in which reference was made to some greenish sandy beds found in the estuaries of the Knysna and Bitou Rivers having a depth of more than 47 feet in places, containing recent shells determined by Mr. E. A. Smith of the British Museum, the commonest of all being *Cryptodon globosus* (Cape of Good Hope, Dept. Agriculture, Ann. Rep. Geol. Commission 1899 : 1900 p. 61). The species were listed as follows :—

PELECYPODA.

Chione Kraussi, Deshayes.
Cryptodon globosus, Forskål.
Dosinia hepatica, Lamarck.
Gastrana abildgardiana, Spengler.
Loripes clausus, Philippi (=*lactea*, G. B. Sby.)
Macoma calcarea, Chemnitz.
Mactrinula ovalina, Lamarck.
Ostrea cucullata, Born.
Solen.

GASTROPODA.

Nassa kraussiana, Dunker.
Natica imperforata, Gray.
Turritella knysnaensis, Krauss.

In a correlation chart of South African formations, Dr. G. S. Corstorphine introduced the term "Albany Formation" for the "Tertiary Beds", but with no explanation in the text (Rept. South African Assoc. Adv. Sci., Johannesburg, 1904). He mentioned it under the name of A. Moulle, although the memoir of that author (Ann. Mines, 1885, Ser. 8, Vol. 7, pp. 216, 217) is without reference to such a group of rocks. The only inference, therefore, is that Corstorphine must have been the originator of the so-called, "Albany Formation," which, if adopted by South African geologists, its limitations should be accurately stated.

A list of raised beach mollusca found above a terrace of quartzite at Shark's River and the Creek, Algoa Bay, was given by Mr. J. P. Johnson in 1904 (Trans. Geol. Soc. South Africa, 1904, Vol. 6, p. 9). The species were identified by Mr. Crawford as follows, the commonest being *Cominella porcata*, and *Loripes flexuosus* :—

PELECYPODA.

Arca obliquata, Gray.
Cardium fasciatum, Montagu.
Donax oweni, Gray.
Dosinia lincta, Pulteney.
Gastrana abilgardiana, Spengler.
Lima hians, Gmelin.
Loripes flexuosus, Montagu.
Lucina lactea, Lamarck, sp.
Lutraria oblonga, Chemnitz.
Mactra capensis, G. B. Sowerby.
Mactra decora, Deshayes, sp.
Modiola lignea, Reeve.
Mytilus meridionalis, Krauss.
Pecten capensis, Gray.
Pholas dactylus, Linnaeus.
Solen marginatus, Koch.
Tellina littoralis, Krauss.
Tellina rosea, Spengler.
Venus verrucosa, Lamarck.

GASTROPODA.

Ancilla obtusa, Swainson.
Ancilla cinnamomea, Lamarck.
Bulla ampulla, Linnaeus.
Bullia annulata, Lamarck.
Bullia laevigata, Martini.
Bullia semiusta, Reeve.
Cassis achatina, Lamarck.
Cerithium vulgatum, Linnaeus.
Cerithium Kochi, Philippi.
Columbella albuginosa, Reeve.
Columbella cerialis, Menke.
Cominella porcata, Gmelin, sp.
Cominella elongata, Dunker, sp.
Conus tinianus, Hwass.
Conus infrenatus, Reeve.
Crepidula adspersa, Dunker.
Crepidula hepatica, Deshayes.
Cypræa capensis, Gray.
Desmouleo abbreviata, Wood, sp.
Desmoulea retusa, Lamarck, sp.
Dolium variegatum, Küster.
Fissurella mutabilis, G. B. Sowerby
Gadinia costata, Krauss, sp.
Haliotis midae, Linnaeus.
Mangilia clathrata (?), Serres.
Marginella mosaica, G. B. Sowerby
Marginella piperata, Hinds.
Mitra capensis, Dunker.
Mitra patula, Reeve.
Nassa capensis, Dunker, sp.
Nassa Kraussiana, Dunker.
Natica didyma, Bolten.
Natica queketti, G. B. Sowerby.
Natica imperforata, Gray.
Oxystele merula, Chemnitz, sp.
Oxystele tigrina, Chemnitz, sp.
Patella argenvillea, Krauss.
Patella cochlear, Born.
Patella rustica, Reeve.
Philine aperta, Linnaeus.
Pleurotoma rosaria, Reeve.
Pomatias ligatus, Müller.
Pupillea aperta, G. B. Sowerby.
Purpura capensis, Petit.
Purpura squamosa, Lamarck.
Solidula solidula, Linnaeus, sp.
Siphonaria concinna, G. B. Sowerby
Turbo natalensis, Krauss.
Triton doliarium, Lamarck.
Trochus fultoni, G. B. Sowerby.
Turritella carinifera, Lamarck.
Trochus ponsonbyi, G. B. Sowerby.
Trochita chinensis, Linnaeus, sp.

During 1906 Dr. A. W. Rogers alluded to marine beds of "Tertiary or recent age" occurring in the Addo Hills, Grass Ridge and the flat ground between Zwart Kops and Koega Rivers, forming shelly limestones lying unconformably on the Uitenhage series. Such beds were present at various elevations, from a few feet on the shores of Algoa Bay up to some 1,300 feet on the Addo heights—it was said to be "probable that they included deposits representing a very considerable period." (10th Ann. Rept. Geol. Com.—Cape of Good Hope—1906, p. 43).

In the same year, Dr. A. W. Rogers published a list of shells found in a raised beach near Klein Brak River (west of Knysna River) Mossel Bay region, the species of which were determined by Mr. E. A. Smith (Cape of Good Hope Dept. Agriculture, 10th Ann. Rept. Geol. Commission, 1906, p. 293, with sketch map showing deposits) as belonging to recent seas. They were referred to as follows :—

PELECYPODA.

Cryptodon globosus, Forskål.
Diplodonta cf. senegalensis, Reeve.
Lima rotundata, G. B. Sowerby (large form).
Lucina liratula, G. B. Sowerby.
Lutraria capensis, Deshayes (narrow form).
Mactra glabrata, Linnaeus.
Ostrea spp.
Panopœa natalensis, S. P. Woodward.
Tapes corrugatus, Gmelin.
Tapes deshayesi, Hanley.
Tellina rosea, Spengler.
Venus verrucosa, Linnaeus.

GASTROPODA.

Bulla ampulla, Linnaeus.
Calliostoma n. sp. (?)
Cassis achatina, Lamarck.
Cerithium, n. sp. (?)
Cymatium cutaceum, Lamarck.
Cymatium cutaceum var. *doliarium*, Lamarck.
Nassa kraussiana, Dunker.
Natica imperforata, Gray.
Priotrochus obscurus (Wood).
Triton australis, Lamarck.
Turritella carinifera, Lamarck.
Turritella knysnaensis, Krauss.

In 1906, Dr. Richard Beck discovered three mammal teeth in the Diamantiferous gravels of the Transvaal on the Vaal River near Kimberley, South Africa, two of which were determined by Mr. G. A. Boulenger as belonging to *Equus* probably a zebroid species, and *Hippopotamus*, the third specimen being regarded by Dr. Johannes Felix as *Mastodon* of the subdivision *Bunolophodon*. The author stated that *Mastodon* remains had already been recorded from the younger Tertiaries of Northern Africa (Egypt, Tunisia, and Algeria), but that the present discovery of an extinct proboscidian from the Pleistocene of South Africa was of great interest. (Mastodon in the Pleistocene of South Africa—*Geol. Mag.* 1906, pp. 49, 50). *Dr. Beck's specimens were further studied by Dr. E. Fraas (Pleistocane Fauna aus den Diamantseifen von Sudafrika—*Zeitsch. Deutsch. Geol. Ges.* 1907, Vol. 59, pl. 8, pp. 232-243), who in addition pointed out that a number of Pelecypods, determined as *Iridina sp.*, were found in the same gravels.

During 1908 Mr. H. Woods described and figured some internal casts of a large *Perna* obtained from the upper part of the Need's Camp limestones, as of Cretaceous age (*Ann. South African Museum*, 1908, Vol. vii, part 1, text-figures 4-6, pp. 17, 18), which, since studying the Redhouse fauna, is clearly found to be identical with *Melina cf gaudichaudi* of the present paper, and therefore of Kainozoic horizon. [Attention is called to this fact with the full permission and agreement of Mr. Woods.]

Writing on the Alexandria formation of the South African coast, Prof. E. H. L. Schwarz included therein some of the forms of Mollusca described in the present paper mentioning especially "*Pectunculus*, several species, some gigantic," from Koega (-Coega), Uitenhage, Bushman's River, &c. (Trans. Geol. Soc. South Africa, 1908, Vol. xi. pp. 107, 113).

Messrs. A. W. Rogers and A. L. Du Toit rendered an excellent account of the distribution of the "Tertiary and Recent Deposits" of South Africa in 1909, treating of the origin of the Sand dunes, raised beaches, surface limestones, gravels, Knysna beds, &c., the last named deposits being probably of Tertiary age, although this determination was not qualified by palaeontological evidence. Mention was, also, made of the "very large *Pectunculus*" occurring in the terrace deposits of Algoa Bay, which was said to be characteristic of those beds (An introduction to the Geology of Cape Colony, 1909, Ed. 2).

*According to Prof. Schwarz: "More recently, further remains of Mastodon have been discovered in the same district, although not yet referred to in literature. See also description of Extinct Mammalia from Zululand, W. B. Scott, 3rd, Rept. Geol. Survey of Natal, London, 1907." [Ed.]

Lists of shells, belonging to living species, were published in 1910 by Prof. Schwarz, as occurring in the Pleistocene deposits of Port Elizabeth and adjacent regions (Trans. Geol. Soc. South Africa, 1910, Vol. 12, pp. 112-118). The author was of opinion that these beds, containing about 84 per cent. of living species of Mollusca. would be younger than the Pliocene and therefore equivalent in age to the Pleistocene or Glacial Drift of Europe and America. These lists under their localities were as follows, specific determinations having been made by Mr. E. A. Smith, Dr. H. Becker and Mr. J. Farquhar :—

Post-Pliocene Mollusca from Keurboom's River (about 100 miles W. of Port Elizabeth in Plettenberg Bay) and Little (Klein) Brak River, Mossel Bay determined by E. A. Smith.

PELECYPODA.

Chione Kraussi, Deshayes.
Cryptodon globosus, Forskål.
Diplodonta cf. senegalensis, Reeve.
Gastrana abilgardiana. Spengler.
Lima rotundata, G. B. Sowerby.
Loripes clausus, Philippi (= *L. lactea*, G. B. Sowerby).
Lucina liratula. G. B. Sowerby.
Lutraria capensis, Deshayes.
Macoma calcarea, Chemnitz
Mactra glabrata, Linnaeus.
Mactrinula ovalina, Lamarck.
Ostrea cucullata, Born.
Panopæa natalensis, S. P. Woodward.
Solen marginatus, Koch.
Tapes corrugatus, Gmelin.
Tapes deshayesi, Hanley.
Tellina rosea, Spengler.
Venus verrucosa, Linnaeus.

GASTROPODA

Bulla ampulla, Linnaeus.
Calliostoma n. sp.
Cassis achatina, Lamarck.
Cerithium, n. sp.
Cymatium cutaceum, Lamarck.
Cymatium cutaceum var. *doliarium*, Reeve.
Nassa kraussiana, Dunker.
Natica imperforata, Gray.
Priotrochus obscurus (W. Wood), Jonas in Philippi.
Triton australis, Lamarck.
Turritella carinifera, Lamarck.
Turritella knysnaensis, Krauss.

Post-Pliocene Mollusca from the Creek, Port Elizabeth, and Zwartkops, determined by Dr. H. Becker and Mr. J. Farquhar:—

PELECYPODA.

Cardium pulchellum. Hinds.
Cardium, turtoni, G. B. Sowerby.
Cryptodon globosus, Forskål.
Donax cf. burnupi, G. B. Sowerby.
Dosinia hepatica, Lamarck.
Gastrana abilgardiana, Spengler.
Lima rotundata, G. B. Sowerby.
Lima multicostata, G. B. Sowerby.

Loripes clausus, Philippi.
Mactra adansoni, Philippi.
Modiola capensis, Krauss.
Modiola dura var. *similis* (?), Deshayes.
Modiolaria discors, Linnaeus.
Panopæa natalensis, S. P. Woodward (large form).
Pecten (Vola) sulcicostatus, G. B. Sowerby.
Pholas dactylus, Linnaeus.
Solen marginatus, Koch.
Tapes corrugatus, Gmelin.
Tapes dactyloides, G. B. Sowerby.
Tapes auriculata, Krauss.
Tellina queketti, G. B. Sowerby.
Tellina rosea, Spengler.
Veneruois rugosa, Deshayes.
Venus verrucosa, Linnaeus.

GASTROPODA.

Acteon (Tornatella) albus, G. B. Sowerby.
Ancilla obtusa, Swainson.
Bulla ampulla, Linnaeus.
Bulla aperta, Linnaeus.
Calliostoma farquhari, G. B. Sowerby.
Calliostoma fultoni, G. B. Sowerby.
Cassis achatina, Lamarck.
Cerithium Kochi, Philippi.
Cerithium rufonodulosum, E. A. Smith.
Cerithium oscitans, G. B. Sowerby.
Columbella atrata, Gould.
Cominella lagenaria, Deshayes.
Crepidula lentiginosa, G. B. Sowerby.
Crepidula hepatica, Deshayes.
Cymatium cutaceum, Lamarck.
Cymatium cutaceum var. *doliarium*, Reeve.
Diala capensis, G. B. Sowerby.
Dolium dunkeri, Hanley.
Fissurella natalensis, Krauss.
Gibbula sp.
Mitra capensis, Dunker.
Nassa kraussiana, Dunker.
Natica imperforata, Gray.
Oxystele impervius, Menke.
Purpura scobina, Quoy.
Ringicula australis, Crosse.
Rissoina fenestrata, Krauss.
Stomatella sulcifera, Lamarck.
Stomatella articulata, A. Adams.
Triforis punctata, G. B. Sowerby.
Triton africana, A. Adams.
Trochita chinensis, Linnaeus.
Turbo cidaris, Gmelin.
Turbonilla lactea, Linnaeus.
Turritella carinifera, Lamark.

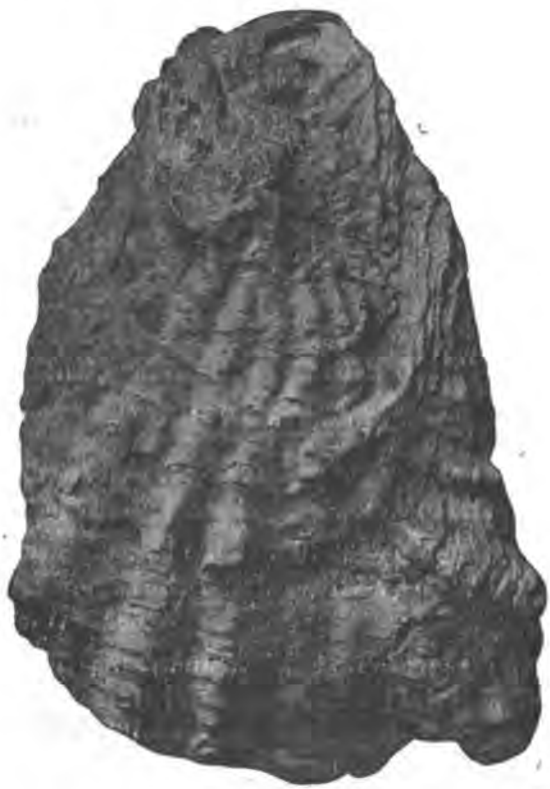
3. Description of the Specimens.

PELECYPODA.

OSTREA ATHERSTONEI, sp. nov.

(Plate XVII., figs. 1, 2. Plate XVIII., fig. 1 and Text Figure).

DESCRIPTION.—Shell robust, elongately triangular, tapering from the summit, widening gradually to the base. Lower valve moderately shallow, lateral margins more or less straight and oblique; ligament area produced, excavated, varying in width, sometimes narrow; adductor scar large, antero-central, transversely oblong, concentrically ridged, vertically striated; outer surface furnished with elevated lamellose, radial plications, often distant, broadening in the ventral direction and occasionally bifurcating. Upper valve depressed, non-plicated, sometimes undulating, margins more or less regular; ligament region narrow oblong; adductor scar large, antero-central, sometimes excavated above, surface marked as in lower valve; external aspect finely lamellose, coarser ventrally.



OSTREA ATHERSTONEI, sp. nov. (Nat. size).
External form of a lower valve showing the radial and somewhat distant lamellose costæ; from the Zwart Kops River district.
[Original in British Museum collection.]

REMARKS.—The characters here referred to apply not only to the specimens figured, but also to certain valves in the British Museum collection obtained from the Zwart Kops River district by the late Dr. W. G. Atherstone, to whom the species is dedicated. The general form is somewhat variable although mostly trigonal with a more or less pointed summit region. The contour, together with the lamellose and more or less distant plications suggest a close relationship with Pliocene oysters from Southern Europe, and particularly with such forms as *Ostrea undata* of Lamarck as interpreted by Serres (Géogn. Terr. Tert., France, 1829, pl. 6, Figs. 4, 5, p. 136) and Goldfuss (Petrefacta Germaniæ, 1833, Vol. 2, pl. 78, Figs 2 e. and f., p. 18), as well as *Ostrea perpiniana* of Fontannes (Moll. Pliocène Rhône Roussillon, 1879. Vol. 2, pl. 16, Figs. 3—5, p. 224) especially his figure 4 of pl. 16, which appears to embrace the shape and sculpture details more particularly observed in the valves from the Zwart Kops River limestones, on account of their better preservation. It is highly probable that the *Ostrea cornucopia*, quoted by Prof. Schwarz from the Bathurst limestone,* may belong to this new species. (*Trans. Geol. Soc. South Africa*, 1908, p. 113).

Dimensions : Lower Valve : Length 66 mm. ; Height 90 mm.
Upper Valve : Length 82 mm. : Height 88 mm.

Localties : Opposite Redhouse ; and Zwart Kops River.

OSTREA REDHOUSIENSIS, n. sp.

(Pl. XVIII., fig. 2.)

DESCRIPTION AND REMARKS.—This species is represented by two specimens of squarish contour and of almost similar length and height, both being lower valves. The interiors are deeply excavated, each exhibiting a fairly central adductor scar-mark of great size which occupies a considerable area and is besides furnished with strong concentric ridges and obscure radial striations. The

*Unfortunately this material was not submitted to Mr. Newton. On comparing it with the description and figure of atherstonei, Prof. Schwarz believes it to be quite distinct therefrom. [Ed.]

valves are regularly and closely plicated in front, the plications being radio-vertically and equidistantly arranged and composed of closely fitting V-shaped laminae of growth, divided by similarly regular furrows. The ligmental characters are not preserved in either of the specimens, the whole of the posterior region forming a sloping attachment surface. The slightly smaller second specimen possesses very eroded costae. The regular arrangement of the costae on this species rather resembles Prof. Sacco's figure of *Ostrea edulis* var. *taurolamellosa* from the Aquitanian and Helvetian divisions of the Miocene (I Molluschi Terziarii Piemonte &c., 1897, part 23, pl. 2, fig. 6, p. 9), although that differs in representing a shell of much rounded ventral contour. This shell has not the elongate outline of the previously described species, and therefore a special specific name is thought to be advisable, that of *Ostrea redhousiensis* being suggested.

Dimensions: Length 80 mm.
(Largest valve) Height 80 mm. (about).

Locality: Opposite Redhouse.

MELINA cf. GAUDICHAUDI, ORBIGNY.

Plate XIX., figs. 1, 2.

Perna gaudichaudi, Orbigny: Voyage Amérique Méridionale, 1842, Vol. 3, part 4, Paléontologie, pl. 15, figs. 14-16, p. 131.

Perna chilensis, Conrad: J. M. Gilliss—United States Astron. Exped. Southern Hemisphere, 1855, Vol. 2, Append. H. pl. 42, fig. 7, p. 285.

Melina (*Pernu*) *gaudichaudi*, R. A. Philippi: Tertiären und Quartären Versteinerungen Chiles [Leipzig], 1887, pl. 45, figs. 2, 3, p. 207.

Perna gaudichaudi, Möricke: Versteinerungen Tertiärformation Chile, Neues Jahrb. Beilage-Band 10, 1896, p. 581.

Perna, sp., H. Woods: Annals South African Museum, 1908, Vol. vii., part 1, text-figures 4 - 6, pp. 17, 18.

REMARKS.—The original description and measurements of this South American (Chili) Miocene species stand thus : *testa oblongo-elongata, incrassata, mytiliformi ; latere cardinali, obliquato, truncato ; latere buccali recto ; latere anali, arcuato, convexo ; cardine multisulcato : sulcis angustis, distantibus.*

*Maximum dimensions : Length 140 mm. ; Height 300 mm. ; Diameter 90 mm.

In considering some fragmentary specimens of this genus from the South African Tertiary limestones in the British and Albany Museums certain details of the cardinal region will be referred to for purposes of distinction which will render necessary a comparison with three described species from the two Americas and Europe, showing closest analogy, viz.—*Perna maxillata* of Lamarck from the Mio-Pliocene Tertiaries of Italy and other parts of the European Continent, *Perna conradi* of Orbigny from the Virginian Miocene of North America, and *Perna gaudichaudi* described by Alcide Orbigny from the Miocene rocks of South America (Chili). In all these species the narrower ligament furrows are roughly about one half the width of the others; so that if a space of 1½ inches be measured along, say the central part of the cardinal surface such an area in each species would comprise so many of both wide and narrow ligament grooves—a result which may be tabulated as follows :—

maxillata	1½ inches	contains	10 wide, 9 narrow.
conradi	do.	do.	6 wide, 5 narrow.
gaudichaudi	do.	do.	3 wide, 2 narrow.
South African form	do.	do.	3¼ wide, 3 narrow.

From this comparison it is manifest that the South African species comes nearest to the South American *gaudichaudi*, which exhibits fewest ligamental divisions of the other species mentioned. The European shell (*maxillata*, Lamarck which includes *soldanii*, Deshayes) is furthest removed on account of its more numerous

*Among the British Museum specimens of this South American species, the largest shows the following measurements: Length 190 mm. ; Height 380 mm. ; Diameter (united valves) 90 mm.

grooves, 19 occupying a space of 1½ inches; the North American shell (*conradi*) possesses 11, whilst *gaudichaudi* has 5, and the present South African examples 6½, in, of course, the same space of 1½ inches.

The South African remains also approach *gaudichaudi*, in their great thickness of laminae and the considerable obliquity of the cardinal region—they also belonged to a shell of probably equal dimensions—and everything appears to suggest that their affinities are with the South American form. Moreover, it is observed that there is greatest compression in the valves of *conradi*, whereas *maxillata* possesses the medium convexity, and *gaudichaudi* the maximum, which corresponds with that obtaining in the specimens from South Africa, so far as can be conjectured from their imperfect condition. It is certain, also, that the South African specimens must be regarded as extinct and in no way connected with species found in existing seas. Limestone casts of this shell had been previously described and figured from Need's Camp under the name of *Perna* sp. by Mr. H. Woods as of Cretaceous age, which were later included by Professor Schwarz in his "Alexandria Formation," erroneously regarded as belonging, throughout, to the Cretaceous period. It was, however, clearly demonstrated at the time in Dr. A. W. Rogers' account of the Need's Camp deposits at the end of the paper by Mr. Woods, that two groups of limestones were present in that district, about a couple of miles apart, one being some fifty feet higher than the other. The lower or oldest beds, called the "Polyzoa-limestone" by Mr. Woods, contained the Polyzoa and Corals described by Mr. Lang (*Ann. South African Museum*, 1908, Vol. 7, Part 1, pl. 1, pp. 1—11), as well as forms of Echinoidea, Brachiopoda, and certain Ostreiform shells, including the upper valve of an *Exogyra* bearing an unmistakeable Cretaceous facies which were described by Mr. Woods—the whole fauna being correctly assigned to an upper Cretaceous horizon. It was, however, the upper or younger beds, called "the hard crystalline limestone" by Mr. Woods, which had furnished the examples of *Perna* sp.; and these after due consideration and study, assisted by Mr. Woods himself, together with additional suggestions from Prof. Schwarz as expressed in letters can now be regarded as identical with the shell from Redhouse and other localities. Geologically, this result is of great importance, because it proves the necessity of recognising the "Alexandria Formation" as of Kainozoic age and the consequent elimination from that series of deposits of the Cretaceous beds found also in the Need's Camp area of South Africa, but much lower down and having no connection with the later or Tertiary rocks above.

Localities: Bushman's River and Koega River (British Museum—Bain and Atherstone Collections); Need's Camp (upper beds); and Redhouse.

GLYCYMERIS PILOSA, Linnaeus.

Plate XIX., figs. 3-5,

Arca pilosa, Linnaeus: Syst. Naturae, 1767, Ed. 12, p. 1143.

Pectunculus pilosus, Hoernes: Die Foss. Mollusken Tert.-Beckens Wien—Abhandl. k. k. geol. Reichs. 1864. pls. 40 and 41, figs. 1-10, p. 316, (this work may be referred to for synonymy).

REMARKS.—This collection contains several valves of Da Costa's *Glycymeris* (=*Axinaea* and *Pectunculus* of later authors) which vary in size from 37 to 105 millimetres in length and height, both directions being of equal measurement. They appear to belong to one species, being of squarish and of fairly regular contour, deeply excavated (diameter of largest example with closed valves, 70 millimetres), and possessing prominently inflated umbonal regions. As well as the depressed costae which number between 60 and 70, the whole of the external surface is covered with microscopically fine and numerous radial striations which are furnished with an obliquely striate and a more or less punctate ornamentation, a structure particularly seen on the flanks of the younger examples. The hinge denticles vary somewhat in formation and eccentricity of design, some being longer and more oblique on one side of the umbo than on the other, whilst in aged or more eroded specimens the central denticles are either worn away or become merged with the striations of the ligamental region.

These valves are undoubtedly similar to those that have been referred to as occuring in the "Pliocene Limestones" of the Zwart Kops by G. B. Stow and by Professor Schwarz, in more recent years, as "*Pectunculus*, some gigantic" from the Koega River and other neighbouring deposits. The Linnean shells, *Glycymeris glycymeris* and *G. pilosa* were united under the former specific name by Searles Wood in his description of British Crag specimens (Mon. Pal. Soc. 1850, pl. 9, figs. 1, p. 56), but it seems desirable to recognise *pilosa* as distinct on account of its less oblique and more regular outline and the usually greater convexity of the umbonal region. The present shells are in every way similar to those figured by Hoernes under this designation from the Helvetian–Tortonian deposits of the Vienna Basin; and according to Professor Sacco (I Molluschi Terz. Piemonte, &c. 1898, part 26. p. 31) the species ranges in Italy from the Miocene (Helvetian-Tortonian to the Pliocene (Astian). It is not known to exist south of the Mediterranean, but a living form of the genus from South African waters has been described and figured by G. B. Sowerby under the name of *Pectunculus queketti* (Appendix to Marine shells of South Africa, 1897, pl. 7, figs. 7, 8, p 27) which exhibits some general resemblances to the present specimens, although differing in a lesser convexity, being considerably less inflated in the umbonal region, and, moreover, the pallial line, is more closely approximate to the margin.

Dimensions: Length and height of similar measurement and varying from 37 to 105 mm; Maximum diameter with closed valves 70 mm.

Locality: Below Redhouse, 120 feet elevation.

Specimens are also in the British Museum (Bain Collection) from the Koega River deposits of South Africa.

The species is found in the European Tertiaries ranging from Miocene to Pliocene times and it also occurs in existing seas but not south of the Mediterranean.

CHAMELEA SCHWARZI, sp. nov.

Plate XVII., figs. 3, 4.

DESCRIPTION.—Right valve convex, inaequilateral, ovato-trigonal, length slightly in excess of height; posterior region elongately curved, deep and truncate, anterior short with well marked elongate lunule followed by antero-ventral curvature; umbo recurved, and resting just above the hinge plate; surface ornamented with narrow, concentric and depressed costae containing obscure microscopical, vertical striations (seen mostly in places of decortication).

Dimensions (Right valve): Length 29 mm.; Height 27 mm.; Diameter 10 mm.

REMARKS.—Only the right valve of this species has been sent, of which there are 6 in number. They vary very slightly in size, and possess fairly thick tests showing well marked internal characters, and therefore suggesting that they may represent adult forms. Externally the valves are much eroded causing periodical growth lines to stand out in occasional relief, the space between being often considerably decorticated thus exposing a microscopical transversely striated structure.

This shell, especially in its dentition, is closely related to *Venus gallina*, Linnaeus, the type of *Chamelea* (Klein), Morch (Catalogus Conchyliorum, 1853, Hafniae, Fasc. 2, p. 23), a Mediterranean shell, besides showing a strong resemblance to *Venus paupercula* var. *abbreviata*. Krauss (Die Sudafrikanischen Mollusken, 1848, pl. 1, figs. 10, p 11) which exists in the Bay of Natal. The specific name is in honour of Professor E. H. L. Schwarz of the Rhodes University College, Grahamstown, South Africa, who has largely contributed to our knowledge of South African geology.

Localities: Below Redhouse, 120 feet elevation. The shell is said to "occur in all the beds up to 1,200 feet and more at Sandflats."

Examples are also in the British Museum (Geological Society Collection) having been collected by H. Longlands in the Tertiary limestones on the Zwart Kops River heights.

CHAMELEA ROGERSI, sp. nov.

Plate XVII., figs. 5, 6.

REMARKS.—There is a larger form of this genus in the collection which agrees in many ways with *C. schwarzi* and occurring in the same beds, although having relatively more compressed and longer valves ; this may be recognised as *Chamelea rogersi*, after Dr. A. W. Rogers, the Director of the Geological Survey of the Cape of Good Hope and Author of, "An introduction to the Geology of the Cape Colony."

Dimensions (Right valve) : Length 45 mm. ; Height 35 mm. ; Diameter 10 mm.

Locality : Below Redhouse, 120 feet elevation.

VENTRICOLA VERRUCOSA, Linnæus.

Plate XVIII., figs. 3, 4.

Venus verrucosa, Linnæus : Syst. Naturæ, 1758. Ed. X., p. 685.

Chione (*Ventricola*) *verrucosa*, Römer : Malak. Blätter, 1867, Vol. 14, p. 120.

Venus (*Chione*) *verrucosa*, G. B. Sowerby : Marine Shells, South Africa, 1892, p. 60.

Ventricola verrucosa, Sacco: I Moll Piemonte, Liguria, etc., 1900, part 28, p. 28.

REMARKS—The general characters of this species are well expressed in a left valve, obtained by Mrs. Paterson from the Redhouse deposits. It shows remnants of the wart-like details of the concentric ridges, particularly in the anterior region, as well as the closely arranged vertical striations between the costæ which are mostly exposed through the effects of erosion. The contour appears to differ from Mediterranean and South African examples in being of relatively greater height than usually obtains. According to Mr. G. B. Sowerby, South African recent specimens are "transversely oblong" as compared with those from British and Mediterranean waters, such being recognised as var. *capensis.* This species occurs in British Post-Pliocene deposits (Glacial Beds), and in the Pliocene beds of Southern Europe, especially Italy.

Dimensions : Length 42 mm., height 39 mm.
Locality ; Redhouse.

TIVELA BAINI, sp. nov.

(Plate XX., figs. 1—5).

DESCRIPTION.—Shell subtrigonal, inaequilateral, compressed, thick ; umbones acute, incurved, anterior ; lateral margins oblique, posterior longest with terminal truncation in adult stage, ventral margin curved and extensive ; posterior area long, with obliquely depressed sides and showing the prominent narrow ligamental nymphs: anterior or lunuloid region narrowly concave, elongate and well circumscribed ; outer side of posterior cardinal tooth with a series of more or less scalariform ridges extending from beneath the umbo to basal margin of hinge plate ; muscular impressions large and distinctly marked, pallial line angulated ; sculpture consisting of closely set and deeply impressed concentric striations.

Dimensions: Length 90 mm.; Height 75 m.m. (=adult form).
Diameter (closed valves): 37 mm.

REMARKS.—This shell is allied to the living South African species, *Tivela natalensis* of Dunker (Novitates Conchologicae—Meeres Conchylien—1865, pl. 23, figs. 10, 11, 12, p. 69), which is equivalent to G. B. Sowerby's *Cytherea* (*Tivela*) *alucinans* of the same marine area (Marine Shells of South Africa—Appendix, 1897, pl. 7, figs. 5, 6, p. 24), but differs in the valves being more depressed and consequently shallower, the escutcheon and lunuloid regions being well excavated, while the pallial sinus is distinctly angulated and not rounded as in the recent shell.

It should be mentioned that in young forms the marginal truncation of the postero-ventral area is not perceptible. The valves referred to this species have been subjected to considerable erosion, so that much of the sculpture has been worn away leaving some occasional growth lines standing out prominently from the otherwise decorticated surface of the valve, although the more regular concentric striations are frequently seen well preserved near the ventral margins of the specimens.

The genus *Tivela* was established by Link in 1807 (Beschreibung Nat. Sammlung. Rostock, 1807, part 3, p. 152) for the reception of *Tellina tivel* of Adanson (Histoire Nat. Sénégal Coquillages, 1757, p. 239), $=$ *Venus tripla*, Gmelin, which is recognised as a member of the Veneridae with affinities to Meretrix. It possesses 3 divergent cardinal teeth, the posterior being furnished on its outer lateral face with a series of more or less scalariform ridges or rugosites extending from just beneath the umbo to the basal margin of the hinge plate, in which way it differs from the closely allied genus *Grateloupia* of Des Moulins, 1828, from the European Miocene, which possesses several small, oblique and lamelliform striations behind the posterior tooth but contained between the inner ligamenta border and the lower margin of the hinge region.

The specific name is in memory of Mr. A. G. Bain, one of the pioneer geologists of South Africa.

Localities : Adult examples, numbered 3729, 3734, in a straw coloured sandy matrix with fragmentary shells—Redhouse; young forms in a reddish brown sandy matrix —below Redhouse, at 120 feet elevation; and two adult valves in a hard shelly breccia from Coerney (N. of Redhouse), collected by W. G. Atherstone in the higher level, about 600 feet (Nos. 888-889). The British Museum possesses some adult valves of this mollusc localised as from the Koega River deposits being associated with bard shelly breccia, and which were collected by A. G. Bain and others in a more sandy matrix collected by G. W. Stow.

CARDIUM EDGARI, sp. nov. (*)

Plate XXI., figs. 1-3.

DESCRIPTION.—Shell [right valve] large, robust, cordate, inaequilateral; posterior region subangulate, depressed, deep, moderately smooth; anterior side oblique, margin well curved; umbonal region inflated; costae 40, wide in front, narrower laterally, elevated, obtusely angulate laterally, summits rounded in the anterior area, afterwards flattened and broader, ornamented with equidistant annulations and finer intermediate striations crossed by delicate perpendicular striae which are thickest at the ventral margin; costal grooves widest anteriorly, deep, laterally angulate and oblique, finely striated in correspondence with the costae; interior deeply concave, subquadrangular, closely costated.

Dimensions (Right valve): Length 116 mm.; Height 117 mm.; Diameter 45 mm.

REMARKS.—This fossil is related on the one hand to *Cardium maculatum* of Gmelin (=*magnum*, Born. and *ventricosum*, Bruguière Lamarck) occurring in the South Carolina Post-Pliocene deposits (Holmes: Post-Pliocene Fossils of South Corolina, 1858. pl. 5, fig. 2, p. 23) and also as a recent species in the North Atlantic (Reeve: Conchologia Iconica, *Cardium*, 1844, Vol. 2, pl. 4, fig. 20), and to *Cardium Kubecki* of Hauer, a Miocene form of Germany and Austria, which has been well figured and described by Hoernes in his memoir on the Tertiary Mollusca of the neighbourhood of Vienna (Abhandl. k. k. Geol. Reichs., 1861, pls. 21-23, p. 173). From the recent species, however, the present specimen differs in its much more quadrangularly shaped interior, its possession of a more horizontally constituted hinge line, while the antero-terminal

*Named after Edgar A. Smith, Esq., I. S. O. of the British Museum in acknowledgment of his services in determining shells from South African Post-Pliocene deposits, and for his valuable assistance during the examination of the present collection.

costae are more numerous, narrower and rounder, and without lateral compression.

The Miocene, *C. kubecki* shows perhaps greatest affinities to the South African shell although having coarser and heavier valves, a more massive hinge region which, moreover, possesses considerable obliquity.

The valve figured and described belonged to a medium sized individual. It is in a good state of preservation, and sculpture details are well displayed especially in parts of the anterior region. The internal surface is regularly covered with numerous perpendicular flattened costae the edges of which being slightly elevated form a series of rounded, fine and equidistantly arranged costae. There is a larger example of this species from South Africa represented by a left valve, in the British Museum, which is unfortunately without definite locality, although most probably it had been originally collected by Bain from the Koega river limestones; its dimensions are :—length 130, height 132, diameter 55, millimetres. The South African fossil shows, also, a resemblance to *C. grande* of Philippi, occurring in the Miocene deposits of the Coquimbo area of Chili (Die Tert. Quart. Verstein. Chiles, 1887, pl. 39, fig. 6, p. 177), which has a similar number of costae and is of almost the same contour and size.

Localities: Below Redhouse, 120 feet elevation (figured specimen); a fragmentary example of the ventral region collected by Dr. W. G. Atherstone at Coerney, (about 25 miles N. of Redhouse), 600 feet elevation; an internal cast of a large right valve in a reddish brown calcareous sandy matrix, from Picnic Bush (Zwart Kops River) at 300 feet elevation. The largest valve (left), of this species was probably obtained from the Koega River deposits, having been most likely collected by Bain (British Museum specimen) from that part of South Africa.

MACOMA ORBICULARIS, G. B. Sowerby.

Plate XVIII, fig. 5.

Tellina orbicularis, G. B. Sowerby : Journ. Conchology, 1889, Vol. 6, pl. 1, fig. 20, p. 13; Marine Shells, South Africa, 1892, pl. 3, fig. 64, p. 57.

Macoma orbicularis : As scheduled at British Museum.

REMARKS.—This specimen consists of an external view of a right valve, in a highly mineralised and poor condition, besides being much fractured in the ventral region—it is attached to a hard shelly brecciated matrix. The fossil compares favourably with Sowerby's type in the British Museum, which is found living off Port Elizabeth, although the former is of slightly larger dimensions. There is a well preserved valve of this species in the British Museum (Geol. Soc.—Stow Coll.) from the Ferreira's River deposits of South Africa, showing a good postero-ventral sinuation, which is of very modern appearance and which would belong to a much later part of the Kainozoic Series than the present fossil, *i.e.*, the Post-Pliocene. The species is recognised in the British Museum (Zoological Dept.) cases as belonging to Leach's genus *Macoma*.

Dimensions : Length 63 mm. ; Height 53 mm.
Locality : Redhouse.

TELLINA CF. PERNA, Spengler.

Plate XXII, figs. 4, 5.

Tellina rostrata flavescens, Chemnitz : Conchylien Cabinet, 1782, Vol. 6, pl. 12, fig. 104, p. 112.

Tellina perna, Spengler : Skrivt, Naturhist. Selsk., Kobenhavn, 1798. Vol. 4, p. 79; Hanley : G. B. Sowerby's Thesaurus Conchyl, 1846, Vol. 1, part 6, pl. 63, figs. 202, 217, 219, p. 236; G. B. Sowerby : Append. Marine Shells, South Africa, 1897, p. 22.

REMARKS.—The collection contains a solitary left valve of a Telliniform shell which is very closely related to this species. It possesses, however, a more cylindrical and convex appearance, as well as a more regular dorso-posterior margin which constitutes a long and shallow excavation, while the scar impression of the pallial sinus is narrower and transversely much more elongate. The concentric sculpture lines are well seen, while the "obsolete radiating striulæ" referred to by G. B. Sowerby, can be occasionally traced. The dimensions of the recent and fossil forms are relatively very similar.

		FOSSIL.		RECENT.
Dimensions (left valve):	Length	56	-	62
	Height	25	-	30

The species was originally described from Eastern seas (Singapore, &c.), although we appear to be indebted to Mr. G. B. Sowerby for first determining its occurence in the seas of South Africa (off Natal).

Locality: Redhouse, partly encrusted with a light coloured sandy matrix, otherwise an isolated specimen and not embedded in matrix.

SCHIZODESMA SPENGLERI, Linnæus.

Plate XXII., figs. 1—3.

Mactra spengleri, Linnæus: Systema Naturæ, 1767. Ed. xii., p. 1125.

Mactra spengleri, Gmelin: Systema Naturæ (Linnæus), Ed. xiii, 1790, p. 3256; G. B. Sowerby: The Genera of recent and fossil shells, 1825, No. xxiv., text and plate figure (not numbered).

Scissodesma spengleri, J. E. Gray: Mag. Nat. Hist. (Charlesworth), 1837. Vol. 1, New Series, pp. 335, 370, 371, text figure 29.

Schizodesma spengleri: Archiv Naturgeschichte (Wiegmann), 1838. Vol. 1. p. 86; J. E. Gray: Proc. Zool. Soc., 1847, p. 185.

Mactra spengleri, Reeve: Conchologia Iconica, 1854. [Mactra], pl. 10, fig. 40.

Schizodesma spengleri, W. H. Dall: Trans. Wagner Free Inst. Philadelphia, 1898, Vol. 3, part 4, pp. 865, 880.

REMARKS.—The collection contains some valves of this species, which agree in all essential characters with the living shell, found only in South African seas. The chief points of structural interest appertain to the distant umbones, the great vertical depth of the dorsal region, the crescent-shaped ligament cavity when the valves are united, and the presence of two remote, compressed, and projecting teeth in the left valve, with a third or subsidiary angulate tooth, perpendicular to the umbo and in close proximity to the anterior side of the ligament cavity, also projecting, but less so than the others. In the right valve, are corresponding sockets for the reception of these teeth. The valves are remarkable for their large size in comparison with known living forms.

		Fossil.	Recent.
Dimensions:	Length	115 (about)	92 mm.
	Height	90	70 mm.
	Diameter United valves	65	40 mm.

Localities: Redhouse, associated with a shelly breccia; and a mineralised fragmentary valve from Picnic Bush, near Redhouse, in a hard brownish shelly limestone.

GASTROPODA.

VOLUTA AFRICANA, Reeve.

Plate XXIV., figs. 1, 2.

Voluta africana, Reeve: Proc. Zool. Soc. 1856, p. 2, pl. 33 figs. 3, 4; G. B. Sowerby: Marine Shells of South Africa [London], 1892, p. 18.

REMARKS.—The collection contains an old and somewhat worn example of a *Voluta* which may be safely referred to this species. On account of age, the shoulder nodulations are larger and more robust and become only partially produced towards the base as rounded perpendicular costae. Moreover, there are six plications on the columella of which the earliest three are somewhat fine and obscure, whereas the type is only said to possess "two plaits at the base", a dissimilarity which may be regarded, also, as due to age. In all other features the fossil is in perfect agreement with the modern shell in possessing an ovato-ventricose contour, a well projecting spire with a papilliform summit, concavo-angulate whorls above and nodulose below, an arcuate columella, and a prominently subeffuse aperture. No original colour markings are present but some spiral sculpture can be obscurely seen in the basal region.

The external surface of the shell is punctured with numerous minute perforations (as in the type specimen of the species), while the interior of the aperture is covered with a polyzoan structure belonging to the *Membranipora*-group (according to Mr. W. D. Lang).

Reeve's type, which is in the British Museum, is referred to as coming from the East coast of Africa; another specimen on the same British Museum tablet, collected by Lt.-Col. Turton, was obtained at Port Alfred, Cape Colony.

Dimensions: Length 60 mm.; Breadth 38 mm.;
Locality: Below Redhouse.

BULLIA ANNULATA, Lamarck.

Plate XXIII., figs. 3, 4.

Buccinum annulatum, Lamarch in Brugiuére: Encycl. Méthod. (Vers), 1816, Vol. 3, pl. 399, fig. 4. Explanation of plate, p. 2; Hist. Nat. Anim., sans vert., 1822, Vol. 7, p. 264.

Bullia annulata, Reeve: Conchologia Iconica, 1846, Vol. 3, Mon. Genus *Bullia*, pl. 2, fig. 13.

Buccinanops annulata, Tryon: Manual Conchology, 1882, Vol. 4, p. 14, pl. 5, fig. 74.

Bullia annulata, G. B. Sowerby: Marine Shells of South Africa, 1892, p. 11.

Bullia (*Buccinanops*) *annulata*, G. B. Sowerby: Marine Investigations, South Africa, Depart. Agriculture, Cape of Good Hope, 1902, Vol. 2, pl. 2, fig. 4, p. 95.

Bullia annulata, Crawford in J. P. Johnson: Trans. Geol. Soc., South Africa, 1904, Vol. 6, p. 9.

REMARKS.—A fine and aged example of this species is among those specimens collected by Mrs. Paterson. It is much larger than the usual living forms, and exhibits an irregular and interrupted margin to the shoulder of the body whorl, the sutural platform including a slightly raised encircling and enamelled growth (much mineralised) which is a continuation of the columella callosity from the posterior angle of the aperture. The spinal sculpture is well displayed, although more or less obscure on the central surface of the last whorl, probably through erosion. The species lives in South African seas, and has previously been recorded from the the raised beach deposits of Shark River and the Creek, Algoa Bay, by Mr. J. P. Johnson.

Dimensions: Length 70 mm.
Width 35 mm.

As there appear to be some difficulties in the proper restriction of the two genera *Bullia* of Gray, 1839, and *Buccinanops* of Orbigny, 1841, the present species is included under the older name. So far as shell characters are concerned both genera may possess a more or less enamelled growth at the suture, certain species also being furnished with an angulated and turreted spine as exemplified in the fossil under consideration.

Locality: Redhouse, collected by Mrs. Paterson.

MELAPIUM PATERSONÆ, sp. nov.

Plate XXIII, Figs. 1, 2.

DESCRIPTION.—Shell depresso-ventricose, expansive, subovate, robust; spire concealed within small cavity, initial whorls sometimes exposed; body whorl depressed above, afterwards widely inflated to outer lip, base deeply sinuated, obliquely and sharply ridged, surface furnished with distant, nearly equally spaced, oblique growth lines, crossed by more or less obsolete concentric striations; aperture dilated, elongate, subovate, posteriorly canaliculated, prominently sinuated in front; columella region depressed, twisted, well excavated in centre, smooth, furnished with thick callosity extending obliquely from near the apical cavity to form the inner wall of the posterior canal; base tapering, slightly excavated, forming inner margin of sinuation.

Dimensions of largest specimens:

	FOSSIL.	RECENT. (M. lineatum).
Length	75 mm.	30 mm.
Breadth (max.)	65	28
" (profile)	36	19

REMARKS.—The two examples representing this species include one of considerable size (as figured), and another much smaller, having a length of nearly 50 millimetres. They may be compared with *Pyrula lineata* of Lamarck (the type of *Melapium*) of South African seas, from which they differ however in their greater size, in possessing a more completely hidden spire, together with a generally less rounded or globose contour. According to Mr. E. A. Smith's account of the genus *Melapium* (*Ann. Mag. Nat. Hist.*, 1889, Ser. 6, Vol. 3, p. 267), the species *lineatum* never exceeds the size first alluded to by Lamarck, "13 lignes." The fossil is also very distinct from the second species, *Pyrula elata*, Schubert and Wagner which was wrongly referred to and figured by Reeve (Conch. Iconica, 1847. Vol. 4, pl. 8, fig. 28) as a synonym of Lamarck's *lineatum*. This recent form is of a more truly pyriform contour, its aperture is narrower and more constricted in front, the twisted ridge of the columella and the sinuated base are situated more obviously in front than in the profile or dorsally, as characterises the fossil. Only these two species of *Melapium* are known, both belonging to South African seas; the genus has apparently never been previously recorded in the fossil state.

The specific name is in honour of the collector, Mrs. T. V. Paterson, already known as a discoverer of natural objects in South Africa, and after whom the botanical genus, *Neopatersonia* was recently established by Dr S. Schönland.

Locality: Redhouse.

PIRENELLA STOWI, sp. nov.

Plate XXIV., figs. 5, 6 (× 2).

DESCRIPTION.—Shell turreted, strongly sinuated, whorls depressed, slightly concave, narrow, divided by a nearly horizontal suture, furnished with a row of small distant nodulations above and a double series of the same below, nodulations united by the sinuous growth lines and so resembling continuous longitudinal costæ; basal whorl anteriorly inflated, feebly canaliculated in the centre, ornamental with spiral costæ crossed by numerous fine sinuous striations of growth; aperture small and obliquely oval, columella excavated; labium thin and prominently sinuated.

Dimensions: Length 39 mm., diameter 12 mm.

REMARKS.—On account of mineral colouration in which yellowish and white tints are displayed, this specimen has been difficult to photograph satisfactorily; and although doubly magnified, fig. 5 of plate xxiv., fails to bring out the sculpture of the whorls as well as could be wished; fig. 6, however, gives a very true interpretation of the central canal and details of the basal ornamentation. The shell is entirely unlike any recent form and for sometime it seemed impossible to place it generically, but, with Mr. Smith's assistance, it appears to come nearest to *Pirenella* of Gray, 1847, founded on Philippi's Mediterranean shell, *Cerithium mammillatum*. The fossil form is much larger than the usual size of this genus, and, moreover, it does not possess the closely granulate character generally associated with it. Its very sinuated character, and the short canaliculation at the base which are such striking features of the fossil, are also interesting details of the recent genus. Sacco records small and granulated forms of *Pirenella* from the Miocene (Tortonian) of Italy (I Moll. Terr. Terz. Piemonte, 1895, part 17, pl. 3, figs. 48-51, p. 59). The best preserved of four specimens has been utilized for description; the remaining three are much encrusted and eroded as if they formerly existed under estuarine conditions. If such was the case, then this would add a new interest to the Redhouse deposits and prove their origin to have been both marine and brackish water. The specific name is in memory of G. W. Stow, a former distinguished authority on South African Geology.

Locality: Redhouse.

Collector: Mrs. Paterson.

BARYSPIRA, CONUS, TURRITELLA.

Plate XXIV., figs. 3, 4.

REMARKS.—There are some further gastropods in the collection which on account of bad preservation cannot be determined, including:—

(A) Several fragmentary examples of a species of *Baryspira*, probably related to *Ancillaria australis* of G. B. Sowerby (Species Conchyliorum, 1830, Vol. 1. Ancillaria, figs. 44-46, p. 7), which exists in South African seas, besides occurring in Australasian Pliocene, Post-Pliocene deposits and recent seas (G. F. Harris: Cat. Tertiary Mollusca British Museum, Australasian Tertiary Mollusca, 1897, p. 76). *Baryspira glandiformis* of Lamarck, from the European Miocene, is also a closely allied shell (Sacco: I Moll. Terr. Terz. Piemonte, 1904, part xxx., p. 80). The spiral regions are completely covered with a thick callosity which have been mostly riddled and perforated by some microscopical organism.

(B) A small form of *Conus* which is much broken in the spiral region, and having its surface considerably covered with a parasitic growth containing minute and inumerable perforations.

(C) A single example of a *Turritella*, also encrusted with a similar organism to the last, which does not appear to have any close affinity with the recent species found off the coasts of South Africa such as *T. carinifera*, Lamack, *T. capensis* and *T. knysnaensis* of Krauss, but which is probably more related to *T. gradata* as figured and described by Hoernes (Foss. Moll. Tert. Beck. Wien: Abhandl. k. k. Geol. Reichs. 1855, Vol. 1, pl. 43, fig 3, p. 420) from the Miocene deposits of Austria.

Locality: The above specimens were obtained from below Redhouse at an elevation of 120 feet.

(4) Explanation of Plates.

The specimens figured belong to the Albany Museum, Grahamstown, South Africa, with the exception of that represented on Plate XIX fig. 2 which is in the British Museum (Nat. Hist.) London.

PLATE XVII.

Ostrea atherstonei, sp. nov.

Fig. 1. External view of the right or upper valve.

Fig. 2. Internal aspect of same showing ligament area and adductor scar mark.

Collector : Prof. Schwarz.

Chamelea schwarzi, sp. nov.

Fig. 3. External view of right valve.

Fig. 4. Interior of same specimen.

Collector : Prof. Schwarz.

Chamelea rogersi, sp. nov.

Fig. 5. External view of right valve.

Fig. 6. Interior of same specimen.

Collector : Prof. Schwarz.

PLATE XVIII.

Ostrea atherstonei, sp. nov.

Fig. 1. Two left or lower valves dorsally attached, the larger showing external sculpture and the other internal characters.

Collector : Prof. Schwarz.

Ostrea redhousiensis, sp. nov.

Fig. 2. A left or lower valve showing regular lamellose costae and equidistant furrows.

Collector : Prof. Schwarz.

Ventricola verrucosa, Linnæus.

Fig. 3. External aspect of a left valve showing the wart-like costal structure and intermittant striations.

Fig. 4. Internal view of same specimen.

Collector : Mrs. Paterson.

Macoma orbicularis, **G. B. Sowerby.**

Fig. 5. External view of a right valve, in matrix.
Collector: Mrs. Paterson.

PLATE XIX.

Melina cf. gaudichaudi, Orbigny.

Fig. 1. Ligamental region of a left valve.
Collector: Mrs. Paterson.

Fig. 2. Ligamental region of a right valve belonging to another specimen [British Museum].

Glycymeris pilosa, Linnáeus.

Fig. 3. Interior of a medium sized valve.

Fig. 4. External view of same.

Fig. 5. View showing inflated umbonal region.
Collector: Prof. Schwarz.
Collector: Mrs. Paterson.

PLATE XX.

Tivela baini, sp. nov.

Fig. 1. Interior of an adult left valve.

Fig. 2. External view of an adult right valve of another individual.

Fig. 3. Interior of a younger left valve.

Fig. 4. External aspect of same specimen.
Collector: Prof. Schwarz.

Fig. 5. Hinge region of another left adult valve showing the scalariform ridges on the side of the posterior tooth.

PLATE XXI.

Cardium edgari, sp. nov.

Fig. 1. External view of right valve.

Fig. 2. Internal aspect of same, showing the hinge, umbonal characters and closely ribbed inner surface.

Fig. 3. Sculpture characters (magnified).
Collector: Prof, Schwarz.

PLATE XXII.

Schizodesma spengleri, Linnæus.

Fig. 1. Fragmentary right valve, showing the deeply vertical dorsal region divided by the ligament groove.

Fig. 2. Another view of the same, exhibiting the two large dental sockets and the smaller socket on the anterior side of ligament chamber.

Fig. 3. Dorsal aspect of a left valve with the two large projecting teeth and the smaller anterior tooth, also projecting.

Collector : Mrs. Paterson.

Tellina cf. perna, Spengler.

Fig. 4. External view of left valve.

Fig. 5. Internal aspect of same specimen.

Collector : Mrs. Paterson.

PLATE XXIII.

Melapium patersonæ, sp. nov.

Fig. 1. Front view, showing the very dilated aperture, the posterior canal and callosity, the excavated and flattened columella region.

Fig. 2. Dorsal aspect of same specimen with well indented growth lines, and showing the apical cavity and basal sinuation.

Collector : Mrs. Paterson.

Bullia annulata, Lamarck.

Fig. 3. Front aspect of a form much larger than the usual living shell.

Fig. 4. Dorsal view of same specimen, showing the obscurity of the spinal lines on the body whorl, probably through erosion.

Collector : Mrs. Paterson.

PLATE XXIV.

Voluta africana, Reeve.

Fig. 1. Front view, showing the six plaits on the columella.

Fig. 2. Dorsal aspect of same specimen with the large nodulations at the shoulder.

Collector : Prof. Schwarz.

Baryspira, sp. indet.

Fig. 3. Front view of the upper portion of a fragmentary body-whorl showing the spire completely enclosed by the thick callosity.

Fig. 4. Dorsal aspect of same specimen exhibiting part of the basal fasciola.

Collector : Prof. Schwarz.

Pirenella stowi, sp. nov.

Fig. 5. View showing the general characters of this form including the deeply sinuated aperture. (x 2.)

Fig. 6. Basal aspect of the last whorl showing the short central canal and the spiral sculpture crossed by numerous fine growth striations.

Collector : Mrs. Paterson.

Notes on the Geographical Distribution of the Hottentot and Bantu in South Africa.

BY W. HAMMOND TOOKE.

I. THE HOTTENTOTS (KHOI-KHOI).

The streams emptying into the South Atlantic as far north as Cape Frio all bear Hottentot names, such as Gariep, Swakop, and Khomeb. Serpa Pinto found a yellow-skinned tribe between the Cubango and Kwando, that is about the same latitude, but in the interior; and in 1667 the crew of the Grundel met with Hottentots as far north on the west coast as 12′ 47′ S. Lat., that is near Benguella. The WaSandawi of South Masai-land, British East Africa, speak a language like the Hottentots, full of clicks, while their skulls are of Hottentot type. Again the Wakwak, a tribe so-called by the Arabian geographers of the Xth and XIIth Centuries, living south of the Zambesi but north of the Limpopo are supposed to be Hottentots (Wakwakwa or Wa-Khoikhoi); and the traveller Ludovic de Varthema describes a click-speaking tribe that he saw at Sofala in 1506.

The natives met by Vasco de Gama at St. Helena Bay were certainly those called later by the Dutch Strandloopers. Castanheda's description of them is that they are "small in stature, of an ill-favoured countenance and darkish colour." (de coor baça). "They seem when speaking to make low salutations."*

Thus I venture to translate "quando falauao parecia que saluacauao" — "saluauao?" (fallar, saluar). Dr. Theal renders it "seem to roll about in speaking;" and Nicholas Litchfield the translator of Castanheda in 1582— "and when they did speake, it was in such manner as though they did always sigh."

But at Mossel Bay the natives were clearly Hottentots. "The people are dark (he baça) and clothe themselves with skins, and

*S.E.A. Records V. 304.

fight with assegais and firehardened wood pointed with horns and bones of animals and with stones. In the country are very many very large elephants and also oxen which are very tame and extremely fat. They are gelded and some are hornless. The negroes use the fattest to ride on saddling them with pack-saddles like those of Castile. They also kept sheep." It may be noted that Varthema's click-speaking tribe also kept cattle which shows that they could not have been Bushmen.*

When the Dutch settled at the Cape the Hottentots were not known to range northwards beyond the Orange River.

1. The Korana or Koraqua under the name of Gorachouqua were probably up to the end of the XVIIth Century living in the vicinity of the Cape. Driven back by the Dutch to the Brak River and thence again to the Orange River they separated into three clans: the one located itself at the Orange River falls; of the other two (both known as Great Korana) that of the 'Middleveld' dwelt in the Richmond and Victoria West Districts; the other, an offshoot from the 'Middleveld' branch, crossed the Orange about 1785-90, subsequently fought the Bushmen at Langsberg, then went to Klipdrift (Barkly) where they were treacherously attacked by a Bechwana chief near Taung, and settled at the beginning of last century for the most part in the Riet, Hart and Vaal river valleys, though a few went west to the Koeremanie (Kuruman) river.

2. The Namaqua, among who were numbered the Geiqua (Geikhaua) were regarded as the senior or paramount clan. They were first located on the banks of the Olifant's river and in the Little Karroo. They also split off into the Great and Little Namaquas. The latter soon disappeared like the rest of the Hottentot tribes. The Great Namaqua including the Geiqua went north of the Orange, but we have no record of their movements until 1792, when Van Reenen, on reaching the vicinity of Walfish Bay, found that they had recently attacked a Herero clan and deprived them of their stock.

Rec. S. E. Afr. V. 358,*

Besides the foregoing, knowledge was obtained in the early days of the Dutch settlement of the following tribes :—

3. Goringaiqua residing in proximity to Cape Peninsula; chief Gogosa the "Fat Captain" of Cape Chronicles; succeeded by Schacher.
4. Sassequa or Kryoqua or Saldaniers of Saldahna Bay.
5. Cochoqua or Soeswa, also in Hottentots Holland; chief "Captain Claes."
7. Oudiqua in the Drakenstein.
8. Charigriqua in St. Helena's Bay and Olifants River; a century ago they seemed to have been the preponderating element in a collection of wanderers and refugees from various tribes that were induced by missionaries to settle under the name of Griquas, on the junction of the Vaal and Orange Rivers.

In the time of Governor Van der Stel, exploring parties met the

9. Dariqua along the banks of River Zonder Einde.
10. Amaqua between the Olifant and Groen rivers.
2. Namaqua (already mentioned) along the west coast.
11. Hancumqua or "dacha-makers," a powerful tribe in the Swellendam and Riversdale districts; by some regarded as paramount.
12. Hessequa in the same districts, but more inland; these owned great herds of cattle and sheep.
13. Gourinqua in the valley of the Gouritz river, from which they seemed to have derived their name.
14. Gorogaiqua in the Oudtshoorn district.
15. Attaqua to the north of Mossel Bay district, where the name Attaqua's Kloof still commemorates them.
16. Houteniqua in the George district, giving their name to the Outeniqua mountains.
17. Inqua discovered by Ensign Isaak Schryver between the Bushman and Fish rivers; larger and better proportioned than other Hottentots; chief Hykon.
18. Ganumqua and } tribes adjoining but lying south west of
19. Nambumqua } the Inqua.

Still later we hear of the

20. Kemamqua on the Fish river.
21. Samaqua lying to the north of the preceding.
22. Comemaqua at 'Commaberg' near the Orange River.
23. Tradiamaqua or Trakamaqua (women-folk) also near 'Commaberg.
24. Kirlkambi on the Orange rivar.

There were many migrations of these tribes northwards as Europeans occupied the country, many dying out in the process, or mixing with other races. Here and there a tribe, such as (25) the Copabis, formerly living in the Goudini and since north of the Orange, retained in its purity a language which elsewhere was almost extinct.

In the east, Ensign Butler, so late as 1732, adds the names of (26) Hoengeyqua and (27) Damasonqua living in the vicinity of the Keiskama to the foregoing list; and tradition speaks of the chieftainess Hoho who reigned in the Pirie forest; but as a rule the Hottentots did not occupy territory beyond the Sunday's river; between it and the Great Fish river roamed tribes of mixed Kafir and Hottentot blood, such as the Gonaqua or Ama-Gona and the Damaqua. Beyond that limit, Kafirs came and went, but it was a Bushman country. The name Damaqua, or rather "Damara"—the feminine dual form (to every man a damsel or two)—which means "conquered people," was, it may be observed, also given by the Namaqua to the OvaHerero, a Bantu tribe living contiguously in what is now Damaraland. In the same way the eastern Hottentots called the Tembu and Xosa Kafirs "Chobona" or "Kobona"; the Poudos they called "Hambona"; while the Korana called the Bechwana tribe, the Batlapin, by the name of "Briqua" or "Birina" (goat people).

A century ago, with the exception of the Namaqua and Korana tribes which had fled north beyond the colonial boundary and the Griqua who were half-breeds, the Hottentots had ceased to exist as tribes, but were either set apart in native locations or scattered as farm servants among the Boer's of the interior. The

Gonaqua and Damaqua mixed races subsequently became regarded as Kafir tribes.

The relationship of the Hottentot speech to the Hamitic languages and their former extension northward leads to the inference that the cradle of the Hottentot race was the region now occupied by the Hamitic tribes, Berbers, Gallas, Somalis, and Masai. It is not sought to establish kinship with any of these tribes, notwithstanding their linguistic affinities (extending to the use of clicks by the Galla). Indeed they are themselves of such mixed race, showing so many Negro, Semitic and Caucasian elements that the problem, if entertained at all, should be set the other way, viz: whether any of these tribes are descended from a race of which the Hottentot is evidently, from close conformity to persistency of type the purest representative. For in cross-breeding with the European and perhaps also with the Kafir, it manifests a prepotency equal to that of the Persian sheep when crossed with the Merino or Cape breed. The Hottentots must have found their way southwards perhaps hundreds, perhaps thousands of years ago, driven onward by the pressure of other tribes behind them, who, closing in, cut them off from their northern kinsmen. Like the Galla, a tribe of shepherds and cattle-herds, they would have avoided in their great march the great equatorial forest and its extension among the tributaries of the Congo. At the present time the greater part of the upland regions lying to the south, is still devoid of the tsetse fly,—belts and patches on the Victoria and Tanganyika (west shore) lakes, the rivers Rovuma, Ruva, Sabaki, Tana excepted; and doubtless this area was still freer from this scourge in the distant past. We may imagine the Hottentot clans, therefore, through the ages slowly driving their lazy-pacing oxen and long tailed sheep from the grazing lands of the Upper Nile and the Nyanzas (now depastured by the humped cattle and black headed sheep of Wahuma or Galla herdsmen), on into the districts of Umyamwezi and Ugogo—a parklike grassy country in German East Africa—down on the east side of Tanganyika and Nyassa, past the sources of the Rufiji and Rovuma rivers. Then across the Zambesi near Sena into Rhodesia, until they reached the south bank of the Sabi, and under the name of Wakwak (Waqwaq) found themselves in what is now the Portuguese province of Inhambane. Here they probably received a check, not from any human foe, but from *Glossina morsitans* for the fly is now prevalent along the Coast from Chinde to San Lucia Bay and up the valley of the Limpopo and its tributaries, entering the north eastern Transvaal. Fear for the safety of their stock would, therefore, prevent their further progress. They were still in the country of the Wawak or Wa-Khoikhoi in the Xth century, but many must already, and some at a much earlier date have struck westwards and spread over the high veld, the Kalahari desert and Kaap plateau, still in good grazing country, but probably suffering injury from their habit of grass burning. Then west to the Atlantic coast and south through Orangia and the Karroo, before the scanty rainfall had rendered the rivers periodic or subterranean, and when the grass and timber had not yet been replaced by dry bush and succulent plants· Here they rested their flocks in a fertile region clothed with herbage, shaded with foliage! Behind them, pressing on their heels, forcing them south, reluctantly no doubt, to colder latitudes, there must have been incessant migrations, encroachments, invasions of the restless negro populations to the north! When their wanderings ceased, at what date they reached the southern extremity of the continent we can only conjecture.*

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*Precis of the Archives of the Cape of Good Hope, Riebeck's Journal, 3 vols. Capetown, 1897, Journal 1662-1676, 2 vols. Capetown, 1901-2. H. C. V. Liebrandt.

The Record, or a series of Official papers relative to the condition and treatment of the Native Tribes of South Africa compiled by D. Moodie, Lieut, R.N. Capetown, 1838.

Report of T. Roos and Pieter Marais to Governor Tulbagh, 18th Aug., 1762 (Hendrick Hop's Expedition).

Reis van den Vaandrig Beutler. Dokumenten over Zuid Afrika verzameld door Dr. George McCall Theal. No. 2, Kaapstad, 1896.

II. THE BANTU.

EARLY MIGRATIONS (West).

We know little of the early migrations of the Bantu tribes on the West coast and not much more of the later ones. We know that the banks of great rivers of the Congo system were densely thronged, that the forests were comparatively sparsely populated. Of those tribes which reached the Atlantic coast and were found there by the first European navigators and traders some like the Ba-Fiote (Fiort) at Loango and the Ba-Bihe (Bihenos) at Angola acted as tribes to the interior. From the Roman Catholic missionaries we learn that at the Congo mouth a chief Cungwe or Congo ruled over a tribe or a number of tribes, that he was converted to Christianity, that his great place or Mbanza was re-named San Salvador and that he was dignified with the title of El Rey Catholico do Congo and his country called the Congo Empire. Other tawdry monarchies under the sway of chiefs with the hereditary titles of Muata Yamvo, Kazembe, and Kassongo existed at the sources of the Zambesi and Lualaba (Upper Congo) as late as the end of the XVIIIth century—the so-called "Empires" of Ulunda and Urua and the kingdom of Matamba the later province of Mossamedes.

THE HERERO GROUP.

Three tribes, the vanguard probably of the southward marching colum crossed the Cunene. Although they differ considerably in physical structure and in custom and habit, in language they are closely akin and form what is called the Herero group, part of the Bunda family of dialects which include, beyond our limit, the Mbunda, the Lojazi, the Nano, etc. The Herero group comprises the Ba-Yeiye, the Ov-Ampo and the Ova-Herero. The Bayeiye are a tribe of expert fishermen living around Lake Ngami. The Ov-Ampo are an agricultural tribe and their country, Ondonga, south of the Cunene river is described as covered in season with golden grain interspersed with fine fruit-bearing trees.

The Herero are divided into two chief clans. The Ova-Herero or Rock-rabbit folk and the Ova-Mbanduru or Jackal folk. Ova-Tyimba, their earliest designation, meaning 'outcast' or 'refugee' points to a connection with the once dreaded tribe Ma-Zimba. These people had reached the vicinity of Benguella and the river Cunene in the XVIIth century and it was not long after that we find the Mu-Chimba on the banks of the Coanza and the Ova-Tyimba or Ova-Herero in the Kaokao-veld, a district lying between Ondonga or Ovampoland and the sea. There they were located in good pasturage a hundred years ago, although in 1792 a wandering party were attacked and defeated by the Namaqua not far from Walfish Bay. During the past century they settled down in the land hitherto occupied by Bushmen lying between latitude 20° S and 24° S and between Lake Ngami and the Atlantic where they lived in small scattered tribes. The establishment of German power has wrought another change and we understand that the bulk of the tribe has been transported to the Waterburg district, Transvaal.*

EARLY MIGRATIONS, (East).

According to Sir H. H. Johnston the Bantu emigrants on the East of the African continent traversed the Albert Nyanza district, passing round to the north of Bunyoro, Buganda and Busoga, reaching the Victoria Nyanza at its eastern extremity, avoiding the eastern shore, starting eastwards again from its south-eastern most gulf and eventually attaining the Indian Ocean at Lamu,

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*See Palgrave, W Coates. Special Commissioner. Report of his mission to Damaraland and Great Namaqualand in 1876. Capetown 1877

Chapman, James, Travels in the Interior of South Africa, London 1868.

Anderson, C. J., Lake Ngami, London 1857. The Okavango River, London 1861.

Thomas Baines, Explorations in South West Africa, London 1864.

Galton F., Travels in South Africa, Minerva Library, London, 1889. Reprint of "Narrative of an Explorer in Tropical South Africa," London, 1853.

Tooke, W. Hammond The Damara or Ova-Herero, African Monthly, January, 1907.

following a very irregular course and including the Kilimanjaro on their itinerary. The evidence for this is purely philological. History there is none!—and traditions only take us back to the XVIth century when there flourished on the northern shores of the Victoria Nyanza the ancient kingdom of Kitwara or Bugaya inhabited by a Bantu tribe, Wichwezi, who dominated the non-Bantu Kopi or Chiopi, and who themselves submitted to a line of Galla sovereigns. The Bugaya kingdom subsequently split into the Busoga, Buddu, Karagwe, Bunyoro and the well known Buganda or Uganda.*

Further South were the Wa-Nyamwezi, or People of the Moon, a name doubtless originating the Lunae Montes of Ptolomy the old half-legendary name for Ruwenzori. Here in the XVIIth century there seems to have existed some sort of "Imperio de Moenhemuge," or Monomoezi, or Nimeamaya, corresponding to that of Monomotapa in the South. Then came the Wa-Nyanyembe or people of the Hoe, the Wa-Zogo, the Wa-Sagara, the Wa-Yeiye or Wa-Jiji, the A-Lomwe, the Wa-Makua (or Ma-kua) the Ma-Nganza or people of the Lake (Nyassa), the Ma-Ravi, and the Wa-Yao or A-Jawa, all located between the Lakes and the Indian Ocean in German East Africa and Mozambique.

These tribes were all known to the Arab traders on the East Coast by the general name of Zeng, or Kafir, from the Xth to the XVIth Centuries.

The Bantu, Zeng or Kaffir tribes located at South of the Zambesi are not believed to have extended south of the Sabi river in the tenth century when Al Mas'udy wrote, the country south of that river being occupied by the Wak-Wak, presumably of Hottentot race. During the succeeding five hundred years, however, some of them crossed the Sabi and Limpopo rivers and came still further south. At the beginning of the last century those of them settled south of the Zambesi could be classed geographically into two distinct branches :—

I. Coast or Lowland Tribes.

II. Tribes of the Mountains and Inland Plateau.

*See J. H. Speke, Discovery of Source of Nile, 1863. H. Stanley, Through the Dark Continent, Chap. XIV, and John Roscoe, The Buganda, Chap. VII.

But if we examine the language a further division seems necessary and requires them to be arranged into four groups :—

I. Inland: 1, Makalanga group ; 2, Bechwana group.

II. Coast : 3, Baronga (or Tekeza) group ; 4, Zulu-Xosa (or Zulu-Kaffir) group.

1. THE MAKALANGA GROUP.

The Makalanga group includes the Makalanga, MaKaranga or MaKalaka (as the name is variously pronounced) and the BaNyai. In the XVIth century the chief of the Makalanga tribes was known as the Monomotapa and his so-called empire was bounded on the north-west by the kingdom of Butua or Toroa, formerly independent and powerful, but then subject to the Monomotapa ; on the north-east by the kingdom of "Mongas," by the "Bororos" (Ba-Boro) and by the "Macuas" (WaMakua). These last two tribes were separated by the Zambesi. South-west the "Botonga" (Ba-Tonga) tribe occupied the coast districts between the Sabi river and Inhambane ; and on the south ruled the "King Biri." The Empire itself was divided into four provinces, the north-west ruled directly by the Monomotapa, and three vassal kingdoms—one of Quiteve, north ; one of Sedanda or Sabia, south of Sofala ; and Manica, to the west of these under Tshikango (= chief Kango). This Province or kingdom contained the gold mines.* A hundred years later in the XVIIth century we find the border regions broken into numerous semi-independent principalities such as that of Mongas, that of Baroe, of Manica, of Zimbabwe and the "lands" (as terras) of Urupande.†

The BaNyai according to Burton are the modern descendants of the Mongazi or Mongasi (Munhaes, Banhaes). Dr. Theal alleges, however, that the whole of the old tribe of Mongasi had become the subjects of the Portuguese Manuel Paez de Pinho in 1667.‡

*Dos Santos Records S. E. Africa VII, 263—274.

†Bocarro R. S. E. A. III, 355.

‡Hist. and Ethnog. S. Africa before 1795, Lond. 1907, p. 481.

The term BuNyayi is used by their neighbours the Ba-Tonga to denote the territory which once constituted the empire of Monomotapa. A hundred years ago the BaNyai were confined to the south bank of the Zambesi in the bend of the river convexly to the north between the Lupata and Kariba gorges. They since ranged further south, attacked the BaMangwato and overran the Matoppos. Coillard found them in the Tuli district.

The Mashona or Ma-Swina was the collective name for the tribes of the Senna district who were otherwise called the Ba-Zizulu, anciently Moziruru or Moruruzu when their neighbours across the Zambesi were the BaRoro and the WaMakua. The Mashona have also since then extended southwards and westwards. It may be noted that the old Arab name for Senna as given by Abu'lfeda and Al Idrisy is Siyuna or Siona ; hence the word Mashona or MaSwina. Their dialect, which is also spoken by the Trans-Zambesian tribes of Tette and the MaNganza or people of Lake Nyassa, although distinct from the Ci-Kalanga, closely resembles it.

The BaLozwi or Barotse and the BaLunda, both of which call themselves Ba-Loi, crossed the Zambesi from the north at different periods during the XVIIIth century and filtered through to the south and east. They constitute a large proportion of the population of Mashonaland at the present day.*

The BaTonga (or BaToka) of the middle Zambesi basin are allied to the BaTonga who in the XVIth century occupied a region lying south of Sena. These latter ceased to exist as a tribe at the end of the XVIIth century being parcelled out among the Portuguese "pràzos."†

2. THE BECHWANA GROUP.

On the southern frontier of Monomatapa's country lay the territory of a King called Biri (as terras d'um rei cafre chamado Biri que estao junto da Manica), in 1609.‡ It is possible that we

*R. N. Hall, W. C. Taberer.
†See Theal op. cit.
‡(Dos Santos, Records S.E.A. VII, 52).

see here the tribe of BaMbiri a clan of the Ba-Nyai. Merensky identifies Biri with the Ba-Peri or Ba-Peri, known in Transvaal history as Sekukuni's tribe but this could scarcely be if the BaPeri were only so-called in recent times from the great chief Tulare or Mperi.* The Hottentots in 1689 told Ensign Schryver that there was a race known to them called Briqua, who were cannibals; and in 1782 Messrs. Roos and Marais brought a report from Namaqualand that they had met some Kaffirs (Gobona) who told them that to the north east dwelt a people called "Birina" who lived in the Kingdom of Biri (het ryk van Biri). The word Birina, Briqua is a hybrid word composed of the Hottentot suffix denoting plural masculine or common gender, and the root *biri* of Bantu origin meaning "goat," but whether these people were called "goat-folk" because unlike the Hottentots they kept goats or whether it is the distinctive name of a certain tribe is not made out. The latter view seems probable as they have been identified with the BaTlhaping or some section of this tribe by the Korana.

The language of the BeChwana is very different in pronunciation and in the permutation of consonants from other Bantu languages, especially in the absence of nasalisation peculiar to most Bantu tongues. The Sechuana dialects differ from each other as does Isi-Xosa from Isi-Zulu; and the groups of dialects as a whole differ far more widely from the Zulu-Xosa, the Karanga, the Tonga or Herero groups than do any of these groups from each other. Again in complexion, colour, character, costume and customs the BeChwana show much less resemblance to the MaKalanga, the BaTonga and the Zulu-Xosa than do these between themselves. The different BeChwana tribes themselves seem conscious of a similarity, which is not shared by others, for they give themselves, what is unusual among Bantu, a collective name for the whole group, viz., BeChwana, "the people who are alike." They are lighter in colour than the MaKalanga or the Zulu-Xosa, or the other coast tribes; the body is less robust, the aspect softer, their strength not so great. In another respect do

*Imperial Blue Book, C. 1748, p. 143, Hist. Native Tribes of Transvaal, 1905 (Transvaal Nat. Aff. Dept.) Vide infra.

the BeChwana differ from other Bantu tribes. While the tribes of the west believe in a Nature God, whom they call Nzambi, and the eastern tribes in an ancestral deity whom they call Mulungo or Umkulunkulu, the BeChwana have another word which denotes less the idea of ancestry than of ghost or spirit generally; viz., Molimo, the *great spirit*, from the word "molimo"; plural, balimo, *evil spirits*; coupled with this are evident traces of totetism, as shown in their tribal names, and in the reverence paid to the totem or animal whose name they bear, or adopt as their "seboko."

From this we might infer either that the BeChwana tribes exhibit a fresh cross of the Bantu with some other race; or on the contrary that they are really the purest examples of Bantu, having their blood less mingled than either the negro cross-breeds on the west, or the oriental cross-breeds on the east. The latter hypothesis seems improbable, seeing that, with the exception of the semi-bantu dialects of the north-west border, the Sechuana language shows more evidence of permutation and erosion than any other Bantu dialect. On the other hand, no portion of its vocabulary or syntax has as yet been satisfactorily shown to afford any evidence proving relationship with or intercourse with any North African tribe, although we may note that the Fulah language spoken by a Berber race resembles Bantu in making no distinction between the masculine and feminine genders, but divides all things animate and inanimate into separate classes, two, in Fulah, human and non-human, and as we know up to as many as sixteen in Bantu. The likeness would be stronger if the Fulah suffixes were converted into prefixes or the Bantu prefixes into suffixes, a change not uncommon in Teutonic languages. If we fall back on the former hypothesis, that they are a semi-bantu cross with another race, we must reject the Semitic, for they are less oriental than the Swaheli or Kalanga; and we must reject the Hottentot, with which they have less in common than the Xosa or Tembu (for any slight points of similarity are amply accounted for by recent contact since their arrival south); and still more clearly must we reject the Negro, for no Bantu tribe shows less affinity to this race physically or intellectually. If we may accept the tradition of the Ba-Phoking, an off-shoot of the Bakwena, the Bechuana must have originally left the ancient Libya or Tripolis or Mahommedan Caliphate of Cairo, and crossed the Desert; then when they reached the Equator they split up into two tribes, the Ba-Rolong and Ba-Kwena, and as such reached the southern banks of the Zambesi. It is thus not inconceivable that as the Hottentot separated from the Hamitic Galla bringing their sex-denoting language with them, the BeChwana ancesters separated from the Hamitic Berber, their blood crossed and their language corrupted by subsequent mixture with Bantu.

At all events the BeChwana came from the north. The pioneers were the BaLala and BaKalahari. A hundred years ago these tribes were the vassals or refugees of the BaTlaro and Ba-Tlhaping. The Ba-Tamaha or "red people," a mixed tribe of BaLala and Bushmen, lived, covered with dirt and red paint, near Potchefstroom. The MaSarwa or Vaalpens, a cross between the Bushmen and the BaKalahari became later the cattle herds of the BaMangwato. The next tribes of the Bechwana to arrive were the Ba-Leghoya or Ba-Taung a tribe now practically extinct. In the beginning of the XVIIIth century they were established near the Molapo and Marikwa rivers and in the vicinity of Rustenburg. About fifty or sixty years later the western portion were driven south and east to the Sand river, where ruins of their stone kraals and fortified huts remain in evidence of their former occupants. Next came the Ba-Tlhaping or Fish people. Their route was more to the south and west and they located themselves between the Mashowing and Kuruman rivers at Lattakoo. About the beginning of the last century they were under Molehabangwe and his son Mothibi. Mothibi subsequently left Lattakoo (Kuruman) for Likhatlong taking only a portion of his tribe with him. Mahura, his brother became the real head and established himself at Taung. The subsequent fortunes of the tribe under rival chiefs, Gasibone (the paramount) and his son Botlasitsi, Mankorane and Mahura are involved in Colonial History.*

*Stow, Native Races; Hist. Native Races; Hist. Native Tribes, Transvaal; Theal, Hist. S. A. Republics and Native Territories; "Bechuanaland," by a Member of the Cape Legislature (Sir T. Upington).

Then came the Ba-Rolong or Iron People (Ba bena tsepe). They derived their name from their chief Morolong, who, tradition says, was at the Great Lakes about 1400 A.D. After four generations they reached the Molapo, drove out the Leghoya and occupied their vacant pastures. Here the BaHurutse separated from the main branch and became a distinct tribe. The Ba-Rolong under many successive chiefs enjoyed peace, increased in strength and wealth reaching the zenith of their power under Tau, the fourteenth descent from Morolong. Tau died at Taung about 1700 and the Ba-Rolong tribe divided under his sons into four clans, named from them the Ba-Tlou, or Ba-Ra-Tlou, the Ba-Ra-Tsiti, the Ba-Seleka, and the Ba-Ra-Pulana; but at the commencement of the last century, under their respective chiefs, Mokoto, Tawane, Sihunelo and Makhowe, they still made Kanwana near Maribogo their common headquarters. Moshette the paramount chief still resides there. Some of the Baralong under Makraki were at first located with the Ba-Tlhaping at Lattakoo, but later they migrated east and north-west, their place being filled up by the Ba-Tlhaping and by the Ba-Tlaro who were a clan of the Ba-Hurutse. The Seleka branch subsequently settled at Thaba-Nchu under Moroko who earned the perpetual gratitude of the Boer voortrekkers by aiding them against Moselekatse. Their people had continual disputes with the Basutos under Moshesh, whose territory they adjoined. Finally under Sepinare (Tsepinare) they were absorbed into the Orange Free State in 1884.*

After the Ba-Rolong the Ba-Hurutse seem the next oldest clan. The first division of the Hurutse tribe took place after the death of their third chief counting from their secession from the Baralong. The Ba-Mangwato, the Ba-Ngwaktse and the Ba-Kwena then split off. The chief Mohurutse, who gave his name to the tribe, then removed to Kurrechane, near the sources of the Marikwa. About a hundred years ago the chiefs were Sebiware and Mokgatla. Two of the other tribes just mentioned, the Ba-Ma-Ngwato and the Ba-Ngwaketse came down and settled to the north of the Ba-Ralong and Ba-Hurutse. As explained, they

*A. Wilmot, Hist. Own Times, I, 105).

were cadet branches of the BaRolong tribe, the BaMangwato taking their name from Ngwato, brother of Hurutse. This tribe is also called Ba-Tauana, or men of the young lion. They have never removed from their first settlements in what is known as Khama's country. Their capital until recent times was Shoshong, on the Shoshon river; later Palapye, or Palachwe, on the confluence of the Palachwe and Losani rivers. It is now moved to Serowe, close by. At the beginning of the last century their chief was Kgama, or Khama, the first of the name and great-great-grandfather of his namesake, the present chief.

One branch of the Ba-Mangwato, better known under the name Ba-Tawana, from their chief Tawana, brother of Khama the First, separated and went west. They reached the shores of Lake Ngami about a hundred years ago, when they were met by the traveller Andersson in 1853, under the chief Lecholetébé (Lechulathibi).

The Ba-Ngwanketse a hundred years ago were a restless formidable tribe under their aggressive chief Makaba, whose great place was at Knakua (Kanye), two hundred miles north-east of Lattakoo (Kurumane). They were later known as "Gasisiwe's people."

The Ba-Tlaro, known from their commercial aptitudes as the "Jew's of South Africa," have for a long period been located around their "stad" at Honingvlei between the Molopo and Mashowing rivers.*

We must now turn to the great clan of the Ba-Kwena or Ba-Koni, which according to native traditions, separated from the main Ba-Rolong stem, when the BeChwana were still as far north as the Equator. When they reached the South they had their great place, a town three time the size of Littakoo, at Kokwani, on a tributary of the Notwani. From thence the chiefs Nocwasele moved in 1814 to Litaruba or Molelele, where his descendants Setyeli and Sebele have since resided. In Mocwasele's time a hundred years ago, they were rich in cattle, but the general tendency of their wanderings being eastwards,

*C. 3635, p. 13.

they became involved in the internecine warfare which raged in the country south of the Waterberg and Olifants River east of the Drakensberg, in Magaliesberg, and in the Ba-Tonga borders in the Lebombo. The convergence of the BeChwana, Ba-Tonga and Kaffir tribes had rendered this district a regular colluvies gentium; and as a consequence of the resulting conflicts, the Bakwena tribe was broken up into an immense number of clans whose ceaseless movements it is useless to follow. We need mention only the following :—

The BaKubeng or BaKhofa; great cattle thieves, who in 1808 were settled in Rustenberg and Olifants Neck under Matope and Bugusi (Kuantle). The BaFokeng, of whom one branch went south to Thabanchu (O.F.S.), and the other settled in Rustenberg, at Boschpoort; a remnant in Basutoland under the name of Marimo, chief Tsuane, was accused of cannabalism. The Magopa in Rustenberg; though calling themselves BaKwena they seem to have been an offshoot of the Bangwaketse; under the rival chiefs Diale and Sekete. The Ba-Phalane, a branch of Mocwasele's tribe on on the Crocodile River. The Ba-Khatla or Ba-Kgatla, part of whom settled near Mochudi, Bechwanaland, later known as Linchwe's tribe, part in the Magaliesberg, and a remnant in the Maluti Mountains. The Ba-Pedi or Ba-Peri who seceded under LeLellateng from the BaKgatla, when Diale or Liale was chief and settled in the Eland sand Olifants river valleys, Middelburg; afterwards under Tulare or Mperi going east to Steelpoort. According to Rev. A. Merenskey, they belonged to another Bantu race, who were left behind by the migratory Bechuana tribes. This was 250 years ago and he connects them with the Biri of the old Portuguese maps; but the name Biri dates from at least the XVIth century or 200 years before the eponymous Mperi who died in 1824. Later on they seem to have been neighbours of the BaRaputsa. From the evidence of a Ba-Pedi induna, Ra'lolo, it appears that the Ba-Pedi were originally Ba-Kgatla and took their present name from "Bopedi," the name of the land afterwards known as Sekukuni's country, into which they had been driven by other portions of the Ba-Kgatla Tribe.* Later known as Sekukuni's tribe they lived at Lydenburg in the Luluberg.

*Tradition of Ra'lolo by Revd. J. A. Winter, S.A. Journal of Science, Dec. 1912

The Ba-Tlokwa in the middle of the XVIIIth century were already established on the sources of the Vaal River, and a hundred years ago were in the Zoutpansberg under Musima; their siboko was the leopard. From this tribe sprang

1. A tribe under its chief Mokotyo, later known as the Mantatisi so named from the celebrated Monyalwe, "Mother" of Ntatisi (Ma-Ntatisi*); also called the Ba-Kwabi, men of the wildcat. The Mantatis ravaged the territory north of the Orange River, and were finally dispersed. Sikonyela, son of Ma-Ntatisi died at Herschel, the deposed chief of a disintegrated tribe.
2. The Ba-Raputsa or Ba-Putsa; a portion of this tribe seems to have submitted to the rule of Sapoesa or Umswazi (Motsueze), the eponymous founder of the Amaswazi tribe to which we shall refer when dealing with the Zulu-Xosa group. The BaPutsa became later on better known as the Ma-Kololo under their famous chief Sebituane who led his hordes across the desert and founded the Makololo Empire (Barotseland) north of the Upper Zambesi.

The MaKhoakhoa The BaTlakoana The MaNyanyana The Ba-Phuti The BaRaMokheli The BaMomaheng	Six allied tribes under the general name of Basuto (Abesundu, in Isi-Zulu so-called from their light brown hue) over which Motlome the Monaheng chief was paramount, who formed the nucleus of the Basuto tribe situated on the Caledon River, north and south banks,

are sections of the Ba-Kwena.

It is unnecessary to enter into the history of the Basuto tribe under Moshesh, involved, as it is, in the history of European South Africa.

Suffice it to say that after several rectifications of frontier the Lesuto or Basutoland was by agreement bounded on the north by the Caledon river on the east and south by the Drakensburg on the south-west by the Telle and Cornet spruits. Within these limits the Basuto tribe has flourished under British protection ruled by their chiefs Moshesh (Mosheshwe) and his successors

*Ntatisi was a daughter. The eldest son was Sikonyela.

Letsie, Lerothodi and Letsienyane (Letsie II) in spite of conflicts with mutinous chiefs such as Masupha and the Molapos. Moirosi, a chief subject to Moshesh, living with his tribe the Ba-Phuti in the Quthing district, was in frequent revolt and became ultimately a British subject (1870). He subsequently rebelled, his mountain fortress destroyed, himself slain, and his tribe amalgamated with the Basuto. In 1858 two petty Basuto chiefs, Lebenya and Jan Letele (grandson of Motlome), seperated from Moshesh and were allowed to settle in vacant land south of the Drakensberg, now Mount Fletcher, Griqualand East. The Ba-Ngoni or Ba-koni, probably the Mangoles of Arbousset, are said to have come from the Zambesi; part settled in the Zoutpansberg at Piet Potgieter's Rust and Leydsdorp and near Selati (Palabora), and part reached the Setlopo mountains in Basutoland, when they came under the Ba-Tlokwa chief Putsa, founder of the Ba-Raputsa tribe; their sibokos were the rietbok (mocosa) and wild vine (morara). Some of these mingling with the Endwandwa or Vatwah in their rush to the north under Songundaba and Manukosi probably brought the name of Bangoni (Angoni) north of the Zambesi.*

Before leaving the Bechwana group we must mention three tribes which only partially, if at all, have Bechwana blood in their veins. The Bakwebo or Modjadjie's tribe, said to have come from Mashonaland one hundred and fifty years ago under a chief Mohale, their former abode they call Bakgalaka (Bukalanga?). There have been three Chieftainesses of the name of Mojaji, (Sech. letsatsi,,=sun) the origin of Rider Haggard's "She". The Ba-Lemba, Malemba or Malepa scattered about Zoutpansburg and also in the Belingwe district of Rhodesia; supposed not to be Bantu at all but a remnant of a pure strain of Semite; otherwise their origin is a mystery. The Ba-Venda, Ba-Soetla or Ba-Vesha (people of Tshivasa or Sibasa. This tribe came from Mashonaland at a comparatively recent date now inhabits the Spelonken and Tshivasa districts in the Transvaal.

*Arbousset: Narrative of an Exploratory Tour, 159.

3. The Ama-Tonga or Bathonga Group.

This Group, called also the Tekeza or Inhambane group comprises a number of tribes who speak several dialects sufficiently similar to render the group more homogeneous linguistically than physically. The language contains elements of Kalanga, Nyai and Zulu, and to a slighter extent of Chwana and Makua speech. The Zulu is a recent intrusion due to political causes; the other components admit of the Tonga language being classified (by M. H. A. Junod) into six classes; the Ronga, the Jonga, the Nwalungu, the Hlangenu, the Bila and the Hlengwe (or Fengu); but collectively the tribes which speak these different dialects are called Tonga, a word which in its various forms, (Ronga, Jonga) means "dawn". These tribes from their own traditions must have originally migrated from various regions to their present abodes, driving out or absorbing the tribes that were there before them. Of these we have the names of but two or three which remain still distinct, the Ba-Tchopi (cf non-Bantu Kopi or Chiopi of Uganda see p.) and the Ba-Tonga. The first named up to the present day occupy the shores on each side of the Zavora river mouth (between Limpopo and Cape Corrientes). The other which like the tribes under consideration also bears the name of Ba-Tonga it seems natural to regard as a remnant of the "Batonga" or "Bonga" known to be already occupying the region between the Sabi and the Inhambane rivers in the XVIth and XVIIth centuries among whom the Jesuit missionaries tried to establish a mission in 1560 at Otongwe the kraal of the chief Gamba. Both these Batonga of Otongwe and the Ba-Tonga of which we are now to speak seem distinct from the Batonga or Ba-Toka of the middle and Lower Zambesi mentioned at close of Section 1, Makalanga group. South of the Batonga or Otongwe were other tribes which we may regard autochthonous named by M. Junod the Shibambo, the Mtimba, the Honwana, the Ma-Hlangwana and the Nkunda. Upon these aboriginal tribes came the invading clans which now constitute the Ama-Tonga or Bathonga group.

From the north came:

1. The Nwanati; from this tribe are descended the MaLuleke, the Makhambane (of Inhambane) and the MaKwakwa (perhaps

of mixed Wakwak or Hottentot blood. M. Junod's derivation from the fruit *makwakwa* is not very convincing. The Nwanati speak the Hlungwe dialect.

2. The Ba-Loyi, Ba-ka-Loyi, Ba-Lozi, BaLozwe, or BaLuiana. To-day, the dwellings of the BaLozwe (BaRotse) are on the upper Zambesi, but they say themselves they came originally from the east. They claim to be of the same stock as the Ba-Nyai, and it is a fact that the SeNyai, and the SeLuiana or SeRotse are practically one language. A branch of these Ba-Loi broke off from the main stem in Rhodesia or further north, and accompanied the Nwanati along the "old Gwamba road" to the Limpopo. Their language is now classed as the Nwalungo or northern dialect.

3. The Tembe say they came from the Kalanga country by the Komati river. Formerly they were living on the confluence of the Limpopo and Pafuri (Lirubye). Like the BaLoyi, they are of Kalanga extraction. The main stem is recorded by the Portuguese in 1554. It was then between the Limpopo and Komati rivers and was known as the Zembe, and was probably connected with the people of Cazembe (Ka-Zembe). Until the XVIIIth century they lived under their chiefs or "Kapelas" in amity with, but independent of the Portuguese, and carried on a trade with them in ivory and ambergris. Meanwhile they had worked their way round from the Komati valley, south to the basin of the Maputa river, to which they gave their name; for the Maputa was formerly known as the Tembe or Temby, a name now given to a smaller river on the east. Offshoots of the Tembe are the MaPuta, the MaTolo, the Ma-Nkuna, classed linguistically as Ba-Ronga and speaking the Si-Ronga dialect. The MaPuta subsequently gave their name to what was once the Tembe but is now the Maputa or Usutu river. The Puta chief held the title of Inyaka (Inhaca), to which the Inyak islands owe their name. Their territory includes what was later known, politically, as Tonga-land—the "lands of Umbigiza and Zambaan." The MaTolo were north of the Umbelosi or English river.

From the south west came through the passes of the Lebombo mountains :—

4. The Hlabi, who speak the Tonga dialect.

5. The Nondwana or people of Lebombo who speak SeRonga.

6. Mpfumo or Mafumo, also speaking Si-Ronga, whose chief in the XVIth century, received his name as being king of Terra dos Fumos or Smoky land. He was the most powerful chief north of the Umbelosi, and south of the Limpopo. His tribe was known, as far back as 1589, as the Makomates, and has given its name to or received it from the Komati river. In 1726 the native chiefs in this region were known to the Dutch as Maphumbo, Tembe or Matomane, Matole, Machaja or Bombo (connected probably with Lebombo and Limpopo), Manisa, Mateke ("hidalgo") or "lord," according to Senor Ferao, Kwamba (probably the Hlangwu chief, or title Gwamba) and Mambe. This last, which Ferao explains as corresponding to our "highness," seems quite distinct from the dynastic title of the Monomotopa. We may connect it with the Abambo of Natal. It was Moambo or Wambe, who, in 1798, deprived Mafumo of a portion of his territory, and in 1805 ceded it to Portugal.

7. Khosa was another tribe from the south west, who spoke Si-Tonga and lived on what was known as the Khosine in the Komati tributaries. In 1798 the "Grand Cacha" was rich in slaves and his kraal numbered six hundred houses. He carried on a brisk trade with the Austrians at Delagoa Bay and Inyak, in ivory, rhinoceros horns and copper, which latter he obtained through the agency of the Hlangenu.

8. The Hlangenu (Ama-Hlangana) have dwelt in the Lebombo range as far back as tradition reaches. They were probably the Boa Gente whom Vasco da Gama met on the Rio do Cobre (Limpopo) in 1498. Interspersed with the BaPedi and Ama-Swazi tribes in the Lydenburg, they have traded since Da Gama's day with the copper-working tribes of the Transvaal, with the Makalanga and the BaRolong. The Hlangana are

called by the BaVenda "Ma-Gwamba," by the BaSuto, "Bakwaba," or "the people of Gwamba or Kwamba," their first ancestor by whom they swear. The Dutch call them Knobnenuen from a curious custom of tatooing. They speak a distant dialect, the Hlangenu, very much akin to Jonga.*

4. The Zulu-Xosa (Zulu-Kaffir), Group.

One hundred years ago there was no tribe known by the name of Zulu; only an obscure clan which attached itself to the Mtetwa tribe generally regarded as a section of the Great Ab-Ambo tribe or group of tribes living for the most part in Natal, or as they called the country, "Embo." The sixteenth century term Terra to Natal, must not be taken as precisely equivalent to our modern use of the terms, and Embo may have extended as far south as the Umzimvubu, but towards the north not beyond the (Zululand) Umfolosi. To the north of that again in the present Hlabisa and Ubombo districts were, in 1589, the Makalapapa tribe. Still further north, the more southern tribes of the Tonga group. At the date of the wreck of the San Bento in 1553, the whole of the coast between the Umfolosi and the Umtata rivers were peopled by Bantu tribes speaking dialects distinct from those of the Tonga group, most probably identical with the Zulu and Xosa dialects of a later day. Some of these clans, those most to the south, were impoverished and degraded, without flocks and herds, living like wild animals on roots, which they dug up with wooden pikes or iron pointed assegais. Their rude beehive-shaped, grass-thatched huts were found on the Umgazi. On the Umkomanzi, the tribes were more agricultural, growing millet and keeping cows. North of Port Natal the tribes were larger, wealthier, and more warlike; and across the Tugela a large army was encountered in the region later known as the territory of the Aba-Tetwa. They were described as rebels acknowledging no king, but one appointed by themselves, and subsisting by robbing other tribes.

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*Records S. Africa, var. loc., H. A. Junod, "Les Ba-Ronga," "Life of S. A. Tribe," "Grammaire ronga." F. Coillard, "On the Threshold of South Africa.

ABAMBO.

In 1589 this country was occupied by a tribe of apparently more pacific character known to the Portuguese as Vambe with whom a large trade in ivory was carried on. "The kingdom of Vambe" says Do Couto in his account of the wreck of the Sao Thome (1611), "ran south and included a great part of the land called Natal to the Cape of Good Hope. There are no other kings but all is in possession of chiefs called Ancosses (Inkosis) who are the herds or governors of three or four villages." The Arab writer of the Xth century, Al Mas'udy, mentions a tribe of Zeng, "who give to Allah the name of "Maklangalu." We find this word more or less corrupted in many indeed most of the tribes of the Eastern Bantu. But in its almost entirely unaltered form Unkulunkulu we find it still in use, only in the Zulu-Kaffir dialects. It is not an unfair inference that in the Xth century the Zulu-Xosa tribes were in the vicinity of Sofala. H. Fynn tells us that they were driven four hundred years ago from the region of Sofala the colonial frontier Kaffirs being the first to reach the South.

The Abambo or Vambe undoubtedly the same tribe whose chief Manibe had dealings with the Dutch at Delagoa Bay in 1726, and whose king Wambo or Moambo robbed Mafumo of his lands in 1798 ; and his kingdom is no doubt the same as that described by Capt. W. F. W. Owen thirteen year later,—" north of Matoll lie Moamba, a very considerable state." Although distinct from Embo it was probably occupied by a section of AbAmbo.* A cognate tribe was the Vatwah or Olontotes " whose kingdom bounded Maputa on the south," a very warlike and admirable race of Kaffirs" says Capt. Owen. The Vatwah he adds came from regions beyond the sources of the Umbelosi (Espirto Santo) and Maputa. His subsequent statement that the " present king Zeite of the Vatwahs was a minor at his father's death, and that his uncle was Soongundava proves that he is speaking of Zwide, chief of the Endwandwe who with Tshaka's aid defeated and killed Dingiswayo and who lived north of the Tugela, and also of

*Records S. E. Africa II, 164, 199, I, 218, et. seq.

Songundaba who led a section of the Endwandwe called ANgoni or AbaNgoni north of the Zambesi. Another powerful chief who occupied part of the region between San Lucia and Delagoa Bay at that time was Ekonyane chief of the Umdwandise. He had to fly from the Mtetwa chief Dingiswayo, to the north west of Delagoa Bay, and his son Sotshongana (or Manukosi) was a few years later followed up, driven north and attacked by Tshaka's captain Ngaba. Thus a hundred years ago the Umdwandise had recently settled on the Komati or Crocodile river; Songundaba with a section of the Endwandwe or Vatwah was on the Umbelosi (Espirto Santo); but Zwide with the bulk of the tribe was on the Black Umfolosi as the situation of the present magistracy of Ndwandwe indicates. Sapusa or Zapoesa, who was shortly to weld the scattered bands of AmaNgwane and BaRaPutse into a tribe on the Inkonto or Assegai river which should bear the name of his son Mswazi, was head of a small clan on the Pongolo recently defeated by the UMtetwa. The AmaSwazi and Endwandwe and probably the Undwandise spoke distinct dialects of IsiZulu and it is doubtful whether these tribes can be correctly described as AbAmbo.* The famous UMtetwa also, the tribe of Godongwana or Dingiswayo were apparently distinct from the Abambo and arrived in Natal at a later date. Dr. Theal tells us on the authority of one of Dingiswayo's grandsons that in the time of the father of Punga, Dingiswayo's grandfather, they were driven south across the Zambesi from some place far to the north by their neighbours the Komanti (Makomati ?) and the Ashonga (Ba-Jonga ?). The AmaZulu were originally a sub-tribe of the UMtetwa living on the south of the White Umfelosi in the district called Makosini (the place of chiefs). The story is well known how Tshaka, son of Senzagakona, the Zulu chieftain, acquired supremacy of the Mtetwa tribe on the death of Dingiswayo and entered on a career of conquest

*Arbousset refers to the Endwandwe as the "Atoantoas, who speak the Sesuatse (iziSwazi), a dialect related to the Zula, but so despised at Mokokutlufe (Gunguhlovu, Dingaan's Kraal), that the subjects of Maueue are there usually nicknamed the *maguelegas*, or the stutterers."—Exploratory Tour, p. 215. He to some extent confuses them with the Umdwandise.

and massacre. His impis penetrated what is now called Transkeian territories as far as what was the Colonial border in 1828; to the north his captains followed the fugitive Endwandwe and the Undwandise until until they have chased them across the Limpopo and the Sabi.

The Endwandwe under Songundaba crossed the Zambesi and became known as the ANgoni wandering hither and thither as far as Lake Nyassa and even further; the Umdwandise under Sotshangana (Manukosi) settled in the Sabi valley with head-quarters at Masupa, where the tribe were called the Aba-Gaza; hence their territory is known as Gazaland. After a long internecine struggle between the two sons of Manukosi, Msila and Mawewe, Msila obtained the mastery. On his death he was succeeded by Gungunhama (Ngungunyame) who reigned at Mandlakazi until he was dethroned by the Portuguese, 1896. The followers of Mawewe were known as Shangaans. Upon the destruction of the Endwandwe tribe under Zwide's son Sikunyana at Nkandhla, a large proportion took refuge with Msiligazi (Moselekatse) who had just carried the standard of revolt against Tshaka; and the horde just constituted under the name of MaTebele fled north, and for many years carried rapine and havoc throughout the Transvaal territory, which the Boers on entering found laid waste and depopulated. Coming into conflict with the voortrekkers Moselekatse was more than once defeated as also by the impis sent forth against him by Tshaka. Eventually he crossed the Limpopo and took possession of the old empire of Monomotapa subduing and expelling the Makalanga and Mashona. He died in 1864, and was succeeded by LoBengula (Nombengule) his son. Meanwhile Tshaka by a system of forays enlarged the circle of devastation extending from the Limpopo to the Umzimkulu, from Manica to the coast. To attempt to describe the movements of the various tribes fugitive from the Zulu king, or from the Matebele chief, or the more dreaded Mantati chieftainess would be like trying to follow the movements of the fowls when a couple of foxes were in the hen roost. He was killed in 1828 by his brother Dingaan who succeeded him. Dingaan massacred Retief's party and was soon defeated by the Boers in alliance with Panda, the third brother, he fled to Swaziland when he was slain. Panda supported by the Boers succeeded to the chieftainship but the area of his rule was restricted to a territory bounded by the Tugela on the south, by the Transvaal division of Utrecht on the north-west, on the north-east by Swaziland and Tongaland. This boundary was disputed in the time of Cetawayo, and after his death the Boers annexed the present district of Vryheid and Piet Retief (1884-6). The remaining territory was annexed to Natal.

A hundred years ago the Abambo were split up into a number of tribes of which no less than ninety-five were located in the colony of Natal alone. Of these ninety-five the following may be instanced:

1. The AbaTembu, chief Goza, on the Umzinyati near its confluence with the Tugela; Goza, who could boast of having beaten off Tshaka, was subsequently slain by Faku, the Pondo chief, on the Umzimvubu.
2. The AmaQuabi, chief Pakatwayo, situated on the coast on the banks of the Tugela; Pakatwayo, after frequent defeats by Dingiswayo, was ultimately killed by Tshaka in the Nkandla forest.
3. The AmaCele, chief Dibandhlela, on the coast between the Nonoti and Tongat Rivers; tribe under Magaye dispersed by Dingaan and many joined the white men, Fynn, Biggar, etc.
4. The AmaMbomvane, both banks of the Umkomanzi; afterwards under Moni in Bovanaland (Elliotdale).
5. The AmaTuli, chief Untaba, between Umgeni and Umkomanzi; originally a very large tribe; wore head-ring on a hair-basket a foot high from the top of the head; a portion of this tribe under Uminini took refuge from Tshaka on the Bluff at Port Natal, and succeeded in remaining there until the tyranny was overpast; are still there.
6. The AmaNcolosi, chief Mepo, on the Amanhlabati river (Kranskop); this was probably of Tonga blood since it spoke Tegeza dialect.*

*Bleek, Comp. Gram. 1, 23, 24, 26.

7. The AmaNgcobo, a large tribe on the Upper Umvoti.
8. The AmaBele, chiefs Undingi, Qunta, Jojo, etc., entered Cape Colony as Fingoes under Mabandhla. Ancient residence junction of Sunday's and Tugela rivers.
9. The AmaXesibe or Zasibe, chief Umjoli, on the sources of the Umpanza, tributary of the Mooi river; afterwards moved south to Pondoland (now Mount Ayliff district), and kept up desultory warfare with Pondos.
10. The Enhlangweni and AmaKuze, under Gonyama and Nombewu; originally dwelt on Tugela, Lower and Upper, and migrated south of the Umzimkubu, where Nombewu was attacked and slain by the AmaBaca; succeeded by Fodo.
11. AmaBaca, chief Madikane; ancient residence between Maritzburg and Umgeni; Madikane moved south towards the Cape frontier, when in 1824 he was slain by Tembus and Xosas on Umgeni River. Later on his son Ncapai was killed in war with Faku; the greater part of the tribe remained with Ncapai's widow, on the Umzimvubu (Matatiele); the remainder returned to their old haunts.
12. The AmaHlubi, under Mtinkulu, Mpangazita, and Monakali, resided on both banks of the upper Umzinyati or Buffalo to its sources and upper tributaries; this tribe was the largest of the Abambo, but very disunited; attacked and defeated by the AmaNgwana under Matiwana; the AmaHlubi were driven from their homes with great slaughter, and their chief Bungane with his principal son slain. A large portion of the tribe, under a minor son of Bungane, Mpangazita (Pakarita), crossed the Drakensberg and fell upon the Basuto; overtaken by Matiwane they were utterly defeated in a great battle fought on the Caledon river, and Mpangazita slain; a portion of the fugitives reached the Orange Free State, under Mehlomakulu; a portion under Mpangazita's son Sidinane were allowed by Moshesh to settle near Ficksburg, but afterwards removed to the Herschel District. Other remnants reached the Cape Colony as Fingoes, and were settled there under Zibu, Umhlambiso and Maqoba. A residue under Langalibalele,

who represented the royal line, returned to the eastern bank of the Buffalo (Utrecht).

13. The AmaZizi or BaZizi, although generally regarded as the second largest clan of the Abambo tribe, seem to have been of different origin. We have already mentioned them as driven into Natal in some bygone time by the BaVenda, when they took up their quarters along the Drakensburg between the upper waters of the Tugela and Klip rivers. They were much more intelligent and enterprising than the AmaHlubi and other Abambo, and are supposed by some to be of Kalanga origin. The BaMaru (people of the clouds), the BaMarara (wild vine folk) or BaNgoni* and the BaRaPutse appear to have been related to them, and Sebetuane is said to have been an Umzizi. AmaZizi were the BaHaLanga (Makalanga ?), who at a later date immigrated into Basutoland from Natal, and established themselves at Morijah. The AmaZizi shared the fate of most of the Hlubi tribe, being driven by the Matiwane into the Cape Colony, where they were known as Fingoes, and under Jokweni were located between the Fish and Keiskama rivers.

The AmaNgwane themselves, who have so often been mentioned together with their chief Matiwane, as the scourge of other tribes, were but recent arrivals in Natal, and cannot be regarded as Abambo. Their earlier history and their origin is unknown. Driven by Tshaka, the Zulu king, across the Drakensberg, they invaded Basutoland and Moshesh submitted to Matiwane and his vassal, but afterwards administered a severe check to his captain Moselane and his "Manquanes" (Arbousset). An army from Tshaka subsequently falling upon Matiwane, he recrossed the Drakensberg and attacked the Tembus under Bawana on the Zwart Kei, devastated Tembuland and settled in the Umtata. Ultimately he was totally defeated east of the Bashee by a force consisting of Pondos under Faku, Tembus

*Mnguni, the eponymous founder of the Ba-Ngoni or Aba-Nguni, is stated by Messrs. J. Ayliff and J. Whiteside (History of the Abambo, Trans kei, 1912 p. 9) to have been of Zulu origin. His tribe after his death took service under Bungane, the Hlubi chief, who married a Ngoni woman, the mother of Mpangazita. The Aba-Nguni were scattered with the rout of the Hlubi tribe.

under Vusani, Xosas under Hintsa, and Colonial troops under Colonel Henry Somerset. Matiwane fled to Dingaan, by whom he was put to death, and the AmaNgwane tribe remained in the Transkei to be absorbed by the Fingoes and other tribes. A portion of the Amangwane was, however, incorporated in the AmaSwazi by Sopoesa.

FINGOS.

Mention has been made of the AmaHlubi and AmaZizi, who, with the scattered remnants of other fugitive clans, the AmaKuze, AmaBele, AmaReledwane, Aba-se-Kunene and others, had fallen into the power of the Gcaleka chief, Hintsa—and had been treated with great oppression. In order to save them from the servitude to which they had been subjected, Sir Benjamin Durban brought a number of them into the Cape Colony, and settled them beween the Fish and Keiskama rivers (Peddie). These people had been called AmaFengu or Fingos, because, when in their wanderings they were asked what they wanted, they replied "Siyam fenguza!" "We are destitute!" A large number still remained in Gcalekaland after the migration, and in the war of 1846-7, they acted as spies and auxiliaries to the British, as a reward for which services they were allotted land in Victoria East and Fort Beaufort.

After the 1851 War, a detachment of Fingo warriors, living in Gcalekaland (Butterworth), were brought across the Kei and settled in the Queenstown and King Williamstown districts. After the cattle killing of 1858, the Transkei was almost depopulated. Kreli was only allowed to occupy what are now the districts of Willowvale and Kentane. The remainder of his country was in 1886 divided into "Fingoland" (Ngamakwe, Butterworth and Tsomo), and the Idutywa Reserve and the Colonial Fingos of the younger generation allowed to settle there.

On the termination of the 1877-8 War, part of the Gcalekaland was parcelled out between Gaikas (Kentani) and Fingos (Willowvale).*

*J. Bird, Annals of Natal, Vol. I. W. C. Holden, Past and Future of the Kaffir Races. Ayliff and Whiteside, Hist. of Abambo.

XOSA, TEMBU, PONDIMISI, PONDO, ETC.

The Santo Alberto went ashore in 1593, a few miles south of the Umtata. The survivors in making their way along the coast to the Portuguese settlements, found several tribes between the Umtata and the Umtamvuna, more or less dark in complexion and among them youths dressed in reeds fashioned like mats, "which is the attire of the young noble before he bears arms or has female associates." These were evidently noviciates, "Abakweta," practicising a custom that is characteristic of the Kaffirs. The names of none of the chiefs, however, give any clue to the modern tribes. They were called by their followers "ancosses," a name which among the Makalanga was restricted to headmen or petty chiefs, and is probably identical with a word used by the tribes of the Congo and West Coast to signify "lion."*

A hundred years later we find the shipwrecked crew of the Stavenisse (1687) bringing news to the Cape of certain tribes in the country lying between the Tugela and the Buffalo. "Five sorts of Hottentots" (so they called them) named—beginning from the place of wreck near the Umzimkulu mouth—"the Temboes, the Mapontemousse, the Maponte, the Matimbas, the Maligryhas (the most cruel of all) and the Magossebe (from whom they received every kindness). In 1688 the Noord, in going to the rescue of such of the crew as had been left behind, anchored opposite the "country of the Magosse." The rescued men spoke of "five kingdoms" in a territory of one hundred and fifty 'mylen' along the coast and thirty 'mylen' inland, "namely, the Magosse, the Magrigas, the Matimbes, the Mapontes and Emboas." Their chiefs were also called 'Ingosse.' Of these

*Records S. E. Africa, II., 225, et seq.

*Shi-Kongo, *nkosi*; KiYansi, *nkoshe*. The Portuguese called the chiefs of tribes north of San Lucia Bay, 'fumos'; possibly as an extended use of the title of the Nkomati chief Mfumo or king of the Terra do Fumo; possibly the word is derived from the EshiKongo form, *mfumu*; though this again may not have been originally Bantu, but borrowed from the Portuguese who introduced it from Mozambique. The Bantu word for chief in S. E. Africa was *muene* or *morena*; around Zanzibar, *mfalme*, *jumbe*; the SiKalanga word *che* or *she* is unique. It is contained in Cherengwe, Chicanga, Chiroro, etc.

tribes the Maligrighas or Magrigas were found afterwards to be Batuas or Bushmen; of the others the Emboas are clearly Abambo. The remaining four were members of a group of Bantu at that time residing between the sea-coast and mountain ranges of Stormberg and Drakensberg, whose respective chiefs traced separately to a common ancestor—Zwide, in the following order of seniority :—

1. AbaTembu (Temboes and Matimbas); possibly a section of the AbaTembu tribe already numbered among the Abambo.
2. AmaMpondumise (Mapontemousse).
3. AmaMpondo (Mapontes).
4. AmaXosa (Magosse; also Magossebe; perhaps an error for Magossche; but cf. Gonaqua, Gqunukwe-be. The resemblance to AmaXesibe is probably fortuitous).

While the BaFokeng are able to trace back along a line of thirty chiefs, these "Sons of Zwide" cannot number more than twenty generations of lineal descent; and the most ancient legends of the AmaXosa do not date beyond Tshawe, son of Inkosiyamtu (anax andron, king of men), grandson of Xosa, who was third in descent from Zwide. Zwide was therefore, probably actually a contemporary of Kwena when he seceded from the Baralong stem at the beginning of the XVIth century.

Some fifty years after the Bechwana had reached the Molapo and when the Abambo were already in Natal, Xosa had settled with his tribe in the region south of the Umzimkulu. Possibly they came through a portion of Natal, where, according to Dohne, a small section of AmaXosa were still to be found in 1852. Xosa was succeeded by Malangala, and he by Inkosiyamtu, who, towards the end of the XVIth century, married a woman of the Abambo tribe. On his early death his widow took refuge with her tribe from his elder sons Jwara and Cira, until her own child Tshawe had grown up, and as the son of the great wife laid claim to the chieftainship and wrested it from his brothers. At that time the AmaXosa and AbaTembu shared the land as far south as the Bashee; the Xosa to the north, the Tembu to the south of the

Umzimvubu (St. John's River), and doubtless Ubapu* was a Tembu petty chief, while Vibo* and Nyanza* and the Abakweta youths described by Rodrigo Migueis were AmaXosa, perhaps under the rule of Inkosiyamtu or Cira. Under Tshawe's chieftainship the Xosa clan became a powerful tribe, and either then or soon afterwards (but not later than the end of the XVIIth century), they moved south, passing the Tembu tribe, and building the kraals as far as the Kei and possibly extending their hunting parties to the right bank of the Buffalo. About here they were found in 1688 by the Dutch sailors, under a chief Magamma,† who was at war with a tribe using bows and arrows, called MaKanaena (Kanaiqua? Gonaqua?), who were either Hottentots or Bushmen like the Magrigas and Batua. At this date it is computed that Togu the third, in succession from Tshawe, was the paramount chief. The AmaMpondumise and Amapondo had entered the territory hitherto occupied by the AmaXosa between the Umzimkulu and Umzimvubu, the Pondos being north and the Pondumise south of the Umtamvuna. The AbaTembu seem to have remained stationary.

The Amampondo (known earlier as Hambonas, Mambos and Mambukies) have, up to the present day, not changed their headquarters, although from time to time enlarging and contracting (generally enlarging) their borders; and until recent times the AmaMpondumise did not move far from their kraals of 200 years ago; but the history of the Aba-Tembu and AmaXosa has been one of constant encroachment westward. During the reign of Tshiwo, grandson to Togu, one of his councillors, Kwane, with a few followers joined and obtained the chieftainship of the Gonaqua tribe (AmaGona), since then known as Ama-Gqunukwebe; but Gwali, Tshiwo's right hand son was, in 1702, the first to lead a band of AmaXosa across the Kei, and penetrate the Colony as far as the Boschberg (Somerset East) where they were encountered by a party of marauding Boers.‡ They united with the Damaqua

*Names of chiefs given in the account of the wreck of the Santo Alberto.

†Magamma is mentioned as being chief of the Magosse in one place, and in another as the Magossebe.

‡Gustav Fritsch quotes a tradition of one Gando being chased by Tshiwo to the Fish River and living on the Koonap. Eingeb. Z. A. 463.

Hottentots and became known as the AmaNtinde, Ntinde being the left hand son of Gconde, the paramount chief, son of Togu, and father of Tshiwo. These pioneers were followed by a Xosa clan, the ImiDange, first formed by Gconde's right hand son Umdange; and the AmaMbala or AmaMbalu (Hottentot name Barooqua, Baruqua), headed by Langa, the left hand son of the chief Palo. This took place in 1740 when Palo, son of Tshiwo was paramount chief. Next year followed Rarabe, Palo's right hand son, fighting his way with difficulty against the Hottentot clans and purchasing from Hoho, the Hottentot chieftainess, the land around the upper springs of the Keiskama and the Buffalo. Palo himself followed, crossing the Kei near its mouth and marching on the Nahoon and Buffalo. Thereupon the Keiskama became the southern boundary not only of the AmaXosa but of the Bantu; the AmaNtinde in the van between the Keiskama and Tshalumna; Gcaleka, greatson of the paramount chief, on the west bank of the Kwenugha, Palo in the Izeli valley and the sources of the Buffalo. Rarabe moved to thec ountry between the Tsomo and the White Kei, where he lived on the site of the present village of Butterworth. All this was previous to 1750. In those days the AbaTembu were all in their old haunts on the east of the Kei under the paramount chief Daba, the suzerain of all the children of Zwide.* Twenty-five years later (1775), Palo having died and Gcaleka become paramount chief of the AmaXosa, Rarabe had returned to the Keiskama with his tribe and lived between that river and the Buffalo until 1785, when, being slain in battle with the Tembus on the Kei banks north of the Tsomo confluence, he was buried in the Amabele hills near Emgwali. Gcaleka was still living in the Komgha district until his death in 1790 (?) The AmaGqunkwebe and AmaNtinde occupied the present district of Peddie; the AmaGwali and Imidange had their kraals along the Koonap; those of the AmaMbalu were on the Tyumie.†

In 1779 the Xosa Kaffirs first crossed the Fish River in force. They comprised the AmaGqunukwebe, Imidange, AmaMbalu,

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*Theal. Hist. S. A. 1652—1795, Lond. 1897, Vol. II pp. 121—7, 134—5.
†Theal op. cit. 135—6.

AmaGwali and AmaNtinde clans. Some settled on the Bushman's river, others overran the Zuurberg and Boschberg (Albany and Somerset East). They were ultimately expelled by Van Jaarsveld's commando ; but in 1789 returned in greater force under Langa and Cungwa, the Mbalu and Gqunukwebe chiefs. It is needless to trace their frequent movements and those of the tribes behind them consequent on their efforts to establish themselves in Colonial territory. It suffices to say that a hundred years ago (1809) the position of the Xosa, Tembu and other tribes was as follow :—

Kawuta, great son of Gcaleka who had gone to the eastern side of the Kei with his tribe to live in what are now the districts of Butterworth and Kentani, still resided there, his kraal, when visited by Colonel Collins, being in sight of the sea between the Kei and the Bashee.

The tribe of Barabe had split up, one section following the right hand, but elder son Ndlambe, the other the son of his great-son Umlau, who was named Gaika (Ngqika). We will not detail the varying fortunes of these two antagonists, who gained alter nately the advantage over each other. Since 1796 Gaika had established himself on the Upper Keiskama, where at one time he held Ndlambe prisoner ; but in 1809 he was vanquished and impoverished, and living on the banks of the Upper Keiskama.

Ndlambe who had escaped in 1799, and crossed the Fish River into the Zuurveld, had in 1803 successfully withstood the Colonial forces, and was now still living in the Zuurberg with his son Umhala. Next and neighbour to him was Cungwa, chief of the Gqunukwebe, now a powerful tribe, who had penetrated so far west as Long Kloof and the Gamtoos River. The Imidange were, some with Gaika, the remainder in the Zuurberg and the Zuurveld. The AmaMbalu were also for the most part with Gaika under Eno (Nqeno), the rest were in the Zuurveld together with the AmaNtinde and Ama Gwali.*

The AbaTembu in 1809 were under their paramount chief Vusani between the Bashee and Umtata rivers. The tribe was

*Theal Hist. S. A. 1795—1834, p. 145, 154—5, Col. R. Collins, Journal of a Tour 23 July 1809. Rec. C.C. VII. pp. 19, et. seq.

already divided, though not separated into subordinate clans, such as the Ama-Jumba, Ama-Qiha, Ama-Tshatshu, and Ama-Dungwana; Bawana head of the Tshatshu branch as Napassa's tribe was on the eastern bank of the Tsomo. His people were unsettled and a portion were gradually extending towards the Orange River. The AmaMpondumise were still between the Umtata and Umzimvubu; their chiefs were Mgcambe and Velelo. The AmaMpondo also were still between the Umzimvubu and Umzimkulu or perhaps a little to the south as far as the Umgazi where Faku who had probably just succeeded his father Cungushe built his kraal.

The devastations and ravages of Tshaka, King of the Zulus, caused little change in the geographical distribution of the tribes situated south of the Umzimkulu (St. John's River). The AmaMpondo (under Faku) avoided absolute extinction by the tyrant though suffering temporary loss of a portion of their territory north of the Umzimkulu. The AmaMpondumise were located in what are now the Tsolo and Qumbu districts under Hlontso and Mgabisa.

The AbaTembu under the paramount chief, Bawana, sojourned in the territory which extended from the coast towards the Gatberg (now Maclear) between the Umtata and Bashee rivers. A sudden invasion by Matiwane, chief of the AmaNgwana, sent them flying before the battle-axes of the "Fetcani," "Fecani" (*le-fikani*, Sechwana="those who wield axes") into country watered by the Indwe and White Kei; but the expelled Tembus recovering under Vusani and aided by Hintsa, chief of the Ama-Gcaleka, and a detachment of British troops under Col. Somerset routed the invaders on the Bashee in 1828.

Of the Xosa clans it may be said speaking generally that the AmaGcaleka remained east of the Kei and on the west were the sub-tribes of Rarabe the AmaNgika, the AmaNdhlambe, the AmaMbalu, the ImiDange and the AmaNtinde.

The history of these tribes from the death of Tshaka, 1828 to the middle of the XIXth century, is the history of the Kaffir Wars of 1834-35, of 1846-7 and 1850-1, known respectively as the sixth, seventh and eighth Kaffir Wars. At the conclusion of the sixth Kaffir War, Sir Benjamin Durban received into the colony a large number of Fingoes who were found in a miserable condition as slaves of the Gcalekas and settled them between the Fish and Keiskama rivers, one location in 1837 being made so far west as the Zitzikama. At the close of the 1846-7 war, the land lying between the Great Kei and the existing colonial boundary was annexed to the British Crown under the name of British Kaffraria when the following chiefs made their submission and were settled within the new province. (1) Sandili and Anta, sons of Gaika, Kona, son of Maqomo, Fini and Oba, sons of Tyali--all AmaNqgika; (2) Umhala, Umkayi, sons of Ndhlambe, Seyolo, Siwani, and Umfundisi, sons of Umdushane, AmaNdhlambe; (3) Toyise, son of Gasela and grandson of Rarabe; (4) Stokwe and Sonto sons of Eno (Nqeno), AmaMbalu; (5) Tola and Botumane of the ImiDange; (6) Jan Tshatshu of the AmaNtinde.

Mapassa son of Bawani had seceded from Umtirara, the Tembu paramount chief, and settled himself in the Bolotwa, between the Stormberg and Indwe and the Klaas Smits river, later known as the Tambookie Location in the Glengrey district, where his tribe became subject to the British and was known as the Emigrant Tembus. A large number of Fingoes from the Butterworth region who had served in the war was located in the Tyumie (Victoria East).

The eighth Kaffir War known also as the Hottentot Rebellion made little change in these dispositions. Mapassa's tribe of Tembu was nearly annihilated, and the remnant under Nonesi, widow of the Tembu chief Vusani, was settled in the Glengrey Location. The AmaNgqika lost the Amatola Basin and under Anta, Sandile, Maqomo and Botumane confined in the "Gaika Location" a territory on the west bank of the Kei (now Stutterheim).

Of the AmaGqunukwebe Kama, the Christian chief who had remained faithful during the wars, both of 1846-7 and 1850-1, was given an increase to his territory on the Keiskama. Pato had a long strip of land along the coast between the Keiskama and Kei (East London Dist.). Umhala son of Ndhlambe, a similar strip alongside inland (southern part of Kingwilliamstown), Siwani and Mkayi were settled in Victoria

East and Peddie. Tshatshu and the AmaNtinde, Toyise of the AmaRarabe in the northern portion of Kingwilliamstown.

Fingos were also settled in tracts of land at Lesseyton, Kamastone, Ox Kraal and Windvogelberg (Cathcart). The rest of the country was alloted to Europeans.

The only independent tribes were the AmaGcaleka, who retained their territory between the Kei and the Bashee, under Kreli (SaRili), son of Hintsa, and the AbaTembu under Umtirara and his son Ngangelizwe, who still ruled over what was known as Tambookieland (now Elliot, Slang River, Engcobo, Mqanduli and Umtata).

In 1858 the present district of Idutywa was partially occupied by Umhala's clan (AmaNdhlambe), but later both that district and that known by the name of "Fingoland" (Butterworth) was populated by the prolific Fingoes.*

In 1865 British Kaffraria became part of the Cape Colony. In 1866 a further secession from the main body of the Tembus was effected by Matanzima, brother of Ngangelizwe, who moved from the Qumbu district and the proximity of the AmaMpondumise into St. Mark's district, and were henceforth also known as "Emigrant Tembus."†

The cattle-killing delusion of 1858 wrought the destruction of many of the Xosa clans, and Kreli was only allowed to occupy the southern portion of his territory (Willowvale and Kentani). The war of 1877-8 resulted in bringing the AbaTembu and AmaGcaleka under the direct rule of the Cape Colonial Government, who parcelled out a further portion of Kreli's domain among the Gaikas and Fingos.

The massacre of a European magistrate by the Pondumise chief Umhlonhlo, broke up that tribe. In Pondoland, Faku was succeeded by the chiefs of Eastern and Western Pondoland, Umqikela and Sigcau on the east, and Umdamasi and Nqiliso on the west of the St. John's river, who ruled the Pondos until the annexation of their country by the Cape in 1894, extended the boundary of that Colony to the southern border of Natal.

*Op. cit., Holden, Past and Future of the Kaffir Races.
†Imperial Blue Book C. 2144, 1878, pp. 163, 172.

On some Fossil Fishes in the Collection of the Albany Museum.

By R. Broom, DSc.

In none of the South African Museums is the collection of fossil fishes large. The best collections are those of the South African Museum, of Mr. Alfred Brown, of the Alexander McGregor Museum, Kimberley, and of the Albany Museum. Though this last collection is a small one it is important. It contains the best South African specimens of *Atherstonia* besides one or two other unique specimens.

Acrolepis (?) digitata, Smith Woodward.

A very interesting specimen; a portion of a large ganoid which unfortunately lacks the whole head and pectoral region and posteriorly is broken off abruptly in front of the dorsal and anal fins. The part preserved shows in beautiful condition the scales of the middle body region with the crushed anal fin and part of the pectoral. Smith Woodward has examined a cast of this specimen and in the British Museum Catalogue refers the specimen to *Acrolepis (?) digitata* founded on some scales from Graaff Reinet. Lacking the head, and having the two fins of which parts are preserved in a hopelessly crushed condition, it becomes very difficult to determine the fish at all satisfactorily. Like Smith Woodward I do not feel satisfied that it is an *Acrolepis* at all, and I have also considerable doubts as to its being the same species as the Graaff Reinet type. The fish is of large size; the depth of the body in the plane of the pelvic fin being 125 mm. It came from Koomes River, about 15 miles east of Grahamstown.

Undescribed Palaeoniscid.

From Styl Krantz in the Graaff Reinet district there is a specimen of the terminal part of the tail of a large extremely heterocercal-tailed Ganoid, There is little doubt that the specimen represents a new species and most probably a new genus, but the specimen is too poor to be made a type.

AMBLYPTERUS CAPENSIS, SP. NOV. (Plate XXVIII).

The type of this new species is a fairly well preserved small fish from Alice. Another specimen from Alice, not improbably the same species, is in the British Museum. It was named by Owen on the specimen *Hypterus bainii* but was not described. Smith Woodward in the British Museum Catalogue refers the London specimen to *Atherstonia scutata.* Whatever may be the case with the London specimen, this Albany Museum specimen is certainly not *Atherstonia scutata*, and I doubt if the London specimen is so. The geological horizon of Alice is probably between 2000 and 3000 feet lower than the horizon of Colesberg. While Colesberg is on the typical *Lystrosaurus* zone, and not older than Lower Triassic, Alice is on the *Endothiodon* zone, and either Middle or Upper Permian.

The total length of the type is 165 mm. and the greatest depth of the body in the region of the pelvic fin is 37 mm. The head is too imperfect for description. The dorsal fin is comparatively short based. It commences about midway between the front of the head and the tip of the tail. There are about 27 rays which are jointed and only the posterior ones are bifurcated at their tips. There are feeble fulcra.

The anal fin commences opposite the commencement of the dorsal, but it has a much longer base. There are about 50 rays which are jointed and bifurcated only at their tips. The anal fin extends back almost to the origin of the large caudal.

The caudal fin is powerful and strongly heterocercal. It is moderately deeply cleft. The anterior rays of the lower lobes are powerful, jointed and distally bifurcated. The more posterior rays are slender and are also distally bifurcated. The axis of the caudal fin is long and well developed and has a ridge of elongated scales above.

The scales of the body are moderately large. Unfortunately none of those on the middle of the body show the outer surface. The few nearer the tail which show the outer side are smooth.

ATHERSTONIA SCUTATA, Smith Woodward.

In the Albany Museum are two beautiful examples of *Atherstonia scutata*, from Colesberg. One measures about 340 mm. in length and the other 300 mm. Unfortunately, in neither example is the head well preserved so that it is impossible to add anything to the description.

Note on Mesosuchus Browni, Watson, and on a New South African Triassic Pseudosuchian (Euparkeria Capensis).

By R. BROOM, D.Sc.

About three years ago, Mr. Alfred Brown, of Aliwal North, discovered three or four skeletons of small crocodile-like animals in a soft calcareous sandstone. These were first examined by Mr. D. M. S. Watson, about the end of 1911, and described by him in a preliminary paper in the Records of the Albany Museum (Vol. 2, p. 296), under the name of *Mesosuchus browni*. The various imperfect skeletons were regarded as all belonging to one species. Only an imperfect and much crushed skull was described, but various isolated cranial bones were determined, and most of the limb bones were described briefly. The form was believed to be an ancestral crocodile with affinities to *Proterosuchus*, *Erythrosuchus*, *Ornithosuchus* and other early types.

A couple of weeks ago I had an opportunity of examining Mr. Brown's material, and found myself compelled to differ somewhat from Mr. Watson's conclusions. The little skeletons, in my opinion, belong to two different forms. As they are of nearly equal size, and both primitive Diaptosaurians or Rhynchocephaloids, the confusion of the two is not surprising. In one of the pieces of stone, only slightly developed by Watson, I discovered a perfect skull and most of the front part of the skeleton. This skull removes all doubt about there being two different genera associated.

The one form, represented by the crushed skull and nearly complete skeleton, is a sharp beaked reptile with round blunt teeth completely anchylosed with the bone. In the maxilla, there are 11 teeth irregularly arranged and varying much in size, the outer teeth being about twice as large as those inside. If there was a preorbital vacuity as seems not impossible, it must have been small. The tooth bearing portion of the lower jaw is much shorter than the back part, the lateral vacuity being almost completely to the front of the middle line. As in Watson's description, it is this premaxilla and maxilla with the anchylosed acrodont teeth that are first described, we may regard this imperfect skull as the type of *Mesosuchus browni.*

Mesosuchus, in my opinion, is a Rhynchocephaloid not very far removed from *Howesia*, but less specialised and nearer to the ancestral types.

The other small associated reptile is a near ally of *Ornithosuchus woodwardi*, and for it I propose the name *Euparkeria capensis*, in honour of Prof. W. Kitchen Parker, whose works formed my chief recreation in early student days, and have been the inspiration of much of my research.

Euparkeria capensis differs from *Mesosuchus browni* in having long flattened pointed teeth implanted in sockets. The skull measures, from the snout to the back of the quadrato-jugal, about 90 m.m. The nostril is relatively small, and there is a large antorbital vacuity. The orbit is large and rounded. The supra-temporal fossa is small and looks upwards. The infra-temporal fossa is of moderate size and is encroached upon by the forward bending of the squamosal and quadrato-jugal, as in *Ornithosuchus.* There is no trace of a pineal foramen. In general structure the arches are typically Rhynchocephalian.

The lower jaw has a long slender dentary, and the lateral vacuity is entirely behind the middle line. The whole lower jaw being thus unlike that of *Mesosuchus.* An imperfect dentary of *Euparkeria* was examined by Watson, and the thecodont condition of the teeth recognised.

But little need be said of the post-cranial skeleton in this preliminary note. The coracoid is large, and the scapular long and rather slender, measuring 40 mm. in length and 14 mm. in greatest width at the glenoid region. There is no trace of any acromion. The supposed scapula of *Mesosuchus* described by Watson, and which is said to be massive and to have a large acromion process, is really the ischium of *Euparkeria*, and the supposed acromion is a portion of some other bone crushed on to the ischial border.

The humerus, radius and ulna are long and slender. There is a beautifully developed plastron of abdominal ribs.

The pelvis resembles considerably that of *Erythrosuchus*. The ischium is long, and differs markedly from that of *Mesosuchus*. Four ischia are preserved, which measure 36 x 20, 39 x 20, 40 x 20 and 41 x 22 m.m. In *Mesosuchus browni*, the ischium measures only 24 x 20 m.m., and is thus entirely different in shape.

Most of the post-cranial bones described by Watson as those of *Mesosuchus browni*, are the bones of *Euparkeria capensis*.

Euparkeria capensis has a large series of dermal scutes, probably arranged in pairs down the back—one pair for each vertebra. In *Mesosuchus browni*, there are apparently no dermal scutes.

A complete description of the beautiful skull of *Euparkeria capensis* will shortly be published elsewhere. As every suture in the outer cranial wall can be clearly made out, and as the specimen is allied to Rhynchocephalians, Phytosaurs, and the Gnathodonts and also very near to the ancestor of the Dinosaurs, Pterodactyles, Birds and Crocodiles, its extreme importance will at once be manifest.

On Four New Fossil Reptiles from the Beaufort Series, South Africa.

By R. Broom, D.Sc.

Three of the new reptiles here described were collected for the Albany Museum by the Rev. J. H. Whaits at Hottentot's River in the Gouph. The plain at Hottentot's River apparently corresponds to the upper part of the *Pareiasaurus* zone. A considerable number of specimens have been obtained there at different times, and from the locality we know at least two or three species of *Pareiasaurus*, *Taurops macrodon*, *Tapinocephalus* sp., *Eunotosaurus africanus*, and probably *Delphinognathus* sp. Curiously enough Anomodonts and Therocephalians are rare.

Pareiasaurus acutirostris, sp. nov.

The determination of the species of *Pareiasaurus*, *Propappus* and *Pareiasuchus* is a matter of about as much difficulty as in *Dicynodon*. One feels tempted to make nearly every specimen a distinct species, so great are the variations. In many cases there seems to be no doubt about the specific distinctness, but for the present doubtful specimens had better remain unnamed.

The present specimen consists of an imperfect skull with a considerable series of vertebrae in a much weathered condition and fragments of many of the other bones of the skeleton. The skull has much of the right side preserved but has lost most of the nasal, orbital and upper temporal region. Only a few fragments of the upper cranial bones remain and the left side of the skull is also imperfect. The palate is almost perfect from the occipital condyle to the front of the snout, only the prevomers being lost. The right side of the lower jaw is perfect and much is preserved of the left side.

The skull differs from that of *P.serridens* and *P.baini* in being roughly about two-thirds of the size and in having a much narrower snout, and in a number of other details. The greatest length of the skull from the snout to the back of the posttemporal region is 350 mm. From the snout to the occipital condyle is 308 mm., and from the snout to the lower corner of the cheek is 233 mm. The width of the snout at the plane of the last teeth is about 140 mm. There are a series of 15 teeth on each side and they occupy 140 mm. None of the crowns are preserved.

The cheek comes down a considerable way below the line of the teeth. It is comparatively flat, and along its posterior border there are what might be called rudimentary indications of four bosses with a fifth larger one on the posterior corner of the post-temporal region. The only upper cranial bones preserved have typical Pareiasaurian sculpturing.

The palate has the usual double rows of small teeth.

The lower jaw is more perfect than any Pareiasaurian jaw previously found but the sutures are not all distinct. Rather more than half of the upper border of the jaw is formed by the powerful dentary and most of the lower border of the front half is formed by the splenial. There is a small but distinct coronoid bone which has a rudimentary coronoid process and forms the anterior border of the upper small oval opening into the cavity of the jaw. The angular is a fairly powerful bone which forms the lower border of most of the posterior half of the jaw. The boss or hornlike process is unlike that of the better known species in being a feeble short flattened process passing down about 20 mm. only from the line of border of the jaw. The surangular is much smaller than the angular, and between the two on the outer side is a small oval opening on the same transverse plane as the upper opening. There is apparently a distinct prearticular or goniale. The articular has two shallow articular cavities.

SCYLAEOGNATHUS PARVUS, Gen. et. sp. nov.

The type of this new genus and species is a fairly well preserved little skull, which lacks the mandibles and has the arches of the right side missing, but otherwise shows most of the structure. The form is allied to *Scymnognathus whaitsi* though only about one-third of the size, and is especially interesting as being the oldest known member of the *Gorgonopsia*—a sub-order which we now know extends from the *Pareiusaurus* zone up to the *Cistecephalus* zone.

The skull measures 114 mm. in length, and the breadth across the temporal region is about 94 m.m. From the snout to the front of the orbit is 52 m.m. The interorbital width is about 32 m.m. and the parietal region about 30 mm.

The dentition is apparently i5, c1, m5. Only three molars are preserved but five appear to have been present. In *Scymnognathus* the formula is i5, c1, m4. The incisor series measures 16 mm. and the whole dental series about 40 mm.

The snout is relatively shorter than in the other known Gorgonopsians, the orbit being near the middle of the skull. The peculiar shape of the squamosal is very much like that in *Scymnognathus whaitsi*. It differs from *Scymnognathus* in that the upper plates of the pterygoids are not anchylosed to form a median plate.

SCYMNORHINUS PLANICEPS, Gen. et. sp. n.

This new genus and species is founded on an imperfect snout. Practically the whole preorbital portion is preserved and a considerable part of the lower jaw. The length of the snout to the front of the orbit is 68mm.; the width of the snout in the region of the canine roots is 48 mm. The incisors are arranged round the very obtuse front of the snout somewhat after the manner of *Cynosuchus*. The lower jaw also has a very obtuse anterior portion, the canines being so far forward that they pass upwards and slightly backwards. The dental formula is i $\frac{5}{4}$, c $\frac{1}{1}$ m $\frac{5}{7}$ The first upper incisor is smaller than the others and the whole series measures 17 mm. The canine has an antero-posterior measurement of 9 mm. and from the front of the canine to the back of the second molar is 28 mm. It is difficult to decide whether this is a Therocephalian or a Gorgonopsian. The matrix is too hard to admit of easy development. The specimen has been split up the middle but the structure cannot be satisfactorily made out as the bones are mostly displaced and fractured by crushing. There is certainly no clear evidence of a median vomer, and provisionally I incline to place the genus in the Therocephalia.

DICYNODON STRIGOPS, sp. nov.

This new species of *Dicynodon* is founded on specimens which are believed to have come from Harrismith, O.F.S. None of these specimens are very good, being in hard ferruginous shale and the bone soft and much weathered. Still most of the characters can be satisfactorily made out. There is no doubt that the specimens are from one of the upper zones of the Beaufort—either the *Lystrosaurus*, the *Procolophon* or the *Cynogathus* zone.

The skull is rather small measuring about 118 mm. in length, and about 87 mm in breadth. In the *Pareiasaurus* zone *Dicynodon* is rare and the only known species small. In the lower *Endothiodon* zone small species are common and large species rare. On passing up only a short way through the *Endothiodon* large species become commoner, and in the *Cistecephalus* zone large species are commoner than small. In the *Lystrosaurus* and *Procolophon* zones *Dicynodon* is rare, but on reaching the *Cynognathus* zone large species are common. All the largest species belong to this uppermost Beaufort zone, and hitherto no small species have been known.

The following are the principal characteristics of the skull. The skull is unusually flat, the orbits being directed more upwards than outwards and the tusks passing as much forwards as downwards. The beak is elongated and the upper surface makes an angle of about 45° with the frontoparietal plane. A striking peculiarity of the orbit is that the anterior side instead of being rounded as in every other known species comes to an angle of about 70°-80°; this is not due to crushing as it is found in each of the specimens. The frontal region measures across 33 mm., and the parietal region 23 mm.

The nostril is large and its upper border formed by the nasal, which is much smaller than usual in Dicynodon. There is a small septo-maxilla which only shows to a slight extent on the facial surface. In *Dicynodon* the septo-maxilla varies very greatly in development. For long I regarded it as absent. In many species it does not appear on the outer surface and in some e.g. *Dicynodon testudirostris* it appears to be quite absent. In other species it certainly is present and may even form a considerable part of the face. In *Lystrosaurus* it is well developed.

The prefrontal is large and the frontal unusually large. The greatest length of the frontal is 45 mm. The postfrontal is well developed, and the postorbital large. The parietal region is broad and in the region of the pineal foramen it forms on transverse section a regular curve. The pineal foramen measures 7 mm. by 5 mm. The large parietals bound it on either side, and in front of it lies the large median preparietal, which passes forwards between the frontals to beyond the plane of the anterior end of the fronto-postfrontal suture. The postorbital forms the wide postorbital arch and the upper wall of the temporal fossa. The parietals are unusually large.

The occiput is not well preserved. There is a large interparietal but there appears to be no opisthotic. This latter element is one for which further examination of the Anomodont skull is required. In the skulls of many mammals and of all Cynodonts there is a distinct opisthotic showing in the occiput. There is apparently a distinct corresponding element in Dinocephalians, but there is not in Gorgonopsians. In some Anomodonts there is a small element by the side of the interparietal but whether this is part of the parietal or a distinct element is not known for certain. Pretty certainly there is no opisthotic showing on the occiput of *Cistecephalus*. In *Dicynodon strigops* I can find no other elements here than interparietal, parietal and squamosal.

The other parts of the skull are not well preserved.

Note on a variety of Rhinolophus swinnyi Gough from Pirie, E. Cape Colony.

By J. Hewitt.

The Rev. Robert Godfrey has on several occasions presented to the Albany Museum specimens of a small Rhinolophus which, in the measurements of the forearm, does not agree with the description of any species recorded from Cape Colony, being a little larger than *R. swinnyi* described by Dr. Gough (Annals. Transvaal Mus. 1, p. 71) from W. Pondoland. On comparing with a topotype of *swinnyi*, kindly lent by the authorities of the Transvaal Museum, there does not appear to be any other difference between the two forms, except that the concavity on the inner margin of the ear in the Pirie specimens is slightly more pronounced than in the Pondoland form. The measurements of nose-leaves as recorded from skin specimens are apt to prove very misleading unless such skins have been prepared with particular care, but fortunately the figures taken from the dried skins which formed the types of *swinnyi* seem to be correct, for they are only very slightly less than those taken from spirit specimens of the Pirie form, the nose-leaf of the latter having an extreme width of 7 mm., and the distance from the front of the horseshoe to posterior point of the lancet being 11 mm. Though I have no hesitation in referring these two forms to the same species, it seems advisable to recognise the Pirie Rhinolophus as a distinct sub-species, for in each of four specimens the forearm is longer than that of *swinnyi*, as represented by two types and a topotype. For this form I propose the name *piriensis*, distinguishing it as follows:

Rhinolophus swinnyi piriensis, sub-sp., nov. Very like the typical form of the species, but the measurements of the wing-bones slightly greater. Forearm in four specimens: 42·5, 42·75, 43·5, and 43·75 mm. Second joint of third finger, 22·75–24.5 mm. Tail about 19·5 mm. Locality: Pirie (Rev. R. Godfrey). I suspect that this species will eventually prove to be only a small eastern variety of *Rhinolophus capensis.* The nose-leaf is very similar to *capensis*, and the broad ears and short tail which are amongst the most distinguishing features of *capensis*, are also found in *swinnyi*.

According to Mr. Knud Andersen, the forearm in eight typical specimens of *capensis* varies in length from 47·6 to 51·5 mm., the average being 49·5 mm. The Knysna species, *R. auritus*, Sund., now recognised as the same as *capensis*, was described as having the forearm only 45 mm. long, but Andersen's measurement of the type specimen was 50 mm.; apart from this ambiguous case, no small varieties of *capensis* have been recorded as such. I take this opportunity of recording the typical form of *R. capensis*, from Brakkloof near Grahamstown (Mrs G. White); we also have *R. augur zuluensis* from Grahamstown (K. Graham, in 1902).

Descriptions of new and little known species of trapdoor spiders (Ctenizidae and Migidae) from South Africa.

By John Hewitt.

Trapdoor spiders from South Africa have been described during the last forty years by various European authorities, but not until the last decade when Dr. W. F. Purcell published the results of his excellent work on the large collection in the South African Museum, have we had any comprehensive account of this fauna. We now know that the Ctenizidae are very richly represented in South Africa, yet, as Dr. Purcell's descriptions mainly relate to the fauna of the western and some of the central districts of Cape Colony, there remains a wide area in this sub-continent which has not been systematically explored, though a number of species have been described therefrom by Messrs. Simon, Purcell, Pocock and others. Only in very few cases are we acquainted with both sexes of a species, and in fact a great number of species are only known from single specimens; in consequence of this paucity of material we are, as yet, unable to distinguish between important and trivial specific characters, and in some cases, no doubt, species have been ill founded. The most remarkable species described in this paper is *Galeosoma schreineri*.

Stasimopus insculptus, Poc. (A. M. N. H. 7, 7, p. 285).—Of this species the male only has been hitherto described. The following notes on the characters of its supposed female* are drawn up from a series of specimens, mostly from King William's Town, kindly lent to me by Mr. F. A. O. Pym. Tibia of pedipalp with a distal patch of spinules above: basal patch of spinules on upper side of metatarsus I. short, extending over $\frac{1}{8}$ to $\frac{1}{5}$ of the length of the segment: basal patch of spinules on metatarsus II.,

*It is just possible that these females belong to an unnamed species, seeing that *S. schönlandi* occurs not far from King Williamstown, and Pocock's example of *insculptus* may therefore have been the male of *schönlandi*.

a little shorter than the distal dorsal patch of tibia II.: metatarsus III. without an apical group of spines below in three examples, but two others have some weak but distinct spines and a very large specimen from Emgwali (20 miles N. E. of King Williamstown), also has quite distinct spines at the apex of the third metatarsus inferiorly; patella III., with some stout red spinules at the apex above, usually without any spinules on its posterior lateral surface, but one specimen has a single spinule on the distal edge, and the Emgwali specimen has on the one side two apical spines and two in the middle, but on the other side one apical spine and one in the middle of that surface; metatarsus IV. with an infero-posterior apical tuft of four equal spines in a compact row in two examples, whilst two other specimens have a group of 10 to 12 spines; in the King Williamstown specimens, the ocular area is equal in width to the length of metatarsus I., and sub-equal to the length of tibia I. measured along the mid-dorsal line, but in the Emgwali specimen the ocular area is distinctly narrower than the length of either metatarsus I. or tibia I.; anterolateral eyes not much elongated, the distance between anteromedian and anterolateral, being greater than the diameter of either. Labium usually with from 5 to 10 apical teeth; only 2 in the Emgwali specimen. We possess two immature specimens from Pirie, presented by the Rev. R. Godfrey.

Stasimopus artifex, Poc.—The original description (A. M. N. H. 7, 10, 10) is very brief. The following notes are based on a very fine specimen from Rokeby Park presented to the Albany Museum by Mr. G. Davies. Tibia of pedipalp with an apical patch of spinules; basal patch of spinules on upper side of metatarsus I. occupying about $\frac{1}{8}$ of the length of the segment; distal patch of spinules on tibia II. longer than the basal patch on the upper surface of metatarsus II.; patella III. without spines on its posterior lateral surface; breadth of anterior lateral eyes, greater than distance between anteromedian and anterolateral eyes. The last mentioned character will serve to distinguish this species from *insculptus*.

Stasimopus schönlandi, Poc.—To the descriptions given by Pocock (A. M. N. H. 7, 6, 319 and 7, 10, 11), I may add the following: No distal patch of spinules on upper surface of tibia of pedipalp; basal patch of spinules on upper surface of metatarsus I. extending for a distance of at least ¼ but usually about ⅓ or even more of the length of the segment; basal patch of spinules on metatarsus II. rather shorter than distal patch on upper surface of tibia II.; on the posterior lateral surface of patella III., there is usually 1 or 2, occasionally 3 or 4, spinules at the distal edge and 1 or 2 in the middle of the segment, the latter being sometimes absent; usually no trace of spines at the apex of metatarsus III. inferiorly, but in a specimen from Atherstone Station there are several long spiniform setae—the basal patch of spinules on metatarsus I. is short—,in a specimen without precise locality data in the Kingwilliamstown Museum there are long spiniform setae at the apex of metatarsus III. inferiorly—this specimen has the basal patch of spinules on metatarsus I. unusually long, almost reaching half the length of the segment—, and an example from Debe Nek, near Kingwilliamstown (F. A. O. Pym), has about 10 strong spines there; breadth of ocular area slightly less than length of metatarsus I., but only very slightly less than, or subequal to the length of tibia I. measured along the dorsal midline; labium with 3 to 6 apical teeth. A specimen from Kamacks Rd. has 2 spines along the middle of metatarsus IV. inferiorly, just as described in *S. castaneus*, Purcell, but there are none below the tibia.

Our largest specimen (carapace 13·75 mm. long) is labelled Jansenville; it has a few spiniform setae at the apex of metatarsus III. inferiorly, and the series of spines on metatarsus IV. includes a row of 8, as well as 3 or 4 adjacent ones more medially situated. *S. astutus* was described by Pocock from Jansenville and Pearston material, but, according to the description, that species must be very different from our Jansenville specimen unless Pococks specimens were all very juvenile. The supposed male of *schönlandi* has been described by Strand (Zeitschr. Naturwiss. Halle a. S. 79, 1907, p. 178); unfortunately we possess no male example of this species. Known to me from Grahamstown

(Messrs. K. and R. Graham), Brak Kloof (Mrs. G. White), Atherstone Station (Mr. D. C. Hoole), Somerset East (Mrs. G. White, Mrs. M. Bowker), Middleton, near Carlisle Bridge (Mrs. J. O. Norton), Jansenville (Mr. M. P. Daneell), from Kamacks Road, near Uitenhage (Mrs. T. V. Paterson), from North End, Port Elizabeth (Pt. Elizabeth Mus.), and from Debe Nek (F. A. O. Pym).

Stasimopus qumbu sp. nov.—Type: one female specimen from Qumbu, presented to the Albany Museum by Miss I. Hoodless of Shawbury, Aug. 1912.

COLOUR. Carapace and legs dark chestnut brown above, pale beneath ; abdomen fuscous above, yellowish below·

CARAPACE equal in length to the patella, tibia and metatarsus of the first leg and to the tibia, metatarsus and $\frac{3}{4}$ of the tarsus of of the fourth leg.

OCULAR AREA. Width behind about $\frac{2}{3}$ the length of metatarsus IV., slightly less than the length of tibia I. measured along the dorsal mid-line. Anterior row of eyes with their anterior margins in a procurved line; the lateral eyes oblique and elongated, their long diameter only very slightly less than distance between the anterior median and anterolateral eyes. Posterior row of eyes with their anterior margins in a very slightly recurved line, the medians oval, their long diameter greater than their distance from the posterolaterals ; the latter longer than the medians, their distance apart subequal to the width of the anterior row, the distance between the posterior and anterior lateral eyes exceeding the long diameter of either.

PEDIPALPS with a broad band of short spines on inner side of tarsus extending almost to the base ; 7 or 8 strong spines on inner side of tibia ; patella with or without a single apical spine on the inner side ; tarsus with a small basal patch of stout spinules above, the tibia without a distal patch of stout spinules above.

LEGS : Tibia I. subequal to the metatarsus, the distal patch of spines on its inner surface including about 22 spines and occupying more than half the length of the surface ; the metatarsus with basal patch of spinules above occupying about $\frac{1}{6}$ of the length of the segment, the distal patch on upper surface of the tibia about equal thereto. Basal patch of spinules on metatarsus II. shorter than distal dorsal patch on tibia. Metatarsus III. with a band of about 21 stout spines (excluding some smaller ones basally), on its anterior side and about 27 on the posterior side, no apical spines below; patella with a single spine distally situated on its posterior surface, a small patch of short red spinules on the distal edge of upper surface; distal patch of spinules on tibia extending over about $\frac{1}{2}$ the dorsal length. The patch of red spinules on patella IV. rather small, dorsally covering less than half the length of the segment; inferoposterior apical tuft on metatarsus composed of 4 strong spines with 2 or 3 scattered spines more internally situated, no spines along the middle of metatarsus below.

LABIUM with 5 apical teeth.

MEASUREMENTS: Length of carapace 12·5 mm. Breadth of carapace 10·5 mm. Length of metatarsus of first leg 4·2 mm.

This species may be distinguished from *umtaticus*, *kentanicus* and *kolbei* through the absence of apical spinules on the tibia of the pedipalp.

Stasimopus patersonae sp. nov.—Type: a female specimen found by Miss Ryneveld at Perseverance (between Port Elizabeth and Uitenhage) and presented to the Albany Museum by Mrs. T. V. Paterson, October, 1912.

COLOUR. Carapace and appendages very dark brown, almost black, the abdomen fuscous; lower surfaces dark brown.

CARAPACE: subequal in length to the patella, tibia and metatarsus of the first leg.

OCULAR AREA. Width behind about $\frac{2}{3}$ the length of metatarsus IV. Anterior row of eyes with both anterior and posterior margins in straight lines; the lateral eyes oblique and rather large. Posterior row with its anterior margins in a slightly recurved line; the medians obliquely elongated, about half their own diameter distant from the posterior laterals; the posterior laterals oval, not so long as the medians, their distance apart less than the width of the anterior row; distance between the posterior and anterior lateral eyes about equal to the long diameter of the latter. Distance between the anterior medians a little greater than that between an anterior median and anterior lateral, which latter distance is slightly greater than or subequal to the diameter of a median.

PEDIPALPS with a broad band of short spines on inner side of tarsus extending right to the base; 6 strong spines on inner side of tibia; patella without spines; tarsus with a small basal patch of spinules above, the tibia without a distal dorsal patch of spinules.

LEGS: Tibia I. slightly shorter than the metatarsus and distinctly longer than the width of the posterior row of eyes, a distal patch of 10 or 11 spines occupying about $\frac{3}{5}$ of the length of the inner surface; metatarsus with a basal patch of spinules occupying about $\frac{1}{3}$ of length of the upper side, the tibia with a smaller distal patch above occupying about $\frac{1}{5}$ of the length of the segment. Basal patch of spinules on metatarsus II. above not longer than distal dorsal patch on the tibia. Metatarsus III. with about 17 stout spines in the band on its anterior surface and about 25 in the band on the posterior surface; metatarsus with a few weak spines below distally; patella with a small patch of short red spinules situated distally above, the distal patch on the tibia extending over about half its dorsal length. Patch of red spinules on patella IV. not very large, only conspicuous over about half the segment though scattered spines extend almost to the distal margin; inferoposterior apical tuft on metatarsus composed of 5 spiniform setae arranged in a regular transverse row, the underside of the segment without spines along the middle.

LABIUM with 5 apical teeth.

MEASUREMENTS: Length of carapace 9·5 mm.; Breadth of carapace 8·5 mm. Length of metatarsus of first leg 3·6 mm.

The single specimen which forms the type is probably not quite adult. It is closely related to *S. schönlandi* Poc. the young of which occasionally vary in the direction of this form with regard to the ocular characters, but in that species the eyes are distinctly smaller, and the intervening spaces greater. It differs from *S. castaneus* Purcell, the only species hitherto recorded from Port Elizabeth, in respect to the spinulation of metatarsus I. and in the absence of spines below the fourth metatarsus and tibia. In its ocular characters this species seems to resemble *S. astutus* Poc. described from Pearston and Jansenville, a species not known to me, but Pocock states that *astutus* has no spines on the apex of metatarsus III. inferiorly and Purcell, dealing with Pearston material, places *astutus* under the group of species characterised by a short basal patch of spinules on upper side of metatarsus I. (Ann. S. African Mus. 3, 83)· From *S. artifex* Poc. it can be distinguished through the spinulation of the tibia of the pedipalp and of metatarsus I.

A nest sent along with the specimen is unusually short, being only three inches long; the lid is D-shaped, its hinge being longer than is usual in this genus.

Stasimopus dubius sp. nov. This may be the same as the Pretoria species *S. robertsi* Hewitt, the female of which is unknown: it seems to be distinct from *S. oculatus* Poc. from Bloemfontein through the number of spines in the comb on the fourth metatarsus.

TYPE: A female specimen from Potchefstroom presented by Mr. M. L. Gunning to the Transvaal Museum in March 1910.

COLOUR: Carapace and legs pale chestnut, the abdomen fuscous laterally.

CARAPACE as long as the patella, tibia and two thirds of the metatarsus of the first leg and as long as the tibia, metatarsus, and half the tarsus of the fourth leg. Ocular area very slightly narrower than the length of the metatarsus of the first leg and subequal to the length of the first tibia (measured along the mid-dorsal line): anterior row of eyes distinctly procurved along their front margins the lateral eyes directed rather obliquely; posterior row of eyes practically straight, the medians oval, the same distance from each other as are the anterolaterals from each other, and distant about half a diameter from the posterolaterals to which they are subequal in size, their long diameter very slightly exceeding the diameter of the anterior medians; posterior lateral eyes oval, their distance from the anterolaterals subequal to the long diameter of the former, and their distance from each other very slightly greater than the width of the anterior row of eyes.

PEDIPALPS: The band of spines on the inner side of tarsus not extending to the base, including about 8 or 10 spines; the tibia with two spines, the patella without spines on the inner surface; basal patch of spinules on the tarsus above, extending $\frac{3}{5}$ of the length of the tarsus; from 1 to 3 similar stout spinules in an isolated patch at distal end of tibia above, beyond which (i.e. proximally) are numerous, much weaker, short spinules in a patch extending backwards about half the length of the segment.

LEGS: Inner surface of tibia I. with about 24 short spines, upper surface with a small apical patch of spinules not extending $\frac{1}{6}$ of the length of the dorsal surface; basal patch of spinules on metatarsus above, extending over about $\frac{2}{3}$ of the length of the dorsal surface. Basal patch of spinules on metatarsus II. above, three or four times the length of apical patch on the tibia; inner surface of tibia with 10 or 11 short spines. Anterior and posterior surfaces of metatarsus III. with a band of about 19 spines, patella with 10 or 12 spines on its anterior surface, but without a patch of distinct spinules—there are a few weak ones—at the distal end above; metatarsus without apical tuft of spiniform setae below. Inferoposterior apical tuft on metatarsus IV. composed of 3 spiniform setae arranged in a transverse row; patch of red spinules on upper surface of patella large, extending over $\frac{4}{5}$ of the length of the anterior surface.

LABIUM with 6 teeth.

LENGTH of carapace 10 mm., breadth of carapace 8·75 mm.; length of metatarsus of first leg, 3·5 mm.

The Transvaal Museum has also a specimen from Madibi (Mr. G. E. Harding pres.), which appears to belong to the same species, though it presents a few points of difference as follows: distance between posterior median eyes, a little greater than that between the anterior laterals; inner surface of tibia I. with about 16 short spines, of tibia II. with 8 short spines; about 22 spines in the band on anterior and posterior surfaces of metatarsus III., the patella with seven spines on its anterior surface; labium with 4 teeth; length of carapace, 11·5 mm. When the males are known, it may be necessary to refer the Madibi form to a distinct species, but the above mentioned characters seem hardly sufficient to justify specific separation.

Stasimopus robertsi, Hewitt.—To the description given in Annals Transvaal Mus., Vol. II., p. 74, the following notes may be added: the teeth on the paired claws of the fourth tarsus form a comb of 8 or 9 teeth; at the distal end of the fourth metatarsus inferiorly, there are a number of spines, forming on the posterior side a continuous row of 5 or 6 spines, on the anterior side a group of 2 spines, and between the two groups an odd spine more or less medially situated.

Stasimopus unispinosus, Purcell (Ann. S. African Mus. 3, p. 22).—Along with some female specimens taken at De Aar, Mr. Cronwright-Schreiner presented to the Albany Museum what seems to be a large male which, though possessing a palpal organ, has the general appearance of a rather slender female; it would appear to be an immature form (internal sexual organs could not be found, though the ovary is distinct enough in females of smaller size). The colour is like that of a female, except that the anterior part of the carapace, the pedipalps, and the first two pairs of legs are dark brown; the carapace is entirely without granules or ridges; the pedipalps and all the legs are longer and more slender than those of the female, yet not so long as those of a typical male as known in other species of the genus. Its size is much greater than that of a typical *Stasimopus* male, the carapace being 10·3 mm. long (in *schreineri* 4·9 mm., in *robertsi* 7 mm.) and the total length being 29·4 mm. (of *schreineri* 12, of *robertsi* 17 mm.). The femur and patella of the pedipalp are both much bowed, the first leg is 27 mm. long, the fourth leg 28 mm. The process of the palpal organ is not present.

Ctenolophus transvaalensis, sp. nov.—

TYPE. A single female from Newington (Zoutpansberg Dist.), presented by Dr. J. P. Fenoulhet to the Albany Museum, March, 1912.

COLOUR. Carapace and legs pale brown above and below; abdomen pale throughout except in the mid-dorsal region anteriorly.

CARAPACE as long as the patella, tibia and metatarsus of the first leg and as long as the tibia, metatarsus and $\frac{2}{3}$ of the tarsus of the fourth leg.

OCULAR AREA about as wide as long, extending backwards not more than $\frac{3}{5}$ of the distance from the anterior margin of the carapace to the fovea; its width only very slightly less than the length of metatarsus of first leg. Area formed by frontal and anterior median eyes slightly wider behind than in front, its length scarcely more than twice its posterior width; the frontals large, placed on a common tubercle grooved above, their clear areas about $\frac{1}{4}$ of a diameter apart, the median eyes small about a diameter apart. Posterior margin of posterior row of eyes in a very slightly recurved line, the medians much nearer to the laterals than to each other; the laterals large and reniform. Area formed by the four median eyes distinctly wider behind.

LEGS. Band of spines on anterior surface of tibia I. reaching to the base, of tibia II not reaching the base and including only 4 or five spines. Metatarsus III. without spines below except for a couple of long ones at the apex; coxa III with a strip of spinules along posterior margin of lower surface and a similar strip occurs on coxa II., but the spinules are finer; patella III. on its distal upper edge with about 6 spinules on the anterior side and 5 posteriorly, the band along the anterior surface of this segment including about 9 spines. About 4 long spines on metatarsus IV. inferiorly, as well as 3 stout ones at the apex; tibia with a long apical spine below and a weaker spiniform seta about the middle of the lower surface; patella with a band of short stout spines along the upper anterior edge stretching four-fifths of the length of the segment.

LABIUM with 3 apical teeth, behind which a row of 6 much smaller ones.

CHELICERAE. Inner row of teeth on under surface of chelicera including 4 strong teeth; outer row comparatively long and well developed, including 5 small teeth.

MEASUREMENTS : Length of carapace 6 mm. ; width of carapace 4·75 mm. Length of tibia of first leg ·2 mm.

The Transvaal Museum has a somewhat larger specimen (carapace 7 mm. long) of what seems to be the same species labelled Lydenburg (Krantz). It differs however as follows: patch of spinules on coxa II. not so distinctly marked, the spinules being interspersed with long hairs; band of spines on anterior surface of third patella including 15 spines; band of spines along anterior surface of patella IV. stretching between $\frac{2}{3}$ and $\frac{3}{4}$ of the length of the segment. The area formed by the frontal and anterior median eyes is very decidedly wider behind than in front. On under surface of chelicerae an inner row of 5 large teeth, a short outer row of 3 small teeth. Labium with 5 apical teeth.

A much smaller specimen (carapace 5·5 mm. long) in the same collection and with the same locality data differs considerably in its eye characters, The frontal eyes, which are closely approximated as in the two just described, are very large, the area formed by the frontal and anterior medians being wider in front than behind. The laterals are also very large, their anterior and posterior margins being almost in a line with the anterior margins of the anterior medians and the posterior margins of the posterior medians respectively. These are no doubt juvenile characters.

Ctenolophus fenoulheti, sp. nov.

TYPE. A single female specimen from Newington (Zoutpansberg Dist.), presented to the Albany Museum by Dr. J. P. Fenoulhet, Feb., 1912.

COLOUR. Legs and carapace light brown above and below, the abdomen also pale except in the middle dorsal region anteriorly.

CARAPACE as long as the patella, tibia, and two-fifths of the metatarsus of the first leg, and as long as the tibia and metatarsus of the fourth leg.

OCULAR AREA as wide as long, extending backwards about two fifths of the distance from the anterior margin of the carapace to the fovea; its width, less than the length of the first metatarsus. Area formed by the frontal and anterior median eyes, very slightly wider in front, its length slightly exceeding twice the posterior width; the frontal eyes large, their clear areas separated by a distance equal to ⅜ of the long diameter of an eye, but placed on a common tubercle which is shallowly grooved above; the median eyes small, about a diameter apart. Posterior row of eyes with its posterior margins in a slightly recurved line, the medians nearer to the laterals than to each other, the anterior margins of the laterals in a line with the posterior margins of the anteromedian eyes; medians small and rounded, very distinctly smaller than the anteromedians; laterals large and reniform; area formed by the four median eyes broader behind.

LEGS. Band of spines on anterior surface of tibia I. reaching almost to the base, of tibia II. including 12 or 13 spines and almost reaching the base. Metatarsus III. without distinct spines below, except for a couple of long ones apically situated. On distal edge of upper surface of patella III. are 3 spines on the anterior side and 2 spines on the posterior side, the band along the anterior surface including about 13 spines. Metatarsus IV. with 3 long spines inferiorly, and 3 stout ones at the apex below; tibia with 2 long apical spines below and 2 weaker ones along the middle of its lower surface; patella with a band of short stout spines along the upper anterior edge, stretching scarcely more than half the length of the segment. Coxae of legs without spinules below, the third coxa having a narrow patch of numerous slender bristly hairs along its posterior border ventrally.

LABIUM with a row of 5 apical teeth, posterior to which are 3 much smaller ones.

CHELICERAE. Inner row of teeth on under surface with 5 very strong teeth; outer row short, including about 7 very small teeth.

MEASUREMENTS. Length of carapace 8 mm.; width of carapace 7 mm. Length of tibia of first leg 3·5 mm.

Ctenolophus oomi, sp. nov.—

TYPE. A single female from Lüneburg near Paul Pietersburg, presented to the Albany Museum by Mr. W. Oom, Dec., 1912.

COLOUR. Carapace and legs olive above, the distal segments of pedipalps and anterior legs very dark, the lateral surfaces of their femora pale, in parts almost white, the patella and distal segments of fourth leg reddish brown, lower surfaces pale but darker anteriorly; abdomen dark above, paler below.

CARAPACE as long as the patella, tibia and ½ of the metatarsus of the first leg, and as long as the tibia, metatarsus and ⅓ of the tarsus of the fourth leg.

OCULAR AREA broader than long, extending backwards about two-fifths of the distance from the anterior margin of the carapace to the fovea; its width slightly less than the length of the first metatarsus. Area formed by the frontal and anterior medians distinctly wider in front, its length about 2½ times the posterior width; the frontal eyes large, their clear areas separated by a distance equal to almost ⅓ of the long diameter of the eye, the common tubercle grooved in front; the median eyes small, about 2 diameters apart. Posterior row of eyes with its posterior margins in a slightly recurved line, the medians about the same distance from each other as from the laterals, the anterior margins of the laterals in a line with the middle of the anterior medians; medians rounded, as large as or slightly larger than the anterior medians, the laterals large and pearshaped; area formed by the four median eyes broader behind.

LEGS. Band of spines on anterior surface of tibia I. reaching to the base, of tibia II. including 11–13 spines and almost reaching the base. Metatarsus III. without distinct spines below, except for a couple of long ones apically situated. Near the distal edge of upper surface of patella III. on its posterior side are 7 spines, but on the anterior surface is a group of many (30 or more) short reddish spines. Metatarsus IV. with 3 stout spines at the apex below, and 4 or 5 weaker ones on the lower surface, the patella with a band of short stout reddish spinules on the anterior surface stretching from the distal edge of the segment to near its base and meeting the compact basal cluster of spinules. Coxae of legs without spinules below, the third coxa with only a thin band of hairs along its posterior border below.

LABIUM with a row of 4 apical teeth.

CHELICERAE. Inner row of teeth on under surface with 6 very strong teeth, the outer row obsolete, represented only by 2 very minute teeth basally.

MEASUREMENTS. Length of carapace, 8 mm.; breadth of carapace, 7·5 mm. Length of tibia of first leg, 3·6 mm.

Idiops gunningi, sp. nov.

TYPE: a female specimen in the collection of the Transvaal Museum, labelled Zwartspruit, Pretoria district, F. C. Zwarts, 17/12/1910: named after Dr. Gunning, the Director of the Transvaal Museum.

COLOUR. Carapace and appendages dark brown: abdomen fuscous.

CARAPACE. As long as the patella, tibia and half the metatarsus of the first leg but slightly shorter than the tibia and metatarsus of the fourth leg.

OCULAR AREA wider than long its width subequal to the length of the metatarsus of the first leg. Area formed by the frontal eyes and the anterior medians almost parallel sided but slightly wider behind. The frontals large, slightly less than one third of a diameter apart, situated on a common tubercle which is grooved above. Posterior laterals elongated their anterior margins only very slightly posterior to a line joining the posterior margins of the anterior median eyes and their hind margins slightly posterior to a line joining the hind margins of the posterior median eyes. Rectangle formed by the four median eyes slightly wider behind. Anterior medians round, a little more than 1½ diameters apart. Posterior medians smaller, subtriangular to subrotund, their distance from the laterals about ½ to ⅓ greater than their distance from each other.

LEGS. Coxae without spinules. Tibia I. about equal in length to the metatarsus and half the tarsus. Tibia II. on its anterior side with a band of 11 or 12 spines stretching from the apex to the base of the segment, posteriorly with a ventral row of 4 stout spiniform setae, above which are 2 or 4 isolated spines. Tibia IV. with a single spine on the middle of its anterior surface.

Patella III. with 3 apical spines overhanging the upper posterior part of the distal edge and a single spine on the middle of the posterior surface. All the tarsi spined below.

LABIUM with an apical row of 4 teeth, posterior to which are 3 others.

CHELICERAE. Inner row of teeth below chelicerae including about 6 large teeth, outer row with about 4 large teeth, with a number of smaller ones in each case. Fang with only one or two serrations below.

MEASUREMENTS. Length of carapace 10·5 mm; Breadth of carapace 9 mm. Length of metatarsus of first leg, 3·6 mm.; of metatarsus of fourth leg 6 mm.

A smaller specimen of the same species labelled Gezina (Pretoria) has different ocular characters: the frontals are larger relatively to the anterior medians; the posterior laterals are larger and rather nearer to the medians; the posterior medians are as large as the anterior medians. This species is related to *I. pretoriae* Poc. but may be distinguished through the characters of the posterior row of eyes, and by the degree of serration of the fang.

Idiops pretoriae Poc. (*Acanthodon pretoriae* Poc.). (A.M.N.H. 7. 1. p. 319 and Ann. Transvaal Mus. 2. p. 74.)

The inner row of teeth below the chelicerae includes about 6 large teeth and 4 or 5 small ones, whilst the outer row has 4 or 5 large teeth and 4 small ones; the fang is distinctly serrated inferiorly for a distance equal to half its length. The width of the ocular area is less than the length of the metatarsus of the first leg. The frontal eyes are about $\frac{1}{3}$ of a diameter apart, but in a half-grown specimen scarcely more than $\frac{1}{4}$ of a diameter apart. The posterior median eyes are small and round; a line touching their hind margins would approximately pass through the middle of the lateral eyes which latter only reach slightly in front of the posterior medians anteriorly. The row of spinules along the upper anterior surface of the fourth tibia is probably an adult character; it is represented by only two spinules in a half-grown specimen in the Transvaal Mus. collection.

Idiops gerhardti, sp. nov.

TYPE. A female specimen from Doornkop, Witbooi, near Belfast (Transvaal) presented to the Albany Museum by Mr. R. Gerhardt in Feb. 1911.

COLOUR. Carapace and legs reddish brown; abdomen pale, a little fuscous posteriorly.

CARAPACE as long as the patella, tibia and half the metatarsus of the first leg and very slightly longer than the tibia and metatarsus of the fourth leg.

OCULAR AREA wider than long, its width only very slightly less than the length of the metatarsus of the first leg. Area formed by the frontal eyes and the anterior medians almost parallel sided but slightly wider behind. The frontal eyes large, oval, about half a long diameter apart and looking obliquely forwards. Posterior laterals reniform, only very slightly longer than the posterior medians; rectangle formed by the four median eyes very slightly wider behind; anterior medians round, nearly two diameters apart; posterior medians quite as long as anterior medians but longitudinally oval, their distance from the laterals about a $\frac{1}{4}$ more than their distance from each other.

LEGS. Coxae without spinules. Tibia I. about equal in length to the tarsus and metatarsus. Tibia II. anteriorly with a band of 11 or 12 spines reaching from apex to base, posteriorly with a ventral row of about 4 spiniform setae, above which are 1 or 2 isolated short spines. Tibia IV. with 1 or 2 short spines on the middle of its anterior surface. Patella III. with 1 apical spine overhanging the upper posterior part of the distal edge but with no spine on the middle of the posterior surface. All the tarsi spined below.

LABIUM with 6 apical teeth comprised in two rows.

CHELICERAE. Inner row of teeth below chelicerae including 6 large teeth and a few small ones, outer row with about 4 large teeth and as many small ones. Fang distinctly serrated inferiorly for a distance equal to quite half its length.

MEASUREMENTS. Length of carapace 10·75 mm., of metatarsus of first leg 3·4 mm., of metatarsus of fourth leg 5·25 mm. A very distinct species apparently, at once recognised by the characters of the posterior row of eyes.

Idiops castaneus, sp. nov.

TYPE. A female specimen from Newington (Zoutspansberg Dist.) presented to the Albany Museum by Dr. J. P. Fenoulhet. April, 1912.

COLOUR. Carapace and legs dark chestnut brown, the more anterior appendages almost blackish; femur of fourth leg dark above, but lower surfaces and more distal parts of leg pale brown; abdomen fuscous.

CARAPACE as long as patella, tibia and metatarsus of the first leg and as long as the tibia and metatarsus of the fourth leg.

OCULAR AREA wider than long. Area formed by frontal eyes and anterior median eyes very slightly wider in front, the frontal eyes large, their clear areas scarcely $\frac{1}{4}$ of a diameter apart. Posterior lateral eyes long, reniform, their anterior margins in a line with the centres of the anterior medians, their posterior margins very slightly posterior to a line touching the hind margins of the posterior medians; rectangle formed by the four median eyes broader behind; distance between anterior medians about one and a half times the diameter of an eye; posterior medians much smaller, rounded, their distance from each other quite one and a half times the distance between a posterior median and corresponding lateral.

LEGS. Coxae without spinules. Tibia I. as long as the metatarsus and $\frac{2}{3}$ of the tarsus. Tibia II. with an anterior band of 6 spines and on its posterior side with a ventral row of 4 long spiniform setae. Tibia IV. without spines on the middle of its anterior surface. Patella III. with 2 strong apical spines overhanging the upper posterior part of the distal edge, and 2 weaker spines on the middle of the posterior surface. All the tarsi spined below.

LABIUM with 6 apical teeth in two rows.

CHELICERAE. Inner row of teeth below chelicerae including 3 or 4 large teeth and 2 small ones; outer row with 2 large teeth and 2 small ones. Fang distinctly serrated below for a distance equal to quite half its length.

MEASUREMENTS. Length of carapace 8 mm., of metatarsus of first leg 2·3 mm., of metatarsus of fourth leg 3·5 mm. This species is closely related to *I. pretoriae*, Poc., and to *I. gunningi*, sp. nov. The large size of the frontal and posterior lateral eyes may be an immature character; the arrangement of the posterior row of eyes is however decidedly different from that in immature specimens of *pretoriae* from Pretoria, and *gunningi* from Gezina (?loc.), though, it must be added, these latter are both larger than the type of *castaneus*.

Idiops fryi, Purcell (Ann. S. African Mus. 3, p. 91).—We have what appears to be this species from Zonderhout, Holfontein, O.F.S. (Mr. T. F. Austen); it differs from the type in that the distance between the posterior median eyes is about equal to, or only very slightly less than their distance from the laterals. The fang of the chelicera is distinctly serrated below for only a very short distance.

Galeosoma schreineri, sp, nov.—Description based on a series of female specimens collected at De Aar, during 1912, by Mr. S. C. Cronwright Schreiner who presented them to the Albany Museum.

COLOUR. Carapace, appendages and soft portions of abdomen pale brown, with a darker olive tinge which forms a more or less regular reticulation on the hinder half and sides of the carapace, and inconspicuous narrow bands along the upper surfaces of the legs. Abdominal shield black.

CARAPACE as long as the patella, tibia and metatarsus of the first leg.

OCULAR AREA wider than long, the area formed by the frontal and anterior median eyes the same width in front and behind and 1¾ times as long as wide; frontals much larger than the anterior medians. Posterior row of eyes with its hind margins in a procurved line, the medians rounded, subequal to the anterior medians, the laterals large, reniform or pear-shaped; distance between medians greater than distance between a median and its lateral which distance again is greater than that between the anterior medians.

LEGS, Tibia I. slightly less than the metatarsus and tarsus in length. Patella III. with some strong short spines on or near its posterior distal edge, usually 4, sometimes 5 or 3, occasionally only 2. The band of short stout spines along the posterior surface of tibia III. includes usually about 10 spines but varying from 7 to 15. Patch of spines on anterior surface of patella IV. extending more than half the length of the segment, sometimes almost reaching the apex.

ABDOMEN. The dorsal shield is a thick, broadly oval, or subcircular plate, occupying the posterior part of the abdominal surface above; the shield has a convex upper surface with a slightly upraised and clearly defined edge, the raised edge being specially marked in young specimens; anteriorly where the marginal surface is obtusely inclined to the upper surface the thickness is about 2½ mm., but posteriorly where the two surfaces are acutely inclined to each other the thickness is only about 1¾ mm. Upper and marginal surfaces of shield coarsely punctate and hairy, the hairs around the the upper edge forming a loose fringe. The uncovered anterior part of abdomen above considerably exceeding half the upper surface of the shield in length. The posterior scars on under surface of abdomen oblique, subcrescentic, the crescent being expanded outwards in the middle.

LABIUM with one row of teeth along its apical margin includfrom 3 to 7 teeth.

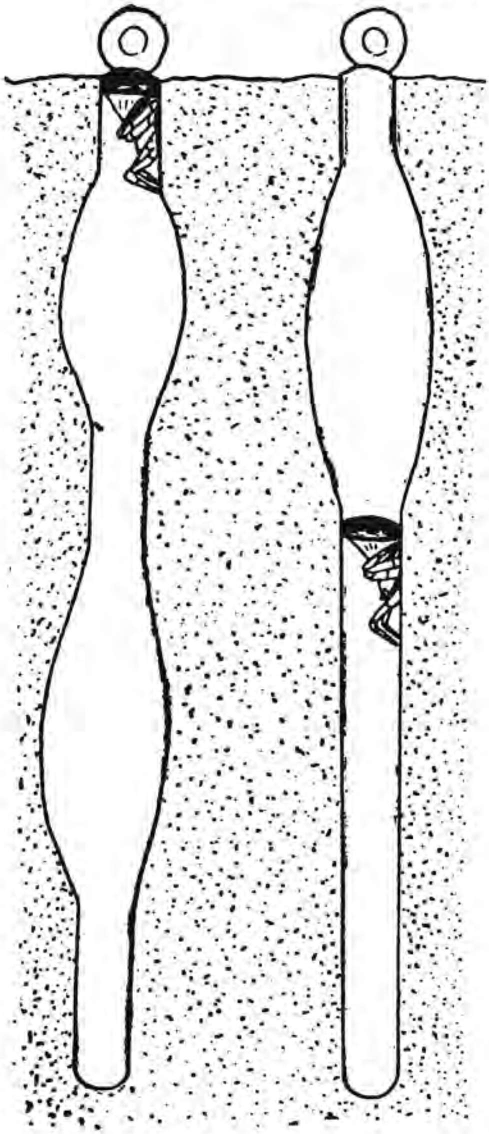
PEDIPALPS. Under surface of coxa toothed only in the anterior half of its area, strongly so at each end of the segment.

CHELICERAE. The fang serrated below over a distance equal to half its length. An internal row of 5 or 6 strong teeth below chelicera as in a *Ctenolophus*.

MEASUREMENTS. Total length 20·5 mm. Length of carapace 8 mm. Breadth of carapace 6·25 mm. Length of shield 9·75 mm. Breadth of shield 8·75 m.m.

(1)

(2)



(3)

Galeosoma schreineri, sp. nov.

(1) Female in dorsal view.

(2) Side view of same.

(3) Vertical section through two nests shewing spider in situ and the "turning chambers." (After sketch by Mr. S. C. Cronwright Schreiner.)

NEST. We are also indebted to Mr. Schreiner for the following notes on the nesting habits of this remarkable species. The lid of the nest is placed slightly above the level of the ground (not sunk into it nor flush therewith as in the case of *Stasimopus*), and the narrow tubular passage descends vertically downwards expanding below into one or two definite chambers. The shield of the spider very closely fits the narrow passage and thus at any point therein the spider can completely block the way against intruders by stationing herself there with abdominal shield upwards. When moving along the narrow passage the spider is unable to turn round on account of her shield, and no doubt the one or two chambers, appropriately termed "turning chambers" by Mr. Schreiner, are constructed for that purpose. These turning chambers are vertically elongated, and oval in cross section, the sectional area being several times greater than that of narrow passage. If a light straw be pushed into the nest the spider takes up her position in one of the narrow passages, shield upwards. An actual observation by Mr. Schreiner suggests what I suspect to be the chief function of the shield. In one nest a living pompilid wasp* was found in the upper part of the narrow passage but was prevented by the shield of the spider from going further down. It is well known that pompilids are most deadly foes of four-lunged spiders ; the shield of *Galeosoma* is probably a special armour against such foes. A somewhat similar structure, though formed in a different way, is found in the *Cyclocosmieae* of Mexico and China, but these are not related to *Galeosoma*.

Paromostola ? pardalina sp. nov.—The species here described is a very distinct one and may prove to be worthy of generic rank, but as it belongs to a group of genera (*Homostola* E. Sim., *Paromostola* Purc., *Stictogaster* Purc., and perhaps *Bessia* Poc.) the limits of which are as yet not clearly defined and which may eventually have to be reduced in number, I have thought it best

*Dr. H. Brauns identifies the specimen as Clavelia (*Pedinaspis olim*) caffra Kohl; he also informs me that Ferton has observed other species of *Pedinaspis* in the act of hunting Nemesia (the trap-door spider of S. Europe). Dr. Brauns suspects that the wasp does not carry off the spider but leaves her in situ after depositing an egg.

not to distinguish it generically. It seems to be allied to *Paromostola abernethyi* Purc. (Ann. S. African Mus. 3, p. 93), but may be easily distinguished therefrom through the numerous teeth on the labium.

TYPE. A single female specimen from Barberton Jan. 1910, collected by Miss L. de Beer and now in the Transvaal Museum.

COLOUR. Carapace and appendages chestnut brown above, the patellae of first two pairs of legs paler ; abdomen pale over an anterior median area, elsewhere dark with numerous pale spots at the sides and posteriorly ; lower surfaces pale.

OCULAR AREA parallel sided, about twice as broad as long, all the eyes situated on the tubercle, the anterior row procurved, the posterior row recurved, the anterior and posterior laterals subequal or the latter slightly smaller. Eyes of anterior row with their hind margins in a slightly procurved line, the medians only slightly more than half a diameter apart but almost their own diameter distant from the laterals which latter are about 1½ times as long as the medians ; distance of laterals from margin of carapace about equal to their short diameter. Eyes of posterior row with their anterior margins in a recurved line, the medians very much smaller than the anterior medians and distant from the laterals about ¼ (or even less) the long diameter of the latter, the distance between anterior and posterior laterals being about ½ the long diameter of the latter.

LEGS. Tarsi I. and II. and distal half of metatarsus I. on its anterior side scopulate, tarsi III. and IV. thickly covered below with fine bristles which also occur on the posterior side of tarsus II. Metatarsi of anterior legs considerably longer than the tarsi. Tibia I. equal to the metatarsus and ⅓ of the tarsus. Metatarsi I. and II. with 2 apical and 2 strong spines posteriorly below, their upper surfaces without spines, III with 3 apical spines below, with 2 spines posteriorly below, and with 10 or 11 spines on the upper surface, IV with 2 strong spines at the apex inferiorly, a few others on the lower surface, and a row of about 4 strong spines on both anterior and posterior sides of the upper surface. Tibia I. with 1 or 2 long setiform spines below, II. with 2 setiform spines below and a weaker one at the apex, III. with 2 setiform spines at the apex inferiorly, and 2 pairs along the lower surface, the upper surface with 2 spines on or near both anterior and posterior upper edges, IV. with 2 strong spines at the apex inferiorly and 7 or 8 spiniform setae along the lower surface, a row of 3 spines along the posterior upper edge. Patella III. with a row of 3 short stout spines along its anterior side accompanied by short weak setiform spines covering the anterior surface, IV. with weaker setiform spines scattered over its anterior surface, stronger and more concentrated near the base. Femur III with a transverse apical row of short setiform spines on the anterior side, IV. with a group of short spines and short setiform spines at the apex above, the group being concentrated on the anterior side. Claws of first leg biseriately dentated below, the basal row composed of 4 teeth the distal one longest, the row nearest the axis of the leg comprising 2 distinct teeth near the middle of the claw ; claws of fourth leg with 3 strong teeth at the base the distal one longest, and the posterior claw has also 2 quite distinct teeth comprising the axial row, this being situated near the middle of the claw. Inferior claws well developed. Coxae of legs III. and IV. with the inferior medio-basal naked area quite short but that at the anterior lower edge long, reaching beyond the basal third of the segment.

PEDIPALPS. Tarsus with 2 or 3 short spines below ; coxae with a large group of numerous teeth at its base in front.

CHELICERAE. The inner (about 6) spines of the rastellum stout and strong ; 2 well developed rows of teeth below chelicerae of about 10 each, the outer row weaker but reaching nearly to the end of the groove.

LABIUM about 1½ times as broad as long, its anterior half thickly covered with numerous (quite 50) teeth.

SIGILLA. Posterior sternal sigilla oval and elongated, only slightly less than their own diameter distant from the sternal margin and slightly more than 2 diameters apart.

FOVEA deep, wide and procurved.

POSTERIOR SPINNERS. The apical segment ½ to ⅔ as long as the penultimate segment.

Measurements. Length of carapace 6 mm., width of carapace 4·5 mm. Length of tibia of first leg 2·8 mm.

Pelmatorycior pretoriae sp. nov.

Type. A single male specimen from Garstfontein near Pretoria, in the collection of the Transvaal Museum,

Colour. Carapace chestnut brown, much darker anteriorly, the chelicerae almost black; legs and pedipalps above and below pale ochraceous; abdomen brown above, paler below.

Carapace not more than $\frac{1}{4}$ longer than broad, with a row of stout curved marginal spines on each side above the bases of the third and fourth legs and with a few setae and setiform spines posteriorly.

Ocular area about $2\frac{1}{2}$ times as wide as long, distinctly wider posteriorly; anterior row of eyes considerably procurved, the lateral eyes about $\frac{1}{2}$ longer than the medians, the latter rather large, further from each other than from the laterals: the posterior row of eyes transverse, their anterior margins in a straight or very slightly recurved line, their posterior margins in a distinctly recurved line, the laterals further from the anterior laterals than from the posterior medians, only slightly shorter than the former but much longer than the latter, and very slightly longer than the anterior medians which are much larger than the posterior medians.

Pedipalps unspined; the tibia long, convex along the under side; tarsus short; viewed from below, the bulb is broadly pear-shaped, the process distinctly longer than the bulb, twisted, its distal portion filiform and upcurved.

Legs. Tarsi scopulate to the base. Metatarsus I. slender and straight, shorter than the tibia but longer than the distance from the centre of the fovea to the anterior margin of carapace and almost twice the length of the tarsus, scopulate distally for about $\frac{1}{3}$ of its length but metatarsus II. scopulate for not more than $\frac{1}{4}$ of its length. Tarsus I. unspined, II. and III. without distinct spines or spinules, IV. with 1 or 2 spines on the anterior side only. Metatarsus I. with 1 anterior and 2 posterior spines at the apex inferiorly and with 2 spines along the ventral surface; II.

with 1 anterior and 2 posterior apical spines below and with 1 spine along the ventral surface: III. with 2 or 3 spines on the lower surface in addition to those at the apex: IV. with about 5 or 6 spines on its ventral surface besides some at the apex and others on the anterior surface. Tibia I. with 2 or 3 strong spines along the anterior surface, about 4 on the posterior surface and others along the lower surface and at the apex: II with about 4 on the lower surface, 3 at the apex, and 1 on the anterior upper edge: III with only 1 spine on the lower surface apart from those at the apex: IV. with 3 or 4 spines below, 2 at the apex, 1 or 2 on the posterior surface, the anterior surface without spines. Patella I. with or without an apical spine inferiorly and with 1 or 2 spines on the anterior surface, II without apical spines inferiorly but with a single spine on the anterior surface, III. with numerous spines on anterior surface and 2 on the dorsal surface, IV. completely without spines. Femora with a few spines above comprised in 1 or 2 rows, the fourth with a distal group of spines above, and a patch of spinules near the anterior distal edge. Anterior tarsal claw of fourth leg with 8 teeth on the axial row and 7 on the outside row, the posterior claw with an axial row of 5 teeth and an outside row of 4 or 5: all the claws with a double row of teeth below.

ABDOMEN clothed above with long hairs many of which are setiform and anteriorly become more spiniform.

POSTERIOR SPINNERS with apical segment as long as the penultimate segment.

POSTERIOR STERNAL SIGILLA fairly large, pear-shaped, their distance apart less than their length and slightly exceeding their distance from the lateral margin.

MEASUREMENTS. Carapace 5·5 mm. long, 4·65 mm. broad Metatarsus of first leg 4 mm. long.

The following is a description of a female specimen which, in all probability belongs to the same species; the example described came from Gezina, near Pretoria, and is also in the collection of the Transvaal Museum.

COLOUR. Carapace chestnut brown, paler posteriorly; legs brown, the patella and tibia of the pedipalps and first two pairs of legs, pale yellowish brown; abdomen infuscated above, but pale in the mid-dorsal region.

OCULAR AREA slightly more than twice as wide as long, and slightly wider behind than in front; the hind margins of the anterior row of eyes in a slightly procurved line, and the front margins of the posterior row in a recurved line; posterior lateral eyes long and oval, much smaller than the anterior laterals, but longer than the anterior medians, their distance from the anterior laterals nearly twice as great as from the posterior medians; the posterior medians flat and pearshaped, their distance from the anterior medians about half greater than that from the posterior laterals.

PEDIPALPS spined below on the tarsus and tibia, the coxa with some spinules and numerous short spiniform hairs.

LEGS. Tarsus I. with a single short spine below, distally situated, II. with a proximally situated spine also, III. with several inferior and anterior spines and a posterior dorsal row of 5 spines, IV. with 13 strong spines below, apart from which there are none on the lateral surfaces. Tarsi I. and II. thickly scopulate, also the metatarsi almost to the base, but scopular hairs are absent on the posterior side of metatarsus II., except distally. Metatarsus I. and II. with 3 apical and 2 median spines below, III. with about 10 spines along the upper part of the anterior surface, a series of about 13 spines along the postero-dorsal edge, and ventrally only one or two spines in addition to the 3 long ones apically situated, IV. with 5 or 6 spines apically situated below, and in addition, about 8 or 9 on the ventral and anterior surfaces, but only 2 on the postero-dorsal edge. Tibia I. without spines below or with but one one setiform spine at the apex, II. with a strong spine at the apex below, III. with a pair of long apical spines below, 3 or 4 dorsals, 2 postero-dorsals and about 6 antero-dorsal spines, IV. with 2 setiform spines at the apex below and several pairs of weak setiform spines inferiorly, with or without a single spine on the dorsal part of the posterior surface. Patella III. covered with short stout spines on the anterior surface and with 1 or 2 stout spines along the postero-dorsal margin, IV. with some short setiform spines on the anterior surface, crowded together basally, elsewhere diffused. Femur IV. with a dense group of short stout apical spines above and anteriorly. Claws of fourth tarsus with only 1 row of teeth each, the row on the anterior claw comprising 2 moderate sized teeth and 2 or 3 smaller denticulations, that of the posterior claw comprising 3 moderate sized teeth.

POSTERIOR STERNAL SIGILLA distinctly more than their own length apart, and very slightly more than their own length distant from the lateral margin of the sternum.

POSTERIOR SPINNERS with the apical segment a little shorter than the penultimate segment.

MEASUREMENTS. Length of carapace 5·5 mm. Breadth of carapace 4·2 mm.

Pelmatoryctor barbertoni, sp. nov.

TYPE. One male specimen from Barberton (25. 11. 1911), collected by Miss L. de Beer; now in the Transvaal Museum.

COLOUR. Carapace dull reddish brown, chelicerae blackish brown, pedipalps and legs dull brown; abdomen fuscous above; lower surfaces pale.

CARAPACE. About $\frac{1}{4}$ longer than broad, with a marginal row of stout curved spines and setae on each side above the bases of the 3rd and 4th legs, and with a few setae and setiform spines posteriorly.

OCULAR AREA quite $2\frac{1}{3}$ times as wide as long, considerably wider posteriorly, the anterior row of eyes procurved, the lateral eyes about $\frac{1}{3}$ longer than the medians, the latter rather large, further from one another than from the laterals; posterior row transverse, the anterior margins in a very slightly procurved line, the posterior margins in a recurved line, the laterals slightly nearer to the posterior medians than to the anterior laterals, and quite as long as the latter, the medians being very small.

PEDIPALPS with a single spine on the anterior surface of tibia, near its base, and with 2 spines on the anterior surface of patella, near its apex, as well as a number of long spiniform setae inferiorly; viewed from below the bulb is oval, its process being about as long as the long diameter of bulb, slightly twisted and sharply upcurved near the end.

LEGS. All the tarsi scopulate to the base. Metatarsus I. slender, only very slightly shorter than the tibia, but longer than the distance from the centre of fovea to anterior margin of carapace, less than twice the length of the tarsus. Metatarsus I. and II. scopulate distally for about two-fifths of their length, I. with 1 anterior and 2 posterior spines at its apex inferiorly, with 2 spines along the ventral surface and 1 on the anterior side superiorly near the base, II. similarly spined but with 2 spines anteriorly in the basal half of the segment, III. with a number of strong spines on all the surfaces, IV. with fewer and rather weaker spines, none on the upper surfaces, except 1 or 3 along the posterior dorsal edge. Tarsus I. without spines, II. with 2 small ones on the posterior side, III. with 2 on the anterior side, IV. with 3 or 4 spines anteriorly and 1 or 2 posteriorly. Tibia I. with 5 strong spines inferiorly and 3 at the apex below, 2 on the anterior surface, but none posteriorly, II. with 4 on the lower surface, 3 at the apex and 3 along the anterior surface, III. with 1 on the ventral surface, 3 at the apex, 4 on the anterior surface, 3 to 6 on the dorsal surface and 1 to 4 on the posterior surface, IV. with 4 spines below and 2 at the apex, the anterior surface without spines, the posterior surface with a row of 3 spines. Patella I. and II. with an apical spine inferiorly and with 2 spines on its anterior surface, III. with numerous spines anteriorly and 3 on the dorsal surface, IV. without spines. Femora with 1 or 2 rows of spines above, the fourth with a small distal group of spines above and a patch of spinules near the anterior distal edge. Anterior tarsal claw of 4th leg with a basal row of four longish teeth, and an inner much longer row of about 6 short teeth ; posterior claw of 4th leg with an outer basal row of 5 longish teeth and an inner much longer row of 5 or 6 short teeth.

POSTERIOR SPINNERS with the apical segment as long as the penultimate or very slightly longer.

ABDOMEN mostly clothed with short silky hair, quite without setiform hairs above except near the base.

POSTERIOR STERNAL SIGILLA fairly large, pearshaped, their distance apart slightly less than their length and greater than their distance from the margin of the sternum.

MEASUREMENTS. Carapace 5·6 mm. long, 4·5 mm. broad. Metatarsus of first leg 3·8 mm. long.

The Transvaal Museum has also a single female *Pelmatoryctor* from Barberton (coll. Miss L. de Beer), which is no doubt of the same species as that just described. This female may be described as follows.

COLOUR. Carapace chestnut-brown, pale posteriorly, the hinder half margined with white; legs brown, patella and tibia of pedipalps and patella of second leg paler than the adjoining segments. Abdomen dull brown with a pale dark margined area on the midline dorsally.

OCULAR AREA about twice as wide as long, very slightly wider behind: posterior margins of anterior row of eyes in a slightly procurved line, the anterior margins of posterior row of eyes in a straight line: posterior lateral eyes long and reniform, separated by rather less than half their own length from the very much larger antero-laterals and about the same distance from the postero-medians; posterior medians rounded, their distance from the antero-medians about half greater than that from the posterolaterals.

PEDIPALPS spined on the tibia, tarsus and patella, the coxae with 2 or 3 teeth at the base anteriorly.

LEGS. Tarsus I. and II. each with 1 short weak spine inferiorly near the apex, III. with a few spines anteriorly and inferiorly but the posterior dorsal row includes only 2 spines, IV. with an antero-ventral group of from 9 to 11 spines. Tarsi of legs I. and II. thickly scopulate, the metatarsi scopulate to the base. Metatarsus I. and II. each with 3 strong spines inferiorly in addition to 3 apically situated, III. with about 9 spines on the upper part of the anterior surface, about 12 spines along the postero-dorsal edge, ventrally 4 long and weak spines in addition to the 3 apically situated, IV. with 4 spines at the apex below and about 14 on the ventral and anterior surfaces, on the posterior dorsal edge 3 spines. Tibia I. and II. with 2 setiform spines below and a strong one at the apex, III. with 2 long apical spines below, with 7 short dorsal spines, 2 short postero-dorsal spines near the apex and 5 antero-dorsal spines, IV. with only a single apical spine below. Patella III. covered with short stout spines on the anterior surface and with 1 stout spine on the postero-dorsal edge, IV. with some spinules on its anterior surface basally and numerous setiform spines. Femur IV. with a dense group of short stout apical spinules dorsally and anteriorly. Posterior claw of fourth tarsus with an outer row of 4 teeth and an inner row of 3 more distally situated ; teeth on anterior claw minute, the outer row including 2 very small teeth and 2 others still more minute.

POSTERIOR SPINNERS with the apical segment only a trifle longer than the penultimate segment.

POSTERIOR STERNAL SIGILLA about three-fifths of their own length apart, their distance from the lateral margin of the sternum about equal to their long diameter.

MEASUREMENTS. Carapace 7 mm. long, 4·75 mm. broad.

Moggridgea intermedia, sp. nov.

TYPE. A single female specimen in the Transvaal Museum from Knysna, collected by Mr. J. H. Rex, 21. 5. 1912.

COLOUR. Carapace and appendages dull brown above, paler below and tinged with red especially on the labium and coxae of the pedipalps.

CARAPACE. Fovea slightly recurved, with a distinct median groove behind. Anterior row of eyes with its front margin forming a procurved line, the lateral eyes comparatively small, their area only about twice that of the posterior laterals. Anterior medians less than a diameter apart, and about $1\frac{1}{3}$ to $1\frac{1}{2}$ diameters distant from the anterior laterals, the long diameter of which is about $1\frac{1}{3}$ times that of the anterior medians or very slightly more. Posterior medians narrow and elongated, about as long as the laterals or very slightly less.

LEGS. Coxa III. without a basal patch of spiniform setae. Patella III. with an anterior band of spines and long spiniform setae of which 10 or 11 are arranged in a single row superiorly, a few others being scattered about more inferiorly. (Fourth leg wanting in the specimen.)

LABIUM with 23 spines.

MEASUREMENTS. Total length 17 mm.; length of carapace 6·7 mm.; breadth of carapace 6 mm.

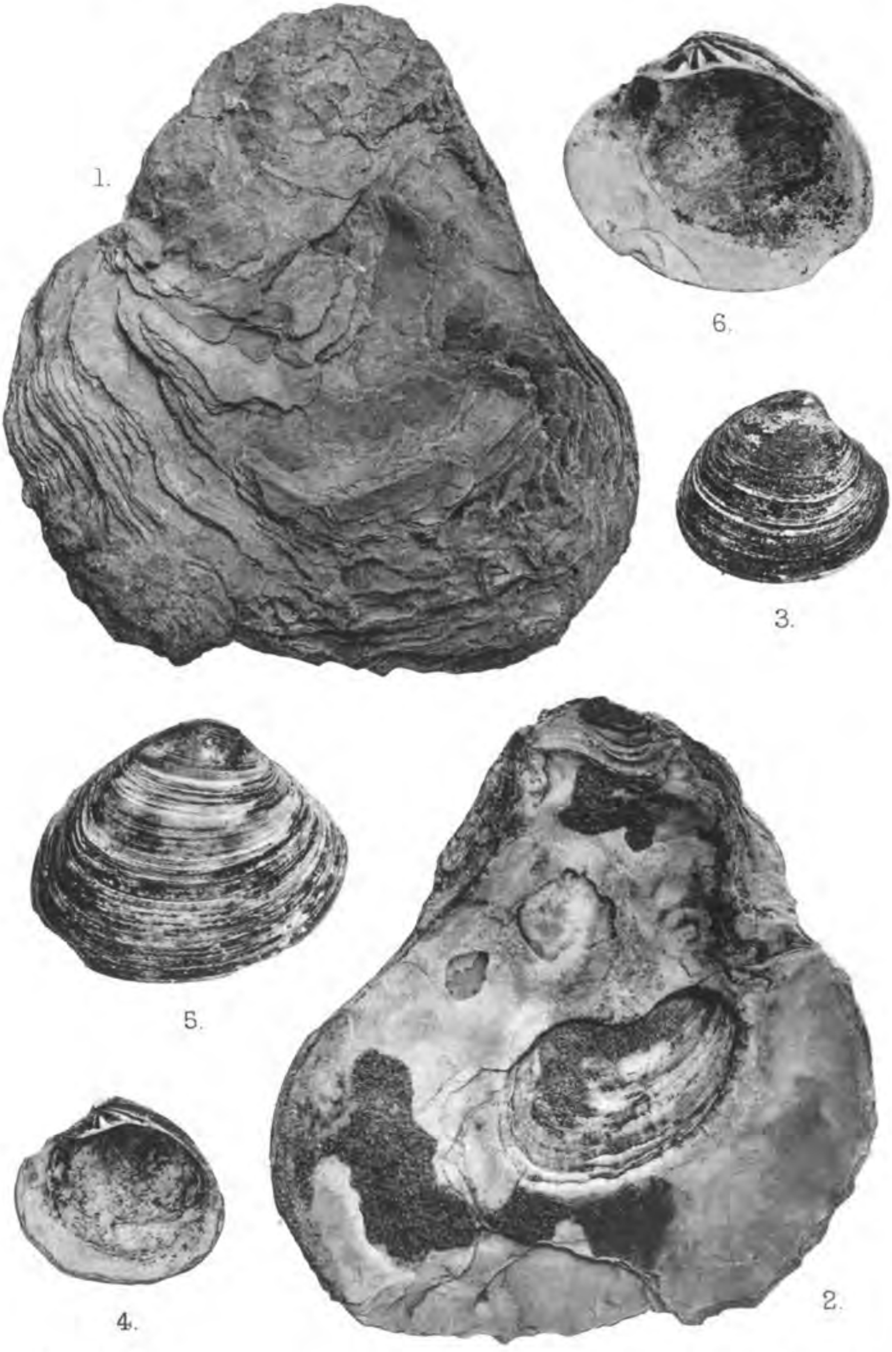


Photo. by H. G. Herring. Bemrose, Collo, Derby.

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

[Nat. Size.]

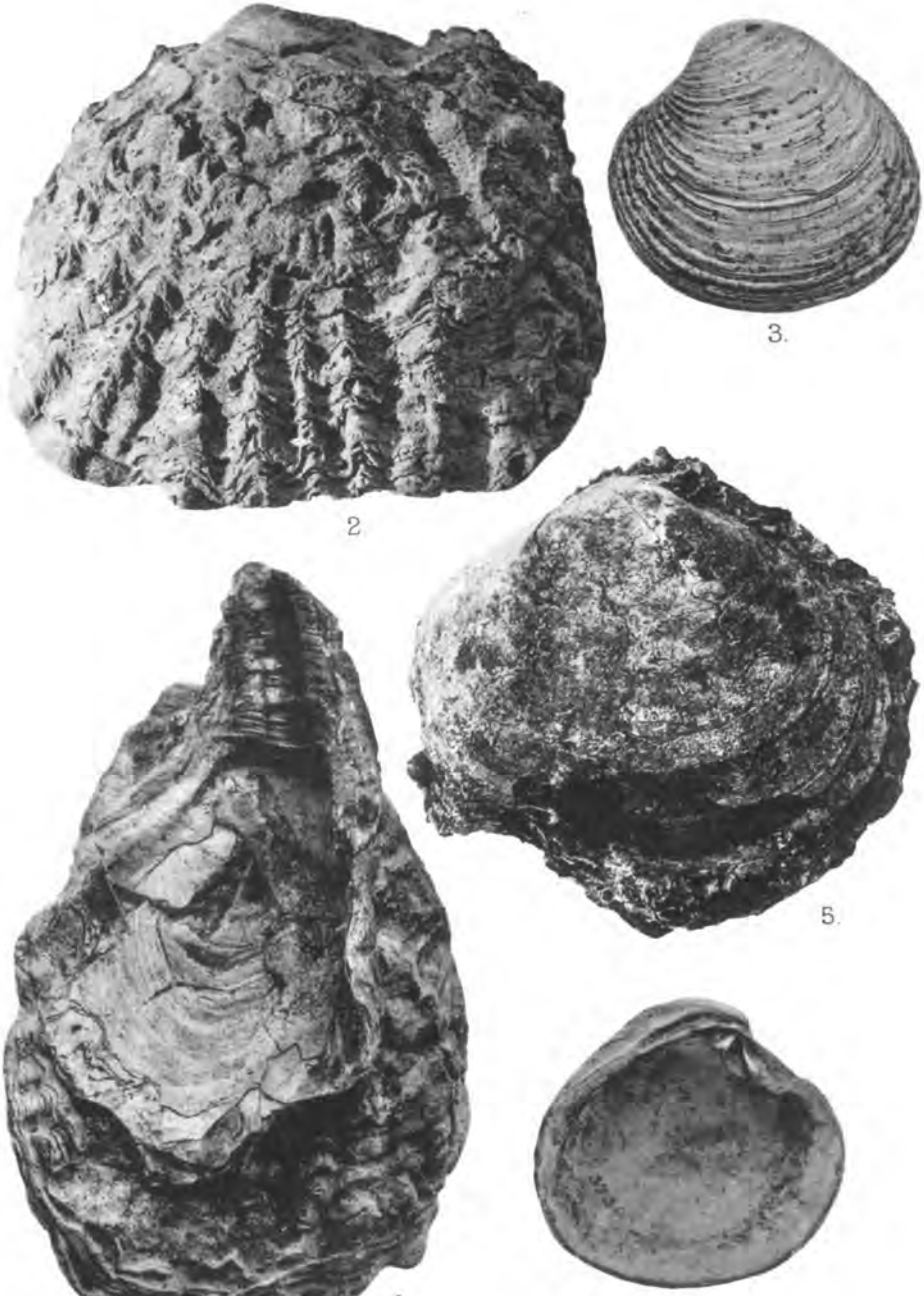


Photo. by H. G. Herring. Bemrose, Collo, Derby.

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

[Nat. Size.]

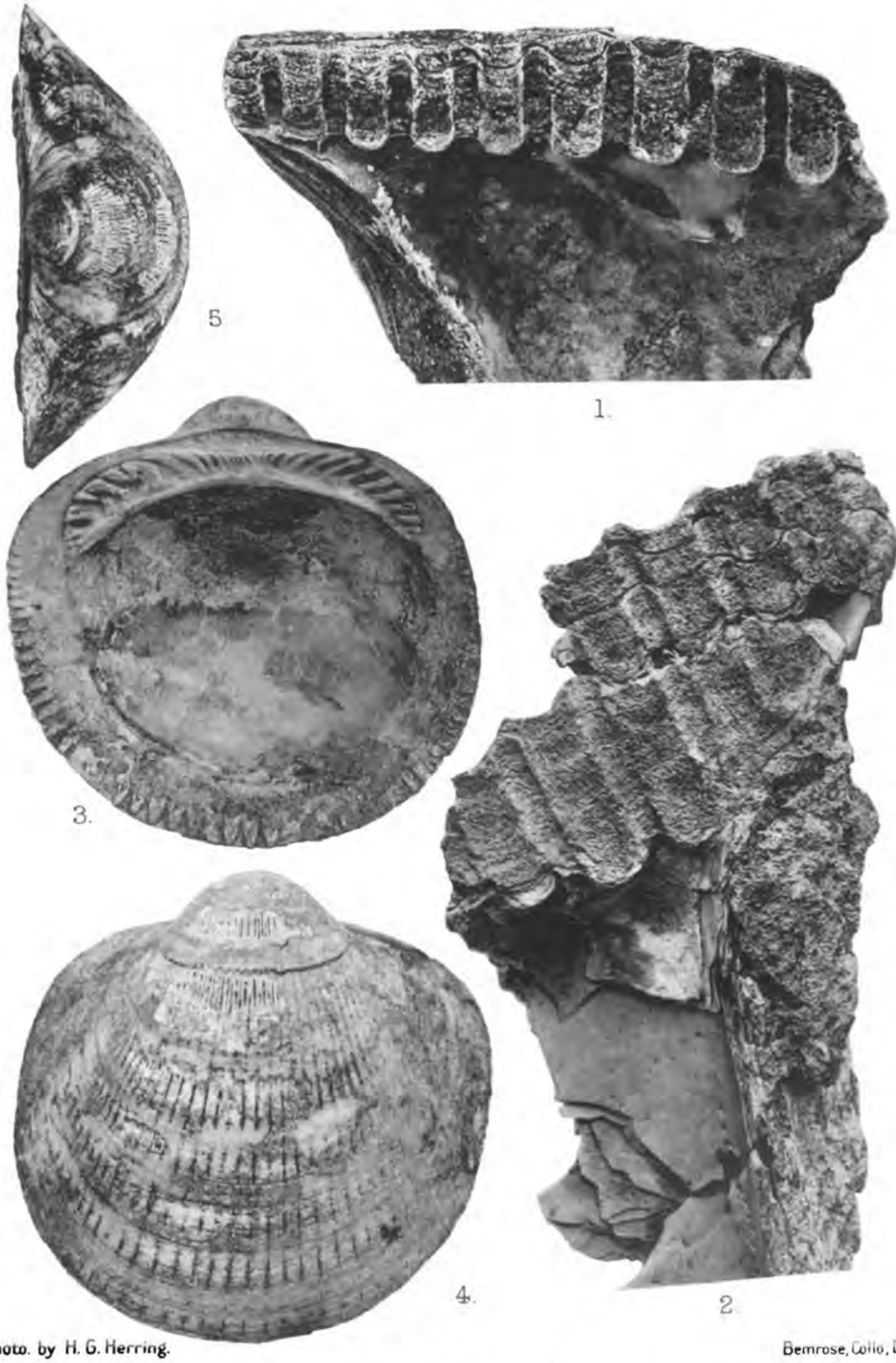


Photo. by H. G. Herring. Bemrose, Collo, Derby.

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

[Nat. Size.]

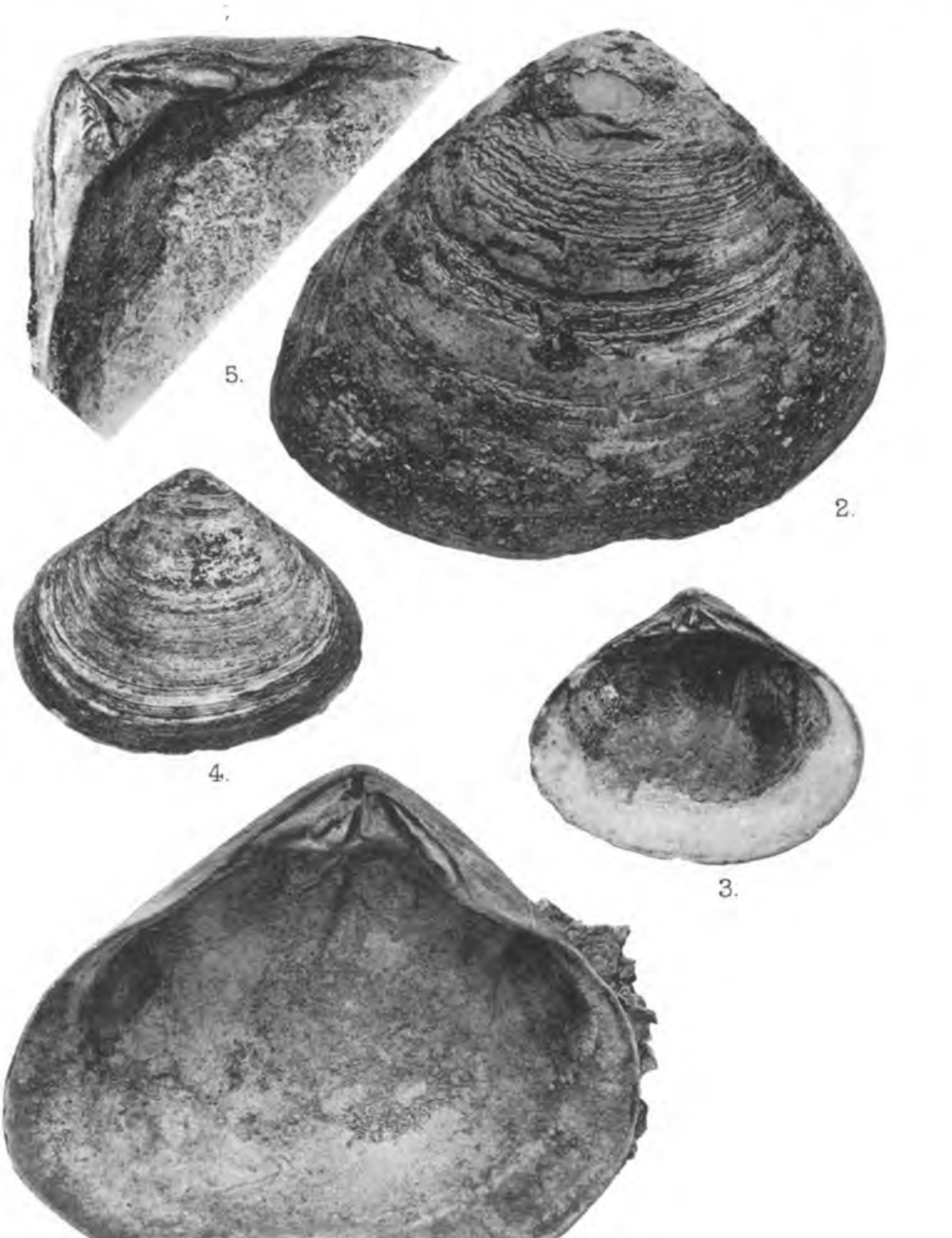


Photo. by H. G. Herring. Bemrose, Collo, Derby.

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

[Nat. Size.]

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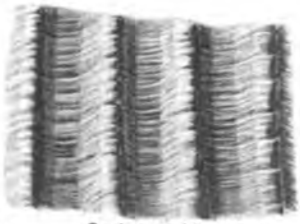

3.

Sculpture Magnified.

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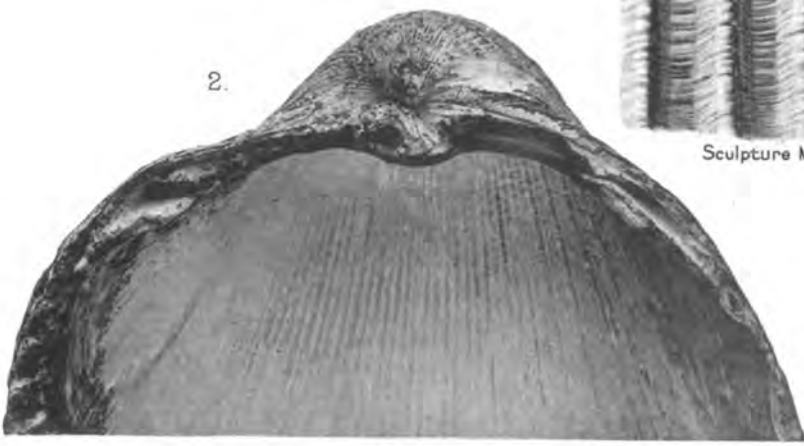

Photo. by H. G. Herring. Bemrose, Colln, Derby.

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

[Nat. Size, except Fig.3.]

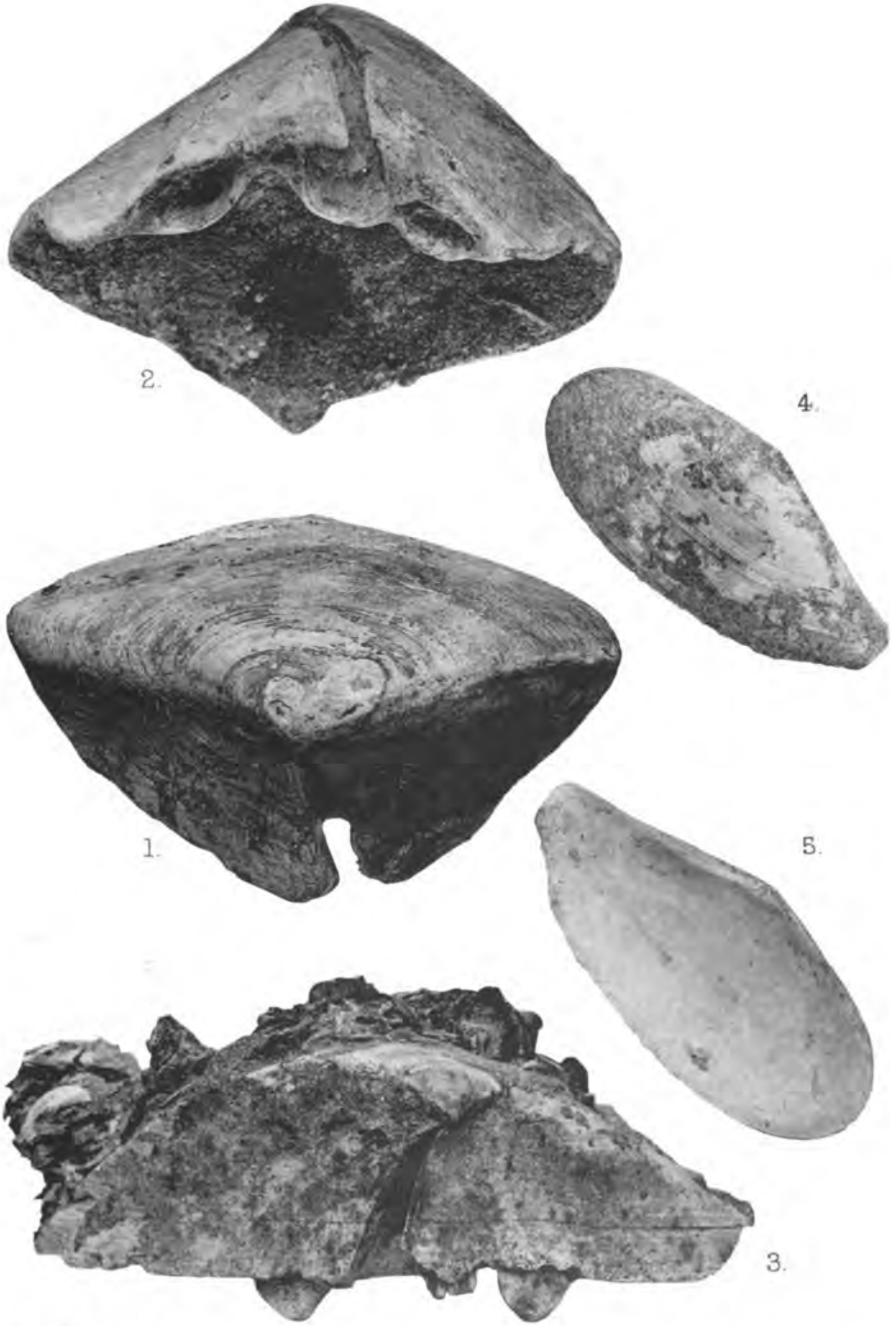

Photo. by H. G. Herring. Bemrose Collo, Derby

KAINOZOIC PELECYPODA FROM SOUTH AFRICA.

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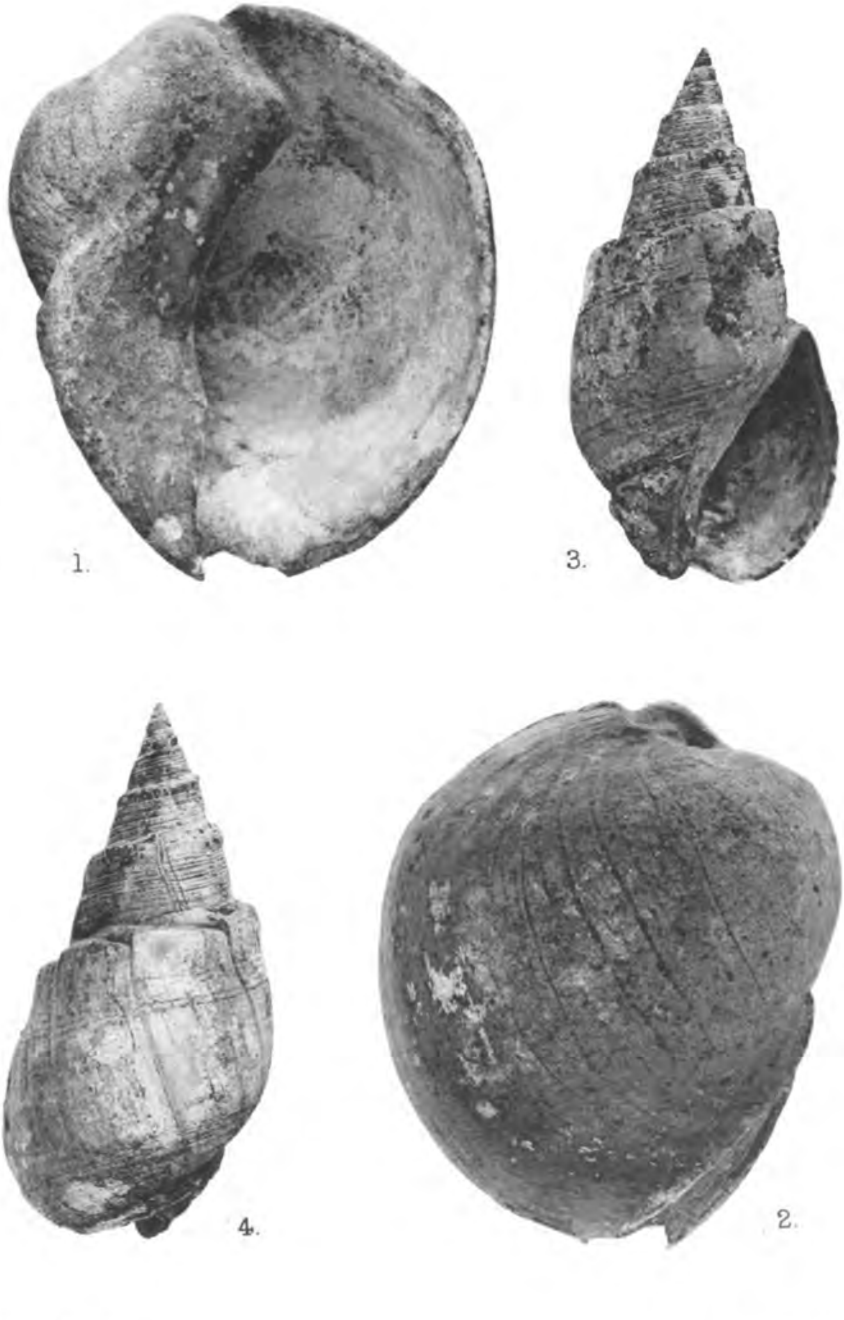

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Photo. by H. G. Herring. Bemrose Collo, De.

KAINOZOIC GASTROPODA FROM SOUTH AFRICA.

[Nat. Size.]

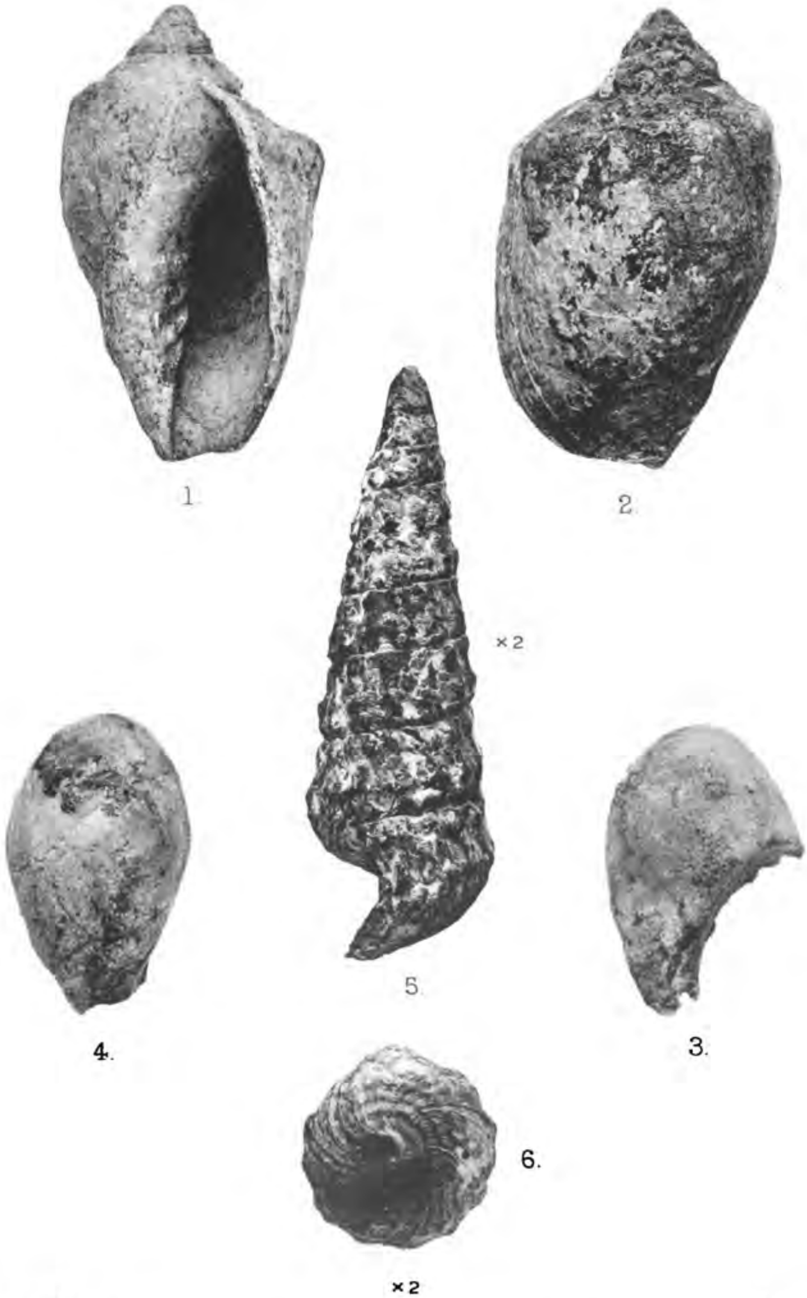
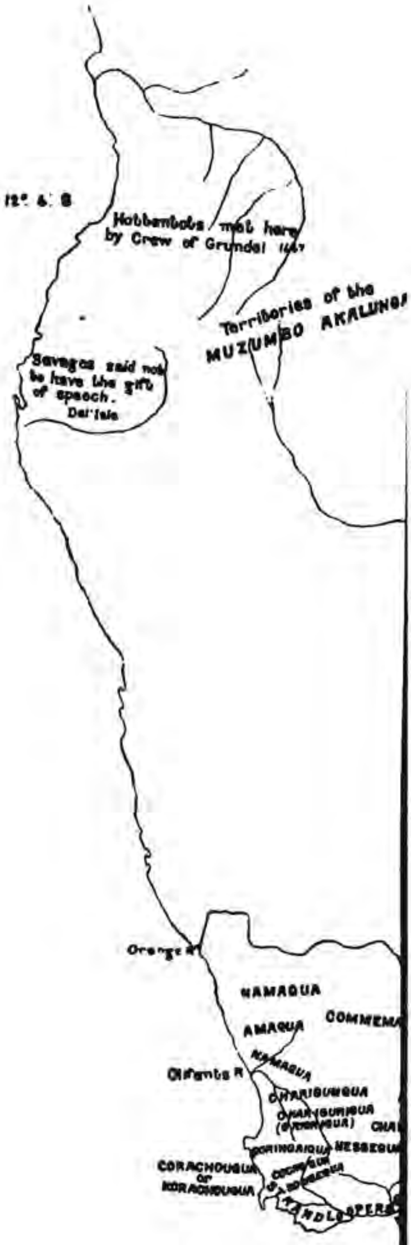


Photo. by H. G. Herring. Bemrose, Collo, Derby.

KAINOZOIC GASTROPODA FROM SOUTH AFRICA.

[Nat. Size, except Figs. 5 & 6.]



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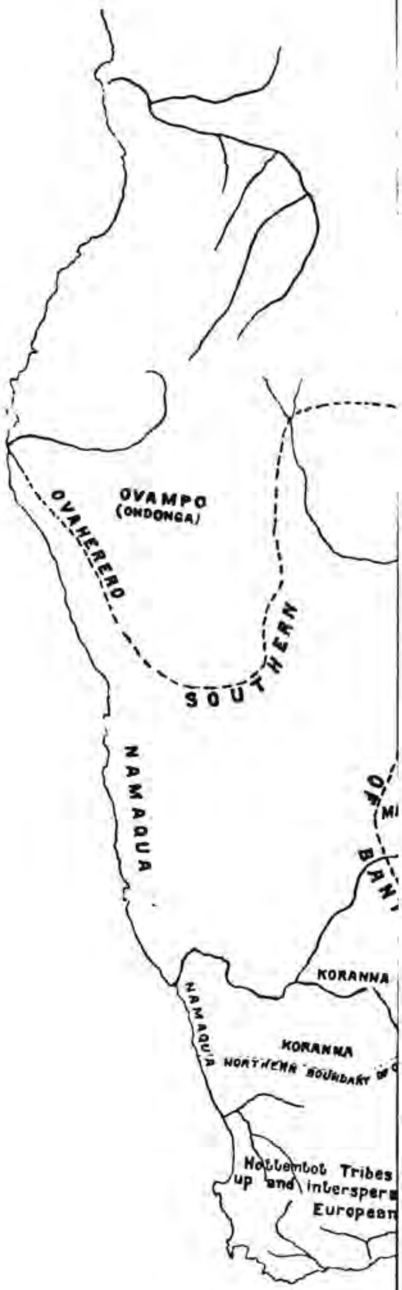

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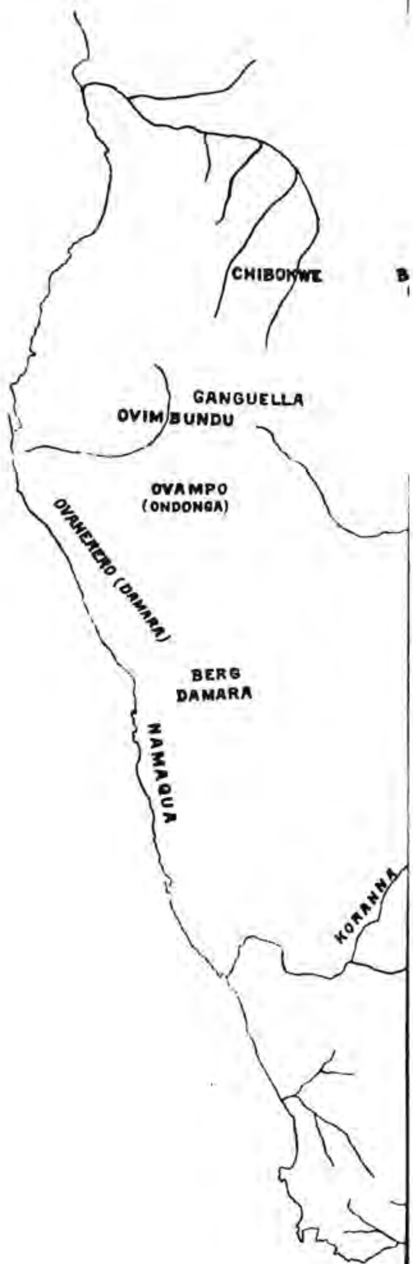

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On so-called "Wood-Flowers" on Burkea africana, Hook., caused by Loranthus Dregei, E. & Z.

(With Plates XXIX, XXX and XXXI and one figure in the text.)

By S. Schönland.

I have repeatedly received from correspondents in Rhodesia and the Transvaal so-called "wood-flowers" on dead branches of trees. They are curious outgrowths which in their appearance resemble some fungi, but even a superficial examination shows that they are phanerogamous growths, in fact outgrowths of the branches on which they are situated. Outgrowths of identical appearance are known from other parts of the world. In Mexico they are known as "Rose de Palo," in Guatemala as "Rose de Madera." The Germans call them "Holzrosen." According to Engler and other authors they are hypertrophied parts of the host. Strictly speaking they are produced by "hyperplasy" (cell-increase) not by "hypertrophy" (cell-enlargement). They are caused by parasitic *Loranthaceae* and are, therefore, of the nature of galls. A specimen from Mexico figured by Engler [1] was caused by a species of *Phoradendron* on a leguminous plant. I could not help doubting this interpretation as long as I had only specimens which were simply picked up as curiosities, no trace of any parasite being found in connection with them. To have further light thrown on them I requested Mr. C R. Prance, who resides in the Nylstroom district of the Transvaal and from whom I had received some of the specimens previously alluded to, to get me some living material on which to make further observations. He very kindly took a great deal of trouble to collect and send to me a fair

[1] Engler in "Natürl. Pflanzenfamilien" IV, III, 1 p. 161 fig. 107 B.

amount of living material on which the following account is mainly based. I wish to take this opportunity of thanking him for the great interest he has shown in this matter. The specimens collected in a live state showed at once that the "wood-flowers" received from him were caused by *Loranthus Dregei*, E. & Z. on *Burkea africana*, Hook. and they were sufficiently numerous and varied to allow me to study the main phases in the germination of this species of *Loranthus* and in the development of the peculiar growth which it causes. For reasons, which will be made plain in the following, I distinguish between (a) the "wood-flower," being the macerated growth as usually received (Plate XXIX, fig. 1), (b) the "chimera," the whole growth before maceration (Plate XXIX, fig. 2 and 3), (c) the "wood-gall" the part of the chimera produced by the host after stimulation by the parasite, (d) "internal portions of the chimera" which are derived from the *Loranthus*. Not every specimen of the parasite induces the formation of a wood-gall, though, as far as I can judge, the parasite does not live long if it does not produce a wood-gall, while in association with one it may live for years. The wood-galls are usually cup-shaped, but often they are developed on one side only. I have seen several instances in which 2 of them coalesced (Pl. XXIX, fig. 3). The largest I have seen were about 20 cm. wide and about 5 cm. deep. The thickest stem of the parasite which I received was about 3.5 cm. in diameter, and was evidently in its fourth year, but as it was associated with a wood-gall which had not reached the maximum size, thicker and older stems no doubt occur and the bushes of the parasite must reach a considerable size.

Engler in his account of African *Loranthaceae*[1] mentions 12 species of *Loranthus* (including *L. Dregei*) which produce growths like those produced by *Phoradendron*, while two others known to him do not cause formation of galls but form long roots which creep along the branches of their hosts and have numerous discs by which they are attached to them.

[1] Engler in Bot. Jahrb. XX p. 79, 80.

STRUCTURE OF THE FRUIT AND SEED OF LORANTHUS DREGEI.

The fruit of *L. Dregei* is baccate, oblong, dull red, pubescent. Its length is 8 mm., its breadth 5 mm. Though, as in all other *Loranthaceae*, strictly speaking a pseudocarp, it is here as in the majority of *Loranthaceae* in its ripe state not to be distinguished from a berry and it has also at the border between the hollowed out flowering axis and the real fruit a viscine layer which surrounds almost the whole ovary. It contains only one "seed" [1] which has copious endosperm mostly composed of cells rich in starch but also of a fair amount of viscine cells. There is one embryo which is surrounded by the endosperm nearly reaching its circumference at the radicular end, while the ends of the cotyledons are further removed from it. The form of the embryo is not unlike that of *Viscum album*, L. but it is much more broadened out at the base forming a disc which is irregularly crenate on the margin. The embryo, like the endosperm, contains a fair amount of starch.

GERMINATION OF THE SEED OF LORANTHUS DREGEI.

A number of germinating seeds were received from Mr. Prance towards the end of Feb., 1913. Some were picked up on the ground, while many others were found attached to branches of *Burkea*. It seems, therefore, that germination may start anywhere provided suitable conditions obtain. None of them showed any signs of having been tackled by birds or other animals. In one case (Pl. XXX, fig. 5) 4 seedlings were found close together on one branch more or less on one side, presumably the upper. This may be perhaps interpreted as showing that they all dropped down and were, as it were, caught by the branch to which they were glued by viscine derived from the splitting "berry." Viscine could be clearly seen all round the points of attachment. Sometimes 2 berries were found very close together. Such close proximity may lead to the formation of compound wood-galls to which reference has already been made. Some of the "berries" were attached to cracks while others were glued to places in

[1] I have employed this term here in the popular sense as I had no material to determine its exact morphology. Compare Engler in "Natürl. Pflanzenfam." IV, III, 1 p. 173.

which the bark was perfectly closed. The process of germination and subsequent behaviour of the seedlings was practically uninfluenced by these differences. Again the thickness of the branch of the host does not seem to cause much difference as regards the penetration of the parasite and subsequent development.

Germination is started by an elongation of the cotyledons by which the hypocotyledonary disc is pushed out of the seed. This disc enlarges slightly having then a diameter of about 6 mm. It becomes firmly appressed to the host. It bears on its lower side short hair like cells which secrete a slimy substance. The exposed portion of the cotyledons and the disc are green. The apical portion of the cotyledons remains embedded in the fruit and eventually the cotyledons which are united to one another drop off with the fruit when the endosperm has been consumed. The hypocotyledonary disc forms on its under side a flat, narrower and paler coloured secondary disc with circular outline from the centre of which arises a sucker exogenously (Pl. XXX, fig. 6). This sucker penetrates into the host. It has no vascular strands, being composed of parenchymatous tissue interspersed with small irregular groups of stone cells. It has no root cap. It passes straight into the host causing in many cases no disturbance whatsoever outside its circumference. It evidently excretes an enzyme which dissolves the constituents of the bark, the cortex and the phloem, but it stops when it has reached the xylem. There are, however, cases in which its power of penetration appears to be insufficient. In these cases the cortical tissues of the host die off around the sucker or one may then see the sucker slightly deflexed side-ways while in normal cases it only grows at right angles to the axis of the branch into which it penetrates. In one case only I found that the primary sucker had almost completely died off and that root-like secondary suckers had arisen endogenously from its base. However if the tissues of the host around the primary sucker are disorganised the seedling may continue to develope but eventually it dies off. If they are disorganised to some extent only it may continue for a more considerable time, but as far as my experience goes, *unless a wood-gall is* *formed sooner or later the seedling dies*, reaching only a height of a few centimetres. For the healthy and continued growth of the parasite a "wood-gall" seems to be absolutely necessary since the parasite never sends suckers for any great distance into the host and but for the wood-gall the contact between the parasite and the host is of the slightest. The further development of the parasite must be considered in connection with the

DEVELOPMENT OF THE WOOD-GALL.

When a primary sucker of the seedling of *L. Dregei* reaches the cortical tissues of the host and these are not disorganised, the living cells of the host in the immediate neighbourhood of the sucker begin to increase rapidly and to form a more or less complete cup round the sucker which by intercalary growth more than keeps pace with the development of this cup-like structure and in this way the primary disc with the primary shoot of the parasite is raised and removed above the level of the surface of the bark of the host (Pl. XXX., fig. 6). It is most remarkable that the influence of the parasite is strictly circumscribed and that it does not penetrate further into the host.[1] No trace of it can be found outside the wood-gall and no effect is exercised on the growth of the branch of the host to which it is attached except that not unfrequently the apical portion of the branch dies off (Pl. XXIX, fig. 3 a.) possibly owing to a restricted supply of water which is appropriated by the wood-gall and parasite. In such cases the wood-gall becomes subterminal and the shape of the portion of the branch on which the gall is situated becomes slightly modified from purely mechanical causes (Pl. XXIX, fig. 3).

The cup or (when only developed on one side) shield-like structure has from the first an uneven surface and uneven upper edges and is mainly composed of parenchymatous tissue, but already in one 4 mm. long (above the bark) which I sectioned,

[1] I may here call attention to the very different behaviour of *Loranthus europaeus* in penetrating its host and in its further development. This has been frequently described. Compare e.g. Engler in "Natürl. Pflanzenfamilien" IV, 3, 1 p. 163, fig. 109, and Lindau in "Sorauer," Pflanzenkrankeiten, 2. Band, 3. Aufl. p. 496.

procambial strands had caused the formation of xylem strands and cork had also been already differentiated (Pl. XXX, fig. 7). A fascicular cambium then becomes active which gradually joins on to the fascicular cambium of the stem of the host, xylem is joined to xylem, phloem to phloem and altogether the excrescence develops the same tissues and on the whole also the same tissue-elements as the parent branch, the development of the bark is however slightly different and *further there is no medulla, its place being taken by the enlarged infradiscal portion of the parasite, a periclinal chimera being thus formed.*

In the meantime a few leaves may have been developed from the plumule of the Loranthus seedling but this does not seem to occur always. Moreover in almost every case I have seen, the primary shoot had died at an early stage, a layer of cork being formed in the lower portion of the primary disc (Pl. XXX, fig. 7, c). Consequently the disc and with it the primary shoot, if it is developed at all, dry up very early and the whole seedling plant consists then of the infra-discal portion enclosed in the wood gall. This portion, however, forms branches at an early stage. The dried up disc may often be seen on the top of the chimera even when it is 1-2 cm. long; no trace of the main shoot of the Loranthus seedling is left while several branches from the infra-discal portion are already well developed. Frequently in such cases one sees the disc pushed on one side by one of these branches. The branches of the ultimate plant of the Loranthus are therefore, often one and all of adventitious origin. Similar adventitious shoots are also known in other Loranthaceae, e.g. according to Engler they are formed from the adhesive disks ("Haftscheiben") and cortical haustoria of *Viscum album*, L. and *Arceuthobium Oxycedri* (DC.) M. Bieb.[1] From the very beginning and also

[1] According to von Tubeuf they are formed from the haustoria of *Viscum minimum.* They appear to occur also in *Viscum obscurum* Thunb. I found growing on *Euclea* sp. (*E. polyandra* E. Mey.?) collected at Despatch by Mr. F. Holland and received through Mr. J. L. Drege, one large specimen and three smaller ones in close proximity. I could not make quite sure whether the smaller ones were formed from suckers of the larger ones, but all the facts which I could ascertain pointed to this conclusion. Terete suckers 2.5—3 mm. in diameter from the central strands were found penetrating the wood of the *Euclea* but could not be traced very far.

during further development the internal portion of the chimera and also of its projections into the woodgall consist of parenchymatous cells and huge quantities of groups of stone cells. These, with the xylem of the woodgall, confer enormous strength on the chimera and consequently it is easily able to bear the strains put upon it by the large Loranthus-bushes which it may have to bear. The xylem of the Loranthus-bushes in the portions embedded in the chimera is broken up into small irregular strands consisting only of tracheids near the xylem of the woodgall and thus the connection with the latter is only a loose one. When the parenchymatous tissue decays the whole interior ot the chimera as far as the xylem of the woodgall must, therefore, easily become detachable and this is no doubt the reason why hardly any trace of the Loranthus remains after decay has been at work for some time. Possibly termites also help in the process of disintegration.

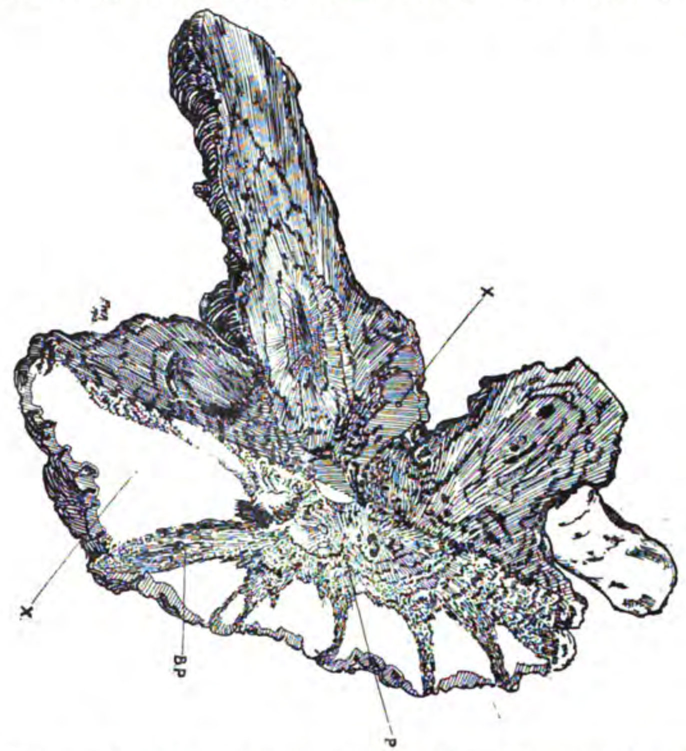
In the further development of the wood gall the following points require special attention :

1. The separation of its living elements from the living elements of the parent-stem.
2. The unequal growth in thickness of the xylem resulting in the lamellated appearance of the interior of "wood-flowers."
3. Its growth in length at the edges and the formation of the irregular branches which in the macerated state leads to the characteristic appearance which has earned the name of "woodflower."

As regards the first point, both the woodgall and its parent branch increasing in diameter add xylem, composed of very hard wood, towards their outer surfaces. In the angle where they meet a sharp constriction can be seen (Pl. XXX., fig. 8). There, for obvious reasons, growth in thickness must sooner or later come to an end as the xylem portions come closer and closer together. The bark in this angle formed by the woodgall and its parent branch becomes firmly pressed together and this pressure leads eventually to the death of the living elements underneath. The cambium producing the wood, and the phloem, cortical parenchyma and the cork cambium, all are killed, and as this occurs all round at the base of the woodgalls *their living elements lose their connection with the living elements of the branch of the host*, while at certain points they remain connected with the living elements of the *Loranthus*. In the double woodgalls such as the one figured in section on Plate XXIX, fig. 3, this separation can be plainly seen in the outer portions where they join the parent-branch, while in the central portion (Plate XXIX, fig. 3 x) it has even taken place at an earlier stage from somewhat similar causes. We have in the specimen figured a cup-shaped woodgall on the left-hand side with xylem x and x^1 and a unilateral woodgall on the right-hand side with xylem x^2. The xylem x is only near the upper edge accompanied by living elements belonging to the woodgall, in the lower part its phloem and cortical tissues, which were originally on its right-hand side, are quite disorganised.

The 2nd and 3rd point referred to above are intimately connected and must therefore be dealt with together.

The upper portion of the chimera is made up by the tissues of the host, both by upright and almost horizontal branches, but the woodgall grows around them and in between them. It is thus split up into irregular branches which eventually give its xylem the characteristic appearance which we find in the "woodflower." As some of the lateral branches (especially those formed first) of the *Loranthus* die off, the gaps in the woodgall formed by them may be closed up by the woodgall in a similar manner in which wounds are closed in woody stems generally. Consequently the lower portion of the full-grown "woodflower" shows generally uninterrupted wood. In addition to outgrowths which develop into proper branches, the portion of the *Loranthus* surrounded by the woodgall sends from the first numerous wedge-shaped outgrowths towards the periphery. They have no chance of growing in breadth in places where the xylem of the woodgall is already developed. Sooner or later they become walled over on the outside by xylem elements of the woodgall and the usual cortical elements including cork, but they continue to grow in an upward direction, usually broadening out. Thus wedge-shaped portions of the *Loranthus* alternate with wedge-shaped portions of the woodgall. (See text-figure). The inner portion of the xylem of the woodgall contains numerous parenchymatous elements Still it is more resistant to maceration than the adjoining portions of the *Loranthus* and consequently the shape of the xylem wedges remains after maceration, although their inner portions become more or less spongy



Chimera (about ⅔ natural size) cut vertically and transversely, with lower part removed, showing intrusions of the parasite into the woodgall. X—Xylem of woodgall; P—Parasite; B P—Branch of the parasite, nearly walled over by the woodgall.

in the "woodflower." The lamellation of the xylem of the woodgall gives an enormous area of contact between it and the *Loranthus*, and thus water can be more readily withdrawn from it, an important point in view of its very loose connection with the xylem of the *Loranthus* and moreover there are numerous points of contact of the living elements of the parasite with the cambium of the woodgall, another important point to which reference will be made presently. At the same time it must be borne in mind that the tissues of the woodgall and the *Loranthus* remain always fairly sharply defined not only when viewed with the naked eye but also under the microscope.

NUTRITION.

We are in the habit of designating the species of *Loranthus* and other autotrophous plants with similar mode of life as semi-parasites. They must undoubtedly draw their supply of water with dissolved inorganic salts from their host plants while they perform the processes incidental to carbon-assimilation. But even in the Misteltoe the relation with the host plant does not seem to be quite so simple. It has been made probable by Bonnier[1] that *Viscum album* growing on apple trees supplies some organic material to the host during winter, its relations to the host seem, therefore, to a certain extent reciprocally advantageous.

Judging from anatomical investigations only, it does not seem to be likely that the *Loranthus* derives any organic material from its host at any stage of its life-history, possibly with the exception of the very early stage when it penetrates into it. Of course its water supply must be drawn from it through the Intermediary of the xylem of the woodgall. That the undisturbed portions of the host derive any organic material from the *Loranthus* is again, to say the least, not likely. But, as far as I can judge, it is different with the woodgall. Stimulated into existence by the *Loranthus*, it has eventually to depend upon it for its organic material. At no time is there much connection between its living tissues and the living tissues of the branch from which it springs. Eventually, as I have shown, this connection is broken and it must receive its ordinary supply of organic food from the *Loranthus* and *forms* as it were *a symbiotic organism with it*, a conclusion which in view of Bonnier's investigations is not so startling as it appears at first sight.

[1]Bonnier in Compt. Rend. CXII, 1891, p. 1074. I have not seen the original paper, only the summary given by Lindau in "Sorauer, Pflanzenkrankheiten," 3. Aufl. 2. Band, p. 497.

The whole structure, composed of woodgall and enclosed portions of the *Loranthus* has thus a striking resemblance to a graft-symbiont and it may even be looked upon as a *periclinal chimera* as it consists in its outer portion mainly or entirely of parts of the host produced by hyperplasy and in the central portion of tissues derived from the *Loranthus*, thus establishing a resemblance to other periclinal chimeras.

The effect of the formation of the chimera on the host plant does not visibly extend beyond its immediate neighbourhood, except that, as mentioned before, often the apical portion of the branch bearing a chimera dies off, probably owing to the large amount of water which the *Loranthus* abstracts during the course of its existence. It is not unlikely that as the latter, and with it the wood gall, grows, its demands become so great in this respect that they become ultimately even prejudicial to the well-being of the lower portions of the branch.

There is no reason to doubt that the structures figured by Engler (in Natürl. Pflanzenfamilien IV, III, I, p. 161, fig. 107) are essentially of the same nature and similar origin as those which I have described, his fig. 107A showing a chimera caused by *Phoradendron* on a samydaceous plant, fig. 107B a larger one after decay of the "parasite." Considering that these were formed by a different genus of *Loranthaceae* on plants belonging to different natural orders in a widely separated part of the world we may perhaps be permitted to draw the conclusion that they owe their formation to similar reasons. It is hardly safe to speculate as to these reasons. It is, however, clear that as compared with the hosts on which e.g. *Loranthus europaeus* grows, the hosts on which real "woodflowers" are formed have a great advantage in so far as the attack of the parasite becomes localised. In *Loranthus europaeus* we find that after penetration it sends suckers along in the cambium and young xylem portions of the host and it may form broodbuds from which new individuals are produced on the same branch. The suckers, however, in the course of time are, but for branches sent into the cortex, walled over by the wood and further they find eventually such resistence in the hardening wood that they are pushed further and further outwards. Here also growths on the host may be produced which reach the size of a man's head. Though also called "Holzrosen" in German their structure and development is of course quite different from those on *Burkea africana*. One is figured in section by Engler in Natürl. Pflanzenfam. IV, III, I, p. 163, fig. 109. In a sense the attack of *Loranthus Dregei* is much feebler as it does not extend laterally, but there is no need for the production of lateral suckers as the woodgall supplies its needs quite well without much interference with the host, and thus it gains its end at the expenditure of much less material and energy.

The relations of various smut-fungi to their hosts present to a certain extent an analogy to the relations of the two species of *Loranthus* to the plants on which they grow. *Ustilago Maydis* (DC.), Tul. like *Loranthus Dregei* is localised in its effects. It causes, as it were in its own interests, a great cell-increase of the host, but on the other hand the remainder of the host, as long as there is no infection, does not suffer from its attack at a distance. The mycelium of *Ustilago Avenae* (Pers.) Jens. and of other species on the other hand, may keep pace with the growth of the host and, thus while not causing any malformation of the host, eventually do it much more injury by penetrating into the ovaries and thus preventing the formation of seeds; in one case a strong local tissue-reaction, in the other case, at first at all events, no strong local effect and yet eventually much greater injury. Beyond this the analogy of course does not go.

Some specimens of *Loranthus oleaefolia*, Ch. and Schl., growing on *Rhus excisa*, Thunb. var. *Thunbergiana* Sond., collected by Mr. F. Holland at Despatch, near Uitenhage, and kindly forwarded by Mr. I. L. Drege showed that this species may behave either like *L. europaeus* or like *L. Dregei*. One of them caused a swelling on the host without forming a proper woodgall. A large grub was at work hollowing out the swelling. The parasite had sent out suckers, some of which were found between bark and wood, others were found in the wood itself running longitudinally. One of these suckers was traced to a distance of about 5 cm. in a branch about 1.8 cm. thick. In its distal end it passed to the surface of the wood suggesting that in the proximal portion it had gradually been walled in by the xylem.

The other specimen of the parasite had formed a distinct woodgall which in its essential features did not differ from young ones formed by *Loranthus Dregei*. It was about 4 cm. in diameter. It showed the characteristic growth of the host round the base of the parasite which as in *Loranthus Dregei did not send suckers into the host beyond the woodgall.* Thus we find in this species that the host may also react on the attack of the parasite by a local growth capable of increase in thickness and length and thus supplying the gradually increasing needs of the parasite while in other cases, just as in *L. europaeus*, no such well defined growth-reaction takes place but then the parasite is able to go further afield and no doubt injures the host to a larger extent.

SUMMARY.—1. It has been shown that the woodflowers on *Burkea africana* are the hard portions of outgrowths of the host induced by *Loranthus Dregei* which in their entirety must be looked upon as woodgalls.

2. The development of the parasite and its relations to the woodgall have been traced.

3. The woodgall becomes, except for its water supply, independent of the branch from which it springs, and forms with the base of the parasite a periclinal chimera. It draws its organic food from the parasite and thus is enabled to continue its growth[1].

In conclusion I wish to thank Mr. F. W. Armstrong, A.R.C.A., for the drawings reproduced in the figure in the text and plate xxx., fig. 5 and 6.

[1]Since the above was in print I have had an opportunity of examining young woodgalls caused by *Loranthus Dregei* on *Combretum salicifolium* E. Mey., *Acacia caffra* Willd. and *Zizyphus mucronata* Willd. They were collected by Mr. F. S. Salisbury at Middledrift, Cape Colony. In all essential points they were like those caused on *Burkea africana*. These specimens showed plainly the localisation of the attack of the parasite and the early severance of the living times of the woodgall from the living tissues of the host. Mr. Salisbury found, in the same locality, the parasite growing on *Royena sp.* and *Salix sp.* It was most abundant on the *Combretum* which, however, was the predominant arborescent plant in the neighbourhood. One bush of the parasite was over 4 feet high.

Explanation of figures illustrating the structure and development of "woodflowers" caused by *Loranthus Dregei*, E. & Z. on *Burkea africana*, Hook.

PLATE XXIX.

Fig. 1. Woodflower ($\frac{2}{5}$ natural size). From a photograph. Showing the characteristic branching and lamellated inner surface.

Fig. 2. Chimera (about $\frac{4}{5}$ natural size). From a photograph.

Fig. 3. Section of the chimera represented on fig. 2. From a photograph.

The section was stained with acid aniline sulphate to increase contrast. Note that the chimera is a double one, the part on the right-hand side being unilateral. The apical portion of the branch of the host (a) has aborted. The figure shows pretty plainly the loose connection of the water-conducting elements of the xylem of the parasite with the xylem of the woodgalls, besides other features referred to in the text. x and x^1=Xylem of a cupshaped woodgall. x^2=Xylem of a unilateral woodgall, both woodgalls being united.

PLATE XXX.

Fig. 4. Young seedling of the parasite with a bit of the branch on which it grew. (Almost natural size.) From a photograph.

Fig. 5. Four young seedlings growing close together. (Twice natural size). In each case the remains of the "berry" are still attached. The groove on the hypocotyledonary disc shows the position of the cotyledons, the upper portions of which are enclosed in the "berry." From a drawing by F. W. Armstrong, Esq., A.R.C.A.

Fig. 6. A young seedling in which the hypocotyledonary disc has been raised by the intercalary growth of the infradiscal portion of the parasite. From a drawing by F. W. Armstrong, Esq., A.R.C.A.

Fig. 7. Sketch of a slightly older seedling halved. (Twice natural size.) The black areas indicate dead tissue. d=disc, on which is seen the primary shoot bearing the first leaves and one adventitious shoot on which no leaves are developed yet. At c

a corkcambium has been formed which soon would have led to the death of the upper portion of the parasite. u=procambial strands developed in the tissues of the infra-discal part of the parasite. There were tracheids in the lower portion. x=xylem, p=phloem of the woodgall. Neither of these are at this stage connected with the corresponding tissues in the stem, whereas a corkcambium on the outside is continuous, and has already formed several layers of cork. The irregular line near the surface indicates isolated groups of stone-cells which are found in the cortex of the host and woodgall.

Fig. 8. Sketch of still older seedling with its host, halved. (Natural size.) A woodgall is, as in fig. 7, developing only on one side of the parasite. The parasite bears one main shoot, which, however, is adventitious and two young adventitious shoots. The portion of the parasite (h) in connection with which the woodgall is formed is seen to penetrate only as far as the xylem of the host. The xylem (x) of the woodgall is seen to be connected with the xylem of the branch from which it springs. The connection of the live elements of the woodgall (outside the xylem) with the live elements of the branch is seen to be very slight and it can be plainly seen that with the growth in thickness of the xylem this connection must be broken.

PLATE XXXI.

Fig. 9. Chimera (natural size). From a photograph. The shoot, of which the lower portion is shown, is the primary shoot of the parasite and bears at its base remnants of the hypocotyledonary disc which has thus been raised considerably above the host.

Fig. 10. Chimera (natural size) with a portion of the branch on which it is seated. From a photograph. The shoots of the parasite shown are all adventitious. Note the deep constriction at the base of the chimera which is quite a characteristic feature and can also be seen in the next figure as well as in Plate XXIX, fig. 2 and 3.

Fig. 11. The same (slightly over natural size) halved. The woodgall and inner portion of the chimera can be plainly distinguished.

New Species of Crassula.

By S. Schönland.

Crassula parvipetala, Schönl. n. sp.

Pusilla, radice filiformi, caule parum ramoso laxe foliato. Folia carnosa late ovata in petiolum brevem attenuata, superiora quam inferiora gradatim breviora ovato-lanceolata, omnia minutissime papillosa. Flores pentameri in cymis paucifloris axillaribus et terminalibus pedicellatis, pedicellis brevibus filiformibus. Lobi calycis erecti ovati obtusi minutissime papillosi. Petala lanceolata quam sepala breviora. Stamina quam petala breviora filamentis subulatis antheris latioribus quam longis connectivo distincto. Carpidia quam stamina breviora uni-ovulata ovariis oblique oblongis dorso papillosis, stylis subulatis ovariis subaequilongis. Squamae stipitatae apice inaequaliter flabelliformes.

Khamisberg. Shady damp places beneath rocks. Pearson 6658 (p. pte.).

The plant is 1.5—2 cm. high. The stem bears 3—4 pairs of foliage leaves, the lamina of the lower of which is 7 mm. long, 6 mm. broad. The sepals are 1 mm. long (incl. the tube which is nearly as high as the lobes). The petals are about $\frac{3}{4}$ mm. long, the stamens $\frac{1}{2}$ mm. long, the carpels a trifle shorter. The squamae are about $\frac{2}{3}$ the length of the ovaries.

This species is allied to *Cr. minutiflora*, Schönl. et Bak. fil., and *Cr. tenuipedicellata*, Schönl. et Bak. fil. Through its uni-ovulate ovaries it approaches also the species of *Crassula* which used to be placed in the genus *Helophytum* E. & Z., but it also approaches Harvey's sect. *Crenato-lobatae* of the genus *Crassula*. Its leaves, though very small, remind us of those of *Cr. nemorosa*, E. & Z., but a more important character is the very distinct, one might almost say broadened, connective which is always found in that group and is present in *Cr. parvipetala*.

Crassula pusilla, Schönl. n. sp.

Annua pusilla simplex dense foliata, foliis oppositis connato-perfoliatis rubris subplanis subcarnosis ovatis acutis apice breviter aristatis, marginibus albidis minutissime papilloso-ciliatis. Flores pentameri breviter pedicellati, inferiores in axillis foliorum solitarii, superiores in dichasia 3-flora dispositi, bracteae foliis similes sed minores; sepala rubra lanceolata margine minutissime papilloso-ciliata apice aristata, petala alba ovata obtusa sepalorum longitudinem subaequantia, stamina et carpidia petalorum c. 4/5 longitudinem aequantia, filamentis subulatis antheris parvis luteis late oblongis, ovariis margine ventrali laevibus, dorsali apicem versus papillosis, late et oblique ovatis multi-ovulatis in stylum brevem subulatum sensim contractis, squamis minutis stipitato-obcuneatis apice truncatis.

On arid ground near Worcester, Cape Colony. S. Schönland. Sep. 1910. Apparently rare.

Height of plant 5—12 mm., leaves (without the small awn) about 6 mm. long, about 4 mm. broad. Calyx lobes about 2 mm. long, their awns 0.5-0.75 mm. long, calyx-tube about 0.25 mm. long.

This species is closely allied to *Cr. aristata*, Schönl. (in Engl. Bot. Jahrb. 43, p. 362) from which it is chiefly distinguished by the relative length of sepals and petals, by shorter awns on the leaves and by being unbranched. It is also allied to *Cr. bergioides*, Harv., which however has not the short awn on the leaves, and no awn on the sepals. Further, in *Cr. bergioides* the calyx lobes are larger than the petals.

Crassula basutica, Schönl. n. sp.

Suffruticosa fastigiata. Caulis ramique basi efoliati. Rami novelli dense foliati pubesentes internodiis quam folia brevioribus. Folia connata subulata acuta vel breviter mucronata, infra canaliculata marginibus reflexis subglabra. Flores in cymis paucifloris terminalibus subsessilibus breviter pedicellati, bracteis foliis similibus sed minoribus. Sepala lanceolata basi breviter connata. Petala erecta apice leviter recurvata oblongo-lanceolata infra apicem dorso minute mucronulata alba (?). Stamina petalis subaequilonga filamentis anguste subulatis antheris ovatis brunneis. Carpidia petalis subaequilonga gracilia stylis elongatis subulatis. Squamae minutae obcuneatae apice rotundatae.

Leribe, Basutoland. Mrs. Dieterlen, 252 A.

A much branched sub-shrub about 12 cm. high. Leaves about 7 mm. long. Length of sepals 2 mm., of petals 4.5 mm., of stamens 4 mm., of carpels 4.5 mm., of styles about 1.5 mm.

In habit and general appearance this plant is somewhat like *Cr. Harveyi*, Britt. et Bak. f. (*Cr. alpestris*, Harv. [non Thunb.]). It can at once be distinguished from it by the pubescent branches.

Crassula inaequalis, Schönl. n. sp.

Herba perennis simplex spectabilis. Caulis erectus glaber crassus e basi ad inflorescentiam usque dense foliatus. Folia carnosa basi connata, inferiora ovato-lanceolata acuta, superiora lanceolata, omnia supra concava faciebus glabris, toto margine minute ciliato-denticulata, superiora quam inferiora gradatim breviora. Cyma corymbosa in toto subhemisphaeroidea dense multiflora, bracteis inferioribus foliis similibus sed minoribus, superioribus parvis. Flores inferiores in dichotomis solitarii longipedicellati, superiores congesti breviter pedicellati. Calycis lobi triangulares margine laeves. Petala oblonga sub-acuta alba infra apicem dorso minute mucronulata. Stamina quam petala subduplo longiora, filamentis filiformibus, antheris late ovatis. Carpidia quam petala breviora, ovariis oblique oblongis margine ventrali apicem versus minute ciliatis in stylum brevem contractis. Squamae minutae obcuneatae truncatae membranaceae.

Swaziland, Miss Stewart, 108, Transvaal Mus. Herb. 9624; Transvaal, E. Dyke, Herb. Marloth 5348 (fl. Majo 1913).

A remarkably large species reaching a height of 1.2 m. with an upright densely foliate stem. Lowest leaves circ. 2.9 dm. long. Width of inflorescence circ. 3 dm. The flowers in the lower bifurcations of the inflorescence have pedicels 3 cm. long, while the pedicels of the majority of the flowers are only 2-4 mm. long. Calyx tube circ. ½ mm. long, lobes circ. 1 mm. long. Petals 3.5 mm. long. Stamens 5.5 mm. long. Carpels 2.25 mm. long.

I owe a photograph and a fresh flowering branch of this very distinct new species to Dr. Marloth. The inequality of the pedicels and the long stamens are very noteworthy. It is allied to *Cr. Goetzeana*, Engl. and with this belongs to the neighbourhood of *Cr. vaginata*, E. & Z.

Crassula spectabilis, Schönl. n. sp.

Herba perennis simplex spectabilis. Caulis erectus glaber crassus e basi ad inflorescentiam usque laxe foliatus. Folia quam internodia longiora basi vaginato-connata lanceolata subfalcata, basin versus attenuata, acuta, faciebus laevibus nervis 5 longitudinalibus (in statu sicco) prominulis, margine minute papilloso-ciliata, superiora quam inferiora gradatim breviora. Cyma corymbosa in toto subhemisphaeroidea dense multiflora, bracteis inferioribus foliis similibus sed minoribus superioribus parvis. Flores pedicellati. Calycis tubus brevissimus, lobi ovati obtusi margine laeves. Petala alba erecta oblongo-lanceolata obtusa infra apicem dorso breviter mucronulata quam sepala subtriplo longiora. Stamina quam petala breviora filamentis subulatis antheris oblongis. Carpidia staminibus subaequilonga, ovariis oblique oblongis, stylis brevibus subulatis. Squamae minutae obcuneatae apice rotundatae.

Entumene, Zululand, alt. 4-5000'. J. Wylie, 6.4.03., Natal Government Herbarium 9344.

There is only one specimen which is about 73 cm. high. The lowest leaves are about 30 cm. long and about 3 cm. broad in the widest portion. The inflorescence is 11 cm. in diameter. Length of calyx tube ½ mm., of lobes 1½ mm., of petals 3.5 mm., of stamens 2.75 mm., of carpels 3 mm. This species is allied to *Cr. inaequalis*, Schönl. but does not show the inequality in the pedicels, the shape and length of the calyx-lobes is different, the stamens are much shorter and the nature of the cilia on the margins of the leaves is different. In *Cr. inaequalis* they are narrow and sharp-pointed while in *Cr. spectabilis* they are papillose, rounded. Both species seem also to be allied to *Cr. acinaciformis*, Schinz. (*Cr. aloides*, N.E. Br.) which I have never seen, but this species has yellow flowers and differs according to Brown's detailed description from both in numerous details.

Crassula longistyla, Schönl. n. sp.

Caulis elongatus teres villosus parum ramosus. Folia quam internodia multo minora connata crassa obovata obtusa dense retrorsum papilloso-setosa. Inflorescentiae terminales laxe cymoso-corymbosae pauciflorae, bracteis lanceolatis villosis. Flores pedicellati pedicellis brevibus. Calycis tubus brevis, lobi oblongo-ovati extus villosi margine ciliati apice mucronati. Petala erecta alba oblonga basin versus attenuata dorso carinata infra apicem mucronulata quam sepala subduplo longiora. Stamina quam petala breviora, filamentis subulatis antheris ovatis. Carpidia gracillima petalis subaequilongis, stylis subulatis quam ovaria longioribus. Squamae minutissimae late obcuneatae apice emarginatae.

Natal (probably Paddock, Murchison flats near Port Shepstone). T. R. Sim. Natal Government Herbarium 11902.

There is only 1 piece preserved which is about 16 cm. high. Lowest leaves 12 mm. long., 5 mm. broad, upper gradually smaller. Lowest internode 4 cm. long, upper gradually smaller, uppermost about 1.5 cm. long. Length of calyx tube about 0.75 mm., of calyx-lobes 3.5 mm., of petals 6.5 mm., of stamens 5.5. mm., of carpels 6 mm., of styles 3.3 mm., of ovaries 2.7 mm.

A very distinct species which must be placed in Harvey's section Squamulosae. The widely separated comparatively short leaves covered with stiff retrorse elongated papillae and the long internodes covered with longish hairs give the plant a very characteristic appearance.

Crassula rufo-punctata, Schönl. n. sp.

Herbacea radicibus fibrosis. Caulis brevis, foliis connatis densissime imbricatis, in toto subhemisphaeroidiis vel subquadrangularibus. Folia apicem versus deflexa subreniformia vel subrotunda, apice abrupte acuminata viridia vel apicem versus rufescentia, supra apicem versus dense infra sparse rufo-punctata, utrinque laevia margine dense papilloso-ciliata. Inflorescentia terminalis elongata spicaeformis basi saepe deflexa. Pedunculus albus teres laxe foliatus, bracteis subovatis remotis basin versus vacuis sursum gradatim descrescentibus cymuliferis, cymulis sessilibus 3-floris. Sepala basi connata, lobis viridibus dorso convexis rufo-tinctis, ovatis acutis, margine denticulatis. Petala alba basi connata erecta apice recurvata sublingulata dorso infra apicem mucronulata. Stamina quam petala breviora, filamentis subulatis antheris ovatis brunneis. Carpidia brevia, ovariis oblique ovatis, stylis brevissimis crassis stigmatis subdorsalibus. Squamae minutae flavidae subquadratae apice subrotundatae.

Redhouse, near Uitenhage (top of hill), January 1911, Mrs. T. V. Paterson 1895.

Height of plant (incl. inflorescence about 6.7 cm. Length of stem 1 to 1.5 cm., diameter (incl. leaves) 1.5 to 3 cm.. Length of leaves 0.5 to 1 cm., breadth 1.2 to 2 cm. Leafy part of peduncle about 2 cm., floriferous part 4 to 5 cm. long Smallest (uppermost) bracts about 1.5 mm. long, largest (lowest) about 5 mm. long. Length of sepals about 2 mm., of petals 2.5 mm., of stamens about 2 mm., of carpels about 1.25 mm.

This species is allied to *Crassula hemisphaerica*, Thunb. (*Cr. alooides*, [Soland], in Ait. Hort. Kew 1, 394). Compare Marloth in Trans. S. Afr. Phil. Soc. Vol. 18 p. 48. Amongst a number of distinguishing characters of the new species may be mentioned its sessile cymules and flowers and its broad bracts. The marginal cilia on the leaves are longer, about 3 times the length of those in *Cr. hemisphaerica*. Like *Cr. hemisphaerica* it seems to go on growing for some years, then produces the inflorescence terminally and then dies.

Crassula Wylici, Schönl. n. sp.

Glaberrima. Caulis herbaceus reptans ad nodos radicans, radicibus fibrosis. Rami adsendentes laxe foliati internodiis longissimis. Folia glabra petiolata connata petiolo supra canaliculato, lamina plana ovata basi cuneata apice acuta, margine irregulariter sinuata vel crenata incrassata. Inflorescentia terminalis laxe cymoso-corymbosa multiflora bracteis 2 inferioribus foliis similibus sed minoribus, superioribus parvae acutae. Flores stellati pedicellati pedicellis filiformibus. Tubus calycis brevis lobi spathulati apice crassi. Petala lanceolata acuta alba. Filamenta filiformia antherae late ovatae. Carpidia gracilia, stylis filiformibus longitudinem ovariorum subaequantibus. Squamae minutae obcuneatae apice profunde emarginatae.

N'Kandhla, Zululand. J. Wylie, 21/3/1903. Natal Government Herbarium 13025. J. M. Wood 8830.

The sterile branches rise from the creeping stem to a height of about 12 cm. The lowest internodes are 4.5 cm. long, the upper gradually smaller. Length of petiole 6—12 mm., of the lamina 1.2—4.5 cm. Breadth of lamina 0.9 to 3.5 cm. Length of pedicels about 5 mm., of sepals 1.5 mm., of petals 5 mm., of stamens and carpels about 3 mm. A very distinct species allied to *Cr. latispathulata*, Schönl. et Bak fil. The shape of the sepals is noteworthy.

Crassula laticephala, Schönl. n. sp.

Caulis brevis herbaceus crassus albus obconicus ad inflorescentiam usque dense foliatus. Folia quadrifariam laxe imbricata quam interiodia multo longiora carnosa farinosa vaginato-connata ovato-lanceolata acuta abrupte deflexa supra subplana subtus convexa margine basin versus minute ciliata. Inflorescentia terminalis sessilis densissime capitata multiflora subplana involucrata, foliis involucralibus 4 late triangularibus apice abrupte lanceolatis vel subgibbosis. Bracteae membranaceae, exteriores late triangulares obtusae margine ciliatae, interiores lineares obtusae margine ciliatae (saepius abortientes). Flores sessiles. Sepala connata, tubus lobis subaequilongus, lobi late lineares obtusi margine ciliati apice obtusi rubri. Petala alba apice minute rufo-punctata, lobis lanceolatis obtusis intus canaliculatis. Stamina tubo corollae adnata, filamentis quam petala multo minoribus subulatis antheris oblongis. Carpidia brevia oblique oblongo-lanceolata margine centrali ciliata, stigmatis subsessilibus. Squamae latae subflabelliformes, breviter stipitatae.

Riversdale, Mr. J. E. A. Volschenk, Jul. 1913.

There is only a single specimen available which is 5 cm. high. A small portion of the lower part of the stem is efoliate, then come 2 pairs of dried up leaves then 5 pairs of foliage leaves, and lastly, 2 pairs of leaves which resemble the foliage leaves but are broader and shorter forming the involucre, the whole forming roughly a 4-sided prismatic structure circ. 2.5 cm. in diameter. The strongly deflexed leaves are circ. 3.3 cm. long, 12 mm. broad at the base and (except at the base where abruptly they become rather thin) 5 mm. thick. Inflorescence 2.2 cm. in diam, almost flat. Length of calyx tube circ. 1.9 mm., of sepals circ. 2.1 mm., of corolla-tube circ. 2 mm., of corolla-lobes circ. 5 mm., of free parts of filaments circ. 2 mm., of anthers 1 mm., of carpels circ. 1.75 mm., of squamae 0.75 mm.

This species is closely allied to *Cr. pachyphylla*, Schönl. in "Records of the Albany Museum" 1, p. 58. Since describing the latter I have had specimens of it collected at Matjesfontein by Mr. N. S. Pillans in which the leaves were as in *Cr. laticephala* ovate-lanceolate, acute. It might, therefore, be thought that the latter is only a dwarf-form of the former. We find such dwarf-forms in *Cr. alpestris* Thunb. (*Cr. multiceps*, Harv.) and other species of *Crassula* belonging to §*Pyramidella*, but apart from the smaller size of the flowers and other parts in *Cr. laticephala*, the relative length of the corolla-tube is different in the two species as also the relative length of the free parts of the filaments, further the squamae in *Cr. pachyphylla* have rather long stalks while in *Cr. laticephala* they have very short ones and the expanded portion is moreover very much broader. However, I should not be surprised if intermediate forms would turn up in which case *Cr. laticephala* would have to be looked upon as a variety of *Cr. pachyphylla*. In both the flowers emit a sweet scent.

On Smelophyllum Capense, Radlk.

By S. Schönland.

Sonder in Harvey and Sonder "Flora Capensis" I, p. 240, described under the name *Sapindus capensis*, Sond., a plant collected by Drege in the Langekloof, George. Its flowers were unknown to him. Radlkofer, to whose extensive researches we owe so much of our present knowledge of *Sapindaceae* made it the type of a new genus which he called *Smelophyllum*.[1] He gave the following description (translated from the German).

"Flower regular, sepals 5, small, yet covering one another. Petals 5. Stamens 8. Fruit fleshy with two parts each as large as cherries.—Tree? with 3–4 jugate leaves and bluntly toothed leaflets which contain a saponine-like substance in large cells that appear as transparent dots and which when young, as all young parts, are covered with glandular hairs with broadened heads."

"1 species in Cape Colony, *S. capense*, Radlk. (*Sapindus* c. Sonder), *only incompletely known*."

He placed the genus amongst his "*Eusapindaceae anomophyllae* et *subadiplecolobae*." tribe "*Lepisantheae*."

A few years ago I received from the nephew of the original discoverer of this plant, Mr. J. L. Drege of Port Elizabeth, specimens of a woody plant which was kindly determined for me at Kew as *Smelophyllum capense*, Radlk. In view of our incomplete knowledge of the plant I have drawn up the following descriptive notes based on Mr. J. L. Drege's specimens collected in the Baaken's river valley, Port Elizabeth and on others collected by Mrs. T. V. Paterson in the same neighbourhood. I have also made use of some field notes supplied by Mr. Drege.

[1]Radlkofer in "Sitzb. d. K. bair. Ac.," 1878, p. 331 and in Engler und Prantl., "Natürl. Pflanzenfamilien" IV, III, 5 p. 321.

The plant forms bushes 4 to 6 feet high and 6 to 10 feet in diameter. At a distance it can be recognised by its yellowish-green appearance. It grows in rocky ground. Some of the bushes at Port Elizabeth grow in crevices in a line and overhang the rocks. The wood is very brittle and breaks easily. It flowers in December. The fruits are rather scarce. Very few of the bushes have even a small number of them. It is richly branched, the branches have a greyish rugose bark and are densely covered with leaves which are 6—7 cm. in length. Leaflets 5 to 8, in pairs or approximated in pairs, the uppermost and lowest frequently by themselves. Rachis slightly prolonged beyond the uppermost leaflet, lowest leaflet about 1.5 cm. above insertion of the leaf, the pairs or pseudo-pairs about 12 mm. distant from one another. Leaflets slightly ascending with coarse, blunt and irregular teeth, ovate or oblong, frequently subfalcate, at the base obliquely obcuneate, contracted into a short stalk with a distinct pulvinus, when young minutely glandular pubescent yellowish green, the older ones glabrous, above shining green, below dull glaucous, coriaceous, with minute pellucid dots. Midrib distinctly raised on upper and lower surface. Average length of leaflets 5.5 cm., average breadth 2.5 cm.

Panicles axillary, circ. 2 cm. long, densely multiflowered. Bracts and bracteoles very small, teethlike. Pedicels 1.25–3 mm. long. Flowers regular, buds globular. Male and female flowers on different branches (or on different plants?), in the male flowers the gynaecium is rudimentary, in the female the stamens, although looking quite normal, do not produce ripe pollen and have shorter filaments than in the male. Calyx urceolate, somewhat fleshy, when young glandular pubescent, tube about ½ mm. long, lobes 5, ovate, obtuse, about the same length. Petals 5, about 1.75 mm. long and 1.5 mm. wide, obcuneate, consisting of an outer scale which is membranous, and an inner longer and fleshy scale which is slightly toothed or irregularly crenulate at the apex. Extrastaminal disk inconspicuous, annular, 5-lobed, lobes small subglobular. Stamens 8, filaments subulate, in the male flowers circ. 3 mm. long, in the female ones about half the length.

Anthers 1.25 mm. long, oblong, pollen sacs pointed and slightly prolonged at the base, connective mucronulate. Gynaecium usually dimerous, but sometimes trimerous. Ovary 2-lobate (rarely 3-lobate), circ. 1.5 mm. broad and high, lobes sub-globular, style thick slightly curved, circ. 1.5 mm. long, loculi uni-ovulate, ovules apotropous and ascending. Fruit a loculicidal capsule 2- (or 3- or through abortion 1-) locular; pericarp chartaceous, opening first along the median line eventually usually 4-valved. Seeds globular, drupaceous, about 1 cm. in diam., aril soft, fleshy, testa dark brown, smooth, leathery. Embryo globular, cotyledons thick, fleshy, accumbent, strongly curved on the inner surface embracing one another, containing starch (but no oil).

It remains now briefly to consider the position of the genus in the order *Sapindaceae*. Taking Radlkofer's key in Engler and Prantl's "Natürliche Pflanzenfamilien" IV, III, 5, p. 300, as a guide, it seems plain that it cannot belong to the tribe *Lepisantheae* to which Radlkofer had doubtfully referred it, as in this tribe the fruits are indehiscent and the seeds without aril. As the seeds are found singly in the loculi of the ovary, are apotropous and ascending it belongs to the section *Eusapindaceae*. It also has the characters of the subsection *Eusapindaceae-anomophyllae*, and the question can only be whether it belongs to the tribe *Nephelieae* or *Cupanieae*. I am inclined to place it with the *Cupanieae lomatorrhizae* to which hitherto only tropical American genera were referred. The manner in which the capsule opens in *Smelophyllum* is exactly as in *Cupania tenuivalvis*, Radlk. figured by Radlkofer (l. c., p. 338, fig. 172 F.). It is undoubtedly also allied to *Pappea*, E. & Z. and *Stadmannia*, Lam., both of which might also be transferred to *Cupanieae*.

Descriptions of new species of Arachnida from Cape Colony.

By John Hewitt.

ORDER ARANEÆ.

Family Migidæ.

Moggridgea rupicola, sp. nov.

This species is related to *M. crudeni*, Hewitt (Ann. Transvaal Mus., Vol. IV., Pt. I.), and more remotely to *M. dyeri*, O. P. Cambr., but may at once be distinguished therefrom through the complete absence, or very weak development, of the patch of spinules at the base of the coxa of the first leg: both *crudeni* and *dyeri* have a large patch of strong spinules thus disposed. From *M. mordax*, Purcell (Ann. S. African Mus., 3, 69), described from Montagu, it may be distinguished through the characters of the anterior row of eyes and in the spinulation of the coxa of the pedipalp inferiorly.

Types. A series of female specimens from Alicedale collected by Mr. Frank Cruden in March, 1913, and presented to the Albany Museum.

Colour. Carapace and legs pale yellowish brown above and below, with some darker olive markings, the patellae being paler than the other segments of the legs. Abdomen with or without a purple tinge above.

Carapace longer than broad, its length equal to that of the tibia, metatarsus, and one fourth of the tarsus of the fourth leg, and considerably exceeding that of the tibia, metatarsus, and tarsus of the first leg. Fovea usually almost straight but recurved at the two ends with no short backward prolongation in the midline or with only a very slight indication thereof and usually with no trace of a fine median groove behind the fovea.

Anterior row of eyes with its front margins forming a slightly procurved line, the lateral eyes of moderate size, their area considerably more than twice that of an anterior median: posterior laterals and posterior medians subequal in size. Anterior medians about a diameter apart and three or more diameters distant from the anterior laterals. Width of ocular area exceeding the length of the first metatarsus. Posterior row of eyes distinctly recurved.

LEGS. Metatarsus IV with 3 spiniform setae in the apical tuft. The band of spines and hairs along the anterior surface of patella III is composed of a double row of setiform spines and inferiorly a row of hairs. Coxa II and III with a basal patch of sharp stout spinules, that on the second coxa larger, that on coxa III. including about 12 to 16 spinules: coxa I. without spinules or with four or five very weak ones.

PEDIPALP. On the under side of the coxa there are only from 10 to 15 teeth comprised in two irregular rows.

LABIUM with 7 to 14 teeth.

TOTAL LENGTH, 11 mm.

In the poort at Alicedale this species occurs in precisely the same localities as *M. crudeni*. The nests of both species are often found within a few feet of each other in the same rock crevice. The lids of *rupicola* and *crudeni* differ slightly in shape and thickness, that of the former being distinctly thinner and more oval than the lid of *crudeni*. I have recently taken two examples of *rupicola* on a limestone rock at Dassie Klip, Bushman's River.

The following description of the male is based on four specimens, one of which was taken by Mr. Cruden in a nest, the lid of which was exactly like that of a female *rupicola*.

MALE.

COLOUR. Carapace brown, appendages olive-brown, the tarsi of the legs pale, more definitely so in legs I. and II.

CARAPACE. Surface finely shagreened throughout except on the oblique groove on either side which marks off the cephalic area. Fovea recurved at the ends. A slight superficial median groove extends from the fovea anteriorly towards the ocular area. Ocular arrangement similar to that of female but the eyes of the anterior row more closely approximated and the anterior medians are relatively distinctly larger. Between and very slightly in front of the anterior medians is a single vertical spine. Carapace is slightly longer than broad.

PEDIPALP. The bulb is reddish and has a straight black process which is considerably longer than the long diameter of the bulb itself. Metatarsus with numerous bristly hairs dorsally: viewed from above it is shallowly cleft anteriorly for attachment to the basal part of the bulb. Tibia considerably expanded ventrally and with very long bristly hairs arising from its lower surface, its length about 2½ times its depth.

LEGS. On lower surface of tarsus and greater portion of metatarsus of 4th leg is a distinct scopula and indications of a scopula of coarser type occur on the other tarsi especially the third. No apical transverse row of spinules on lower surface of metatarsus IV. No stout spiniform setae below the second femur. Spinules on labium and coxae of legs very weak: coxa I. quite without spinules, coxa of pedipalp with some very weak ones, labium with 2 somewhat larger and a few scattered weak ones: a small patch on coxa II. and III. the latter including about 10 or 12 spinules. Tibia I. with some very strong spines laterally and ventrally and a few weaker ones on the metatarsus: there are also 3 or 4 strong ones on the inside of the patella. Second leg with no spines on patella or with one or several at the apex, a few long spines or strong bristles on the metatarsus and some strong spines on the ventral and lateral surfaces of the tibia. Patella IV. with no band of spinules or short bristles on its anterior side.

CHELICERAE. Inner row of teeth under chelicera comprising only about 4 weak teeth, and outer row only a single somewhat stronger tooth opposite the basal end of the inner row (in one example there are indications of more proximally situated teeth in the outer row).

ABDOMEN rather sparsely clothed above with short hairs amongst which are a few longer and more bristly ones.

MEASUREMENTS. Total length 8.5, first leg 11.75, fourth leg 12.25, second leg 10.5, third leg 8.75, pedipalp 7 millimetres.

Moggridgea rupicola **sp. nov., fourth tarsal claw and palp of male.**

So far as I can ascertain no male of the genus *Moggridgea* has been previously described. The Rev. O. P. Cambridge gave a description of the male of a closely related form which he referred to his genus *Caedmon*—this being a synonym of *Poecilomigas*, Sim. —in Annals S. African Mus., Vol. III., p. 144, Pl. IX., from which it would appear that the males of *Poecilomigas* and *Moggridgea* are hardly distinguishable except in the curvature of the anterior row of eyes: on the other hand the females of *Moggridgea* and *Poecilomigas* differ in respect to several other characters. An apparently good generic character, not hitherto pointed out, is found in an oblique patch of peculiar stiff hairs arranged in one or several rows, occurring on the inferior surface of the patellae of the first and second legs in both sexes of *Moggridgea* but not in the females of *Poecilomigas*: each hair abruptly tapers to a fine point at its end but elsewhere is of uniform thickness throughout.

Moggridgea crudeni, Hewitt (Annals Transvaal Mus., Vol. IV., pt. I.).

The thoracic fovea of this species resembles the type common to the several Malagasy genera of this family, particularly that of *Thyropoeus*, Poc. As the character of the fovea has hitherto provided the most important distinction between the subfamilies Migeae of S. Africa and New Zealand, and Myrtaleae of Madagascar, the discovery of *M. crudeni* makes it inadvisable to recognise the two groups as distinct subfamilies.

I have recently found this species on sloping ground in the bush near Dassie Klip, Bushman's River.

Moggridgea crudeni **Hewitt, fovea and ocular arrangement in female.**

FAMILY CTENIZIDAE.

Hermacha crudeni, sp. nov.

TYPE. A single female specimen collected at Alicedale by Mr. F. Cruden in June, 1913, and presented to the Albany Museum,

COLOUR of legs and carapace light chestnut brown, the carapace thinly covered with fine yellow hairs; abdomen dull brown with a dark tree-pattern on the upper surface.

CARAPACE only very slightly longer than the fourth metatarsus and tarsus, and as long as the tibia, metatarsus, and $\frac{1}{3}$ of the tarsus of the first leg. Fovea straight. Posterior lateral eyes smaller than the anterior laterals and separated from them by a distance equal to about $\frac{1}{4}$—$\frac{1}{3}$ the long diameter of the latter; posterior medians almost touching the laterals and almost equal to the latter in area.

LABIUM with 3 small apical teeth.

COXAE OF PEDIPALPS with about 50 or more teeth arranged in a triangular patch at the base.

LEGS. Tibia I. very slightly longer than the metatarsus, inferiorly with 2 apical and 1 other spiniform setae, and 1 near the inner upper edge. Metatarsus I with 1 spine at the apex and 2 nearer the base below, scopulate to the base inferiorly; metatarsus II. scopulate almost to the base, III. and IV. not scopulate. Tarsus I. with dense undivided scopula, in II. the scopula is divided by a row of very slender inconspicuous setae, and in III. and IV. by a broad band of setae.

CHELICERAE. Rastellum composed of stout and fine setae. Inner row of teeth on fang groove with 9 large teeth; the distal tooth of the outer row of small teeth is opposite the interval between the third and fourth tooth of the inner row.

POSTERIOR SPINNERS very slightly exceeding the sternum in length; apical segment longer than the basal and about twice as long as the penultimate segment.

POSTERIOR STERNAL SIGILLA moderately large, oval, the long diameter greater than distance from the margin of the sternum.

MEASUREMENTS: Total length 21.5 mm. Length of carapace 7 mm., of tibia of first leg 3.75. Breadth of carapace 5 mm.

No species of *Hermacha* has been hitherto described or recorded from Eastern Cape Colony, and six out of the seven species referred to this genus are only known through male examples. *H. crudeni* seems to differ from *H. evanescens*, Purc. (Ann. S. A. Mus. III. p. 100), collected at Hanover, in the shape of the fovea, the length of the apical segment of the posterior spinners and in the absence of scopulae on the third and fourth metatarsi.

Spiroctenus armatus sp. nov.

TYPE. A single male example found by myself in a trap-door nest on the west bank of the Kowie River about two miles from Port Alfred in June, 1913.

COLOUR. Carapace dark reddish brown, becoming almost black in front and on the chelicerae, pedipalps and legs reddish brown the basal joints darker, especially the trochanters, abdomen pale yellowish above with an irregular black pattern: lower surfaces paler than the upper.

CARAPACE as long as the metatarsus and $\frac{1}{3}$ of the tarsus of the fourth leg, about equal to the metatarsus and tarsus of the first leg but shorter than the tibia and metatarsus of that leg. Fovea distinctly procurved.

CHELICERAE with about 15 teeth of moderate to small size in the inner row below.

LABIUM armed with numerous closely set cusps in its anterior half, and a patch of similar cusps occurs at the base of the coxa of the pedipalp in its anterior half.

POSTERIOR SPINNERS with the distal segment about ⅔ the length of the penultimate.

PEDIPALP. Process slightly curved and tapering, not very slender, distinctly longer than the bulb if the expanded basal portion of the process be included.

LEGS. Tarsi without spines. Metatarsus I. curved near the base, the underside distinctly concave, the inner surface with 2 large curved spines, outer surface inferiorly with 2 straight spines, the apex inferiorly with a pair of spines ; II. with 1 spine on the inner surface and 2 on the outer surface inferiorly besides a pair at the apex below ; III. and IV. with more numerous spines. Tibia I. with 2 very stout spur-like distal spines each raised on a tubercle, the more distal spur slightly twisted, its tubercle very prominent and situated on the inner inferior edge near the apex, the other spur sigmoidly curved and rather longer, its tubercle not very prominent and situated on the inner surface at a distance from the apex very slightly less than ¼ the length of the segment, each of these tubercles terminating in a pointed projection on one side of the spur ; the under surface of the tibia has otherwise only 2 rather slender spines (1 in the middle and 1 on the inner edge) and there is 1 long slender spine on the inner surface a short distance proximal to the smaller tubercle ; tibia II. with 2 spines at the apex also 1 on the lower surface and 1 or 2 on the inner surface ; III. and IV. with a number of spines. Patella III. with a row of 3 spines along the anterior surface but otherwise without spines. Femora armed above with strong bristles not spines. All the tarsi scopulate to the base, a mesial band of setae, narrow in the first three legs but much broader on the fourth, dividing all these scopulae ; distal two fifths of metatarsus I. and one third of II. scopulate ; a few scopular hairs at the distal end of metatarsus III. but none on IV.

REMARKS. This species is distinct from any male *Spiroctenus* yet described in the procurved fovea and the densely armed labium and coxae of the pedipalp. From the Eastern Province of Cape Colony only two species of this genus have been described, each from female specimens, viz., *S. flavopunctatus* Purc. (Ann. South Afr. Mus. III p. 97) from Hogsback, and *S. fuligineus* Poc. (Ann. Mag. Nat. Hist. 7. X. p. 14) from Brakkloof, near Grahamstown. The Albany Museum has no specimens of the latter species, which unfortunately is not recognisable from the description alone; assuming that the type locality of *fuligineus* is correctly stated, *S. armatus* will probably prove to be distinct therefrom.

Bessia minor sp. nov.

TYPES. Two female examples from Alicedale collected by Mr. F. Cruden in May and June, 1913.

COLOUR. Carapace and appendages pale chestnut olive above, the patellae of the first two pairs of legs paler and with a reddish brown tinge; abdomen dorsally is pale with an extensive but indefinite variegated blackish pattern. Lower surfaces pale brown, the chelicerae, coxae of pedipalps, and labium with a reddish tinge.

CARAPACE much longer than broad, about as long as the tibia metatarsus and tarsus of the first leg. Anterior lateral eyes quite 3 or 4 times as large as the anterior medians; posterior medians only a little smaller than anterior medians in area.

LEGS. On the sides of the tarsus and distal third of the metatarsus of the first leg there is a well developed scopula; a less strongly developed scopula occurs on the sides of the second tarsus. On metatarsus I. inferiorly there are 2 short spines at the apex and 2 along the lower surface; on metatarsus II. the corresponding spines are much longer and stronger whilst others of smaller size may or may not be present; on III. and IV. the spines are more numerous. Superiorly on metatarsus II. there is a single spine on the inner surface, on III. a number of strong spines on the upper and inner surfaces and on IV. there is a number of strong spines on the inner surface and 2 or 3 along the outer side of the upper surface. At the apex of tibia III., femur IV. and tibia IV. a weak rastellum is present. On the anterior surface of patella III. is an extensive patch of setiform spines reaching from base to apex; amongst them are 3 or 2 very stout spines. Inferior claws of tarsi well developed. Paired claws of tarsus I. have 3 basal teeth (2 large and 1 small) constituting the outer row, and 2 or 3 very minute teeth about half way up the claw representing the inner row; tarsus IV. is similar except that there are 4 basal teeth. Coxa of third leg having the inferior medio-basal naked area quite short but that at the anterior lower edge long and narrow reaching half way along the segment: elsewhere however the surface is only sparsely clothed with hairs.

CHELICERAE. Rastellum composed of rather slender spines but including about 4 or 5 stout ones in its inner portion. The teeth on the fang groove not arranged in straight lines excepting distally where the group ends in a short series of about 4 teeth; elsewhere there may be 2 or 3 teeth in the same transverse line; altogether there are about 16 larger teeth and rather more small ones, the former occupying the inner and more anterior portions of the group, and the latter mainly situated posteriorly and externally.

LABIUM wider than long, but not twice as wide as long, beset with about 22 cusps in its anterior half. At base of coxa of pedipalps there is a triangular patch of about 30 cusps.

POSTERIOR STERNAL SIGILLA elongated pear-shaped, a little less than their own length distant from the margin of the sternum, and about $1\frac{1}{3}$ times their own length distant from each other.

POSTERIOR SPINNERS. Apical segment shorter than penultimate segment.

MEASUREMENTS. Total length 22.5 mm. Length of Carapace 8 mm. Breadth of same 5.5.

Bessia minor sp. nov., dentition of chelicerae.

This species I refer with some hesitation to the genus *Bessia* Poc. (A. M. N. H. 7. 6. p. 320).

According to Mr. Pocock, his *Bessia fossoria* from Port Elizabeth has amongst other characters "legs not scopulate, claws armed with 3-4 basal teeth, mandible armed below with a single row of about 15-16 teeth a few smaller cusps at the posterior end of the row." If these characters prove to be strictly applicable to *fossoria* it will be necessary to refer the Alicedale species to some other genus near *Homostola*, Sim. or *Spiroctenus*, Sim. I am inclined to suspect however, that *B. fossoria* is founded on a very immature specimen (total length 12 mm.) for we have a much larger example from near Redhouse, Port Elizabeth (Mrs. T. V. Paterson) which has most of the characters ascribed to *fossoria* and is probably identical therewith ; the Redhouse example agrees with *minor* in respect to the scopulation of the anterior tarsi and the spinulation of the claws.

B. minor differs from the Redhouse species in the labium, which in the latter species has much more numerous cusps (more than 100), also in the eye characters, the anterior laterals of the latter species being not more than twice as large as the anterior medians. The Redhouse species is much stouter than *B. minor*.

Acanthodon microps, sp. nov.

TYPE. A single adult female, the nest of which was found by my wife on a steep-sloping roadside cutting near the Grey Reservoir, Grahamstown, Aug. 4, 1913. Type in the Albany Museum.

COLOUR. Carapace and appendages olivaceous brown above, abdomen with a dull purplish tinge: lower surfaces somewhat paler, sternum castaneous, abdomen pale.

CARAPACE as long as the patella, tibia, and three-fifths of the metatarsus of the first leg and as long as the tibia and metatarsus of the fourth leg.

OCULAR AREA about as wide as long, extending backwards quite two-fifths of the distance from the anterior margin of the carapace to the fovea: its width equal to the length of the first metatarsus. Area formed by the frontal and anterior median eyes wider in front, its length slightly exceeding $2\frac{1}{2}$ times the posterior width: the frontal eyes large, their clear areas separated by a distance equal to $\frac{2}{5}$ of the long diameter of an eye, but placed on a common tubercle which is deeply grooved above in front: median eyes of moderate size, a little less than a diameter apart. Posterior row of eyes with its posterior margins in a slightly recurved line, the medians very slightly nearer to the laterals than to each other, the anterior margins of the laterals in a line with the posterior margins of the antero-medians: medians small and rounded, much smaller than the antero-medians: laterals large and reniform: area formed by the four median eyes slightly broader behind. A few long bristles arise from the anterior region of the carapace, viz.: 1, the longest and strongest, between the anterior median eyes. 2 much weaker ones between the posterior median eyes, and 2 of moderate length and strength between the ocular area and the fovea but nearer to the former.

Legs. Band of spines on anterior surface of tibia I reaching almost to the base, of tibia II including about 12 spines most of which are very short and which are absent in the basal fourth or third of the segment. Metatarsus III with 4 or 5 long spines below as well as a stout pair at the apex inferiorly. On distal edge of upper surface of patella III are 3 spines on both anterior and posterior sides, the band along the anterior surface including about 12–14 spines in addition to those on the distal edge. Metatarsus IV with 9 or 10 spines on the lower surface in addition to 3 at the apex inferiorly; tibia with 3 inferior apical spines and 4 or 5 long but rather weak spines along the lower surface; patella with a band of short stout spines along the anterior surface, stretching quite $\frac{4}{5}$ of the length of the segment. Coxae of legs without spinules below, the third coxa having a patch of rather coarse bristles along its posterior border ventrally.

Labium with a row of 3 apical teeth.

Chelicerae. Inner row of teeth on under surface including 4 strong teeth separated by an interval from a strong basal tooth: outer row short, including only 2 or 3 small teeth which are almost in a line with the 4 strong teeth of the inner row.

Measurements. Total length 18 mm., length of carapace 6.5 mm., width of same 5.8, length of tibia of first leg 3 mm.

The specific name applied to this species has reference to the small size of the posterior median eyes. A species of the same genus was described by Mr. Pocock from 'near Grahamstown' (Mrs. White)—probably taken at Brak-kloof—in Ann. Mag. Nat. Hist. 7.7. p. 286, under the name of *Acanthodon flaveolum*, but unfortunately the description is too imperfect to be utilised for identification purposes, and the Albany Museum possesses no examples of the species: however, according to information received from Mr. S. Hirst of the British Museum, who has very kindly re-examined the type of *flaveolum** on my behalf, there can be no doubt but that *flaveolum* is quite different from *microps*. The characters of the ocular area and of the third coxa will serve to distinguish *microps* from any species of which the female is described. It appears to be related to *Ctenolophus kentanicus* Purcell,† from Kentani.

Gorgyrella abrahami, sp. nov.

This species can at once be distinguished from the other Cape species of the genus (*G. namaquensis*, Purc. and *G. schreineri*, Purc.) through the total absence of spinules on the coxae of the legs: it is also considerably smaller than either. In these respects it resembles certain species of *Acanthodon*‡ and I believe that *Gorgyrella* will eventually rank only as a sub-genus of the former:

*I am indebted to Mr. Hirst for the following notes on *A. flaveolum* Poc.: Frontal eyes on a common tubercle, placed very close together, being about ¼ of the long diameter apart: the anterior margins of the posterior lateral eyes are about in a line with the centres of the anterior medians: a line touching the posterior margins of the posterior laterals would pass through the posterior medians a little in advance of their centres: coxa III with a strip of very fine setae along the posterior margin of its lower surface: patella III with 19-21 spinules on its anterior surface: mandible with an inner row of 7 teeth most of which are well developed, outer row including 4 very small teeth forming a short basal series.

†According to Mr. S. Hirst, the genus *Ctenolophus* Purcell is a synonym of *Acanthodon* Guérin, the type of which *A. petiti* Guér., from Brazil is in the British Museum.

‡I may here mention that the species described by me under the name of *Ctenolophus transvaalensis* (Rec. Alb. Mus. II., p. 412) should provisionally be placed under the genus *Gorgyrella* as it possesses 3 pairs of sigilla though the 3rd pair is very small.

at any rate if the number of sternal sigilla being utilised as the main distinction between the two genera, intermediate conditions will no doubt be found: for instance, in one specimen of *Acanthodon spiricola* from Kentani, I find 3 left sternal sigilla, the third one being smallest, but only two sigilla on the right side.

TYPES. A series of female specimens from Alicedale, one of which was collected many years ago by the Rev. N. Abraham, and the remainder were taken by Mr. F. Cruden during February, March, and April, 1913, a brood of newly hatched young being taken in May.

COLOUR. The whole of the upper and lower surfaces more or less uniformly pale yellowish brown.

CARAPACE as long as the tibia, metatarsus and $\frac{3}{4}$ of the tarsus of the fourth leg and as the patella, tibia, metatarsus and tarsus of the first leg. Ocular area only slightly wider than long, its width very slightly exceeding the length of metatarsus I., its length only slightly more than one third of the distance from the anterior margin of the carapace to the fovea. Area formed by the frontal and anterior-median eyes very slightly wider behind, the median eyes about $1\frac{1}{2}$ times their diameter apart, the frontal eyes appreciably larger than the medians, about a diameter or slightly less apart and generally situated on quite separate tubercles. Posterior median eyes nearer to the posterior laterals than to one another: the area formed by the 4 median eyes distinctly wider behind than in front: posterior lateral eyes large, their distance from the anterior margin of the carapace about $\frac{2}{3}$ the width of the ocular area: a few long, curved, very strong spiniform hairs arise from the anterior region of the carapace, viz: 1 between the frontal eyes, 1 between the anterior median eyes, 2 between the posterior median eyes and several somewhat weaker ones just behind the ocular area.

PEDIPALP AND LEGS as described in *namaquensis* (Trans. S. A. Phil. Soc. XI., p. 351) except that the femur of the pedipalp has no spiniform setae along its inner inferior edge: tibia IV. with 2—4 spinules along the outer surface: metatarsus III. with 2 apical spines below as well as 2 or 3 others along the inferior surface: patella III. on its posterior upper edge has 3 (or 2 or 1) apical spinules, on the anterior upper edge are 5, 4 or 3 apical spinules: coxae of the legs quite without spinules, but along the posterior half of coxa III. inferiorly is a compact tuft of bristly hairs, a larger patch, but less compact and less conspicuous, occurring on coxae II.

CHELICERAE. The abbreviated outer row of teeth under the chelicera includes one fairly large tooth and from 2 to 4 smaller ones: the former is not so large as any of the 5 composing the inner row.

LABIUM broader than long, usually with 4 strong teeth on its anterior edge, but sometimes 5 or 6.

SIGILLA. Posterior sternal sigilla long and narrow, not larger in area than either of the anterior sigilla.

MEASUREMENTS. Total length 19 mm. Length of carapace 7 mm. Width $5\frac{1}{3}$ mm. Length of tibia of first leg 2 mm.

Mr. Abraham found the nests of this species in the steep sloping sides of a "donga." According to Mr. Cruden, the lid of the nest hangs almost vertically, and the tube runs horizontally for an inch or more before it descends, the nests being on a hill side or on sloping ground under the lee of stones or protected by vegetation. The D-shaped lid is heavy and thick, sometimes very much so, its edge being strongly bevelled and the hinge being considerably longer than the width of the cylindrical part of the tube. It is of interest to note that a species of *Acanthodon*, indistinguishable to the naked eye from *Gorgyrella abrahami*, is also found at Alicedale. Mr. Cruden informs me that the two species do not occur together, the *Acanthodon* being found on the surface of clay banks exposed to wind and weather. Its lid, also D-shaped, is comparatively thin and light, the edge not bevelled: the tube enters the ground at an angle of about 45° to the perpendicular.

I have recently taken *G. abrahami* at Bushman's River, near Dassie Klip.

FAMILY AGELENIDÆ.

Desis beckeri, sp. nov.

TYPE. A single female specimen collected by myself at Port Alfred in March, 1913. The spider was obtained on breaking into the calcareous masses of serpulid worm tubes found attached to the rocks exposed at low tide.* It is not quite adult.

COLOUR. Mandibles castaneous and cephalic region of the carapace lightly so, the margin of the carapace at the anterolateral corners deep brown: rest of carapace and legs pale, except the tarsi of first 2 pairs of legs which are castaneous: abdomen greyish brown.

CARAPACE about as long as the tarsus and metatarsus of the 4th leg, a little shorter than the patella and tibia of the 1st leg, and about equal to the metatarsus and half the tarsus of that leg. Eyes of the posterior row in a straight line, almost equally spaced, the medians only a little nearer together than either is to the lateral, the medians about 2 diameters apart and 2½ diameters from the laterals: anterior medians about half a diameter apart and about 1½ diameters, or slightly more, distant from the anterior laterals. (The ocular arrangement is very like that of a young example of *Desis tubicola*, Poc., from Muizenberg.) In comparison with an example of *tubicola* of same size, the carapace of *beckeri* is distinctly longer and narrower than that of *tubicola*.

MANDIBLES: of the two teeth on the outer border of the fang groove, the distal is much the larger, the proximal one being very small and very much nearer to the 2nd tooth of the inner row than to the distal one of the outer row (see text fig. B): there are 6 teeth in the inner row, the distal one being slightly but distinctly separated from the rest and practically as near to the end of the fang groove as to the 2nd tooth, the remaining 5 teeth are equally spaced and progressively decrease in size.

*An interesting account of the habits of a species of *Desis* was recently published in Agricultural Journal of S. Africa, I., p. 827, by Rev. N. Abraham.

LEGS. 1, 4, 2, 3 in length. Upper surfaces entirely without spines, the nearest approach thereto being a weak bristle at the apex of the 2nd patella and another near the apex of the 3rd metatarsus. Inferiorly at the apex of the 2nd, 3rd and 4th tibiae there is an apical pair of long slender spines; metatarsus of 2nd, 3rd and 4th legs spined at the apex and the third metatarsus has also one or two weak spines along the inferior surface; tarsi of legs III and IV each with 5 or 6 spines arranged somewhat irregularly in pairs; towards the distal ends of the metatarsi of the 2nd, 3rd and 4th legs, the hairs form a thickish dark-coloured cluster.

MEASUREMENTS. Total length (including chelicerae) 10 mm. Carapace $3\frac{1}{3}$, 1st leg 12.5, 2nd leg 8.75, 3rd leg 8 mm., 4th 10.25.

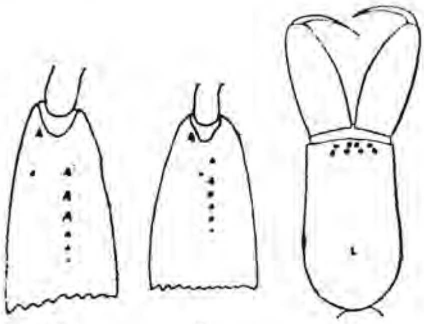
This species is named after Dr. H. Becker, the well-known conchologist, who for many years has been actively engaged in the study of the marine fauna and flora of Port Alfred and who seems to have been the first to observe the occurrence of marine spiders on the African coast (see Rev. N. Abraham's note in Mr. R. I. Pocock's description of *D. tubicola*).[1] The species may at once be distinguished from *D. tubicola*, Poc.[1] of which the Albany Museum possesses a good series of both sexes from Muizenberg (presented by Dr. W. F. Purcell), through the arrangement of the teeth on the fang groove, and the spines on the legs (second tibia, third metatarsus), and perhaps also in the ocular arrangement; the spinulation of the legs seems to be fairly constant in *tubicola* though it may be noted that in the male, and sometimes the female also, apical spines are not found on the third tibia inferiorly and there is only one at the apex of the four tibia. A small and very immature specimen, apparently referable to this species, collected by Dr. A. Penther, at Port Alfred, has been in our collection for some years under the name of *D. formidabilis, O. P. Camb.*[2] and is believed to have been thus determined by Mons. Simon. As Mr. Pocock has expressed some doubt with regard to the identity of

[1]R. I. Pocock, Bull. Liverpool Mus. 1. p. 76 fig. 1-3.
R. I. Pocock, Proc. Zool. Soc. 1902 II p. 104.

[2]O. P. Cambridge, Proc. Zool. Soc. 1890 p. 625. Plate 53, fig. 5.

the latter species, the description being short and without precise locality data, I wrote for particulars to the Rev. N. Abraham who collected the types both of *formidabilis* and of *tubicola*; according to Mr. Abraham both species were collected at Muizenberg and he suspects that the two are identical. This point can only be determined by re-examination of the type of *formidabilis*. No other species have been recorded from South Africa though Pocock has suggested that *D. maxillosa (Fabr.)* from St. Crux Island may really have come from St. Croix Island in Algoa Bay; however this may be, the figures of that species published by Simon (Hist. Nat. Araign. II p. 225) undoubtedly relate to a species totally distinct from *D. beckeri*. Besides the type we have a few much smaller specimens from precisely the same locality, and a single half-grown example taken amongst barnacles at the Black Rock, Kowie River (Miss L. Britten).

There is also another species of *Desis* at Pt. Alfred, apparently a form of *tubicola* but smaller than the type; it can be easily obtained by breaking open the large masses of terebellid worm tubes which encrust the rocks between tide marks. It is stouter and darker than *D. beckeri*.



A B C

A and B, dentition of chelicerae in *Desis tubicola* Poc. and *D. beckeri* sp. nov. respectively. C, outline of carapace and chelicerae in *D. beckeri* sp. nov.

ORDER SOLIFUGÆ.

Solpuga maraisi, sp. nov.

TYPE: A single male example from Caledon collected by Mr. B. Marais in December, 1912, and presented to the Albany Museum.

FLAGELLUM reaching back about as far as the ocular tubercle, the anterior bend immediately above the interval between the first and second teeth; the recurrent portion more or less cylindrical but in the terminal third of its length it expands into a lamina with infolded edges and divides into two main portions; the outer and upper portion gradually tapers to a point, its posterior half being upcurved and slightly twisted and its margins being frayed or serrated; the inner and lower portion ends abruptly but is provided with a comparatively short and slender serrated extension which for a short distance runs parallel with the larger terminal process just mentioned. Basal enlargement longer than high, being produced anteriorly: upper margin forming a well-developed keel which is raised above the exposed outer turgid portion.

UPPER JAW OF MANDIBLES: First tooth fairly large, second large, followed by a long concave toothless interval, after which comes a small tooth which is almost confluent basally with the very large one which terminates the single series. Terminal fang of moderate length, the apex suddenly and strongly curved downwards but not outwards; on the inner edge superiorly there is an inconspicuous low tooth which is nearer to the flagellum than to the apex of the fang: no distinct keel in connection with this tooth. No other tooth on the inner side of the fang.

LOWER JAW with two large curved teeth and a smaller one between them, nearer the hind tooth.

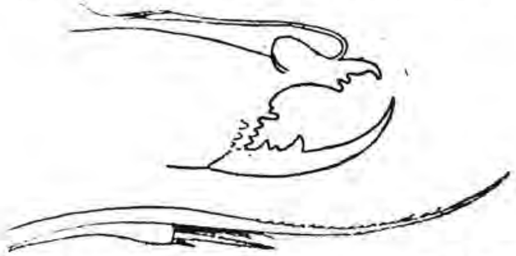
PEDIPALP. Metatarsus scopulate over the greater portion of its length. The whole palp slightly exceeding the third leg in length.

POSTERIOR LEGS with some very long hairs which do not form a mane.

Colour. Headplate, mandibles and legs brownish, with darker brown on the tarsus and metatarsus of the pedipalps and on the tibia, metatarsus and tarsus of the fourth leg. Dorsal plates of abdomen blackened laterally, brown or reddish brown in the middle, the posterior plates however wholly black. Sides of abdomen with silvery white hairs. Abdominal sterna not infuscated. Malleoli with infuscated edges.

Measurements. Total length 32 mm. Length of flagellum 7.5, of mandibles 9, of tibia of palp 7½, of tarsus and metatarsus of palp 8, of tibia of fourth leg 7½, of metatarsus of same 6.5.

This species belongs to the *vincta* group of the genus but seems to be very distinct from any species hitherto described.



Solpuga maraisi sp. nov., jaws and flagellum of male.

ORDER SCORPIONES.

Uroplectes triangulifer (Thor.) var. nov. *flavidus.*

Amongst the various known forms of *Uroplectes triangulifer*, the most widely distributed scorpion in S. Africa, a race found at Kimberley is sufficiently distinct to be worthy of varietal rank. Its principal distinguishing characters are as follows :—Basal pectinal tooth of the female not enlarged ; each abdominal tergite, except the last, with an extensive smooth and polished area in its anterior half which area is very finely, though rather sparsely, granulated in the male (in var. *typica* the tergites have no smooth and polished area except on the articulating border anteriorly) ; ocular tubercle quite smooth above ; superior keels of fourth caudal segment not sharply defined, the terminal tooth not enlarged or only feebly so ;

sides of fifth caudal segment quite smooth above but becoming granular below; sides and lower surface of vesicle either almost smooth, or more or less roughened and granular but not coarsely granular, the prominence below the aculeus blunt and not conspicuous; median area of upper surface in first four caudal segments either quite smooth or only very finely granulated. The female is almost uniformly yellow throughout, the carapace and abdominal tergites only slightly infuscated but the yellow V-shaped markings on the latter are quite distinct; the male is more deeply infuscated. This variety is appreciably larger than the typical form and the tail is stouter. It differs from Thorell's var. *tristis* in the not enlarged basal pectinal tooth, in colour and size, and whereas *tristis* has a perfectly smooth and polished area immediately in front of and at either side of the ocular tubercle, such is not the case in *flavidus*. Total length of female 53 mm. (somewhat swollen specimen), of male 49 mm., length and width of fourth caudal segment in female 5, 3.5, in male 5.75, 3 mm.

TYPES: Three female specimens and one male collected at Kimberley and presented to the Albany Museum by Bro. J. H. Power.

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AMBLYPTERUS CAPENSIS. Broom.

Bemrose, Collo, Derby.

FIG. I.

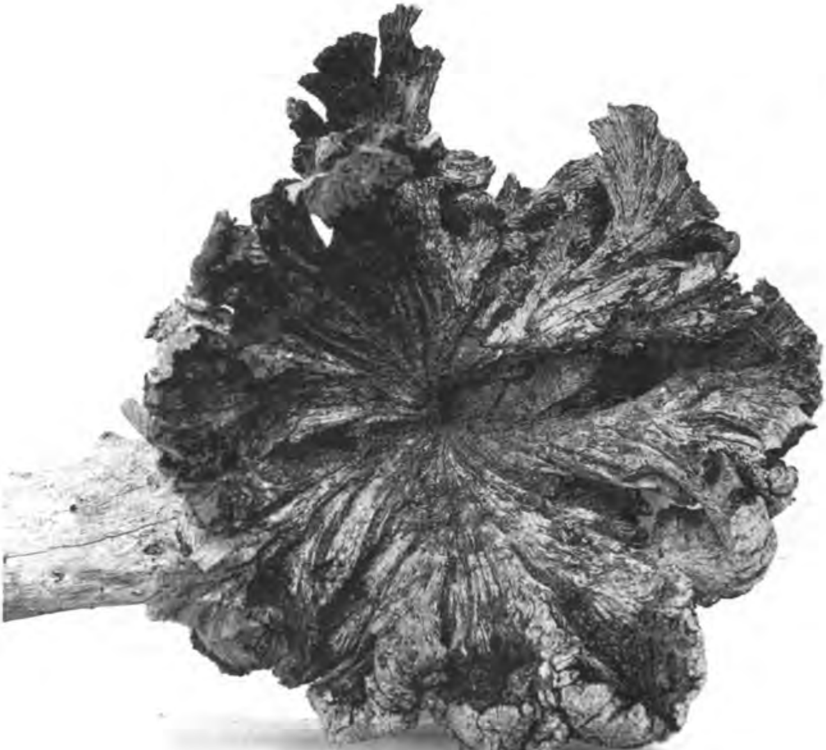

FIG. 2.

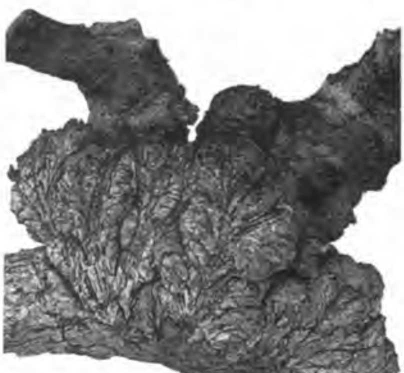

FIG. 3.

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STRUCTURE AND DEVELOPMENT OF "WOODFLOWERS".

FIG. 7.

FIG. 4.

FIG. 5.

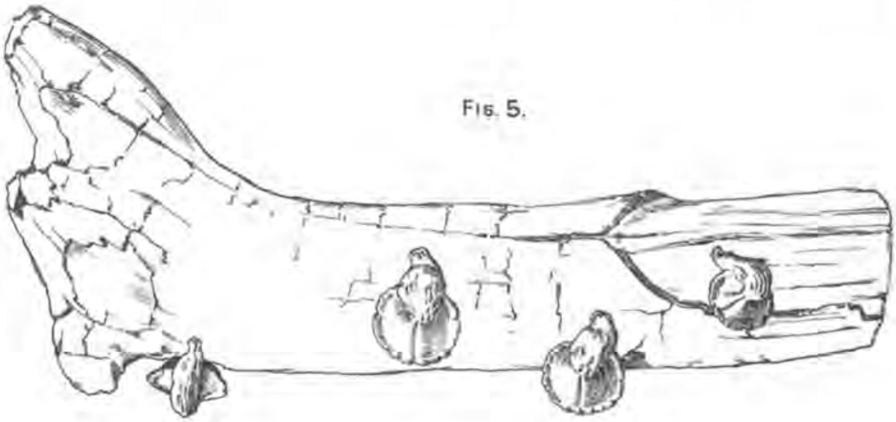

FIG. 6.

FIG. 8.

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Fig. 9.

Fig. 10.

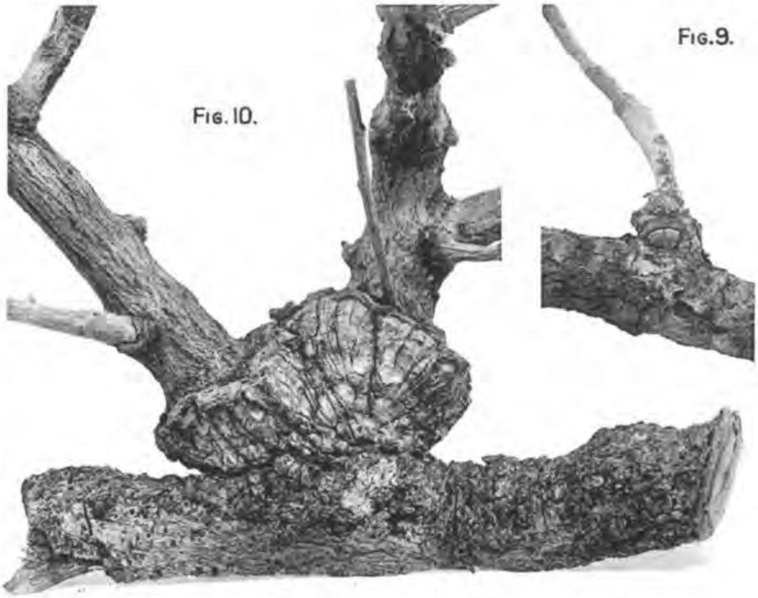
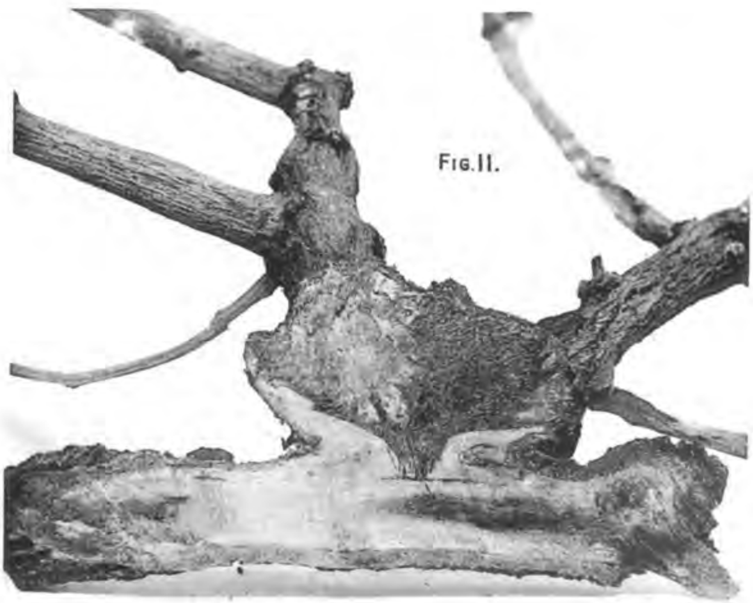


Fig. 11.



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