HE TRANSACTIONS

OF THE

SOUTH AFRICAN

PHILOSOPHICAL SOCIETY.

Only in incomplete sets

VOLUME IV.—PART I.

1884—1886.

CAPE TOWN:
PRINTED FOR THE SOCIETY BY W. A. RICHARDS & SONS.
1887.

TRANSACTIONS

OF THE

SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOLUME IV.

1884–1888.

WITH FOUR PLATES.

CAPE TOWN:
PUBLISHED BY THE SOCIETY.

1888.


W & Co.
PRINTERS &
PUBLISHERS

CONTENTS.

PAGE

MINUTES OF PROCEEDINGS, 1884–5 v

PRESIDENT'S ADDRESS, JULY 29, 1885 xiv

MINUTES OF PROCEEDINGS, 1885–6 xxi

PRESIDENT'S ADDRESS, JULY 28, 1886:—PERSONALIA OF BOTANICAL COLLECTORS AT THE CAPE. By P. MACOWAN, F.L.S., F.R.H.S. xxx

NOTES ON THE GEOLOGY OF THE COAST BETWEEN THE FISH AND JUJA RIVERS, SOUTH AFRICA. By GEORGE MCKAY 1

ON THE VARIATIONS OF LEVEL OF THE CAPE TRANSIT CIRCLE. By W. H. FINLAY, B.A. 6

APPROXIMATE ELLIPTIC ELEMENTS OF COMET, 1884 (*b*). By W. H. FINLAY, B.A. 10

METEOROLOGICAL NOTES. By JOHN G. GAMBLE . . . 10

INSECTS INJURIOUS TO FOREST TREES IN SOUTH AFRICA. By L. PÉRINGUEY 15

AN INVESTIGATION INTO THE ISOBARIC INFLUENCES AND CYCLONIC PATHS OF SOUTH AFRICA. By G. ADOLPH HOWARD 25

PATHOLOGY FROM AN "EVOLUTION" POINT OF VIEW. By J. H. MEIRING BECK, M.B., C.M. 34

AN ADDENDUM TO THE FOREGOING. By J. H. MEIRING BECK 40

PAGE

On Fossil Plants from Indwe and Cyphergat Coal Beds. By John Shaw, F.L.S. 44

Some Remarks on the Taxation of the Cape Colony. By John X. Merriman, M.L.A. 46

A Note on the *Phylloxera vastatrix* at the Cape. By L. Péringuey, F.E.S., F.Z.S. 57

On the Origin of the Diamond Mines of South Africa. By R. Marloth, Ph.D. 62

Second Contribution to the South African Coleopterous Fauna (Plates i–iv). By L. Péringuey, F.Z.S., &c. . 67

Description of New Species of South African Tenebrionidæ. By L. Fairmaire 197

Partial List of the South African Mollusca. By J. S. Gibbons 201

THE TRANSACTIONS

OF THE

SOUTH AFRICAN

PHILOSOPHICAL SOCIETY.

VOLUME IV.—PART I.

1884—1886.

CAPE TOWN:
PRINTED FOR THE SOCIETY BY W. A. RICHARDS & SONS.
1887.

COUNCIL

OF THE

South-African Philosophical Society

FOR 1884—1885.

Roland Trimen, F.R.S., F.L.S., F.Z.S., President.*
Hon. C. A. Smith, M.A., Treasurer.
W. H. Finlay, B.A., F.R.A.S., General Secretary.
Harry Bolus, F.L.S.
Rev. G. H. R. Fisk, C.M.Z.S.
J. G. Gamble, M.A., M. Inst. C.E., F.R. Met. S.
David Gill, LL.D., F.R.S., F.R.A.S., H. M. Astronomer.
F. Guthrie, LL.B.
P. MacOwan, B.A., F.L.S.
H. W. Oakley.
J. Sivewright, M.A., C.M.G.

FOR 1885—1886.

P. MacOwan, B.A., F.L.S., President.*
Hon. C. A. Smith, M.A., Treasurer.
W. H. Finlay, M.A., F.R.A.S., General Secretary.
J. H. Meiring Beck, M.B.
Harry Bolus, F.L.S.
Rev. G. H. R. Fisk, C.M.Z.S.
J. G. Gamble, M.A., M. Inst. C.E., F.R. Met. S.
David Gill, LL.D., F.R.S., F.R.A.S., H.M. Astronomer.
F. Guthrie, LL.B.
Hon. J. X. Merriman, M.L.A.
Roland Trimen, F.R.S., F.L.S., F.Z.S.

---

* The Rules of the Society provide that the President's Office cannot be held by the same person for more than two years consecutively.

CONTENTS.

	PAGE
Minutes of Proceedings, 1884-85	v
,, ,, 1885-86	xxi
Report of the Council, July 29, 1885	xii
,, ,, July 28, 1886	xxviii
President's Address, July 29, 1885	xiv
,, ,, July 28, 1886	xxx
List of Members, July, 1887	liv
Mr. G. McKay, Notes on the Geology of the Coast between the Fish and the Juja Rivers, South Africa	3
Mr. W. H. Finlay, B.A., F.R.A.S., On the variations of Level of the Cape Transit Circle	6
Mr. W. H. Finlay, B.A., F.R.A.S., Approximate Elliptic Elements of Comet 1884*b*	10
Mr. John G. Gamble, M.A., Meteorological Notes	10
Mr. L. Péringuey, F.Z.S., &c., Insects injurious to Forest Trees in South Africa	15
Mr. A. G. Howard, An Investigation into the Isobaric Influences and Cyclonic Paths of South Africa	25
Dr. J. Meiring Beck, M.B., C.M., M.R.C.P., Ed., Pathological Evolution	34
Dr. J. M. Beck, M.B., C.M., M.R.C.P., Ed., An Addendum to a previous Paper entitled "Pathology" from an "Evolution Point of View"	40
Dr. John Shaw, F.L.S., &c., on Fossil Plants from Indwe and Cyphergat Coal Beds	44
Mr. John X. Merriman, M.L.A., Some Remarks on the Taxation of the Cape Colony	46
Mr. L. Péringuey, F.E.S., F.Z.S., A Note on the Phylloxera Vastatrix at the Cape	57
Mr. R. Marloth, Ph.D., On the origin of the Diamond Mines of South Africa	62

stein's, or the Konzé Antelope, which is found near the Zambezi. Also a specimen of the horns of a small antelope of which Mr. Dunn had not seen any previous specimen, and which he believed was new to science. He pointed out that the annulations were very deep and regular. The animal is found to the N.W. of Delagoa Bay.

Mr. Bolus exhibited specimens of Disperis Capensis, and made some remarks on the fertilisation of this Orchid. Of 100 flowers examined, gathered at various times and places, there were :—

Pollinia, both *in situ* ..	88	Stigma pollinated ..	1
,, ,, removed..	10	,, ,, ..	4
,, one ,, ..	2	,, ,, ..	2

Of the flowers which had one or both pollinia removed, therefore, 50 per cent. were fertilised; of those which had neither pollinia removed, only 1·14 per cent. were fertilised. This seemed to point to the probability that the insect agent most commonly fertilised each plant with its own pollen; and the fact that the elastic thread of the pollinia curled round so as to present the pollen granules in almost every direction within a second of their withdrawal, gave some support to this hypothesis. He stated that he had not been able to detect the presence of any nectar, or any insect in the act of fertilisation. One stigma bore a small weak dipterous insect glued to its surface; and upon another flower a curculionid beetle—*Brachycerus tuberosus*, Wied, was found feeding. A want of viscidity in the discs of the pollinia was apparent, the greater number failing to adhere even when firmly touched with a pencil.

The Secretary then read Mr. Garwood Alston's letter on the subject of his model of an ostrich camp, the wires of which form parts of electric circuits enabling a dweller at the homestead to find out, without leaving the house, which, if any, of several gates is left open. The model was explained by Mr. Alston, Junior.

He also exhibited a device used to find ont whether an ostrich egg contains a living embryo: he stated that one addled egg in the incubator will destroy the others. His brother had been successful in hatching about 70 per cent. of the eggs placed in the incubator by means of it.

He also exhibited a home-made drilling and sawing machine.

The thanks of the Meeting were unanimously voted to Mr. Alston.

Mr. Finlay then read his paper on the "Variations of Level of the Cape Transit Circle."

Ordinary Monthly Meeting.

Wednesday, October 3, 1884.

Mr. David Gill, LL.D., F.R.S., in the Chair.

The Rev. G. H. R. Fisk reported the safe arrival in England of a large earthworm, six feet four inches in length (five feet unextended), which he had received from Mr. Bidwell, of Uitenhage.

Professor Guthrie read a note on the "Calculus of Variations," in which he shewed that the formula for an extreme value could be deduced from the ordinary methods of determining maxima and minima values.

Mr. G. Gresswell then read a paper on the question, "In what sense, and how far, can the Evolution Theory be reconciled with sound Philosophy?"

An animated and interesting discussion followed, in which Dr. Gill, Hon. C. A. Smith, Dr. Shaw, Rev. Canon Lightfoot, and the Rev. G. H. R. Fisk took part.

It was resolved, on a motion by Dr. Shaw, that the discussion be continued at the next meeting.

Ordinary Monthly Meeting.

Wednesday, October 29, 1884.

Mr. R. Trimen, F.R.S., President, in the Chair.

The Rev. G. H. R. Fisk exhibited a box-tortoise from the Philippine Islands; also a lizard caught at Robben Island—a rare specimen with red markings—commonly called "Layard's Lizard."

Professor Guthrie exhibited two remarkable ostrich feathers.

Dr. Shaw was unable to be present to carry on the discussion on Mr. Gresswell's paper, and Mr. Gresswell then replied to the various questions and objections that had been raised.

Dr. Kolbe then read a first paper on "Linguistic Pioneering in South Africa."

Professor Guthrie and Mr. Gresswell made a few remarks on the subject of this paper.

Mr. Finlay gave elliptic elements of Comet 1884*b*.

Ordinary Monthly Meeting.

Wednesday, November 26, 1884.

Mr. J. G. Gamble, M.A., Vice-President, in the Chair.

Proposed by Dr. Gill and seconded by the Hon. C. A. Smith,—That the Meeting be adjourned for a week on account of the bad weather.

Postponed Ordinary Monthly Meeting.

Thursday, December 4, 1884.

Mr. R. Trimen, F.R.S., President, in the Chair.

Dr. Gill presented a copy of his and Dr. Elkin's work on "Stellar Parallax," and a copy of his lecture delivered at the Royal Institution of Great Britain.

The thanks of the Meeting were voted to Dr. Gill.

Mr. Gamble then explained his diagrams on "Mean Maximum and Minimum Temperatures at various places in South Africa."

Dr. Gill then described investigations on Stellar Parallax generally, referring to the work of Henderson, Maclear, Struve, and Bessel. He described the Heliometric method and gave results of his observations of α Centauri and other Southern stars.

The thanks of the Meeting were voted to Dr. Gill.

Ordinary Monthly Meeting.

WEDNESDAY, January 28, 1885.

Mr. R. TRIMEN, F.R.S., PRESIDENT, IN THE CHAIR.

The following donations (books) were announced, and the thanks of the Society voted to the donors.

Bericht des Vereines für Naturkunde zu Cassel.

Boletin de l'Academia Nacional de Ciencias en Cordoba Tome VI.

Mr. Péringuey then read a paper on "Insects injurious to Forest Trees in S. Africa."

Mr. Trimen was of opinion that the question of forest insects would never be thoroughly sifted unless it was made someone's special business, as is done in the United States. As instances of the advantage of having specialists, he mentioned the finding of remedies for the Colorado Beetle and the Phylloxera.

The thanks of the Meeting were voted to Mr. Péringuey.

Ordinary Monthly Meeting.

WEDNESDAY, February 25, 1885.

Mr. J. G. GAMBLE, M.A., VICE-PRESIDENT, IN THE CHAIR.

Mr. L. Péringuey was unanimously elected an ordinary Member of the Society.

The following donations were announced, and the thanks of the Society voted to the donors :—

Descriptive Sketch of the Physical Geography and Geology of the Dominion of Canada.

Comparative Vocabularies of the Indian Tribes of British Columbia.

Geological Map of the Dominion of Canada.

Mr. Bolus exhibited a new Orchid, discovered on Table Mountain, by Professor Bodkin, M.A., and which he had named after its discoverer, *Disa Bodkini*.

Professor MacOwan exhibited some specimens of Cape Cochineal collected in the Botanic Gardens, Cape Town.

Dr. Kolbe then read a continuation of his paper on "Linguistic Pioneering in S. Africa."

After some slight discussion, in which Messrs. Bolus, MacOwan, Gamble, Dr. Kitching, and the Rev. F. W. Kolbe took part,

The thanks of the Meeting were voted to Dr. Kolbe for his paper.

Ordinary Monthly Meeting.

WEDNESDAY, March 25, 1885.

Mr. R. TRIMEN, F.R.S., PRESIDENT, IN THE CHAIR.

The following donations were announced, and the thanks of the Society voted to the donors :—

Boletin de la Academia Nacional de Ciencias en Cordoba. Volume VI., Part 4.

Report of the Smithsonian Institution for 1882.

Mr. Péringuey exhibited a number of remarkable specimens of *Phasmidae* which mimicked surrounding objects, *e.g.*, a blade of grass, a piece of dead wood, or even a green leaf, to such an extent as to be almost indistinguishable from these objects to a casual observer. In spite of the protection thus afforded to the insects, he contended that there was here a case of retrogression, because their ancestors were more perfect, instancing specimens of *Phasmidae* found in the coal measures of Commentry.

Mr. Bolus pointed out some difficulties in the way of accepting a theory of retrogression; and in connection with mimicry he instanced a case of *Mesembryanthemum* which imitated closely the stones among which it grew.

Mr. Gresswell was of opinion that mimicry was much more widely extended than we are generally aware of, and that this mimicry implied a state of fixity beyond which there can be no improvement.

Mr. Trimen thought that we might accept degradation in animal organization as a fact, especially in parasitic animals.

The thanks of the Meeting were voted to Mr. Péringuey.

Mr. Gamble read, "The Storms of the Cape Colony," by Mr. A. G. Howard, a précis of the paper to be read at the next Meeting.

He also gave some notes on evaporation. From observations last year at Van Wyk's Vlei, he found that the total evaporation in the year was 80 inches, and at Van Staaden's river, 40 inches.

He also exhibited a diagram shewing the connection between the discharge of the main spring at Cape Town and the rainfall. The spring had recently been cleaned out, and the effect of this on the discharge was very marked.

The proceedings closed with a vote of thanks to Mr. Gamble.

Ordinary Monthly Meeting.

WEDNESDAY, April 29, 1885.

Mr. J. G. GAMBLE, M.A., VICE-PRESIDENT, IN THE CHAIR.

The following donations were announced, and the thanks of the Society voted to the donors:—

Journal and Proceedings of the Hamilton Association, 1882–'83.
The Origin of the Fauna and Flora of New Zealand, by Capt. F. W. Hutton, F.G.S.

Mr. Bolus exhibited an old botanical book, one of the first in which Cape plants were figured.

Capt. Warton exhibited a variety of fungi which he had found at Newlands.

Professor MacOwan gave an interesting description of several of the specimens and of their qualities—among them was the edible variety of the boletus.

Mr. Cairncross exhibited a small anemometer, designed to measure currents of air for the purpose of ventilation.

Mr. Gamble read Mr. A. G. Howard's paper on "The Isobaric Influences and Cyclonic Paths of S. Africa."

The thanks of the Society were voted to Mr. Howard.

Ordinary Monthly Meeting.

WEDNESDAY, May 27, 1885..

Mr. R. TRIMEN, F.R.S., PRESIDENT, IN THE CHAIR.

Dr. Rudolph Marloth was duly elected an ordinary Member of the Society.

The following donations were announced, and the thanks of the Society voted to the donors :—

Mittheilungen des Ornithologischen Vereines in Wien, 9th year, 2, 3, 4.

Catalogue of the Australian Hydroid Zoophytes.

Mr. Péringuey exhibited some plates belonging to his paper on "New Species of S. A. Coleoptera," which was presented to the Society and taken as read.

The thanks of the Society were voted to Mr. Péringuey for this very valuable contribution to the Society's memoirs.

Mr. Gresswell then read a paper on "The Evolution Hypothesis as the fundamental assumption in the Science of Ethics," and

Dr. Beck a paper on "Pathology from an evolution point of view."

Dr. Gill proposed that the discussion on these papers be postponed till next meeting.

Ordinary Monthly Meeting.

WEDNESDAY, June 24, 1885.

Mr. R. TRIMEN, F.R.S., PRESIDENT, IN THE CHAIR.

Dr. Silke and Mr. Henry Sawerthal were unanimously elected ordinary Members of the Society.

Professor MacOwan exhibited a number of specimens of Microscopic Diatoms, prefacing the exhibition by a few explanatory remarks on the life-history of Diatoms.

Mr. E. J. Dunn exhibited some pebbles from the Dwyka conglomerate, which, he considered, shewed distinct traces of ice-scratching.

Dr. Beck gave a resumé, with addenda, of his paper on "Pathology from an Evolution point of view."

This paper gave rise to an interesting discussion, in which Dr. Gill, Dr. Silke, Canon Lightfoot, Dr. Atherstone (a visitor), and Messrs. Péringuey, Bolus, and Trimen took part, and in which the value of Dr. Beck's paper was recognised.

Dr. Atherstone was of opinion that the evidence brought forward by Dr. Beck was not strong enough to warrant his conclusions.

Dr. Beck replied very briefly to the various questions raised, want of time unfortunately preventing his answering them fully.

Annual General Meeting.

WEDNESDAY, July 29, 1885.

Mr. R. TRIMEN, F.R.S., PRESIDENT, IN THE CHAIR.

Dr. Claude Wright and Mr. S. N. Ponder were duly elected ordinary Members of the Society.

The Secretary's and Treasurer's Reports for the past year were read and adopted.

The Meeting then proceeded to the election of President and Council for the ensuing year, Mr. Finlay and the Rev. G. H. R. Fisk being elected scrutineers of the ballot.

Visitors having been admitted, the President's Address was read by Mr. Bolus.

The result of the ballot was as follows:—

President,—Professor MacOwan, B.A., F.L.S.

Members of Council,—Mr. J. H. M. Beck, M.B.
Mr. H. Bolus, F.L.S.
Mr. W. H. Finlay, B.A., F.R.A.S.
Rev. G. H. R. Fisk, C.M.Z.S.
Mr. J. G. Gamble, M.A., M. Inst., C.E., F.R.M.S.
Mr. D. Gill, LL.D., F.R.S., F.R.A.S.
Prof. Guthrie, LL.B.
Hon. J. X. Merriman, M.L.A.
Hon. C. A. Smith, M.A.
Mr. R. Trimen, F.R.S., F.L.S., F.Z.S.

REPORT ON THE PROCEEDINGS

OF THE SOUTH AFRICAN PHILOSOPHICAL SOCIETY

During the Year ending July 29th, 1885.

1. Since the last Annual General Meeting eleven Ordinary Monthly Meetings have been held. The average attendance of members at each meeting has been eleven, and that of visitors seven, making the total average attendance of members and visitors eighteen.

2. At the Monthly Meetings eighteen papers have been read before the Society. Of these three relate to Astronomy, one to Botany, three to Entomology, one to History, two to Meteorology, one to Pathology, two to Philology, one to Pure Mathematics, two to Zoology, and two to Miscellaneous subjects.

3. Donations of books have been received from the Smithsonian Institution, the Hamilton Association (Canada), the Ornithological Society of Vienna, the National Academy of Sciences of Cordoba, the Director of the Geological and Natural History Survey of Canada, Dr. Ackermann, Dr. Elkin, Dr. Gill, and Mr. J. C. Rickard.

The issue of the Society's publications to scientific institutions abroad has hitherto been carried out in a somewhat desultory manner. Steps will be taken during the ensuing year to places the exchanges with foreign societies on a more satisfactory footing, and it is hoped that the result will be a large increase in the number of donations of books.

4. Vol. III. Part 2 of the Society's Transactions is in the press and will very shortly be issued to members. This part concludes Vol. III. and contains a record of the Proceedings of the Society and the papers received to 1884 July. It also contains (*a*) a catalogue of Books nd Papers referring to South African Meteorology which has been compiled by Mr. Gamble, (*b*) a first contribution by Mr. Péringuey on South African Coleoptera, (*c*) an appendix to the Catalogue of Books on South African Botany already published in Vol. II.

5. During the year seven Ordinary Members have been elected. The Society has lost one member by death, three have resigned, and two have left the Colony. The total number of Ordinary Members is seventy-six, and of Corresponding Members twenty-one.

6. The side-room of the Commercial Exchange has been found to answer well for the Society's place of meeting; and it is in contemplation to remove the books forming the Society's Library to that room, where they will be more readily available to members.

W. H. FINLAY,
General Secretary.

Dr. The Treasurer in Account with he "South African Philosophical Society" for the year ended the 30th June, 1885. Cr.

1884		£	s.	d.	£	s.	d.	1884		£	s.	d.	£	s.	d.
July 1	To Balance—							July	By Advertising		..		19	2	0
	In Standard Bank ..	13	1	10					,, Printing Transactions—						
	Mortgage Bond ..	200	0	0					Saul Solomon & Co., Printing	3	1	6			
					213	1	10		Advance to R. Trimen, Esq., (Peringuey's Plates on South African Coleoptera)	20	0	0			
	,, Subscriptions ..	125	0	0					Advance to H. Bolus, Esq., (Plates of Orchids) ..	20	0	0			
	,, Overpayments on same	0	4	10									43	1	6
					125	4	10		,, Clerical Assistance to Secretary and Treasurer ..		..		30	0	0
	,, Interest on Mortgage Bond, 14th June to 31st Dec., 1884 ..	7	13	5					,, Rent of Rooms		..		28	0	0
	Do. 1st January to 30th June, 1885 ..	7	0	0					,, Fees to Collector of Subscriptions		..		0	14	0
					14	13	5		,, Petty Expenses—						
	,, Interest received from D. Hubner, due on Baker's Bond (to 31st March, 1885)		..		21	0	0		Postage, Railway Fares, &c.	7	2	5			
									Carriage on Parcel	0	5	0			
													7	7	5
									,, Amount refunded to F. Baker, interest due to him from D. Hubner (*vide* contra) ..		..		21	0	0
													149	4	11
									,, Balance—Mortgage Bond..	200	0	0			
									Bank Balance (as per Pass Book)	24	15	2			
													224	15	2
					374	0	1						374	0	1

Cape Town, 20th July, 1885. C. ABERCROMBIE SMITH, Hon. Treasurer.

We, the undersigned, Members of the "South African Philosophical Society," do hereby certify that we have examined the above Account, compared the Cash payments with the Vouchers, and the Balance with the Bank Pass-Book and Mortgage Bond, and found the same correct.

Cape Town, 20th July, 1885.

FRED. F. RUTHERFOORD,
SAML. JERRAM, } Auditors.

ANNUAL ADDRESS TO THE MEMBERS

OF THE SOUTH-AFRICAN PHILOSOPHICAL SOCIETY,

On Wednesday, July 29, 1885,

By the President, Roland Trimen, F.R.S., F.L.S., F.Z.S.

It is the fitting custom, in all learned and scientific societies, for the President, at the annual or anniversary meeting, to take stock of what has been effected or attempted during the past twelve months by the body of which he has been for the time the elected head; and it is not unusual for him on the same occasion to dwell specially on such matters as lie more within his own line of study or research. A modification of this course was adopted by our first President, and has been followed—I think with advantage—by his successors in the chair —*vid.*: to give such a summary of the Society's doings (which are not as yet overwhelming in extent) every second year, and to deliver at the annual meeting of the intervening year an address dealing with some subject connected with the President's personal investigations. In this way the Society gains an additional memoir of a more or less interesting character and the more formal summary of its proceedings is rendered less restricted in its scope. The excellent rule of our Society, that the same person is not eligible as President for more than two years consecutively, lends itself very well to this arrangement; for it has so happened that, during the eight years of the Society's existence, each of our Presidents has been re-elected for a second year of office, and thus has been able to give both an address on his special department of research at the close of the first year, and one of the more formal and general description at the end of the second year. It will be remembered that our lamented first President, Sir Bartle Frere, chose for the subject of his special address, in 1878, "The Native Races of South Africa;" that his successor, Mr. David Gill, gave us an admirable account of his three years' researches in connection with "A Determination of the Distance of the Earth from the Sun;" that Mr. Gamble traced for us "The Connection between the Direction and Force of the Wind and the Height of the Barometer;" and that I had the honour last year of addressing you on a very curious and significant class of facts in the domain of Zoology, *vid.*: the "Protective Resemblances and Mimicry in Animals."

2. The following memoirs, or papers, have been read before the Society since the Annual Meeting in July, 1883, *vid.*:—

I. *Astronomy* (2).—Mr. W. H. Finlay: "Elliptic Elements of Comet, 1884 *b*;" Dr. D. Gill: "Description of Investigations of Stellar Parallax."

II. *Geology* (1).—Mr. G. McKay: "On the Geology of the coast between the Fish and Juja Rivers, South Africa."

III. *Meteorology* (4).—Mr. G. Alston: "Some phenomena observed in connection with the Evening Glow." Mr. A. G. Howard, "Isobaric Influences and Cyclonic Paths in South Africa." Dr. W. Muskett:

"Does the Moon influence Weather?" Mr. Andrew Smith: "On disturbances to Thermometers from Local Causes."

IV. *Biology* (8).—[A] *Zoology* (6). Rev. G. H. R. Fisk: "Note on alleged existence in the Colony of Earthworms six feet in length." Dr. E. Holub: "List of Animals collected near Cape Town." The late H. W. Oakley: "On the Snake called the *Mamba* of Natal." Mr. L. Péringuey: "Insects Injurious to Forest Trees in South Africa," and "First Contribution to the South-African Coleopterous Fauna." Mr. R. Trimen: "Note on a remarkable Marine Fish, *Amphisile punctulata*, taken at Port Natal." [B] *Botany* (2). Mr. H. Bolus: "Note on the Orchids of the Cape Peninsula." Dr. E. Holub: "List of Plants collected near Cape Town." [This is actually a portion of the same paper of Dr. Holub's as is mentioned under the heading "Zoology."]

V. *Philology* (1).—Dr. F. W. Kolbe: "Linguistic Pioneering in South Africa."

VI. *Engineering* (3).—Capt. Balfour: "Irrigation in the Valleys of the Visch and Zak Rivers, in the Calvinia and Fraserburg Districts." The late Mr. E. Elmgren: "On the Form of Cross Section of a Channel for Constant Velocity of Water at different Depths." Mr. J. G. Gamble: "On Siphons for use in Reservoirs."

VII. *Mathematics* (1).—Mr. F. Guthrie: "Note on the Calculus of Variations."

VIII. *Miscellaneous* (6).—Mr. G. Alston: "Description of Model of an Ostrich Camp, with Electric Reporter of Fence Gates left open, &c.; and of a Mode of ascertaining whether an Ostrich Egg contains a Living Embryo." Dr. J. Meiring Beck: "Pathology from an Evolution Point of View." Colonel J. H. Bowker: "Other Days in South Africa." Dr. D. Gill: "Account of Longitude Operations connecting Aden with the Cape." Mr. G. Gresswell: "In what sense, and how far, can the Evolution Theory be reconciled with Sound Philosophy?" and "The Evolution Theory as the Fundamental Assumption in the Science of Ethics."

This total of twenty-five papers is smaller than that of the two preceding terms of two years, which were, respectively, twenty-nine for the term 1881-83, and twenty-seven for the term 1879-81, and is identical with the number read during the first and second years of the Society's existence. Of these twenty-five memoirs, read during the two years just completed, thirteen were ordered to be printed, and it is hoped that the new part (the second and concluding one of Volume III.) of our "Transactions" containing them will be in the hands of members before the delivery of this address. On the merits of these memoirs selected for publication it is not for me to descant; but the Society will, I am assured, recognise the care and judgment exercised by the Council in the matter, albeit their critical action renders our published volume somewhat slenderer in bulk than might have been expected. In addition to the memoirs just mentioned, I am glad to be able to report that the second part of the "Catalogue of Printed Books and Papers relating to South Africa," *vid.*, that relating to Meteorology, has been completed by Mr. J. G. Gamble, and will shortly be published by the Society.

3. While on the subject of publications I cannot refrain from congratulating the Society on the action taken by the Council in the matter of plates to illustrate Mr. Péringuey's paper on New Species of

South-African Coleopterous Insects, and Mr. Bolus's memoir on the Orchids of the Cape. Both these gentlemen contributed liberally from their own resources towards the cost of the plates, and the Council, recognising the importance of illustrating these papers by scientifically accurate figures, as well as the much-increased value which such illustrations would give our "Transactions," sanctioned the application of a sum in each case, considerable in proportion to our means, for the purpose in view. The result has been highly satisfactory, as members will see on inspecting the plates published with Mr. Péringuey's memoir, which were drawn by one of the first entomological artists in Paris, M. Migneaux. The plates for Mr. Bolus's memoir have been executed in England, from that gentleman's own most careful drawings from life of the plants to which he has devoted so much study, and will be issued with his paper in the first part of Volume IV of the "Transactions."

4. As usual, the usefulness and interest of our monthly meetings have not been confined to the papers read, but have been largely augmented by the exhibition of zoological, botanical and geological specimens, as well as of scientific instruments and diagrams, and by the remarks of the exhibitors and other members thereon. Among these I would specially refer to the numerous living South-African and other reptiles, and the skin of the very rare and singular Woolly Cheetah (*Felis lanea*, of Sclater), exhibited by the Rev. G. H. R. Fisk; to the fine series of orthopterous insects, illustrating the phenomena of protective resemblances, brought to our notice by Mr. Péringuey; to the numerous lovely orchidaceous plants of the vicinity (one of them new to science), shown us by Mr. Bolus; and to the instructive and elaborate diagrams of average monthly rainfall, and of mean maximum and minimum temperatures at various stations throughout the Colony, explained by Mr. Gamble. It cannot be too strongly impressed upon members of the Society that exhibits of this character, both by the knowledge they directly impart through the eye, and by the information which discussion upon them elicits, are of little, if any, less importance than the more formal papers read in promoting accuracy of observation and stimulating research; and I would urge upon our members generally how much more might be done in the way of exhibits. There are many among us who cannot often find the time or opportunity to draw up a paper or memoir, but who could without difficulty bring to the meetings they attend specimens and objects of great scientific and general interest, and by so doing not only much enhance the attractiveness of our meetings, but also not rarely start a discussion and inquiry fertile in results. Of interest to all, exhibited specimens are specially so to younger members; and I can gratefully recall the delight and instruction I derived as a lad from witnessing as a visitor the numerous exhibits at the meetings of the Entomological Society.

5. In the same way, the reading at our meetings of letters bearing upon matters of scientific interest would often open up a fruitful field of inquiry. I was struck recently by the early accession of valuable material which followed the reading by the Rev. Mr. Fisk of a simple note of inquiry from Mr. Beddard, Prosector to the Zoological Society, as to the alleged existence of gigantic earthworms at the Cape. Several of the members present recollected having met with colossal members of that humble tribe of animals; the newspapers

mentioned the matter in their reports of the meeting; several letters concerning the occurrence of such creatures soon reached Mr. Fisk and myself; and not many months psssed before actual living examples, measuring from four to five feet in length, were received, and sent by Mr. Fisk to England, where they have been duly dissected and determined as a new species of the group.

6. Several of our members have contributed results of their work to European societies and publications, among whom I may mention Mr. Bolus, Mr. Gill, Mr. Gamble, Mr. MacOwan, Mr. Péringuey, Mr. Schunke, and myself. I would call the special attention of members to Mr. Schunke's paper on "Kaffraria and the Eastern Border Districts of the Cape Colony," illustrated by a very useful map, of which the first part has been published in No. V. of Petermann's "Mittheilungen" for the current year.

7. As regards the strength of our muster-roll of members, it is certainly encouraging to find that, notwithstanding the extreme depression of circumstances generally, and the natural result that resignations have been somewhat frequent, our numbers have not decreased during the two years, but there has been even a slight increase. While we have lost two members by death, two by departure from the Colony, and twelve by resignation, we have elected sixteen ordinary and two corresponding members, so that our numerical gain has been two. On looking back, I find that we started in 1877 with 78 members, and that our maximum was attained in 1881, when we mustered exactly a hundred, *vid.*: 86 ordinary and 14 corresponding members. Our present strength is ninety-four, *vid.*: 74 ordinary and 20 corresponding members. Although this number is far below the hopes and anticipations of many of those who co-operated to launch the Society eight years ago, it yet emphatically shows how ill-judged was the prediction of the distinguished Astronomer, who, in declining to join us, sarcastically assigned to the Society an existence of less than two years!

8. The death of Sir Bartle Frere, on the 19th May, 1884, must have keenly recalled to very many of us the sense of loss experienced when, in September, 1880, our distinguished founder and first President finally quitted the Colony. Of his eminent public services in India and other parts of the Empire I need not speak; they were recognised and rewarded by the Sovereign and by Parliament, and will hold their place in the national records. It is not as the statesman and administrator that Sir Bartle Frere fills so large and so high a place in the memory of this Society, but as the man of "light and leading;" the friend of literature and science; the cordial promoter of every honest effort for progress and improvement; the student whose wide culture was balanced by an equally wide knowledge of men; and the most dignified, able, and yet most genial of chairmen;—it is thus that we delight to remember him; and it is such memories as these, no less than those which he left behind him as courteous host and high-bred gentleman, which lend a lasting poignancy to our regret for his loss. Sir Bartle's honours were by no means limited to those won in his official career. Both the great English Universities accorded him the honorary Doctorate of Laws; he was successively Vice-President and President of the Royal Geographical Society, and President of the Royal Asiatic Society; he was elected a Fellow of

the Royal Society in 1877, and Chancellor of the University of the Cape of Good Hope in 1881.

The Society will share the sincere regret of the Council and myself at the loss we have sustained in the death of our colleague, Herbert William Oakley, which occurred suddenly on the 14th November last. Born at Taunton, in Somersetshire, in 1848, he early in life showed a strong taste for Natural History, and gained much knowledge of the fauna of his native country. At the age of 22 he became assistant to Professor Boyd Dawkins, in the Museum of the Owens College at Manchester. He retained this situation until 1877, gaining the esteem and approval both of his immediate chief and of Dr. Greenwood, the Principal of the College. In 1877, his desire for experiencing something of the zoological and sporting facilities which South Africa affords led to his joining the Cape Mounted Police. Unfavourable as were the conditions of his life as a trooper in that force, he nevertheless managed to make some very interesting notes on the fauna of the Transkei Territory, and to form a good collection of the birds of that district. At the storming of Moirosi's mountain in Basutoland Mr. Oakley greatly distinguished himself, and received most honourable mention in the despatches relating to the affair. It was through our first President, the late Sir B. Frere, then Governor of the Colony, that Mr. Oakley was enabled to obtain employment more suited to his training and abilities, and was appointed by the trustees, in 1879, my assistant in the South-African Museum. He held this post until the date of his decease—a period of over five years. His knowledge of geology, special acquaintance with the vertebrate skeleton, and manual skill in the preparation of osteological specimens, were of great value to the Museum; and his zeal and activity as a collector resulted in very numerous additions of specimens in all classes, but especially in that of birds. In addition to frequent exhibitions of specimens at our meetings, Mr. Oakley contributed several papers to our *Transactions*, of which the following were published, viz.: "On the Habits of some of the birds of the Transkei;" "On the Skeleton of the African Darter or Snake-bird (*Plotus Levaillantii*);" "On the Anatomy and Habits of South African Snakes;" "On *Peripatus Capensis*;" and, lastly, "On the Snake called the *Mamba* of Natal." He was elected a member of the Council in July, 1884. In character most modest and retiring, Herbert Oakley's natural ability was rather hidden by his habitual reserve and shyness of manner; but his many good qualities of mind and heart were cordially recognised by those who knew him with any intimacy, and his untimely death has been the loss to us of a most kindly, amiable companion, as well as of an intelligent, helpful colleague.

Dr. Benjamin F. Bradshaw was not on our roll of members, but he took great interest in our work, and in 1880 contributed a paper to our *Transactions* on the "Tsetse Fly," based on his personal observations during six years travel in the interior. He was an enthusiastic naturalist, and made large collections of zoological specimens, especially of birds and insects. His bird-skins were remarkable for their excellent preservation, and he had recorded most careful and interesting ornithological notes, of which the greater part have fortunately been utilised by Mr. R. B. Sharpe in his recently published edition of Layard's "Birds of South Africa." Dr. Bradshaw was a liberal donor to the South-African Museum, and left to it the only example

he ever met with of the very rare hawk, *Poliohierax semitorquatus*. Several of his birds proved to be new to science, and I had the pleasure of describing two of them, viz., a Racket-tailed Roller (*Coracias spatulatus*), and a Yellow-breasted Shrike (*Laniarius atro-croceus*). Dr. Bradshaw's health was seriously undermined by the hardships attendant on his Zambezian journeyings, and never afterwards really rallied. He had filled several district surgeoncies in the Colony, and in 1880 was appointed surgeon to the Northern Border Police. On the Orange River he was for some time in better health, but in 1882 had to visit England for change and medical advice. He returned without having derived much benefit; and a long Karroo journey on duty proved too much for his weakened state. He died on 1st December, 1883, in his thirty-sixth year. Singularly straightforward, unworldly, and of simple tastes and habits, Dr. Bradshaw possessed great resolution and endurance, combined with a gentleness and kindness that endeared him to his friends and fellow officers.

Emil Elmgren, whose paper "On the Form of Cross Section of a Channel for Constant Velocity of Water at different depths" has been mentioned above, and will be published in the "Transactions," was a native of Sweden. His mathematical knowledge was considerable; and he had designed and hoped to construct a calculating machine—the merit of which was recognised by both the Astronomer-Royal and the Hydraulic Engineer. He was a great sufferer from pulmonary disease, to which he succumbed in February last.

9. In response to an invitation published in *Nature* of the 26th March last by the British Association for the Advancement of Science, application has been made to that body to have our Society recognised as one in "correspondence" with it. This designation is by the Association's recently adopted rule limited to societies issuing publications devoted to research, and specimens of such publications are required to accompany every application for recognition as a "Corresponding Society." In the probable event of our request being granted, we shall have the privilege of nominating a delegate to represent the Society on the general committee at each successive annual meeting of the Association.

10. After having for so long profited by the liberality of the University authorities in according us the use of their premises, the Council at length thought it advisable to make the experiment of engaging a room centrally situated for the purpose of holding the Society's meetings, and succeeded in obtaining the side-room of the Commercial Exchange at a moderate charge. I think that the members generally will agree with me that, alike in situation, dimensions, and convenience, this apartment is well adapted to our requirements. By its acquisition, moreover, we shall be able, through the courtesy of the Committee of the Exchange, and of their Secretary, Mr. A. Ellis, to render our Library more accessible by removing it to our new quarters; thus saving the rent hitherto paid for the room in which the books have been kept.

11. The mention of our Library reminds me that it has received considerable additions during the past two years, in the way both of donations and exchanges, for our own *Transactions*. Among the donations are especially noticeable those received from Vienna, at the instance of our fast friend Dr. Holub, consisting of the complete "Mittheilungen" of the Vienna Ornithological Society, and a con-

siderable series of very valuable zoological, botanical, and pathological works from the leading Viennese publishers. As regards exchanges for our publications, the Council has been considering the best mode of increasing these by a wider distribution of the *Transactions* among scientific societies in Europe, America, and Australia, and also views with favour the proposal to dispose of a certain number of copies at a reduced rate to the principal dealers in scientific books and memoirs in London, Paris, Berlin, and other capitals. The acquisition of copies of all published scientific works relating specially or partly to South Africa is a matter which it is most desirable to keep constantly in view; and I trust that all members will bear it in mind, and especially that those of us who publish any such works or papers, whether in the Colony or elsewhere, will favour the Society's Library with copies.

12. On the whole, with every endeavour to take an unbiassed view of our condition and prospects, I think that we are justified in concluding that our position is rather encouraging than otherwise. We must remember the unexampled depression of the times, when we feel inclined to look on the darker side, and then we shall have ground for satisfaction in finding that we have thus far fully maintained our credit and our efficiency. Financially, the Society is sound; numerically, there has been a slight increase, which may fairly be taken as the augury of a larger one; and, although we must admit how much room there is for improvement, both as regards contributions to and attendance at the monthly meetings, there can be no doubt that increasing interest is shown in them by all concerned. I have watched the Society from its birth, and cannot deny having felt some anxiety at times as to its condition; but it certainly seems to me to have now escaped the risks incident to infancy, and to give promise of a vigorous youth and maturity. Its establishment and continuance have at any rate removed the reproach of our being the only considerable British Colony which was without some organisation for recording the results of local research; and we can now, as far as in us lies, have the opportunity of contributing to the vast acquisitions of accurate knowledge which are the special glory of modern civilisation.

It now only remains for me, in relinquishing the President's chair, to offer you my sincerest thanks for the unfailing indulgence and support afforded me during my two years' occupancy of it.

MINUTES OF PROCEEDINGS.

Ordinary Monthly Meeting.

FRIDAY, August 28, 1885.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

The ballot for Dr. Atherstone as an ordinary member, and Dr. F. W. Klatt as a corresponding member, resulted in these gentlemen being unanimously elected.

The following presents were announced, and the thanks of the Society voted to the donors:—

Geological and Natural History Survey of Canada.
Report and Maps for 1882-84.
Catalogue of Canadian Plants. Part II.

The Rev. G. H. R. Fisk, exhibited and described the skeleton of a fish's head *Lophius Upsicephalus*, which Günther considers to be the same as the English species *Lophius Piscatorius*, or "Angler." This specimen was taken in Table Bay, and is found at the bottom of the sea embedded in mud or sand.

He also exhibited the skin of a Robben Island snake, *Coronella Phocarum*, and drew attention to the fact that although the snake, when alive, measured only 5 feet 9 inches, the skin, when removed, measured 6 feet 10 inches. Mr. Fisk pointed out that if this rule holds good it is not improbable that an erroneous idea as to the original size of specimens may have frequently been entertained.

The President exhibited and described a specimen of *Welwitschia Mirabilis* from Walvisch Bay. This plant is described by Sir J. D. Hooker in vol. xxiv of the Linnean Society's Transactions.

In reply to the Rev. G. H. R. Fisk, the President stated that the *Welwitschia mirabilis* had germinated at Kew, but he did not imagine it was of commercial value.

Mr. T. Stewart, Mem. Min. Soc., then read a paper on the "Weathering and Erosion of Rocks," as illustrated in the Cape Peninsula.

Mr. E. J. Dunn, F.G.S., remarked upon a powerful agent connected with the disintegration of rocks, which had not been mentioned in the paper just read. He referred to the small lichens which by means of their tiny roots were responsible for the removal of tons of earth and rock in such a circumscribed locality as the Cape Peninsula. Speaking generally as to the erosion and weathering of rocks it is to be noted that the character of the rock generally regulates the form it assumes. Lime stones become shaped into rounded masses. Granites form huge boulders; whilst the dolerites in South Africa are frequently found piled up on one another; the corners of these close-grained rocks being attached both above and below. Amongst the sandstones of the Stormberg huge rocks 40 feet in height may be seen which owe their form and apparently insecure position to the effects of weathering. Sometimes owing to the lower portion being of a softer material these rocks increase from 3 to 4 feet in diameter

at the base to 9 or 10 feet at the upper surface. It would appear from the manner in which the hardest and most closely-grained rocks have been weathered, that no considerable movement of the earth has taken place in South Africa for many centuries.

Dr. J. Shaw, F.L.S., remarked that this country had for many ages been subject to sub-ærial denudation. As an example of the powerful effects produced by means of sand carried by wind, he quoted an experiment made by Dr. Hahn at Somerset West. Some soda-water bottles having been covered with paper, letters were cut in the paper, and the bottles were then exposed to a south-east gale. In a few hours the sand, driven by the wind against the bottles, had distinctly scored the letters on the glass.

Dr. Shaw was proceeding to point out the connection between the ancient character of S. A. Landscape and S. A. Flora, when, owing to the lateness of the hour, the meeting had to be brought to a close with a vote of thanks to Mr. Stewart for his interesting and instructive paper.

Ordinary Monthly Meeting.

Wednesday, October 28, 1885.

Prof. MacOwan, B.A., F.L.S., President, in the Chair.

A letter was read from Mr. Joseph Smith, jun., of 63, Legh-street, Warrington, asking the names and addresses of any members who take up the study of Zoophytes. Also from Mr. H. C. Schunke, forwarding a copy of his essay on Kaffraria and the Eastern Districts of the Cape Colony.

Mr. Trimen exhibited two remarkable specimens of large desert locusts or grasshoppers, sent by Mr. Alston, of Van Wyk's Vley, and stated that they belonged to a peculiar group common to Africa and India. They are usually found in dry soil, the colour of which they exactly resemble. The locusts have a peculiar characteristic, viz., that their colour varies according to the soils and stones among which they live. Mr. Trimen believed that this colour did not change like that of the chameleon, but was adapted to suit certain localities.

Prof. MacOwan exhibited specimens of flowers and bark of *Gonioma Kamassi, E. Mey.* The bark had been sent to him by Mr. W. Groom, Knysna, who had written to say that at the Knysna the bark and rasped wood is infused in spirit and used for same purposes as Angostura Bitters. The tree is not uncommon in the Eastern Province, furnishing a wood of close texture similar to box.

He also exhibited a sample of bark of *Rhamus prinoides, L'Herit*, sent by Mr. W. Groom. The tincture of this bark had been prepared by Dr. Marloth. It is exceedingly bitter, and has purgative properties similar to those of the fruit and bark of the European buckthorn. (*Rhamus frangula, L.*)

He also exhibited a specimen of a rare and curious heath, *Erica* (*Cyatholoma*) *Thunbergii, L.*, sent by Mr. N. Carson, of Ceres, from the Koude Bokkeveld. There was only one specimen of the plant in the Government Herbarium, which was gathered about 1829 by the botanical traveller, J. F. Drege, at Ezelsbank, Clanwilliam. Previous to that date no one but Thunberg seems to have collected it.

Dr. Shaw stated that he gathered the same heath in the Koude Bokkeveld about six years ago.

The Rev. G. H. R. Fisk exhibited a lizard, *Tarentula Capensis*, sent to him from Port Nolloth by the Rev. C. Earp Jones, and read a note thereon.

Dr. Shaw exhibited a concretionary mass of stones resembling conglomerate, which had formed around an old bolt which had lain in the sea for some time. The mass was cemented together by the rust formed from the bolt.

Dr. Shaw then read his paper on "Fossil Plants from the Stormberg, Indwe, and Molteno Coalfields," and Dr. Marloth his paper on "The Adulteration of Food in Cape Town."

The Hon. J. X. Merriman, in proposing a vote of thanks to Dr. Shaw and Dr. Marloth, said that he was glad that the latter gentleman had taken up the question of adulteration. He hoped he would take up the adulteration of liquor in order to shew the quantity of poison which was sold to natives under the name of brandy. Mr. Merriman considered that it was one of the greatest evils with which we have to contend.

The vote of thanks was carried unanimously.

Ordinary Monthly Meeting.

WEDNESDAY, November 25, 1885.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

The Rev. G. H. R. Fisk read a communication from the Prosector to the Zoological Society giving instructions for preserving earthworms.

The Hon. J. X. Merriman then read his paper entitled "Some Remarks on the Taxation of the Cape Colony," in which he shewed the proportion of taxation to gross revenue, giving similar figures for Great Britain, New Zealand, and the Australian Colonies. He also shewed the proportion of Customs dues, to imports, and further compared the revenue raised from tobacco and intoxicants at the Cape with that of Great Britain, Victoria, and New Zealand,

Some remarks were made by the Hon. C. A. Smith, Dr. Gill, and Mr. Bolus, to which Mr. Merriman replied, and the meeting closed with a vote of thanks to Mr. Merriman.

Special Meeting.

MONDAY, January 11, 1886.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

The President read a letter from Inhambane, addressed to Dr. Waters of the S.S. "Melrose," relating to a gum-bearing tree which was discovered by the writer, Mr. J. Heathcote, about three years ago. This tree is found in that part of Eastern Africa called the "Great Thirst Land."

Mr. Péringuey then made a communication to the Society regarding the presence of *Phylloxera Vastatrix*, in this part of the Colony. He stated that he discovered the first specimen on January 2.

He then proceeded to describe the insect in its various stages, from

its inception to its developing its wings, and also the effect produced upon the fibrils of the vine by the puncture of the insect, and concluded by proposing that the Society should appoint a Committee of three gentlemen who would keep them *en courant* with the *Phylloxera* question. He proposed as members of the Committee Mr. Trimen, Prof. MacOwan, and Mr. Bolus.

Dr. Gill seconded the motion, and suggested that the name of Mr. Péringuey should be added. With this addition the motion was carried.

Mr. Trimen then made some remarks on the introduction of the insect into France, and the various means adopted there for its extirmination. He strongly advocated the introduction of the American vine.

After some remarks by Dr. Gill, Dr. Beck, Mr. Trimen, Sir J. H. de Villiers, and the President, a vote of thanks was accorded to Mr. Péringuey, and some time was spent by the meeting in inspecting several of the insects through the microscope.

Ordinary Monthly Meeting.

Wednesday, February 24, 1886.

Prof. MacOwan, B.A., F.L.S., President, in the Chair.

Mr. J. C. Silberbauer was elected an Ordinary Member, and Mr. E. G. Alston a Corresponding Member of the Society.

The Rev. G. H. R. Fisk exhibited some Chameleons which he had received from the Karroo, near Beaufort West. One of these had a curious membrane at the back of the neck which enabled it to turn its head in any direction without moving its body.

Mr. Cairncross exhibited a diagram shewing the connection between the rainfall during the last year and the rise of the springs near Cape Town.

Mr. Gamble called attention to the maps which had been sent to the Indian and Colonial Exhibition shewing the distribution of rain over the Colony, Natal, Basutoland, &c.

Mr. Gamble exhibited, for Mr. E. J. Dunn, some *Fulgurites* (Lightning tubes) found on the west side of the Lange Bergen, Griqualand West. They were found in a tract of white siliceous sand, and are formed by the electric fluid fusing the sand where it strikes the earth.

Prof. MacOwan exhibited (from Mr. Bain) a specimen of *Hyenanche globosa*, Th., a poisonous *Euphorbiacea*, formerly used by Boers for destroying wild animals, before strychnine was introduced. Also (from Mr. Groom, Knysna) specimens of semi-fossilized copal, which is thrown up, in large quantities, on the beach in the neighbourhood of the Knysna. Reference was made to a letter by Sir J. Kirk, in Linnean Society's Journal, 1868, March 20, giving a description of the true copal of Zanzibar.

Dr. Gill exhibited photographs of instruments taken by Mr. C. Ray Woods for the Colonial and Indian Exhibition.

Mr. T. Stewart then read some notes on the "Erosion of the Campbell Valley, Kaap Rand."

Dr. Gill then described the application of Photography to Astronomy, and exhibited a number of photographs of stars, moon, sun, &c.

Mr. C. R. Woods (a visitor) described the influence of the size of the particles of bromide of silver on the rapidity of plates.

A vote of thanks to Dr. Gill and Messrs. Stewart and Woods closed the proceedings.

Ordinary Monthly Meeting.

WEDNESDAY, March 31, 1886.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

The Rev. G. H. R. Fisk exhibited eleven Geckos eggs which had been found under the bark of a fir tree at Camps Bay, and drew attention to the irregular times which elapsed before the eggs were hatched. He also exhibited some specimens of the Geckos (a kind of nocturnal lizard) which laid the eggs. Mr. Fisk further exhibited some eggs which had been found under ant-heaps.

Mr. Péringuey made some interesting remarks on the exhibits.

Mr. Péringuey exhibited a Gastine injector, one of the instruments used in extirpating the phylloxera; and explained the manner in which it was used. The ground is first dug to allow a ready percolation of bisulphide of carbon which is injected by means of the Gastine injector. Owing to the extreme heat which prevails in some of the vineyards situated in low tracts of country, there is considerable evaporation of the bisulphide of carbon, which is not unattended with danger to persons employed in the work.

Prof. MacOwan exhibited, in a glass tube, a specimen of vineroot which had been badly attacked by phylloxera.

Mr. Péringuey presented the second part of his paper on "S. A. Coleoptera," which, owing to the character of the subject, was taken as read.

Dr. Marloth then proceeded to read his paper on "The Origin of the Diamond Mines of S. Africa."

A discussion followed, in which Messrs. Merriman, Stewart, and Drs. Beck and Shaw took part.

On the motion of the President, it was resolved to keep the discussion open till the next meeting.

A vote of thanks was passed to Dr. Marloth for his paper.

Ordinary Monthly Meeting.

WEDNESDAY, May 5, 1886.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

Mr. C. Ray Woods was elected an Ordinary Member of the Society.

The following presents were announced, and the thanks of the Society voted to the donors:—

Transactions of the Linnean Society, vol. 2, pt. 8, vol. 3, pts. 3 and 4.

Faune Coleopterologique Aralo-Caspienne, Part I.

Boletin de la Academia Nacional de Ciencias en Cordoba, vol. 8, part I.

The President exhibited microscopic slide of winged form of Phylloxera, developed in warm and moist atmosphere in an experimental house. This is the form of creature that lays the "winter egg."

Mr. T. Stewart exhibited specimens chiefly of igneous rocks from Griqualand West; also of glacial conglomerate from Douglas, which Mr. Dunn considers uniform with the Dwyka conglomerate of the S. Karroo, although apparently very different. Mr. Dunn explained the difference by the fact of upheaval of Zwartberg having altered the rock. A crystal in one specimen is peculiar, as, if it was a crystal in existence before the conglomerate it would have been rounded, which it was not. We cannot however at present, although the rocks are dissimilar, assert that they are distinct. Mr. Stewart also exhibited a rounded boulder that he had found in a stratum of shale, which could scarcely have got there except by the transporting power of ice. It is necessary to have microscopical examination of specimens before we can correlate the rocks in various parts of this country. Mr. Stewart also exhibited rock specimens from Sutherland similar to that at the bottom of Kimberley mine. This is interesting, as it is said that one or more diamonds were once found at Sutherland. Also specimen of manganese from Du Toit's Kloof. In South Africa manganese always occurs in fissures where there has been much movement up and down—brought up from below.

Remarks and questions on the exhibits were made by Professor MacOwan, Mr. Gamble, and Professor Guthrie.

Mr. Stewart then read his paper on the "Geology of the Cape Peninsula."

A discussion ensued, in which Professor MacOwan, Professor Guthrie, Mr. Gamble, Mr. Bolus, and Archdeacon Lightfoot took part.

Mr. Gamble asked Mr. Stewart to explain why he considered the granite to be more recent than the sandstone, for at first sight it would appear as if the sandstone had been deposited indiscriminately on both granite and clay-slate, the layers of sandstone being at much the same level on both Table Mountain and Devil's Peak.

Mr. Stewart explained that he had found cases where the upper surface of granite had been altered by contact with the sandstone. Tourmaline also is found, which is a strong proof of later formation of granite.

A vote of thanks to Mr. Stewart was proposed by the President, and carried by acclamation.

Ordinary Monthly Meeting.

THURSDAY, July 1, 1886.

PROF. MACOWAN, B.A., F.L.S., IN THE CHAIR.

Dr. Gill exhibited on a screen and explained a number of photographs, taken by Mr. C. Ray Woods, of the instruments in use at the Royal Observatory.

A vote of thanks was accorded to Mr. Woods for his interesting exhibition.

The Secretary then read Mr. A. G. Howard's paper on "The Relationship between Sun-spots and Terrestrial Storms."

Mr. Woods did not agree with Mr. Howard's account of the nature of sun-spots, and he pointed out, with regard to the connection between sun-spots and terrestrial magnetism, that magnetic storms

do not occur with the passage of ordinary spots, but with the outburst of sudden eruptions at any part of the sun's disc.

Dr. Gill thought that, as a rule, there would generally be a sufficient number of spots on the sun to account for the coincidences observed by Mr. Howard. A decided connection between the recurrence of cyclones in the Indian Ocean and the frequency of solar spots had been proved by Mr. Meldrum, Director of the Mauritius Observatory.

Mr. Gamble said that it has been frequently pointed out that South Africa is peculiarly situated for detecting laws of meteorology, and that it was not fair to assume that because in one part of the world drought or floods were found to be associated with frequency of sunspots such should also be the case everywhere.

Mr. Finlay thought that the next step in Mr. Howard's investigation should be the endeavour to establish similar coincidences at other places similarly situated with regard to a permanent high pressure area.

The thanks of the Society were voted to Mr. Howard for his paper.

Annual General Meeting.

WEDNESDAY, July 28, 1886.

PROF. MACOWAN, B.A., F.L.S., PRESIDENT, IN THE CHAIR.

The Secretary's and Treasurer's reports for the past year were read and adopted.

The meeting then proceeded to the election of President and Council for the ensuing year, the Hon. C. A. Smith and Mr. Finlay being elected scrutineers of the ballot.

The President then delivered the annual address, the subject being "Personalia respecting Botanical Collectors at the Cape."

At the close of the address the result of the ballot was declared as follows:—

President,—Mr. H. Bolus, F.L.S.

Members of Council,—Mr. J. H. M. Beck, M.D.
Mr. A. A. Bodkin, M.A.
Mr. W. H. Finlay, M.A., F.R.A.S.
Mr. D. Gill, LL.D., F.R.S., F.R.A.S.
Prof. Guthrie, LL.B.
Prof. MacOwan, B.A., F.L.S.
Hon. J. X. Merriman, M.L.A.
Mr. L. Péringuey, M. Ent. Soc., London.
Hon. C. A. Smith, M.A.
Mr. R. Trimen, F.R.S., F.L.S., F.Z.S.

A vote of thanks to the President for his address was proposed by Sir J. H. de Villiers, seconded by the Hon. J. X. Merriman, and carried unanimously.

REPORT ON THE PROCEEDINGS

OF THE SOUTH AFRICAN PHILOSOPHICAL SOCIETY

During the Year ending 28th July, 1886.

1. Since the last Annual General Meeting eight Ordinary Meetings have been held. The average attendance of members at each meeting has been sixteen, and that of visitors nine, making the total average attendance of members and visitors twenty-five.

2. At the ordinary meetings ten papers have been read before the Society. Of these one relates to Chemistry, two to Entomology, five to Geology, one to Meteorology, and one to Statistics. Notes on a variety of subjects have also been read, of which brief accounts will be found in the Notes of Proceedings.

3. Donations of books have been received from the Smithsonian Institution, the Director of the Geological and Natural History Survey of Canada, the Linnean Society of London, the National Academy of Sciences of Cordoba, the Imperial Society of Naturalists of Moscow, Australian Museum, California Academy of Sciences, the Sydney Observatory, Mr. H. C. Schunke, and Dr. Guild.

4. Vol. III., Part 2, of the Society's Transactions has been issued to members. Seventy copies have also been distributed to foreign Societies. This distribution of the work of the Society has resulted in a considerable increase in the number of presents received in exchange.

5. During the year four ordinary and two corresponding members have been elected. The Society has lost two members by death, eight have resigned, and three have left the Colony. The total number of ordinary members is sixty-seven and of corresponding members twenty-three.

6. The books forming the Society's library have been removed to the side-room of the Commercial Exchange, where a book-case has been placed at our disposal by the Secretary of the Chamber of Commerce. The shelving of this book-case, however, is not suitable for the arrangement of books, and some more convenient arrangement is urgently needed.

7. Application has been made to the British Association for the advancement of Science to have our Society enrolled as one of the Corresponding Societies of the Association, and it is believed that the application will be acceded to.

W. H. FINLAY,
General Secretary.

Dr. The Treasurer in Account with the "South African Philosophical Society," for the year ended 30th June, 1886. Cr.

		£ s. d.	£ s. d.			£ s. d.	£ s. d.
1885.				1885.			
July 1	To Balance in Bank ..	24 15 2		July	By Printing Account	73 5 4	
	,, Mortgage Bond ..	200 0 0			,, Advertising	3 2 1	
			224 15 2		,, Clerical Assistance to Treasurer and Secretary ..	34 0 0	
	,, Subscriptions	..	130 0 0		,, Rent of Rooms, &c. ..	22 6 3	
	,, Interest on Bond to 31st Dec. 1885 ..	..	7 0 0		,, Commission on Collection of Subscriptions	2 0 0	
					,, Petty Expenses	10 2 2	
							144 15 10
				1886.			
				June 30	,, Balance as per Pass-Book ..	16 19 4	
					Mortgage Bond ..	200 0 0	
							216 19 4
			361 15 2				361 15 2

Cape Town, 26th July, 1886. C. ABERCROMBIE SMITH, Hon. Treasurer.

We, the undersigned, Members of the South African Philosophical Society, do hereby certify that we have examined the above Account, compared the Cash payments with the Vouchers, and the Balance with the Pass-Book and Mortgage Bond, and found the same to be correct.

Cape Town, 26th July, 1886.

FRED: F. RUTHERFOORD, }
JOHN E. B. ROSE, } Auditors.

ANNUAL ADDRESS READ BEFORE

THE "SOUTH AFRICAN PHILOSOPHICAL SOCIETY,"

On Wednesday, July 28th, 1886,

By Professor MacOwan, F.L.S., F.R.H.S., &c.

PERSONALIA OF BOTANICAL COLLECTORS AT THE CAPE.

It has been the custom that the President of this Society should, at the close of his term of office, present some subject with which he is familiar, in such form as to interest the members about to elect his successor. The excellent purpose to which this usage may be turned needs no better example than the masterly *résumé* of observations upon "Protective Resemblances in Animals" to which we listened last year in this place. Looking over the report of Mr. Trimen's address, I certainly felt considerable misgivings as to the possibility of presenting you with anything so interesting from the domain of the study which habitually occupies my thoughts. Descriptive botany is not without its attractions, but to appreciate them one must, like the neophytes at Eleusis, have endured hardness, have passed through many grades of botanical free-masonry; and at the best one can only expect to be tolerated, not applauded, by others than the initiated few. I have therefore dismissed the idea of presenting you with an account of this year's botanical progress in South Africa, and then passing on to the larger work of the great centres of scientific activity. There is, however, a very modest little mine of research in which I have now and then adventured some labour, namely, the compilation of personalia respecting the worthy men who by their life-long enthusiasm have made Cape Botany what it is at this day. You take up the three bulky volumes of the *Flora Capensis*, with their curt biographies of four thousand six hundred species, and are informed that fully four volumes, yet unwritten, would be required to complete the tale of plants that crowd this botanically wealthiest of the world's corners. Unless I am much mistaken, as your eye ran over this species from Namaqualand and that from the Transkei, and hosts of others, from out-of-the-way places, whither only the Mounted Police and the process-server find a road, you would inquire: "Who are the men that patiently accumulated these materials, toiling at a task promising scant fame and scantier pecuniary recompense?" That is what I propose to tell you to-night, in so far as I have been able to find the answer for myself, that is, very imperfectly, for comparatively little stands on record, although some of these men lived their hard lives in our very midst not more than thirty years ago.

It is one thing to be a botanist, a passed master in the science, at the head of a botanical department in some wealthy university or well endowed museum, whose patrons are princes, and be able to command the consecutive leisure which goes to the authorship of a great descrip-

tive flora. It is quite another thing to be a botanical collector, travelling in search of plants through outlandish countries, often in peril of life, always poor and certain to receive little recognition. Yet the number of these labourers who bear the burden and heat of the day, and bring the erudite describer his materials, is by no means small. Nor will they cease from the face of the earth so long as the love of wild nature and a certain strain of gipsyhood combine to make men unable to endure the monotony of labour which brings no ideas. I have known a good many British examples of these humble worthies, men like William Gardiner of Dundee, Ibbotson of Stokesley, Richard Buxton of Manchester, and the annals of botany in this Colony show men of the same type,—*fortes*, most certainly, but unknown outside the botanical world, simply *quia carent vate sacro*.

The Dutch settlement at the Cape of Good Hope could not have existed long without some striking examples of its wonderful flora being sent home in vessels touching on their return voyage from the East Indies. Holland was throughout the 16th, 17th and part of the 18th centuries at the head of the European horticulturo. Matthias L'Obel or Lobelius, once court physician to King James the First, in the preface to his *Plantarum seu Stirpium Historia*, praises the zeal of the wealthy Dutch burgomasters in bringing plants from the Levant and the Indies, and avers that their gardens contained more choice exotics than all the gardens of Europe beside. There was a fine garden at Leiden (1), founded in 1577, second only in antiquity to that of Pisa and of Padua. The city of Amsterdam woke up to establish one in friendly rivalry in 1684, and to these two centres the floral riches of the Cape would naturally be drawn. Cluyt and Pauw, whose names are commemorated in the genera *Cluytia* and *Pavia*, successively directed the Leiden garden, and to it the celebrated professor Charles L'Ecluse, better known as Clusius, was attracted from Frankfort as botanical professor. The most renowned physicians of the day gave public prelections upon the new plants which from time to time flowered in the gardens. Among these may be named Bontius and the illustrious Boerhaave, Johannes and Caspar Commelin, Vorstius, Hermann and Adrian van Royen. The collection of natural curiosities of all kinds from the countries visited by the Dutch mercantile marine, then at its best, became the fashion of the day. No doubt the acquisition of rare and curious objects was, with most, a mere amusement, like the modern cult of *bric-à-brac* and old china, but it served science well. Albertus Seba, of Amsterdam, gathered together his wonderful museum, *opus cui nullum par exstitit*, as his volume describing it says upon the title-page. Munting the elder, of Groningen, spent his whole fortune on his garden of exotics, and was glad ultimately to dispose of it to the Municipality, accepting an appointment as its curator. The wealthy Cliffort outshone all private cultivators in his splendid establishment at Hartecamp, near Haarlem, and Linnæus, in his youth, was glad to become Cliffort's botanist, and to catalogue, describe, and figure the rarer plants of the collection. Even the gambling on the stock exchange took a tinge from the prevailing fashion, and the bubble speculation of the South Sea Company in England, and of the bank schemes of M. Law in France were represented in Holland by a Tulip-mania. Shares in the possession of a

(1) See a sketch of its history by Boerhaave, in his "Index alter Plantarum," 4to. Lugd. Bat., 1727, pp. 18—34.

single *Semper Augustus* tulip-root were quoted at high premiums, rose or fell, just as now do Shebas or Turkey bonds. So were the Hollanders florists even in their commercial madness.

The general impression of the time and its strong bias towards culture of rare and curious plants of other countries is easily gathered from contemporaneous literature. It is not so easy to particularise and find exact record of those who introduced the Cape to Holland. The first notice is that of Justus Heurnius [2], a clergyman proceeding to the Dutch East Indies. He, when touching at the Cape, collected a few plants, and sent them to his brother, Otto Heurnius, who was a professor at Leiden. From a drawing, probably of Heurnius's own, Johannes Bodæus à Stapel, in his commentaries on Theophrastus [3] figured and described *Orbea variegata, Haw.* (*Stapelia variegata, L*). the common and sole carrion-flower found on the Cape peninsula, under the inept name of *Fritillaria crassa*. This, then, is the plant which earliest took its station in our published flora. The figure is extremely bad, and will not bear comparison with later ones given in *Burmann's Decades* in 1738, or in *Breynius's Prodromus* in 1739.

Next to Heurnius's small beginning, we have record of Paul Herman, a botanist and physician of some note, who on his voyage to Ceylon made the usual short stay at the Cape, and, in the immediate neighbourhood of the settlement, gathered together a collection which Thunberg describes as *Herbarium insigne*. After his return he became the professor attached to the Leiden garden, but he did not publish anything bearing solely on his Cape collections. His general catalogue of the contents of the garden contains descriptions and meritorious figures of several Cape species, but there is no allusion to his own share in their introduction. From a reference to them in Breynius, it would appear that such portion of his collections as was intended for Europe was sent to Burgomaster Beverningk, a wealthy patron of botany at Gouda, but the vessel taking the consignment was captured off St. Helena by British cruisers, and the collection lost.

By following the order of publication of certain celebrated botanical works of this period, one may most conveniently trace the further introduction of our flora into Europe. Of these, the earliest known to me is the *Exoticarum Centuria Prima* of Jakob Breyne [4], a merchant of Dantzig, better known under his Latinised appellation of Breynius. In this fine folio [5] printed on paper almost as thick as cardboard, and in magnificent type, we have descriptions of no less than forty-eight well-marked Cape plants. The author in every case records the source whence they were received, and in most instances this is stated to be the before-mentioned Hieronymus van Beverningk. The year in which the specimen, bulb, or seed was sent from the Cape is occasionally noted, and varies from 1663 to 1670. Caspar Commelin, in his *Præludia*, or public botanical lectures in the Amsterdam garden, speaks of receiving seeds from Dom. W. A. van der

[2] Either he or his brother, the professor, is commemorated by Robt. Brown in "Huernia," a genus allied to "Stapelia." It does not appear how the vowels in the name have been transposed, whether by a printer's error or inadvertence.

[3] Theophrasti Eresii de historia plantarum libri decem. * * * illustravit Joannes Bodæus a Stapel, M.D., Amstelodamenis. Fol. Amst. 1644.

[4] Born 1637; died 1697.

[5] Jacobi Breynii Gedanensis Exoticarum—Centuria Prima. Gedani, 1678, fol. i—xxxiv, 1—195 pp, tab. 109. Index et Appendix. The copy in the Cape Town Public Library belonged to the elder Commelin, and bears his autograph.

Stell in 1700, and again in the *Plantæ Rariores*, says "*Semina ex Africa a Nobilissimo Promont. Bonæ Spei Gubernatore, D. Wilhelmo Adriano van der Stell quotannis mittuntur.*" Now, throughout and after the time of the two Van der Stells, the Company's garden was, in turn, in the charge of Johan Hertog and Henry Bernhard Oldenland. Thunberg briefly states that they collected plants. Burmann, who was an excellent hand at assimilating other men's work, long afterwards published, as an appendix to his *Thesaurus Zeylanicus*, two rather extended Cape plant lists, one being Hermann's, the other the result of the two gardeners' work. On collation, however, it appears that the latter is almost entirely taken from Petrus Kolbe's delightfully artless "*Beschrijving van de Kaap de Goede Hoop*," where the author frankly confesses that he got it from Hertog (6), for the plain reason "dat ik mij op de kruidkunde niet hebt gelegt."

The Flora Indica of Nikolaus Laurens Burmann, the son of Johannes Burmann, has for appendix a "*Prodromus Florae Capensis*," and in the preface the author says that, besides others, it contains the plants which were collected by Oldenland, and are to be found in his herbarium. Francis Valentyn, the historian of the Dutch East Indies, in his "Beschrijving van de Kaap der Goede Hoop," p. 22, after praising the beauty of the Cape wild flowers and lamenting that no competent artist had attempted to copy them in their natural colours, adds: "Ik heb eenen *Herbarius vivus* gezien die de Heer Hendrick Bernard Oldenland, een fraai Botanicus, dien ik als opziender van de Compagnies Tuin hier in't jaar 1695 gekend heb, had bij een gezamelt, en die wel in 13 of 14 deelen in folio met een zeer fraai beschrijving van yder plant in't Latyn bestont."

It is, therefore, almost certain that these two men were the humble ministers to the scientific zeal of the Amsterdam and Leiden professors, although most of the honour and thanks were given to Adrian van der Stell. Boerhaave, who engraved twenty-four drawings of Proteaceae, sent to him by Hertog, is the only one who gives them any generous praise. Thus, in botany, as in verse making, the adage "*Sic vos non vobis*" repeats itself. One cannot, however, help feeling glad that while the real workers' names are commemorated in the genera *Hartogia* and *Oldenlandia*, the most noble Governor Wilhelmus Adrianus van der Stell has not a single Cape plant dedicated to his rather questionable memory.

Appended to Breynius's works is a tract, "De Frutice Thee," on the virtues of the tea plant, then being introduced as an Oriental luxury into Western Europe. It is by Wilhelmus Ten Rhyne, a physician employed in the Dutch East India Company's service at their Japanese station, Nagasaki. This learned gentleman claims on the title page to be the physician of the Mikado, or as he phases it, "*Magni Imperatoris Japoniæ.*" From Japan he was transferred to Batavia. In 1673 he spent a short time at the Cape, and made

(6) Hertog was not only robbed of his botanical repute by Van der Stell, but suffered at his hands much as Naboth of old did from Ahab. "He compelled one Hertog, the Company's gardener at the Cape, to make a bill of sale to him of a small piece of land which had been granted to the said Hertog and his heirs, in which document Hertog was made to confess a voluntary sale of the said estate for a sum of money, which it is well known he never received."—Kolbe, Nat. Beschryving, ii. This was for the purpose of becoming sole proprietor of the vast extent of land known as Hottentot Holland, where the Van der Stells are said to have depastured no less than twenty thousand head of cattle.

sketches and collections of plants around Table and Saldanha Bays. A catalogue of eighty-five of these follows his essay on tea. Breyn gives the names of nineteen species which he had received from Ten Rhyne (p. 178-9), and elsewhere laments that another parcel of plants and a *Nectarinia*, or sugar-bird, has been forwarded to his uncle, Johan Brayne, of Amsterdam, to be sent on to himself, but "*nec de aviculâ, nec de plantis (quod maxime dolet) quicquam percipere potuimus.*" Ten Rhyne also published a tract entitled "*Schediasma de Promontorio Bonæ Spei.*" (*Scafusii*, 1686) but it contains very little about plants. Of the same station in life as Oldenland was Johann Andreas Auge, born at Stollberg in 1711. Being passionately fond of plants, he proceeded to Holland for improvement in his profession as gardener. Here he was noticed and encouraged by Boerhaave, and acquired a scientific knowledge of plants not then usual in men of his class. Seeing the specimens which Oldenland had sent home, he determined to go to the Cape, and arrived there in 1747, with recommendations from his patron. The Governor, Swellengrebel, forthwith employed him in the Company's garden, and ere long the succeeding Governor, bluff Ryk van Tulbagh, with whom he was a favourite, made him superintendent. His master, sharing the general passion for natural history, sent him on many journeys to distant parts of the country in search of plants, and Auge used his utmost diligence to bring into cultivation every rare and curious African species and thus raise the Company's Tuin above its original cabbage growing into something like a Botanic Garden. Some of the finest specimen trees still existing are due to Auge's assiduous labours. He also collected together a large herbarium, which ultimately fell into the hands of Burmann, of Amsterdam, who used it in his public praelections. Other sets of exsiccata of smaller extent appear to have been prepared by him for sale or gift to distinguished visitors touching at the Cape on the homeward voyage. Amongst these was one Michael Grubb, a China merchant, who took home to his native Sweden a parcel of Auge's plants, and gave them to Petrus Jonas Bergius, of Stockholm, for description. In due time Bergius's opuscule appeared, under the title "*Descriptiones Plantarum ex Capite Bonæ Spei,*" (*Holmiæ*, 1767), and is, in truth, the first *Florula Capensis*, and, so far as it goes, a very meritorious performance. But, alas, in the preface, there is much fulsome laudation of the "*Vir generosus nobilissimus atque æstumatissimus,*"—there is a plant called *Grubbia* in his honour—but not one syllable about the collector, Auge. Really, though it is a matter of a hundred and twenty years ago, it is this day a pleasure to return to Auge the honour that is due, and to drag up the perfidious Michael Grubb for scarification. In 1761 he was sent to accompany an expedition under Commandant Hopp to the Namaqua territory, and returned with a large harvest of plants. Eleven years afterwards he became the companion and guide of Thunberg and Francis Masson in their collecting excursions, and made the acquaintance of the traveller Sparrman. His sight began to fail, and he was allowed to retire upon a small pension to the farm of an old friend living on the Gamtoos River. Here, at the age of seventy years, he became totally blind, and in 1795, when the English took possession of the Cape, he lost his pension. Yet did his worthy friend not the less care for the old man. At this time the marauding bands of the Kafirs were beginning to make descents upon the Eastern fron-

tier, and the farm at which Auge was living was attacked in the night, and the inhabitants compelled to leave everything and fly for their lives. The blind old man, however, was not forgotten. Half led, half carried, he was got away, and lodged in the care of the benevolent Landdrost of Swellendam, who forthwith accepted the charge of this old friend of his father's without a thought of repayment.

Thus far I have condensed the account given by Lichtenstein. What follows is so naïf and pleasantly told that I must endeavour to translate the author's narrative in full:—"The old man having been told we were coming to see him, had found his way to the front of his cottage, and made polite excuses for his blindness and inability to wait upon us. He was tall, still fairly upright, and his snow-white hair hung about his shoulders. The sight of a blind person always moves my compassion; here dignified old age excited respect, which, to me, was blended with reverence for one of the most skilful of botanists. He gave me a brief and connected account of the hardships he had so lately undergone, but dwelt on them far less than on the kindness he had received from his present benefactor. He told us that his health was so good that he did not anticipate death as very near, and feared that he should for a long time be a burden to his kind friend. He was grieved at the loss of his pension, since that would have made him a less heavy charge to the good Landdrost. I afterwards learnt that this excellent man had abstained from applying to the Government for the renewal of Auge's pension purely out of delicacy towards the old man, who might have thought his patron grudged any part of the money expended on him. Subsequently a mere recital of this part of my interview was sufficient to obtain from the Governor the restoration of the pension with a small addition, and thus my visit was at least so far advantageous that it rendered the evening of the old man's life a little more easy and unclouded. It was evident he still kept all his old enthusiasm for his favourite science, and I was astonished to find his memory of the names of plants so good. He was delighted to hear that I too was a collector of plants, and told me of many which were to be found in the Duyvelsbosch. He called them, however, by the older names used by Burmann. He had almost entirely lost his native language, and conversed in the Dutch *patois* of the colonists. He enquired anxiously about the garden at Cape Town, asking whether this and that tree planted by himself were growing well, with the same concern as if he had been asking about the friends of his youth. 'Is my *Heliconia alba* alive? Is my *Corallodendron* as fine as ever?' (7) I could answer in the affirmative, and he begged me to describe them to him, how tall had they grown, and how thick were they, adding that he should die the happier if he could but *feel* them once more. I had the pleasure of being the first to tell him that Thunberg, in order that future botanists should have a lasting memorial of his services, had named a plant '*Augea capensis*' in his honour. The old man was almost angry that I could not at the moment remember to what class it belonged, for he sadly wished to know if it was one with which he was acquainted. I went with him into his room, where everything was very clean and in the nicest order, in charge of an old black slave,

(7) Meaning *Strelitzia augusta, Thb.* and *Erythrina, Thb.* It is satisfactory to be able to add that both are alive and well in 1886.

whom the Landdrost had allotted to him as a servant. He lamented anew the loss of his collection of dried plants, and cursed the Kafir marauders because they had deprived him of the pleasure of interesting me therewith. I was, he said, the first botanist he had seen for many years, and if he could have the same pleasure once a year, life would seem much less tedious to him, for his only recreation was walking out several times a day, supported by the arm of his black attendant. I stayed more than an hour with him, and was really affected on parting with this venerable old man."

Thus far Lichtenstein. I should not have ventured to transcribe so long a passage, for all its kindly *bonhommie*, were it not that, despite Thunberg's wish to commemorate the good old Auge for all time by his *Augea*, Dr. Harvey had absolutely forgotten him, and, under that genus, writes: "Name unexplained by Thunberg." Well, since it is question whether Cheops or Cephrenes was architect of either pyramid that bears his name, it is small wonder that this curious succulent annual of the Karroo should have failed to give Lichtenstein's aged acquaintance the little immortality that rewards botanists. (8)

I think it will be evident how from about the year 1640 to 1770 a continual exodus of Cape plants was taking place, for the most part through the public spirit of the leading citizens of Amsterdam and Leiden, who were anxious to enrich their own and the public gardens of their native cities, and by perpetual solicitations kept the Dutch Governors of the Cape settlement interested in their horticultural work. (9) But we now come to the period of the great collectors, who may be said to have over-run and conquered South Africa for science. The first of these is Carl Pehr Thunberg, a man truly worthy to be called the Father of Cape Botany. He was born at Jönköping, in Sweden, November 11th, 1743. His father Johan Thunberg, was a merchant of that place, and, dying before his son had attained man's estate, his widow married his partner in the firm, Gabriel Forsberg. After the usual course of education at the grammar-school of his native place, the young Thunberg entered the University of Upsala in 1761. This seat of learning was beginning to acquire renown by reason of the botanical teaching of the illustrious Linnæus, who, through evil report and good report, was rapidly bringing into general use his celebrated sexual system of classification, and reforming the cumbrous descriptive botanical nomenclature of the day. When a new doctrine is vehemently opposed it is certain to find equally vehement partisans. Linnæus soon gathered round himself a band of zealous pupils, glorying in the renown of their master, and eager to bring to his feet the spoils of countries yet unexplored. He himself urged them to foreign travel. Forskäl went to Syria and Arabia, Hasselquist to Egypt, Osbeck to China, Pontin to Malabar, not to mention many others who explored the less visited parts of Europe. Thunberg, having gained a small University scholarship, was advised by Linnæus to go and study among the rich collections in Holland. In 1770 he left Upsala for

(8) See Harvey and Sonder, Flora Capensis, vol. i. p. 755. To avoid misconception, it is as well to say that though the order in which this plant is placed was elaborated by Sonder, yet the remarks under the orders and genera where the quoted words occur, were written by Dr. Harvey.

(9) "Cumque a longo abhinc tempore novæ raræque in ipsis Promontorii locis collectæ plantæ *beneficio Gubernatorum* tam per ramulos quam per semina et bulbos afferantur."—N. L. Burmann, Flora Indica.

Copenhagen, passing thence to Paris by way of Holland. Returning to Amsterdam, he was received with much kindness by the two Burmanns, father and son, as a favourite pupil of the great Swedish botanist. It will be remembered that both these men were deeply interested in the wonderful Cape flora, and had brought out several volumes of plates illustrating its more remarkable plants; but the younger Burmann, who had just completed his Flora Indica, desired new material for further work, and advised Thunberg to explore the Dutch East Indies. This, however, was impossible with the slender means at Thunberg's disposal. Ultimately he accepted the not very dignified post of assistant ship's surgeon on board an East Indiaman bound for the Cape. He reached the settlement in April, 1772. His sojourn at the Cape lasted for nearly three years, and of his indefatigable industry during that period we may judge by the fact that his *Flora Capensis* based upon his own collections, enumerates no less than three thousand one hundred species. Nor had he any assistance. Letters of recommendation addressed to Governor Ryk van Tulbagh and Rheede van Oudtshoorn had been obtained for him, but he found the former had long ago deceased, and the latter expired shortly after his arrival. In his preface, referring to his straitened circumstances and hard life at the Cape, there is a touch of real pathos. He says: "Let the following pages show what augmentation I, with my best endeavours and slender resources, have been able to make to this most beautiful and rich flora. It was my chance to find not a few new plants throughout those three years, but I could have done much more if I had been better supported by the aid promised me. I know not how it came to be my ill-luck that nearly always did I find my efforts frustrated, and myself kept down and repressed by penury. Without a blush I frankly confess that there never travelled a poorer lover of flowers than I, yet never one more ardent." The painstaking completeness of Thunberg's researches is significantly shown by the fact that not a few remarkable plants found and described by him a century ago escaped the researches of both Ecklon and Zeyher, who beat over the ground for thirty years, and of Dregè, who completes the lynx-eyed trio of collectors. Only now when railways and good roads have everywhere made things easy, are we smaller men beginning in our turn to pick up these once found rarities. Such are *Kleinia acaulis, DC*, recovered by my friend and pupil Mr. Robt. Reid and myself, *Palmstruckia Capensis, Sond*, refound by Mr. H. Bolus, in Namaqualand, *Chamira corenta, Thb., Eriosphœra Ocalus-Cati, Thb.* Turning over the pages of his Flora, it is easy to see the extent of country he traversed. From the city northward along the Drakensteen, past Piquetberg, the Winterhoek, the Bokkeveld, to the Olifants River, westward by the Zwartberg, past Swellendam, the Houtniquas, as names then went, over the Karroo to the Gamtoos, the Sundays and Visch River. And this wonderful collecting tour was completed, if I rightly construe his Latin, without even the poor assistance of his bursary. *Destitutus omni exoptato per biennium subsidio*, are his words. Truly we have here one of the martyrs of science.

Thunberg makes brief mention of several travellers who collected more or less about the time of his sojourn at the Cape. Andreas Sparrmann made what he characterises as *insignem collectionem* upon the Cape peninsula, but was tempted away to join the two Forsters, father and son, who touched at the Cape on Captain Cook's second

voyage (1772). On the return of the expedition in 1775-6, Sparrmann resumed his Cape collecting, and made an extensive tour in the interior, when, to quote Thunberg again, "*ingens herbarium Capense reportavit.*" Sonnerat also, under Thunberg's guidance, made the usual flying reconnaissance of Table Mountain during the few weeks of his vessel's stay in the harbour. Lady Anne Monson, similarly directed by Thunberg and Masson, improved the shining hours of a similar break in her voyage to India. Our author, however, with unconscious irony, speaks of her collections in somewhat depreciatory terms. "*Curiosa varia congessit,*" that is, they were ladies' specimens. Lieutenant Paterson undertook an extensive journey into Namaqualand, and is said to have sent to England many of the curious succulents of that part of the country.

In March, 1775, Thunberg left the Cape for Java, and there fortune, who had hitherto proved an unkind stepmother, seemed to change. He was promoted to a full naval surgeoncy, and was ordered to the Dutch settlement in Japan. By August in the same year he was settled at Nagasaki, and being acting physician to the Dutch Legation, which annually proceeded with presents to Jeddo, he had the opportunity of passing through a country at that time jealously closed to foreigners. Well knowing the difficulty thrown hitherto in the way of further explorations in any but the immediate neighbourhood of the Dutch factory, he made vast collections in every kind, and transmitted them to his teacher and friend Linnæus. After a stay of sixteen months he returned to Java, visited the neighbouring islands, collecting with unabated enthusiasm, and then, before the close of the year, passed over to Ceylon. In April, 1778, he sailed for the Cape of Good Hope, whether intending to return thence to Europe does not clearly appear. He found a surprise awaiting him. His indefatigable zeal for science had raised up friends and brought him fame. Letters were placed in his hands appointing him Demonstrator in Botany to the Royal Academy at Upsal, and conferring on him membership in four learned societies. He returned to Holland, thence visited England, being well received by Sir Joseph Banks, Dr. Solander, Dryander, and the Aitons at Kew. Finally, he reached his native land, March, 1779, after an absence of nine years, and began his academic duties at Upsal.

Linnæus the younger, who had followed in his father's footsteps, *passibus haud æquis*, died in 1783, and Thunberg was selected to fill the vacant chair of Botany. It was just then that the widow of the elder Linnæus had made that famous bargain with the young English botanist, Sir James Edward Smith, whereby she sold the unique and priceless herbarium of her deceased husband for shipment to England. In vain the Swedish Government sent a swift corvette in chase of the vessel in which it had been consigned, charged to capture the treasure at all risks. It was lost to Sweden, and Thunberg, to fill the void, offered his own very rich herbarium to the University. Life now seemed to go easily with him. He remained at Upsal, teaching daily and supervising the University Botanic Garden for many years, secure in the respect and esteem of the little world of Upsala, and the honour of scientific men everywhere. Many curious traits of his somewhat eccentric habits have been noted. He could not be persuaded to alter in any way the fashion of his attire so as to follow the custom of the day. He would on no account omit

his daily lecture even when in his eightieth year, but would daily drive in from his country house at Tunaberg in a very old carriage as ancient as the fashion of his clothes, celebrated, as the students jocosely said, *vetustate magis quam venustate*, and which they nicknamed "Skällerormen," the rattle-trap. It was not till his eighty-fourth year that he passed over his duty as lecturer to his step-son Forsberg, reserving still to himself the curatorship of the Museum. In the summer of 1828, when suffering from a slight feverish attack, he felt his end was at hand. Ordering himself to be placed in a carriage, he was gently driven over to Upsal, and round all his favourite walks in the Botanic Garden, taking his farewell view of the objects which had been so dear to him throughout a long life. He expired a few days after his return home, August 8th, 1828, at the advanced age of eighty-five. He was buried at Upsal amid an immense following of students and citizens of every degree.

It is to be regretted that Thunberg did not early concentrate his great abilities upon the digest of his results. He published four volumes of travels in 1788-93, which were speedily translated into German, English, and French. But with his Cape collections he procrastinated, issuing at first merely a small Prodromus of two parts, in 1794-1800. This was little more than a descriptive catalogue of the briefest kind. His *Flora* proceeded very slowly. Two parts of the first volume appeared at Upsal between 1807 and 1813. Of the second volume only one part came out in 1818. The whole work was ultimately edited from the author's manuscript in 1823 by Dr. J. A. Schultes, at Stuttgardt. Instead of in good time producing a work worthy of his fame, while yet men were mindful of his scientific zeal, Thunberg frittered away his immense store of observation in a multitude of Academic Dissertations, two hundred and ninety-three in number, and many of them bearing on the title page the names of his pupils, as whose *orationes doctæ* they seem to have appeared. Although one of his panegyrists says *sciant posteri nostrum, a quæstú omni et lucro alienum, partes præsidii gratis suscepisse*—it had been as well if his dissertations had been prefaced by his own name, instead of that of some juvenile sophomore. There would then have been no need to assure us that the real author was a *quæstu et lucro alienum*. Nevertheless, as long as in our paradise of flowers there wanders a single botanist, so long will the name of Thunberg be held in honoured remembrance.

I have mentioned the name of Masson [10] as a comrade of Thunberg's. Francis Masson was a native of Aberdeen, born in 1741. Having commenced life as a gardener, he proceeded to London in hope of advancement and further knowledge of his profession. He obtained employment at the Royal Gardens at Kew, not then a national institution as at present, but a private royal domain, the pleasure garden of "Farmer George" and his wife Charlotte. The elder Aiton was the superintendent. Sir Joseph Banks, returning from the East Indies, had made the usual short stoppage at the Cape, and had seen for himself the extraordinary variety and richness of the Cape flora. He, therefore, took an early opportunity of urging upon the King the advantage which might accrue from sending out a

[10] For most of the detail of Masson's life I am indebted to the full and appreciative sketch of his work by Mr. James Britton, F.L.S., in *Journal of Botany*, 1884, pp. 114-123

smart under-gardener to the Cape to collect seeds, and send home living plants. The scheme was favourably received, and in 1772 Masson was selected for the work, and left England for the Cape. Here he remained two years and a half, collecting as usual in the environs of the Cape Peninsula, and making excursions into the up-country, three of which journeys were of considerable extent. His guide on the first of these was a Swedish soldier named Oldenburg, formerly in the Dutch East India Company's service, and who had been a humble companion and assistant to Thunberg in his botanical travels. Oldenburg had learnt something of the *artes botanicæ* from Thunberg, and had collected plants probably for sale. A collection of one thousand of these, purchased by Sir Joseph Banks, is preserved in the British Museum. Subsequently, in September, 1773, and again in 1774, at the same season of the year, Masson accompanied Thunberg on excursions lasting in each case about four months. Towards the north the travellers penetrated no further than the Olifant's River, and eastwards as far as the Zwartkops and Visch River. Masson's collection of living plants and seeds seems to have given much satisfaction to his patrons, for Sir Joseph Banks, in a memorandum addressed to the King, ascribes the superiority of the Royal garden, which had by degrees, under Aiton's management, eclipsed those of the continent, in great part to the labours of Masson. In those days the number of species cultivated was a large element in the value of a collection, and hence travellers, fortunately for systematic botany, did not hesitate to send home for culture plants of homely aspect and little horticultural beauty. Thus the earlier volumes of the Botanical Magazine (11) contain many Cape plants of Masson's sending, which have since dropped completely out of cultivation, and are not likely to attain that dignity again. They are sufficiently represented by herbarium specimens. Masson did not neglect this mode of collecting. His exsiccata seem all to have been sent to Aiton, the Garden Superintendent at Kew, and Aiton, more a gardener than a systematic botanist, transferred the greater portion of them to the botanical department of the British Museum, where they are now preserved.

After a short stay in England, Masson again solicited employment abroad, and, at the instance of the same patrons, was sent to the West India Islands, *viâ* Madeira, Teneriffe, and the Azores, with the view of ultimately reaching Central America. The breaking out of a war with Spain, however, prevented his accomplishing more than a part of the plan sketched out. In 1782 he returned to England, and next year started on a collecting mission to Portugal. He crossed the Straits and botanised about Tangier. In 1785 he revisited Madeira, and thence returned to England. Still untired, he obtained permission at the close of the same year to revisit the Cape, and landed there for the second time, January 21, 1786. The Dutch Government were at that time jealous of the intrusion of foreigners into the interior, and had been particularly annoyed at the proceedings of the English traveller Paterson. Masson, however, had received strict injunctions not to travel and explore, and on this account found the less difficulty in obtaining permission to

(11) The first 20 volumes of this work contain 775 plates, nearly one-third of which represent Cape species.

remain in the Colony. Sir Joseph Banks lost no opportunity of keeping Masson to his subordinate *rôle* of gardener and plant-collector, and had no intention of letting him play the part of an exploring traveller. The following curious passage in his correspondence is to the point:—"The plants you have sent home have succeeded so much better than any you sent when you was last at the Cape that we have every reason to praise your industry, and to see the propriety of a search near the place of your residence, in preference to expensive journeys up the country, which seldom produce an adequate return in really ripe seeds. I hope that before this time you have taken up your head-quarters, as I directed, at False Bay. The most rare plants to be met with in European herbariums are from that place, and you know that one rare described plant is worth two non-descripts."

Botanists now-a-days are not of Sir Joseph Banks' opinion. With them the non-descripts are precisely the objects of special search, and a botanical collector who should contentedly become a fixture on the shores of False Bay, would speedily hear from his employers something to his disadvantage.

Masson's second residence at the Cape was prolonged to nearly ten years. The records of Aiton's Hortus Kewensis show a regular inflow of new plants from the Cape. Ultimately, in 1795, on the imminent probability of war, he returned with his collections to England, having had sharp experience during his West Indian trip how little count is taken of scientific materials amid the exigencies of military service. One of his first occupations was the publication of a fine series of coloured plates of Stapeliæ, one of the most curious genera of South African plants. It may be noted, in testimony of the zeal and industry of this remarkable man, that despite the extent to which the Colony has been travelled over by observant botanists since his time, and to which railway transit has rendered accessible the carroid habitats of these plants, there are still species figured by Masson which have never been found since his time. Sir Henry Barkly took an interest in Stapelias, and in his many journeys never failed to ask after them wherever the conditions seemed suitable for their growth. But the zealous endeavours of Civil Commissioners and District Surgeons, anxious to humour what they deemed a whim of His Excellency, did not succeed in re-discovering more than a portion of Masson's findings. It is scarcely to be inferred from the wording of the preface to his work that Masson claimed to be himself the artist who made these very fair figures of Stapeliæ. He says:—"In my various journeys through the deserts I have collected about forty, and these I humbly present to the lovers of botany. The figures were drawn in their native climate, and though they have little to boast of in point of art, they probably exhibit the natural appearance of the plants they represent better than figures made from subjects growing in exotic houses can do." According to a notice in the *Journal of Science and Art.* iv, 199 (1818), he is said to have found among the Dutch troops at the Cape a soldier possessed of great skill in drawing, and by this man's aid to have formed a considerable portfolio of coloured drawings of objects which he deemed scarcely capable of transfer to Europe." These sketches, identified by MS. memoranda in Sir Joseph Banks' handwriting are preserved in the Herbarium Library of the British Museum. It is not unlikely that this soldier artist was the beforementioned D. Oldenburg, of whom

Thunberg, in his preface to the Flora Capensis, says that he went in 1774 to Madagascar, where he died of fever. Masson dedicated his work to his royal patron, and in the preface adds :—"Still enjoying, though in the afternoon of life, a reasonable share of health and vigour, I am now ready to proceed to any part of the globe to which your Majesty's commands shall direct me." This roving propensity, unsatisfied after twenty-three years of wandering, was again gratified. Under advice of Aiton, he was sent to North America, arriving at New York in 1797. The records of his transatlantic sojourn are but scanty. He collected in the district of the Great Lakes, finally settling in Montreal, whence his correspondence with Sir Joseph Banks continued. At this place he died, December, 1805, at the age of sixty-four.

As was only fitting, Masson's name is commemorated in a curious endemic Cape genus of Liliaceæ, whose fragrant hyacinthoid flowers, rising in a sessile cluster from the crevice between two broad prostrate leaves, attract the dullest eye by their very singularity. These are *Massoniæ*.

To keep this paper at all within the limits of an evening reading I must omit reference to the labours of Lichtenstein, Carmichael, the celebrated Burchell, perhaps the most painstaking and accurate of botanical travellers, and Adalbert von Chamisso, better known as the author of that delightful little extravaganza, "The Shadowless Man," than as a laborious botanist. Two of these have placed their story themselves before the public in works that have become classic, and are therefore well known to general readers. It is not so with humbler men in a lower rank of life. I therefore pass on to some of these, and now for the first time am dealing with matters within the recollection of our oldest inhabitants.

Two years after Burchell left the Cape, arrived James Bowie, in a capacity similar to that of Masson, whose successor he may fairly be considered.

Bowie ([12]) was the son of a London seedsman, carrying on business in a humble way at the west end of what is now Oxford-street. He entered the service of the Royal private establishment at Kew in 1810, and after four years' work was detached on collecting service with Allan Cunningham, afterwards well known as a discoverer of new Australian plants. They first went to Rio, and remained travelling and collecting in Brazil until 1817. Cunningham was then ordered to New South Wales and Bowie to the Cape of Good Hope. Bowie remained here till 1822, collecting and cultivating sufficiently for export to Kew a large number of bulbous and succulent plants, forwarding seeds, and otherwise fulfilling the duties of collector. He states in one of his letters (November, 1826) that almost every Cape plant figured since 1817 was sent home by himself. This is far from being the case, but still his industry contributed largely to the greenhouse collections of Cape plants then in high fashion. One of the most notable of those he sent home was *Imantophyllum Aitoni, Hook*, the beautiful Cyrtanthoid Amaryllid, well known to Grahamstown cultivators from its station in the Howison's Poort valley. Bowie, however, for prudential trade reasons, reported it from "Orange River." In 1822 the Parliamentary vote for the corps of collectors

([12]) Compare a sketch of Bowie's life in *Gardeners' Chronicle*, October 29, 1881.

for the Royal Gardens being reduced, Bowie was recalled, and spent some time at Kew, unattached, but engaged in arranging such dried plants as he had accumulated. He seems to have become incapable of regular horticultural work, and though several of his patrons did what they could for him, his want of application and business aptitude prevented his thriving. His great pleasure was to spend his time among the free and easy company of bar-parlours, recounting apocryphal stories of his Brazilian and Cape travels, largely illustrated with big snake and wildebeest adventures. In April, 1827, he returned to the Cape, with the intention of dealing in objects of natural history, especially Cape bulbs. As Villette had just sold off the greater part of his zoological collections, and was giving up his establishment at the corner of Wale-street and Long-street, Bowie hoped to take over the chief part of this export trade. His temper and want of perseverance and tact prevented his making anything out of the opportunity. He writes in a very dissatified strain of his prospects: "There is not a snob, a tinker, or tailor, or any other ignorant ass here but is dealing in cats, dogs, and monkeys, and by the opposition to each other, and re-selling of specimens, the prices are raised far beyond their value, considering risk of sea voyage. There is even an officer of the army who has sometimes forty soldiers told off at a time to collect for him." Again, he falls upon the historic Fathers of the Eastern Province with characteristic bitterness: "I find Cape Town much the same, but so many of the rascally settlers in it that I have no inducement to join in chance company. Those wretches are ashamed of their Radicalism, and swear through the world that they are pure, independent, respectable Englishmen." His hopes of finding employment as the manager of a botanic garden, then much talked of, but not started till some years subsequently, were disappointed, and he seems by all accounts to have led an aimless, irregular life, often in great poverty, always complaining of ill-treatments, lack of patronage and appreciation. It was his wont to boast largely of his services to science, forgetting that all he had done was to fetch and carry for pay. The vainglorious character of the man is well illustrated by the volumes of pen-and-ink tracings of the plants in the *Botanical Magazine*, which he used to exhibit as original sketches of plants discovered by him. Towards the close of a wasted life he was, more as a matter of charitable commiseration than for any personal usefulness, employed as gardener by Mr. R. H. Arderne, of Claremont, in whose nominal service he died 30th June, 1869.

Dr. A. H. Haworth coupled this collector's name with a series of plants originally forming part of the genus *Aloe*, but subsequent writers, deeming the grounds of separation insufficient, the name *Bowica* was dropped. Dr. W. H. Harvey, who, as a resident of the Cape, had some knowledge of Bowie, resuscitated the name in a monotypic Eastern liliaceous genus. *Bowiea volubilis, Harv.* is figured in the *Botanical Magazine*, tab. 5619; it was not, however, discovered by the collecter whose name it bears, but by Mr. Henry Hutton, in the neighbourhood of the old Katberg convict station, and has since been gathered in many other places, particularly in Kafirland.

Christian Frederick Ecklon was born at Apenrade, in Schleswig-Holstein, December 17, 1795. Dr. Neuber, a physician of some note at Kiel, and a fair botanist, assisted him in his studies, and encouraged him to qualify himself as an apothecary. He had thus

opportunities of getting a good knowledge of plants, and applied himself steadily to the botany of his own neighbourhood. With a view of making himself acquainted with something beyond the flora of Europe he proceeded in October, 1823, to the Cape as an assistant apothecary to Polemann, in Strand-street, a dilettante botanist, the companion of Burchell's rambles about the Cape Peninsula. He remained in this employment for four years, employing all his leisure in exploring the flora of Table Mountain and the vicinity of Cape Town. His enthusiasm carried him so far as to cause him to give up his situation and rely for support upon the precarious sale of collections of objects of natural history, especially botanical specimens. In 1827 he sent to Europe a large mass of collected material, to be made up into sets and sold to the subscribers to the Unio Itineraria, a kind of botanical exchange club, managed at Esslingen by Drs. Hochstetter and Steudel. Next year he sailed for Europe with a further supply of exsiccata, and these, like the former ones, were mostly distributed by the Unio. Both these collections are readily recognisable by their small printed tickets, the earlier set having the letters UJ (Unio Itineraria) upon them. The directors of the Unio published for Ecklon a topographic catalogue of the Liliaceæ and Irideæ, and apparently intended to issue further lists, for this little opuscule is described as "1ster Lieferung." In the preface the author acknowledges his obligations to Advocate Joubert, who allowed him to use a portion of his garden, near Platteklip (now occupied by Mr. Galloway), as a nursery for the bulbous plants which he brought in from the country. A plan of this earliest of Cape Botanical Gardens is appended to the tract. Many excellent botanists set themselves to study out the rich material supplied by Ecklon. Among these were Nees ab Esenbeck, Bartling, Lessing, and Schlechtendahl, whose memoirs appeared in the seventh and successive volumes of the Linnæa. Professor Hornemann, of Copenhagen, Dr. Reinhardt, and Dr. Nolte interested themselves in Ecklon's favour, and by their means a small pension was granted to him by the King of Denmark. With this encouragement, and with the patronage of the Unio assured, he returned to the Cape about 1829, and again commenced collecting with fresh energy, going over the Cape Peninsula and the neighbouring districts, and even venturing upon what was then a somewhat risky journey into the so-called "Ceded Territory." It was at this period that he formed a botanical partnership with Karl Zeyher, to unite their collections and correlate their mutual herborising excursions, so as to cover more ground. Under this agreement Zeyher went alone to Clanwilliam, the Olifants River, and the Cedarbergen. From these mountains he started for Namaqualand and the Khamiesberg, pushing on to the valley of the Orange River. In returning homewards he suffered much from want of water, and lost many of his travelling oxen. Among the rare plants brought back were *Hydnora* and *Cedon Reyeni*, not gathered since Thunberg's time.

While Zeyher was thus employed, Ecklon had gone by sea to Algoa Bay, and botanised over the districts of Uitenhage, Albany, and what was then known as Kafirland, as far as the Winterhoek. Returning to Cape Town, *via* Port Elizabeth, he commenced ordinating his spoils, making also occasional excursions, in one of which he fell in with his partner Zeyher, returning from his luckless expedition to Namaqualand. In company they ascended the Tulbagh Winterhoek, finding

many remarkable mountain plants, Proteaceæ and Orchids. On regaining Cape Town they commenced preparations for their great expedition to the Eastern Frontier, which lasted nearly two years. Their route was as follows:—From Cape Town, over the Hottentot Holland Mountains, by Houwhoek to Caledon, thence to Cape Agulhas and on to Swellendam. From Swellendam they passed through Kogman's Kloof over the Karroo to Gouritz River, near which they encamped some time collecting, the peculiar Karroo flora. Skirting the line of the Zwartberg, they turned off to visit George and Knysna, and then proceeded up the Langkloof to Uitenhage and Algoa Bay, where they shipped their wagon-load of collections for Cape Town. They then started through the Albany and Somerset districts, and, turning eastwards, reached the Koonap and Kat River. They explored the Katberg and Chumiberg above Balfour and Philipton. The furthest point attained seems to have been the Kei River, some way south-east of the site afterwards occupied by Queenstown, in "Tambookieland," as it was then called.

On their return, Ecklon arranged to go to Hamburg in 1832 to dispose of their joint collections, and with the ambition of producing a descriptive catalogue of the Cape flora. Out of the mass of duplicate specimens five herbaria were assorted, the largest of which contained 3,000 species, priced at fifty shillings per centuria; the next 2,000 species at forty shillings, and so on to the fifth, of 500 species at twenty-five shillings the hundred. While this work was going on, Ecklon was preparing his *Enumeratio Plantarum Africæ Australis Extratropicæ*. Only four fasciculi appeared, dated 1835—1837, and comprising about 400 pages. There is but little botanical sagacity displayed in this fragment, which evinces tokens of great haste, owing perhaps to the knowledge that Dr. Ernest Meyer, of Konigsberg, was preparing for publication his Commentaries upon Drege's plants, collected between the years 1829 and 1834. There is throughout a tendency to rely on external *facies* for grouping plants together, instead of working out less obvious but more reliable characters, and to multiply species unduly. Walpers, in his *Animadversiones Criticæ* speaks of Ecklon's *dira cupido generum specierumque novorum construendorum*, though he stoutly vindicated the priority of this publication over Meyer's Commentaries. The University of Kiel recognised the value of his laborious researches by granting him the honorary degree of Doctor of Philosophy. But the further publication of the *Enumeratio* and Ecklon's stay in Hamburg, were cut short by the loss of the whole remaining collection of plants, constituting his sole possession, and which he was on the eve of advantageously selling. This occurred through a fire which destroyed the warehouse in which they were deposited.† From Dr. W. Sonder, Ecklon received such pecuniary assistance as enabled him to return to the Cape, where he proposed to recommence his labours. But the spring of his former enthusiasm was broken, his health suffered, and occasional mental troubles supervened. He still collected a little in an irregular way, acted as botanical guide to chance visitors interested in the Cape Flora, and made up for sale sets of the bulbs obtainable

† This statement rests upon information given by several old acquaintances of Ecklon in Cape Town. Dr. Seemann, in his notice of Ecklon and Zeyher. (*Bonplandia, Dec.* 15, 1857), does not mention the loss by fire, and gives 1838 as the date of Ecklon's return to the Cape.

within a short distance of Cape Town. He got together a collection of native remedies to be sent by the apothecary Scheuble, the successor of Polemann, to the Exhibition of 1851, and now and then prepared herbal medicines for old-fashioned folk who preferred *kruiden* to the remedies of the qualified practitioner. Dr. Wallich, the celebrated Indian botanist, saw him in 1843, in poor health and unable to accompany him on any lengthened excursions. In 1851 Dr. Berthold Seemann, then Naval Surgeon on HMS *Herald*, visited him, and found him in much the same enfeebled condition, declining to join the party from the ship in their ascent of Table Mountain. On this occasion Zeyher, R. Baur, ([13]) and C. F. Juritz were the guides. In 1863 Ecklon was living at Sea Point, occupying, I am informed, a small solitary house to the right of the road to Clifton, which, from the odd collections of native plants brought in by the tenant, was nicknamed "Botany Bay." Next year came the Prusso-Danish war for the possession of Schleswig-Holstein, ending in the cession of that province by the weaker belligerent. In the clean sweep made subsequently of all things Danish, Ecklon's pension was struck off, and the old man found himself, at sixty-nine years of age, deprived of the meagre pittance on which alone he had for the last twenty years contrived to exist. At this juncture a few friends, who had known him long, kindly clubbed together a little monthly subscription to keep him from actual want of food. He still crept about for a few years in the neighbourhood of the Kloof, the Lion's Mountain, and the Platteklip slopes, always bringing in a handful of poor little twigs and leaves, as if in memory of his old collecting days, or would sit for hours in the apothecaries' stores in town, childishly watching the compounding of the customers' medicines. The winter of 1868 was a severe one. Two medical men, who had always been kindly thoughtful of the old man's ailments, found him wretchedly ill and despondent, induced him to consent to be removed to the Somerset Hospital, and, as one of them phrased it, "physicked him with strong soup and good wine." He rallied a little, but never left the hospital, and died there, December, 1868, aged seventy-three.

The personal history of Karl Ludwig Philip Zeyher, the other partner in this botanical firm, is mixed up with that of Ecklon. He was born at Dillenberg, August 2nd, 1799, and was early placed in the service of his uncle, Johann Michael Zeyher, head gardener at the Grand Duke Karl Theodore of Baden's wonderful toy-garden at Schwetzingen, a place formed at vast cost, when fashion demanded that a garden should be filled with sham ruins, artificial waterfalls, shower bath temples and plaster statues. Thedor Hartweg, the celebrated botanical traveller, was the director. F. W. Sieber, a strange erratic genius, had, among other projects, attempted to form what he termed a *Reise Anstalt*, something like the *Unio Itineraria* of Hochstetter and Steudel, for the collection and distribution of objects of natural history of all kinds. He secured the services of Kohaut, Schmidt, Wrba, Dol-

([13]) Richard Leopold Baur, a worthy Moravian missionary at Shiloh, in the Queen's Town district, was born September 14, 1825, at Ebersdorf, in the principality of Reuss. He came in 1847 to the Cape, having qualified himself as an apothecary, and spent eight years in the Western Province, always ardently attached to botany. His most beautifully prepared specimens from the station founded by him at Eaziya, in Transkeian Kafirland, were sent in the first instance to me at Gill College, Somerset East, whence the rarer and undescribed species found their way to Kew. *Floreat semper!*

linger, Hilsenberg, Bojer, and Zeyher for his scheme of travel. Zeyher, in August, 1822, accompanied him on his voyage to Mauritius, and was either left behind to begin work at the Cape or proceeded thither after a few months' delay. ([14]) Early in 1824, Sieber returned from Australia by way of the Cape, and received from Zeyher all the collections he had made in the interim. These were to be disposed of in Europe and the proportion of the proceeds remitted to Zeyher, who remained at the Cape, still diligently collecting under the original agreement. Sieber, always hare-brained, seems to have treated his obligations towards his comrade very lightly. Certain it is that Zeyher never received anything for his work, and considered his engagement void. Collecting now on his own behalf, he sent consignments of plants to his uncle at Schwetzingen, but the sales effected were not large. About 1829 he joined Ecklon, as we have before seen, in systematic preparation of botanical specimens. After his partner's voyage to Europe, Zeyher went to Uitenhage, where he was for some time in the service of Mr. Joachim Brehm, whose fine garden was to that district very much what Baron Von Ludwig's was to Cape Town and its vicinity. I am told he made some small venture in market gardening also, but with scanty success. His collections, however, were considerable, and they were mainly sent for sale to London under the patronage of Sir W. J. Hooker. But while at Uitenhage he engaged, in November, 1840, to accompany James Burke, the zoological collector sent out by the Earl of Derby to obtain living animals for the private menagerie at Knowsley Park. His journal during this trip possesses considerable interest, and was published partly in Hooker's London Journal of Botany (1846), vol. v, pp. 109-134, 313-343, and the remainder, after an interval of nine years, in the Journal of Botany and Kew Garden Miscellany, vol. vii (1855), pp. 326-334, 362-370. This break in the continuity is not explained. I possess an off-print copy which belonged to Zeyher, and has some curious notes in his handwriting, showing that whatever credit was assumed by Burke, the lion's share of work, both manual and scientific, was done by his more modest companion. Ill luck followed him, tardily, but with certain step. He had spent much time in preparing an elaborate collection of Cape timber and other trees. Each species was represented by transverse, radial, and longitudinal sections, with dried specimens of the foliage, flower, and fruit. The series was so complete and properly appointed that it was quickly bespoken at a high price for the Berlin Museum. But this fruit of several years' solitary labour was to be snatched from him, just as previously had been his share in the joint herbaria burnt in the Hamburg disaster. The collection was duly shipped for Europe by Mr. C. F. Silberbauer, who had taken much interest in its preparation, and befriended Zeyher in many ways. In a week came news of the wreck of the vessel carrying this, his second great venture, and total loss of the consignment.

In 1843 he made a second trip to Namaqualand, and next year, gathering his collections together, went to London to arrange for their sale. He remained at Kew for about nine months, then visited his native place in Germany, and ultimately, in 1847, returned to Capetown.

([14]). There is a little discrepancy in the accounts here. Sieber says (Frühl. 23): "Wir schieden in Mauritius; Zeyher ging nach den Cap, ich nach Neuholland ab." There are several reasons for treating this statement as an error of memory.

That he still collected is evident from occasional notices of his plants being on sale in London. The last I have been able to find is the significant intimation given in the botanical journal last cited, to the effect that his sets are offered by Stevens, the natural history agent, at half the price originally fixed for them. This was in 1851. Evidently collecting of Cape plants, whether living or as exsiccata, was no longer remunerative. Public attention in horticultural circles was absorbed in the mania for tropical culture, especially of orchids. Many fine collections of Cape species, which had once been the pride of European gardens, died out slowly before the invasion of the hot-house and the watering-can. Under pressure of poverty Zeyher parted with his extensive typical herbarium to Dr. Pappe, in whose house in Loop-street he nevertheless used to work at it almost daily until he obtained regular employment in the Botanic Gardens, started at Cape Town in 1848 by Dr. Adamson, Dr. Pappe, Messrs. Arderne, Ross, Clarence, and others. But this garden was from the first supported by the Government in so inadequate a manner ([16]) that the projectors found themselves obliged, in February, 1850, to dismiss Zeyher, whose qualification was botanical knowledge rather than horticultural skill, and find an ordinary gardener who understood how to turn the place into a nursery, and make it pay for itself. Dr. Berthold Seemann, knowing little of the hard necessity of the case, was perhaps more witty than just when he wrote in reference to Zeyher, on his visit in 1851, that the committee had "passed a resolution that the Botanic Garden could do without a botanist." It is true, however, that the system has never been improved, and the Botanic Garden in Cape Town is to this day compelled to peddle roses and fuchsias and sixpenny-worths of seed to eke out its maintenance. On leaving the Garden, Zeyher recommenced collecting seeds and bulbs for shipment to Hamburg, growing the latter in a garden off John-street, belonging to Mr. Kinzlies, an old Wurtembergian, who gave him a lodging in his house. Subsequently he got employment as a gardener to a gentleman who had a place between the foot of the Devil's Peak and Rondebosch. Changes and removals once more threw him adrift. Dr. Pappe and some few other benevolent friends helped him from time to time, especially Mr. P. J. Kotze, who let him have a piece of ground and a cottage on the estate Leeuwenhof, where he thought he could make a living by growing vegetables. He continued to collect a little, both alone and in company with Werner, a German gardener, who afterwards was lost on Table Mountain, and whose remains were never found. In December, 1868, small-pox was rife in Capetown. Zeyher's patron wisely vaccinated his whole household, but on urging the old man to take this precaution, he declined, pointing to his slightly pitted face, and saying that, as he had had the disease in Germany in his youth, he was proof against it now. Only three days after he became very unwell. Ecklon came up to see him, and prescribed some herbal drink. Next day the patient grew worse, and Dr. Flack, whom Mr. Watermeyer sent up to visit him, pronounced the case hopeless. He died the next morning, and was buried in the Episcopalian Cemetery in Somerset-road. Zeyher

([16]) The Government at first promised to support the Gardens on the pound for pound principle, but when the projectors and public subscribed £875 they backed out of their side of the bargain. *Vide* "Minutes of the Botanic Garden Commissioners, Dec. 3, 1851.

was Ecklon's junior by four years, and was little more than fifty-nine years old at his death. Ecklon survived his old comrade exactly ten years, scarcely, however, as we have seen, to be deemed happier in the longer space of life accorded to him.

To my old and valued friend, the Rev. L. R. Baur, I owe much of the detail here given. He writes: "I was great friends with Mr. Zeyher, and he was a most entertaining companion, recounting his adventures in different parts of South Africa, having been a keen hunter and an excellent shot. In the Addo Bush he was fortunate enough to kill an elephant with a single bullet, and once finished off with his dagger only, a tiger (panther), which his dogs had brought to bay. But he told these things in a simple, matter-of-fact way, without a trace of bragging. I well remember the tramp up Table Mountain with him and young Juritz as guides to Dr. Seemann. It was just as Juritz relates, the Doctor's shoes were thin and light, and he had worn the soles through, and was quite lame before we got home again. I had no near acquaintance with Ecklon, who then lived in a very reserved way in Hout or Castle-street. Dr. Pappe and he were not very intimate either—perhaps there was some estrangement—who knows?"

Partly contemporary with Ecklon and Zeyher, and sharing with them the botanical *spolia opima* of South Africa was Johann Francis Drége, a native of Altona. He arrived here in 1826, and collected with much greater system and scientific insight than had been done before by any one, Burchell excepted. Indeed, I have often surmised that as Burchell's two volumes of travels, with their excellent aquatint illustrations, careful itinerary, and accurate map, were published in 1822-4, Drége must have perused them, and taken the author as his model in his laboriously compiled *Documente* ([17]), giving the details of localities and altitudes, and a species list, with references back to the habitats, all strikingly parallel to Burchell's *Catalogus Geographicus*. In one respect he went beyond the elder traveller, for he was the first to attempt the grouping of the South African flora into geographical regions. Considering the data at his command, this work rises almost to an effort of genius, although it has hardly received the recognition it fairly merits. I am happy to think that it has been possible for a member of our own society ([18]) to take up this imperfect work of Drége's, and, assimilating the large amount of new data which the last fifty years have afforded, to rebuild the whole into a simpler and more coherent structure. After sweeping off an ample harvest from the south-west corner of the Colony, he spent eight months in investigating the flora of the Great Karroo, the Nieuweveldt, Winterveldt, the Gouph and Camdeboo. Returning, he fixed his residence at the Paarl, and made that point his centre for the excursions of the next two years. His next important journey in 1829 led him along the Zwartberg, eastwards to the Sunday's River in its upper course, through the Zwartruggens, thence northwards, past Graaff-Reinet to the Sneeuweberg, thence south-east along the Great Fish River Valley to Albany, finally back to the Cape by way of

([17]) Zwei Pflanzengeographische Documente von J. F. Drége, nebst einer Einleitung von Dr. E. Meyer, Prof. in Konigsberg. Regensburg, 1843, 8vo, 230 pp., c. chart. geogr.

([18]) *Vide* "Sketch of the Flora of South Africa," by Harry Bolus, F.L.S., in the Official Handbook of the Cape of Good Hope: Capetown, 1886, 8vo. 32 p.p.

Uitenhage, the Langkloof, and Swellendam. Next year he started for Namaqualand, where, like Zeyher, he had an almost fatal experience of that dry and thirsty land, returning by the Cederbergen and the Onder Bokkeveld.

In 1831 he gladly accepted the invitation of the celebrated zoologist, Dr. Andrew Smith, to accompany him on a journey eastward through Kafirland and Zululand up to Delagoa Bay, following the track of the travellers Cowie and Green. Circumstances prevented the carrying out of the whole plan, and Drége proceeded no further than the Umgeni. Returning with the party, he stayed some time in Uitenhage and Albany, and thence started through what are now the districts of Queenstown and Aliwal North to the Witteberg, and, following the course of the Orange River, turned off by way of Colesberg towards the Sneeuweberg, and thence by the Sunday's River Valley back to Uitenhage. After returning to the Western Province he made one more excursion to the mountains about the lower course of the Olifant's River at a more propitious season than before, and with better success.

Drége then collected together the vast material he had amassed, amounting, according to Dr. Ernest Meyer's estimate, to about eight thousand species, represented by two hundred thousand specimens. The same author pays a warm tribute of praise to this laborious and modest traveller. "He collected the same species not once only, but as many times as it occurred, recording always the peculiarities of its habitat. He travelled through barren districts with equal attention as through fertile ones, at various times of the year, and collected their flora with equal care and diligence. Wherever he went he took care to determine the altitude above the sea level and the temperature of the springs." It is impossible to quote the whole of Meyer's well deserved eulogy of this remarkable man, of whom, outside botanical circles, no knowledge exists, and whose labours were enough to have made famous half a dozen scampering travellers of the ordinary type. I must refer you to a translation of the entire memoir, printed in 1875 by a talented member of our society ([19]), with the assurance that it will well repay perusal.

Drége lived after his return to Europe, in his native Altona, to a good old age, and in a fair measure of comfort. I am glad to be able, by the kindness of a friend, to exhibit two portraits of this excellent Cape botanist, and to have the opportunity of making his name and fame known to-night to some who have not heard of him before. He died in 1881.

I regret that my notes contain so meagre an account of Dr. Karl Wilhelm Ludwig Pappe, long resident and practising medicine in this city. He was born in Hamburg in 1803, and died here in December, 1862. He was a most accurate and painstaking botanist. Besides his enumeration of the flora of Leipzig, presented as a thesis for his degree in 1827, he was the author of three excellent little treatises of botanical interest: *Floræ Capensis Medicæ Prodromus*, an enumeration of South African indigenous plants used as remedies; *Silva Capensis*, a description of South African timber trees, and a *Synopsis of Cape Ferns*, published in conjunction with Mr. Rawson. Incidentally I have mentioned his practical interest in the welfare of Karl Zeyher, whose

([19]) On the Geographical Distribution of Plants in South Africa, by Ernest Meyer. Translated, with notes, by H. Bolus, F.L.S.: Capetown, 1875, 8vo. pp. 61.

herbarium he purchased and incorporated with his own. This splendid collection became the property of the Government in 1863, but like Dr. Wright's Indian collection, was simply stored without any supervision, the result being much irreparable damage. Of Dr. Harvey's working up of about one-third of it I will speak presently.

Next in the record stands one who was a great collector of Cape plants, and something more—the chiefest of their historians.

The name of Dr. William Henry Harvey is known to almost every educated person at the Cape as *par excellence* the botanist of our Colony. He was born February 5th, 1811, at Summerville, near Limerick, in which city his father was a respected merchant and a member of the Society of Friends, or "Quakers." Educated in a school belonging to that religious body, young Harvey entered his father's counting-house with the intention of commencing a business life. He spent all his spare time, however, in the pursuit of natural history, being particularly attracted to the study of mosses and algæ. The discovery of a new locality for a rare moss, *Hookeria lætevirens*, led to a correspondence with Sir William Jackson Hooker, and the formation of a lifelong friendship with him. By degrees Harvey's predilection for science became so marked that he began to consider in what way he could give all his leisure to new investigations. He was ultimately recommended by Lord Monteagle, then Mr. Spring Rice, for the office of Colonial Treasurer at the Cape. By a clerical error, the name of his elder brother was inserted in the commission, and political changes rendered it impossible to rectify the error. In consequence, the two brothers sailed for the Cape in 1835, the one to take up an appointment wholly undesigned, the other to act as his assistant. Before the year was out, however, the health of the elder brother utterly failed, and he died on his passage home. The post was then offered to William Harvey, for whom it had been originally solicited. He fufilled its somewhat onerous duties in official hours for three years, but devoted every moment of leisure to collecting and study, rising with early dawn to visit the mountain slopes and plateaux to bring material for the evening's labours. So incessant was his application that he, too, was compelled to return home for six months' rest. In 1840 he resumed his duties, but was only able to continue working for a short time. Most reluctantly he resigned his appointment, being threatened with serious mental derangement, and returned to his friends for complete rest and medical treatment. In 1844 he was so far re-established that he accepted the position of Keeper of the Trinity College Herbarium at Dublin, on the demise of Dr. Coulter. The collection was a mere unarranged mass of material, the gatherings of his predecessor during travel in California and Mexico. Harvey threw into it his own very extensive Cape collections, and commenced to ordinate the whole into something worthy of the College. The Professorship of Botany fell vacant about this time, and as the statutes required that it should be held by a qualified Doctor of Medicine, the Senatus of the University conferred on him the honorary degree of M.D. But difficulties arose, Harvey declined to push his claim, and the chair was ultimately filled by Dr. Allman.

From this time Dr. Harvey's life was one of continuous work. In the third year of his Cape career he had published a most useful compendium of Cape Botany, the "*Genera of South African Plants*," revising and reconstructing the older generic definitions according to

his own observations upon living plants. Considering the time at which it was produced, and the absence of literary adjumenta, it is a wonderful performance. But his study of predilection was that of *Algæ*, and in this branch he had few rivals. His "*Manual of British Algæ*" was the precursor of the large and beautiful "*Phycologia Britannica*," the whole of the 360 plates in which were drawn in color on the stone with his own hand. In 1849 he was invited to visit and lecture in America, both at the Boston Lowell Institute, and at the Smithsonian, in Washington. This accomplished, he commenced exploration of the southern seaboard of the United States, and spent part of a year in investigations, the result of which appeared under the auspices of the Smithsonian Institution as *Nereis Boreali-Americana*, published in 1852-58. The manuscript of this work was scarcely completed when he entered upon a graver task. Obtaining extended leave of absence he went *viâ* the Red Sea and Point de Galle to Australia, and explored every accessible part of the coast. Then returning to Sydney after an examination of the Tasmanian shores, he found the missionary brig *John Wesley* in the harbour, about to start on her annual cruise from station to station in the South Sea Islands. He took passage in her and visited the Friendly Islands, Navigators' Islands, and lastly Fiji, then just emerging from its early cannibal state, Here he was for a long time the honoured guest of my brother-in-law, Rev. W. Wilson, at Viwa. He returned laden with the algological spoil of many lands in 1856, and before two years elapsed had issued the first part of his *Phycologia Australica*, a magnificent work in five octavo volumes, with 300 coloured plates. Two-thirds of these drawings were made on stone by himself.

The transfer of Dr. Allman to Edinburgh in 1856 threw open the Chair of Botany once more. This time there were no difficulties raised, and Harvey accepted the duty, although it greatly increased his amount of routine labour.

He was about this time solicited by Sir W. J. Hooker to assist in his great scheme of Colonial Floras, which in case of Australia, the West Indies, Mauritius, and Hong-Kong, has been brought to a conclusion, but in that of India has been prolonged by the very magnitude of the work, and in that of the Cape has stopped for over twenty years, it is hard to say for what reason. Harvey undertook a new *Flora Capensis* in conjunction with Dr. Otto Wilhelm Sonder, of Hamburg, a learned and most accurate botanist, well acquainted with the subject. Three volumes appeared at intervals from 1859 to 1865, and, collaterally with them, two volumes of illustrations under the title of "*Thesaurus Capensis*," containing each one hundred lithographic sketches of new and rare plants, being the work of his own facile pencil. Amid all this work, the lecture duty only seemed to be a strain upon his powers. In 1861 he was threatened with hemorrhage from the lungs, and passed through a series of apparent recovery and relapse till 1864, when he was ordered to the south of France to recruit. Returning to Dublin, he worked on his Flora cheerfully, but with increasing difficulty, and just completed the manuscript of the third volume. He retired for rest to Torquay, where Lady Hooker, the widow of his old friend of earlier days, was residing, and there, amid the loving regrets of many to whom he had endeared himself, he peacefully passed away, May 15th, 1866. ([20])

([20]) Condensed from Dr. Asa Gray's obituary notice in Silliman's Journal.

Independently of his literary work, Cape Botany owes much to Dr. Harvey. Whoever at the Cape was interested in the science was sure of sympathy and help from him. He would carefully name hundreds of specimens for the veriest tyro, point out and excuse his errors in the kindliest manner, and keep up the beginner's enthusiasm by a reflex of his own. No task even of a mechanical kind seemed to dismay him. He learned the art of lithographic drawing to illustrate his books, and when the Cape Government became possessed of the large herbarium of the late Dr. Pappe, he volunteered to take it in hand and mount up selected types as his work on the Flora Capensis proceeded. I estimated this labour to have extended over nearly eight thousand sheets, and it will remain as the best monument of his learning and industry that the Colony he loved so well could possibly possess.

De mortuis nil nisi bonum, but of the living let us say absolutely *nil*, good or bad; lest in the one case we cause such modesty as they have to blush, or in the other case we make an enemy. Therefore I must stand excused if to-night I say nothing of the small band of living collectors who are following in the steps of the men whose labours have been chronicled to-night. Let it be sufficient to say that though few, they are enthusiastic, and are not likely to let the lamp of science that has been handed on to them go out for want of careful tending.

LIST OF ORDINARY MEMBERS

OF THE

South-African Philosophical Society.

JULY, 1887.

Abercromby, A., M.D.
Anderson, T. J.
Arderne, H. M.
Atherstone, Hon. W. G., M.D., M.L.C.
*Beck, J. H. M., M.B.
Berry, Dr. Bisset.
Biden, A.
*Bodkin, A. A., M.A.
Boettger, G.
*Bolus, H., F.L.S., *President*.
Buchanan, E. J., Hon. Justice.
Caincross, T. W.
De Smidt, Adam.
De Villiers, Sir J. H., K.C.M.G., C.J.
De Villiers, I. H.
Du Preez, H. P.
Easton, J.
Eaton, C.R.
Ebden, Hon. A., M.L.C.
Fairbridge, C. A.
Fisk, Rev. G. H. R., C.M.Z.S.
*Finlay, W. H., M.A., F.R.A.S., *General Secretary*.
Fuller, T. E., M.L.A.
Gamble, J. G., M.A., M. Inst. C.E.
*Gill, David, LL.D., F.R.S., F.R.A.S.
Grier, W. M., M. Inst. C.E.
Guild, R. K., M.D.
*Guthrie, F., LL.B.
Hahn, P.D., Ph.D.
Hahn, Theophilus, Ph.D.
Herman, C. L., M.B.
Hewat, Capt., C.M.Z.S.
Innes, J. R., M.L.A.
Kotze, Rev. Dr. J. T.
Leonard, J. W., Q.C., M.L.A.
Lightfoot, Ven. Archdeacon, B.D.
Marloth, R., Ph.D.
*MacOwan, Prof., B. A., F.L.S., F.H.S.
Marchand, Rev. B. P., B.A.
Marquard, L.
Maskew, F.
*Merriman, Hon. J. X., M.L.A.
Michell, L.
Molteno, Chas.
Molteno, P. A., B.A., LL.B.
*Peringuey, L., M. Ent. Soc. Lond.
Ponder, S. N.
Rose, J. E. B.
St. Ledger, F. Y., B.A.
Sawerthal, H.
Southey, Hon. R., C.M.G.
Schunke, H. C.
Shaw, J., Ph.D., F.L.S.
Silberbauer, C. F.
Silberbauer, J. C.
Sivewright, J., M.A., M.S.T.E.E. C.M.G.
*Smith, Hon. C. Abercrombie, M.A., *Treasurer*.
Stegmann, Rev. G. W.
Stewart, T., F.G.S., M. Min. Soc.
Tait, M. M.
Tooke, W. H.
*Trimen, R., F.R.S., F.L.S., F.Z.S.
Upington, Sir T., M.A., Q.C., K.C.M.G., M.L.A.
Warton, Major T. G., F.G.S.,
Wiener, L., M.L.A.
Woods, C. R.
Watermeyer, E. B.

Those marked * are the present Members of the Council.

THE TRANSACTIONS

OF THE

South-African Philosophical Society.

NOTES ON THE GEOLOGY OF THE COAST BETWEEN THE FISH AND JUJA RIVERS, SOUTH AFRICA.—By George McKay (communicated by John G. Gamble, M.A.).

[Read 1884, March 26.]

Part I., Igneous Rocks.

Though the writer proposes to deal with the surface or newer geographical features only, it will be necessary—in order that he may clearly carry the reader with him—to run rapidly over some of the older formations that have an important bearing on their successors. In this paper, therefore, the writer devotes his remarks exclusively to one class of rocks, viz., the igneous; reserving to another time the consideration of the sedimentary formations and the superficial accumulations.

Every one acquainted with the geology of South Africa is aware of the very remarkable formation known as the "trap conglomerate," which, shewing itself on the east coast between the 33rd and 34th degrees of south latitude, trends in a westerly direction for hundreds of miles, till it turns north and becomes lost among the metamorphic rocks of Namaqualand, everywhere maintaining a character so uniform and peculiar as to make its recognition an easy matter to any one acquainted with the subject. The formation is also important from the fact that it marks the northern boundary of the palæroic rocks in the southern part of the Colony. For these reasons it has been selected as the starting point of this paper.

The principal band (there are several) of the trap conglomerate is well seen at Stalwart Point, near the Fish River, where it forms the eastern horn of Waterloo Bay. This shallow inlet owes its formation to the greater endurance of the "trap conglomerate" and the angle which it presents to the great swell of the southern ocean. A reference to the maps will show that most of the igneous rocks form small promontories on the coast. It is not intended to enter on the difficulties that surround a satisfactory solution of how the trap conglomerate was formed. In the following remarks the reader is supposed to be travelling eastward from Stalwart Point along the coast between high and low water marks—the position most favourable for ascertaining the nature of the rocks travelled over. On arriving near the mouth of the Bequa River he will find another, though much smaller, band of trap conglomerate. It forms what is called the "Madagascar Reef" on maps. Whatever difficulties there may be in accounting for the peculiar contents of the trap conglomerate, if they be assumed to be

intrusive rocks—and the objections are admittedly great—there can be little doubt that the band that forms Madagascar Reef is an intrusive rock like an ordinary trap dyke.

Between Madagascar Reef and the Keiskamma River occurs the most southerly dolorite rock known in the colony—marked No 1 on map 2. In the Western Province the most southerly that is known is about five miles to the south of Sutherland, in the division of Fraserburg; there it partakes more of a syenitic greenstone than of a dolorite. It would be a matter of considerable interest to ascertain if dyke No 1 and that at Sutherland have any connection with each other. The direction is the same in both cases—10 deg. north of true west. To observers who travel by railway and take an interest in these matters, I would recommend the following points for examination :—

1st—On the Beaufort West Railway—about ten miles north of Beaufort West.

2nd—Near the Bull River, Zwart Ruggens, on the Graaff-Reinet Railway.

3rd—At the Little Fish River on the Cradock Railway.

Between the Keiskamma and Chalumna Rivers and at Payne's Drift, at points marked by a cross on map 2, are bare patches of a peculiar jaspery conglomerate containing pebbles of wood-opal, calcedony, and other rounded fragments of foreign rock, set in a matrix of liver-coloured jasper. The conditions of this rock have not been satisfactorily ascertained; but it is highly possible that it has been an over-spreading mass of molten matter that has flowed over the dicynodon rocks while they were in process of deposition. This would, of course, make it older than the overlying shales and the subsequently intrusive traps. The three points marked × on the map are nearly on one level, and doubtless form one continuous sheet, probably an outflow from the neighbourhood of Mount Coke, where an inextricable complication of almost every variety of erupted rocks occurs. Part of the complication there may arise from the intersection of dykes Nos. 4, 5, 6, 7, 8, 9, 10, 11 and 12. In addition to this, however, it is inferred from the beds of laterite found that it must have been the centre of a more recent and independent heat action. As it would be impossible to indicate even a remotely accurate delineation of the rocks here without an expenditure of time and labour that is not at the command of the writer, the space it should occupy on the accompanying map has been left blank. Mount Elizabeth—one of the three cone-like hills which form what is known as the district of Mount Coke, is a core-like mass of trachyte, is more recent and quite unconnected with the bewildering numbers of trap-dykes by which it is surrounded. At Fort Grey, near East London, and at the Quintani in the Transkei, bosses of a similar trachyte occur under the same conditions.

Dyke No. 8 is a very beautiful porphyry, about 15 feet wide, of a dark reddish-brown colour with crystals of pearly felspar, about a quarter of an inch square, very regularly distributed through it. It will, at some future day, be a stone of considerable value for architectural purposes.

About two miles to the south of dyke No. 15, and near Peelton, a dyke crops up, the strike of which I have not been able to determine. It is composed of albite and hornblende, and is probably connected with a dyke that occurs at the Izeli (King Williamstown divi-

sion, beyond the range of map 2). It is mentioned here to note its peculiarities in weathering, being galleried and caverned in all directions into the most fantastic shapes. (A specimen was sent to me from the Izeli as a huge fossil human pelvis, to which it bore a very strong resemblance). This peculiarity of weathering is due to the comparatively speedy dissolution of the soda contained in the albite, under the influence of damp and moisture. Every change of wind lodges dust in some crevice or irregularity of surface; this dust retains the moisture, which, acting on the soda, corrodes it into a pit which may continue to deepen till it meets a similarly formed pit from another direction; or a change of wind may lodge dust in another position in the enlarged pit, causing galleries within galleries, and as this goes on at all angles that dust can be collected or moisture retained, the results are more easily imagined than described in words.

Dyke No. 31 is a large dyke of orthoclase with brush-like diverging tufts of hornblende distributed through it. This dyke forms a very striking feature in the landscape. Looking to eastward from the heights above the Kei on the east side, it presents the appearance of a deep depression on the surface, running in a perfectly straight line through hill and valley without interfering with the general surface drainage of the land, which follows its shortest course to the sea, crossing the dyke at an angle of about 40°. It is marked on our best maps as the "Transkei Gap," with the note "probably caused by an earthquake." The explanation of this singular appearance is very simple. The felspar of which the dyke is principally composed decomposes more rapidly than the adjoining stratified rocks, and permits of greater wear and tear along the line occupied by the dyke.

A similar depression, occupied by a dyke largely composed of potash-felspar, occurs a little to the south of Cathcart, and may possibly be a continuation of dyke No. 31.

The crowding of the dykes where my opportunities of observing have been greatest (in the neighbourhood of East London and on a line from the mouth of the Gonubie River to the Kei Bridge) warns me that I have not exhausted their number, and that others may exist that have escaped my observation. Of the 34 numbered in the space of 100 miles, only two of them (Nos. 33 and 34) deviate from the (roughly) east and west direction taken by the other 32 dykes. This they do to the extent of 30 deg. They are singularly parallel to each other, and have the same appearance and mineral composition—a coarse-grained dolorite, which yields a large amount of titantic iron in minute crystals on decomposition. They are newer than the other 32 dykes. No. 34 has been traced through Nos. 9, 8, 7, 6, and 5 without suffering alteration. No. 33 cuts through Nos. 26, 25, and 22. This dyke will be easily recognised as the road passes over in the direction of its length from Draaibosch to the Komgha, and in cutting in the road on the west side leading to the Kei, and about a mile from the bridge, it intersects the centre of the larger dyke No. 26, and presents so marked a difference to the adjoining rocks as to arrest the attention of any one at all observant.

A rapid *en passant* notice of these erupted rocks does not permit of minute details. And as all geological correctness is a work of very gradual approximation and very extended research, it would be out of place here to enter into any, based as they would be on a comparatively narrow range of observation. But as little or nothing is

known of the trap rocks in the Karroo districts of the colony, I am encouraged to offer what have suggested themselves to me as the salient points connected with them, with the hope of receiving corroboration or correction from other observers.

1st. They are more recent than the Dicynodon Beds (Lower Triassic of Europe).

2nd. They do not occur to the south of the line of trap conglomerate.

3rd. Their numbers are very great (in the proportion of one to every three miles of lineal space).

4th. They traverse great distances (hundreds of miles) in a perfectly straight line, have a remarkable parallelism to each other, and are of a magnitude unprecedented in any record that has come within my knowledge. Most of the works that I am acquainted with treat the subject incidentally, and I know of no attempt to trace a dyke to its termination. They are usually treated as emanations from some centre in their immediate neighbourhood, or regarded as mere veins. Though beyond the range of the accompanying plans, I will here note my attempt to trace a dyke over a very considerable space of ground. This may for convenience be called the "Spitzkop Dyke."

(a) Between three and four miles north of the Bashee river mouth there is a large dyke of dolerite. A scrubby bush growing on loose sand approaches down to high water mark, and obstructs a view of the direction of the dyke.

(b) But seven miles from the sea shore a dyke similar in mineral composition crosses the Bashee just above the lowest bridle drift. It is there nearly vertical, and has a trend of 37 deg. west of magnetic north—or corrected for variation 8 deg. north of true west.

(c) Close to Txakxa—a mission station in the Idutchywa Reserve, in the Transkei—there is a similar dyke trending 37 deg. west of magnetic north.

(d) A dyke traversing the Xolosa mountain—between the Tsomo and the Kei Rivers—has precisely the same trend. From the top of this mountain an uninterrupted view eight miles long can be had of this dyke.

(e) About two miles south of St. Mark's—there is a dyke of dolerite trending 37 deg. west of magnetic north.

(f) The Queenstown railway crosses a dyke at nearly right angles one and a-half miles beyond (north) Tylden.

The foregoing six points are from personal observation. In extension of this, a dyke that passes through or close to the town of Tarkastad is described as having a north-east and south-west direction.

(g) The summit of the Doornberg, in the division of Cradock, is cut through by a dyke, but up to date I have not been able to learn the direction it takes.

(h) The Spitzkop of the Compass Berg, in the division of Graaff-Reinet, was ascended by Wyley in 1857. He describes the dyke that intersects the peak as cutting the perpendicular south-west face at an angle of 50°. This description, though not as precise as could be desired, leaves little doubt that the dyke there takes the same general direction as the other points, that have their trends fixed, do. Now if the reader will plot these points on a fairly good map, it will afford a strong presumption that the Spitzkop dyke forms one continuous and direct line to the Bashee mouth, a distance of upwards of 260 miles.

5th—The dykes do not interleave or intrude themselves horizontally into the stratified rocks they pass through till they reach an elevation of upwards of 2,500 feet above the present sea level. Above this height, in many places they have thrust themselves horizontally between the strata at different levels—where they form extensive sheets—protecting those portions of stratified rocks covered by them from rapid denudation, and causing the form of many of our tea-caddy and table-shaped mountains seen in the divisions of Queenstown, Cradock, and the Tarka. And absence of these horizontal beds in the lower regions has produced the clustered hummock-like and rounded outlines that form so distinctive a feature of the country lying below the 2,500 feet level.

6th—They have caused very little disturbance or displacement in the stratified rocks, through which they have forced their way—a fact of some importance which may be of value in determining the conditions under which the dykes were formed. The corrugations seen in the section on plate or map 3 are the results of a lateral compression, subsequent to the formation of the dykes. The greatest disturbance that I have observed (within the range of the maps) occurs at dyke No. 29, between the Kei Bridge and Toleni. A cutting in the new road gives a good section of the stratified rocks and this dyke, which is here about 70 feet wide. The south side of the stratified rock is not disturbed; on the north side it is tilted about 30°, and this shades off into the general bedding of 5° N.W. at 200 yards from the dyke. In Griqualand East, however, a tilting up of 70° in a ripple-marked shale has been observed near Ficani's Kraal, on the Umzimkulu river.

7th.—That though the smaller dykes (100 feet and under in width) are sufficiently homogeneous to be comprehended under one term, as dolorite, diorite, &c., as the case may be, the same does not hold good with respect to the larger dykes, some of which are upwards of a mile in width. In the larger ones every variety of erupted trap (not vesicular or amygdaloida) may be seen, shading gradually off into each other, so that it is impossible to point out where one begins or the other ends. In illustrating this I will particularly refer to dyke No. 9, being the one which my opportunities of studying have been greatest, having had the platform between high and low water marks laid out like a map before me daily for a great number of years. The eastern edge of this great dyke consists of a coarse rough trachyte, light coloured, with glassy felspar. At 100 ft. to westward this passes insensibly into a dark hornblendic rock with crystals of albite. This is the only portion of the dyke that decomposes into globular masses and concentric layers with a solid kernel—the so-frequently mentioned but never-explained cheeses, cannon balls, &c., of authors. The concentric layers are studded with hexagonal plates of a bright yellow-coloured mica 1-20th of an inch in diameter, which are not to be found in the solid kernel or in those portions of the rock not undergoing decomposition, though slices have been subjected to scrutiny by microscope. They are therefore assumed to be a secondary combination, resulting from the decomposition of the original rock. This portion of the dyke is also traversed by a multitude of parallel lines of a jet black hornblende, from the finest line to a quarter of an inch in thickness; the lines follow the general direction of the dyke, and cut clean through the crystals of felspar and hornblende which com-

pose the rock, passing through concentric coatings quite unaltered, and forming miniature black ridges through them.

The hornblendic portion of the dyke passes gradually into a very compact and highly crystalline basalt. The basalt passes into orthoclase, which in its turn merges into a mass mainly composed of augite in coarse crystals. And these variations continue till the dyke terminates on the west side in a vertical wall of highly crystalline basalt, the beds of the adjoining stratified rocks being undisturbed, though the effects of heat are visible on east and west sides for a considerable distance Now, though there is a great probability that the hornblendic rock referred to above is a later injection into the main dyke, the conditions under which it was formed must have been peculiar, as the gradations from trachyte on the one side and basalt on the other are perfect. The same inference cannot be made with regard to the other variations in the dyke, which in many places show a tendency for the particles of a single mineral to aggregate themselves together over considerable areas, and thus increasing the difficulty of finding any name sufficiently comprehensive and yet distinctive for a dyke of this magnitude and condition.

A few broad terms in connection with erupted rocks fit for a geologist to handle in the field is a great want. Mineralogy gives no assistance; it, of all the sciences that cluster round the broad term geology is the oldest, the most pretentious, and least satisfactory.

ON THE VARIATIONS OF LEVEL OF THE CAPE TRANSIT-CIRCLE.—By W. H. Finlay, B.A.

[Read 1884, Sept. 3.]

The Cape transit-circle was erected in 1855 and brought into regular use in 1856. From that time to the present date a continuous series of observations has been maintained for determining the instrumental adjustments.

The instrument is one of the largest of its class and is exactly similar to the Greenwich one. The piers consist of a few large blocks of very hard sandstone from a quarry near Tiger Berg, and rest on the rock; every care was taken to cement them into two solid masses. It was expected with such a strong and massive instrument that the changes in the adjustments would be very slight indeed, but this expectation was not fulfilled.

For the first three or four years the instrument was fairly steady, but from about 1860 up to the present time there have always been large and well-marked changes of position in the course of the year.

This is more especially the case with the level error, and a constant and continuous watch has consequently been kept on it.

The telescope cannot be reversed on its bearings and is not adapted for the application of an ordinary spirit level; but the level error and zero of the vertical circle (or Nadir-point reading) are determined by observing the images of the wires reflected from a trough of mercury, an observation admitting of extreme nicety and accuracy; the error of azimuth is determined by observations of polar stars.

FIG. I.

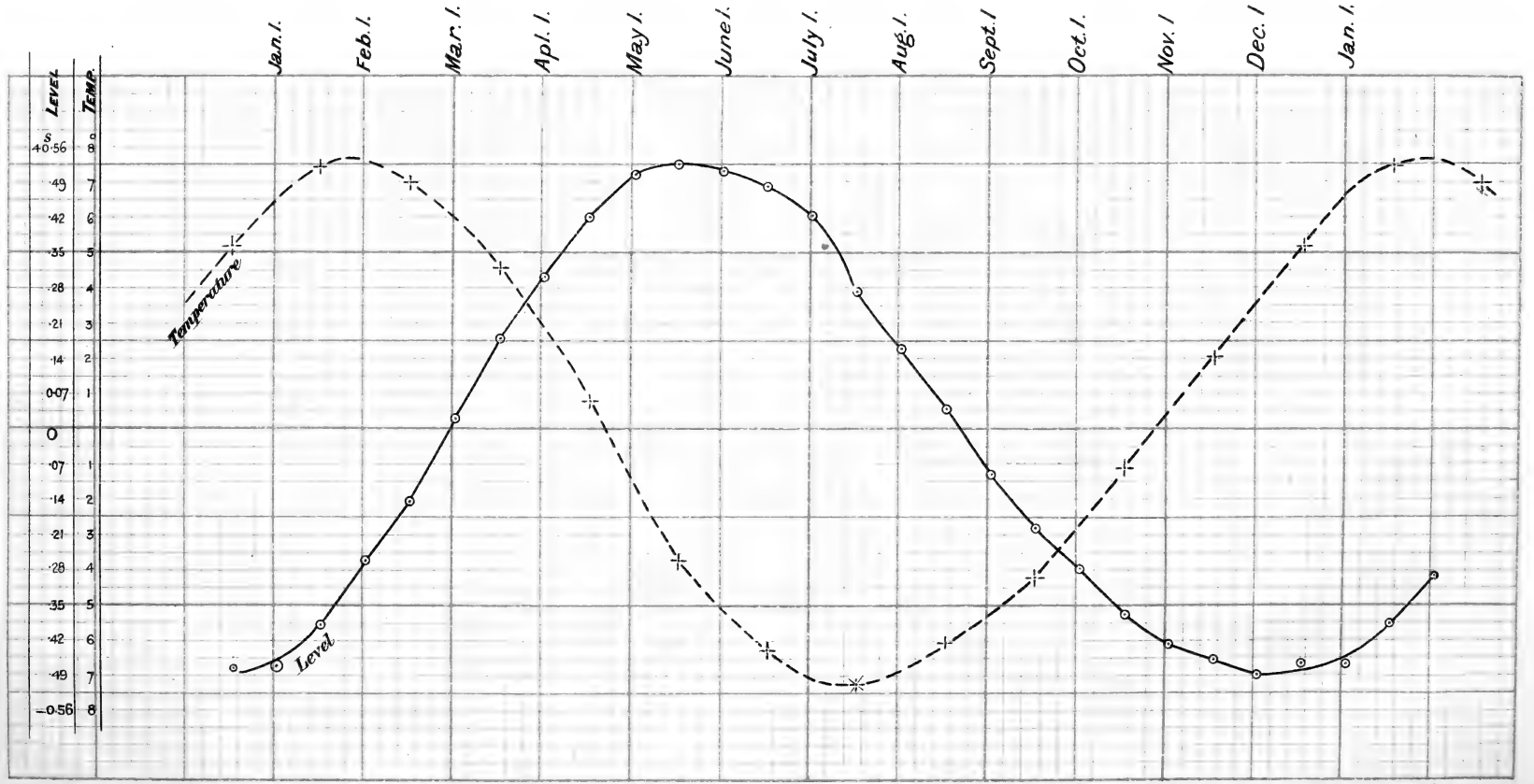
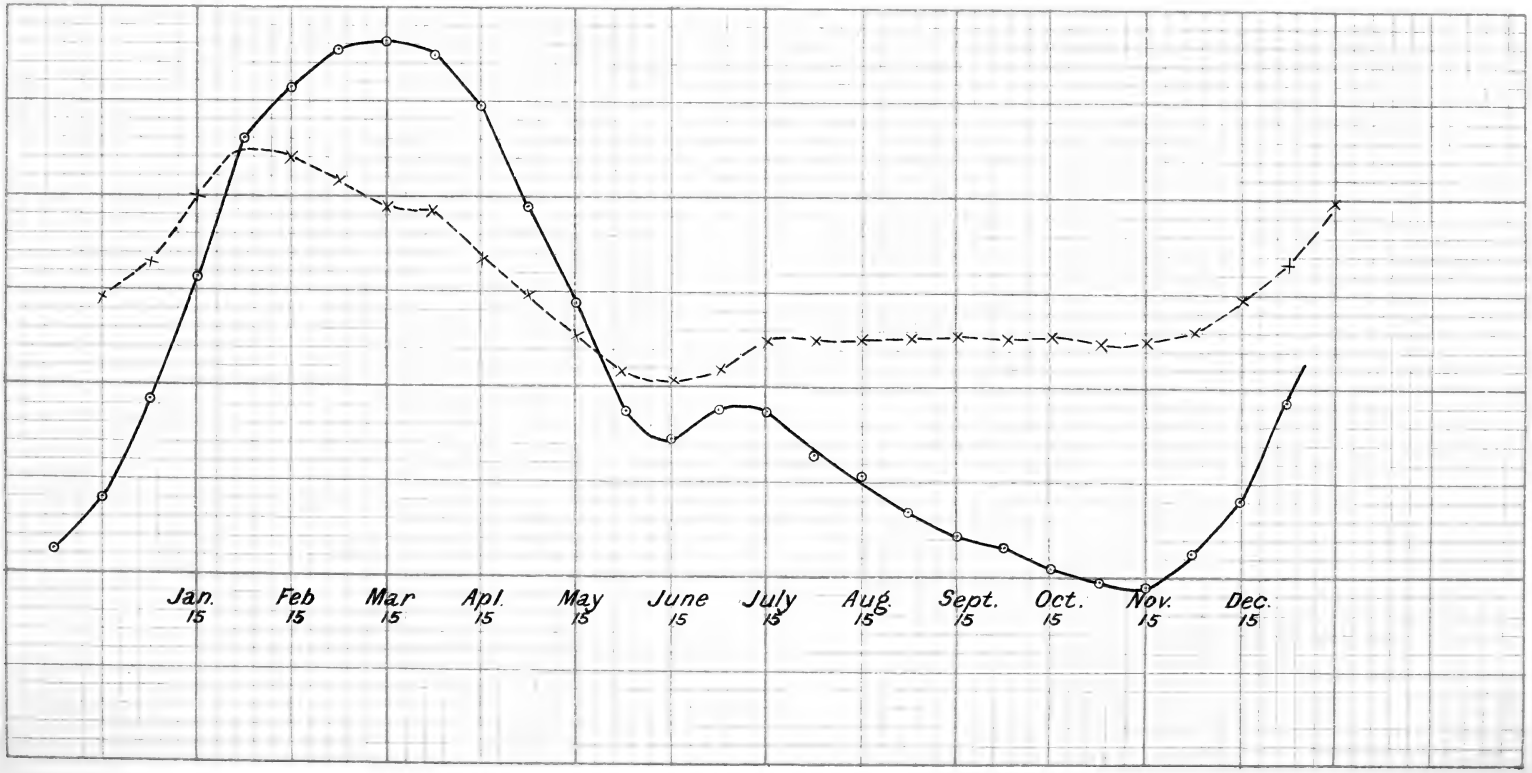

Jan.1.
Feb.1.
Mar.1.
Apl.1.
May1.
June1.
July 1.
Aug.1.
Sept.1
Oct.1.
Nov.1
Dec.1
Jan.1.
LEVEL
TEMP.
S
40·56
·49
·42
·35
·28
·21
·14
0·07
0
·07
·14
·21
·28
·35
·42
·49
−0·56
8
7
6
5
4
3
2
1
1
2
3
4
5
6
7
8
Temperature
Level

FIG. 2.


Jan. 15
Feb 15
Mar 15
Apl. 15
May 15
June 15
July 15
Aug. 15
Sept. 15
Oct. 15
Nov. 15
Dec. 15

These adjustments are very constant from day to day and throughout the day; no appreciable change has been detected in them depending on the time of day, though the range of temperature from noon to midnight is often very large.

The observatory is situated on the northern end of a small hill, and is only 37 feet above sea-level. The Liesbeek on the west and the Black river on the east, which carry off a great part of the rain falling on the Flats and the East side of Table Mountain, overflow their banks in the winter, and a large sheet of water stands for a considerable time to the north and north-east of the hill. It has generally been supposed hitherto that the rains or pressure in some way from this standing water were the chief agents in producing the changes of adjustment in the Transit-circle, and it was to test the truth of this supposition that I undertook the present investigation.

Tables of the values of the errors were formed for every half-month from 1856 to 1882 by taking the mean of three or four determinations about the first of the month as the error on the first, and similarly for the 15th. The means of these semi-monthly values, though not strictly the mean of the year, will not differ much from the true mean. On three occasions, in 1856, 1860, and 1872, the amount of the level error was reduced by the insertion of tinfoil under the bearing plate of the western pivot; but as the level error was taken before and after these changes I have been able easily to allow for these changes and tabulate the errors in one uniform system. The following are the means of the 27 semi-monthly results for the level error, to which I propose chiefly to confine myself to-night :—

	s.		s.		s.		s.
Jan. 1 ..	—0·58	Apr. 1 ..	—1·35	July 1 ..	—1·47	Oct. 1 ..	—0·77
,, 15 ..	—0·66	,, 15 ..	—1·47	,, 15 ..	—1·32	,, 15 ..	—0·68
Feb. 1 ..	—0·79	May 1 ..	—1·55	Aug. 1 ..	—1·21	Nov. 1 ..	—0·62
,, 15 ..	—0·91	,, 15 ..	—1·57	,, 15 ..	—1·09	,, 15 ..	—0·59
Mar. 1 ..	—1·07	June 1 ..	—1·56	Sept. 1 ..	—0·96	Dec. 1 ..	—0·56
,, 15 ..	—1·23	,, 15 ..	—1·53	,, 15 ..	—0·85	,, 15 ..	—0·58

A minus sign denotes that the western pier is lower than the eastern, and an error of — 1·0s. corresponds to a relative depression of ·0048 of an inch. Thus the western pier is about $\frac{5}{1000}$ths of an inch lower in May and June than in December. If the differences of these values from the mean of all be laid down to scale and a curve swept through them, we have the continuous black curve in fig. 1, shewing the relative motion of the east pier. To find a formula which will represent these changes I assume—

$$L = c + a \sin (\odot + A) + b \sin (\odot + B.)$$

Where L = the level error at any time

$\odot = 0°$ for Jan. 1, 15° for Jan. 15, &c., &c.

and c, a, b, A and B are constants to be determined.

Each of the semi-monthly values above gives an equation of this form, and solving the 24 equations by the method of least squares I find—

$$L = -1{\cdot}035 - 0{\cdot}519 \sin (\odot - 55°\ 3') - 0{\cdot}044 \sin (2\odot + 203°.2').$$

If with this formula we compute the valeus of L for each half

month, we get the following differences between the computed values and the observed values of the table above:—

	s.		s.		s.		s.
Jan. 1 ..	+0·01	Apr. 1 ..	0·00	July 1 ..	−0·03	Oct. 1 ..	−0.01
,, 15 ..	+0·01	,, 15 ..	0·00	,, 15 ..	+0·01	,, 15 ..	−0·01
Feb. 1 ..	−0·02	May 1 ..	0·00	Aug. 1 ..	0·00	Nov. 1 ..	−0·01
,, 15 ..	−0·01	,, 15 ..	+0·02	,, 15 ..	0·00	,, 15 ..	−0·02
Mar. 1 ..	−0·01	June 1 ..	+0·02	Sept. 1 ..	+0·01	Dec. 1 ..	−0·01
,, 15 ..	−0·02	,, 15 ..	0·00	,, 15 ..	0.00	,, 15 ..	−0·02

These residuals are so small that we may say the formula represents the observed values perfectly.

The question now comes "To what cause are these changes due? Will rainfall or temperature account for them?" The following table gives the mean monthly amount of rainfall and the mean monthly temperature of the air for the same years:—

Table II.

	Rainfall.	Temp.		Rainfall.	Temp.
	in.	°		in.	°
January	0·55	68·86	July	3·79	54·24
February	0·61	68·46	August	3·40	55·36
March	1·03	66·03	September	2·00	57·24
April	1·84	62·20	October	1·78	60·33
May	4·13	57·78	November	1·13	63·52
June	4·53	55·17	December	0·95	66·67

Mean monthly rainfall = 2·14 in., mean temperature = 61·32°.

The temperatures are taken from the readings of Dollond's thermometer in the window-crib close to the transit-circle, and though not representing perfectly the shade temperature, on account of the position of the crib, yet they have the advantage of being a continuous series by the same thermometer in the same position.

In considering the rainfall I am at a loss how to represent its accumulated effect, whether simply according to the amount of rain or according to some more complex law. The sudden increase of rain in May and June agrees well with the fall of the level curve towards the end of June, but while the rainfall has reached its average amount in September, the level curve still continues to fall till the end of November. This, however, may be due to accumulation of rain. Again, the level curve mounts steadily through March and April, although the rainfall in April is three times as much as in January or February. On the whole, I do not think the rainfall is a perfectly satisfactory determining cause.

The dotted curve in fig. 1 represents the variation of the monthly temperatures from the mean of the year laid down to scale so that the amplitudes of the temperature curve and the level curve shall be nearly the same. The perfect similarity of the two curves is striking, and it is impossible to withstand the conclusion that the two curves are intimately connected, and that the changes of level are in some way due to the changes of temperature throughout the year. But now a curious point arises—the times of maxima and minima of the two curves do not agree; the level follows the temperature by about four months. It seems, therefore, that the changes of level are not due to the effects of heat directly on the instrument itself, but to an actual movement of some part of the Observatory Hill, in such a posi-

tion or at such a depth below the surface that the heat of summer and the cold of winter take four months to reach it.

Unfortunately no deep-sunk thermometers have ever been observed here, so that I am unable to say what this depth may be.

From observations at Edinburgh it has been found that the temperature at a depth of 12·8 feet follows the surface temperature by $2\frac{2}{3}$ months and at a depth of 25·6 feet by $5\frac{1}{2}$ months. The thermometers there were sunk in the rock which is porphyry. At Greenwich, where the beds were sand and flint-gravel, the numbers were, at 12·8 feet $2\frac{1}{3}$ months, and at 25·6 feet $4\frac{1}{2}$ months.

To throw further light on these changes I have examined the records of the level errors of the old transit, which is situated 54 feet to the west of the transit-circle. The changes of level in this case are smaller, and not very easy to follow. Sudden jumps are by no means rare, and there are often long intervals without any determination, but on the whole they follow a law somewhat similar to that of the transit-circle levels.

Up to 1862 the changes are much smaller than in any of the subsequent years. Now, the embankment for the Wellington Railway was completed to Salt River at the end of 1860, and it has been said that the effect of it has been to cause an accumulation of water of much greater extent and longer duration to the north and east of the Observatory than was formerly the case. It may be, therefore, that the present large changes of level are due to the action of heat on the water which has forced its way into crevices and hollows in the hill.

On figure 2 curves are drawn showing the changes of Nadir-point reading and of azimuth in the course of the year. The Nadir-point curve agrees fairly with the temperature curve, but there is a well-marked effect of rainfall in June and July.

APPROXIMATE ELLIPTIC ELEMENTS OF COMET, 1884*b*.

By W. H. Finlay, B.A., F.R.A.S.

It was soon found by myself and astronomers in Europe that a parabolic orbit would not satisfy the observations of this comet. I determined therefore to try and deduce an elliptic orbit. As my own observations were the only ones available at the time I did not attempt more than a fairly close approximation, and for that purpose chose the observations of July 27, August 22, and September 17: the observations on these nights were noted as "good," and they were nearly equidistant. From them I derived the following elements:—

		d.			
Perihelion passage	..	Aug. 16·5095			Greenwich mean time.
π	..	306	3	30	Mean Equinox and Ecliptic 1884·0
A	..	4	54	1	
ι	..	5	30	36	
log. a	..	0·5017524			
log. μ	..	2·7973780			
ρ	..	36° 34′ 31″			
Period	..	5·6615 years.			

The comet, therefore, belongs to the class of short-period comets, of which we have about a dozen instances. At its nearest approach to the sun it is about midway between the orbits of the earth and Mars, and at its furthest distance it almost reaches the orbit of Jupiter. Like others of its class it has probably been diverted from its original path in space by the attraction of Jupiter, and forced to become a member of the solar system. The elements, with the exception of the Node, show a strong resemblance to de Vico's comet of 1844, for which a period of $5\frac{1}{2}$ years was found, but which has never been seen since.

METEOROLOGICAL NOTES.

By John G. Gamble, M.A.

[Read 1884, Dec. 4.]

I. The Monthly Averages of the Daily Readings of the Maximum and Minimum Thermometers.

Nearly four years ago I read a paper before this Society on summer and winter temperature in South Africa. Since then the observations have improved both in quantity and quality, the latter being mainly owing to the annual inspection by the Secretary.

I have now calculated the monthly averages of the daily readings of the maximum and minimum thermometers. These tables have been printed in the Colonial Blue Book [and therefore are not again reprinted here.] In order, however, to make the statistics more interesting and useful, I have prepared twelve maps giving the maximum and minimum isothermals for each month in the year, and forty-two diagrams showing the annual march of maximum and minimum temperature at each of the twenty-one selected stations. I do not ask the

Society to engrave these as in a few years time more accurate ones can be drawn.

The Colonial observations are those given in the reports of the Meteorological Commission, except in the case of Graham's Town, where a series of five years' observations, carefully taken some years ago by the Royal Engineers, was preferred. The Maritzburg observations have been published by Dr. R. Mann, and th se at Durban, Natal, are from sheets printed in Natal.

Mean temperature is roughly speaking about one degree less than the half sum of the maximum and minimum. Until we can get hourly readings from some up-country station, perhaps this is the most trustworthy way of getting mean temperature that is available.

The periods are not simultaneous; had only simultaneous registers been chosen, some very valuable registers would have been omitted, for example, that kept at Worcester by Mr. Hugo, now C.C. of Aliwal North, for the ten years 1862-1871.

Of late years Stevenson cribs have been used everywhere, but formerly there was no uniformity of exposure. The importance of attending to exposure was well shown by Dr. Gill in a paper read before the Royal Meteorological Society. At the Royal Observatory one set of thermometers have for many years been kept in a window crib, another set have recently been placed in a Stevenson screen. The mean maximum in the window is more than three degrees lower than the mean maximum in the Stevenson, while the minimum in the window is nearly three degrees higher.

With unpaid observers the maximum and minimum are convenient, as there is no absolute need to read them exactly at the same hour every day, and for most purposes of animal or vegetable life we wish to know the extremes rather than the temperature at any fixed time.

The maps and diagrams are very suggestive. For example, the small mean monthly range (12°) at coast places, the large range (often over 30°) at inland places. Dry places also like Clanwilliam and Nel's Poort have hot days and cool nights. Simon's Town, Mossel Bay, Port Elizabeth, East London, and Durban have all comparatively warm nights. This is partly due to the blanket-action of watery-vapour preventing the radiation of dark heat from the earth, partly to the Mozambique or L'Agulhas current, the temperature of the sea being never less than 70° off Durban and over 76° in summer.

It will be seen that the summer afternoons at Maritzburg are not so hot as in our Western and inland districts; and Mossel Bay, Port Elizabeth, and East London have cooler summer afternoons than Wynberg or Cape Town, the reason being that in the extreme West the summer is the dry time, while in the East summer is rainy, and along the south coast there is some rain at all seasons.

The coldness of the winter nights up-country is mainly due to the considerable height above sea-level—radiation into space going on unchecked.

It is well known that the maximum always reads less on a mountain than on the plain below, but this is not the case with the minimum. The night temperature is sometimes colder on the plain than on the mountain, as has been found in comparing the readings taken on Table Mountain with those taken at the Royal Observatory.

The difference between the hottest and coldest years is greater inland than on the coast.

	max.	min.
At Aliwal North ..	7·5	8·1
Port Elizabeth ..	2·9	3·2
Royal Observatory	3·2	3·5
Worcester ..	2·6	3·0

A curious feature is a hesitation in the annual curve of temperature, both at Maritzburg and Durban, in October and November. This is probably owing to the commencement of the rainy season.

Inland places get their maximum and minimum temperatures earlier than coast places, the latter having what is called a retarded climate; this is seen in the diagrams.

II. Barometric Observations at the Cape.

Simultaneous readings of the barometer at 8 a.m. have for some time past been taken at several points along the coast, and telegraphed to the Secretary of the Meteorological Commission, who reduces them to a uniform temperature of mercury, and to what they would have read at sea-level, thus rendering comparisons between them possible, and giving us some idea of which way the barometric gradient runs.

The question is frequently put, Why do you not include up-country stations? The reply is that we do not know the law of reduction to sea-level. In European weather-charts, places more than a few hundred feet above sea-level are omitted. The formula of Laplace, amended by Bessel and others, applies fairly well to mountains near the coast, but does not apply to elevated table-lands, as has been shewn of the simultaneous observations taken at Clermont and on the Pûy de Dome. The reduction used for low levels cannot be satisfactorily applied to great heights, and if applied has no physical meaning.

Until the organization of an annual inspection by the Secretary, the up-country barometric observations were generally untrustworthy. I would except Mr. Hugo's observations at Worcester, and one or two others. To show *this*, it may be mentioned that when the railway reached King William's Town, the level of the hospital was connected with the rail-level, and found to be 1314 feet above sea. But we had previously supposed from comparison of barometer readings that it was 1647! On examination it was found that the hospital barometer had air in it. A similar experience was made at Colesberg bridge.

In finding heights by barometric readings, it is most important that both summer and winter observations should be taken, as the daily and annual variations of pressure at sea-level are not at all the same as those at five thousand and more feet above the sea. Some years ago I made a long journey in the Colony in an ox-wagon, and I took a travelling mercurial, which I slung and "guyed" to the roof of the wagon. This journey was in summer time, and I have reason to believe that most of the heights I then calculated are too high. On the occasion of a subsequent journey in winter time I made the heights of places too low.

As a test of what may be the errors of barometic measurement of heights, the following examples are interesting. The town of Colesberg is found by railway levelling to be 4407 feet above the sea. The botanist, Drège, a very careful observer, is less than one per cent. wrong, he having made it 4430, but this, no doubt, was somewhat fortuitous. Wyley, the geologist, made it five per cent. too low, 4200.

Dr. H. Leach, whose heights are all much too high is in this case seven per cent. out, 4700. The readings of the mercurial barometer, carried by the Secretary of the Meteorological Commission on one of his inspections, gave 4023 or nine per cent. too low.

The private meteorological observatory at *Aliwal North* is 4330 above sea level by spirit-levelling. By comparing the mean barometric readings of the years 1877, 1878, 1879, with the mean at Port Elizabeth for the same time, I make 4375 or one per cent. too high. By comparing '77 only with the Royal Observatory, I make 4326, '78, 4337, '79, 4368, '80, 4334, which are remarkably close.

The height of Pretoria is given somewhat variously:

Dr. Leach	4620
Jeppe	4450
Serpa Pinto	4298
A. Anderson	4090
Baines	4007

As also is Lydenburg:

Baines	5825
Erskine	4781
Cohen	4706
Sir Chas Warren	4350

I think we may say that simultaneous barometric readings continued for a year with all proper precautions should give the height within two per cent. When however heights are got from a single observation or even from several observations taken much about the same time, an error of ten per cent. may be expected.

The great uncertainty of the air-temperature is the great drawback to accurate work. The correction is a rather large one, the factor being $\frac{t_1 + t_2 - 64.}{900.}$

Curves showing the fluctuation of pressure in the yearly period have been drawn for three coast stations, Royal Observatory, Mossel Bay and Port Elizabeth, and for five up-country stations, Worcester, Lovedale, Aliwal North, Bloemfontein and Sutherland. [The tables from which the diagrams were drawn are given below].

All the averages are, of course, corrected for temperature of mercury, but only the observations taken close to the sea are reduced to sea-level for reasons given above.

The early appearance of the maxima and minima for the year at the up-country stations is noteworthy, pressure agreeing with the temperature in this peculiarity.

There is at most stations a very remarkable hesitation or bend in the month of May. At some stations this is not so clear, and this is the case at the Royal Observatory. I believe this depression is a true feature, and that the reason why it is not shown in the Royal Observatory's diagram is that the periodic minimum frequently occurs there in the beginning of June instead of at the end of May, thus masking or smoothing out the depression when the curve is only drawn from monthly averages. I am in the hope of being able to get out five day means for some places, which will no doubt throw light on the question. It seems probable that this May depression is analogous to the well-known "November wave," of the northern hemisphere, and perhaps also to the short period of unusually mild weather generally experienced before the beginning of winter, and called "the Indian" or St. Martin's summer.

MONTHLY AVERAGES for three Coast Stations reduced to 32° F., to Sea-level, and to Kew Standard.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Royal Obervatory, 40 years obs. ..	29·949	29·947	29·989	30·045	30·085	30·152	30·184	30·156	30·123	30·063	30·012	29·975	30·057
Mossel Bay, 7 years	29·942	29·965	30·012	30·052	30·047	30·163	30·151	30·170	30·122	30·055	30·012	29·975	30·055
Port Elizabeth, 16 years	29·963	29·987	30·026	30·082	30·070	30 177	30·180	30·151	30 144	30·079	30·032	29·976	30·072

MONTHLY AVERAGES for Five Up-country Stations reduced to 32° F., but not to Sea-level.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Worcester, 7 years, 776 ft. above sea level	29·145	29·140	29·206	29·223	29·242	29·302	29·340	29·341	29·307	29·231	29·217	29·156	29·238
Lovedale, 5 years, 1,800 ft. above sea level	28·154	28·190	28·249	28·287	28·288	28·445	28·387	28·367	28·304	28·253	28·210	28·164	28·275
Aliwal N., 7 years, 4,330 ft. above sea level	25·619	25·652	25·702	25·747	25·763	25·866	25·845	25·806	25·755	25·683	25·630	25·602	25·722
Bloemfontein, $5\frac{3}{4}$ years, 4,500 ft. above sea level ..	25·473	25·505	25·536	25·598	25·612	25·706	25·689	25·640	25·600	25·532	25·480	25·471	25·570
Sutherland, $4\frac{1}{2}$ years, 4,777 ft. above sea level	25·251	25·257	25·290	25·318	25·321	25·437	25·428	25·406	25·348	25·310	25·257	25·241	25·322

INSECTS INJURIOUS TO FOREST TREES IN SOUTH AFRICA.

By L. Peringuey, F.Z.S., &c.

Considerable research has been devoted to Entomology in South Africa, but the result has been mostly a nomenclature of the insect fauna and scarcely anything more.

An immense number of insects has been collected as far back as the end of the last century, by travellers and naturalists such as Le Vaillant, Thunberg, Burchell, Delalande, Waalberg, and a host of others and, has enriched the Museums and private collections in Europe. Descriptions of many of those insects, of most of them in fact, have been published; but, so far, nomenclature alone has benefited by the collecting of these men. That nomenclature is absolutely necessary, is undeniable. That it has been the means already of producing an immense revolution in philosophical views and ideas, cannot be doubted, for, without a nomenclature, how could the examples or proofs of the theory of evolution and natural selection have been presented to the mind. That words are mere symbols, either material or mythical, must be recognised as a fact, and it is a fact also, that, unless an animal (or a plant) is symbolised with a name or a name with an animal, it would be impossible to conceive anything like the object the philosopher speaks of.

But nomenclature alone must not be the goal which a Zoologist must aspire to reach. His object must be also the economy of the animal or animals he has assumed to study, and as the study of the life habits of insects injurious to forest trees in South Africa has not been attended to yet, the object of this modest paper is, not naturally to speak of a thing we have no knowledge of, but to sketch as it were, the lines on which to proceed to arrive at some knowledge on the subject.

If the geographical distribution of insects in Europe proper, their habits, primary stage, their economy in nature are so well known now-a-days, the fact is due: 1st, to the wars of the end of the last and the beginning of this century which, making travelling a matter of much danger, prevented, to a great extent, the arrival in Europe of numerous specimens of Natural History from distant countries, thus compelling the observers to resort to the fauna of their native land; and 2nd, that there are in Europe men, many men, whose means or tastes enable them to prosecute their researches *con amore*.

I am afraid that the same may not be said of this Colony. Pursuits of different kinds tending to the same end, to which a friend of mine, who is rather cynical and who calls a spade a spade, gives the name of "filthy lucre" seem to make the colonist a practical kind of individual, who is not, as a rule, disinclined to look with a contempt somewhat allied to pity upon a collector of "bugs and flies," and if perchance a more enlightened member of the Executive places a very, very modest sum on the Estimates, either for the keeping of a museum, or still more seldom, for investigation or researches in Natural History, it is not without loud grumblings that the modicum is voted, when it is voted at all.

These remarks are, I believe, necessary to explain how so little

has been done in the Cape Colony, for investigation into the life-habits of those insects that are injurious to vegetation in general and forest trees in particular.

It is only lately that a Forest Department has been formed. The head of the department, Count de Vasselot, has succeeded in bringing together some specimens of the indigenous woods, and in having them exhibited in the Forestry Exhibition of Edinburgh, where a gold medal was awarded to the Cape Colony. The sundry kinds of woods must, then, have been admired, or at least, thought worthy of attention, and, for all we know, may become a source of revenue for the Colony, under a careful and systematic plan of forestry regulations.

Now, the insects, mostly or almost exclusively coleopterous (with the exception perhaps of certain moths of which more anon), have a very great influence on forest trees. In truth, a giant of the forest will succumb before the attacks of an insect one line long. What a single *Scolytus* cannot do, thousands will, and they do it too, because their number is legion. Many times in looking at some of the larger forms of *Prionidae* (a few of which I exhibit), the fact that a single one of these has perhaps caused the utter destruction of a noble tree that took years to come to a perfect state, until the auger of a female of those insects selected its surface in which to deposit an egg, has forcibly been brought to my mind.

I do not pretend to say that a knowledge of the life-habits of the insect or insects, thus causing damage to trees, will enable one to eradicate the evil; but it will go far towards finding a remedy for it, and I will give as example the case of the European long-horn "*Cerambyx heros*." Common formerly, near Paris, according to Blanchard, it is now very scarce, and that, because from the moment that its life-habits have become well known, man has been able, knowing where, when and how to find it, to cope with it successfully and to reduce its ravages to a minimum.

Being, unfortunately, without any knowledge of the habits of life of ligniperdous South African insects, I must treat by analogy of those which happen to be noxious elsewhere, and which according to their natural affinities, *must* be noxious also in South Africa.

As I have stated before, the coleopterous order of insects is that which causes most damage to trees, and, as I have devoted eight years to forming a collection of South African Coleoptera, I have been able, I believe, to arrive at an approximate idea of their affinities.

DISTRIBUTION OF INSECTS.

The forests, or bushes, as they are termed in colonial phraseology, are comparatively of small extent. They are mostly found in the eastern part, beginning from Plettenberg Bay, and extend along the sea-coast, as far as Mozambique. Nowhere is, I believe, this more exemplified than near Durban, Natal, which possesses a luxuriant semi-tropical vegetation, which ceases entirely as one advances into the interior of that Colony. If we take the western parts, we find a stunted vegetation; and here and there a clump of trees, mostly thorn (*Acacia horrida*) some Karee Boom (*Rhus viminalis*), except in kloofs in which a few indigenous trees are still found, where the work of denudation by the axe has been hampered for some reasons. Some mountains have a few *Proteacae*. That rarity of trees implies

naturally a rarity of insect-life in general, and mostly of wood-boring insects. But the more we advance towards the east, the more numerous trees become and the more numerous is also the insect-life, which reaches its maximum when we come to the borders of Natal along the sea coast. The forests of Kaffraria have not yet, as far as I know, been well explored for the purposes of Entomology, nor has the Knysna forest. But we may take for granted that the Port Natal forms are found in the Kaffrarian forests, although perhaps in lesser numbers, because there is no natural barrier between the two borders.

We have then two distinct fauna—the western and the eastern; in the latter I include the northern. The western part with barren wastes, few trees, subject to intense droughts and with the hotter and more northern parts separated from the corresponding ones on the east by the Kalahari Desert.

The typical timber-loving insects there are the *Julodis* family of Buprestidae; lovely insects whose bodies covered with long tufts of hair make them so well adapted to the fertilisation of the flowers of the *Acacia horrida*, which is their favourite resort; a few longicorns, three species of which, *Ceroplesis Œthiops*, *C. hottentota* and *Zographus oculator*, are very numerous. Now and then, one meets with some large form of *Prionidae, vid.*: *Tithoes capensis*, *Cacosceles Œdipus* and *C. latus*, all of them rare; also with *Herioderus hirtus*. *Tithoes capensis* found in Beaufort West and near Kenhardt, seem to me to imply the disappearance of trees in those localities. The Cacosceles *latus* comes from Namaqualand.

The Northern Border of the Colony formed by the Orange River, the banks of which are clothed with a dense vegetation, has not been much explored. But the banks of the Vaal River, an affluent of the Orange River, has yielded a certain number of specimens which, added to a few collected near Upington by the late Dr. Bradshaw, enable me to say that as far as I at present know, the coleopterous forms are related more to the splendid fauna of the Magaliesberg Range near Rustenburg, in the Transvaal, than to the Port Natal forms. We can easily understand that insect-life has been preserved all along the wooded banks. There, seems to be the limit of habitât of the large *Prionus*. "*Tithoes confinis*," also found in Senegambia, Rustenberg and Mozambique, and whose larva, judging by that of allied genera, is one-fourth longer than the insect and a little broader. That larva would naturally be fatal to the tree it attacks. We must notice also that it is on the banks of that river that the *Euclea pseudebenus*—Cape ebony—and the Camel thorn—*Acacia giraffae*, both woods of the hardest texture, grew. I purposely say grew, because those valuable trees have now well-nigh disappeared before the wants of the Kimberley market for fuel. The eastern part of the Colony, including Plettenberg Bay, possesses but few typical insects; they are mostly the Natal forms, in the same way that those Natal coast-forms are akin to those of the Transvaal, although separated from the latter country by a comparatively treeless tract, and by several plateaux; the connection taking place very likely through Zululand; but Delagoa Bay, which is the limit for us, at present, is decidedly Mozambican in forms.

Of the extreme western part of the Colony, Damaraland, I cannot say much, having seen but few insects from those parts, but I exhibit, nevertheless, a *Prionus* from that country, allied to, if not identical

with, the "*Dorycera spinicornis*," from Fernando Po on the West Coast.

NUMBER OF SOUTH AFRICAN COLEOPTERA.

The number of South African described Coleoptera compiled from the Munich Catalogue amounted 10 years ago to 4,920, not including the family of *Staphylinidae*. In that number are included the insects from M zambique in the East, to Damaraland in the West. But many of the Mozambican insects described in Peter's "Reiss nach Mozambique," are also found in Delagoa Bay; many, if not most, of the few from Damaraland, described in Boheman's Insecta Caffrariae, are found in the Transvaal; most of the Transvaal insects are found in Natal and many of them on the Orange and Vaal Rivers, and doubtless those Natal forms are also found in the adjoining districts of Kaffraria so that, it may be said, that fully two-thirds of that number inhabit Cape Colony proper, and if we add those insects, new to science, contained in the South African Museum collection and in my own, we come to the respectable number of about 3,250 species of described Coleoptera, a very large number indeed.

Of South African wood-eating beetles, either ligniperdous (that is to say devouring wood) or living in the decomposed timber, either in the larval state, or in the imago (perfect state), being those bearing relation to the devastation of trees, I will enumerate the families and number of known species. Before, however, giving that enumeration, I should explain that, with the exception of the whole family of *Bostrichidae*, sufficient proofs have not been forthcoming to show that so-called xylophagous insects necessarily cause the death of living trees or at least of those that are healthy.

I am rather inclined to think that the contrary is the case. The instinct, I almost said the intelligence, of insects is truly wonderful, and I can hardly believe that small insects, in small numbers, attacking a tree in very healthy condition, can make or pierce galleries impairing the health of the said tree, without some attempt being made in the part of the tree itself to get rid of its enemies by an abundant flow of sap or rosin, or such like matter. The minute larvae must necessarily be drowned in their galleries by that flow of sap. But when the insects attack the parts of trees already deteriorated, the tree will have no remedy against the intruders, because the neighbourhood of the parts so affected is already in a morbid condition which will be accelerated or spread, as the holes bored by the insects will admit damp and, therefore, minute fungi following in their suite. You have, doubtless, noticed how quickly the timber in such affected parts becomes deteriorated, and the entomological collector can safely expect to find an ample harvest of insects in the humus thus accelerated if not caused mostly by insect agency. Certain forest trees have a wonderful vitality. We have an instance of it in some of the avenue oaks in Cape Town, some of which are perfectly hollow and yet apparently healthy. Now, since they have been (under the supervision of Mr. De Vasselot, the Superintendent of Woods and Forests) freed from the decayed branches, and all the intertices carefully cleaned, filled with cement, and tarred, to keep the insects off, their old sores have mended wonderfully, and in fact, some of the cavities have been naturally filled, over the cement, by the growth of the adjacent liber, and will hardly show any scars

in time to come. And that the effect of the tar in keeping away the insects has been most beneficial I can testify, having carefully observed it since the beginning of last year.

I will ask you therefore to bear in mind that those insects that live, or whose larvae live in decomposed *standing* timber, are no less pernicious indirectly than those who live in the tree itself, because, first, they are much more numerous, and secondly, that they occasion a rapid disintegration of the fibre, enable the water to percolate, and cause often that black stain called "dry rot" in Knysna, so noticeable among other timber, in the Outeniqua Yellow-wood—*Podocarpus elongatus*.

FAMILY NITIDULARIAE.

The larvae and imago of some species live in rotten wood, also in fallen timber, in damp places. Some species are very numerous in the chinks and crevices of the oak-tree "*Quercus pedunculata*." We have only 28 species described, but I expect that this number will be more than doubled. They are all small.

FAMILY CUCUJIDAE.

The form of these insects which is extremely depressed, points at once to their mode of existence. They are generally found under the bark of trees, and so are the larvae. It is not quite certain that they live on wood, some Entomologists think that they prey on insects, but I am inclined to believe that they are xylophagous. I only know three species, 1 *Hectarthrum* from the Transvaal and the banks of the Zambezi, and two *Parandridae*, one the "*Catagenus carinatus*," found in the silver-tree "*Leucodendron argenteum*," and another from the Transvaal. All those three species seem to be rare.

LUCANIDAE.

The larvae of that family live in decomposed timber, in the rotten trunks and forks of standing trees. We have only seven species. The genus *Colophon* with two representatives is strictly South African. It is rather singular that there should be so very few representatives here of this wood-loving family, and we have an instance of the natural barrier caused by the absence of forests in the western side, to the mingling of one fauna with another. The West Coast of Africa possesses many species of the genus *Cladognathus*, allied to the English well-known Stag-beetle, but the only representative here of this genus *C. natalensis*, whose appearance is very peculiar, is found in the extreme eastern parts of the Colony, Natal and the Transvaal. The affinity of forms in that region lies with the eastern coast of Africa, and no *Cladognathus* has been found there until now. This is a singular case of isolation.

SCARABAEIDAE.

Of this considerable family, the tribe "*Melolonthidae*" feeding only on leaves when in the imago state, is the only one known to be seriously injurious to trees, for it has been ascertained that the growth of the concentric rings in those trees, the foliage of which is devoured by the cock-chafer, *Melolontha vulgaris*, was greatly impaired. We have no true *Meloloutha*, but a closely allied tribe, the *Macrophylidae* includes the *Leontochaeta alopex*, an hirsute beetle of good size,

which is found at times in great number, I am informed, on the peach-trees. But that family does not really come within our range, although the larvae of one of the sub-tribe, the *Oryctidae*, to which belong the so-called Rhinoceros beetle, "*Oryctes Boas*," so common in the east, and found also in Senegambia, live in old trunks. Near Cape Town, the larva of an allied species, *Cyphonistes, corniculatus* is very common on the Cape flats, under the mounds of a species of *Termes*—white ant. Must we see there an instance of struggle for existence brought by the denudation of that part of the country? No less than 645 of those leaf and fruit feeding insects are described from the Cape.

It is to that family that the gigantic insects of the genus *Scarabæus* proper, *Megasoma* and *Goliathus*, belong. Some of them are bigger than a man's fist. The *Scarabæus Hercules*, of the West Indies, is said on no less an authority than Lacordaire's to seize young branches between the long horns his head and prothorax are armed with, and to cut them by a rapid rotating flight. We have only one true *Goliathus* of comparatively small size. It is found near the Magalisberg Mountains, in the Transvaal.

BUPRESTIDAE.

224 S. African species.

The larvae of these insects live mostly in decaying wood, many of them between the bark and the wood of unhealthy trees, but many also in trees in good condition. For these insects (as well as for the *Scolytidae*), it is not certain whether they cause the death of trees, or if they only select those that are beginning to decay. The females are provided with a horny auger, composed of three pieces, with which they drill holes to deposit their eggs in. I exhibit the larva of one Buprestis, either a *Julodis* or a *Chalcophora* which was sent to the Museum by Mr. Garwood Alston. It is unfortunately dead.

The most numerous of that group in S. Africa are the *Julodis*. These lovely insects, in spite of the damage they *must* occasion to timber, are of some use in the Economy of Nature, because I consider them as the most powerful instruments of fertilisation, mostly of the flowers of the Thorn-tree, "*Acacia horrida*." The genus *Julodis* is represented in Nubia, Senegal, Arabia and Syria, but it is only those inhabiting South Africa that are provided with those curious tufts of hairs. The duration of the metamorphosis of the Buprestidae is very long. An instance has been recorded of the *Buprestis splendida* emerging from a deal table, which had been used for more than 20 years. Mr. S. Windham, of Maritzburg, informs me that he has repeatedly captured the *Psiloptera viridimarginata* on the stems of a small plantation of conifers.

This would seem to be a habit of the European species. If I mention the fact of the *Psiloptera viridimarginata*, showing such a natural taste for the conifers, it is because of the damage done to the Forests of the South of France, by a species of that family, the *Coraebus bi-fasciatus*, oliv, a small insect, which was ascertained to be rare less than 30 years ago, and which now seems to defy all the powers that be in Forestry. It is probable, nay, it is likely that the re-wooding of the Colony will be made mostly with European timber; the valuable Cape trees being of slow growth on the average. We have no less than 15 species of that genus, *Coraebus*, in South Africa.

It is to be hoped they will not emulate their congener, but hardly to be expected.

EUCNEMIDAE.

The larvae of that family tunnel in trees that have died recently. 3 species are known.

ELATERIDAE.

96 species. Some of those are gigantic. The genus *Tetralobus* includes 7 species. I have been able to capture the larva of the *Alaus mœrens*, which is considerably larger than the perfect insect (the larvae of the Buprestidae and Elateridae contracting much when assuming the chrysalid state). I found that larva in a dead standing trunk of oak, which was perfectly riddled by large galleries. On the outer bark was a single hole, and although I searched diligently for more grubs, tearing the tree to shreds; nevertheless I found but one. I had that larva for thirteen months without noticing any increase in its size. But when I opened yesterday the receptacle I kept it in, I found that the larva which I had not examined for a month, had assumed the imago state, but was still very soft. The chrysalis state, as you can see, is of short duration; not more than one month. The perfect insect is often found feeding on the sap exuding from the oak. I also have captured it on the cluster pine. The grubs of that family are known in England under the name of wire-worm, and the perfect insect as skip-jack.

PTINIDAE.

It is mostly in dead wood or cut timber that those insects are met with. 3 species of the genera *Ptinus*, *Anobium* and *Dorcatoma* are known. The *Anobium* has probably been imported.

BOSTRICHIDAE.

If the *Ptinidae* attack only dry timber, the *Bostrichidae's* attacks are only on living trees, and the damage done by them is very great. They are essentially ligniperdous. Provided with extremely strong jaws, they make a hole in the living trees, penetrating to the core, and almost always cause death. Cases have been authenticated of larvae of *Bostrichidae* having perforated some leaden roofs and also typographic plates. Professor MacOwan has communicated to me a species of *Apate*, which I believe to be the *Apate frontalis Fahreus*, and the Museum has received a specimen of the same insect from Col. Bowker, who says that it causes great damage in Natal. I have received a species of *Synoxilon*, found in a piece of Mimosa firewood, but I have not been able to find out whether the wood had been freshly cut, which I surmise to be the case. The grub of *Bostrichidae* is a fat, legless rounded creature, very much the shape, though very much smaller, of the larva of the *Cyphonistes*, I have shewn you. We have 19 species of *Bostrichidae*. One of them, *Apate muricata*, from Leydenburg, is also found in old Calabar.

While preparing the woods for the Forestry Exhibition, I found every morning, under some logs of freshly cut Sneezewood, *Ptaeroxylon utile*, little heaps of fine yellow dust; when turning those logs, new heaps were forced on the upper side. I knew at once that I had before me the result of the work of Bostrichidae, and when I had those logs sawed into planks, I found numberless galleries spoiling

the rich-yellow alburnum or sap-wood, to the distance of one inch from the surface, and tenanted by small fat grubs who had hastened to close the orifice of their galleries by agglutinated saw-dust. I was not able to retain the planks, and wait for the development of those insects. The similitude of the larvae of the Ptinidae and Bostrichidae is so great, that I cannot venture to ascribe to which family those larvae belonged.

Cedar-wood is supposed, on account of its fragrant smell, to be distasteful to insects. But I found our blocks of Cedar (*Widdringtonia juniperoides*) tenanted by numbers of a little *Bostrichus*, less than 1 line long, and I was greatly amused to watch a small Ichneumon fly very numerous also, entering every hole, looking evidently for the larvae of the Bostrichus to deposit its eggs in. The damage done by the Bostrichus was not great, however, only the bark and a little of the sap-wood being perforated.

TENEBRIONIDAE.

Of that family, few species, belonging mostly to the tribe Helopinidae, are known to be injurious to trees. Yet I have found the gregarious Helopid "*Zophius rufopictus*" in the decaying trunks of the willow "Salix capensis," and also in the crevices of fencing poles made of poplar.

CURCULIONIDAE.

In their perfect state—imago—the *Curculionidae* or weevils are mostly inoffensive, but in their primary stage, they are among the most injurious of insects. There is really not a single vegetal, says Mr. Ed. Perris, whose bud, leaf, stem, bark, wood, sap or root, is not attacked and destroyed by those insects. We have no less than 1,073 kinds of those pests in S. Africa. Most noticeable among the tree-haunting species, is the large *Mecocorynus loripes* (exhibited in drawer No 3). Dr. Becker, of Kowie, sent some time ago to the Museum some branches of the Kaffir Plum-tree, *Harpephyllum caffrum*, on which that weevil is found, which had circular holes on the outside. He suspected those galleries to be made by the larvae of the *Mecocorynus*. But on inspection, they were found to be due to the larvae of a Longicorn, probably either the *Erioderus hirtus* or the *Megopis modesta*. The larva of the *Sphadasmus camelus* (exhibited in drawer No. 7) constructs an earthen cocoon, which it affixes to the stem of a tree, which I have not been able to identify.

BRENTHIDAE.

16 species. All of them are truly xylophagous, but apparently scarce.

ANTHRIBIDAE.

28 species, living mostly in standing dry timber. The *Ischnocerus nigellus* is common round Cape Town, but seldom have I captured it on indigenous trees, except on the *Salix capensis*. The poplar seems to be his favourite haunt, and it is easily captured on the fencing poles made of that wood.

SCOLYTIDAE.

The representatives of that family are the tree-destroyers par excellence. Fortunately for us, six species only are described from S.

Africa, and, although they may be common in the wooded districts, I have only captured 4 specimens of one *Hylurgus*, I believe, near Cape Town, and have never here met with any sign of their presence. No doubt the number of species will be increased by further systematic research. *All the Scolytidae attack living trees.*

In the adult state, they notch the bark of trees to extract the juice. The female gets under the bark and hollows out a gallery, making series of notches in the sap-wood as she goes on, in which she deposits an egg. The larvae after they are hatched from the egg deposited by the parent insect, begin to gnaw the alburnum or sap-wood and form parallel tunnels proceeding on all sides from the central one, on which the eggs were placed, and form thus a most curious labyrinth. They choose for their resort the trees, the wood of which is of a hard texture. I have noticed traces of the presence of those in the Hard Pear, *Olinia capensis*, and White Pear, *Pterocelastrus rostratus*. I am not quite certain that I have also noticed traces in the Iron-wood, Olea capensis.

Through interruption of the flow of sap, and admission of wet between the bark and wood, decay speedily ensues.

The damage done by the Scolytidae has caused a great divergence of view among Entomologists and Foresters of great repute. Some, Ratzeburg among them, maintain that they attack the healthy trees; others, that they select only those trees which, without being exactly in a state of decay, are not in healthy condition. Audouin has gone further, and states that the female *Scolyti* never lay their eggs but on trees which are in a declining state, and that the healthiest elms on which the *Scolyti* abound, are constantly brought into this languishing state by the attacks of the males upon the bark, for food, so that, in consequence of the loss of sap from the numerous holes which they gnaw, and the subsequent mischief from the rain penetrating into them, the trees are soon brought into that unhealthy condition which the instinct of the female requires, to induce her to lay eggs in them."

It seems however to me that the punctures would determine in healthy trees, a flow of sap which would infallibly drown or agglutinate the newly-born larvae; but on the other hand, although those insects are very small, their number is so great that the extravasation of sap may not be in sufficient quantity to choke the young larvae of all the Scolytidae, although causing the destruction of many.

LONGICORNIA.

Some larvae of the insects composing that family, gnaw the bark only without touching the wood; others excavate very deep in the heart-wood (duramen) and some attack even the medullary substance. If the damage caused by them is less great than that caused by the *Bostrychidae* and *Scolytidae*, because they are undoubtedly less numerous; yet, the large size of most of them compensates for their numerical inferiority.

Although not always destroying entirely full-grown trees, they nearly always cause the death of young ones. But it is when the trees are felled and left to season, that they suffer most from those insects, and some species abound in timber yards, causing great losses to the owner, and attacking even those logs which are shorn of the

bark,—the best preventive remedy against the attacks of the xylophagous insects generally.

The largest examples of that family are the *Prionidae*, 14 of them known in S. Africa. The damage done by the *Tithoes confinis*, must be very great. In fact, I attribute to it, or to its congener, the *T. capensis*, the galleries, 1 inch deep and 1 inch broad, excavated in the sap and heart-wood of a small piece of Cape Ebony (*Euclea Pseudebenus*), a wood of extremely hard texture. I thought to be able to exhibit this little log, but I found that it has gone to Edinburgh.

The small *Delochilus prionides* is not uncommon near Cape Town, and I found the larva, a cylindrical legless one, in the Poplar tree, the Keurboom, *Vergilia-capensis*, and the oak. The *Erioderus hirtus*, sometimes met with here, is common in Knysna. I captured a female of that species in a healthy *Protaea grandiflora*, in the Hex River mountains. The *Cacosceles Ædipus*, an insect rare in collections, I found in the same place, in a decaying oak-tree, tunnelled perpendicularly by what, I have no doubt, was the larva lately emerged. In Natal, the extreme East, and also on the Orange River are found the large *Macrotoma*. The whole family numbers in S. Africa, 303 species, mostly all of large size, and of the tribe *Cerambycidae*, three of them only, the size of the *Cerambyx heros* too well known in Europe on account of its destructive powers. This closes the list of Coleopterous insects known or suspected to be injurious to forest trees in South Africa.

LEPIDOPTERA.

Of the Lepidoptera, Butterflies and Moths I will say little, because I know but little about that Order.

The genus *Cossus*, to which belong the English Goat Moth, *Cossus ligniperda*, injurious in Europe to nearly all kinds of timber and fruit-trees, possesses here two representatives only: that is to say as far as is known to Mr. Trimen. A tolerably large caterpillar, very beautifully marked, has been sent to us from the neighbourhood of Carnarvon, by Mr. Garwood Alston, to whom I am indebted, as also to his son, for several discoveries in the primary stages of several beetles. It feeds in the wood of a ligneous Mesembryanthemum *(M. junceum*)*, the ash-bush of the Colonists. The other Cossus is found in a *Buddleia sp.*?; it is the *C. tristis (Drury)*.

The grand Silver Moth (*Leto Venus*) found only in Knysna, I believe, haunts the Keurboom (*Virgilia capensis*) only, it is said. The Bombycid moths of the family *Saturnidae* have here about 20 species, mostly all of large size. Some of them are omnivorous, and residents on the Camp Ground are, doubtless, too well acquainted with the large deep red, green and yellow-spotted one, which devours so speedily the leaves of the pine-tree. It is the larva of the *Antherea Cytherea*. But the ravages of these Bombycidae are limited to foliage only.

We have then, on the whole, a sufficiency of insects injurious to trees, which will, no doubt, be anything but satisfactory to a Forester.

And now, will you say, that we know the possible extent of the damage that could be done by those insects, what are the preventives?

It is with sorrow, that I must answer, that the use of preventives against damages caused by insect agency have not always been followed by satisfactory results. It is extremely difficult to cope with

* Determined by Mr. P. MacOwan.

the innumerable minute *Scolyti*, for instance, and only radical measures, from the very beginning of the supervision of our forests by the officers of the Department, may partially eradicate the evil. We have the results of the same measures carried out in other countries, and I will not dwell on their efficacy, more or less ascertained.

The object of this paper, which I do not in any wise deem scientific, is simply to call your attention to the number and varieties of insects injurious to Forest trees, and also to ask for some information on the life-habit of those insects.

As I have said before, nothing is known on that subject, and what is needed is: true and reliable observations in different parts of the country. One man alone cannot do much. I cannot, for the present, at least, visit those districts where forests are found, but I would gladly make out, to the best of my abilities, those species which would be sent to me for that purpose, and keep due record of the observations which my correspondents would favour me with.

And then, I hope, that by manifold researches of that kind, we will be able, in time, to know the name and be acquainted with the life-history of those insects that are prejudicial to a certain given tree, as is now the case in European Countries and in the United States of America.

EXHIBITS.

Three drawers of Beetles.
One box of Bombycidae.
One box containing *Ledo Venus* and *Cossus*.
One piece of Ebony Wood.
Two showing the galleries of *Ledo Venus*.
One box containing *Alaus moerens*.
Larva of *l'Alaus moerens*.

AN INVESTIGATION INTO THE ISOBARIC INFLUENCES AND CYCLONIC PATHS OF SOUTH AFRICA.

By Adolph G. Howard.—April, 1885.

To the President and Members of the South African Philosophical Society.

Gentlemen,—In placing before you the following investigations into the Meteorology of South Africa, with my theories based thereon, I do not wish to convey the idea that they are facts fully proved, because such most decidedly is not the case. I wish them to be understood as representing merely the chrysalis from which a fully developed and practical law may ultimately be established, so that I merely offer them as a basis on which others (or perhaps myself) may erect a more useful superstructure.

The reason which induced me to make meteorology a study in this Colony, was the assertion of a friend of mine, soon after I arrived here, to the effect that the barometer always rose with a south-east

and fell with a north-west wind. This would of course be the case if the atmospheric waves travelled from S.W. to N.E., and as the great European waves travel from N.W. to S.E., I naturally supposed that the reverse would be the case here, and moreover my friend's assertion went to prove it.

But upon actually observing these phenomena myself, I was very much surprised to find the reverse the case.

Continuing my observations, I further discovered that the barometer very often fell, rose, and then fell again, the wind blowing from some point of south all the time, after which a north wind would set in, and the barometer begin slowly to rise. By this it was evident that the waves passed over us from north to south, and that cyclonic disturbances were passing us from north to east.

Again, and especially during the winter months, the barometer would fall with a northerly wind, which, chopping to the west, generally brought rain and a rising barometer, the wind ultimately going round to the S.W. These were evidently cyclones passing by the south of the Cape to the eastward.

It was not until the beginning of last year that I began a serious investigation of the storms of South Africa, at which time a daily report began to be issued by the Meteorological Commission from ten stations, principally on the coast, and from these I essayed the formation of synoptic charts, with a success beyond my expectations.

This year, through the kindness of Mr. Fry, the Secretary to the Meteorological Commission, I have obtained access to the up-country registers for January, and having reduced them to an approximate sea level, have plotted for each day on the series of charts marked A (and which I have lent to illustrate the paper) the differences whether for rise or fall between the reading on that day and that of the day before. Each station I have indicated by a small open circle, and where the barometer was either rising or falling I have shown this by a small red or black dot, the red meaning a rise and the black a fall. When the extreme limit on either side has been reached, the circle is entirely filled in with the indicating colour. Besides this I have plotted on the direction and force of the winds. By glancing at this series of charts it can be seen in a moment where the barometer is lowest and where highest, where rising and where falling. Moreover by following the directions of the wind it is possible to define where the areas of low or high pressure are situated.

The series of charts marked B (also lent to illustrate this paper) shew the utility of synoptic charts, and the fact that it is possible to prepare them if we can secure proper stations properly equipped. I am of opinion that it will be through the medium of synoptic charts, and by them alone, that the true data of South African storms will be arrived at, and the sooner some good stations are founded the better for our meteorology.

With these preliminary remarks I will proceed with my paper.

Before devoting my time to the study of South African meteorology, I made myself thoroughly acquainted with that of the Northern Hemisphere, because there are many things which are applicable to all places, such as the formation of cyclones in the permanent areas of low pressure; and that part of the world (that is, from Europe to America,) is so favourably situated for investigation, and has had such an amount of study devoted to it by the very best men of the day.

I shall refer as little as possible to the Northern Hemisphere, so will now state that I have taken the conditions there as a basis, and have proceeded on the assumption that "like conditions give like results," reversed, of course, on account of the different hemisphere.

* * * * * *

To Professor Buys Ballot of Utrecht belongs the honour of placing on record the law of the relationship between winds and gradients.

For the Southern Hemisphere the law is, "Stand with your back to the wind and the barometer will be lower on your *right* hand than on your left." Thus when a south-east wind is blowing in Cape Town the area of low pressure must be to the north-east, and the steeper the gradient the stronger will the wind blow.

The wind, as a rule, neither blows direct to the area of low pressure nor parallel to the isobars, but takes an intermediate course, blowing nearly parallel when far removed from the centre of low pressure, and nearly at right angles to them when close in: this centre is generally an area of dead calm. Hence it is evident that we have to examine the configuration of the isobars to arrive at the direction of the wind.

Isobars, though they are constantly changing, and form themselves into almost every shape, have several recognizable and general forms, the two principal ones being the cyclone and the anticyclone, the relative positions and pressures of which govern the weather of the world.

A cyclone is an area with the lowest barometer reading at the centre and the highest round the edges, the wind of course circling inwards, according to Buys Ballot's law. A cyclone can be of any size, and although the circular form is generally noticeable, still they are often so distorted as to appear of almost any shape.

To shew the immense size of some of these I may mention that it is no uncommon thing for one of them to rest over the whole North Atlantic, so that New York, Newfoundland, Greenland and Europe are being influenced by the same atmospheric circulation. On the 12th of November, 1875, one of these depressions covered the whole of Europe with the exception of Spain.

Although cyclones are often of such grotesque forms, still they have many points in common, and, as I said before, the circular form is generally noticeable, especially as the central isobars are reached, so that they are easy to be seen on a synoptic chart.

Besides this, there is a great similarity of weather in them, so that by examining one system we have the approximate conditions for them all.

Let us, therefore, imagine a cyclone to be situated over South Africa, and travelling from north to south. Having plotted it down on a chart, and divided it into four quadrants by lines running from north to south, and from east to west through the centre, the following is the weather we should expect to see.

South-west Quadrant.—To the south and west thin cirro-stratus, with a pale moon and perhaps a large halo. As the trough is approached the sky becomes overcast and threatening with heavy cumulo-stratus. Further from the centre, cirrus blown from the S.E. will be seen. Just as the trough is reached, if near the centre, a few misty showers will fall, but if away from the centre the cirrus will be clearing away to the south, and a hard blue sky be seen.

North-west Quadrant.—Mostly a blue sky, with the exception of occasional patches of detached cumulo-stratus.

South-east Quadrant.—To the south the usual watery sky with a halo round the moon, while further to the north very gloomy and threatening weather will be experienced. As the trough is approached we will find near the centre drizzle and driving rain, and further to the east a gloomy sky with dense cumulo-stratus.

North-east Quadrant.—Showers and squalls, followed by detached cumulus, windy cirrus, and finally blue sky.

The foregoing is the general description and position of the weather in a cyclone, but of course several conditions have a varying tendency, and considerably modify the weather: thus the presence of an anti-cyclone will increase the gradients, and cause more intense weather on that side than on the others.

Another cause of variation is when a secondary forms, which generally takes place along the prolongation of the trough or against an area of high pressure. The effect of this is to increase the force of the wind on the side furthest from the primary, and to reduce it between them, sometimes causing a dead calm.

The secondary forms a most important factor in the study of South African Meteorology, as scarcely a cyclone passes without having a secondary developed over the south-western districts.

Sometimes when a cyclone is in close proximity to two areas of high pressure a V depression is produced, which also modifies the weather.

An anti-cyclone is in every way the converse of a cyclone, the isobars, in this case, enclosing an area of high pressure, the circulation of wind being the reverse of that in a cyclone. Anti-cyclones are of all conceivable shapes, but are generally longer from east to west than from north to south, very often rising into two or more heads. When an offshoot takes the form of the letter V, it is called a wedge, and plays an important part in the formation of secondaries.

When two anti-cyclones approach close to one another they are generally joined by a neck of comparatively low pressure called a "Col," a formation of a very treacherous nature, because upon the near approach of a cyclone the tendency is for secondaries to form in this "Col," and it then becomes a matter of great doubt which way the secondary will travel.

The only other barometric influence affecting the weather is caused by waves travelling from the low pressure areas towards those of high pressure. In the central areas of low pressure the barometer is seldom stationary, but keeps on gently rising and falling. This oscillation causes a series of ring waves to flow outwards, similar to the wavelets caused by dropping a stone into still water.

With the foregoing general types of isobaric forms we will now devote a short time to the consideration of the storms, &c., of South Africa.

On Chart C, Nos. 5 and 6, I have delineated the mean barometer readings for the months of January and July, over that portion of Africa and the adjacent seas which affect Cape Colony.

We will first devote our attention to January's chart, and see how the differences of level influence our weather.

On either side of South Africa is to be seen an area of high pressure. These are called respectively the South Atlantic and Indian Ocean permanent anti-cyclones, and are joined together by a "Col."

To the north is the assumed low pressure area of Central Africa. The limits or position of this area are, of course, not known, but all the surrounding conditions go to prove that such a depression does exist, because in no other way can our summer storms be accounted for.

To the south of the two anti-cyclones is the south sea belt of low pressure which completely surrounds the South Pole.

It is from the area of low pressure to the north of us that the great majority of our summer cyclones come, the motive power of generation being the great South Atlantic anti-cyclone.

Neither cyclones nor anti-cyclones are ever motionless, but are constantly varying in shape and pressure, the accompanying chart merely giving the mean of a very great number of years. The reason of this is that the two areas, high and low, are constantly reacting on one another. The air in the depression is more rarified at one time than at another, and consequently the quantity of atmosphere flowing onto the neighbouring high pressure areas varies, hence these areas fluctuate both in pressure and size, sometimes almost embracing the low pressure areas. When such a state of relationship exists, there is a great inclination on the part of the low pressure area to form a secondary, which is accelerated if the high pressure forms itself into a wedge.

Anti-cyclones change very slowly, and cyclones very quickly, so it can be seen how several of these secondaries may form, become veritable cyclones, and pass to the south before the anti-cyclone changes its shape.

On the same chart, Nos. 1 to 4, I have depicted the formation of an imaginary cyclone, the area of high pressure extending along the coast and almost embracing the depression on the north. On No. 1 we have a cyclone passing off the Colony, while a secondary is forming to the S.W. of the central depression. In No. 2 the whole system has moved further to the S.W., the secondary has increased in proportions, and the permanent area decreased. Low pressure exists at Natal, where the last depression is passing to the eastwards. On No. 3 the secondary has become a veritable cyclone, and is travelling to the south, while the permanent area has retreated and assumed its original proportions. Lastly, on No. 4 the cyclone is fairly over the Colony, and has developed a secondary towards the S.W. Another secondary is forming in the permanent low pressure area, and as long as the relative position of anti-cyclone and depression remains unaltered the same sequence of weather will be experienced. The colonial isobars of these diagrams were taken from my synoptic charts for the 17th to 20th January of this year. Of course when the shape and pressure of the anti-cyclone changes, the paths of the cyclones will change also.

The foregoing diagrams merely illustrated the formation of a cyclone on the S.W. side of the central depression, but I am of opinion that they are formed all round this area, those on the eastern side, if they do not move away eastwards at once, will revolve round from E. by S. to W., and then if not retarded by an anti-cyclonic wedge, will pass off and be lost in the S.E. trade zone of the Atlantic; but if the anti-cyclone bars their further progress, they will be deflected and travel south, and pass off to the east.

These I call the summer cyclones, in opposition to the winter ones to which I shall refer later on.

By referring to the weather in the typical cyclone mentioned before, we can form a very fair estimate of that which may be expected to visit the different districts traversed by the cyclone. In the western districts, as it approaches, thin cirro-strati will be seen, with a halo round the moon, as the trough is approaching cumulo-strati will be developed, and high cirri blown into threads from the south-east. The wind will meanwhile back, or veer as the case may be, to the east and south-east, going more to the south as the trough approaches. As soon as the barometer begins to rise a few hazy showers may fall, or else a dense fog form, when the wind freshening from the south, will ultimately blow strong with a rising barometer and a hard, clear sky. I think it must be confessed that the foregoing is a very accurate description of the sequence of weather in Cape Town during the passage of one of these cyclones.

The heaviest rain would naturally fall over the north-eastern districts. Thunderstorms are prevalent in the advancing left hand quadrant, consequently the north-eastern districts with Natal would be very subject to them during the summer months. Moreover, as this is the wettest half of the cyclone, these same districts would have their wet seasons during summer and autumn, and comparatively dry seasons during the other two quarters.

Now what are the real facts of the case? According to Mr. Gamble's rainfall means, the N.E. and Eastern Districts of the Colony, with very few exceptions, have their wettest months during the summer, while the west and S.W. districts have their driest months then. I think this of itself proves the general track of summer cyclones.

When a cyclone advances over the Colony from the N. or N.W. it is usually checked in its onward career by the comparatively higher pressure to the south of us, but as this higher pressure is merely the "Col" joining the two anti-cyclones, there is a great tendency for the cyclone to develope a secondary in it, and we know from experience that primaries and secondaries, aud often two or more cyclones, very often coalesce to form one again; the whole system very often in this way passes through the "Col," and is lost in the south seas. A case of this kind was experienced over Europe in June, 1882. On the 26th a "Col" lay to the east of England, joining two anti-cyclones, one north and the other south. A small secondary was near Aberdeen, while the primary was advancing on the coast of Ireland. The forecasts were issued on the assumption that the cyclones would advance to the north and the "Col" remain intact, but by next morning the two cyclones had coalesced and formed a single system, which was passing *between* the two high pressure areas, over the exact spot where the "Col" was the day before. I have heard doubts expressed as to the possibility of a cyclone breaking through a bank of higher pressure, but from experience this is often known to be the case in Europe, and I see no reason to doubt the possibility of it here. But very often the advancing cyclone *is* checked by this bank, and either fills up and dies away, or else passes off to the east. The result of this is what one would look upon as a contradiction. According to the law of winds as the cyclone advances we would expect N.E. winds in Natal, east winds round the coast, and S.E. winds at the Cape, all changing to S. as the cyclone moved away to the eastward. But if the "Col" happens to stretch across the Colony, so as to have gradients for west winds at, say Cape St. Francis to Port Alfred,

these places will not be affected by the cyclone, and the in nowise uncommon occurrence of N.E. winds at Natal and East London, S.E. at the Cape, S.W. at Cape L'Agulhas, and W. or N.W. winds at the other coast ports, will be experienced.

Another source of variation is the almost invariable formation of a secondary against the Atlantic anti-cyclone, which secondary always passes close to Cape Town and intensifies the S. or S.E. wind there and at Cape Point by increasing the gradient. Sometimes a secondary forms on the "Col," which, becoming an independent cyclone, passes off to the S.E., while the primary travels to the N.E.

All these conditions make the forecasting of weather round the coast very difficult.

I am of opinion that sometimes this "Col" is absent for several days at a time, and if during that period a cyclone approaches it is sure to pass to the S. or S.E. The centre of a cyclone travelling from N. to S. passed over Cape Town on the night of the 2nd of this month (April), the wind chopping very suddenly from S.E. strong to N.W. fresh. By the foregoing it will be seen how beneficial it would be to know the true state of the atmosphere in this region upon the approach of a cyclone.

I cannot pass over this portion of my paper without referring to the immense value that would be attached to stations further north, say at Port Nolloth and Walvisch Bay. Of course at the present time telegraphic communication with these stations has not been established, consequently it would be useless to refer to them in any other way than to shew their importance for the future, when perchance they may be joined to Cape Town by wire. Whenever a depression is advancing from the north, Walvisch Bay will be the first to feel it. An east wind with a falling barometer will be the sign of its approach. If the wind becomes more northerly the depression will pass off to the Atlantic, but if it turns to the S.E and S., the cyclone is travelling southwards, and will pass over the Colony. The next stations to watch then are Bloemfontein or Kimberley and Port Nolloth, between which most of the cyclones pass. By carefully noting the changes of wind at these places the path of the storm can easily be followed.

I do not think I need say anything more in connection with these summer storms; I hope I have placed enough before you to influence a further investigation, which I sincerely trust to see before long worked out into a practical form, and if through the instrumentality of these few ideas anybody succeeds in advancing practical meteorology in South Africa I shall be satisfied.

I shall now pass on to what I call the winter cyclones. By referring to the charts for both January and July, it will be seen that a permanent area of low pressure exists to the south of us, but that whereas the positions of the anti-cyclones during January cause the storms formed in this area to have but little effect on the Colony, their positions during July being much further north, exposes the whole Colony to the full force of the South Sea cyclones. Furthermore it will be noticed, on July's chart, that the area of low pressure to the north has entirely disappeared, or travelled so far north that its effects cannot be felt over South Africa, thus it is that though a few of these winter storms make their influence felt during the summer months, during winter they are the *only* type that ever visit us.

These storms must be generated on the southern edge of the Atlantic anti-cyclone, somewhere to the west of us, and travel from west to east. By referring to our typical cyclone we will be enabled to judge the sort of weather which might be expected.

The position and size of the Atlantic anti-cyclone will also affect the path of these storms and cause them either to advance to us from a W.N.W. or a S.W. direction, from either of which points, or somewhere between them they always come. The position and size of the Indian Ocean anti-cyclone will also govern the direction they leave us. Numbers of these depressions come from the S.W., pass the Cape from west to east, and leave us in a south-easterly direction, their path being in the form of the arc of a circle. Others again come from a W.N.W. direction, and pass by us towards the S.E.

There is very little doubt that secondaries are of as common an occurrence on the northern edges of these cyclones as they are on the S.W. edges of the summer ones; in fact I am of opinion that the great majority of our winter weather is caused by these secondaries, for in no other way can we account for the directions of the wind. Captain Toinbee has proved that these South Sea depressions are of enormous magnitudes, stretching from the South Coast of Africa to the 70th parallel of south latitude, so that if our weather were merely affected by these larger depressions, our winds would only range from N.W., through W. to S.W., but very often the approach is heralded by N.E. winds all round the coast, and the constant phenomenon of the wind suddenly chopping from N. to W. as the trough passes, points to the fact that the centre is not very far from us, and consequently these depressions mu t be of small dimensions as compared with the great South Sea cyclones, and must either be secondaries or small independent storms generated, as I before said, on the southern edge of the great South Atlantic anti-cyclone.

But the question as to whether these storms be secondaries or not does not affect our meteorology very much, because they are of such dimensions as to bear all the characteristics of independent cyclones, in which light we can study them. Smaller secondaries are often formed against the South Atlantic high pressure area, which secondaries materially affect the Cape Peninsula, causing the wind to blow from the N.W. when a S.W. wind would have been prognosticated.

An example of this may be seen in the storm which passed us from the 21st to 24th of March this year. On the 21st the barometer was steadily falling with a N.W. wind and all the atmospheric indications of a winter storm. The predictions for Cape Town would have been a sequence of N.W., W., and S.W. winds. On the 22nd the wind went more to the W.N.W., the indications increased, and a thunderstorm broke over Piquetberg, with a few showers here. On the 23rd the barometer had risen, but instead of the wind being S.W. it was N., ultimately turning to N.W. and W. Heavy showers fell all day. On the 24th the wind remained at W. till the afternoon, when it backed to the N.W. again. Slight showers fell all day. Next day the wind was S.W., and the barometer reached its maximum. By studying the foregoing it is very evident that a secondary formed to the west of us, which altered the direction of the wind here on the 23rd and 24th.

These secondaries upset much of our forecasting if they are the

exception, but when they are the rule, which I believe is the case with these storms, we know then what allowances to make. For instance, when a winter storm is approaching, look out for strong N.W. and W. winds with heavy rain at Cape Town, when the barometer begins to rise.

The last type of storm I wish, for the present at least, to bring to your notice, is akin to the winter type. The conditions are these: A strong N.N.E. wind is accompanied by a falling barometer and all the indications of the left-hand advance quadrant of a cyclone. As soon as the rain falls, which it generally does in heavy squalls, the wind veers to N. and N.W., when the barometer begins to rise. This I take to be caused by a high pressure wedge over the Colony, deflecting the cyclone and causing it to travel from north to south, and very likely the same storm might be recognised a few days later in the Eastern Districts travelling from the S. or S.W.

The storm which passed us from the 8th to the 11th of last February, was deflected in this way by a wedge of high pressure over the Colony. During the passage of this storm (which was an exceptional one for summer), the barometer fell considerably at the coast stations, amounting to four-tenths at Port Elizabeth and three-tenths at Cape Town, while at Kimberley and Bloemfontein it remained approximately steady.

As a passing remark I will mention how fortunate it is for the Colony that the permanent anti-cyclones are not always of one form, for if such were the case, no western storm would ever reach us during the summer months, and as a consequence the western and southern districts would be no more than a drought-stricken wilderness for four or five months each year.

I cannot conclude without recording my sincerest thanks to Mr. Fry, the Secretary to the Meteorological Commission, for the kind and courteous manner in which he has placed the various data at my disposal, and also to Mr. Gamble, who so kindly consented to read this communication.

I hope that before long I, or someone else better able to do so, will have brought these theories of mine into a more tangible form, and that the actual practical deductions will be greatly in excess of theoretical ideas.

Meteorology is not a science reduceable by mathematical rules, nor do I believe it ever will be. Astronomy has to deal with solid and unyeilding bodies governed by fixed laws, but though, no doubt, there *is* a law governing the formation of atmospheric pressures, still the materials we have to deal with are of such a changeable nature, that even the contour of the earth's surface will cause a material deflection. Astronomy has taken many thousands of years to bring it to its present degree of precision, and even now it is not perfect, and although we have greater advantages now, than had those who in former years traced the science of Astronomy through such grotesque and tortuous windings and absurd theories and investigations, still it will be many, many years before Meteorology can be looked upon as, it will ultimately be, the younger brother to Astronomy.

In conclusion, Mr. President and Gentlemen, let me thank you for having listened so patiently to the foregoing, and my only hope is, that some of these ideas will be food for thought, for if I have but caused one more to care for the study of Meteorology, and to advance on a train of ideas which he would never have thought of doing but for this paper (whether for or against my theories), I am satisfied.

PATHOLOGICAL EVOLUTION.

Pathology from an "Evolution" point of view, by J. H. Meiring Beck, M.B., C.M., M.R.C.P., Ed.

[Read 1885, May 27.]

I may be excused if I approach my subject with considerable hesitation. Its importance on the one hand, and its difficulties on the other, are sufficiently great to induce the greatest diffidence in bringing it forward. There are reasons why here in this country, however, where to a large extent we have very special opportunities for the investigation of disease phenomena, where, through comparative isolation of the inhabitants, it becomes less difficult to trace the development of disease, its progress, and means of arrest—there are reasons why here particularly the question should be regarded with the greatest interest.

Since modern medical thought has begun to busy itself with the "Germ basis" of disease, and since it has become almost universally accepted as a part of medical dogma that most of the diseases we have to deal with have their origin in living germs, in organisms having for their regulation the same laws that guide living matter in other directions—since the modern medical mind has commenced to realise this great fact, methods of reasoning which before would have been considered inadmissible have more and more begun to force themselves as proper, and in the highest degree applicable.

In order to render excusable my object, it is necessary that I should, in a concrete way, attempt to convey to the minds of those here what really I consider the relationships existing between the *Doctrine of Evolution* and the development of disease, and further that I should in the same concrete manner attempt to convey in how far human knowledge will be advanced by a demonstration of the fact of such application.

My theory as it stands might be postulated briefly, and simply thus:

Most diseases with which we are acquainted have their origin in tangible and living germs, demonstrable in many instances by the microscope to the sense of sight.

These germs are organisms which are low in the scale of life, and have an extremely short life history.

A germ produced from a pre-existing germ at this moment may, before many hours have passed, have given rise to others, which again in their turn, and in an equally short space of time, may give rise to further and more successive crops. This may be demonstrated experimentally—*e.g.*: If into a rabbit, a small quantity of septicœmic fluid be infected, in a few days' time the blood will be found teeming with millions of minute organisms, which go on multiplying till probably they so drain the sources of food supply which are necessary for the maintenance of life, in the various living cells which go to make up the various organs of the rabbit, that death of the whole animal ensues.

Being low organisms, and having a short life history, many genera-

tions may succeed each other rapidly, and a consequent possibility follows that surrounding circumstances may modify appreciably and rapidly the constitution and organization of these germs, so that it is possible for a germ, harmless now, to assume extremely virulent properties soon.

That this is no mere speculation but actual fact, Pasteur has demonstrated experimentally. His results are too well known to render it necessary for me to do more than briefly indicate what they prove. He experimented largely with the germs that are associated with "splenic fever" in sheep. This, an extremely infectious and fatal disease, attacking sheep in various countries, Pasteur found was caused by a germ which could be changed completely by simply cultivating it in certain fluids. Starting with a virulent germ, he found that after cultivating about 30 or 40 generations in such fluids, he obtained a changed organism, unmistakeably derived from the harmful parent, but quite incapable of exercising its functions, in other words, quite incapable of causing the same virulent type of disease that the parent germ could.

Here, actually in an artificial laboratory, it was possible to create changes in an organism sufficiently tangible to be appreciable by ordinary observation, and at least this *fact* then is proved: that the germs we deal with in disease are *not fixed* in character, and that if they could be experimentally modified, then in Nature's laboratories existing around us far more exquisite modifications may be possible.

The fields for speculation opened up by Pasteur's results are as wide as they are beautiful, and I do not say too much when I declare that they usher in a completely new epoch in the history and practice of medicine.

We have seen that we deal with living organisms of a low order, demonstrated by Pasteur to be changeable in *type*.

May we not go one step further, and speculate also as to their changeability of *species*. Up to this I am perfectly aware this question has neither been much discussed nor much entertained, and it is just one of those speculations which does not admit of proof at present.

Because it has not been demonstrated that *higher organisms* have ever changed their species, the conclusion at once is rushed at that such a thing as modification of species is absurd.

"De Quatrefages," in an admirable book on the "Human Species," published not long ago, devotes 500 or 600 pages to an attempt to prove the unscience (if I may so call it) of such an assumption, and though expressing the greatest admiration for Darwin, he criticises the assumption of "*Origin of Species*" in terms of the greatest severity. He bases his antagonism to Darwin's hypothesis almost entirely upon the assumption that no fertile hybrid has ever resulted from the crossing of plants or animals of different species. Now, it is not for me to say anything in this connection. I have, however, taken the trouble to look into the matter, and I have the good fortune to be able to quote from papers which appeared in the "*Botanische Jahrbücher*," and in the "Naturforscher," by Herr W. O. Focke, observations which at least do not render this fact quite so certain as "De Quatrefages" would make out.

Focke studied particularly the behaviour of different species of "blackberry" existing in Europe. Since 1857, *i.e.*, prior to the publication

of Darwin's great work, he has devoted study to this group of plants, and this is what he says :

"That the blackberries do in fact very frequently produce hybrids is certain. Rubus Cœsius a well-known variety of the plant fertilises all other species with which it occurs in common, and like various other species is accompanied by its hybrid progeny.

"It has often been doubted whether permanent species can arise from hybrids.

" Hybrids between species mutually remote from each other are often sparingly fruitful. But we often find, *e.g.*, in Rubus Cœsius, and R. Tomentosus (two well-known species of blackberry), in favourable localities, all intermediate links between sterile and fairly fruitful specimens. The original lack of permanence in hybrids, as numerous observations prove, *loses itself often entirely in successive generations.*"

He further on adds : "If we consider that the majority of our cultivated plants have been produced by crossing, whilst all our art and all our exaggerated influences of soil and climate have not been able to affect much change in given natural species, we shall not be able to resist the conviction that the crossing of species and races has a greater effect in the formation of *new* species than has hitherto been credited."

Now, I have quoted the above simply to show that the whole question of " *Origin of Species* " is still on debatable ground. That being so, surely De Quatrefages has fallen into error, when, instead of beginning his study with the lowest of organisms, he goes to the other extreme, and studies the " highest " for proof of his position.

Now it would be manifestly rash to jump to a positive conclusion with regard to at present an insufficiently proved assumption, the origin of one species from another, but this I do submit, that in a study of disease phenomena, and in a close observation of the behaviour of the low organisms associated with them, lies a possibility of a solution of this difficult question which is not properly appreciated, and the proud possibility rests with students of the conditions of life of these low organisms, in other words, with students of "Modern Pathology," to supply the links wanting in the admirable chain woven by Darwin and other great workers on his lines.

In this lies the value of the work, and *in this* lies the positive addition which it may be possible for students of modern pathology to make to human knowledge.

Compare for a moment how favourably situated our "disease germs" are for study in this connection, as opposed to higher organisms. Take man—an organism made up of infinitely numerous parts, every organ composed of an infinite series of living cells—consider what must happen before a change even of type is possible, to say nothing of a change which will permanently perpetuate itself in the offspring. Why, infinite generations would be required before a type differentiated from the present could become permanent and perpetuate itself, and infinite generations would comprise for man a number of years not measurable by ordinary human calculation.

In our "disease germs" we have on the other hand a "simple organism," differentiated, perhaps, not even as highly as the individual "cell" in any one human organ. Not only is this organism low in the scale of life, but it has a power of multiplication which renders infinite generations possible in an extremely short time. A few days

suffice to supply us in this connection with as much scope for observation as thousands of years in connection with higher organisms.

More than a year ago, in a communication I made to the South African Medical Society, I contended for a possible *de novo* origin of small-pox. More than *two years ago* I read before the members of this Society a paper in which I attempted to explain the cause of the camp fever of Kimberley.

In both papers I followed a line of reasoning which assumed the possibility of the development of "disease germs" where before none existed, and where special conditions had arisen to favour their development.

Since then I have closely watched such disease phenomena as have come under my notice, and my observations have only strengthened my conviction as to the variability of germs.

Last year an epidemic of pneumonia occurred in Worcester, where I at that time practised.

It is not necessary for me to go into modern ideas with regard to this disease, but I may by way of explanation say that a large school of pathologists now regard it no longer as a disease of the "lungs" proper, but as a fever having for its distinctive character certain changes in the lungs, just as in the same way small-pox is a fever which has for its distinctive charater certain changes in the *skin*. At the same time with this epidemic occurred an epidemic of *rheumatic fever* and an epidemic of *remittent fever*.

The last we all recognise as a malarious fever. Rheumatism, Maclagan, one the greatest authorities at the present time on the subject, and the collaborator of the *salicin* treatment of the disease, declares to be also malarious in origin. If we agree with him, and I for one do agree with him, then the remittent and rheumatic fevers must have more or less allied conditions causing them, and be subject more or less to the same casual laws. Now in one house a man was attacked with pneumonia, his wife with remittent fever,—both fell ill at the same time, both had typical attacks. The wife suffered from chest complications of a decided kind, a significant fact when taken in connection with the pneumonia of the husband. These passed off after a while. In another house one child developed pneumonia, another child rheumatic fever. Both fell ill at the same time, both had typical attacks. The thought suggested itself very forcibly that the simultaneous occurrence of a pneumonia in the one house with the malarious remittent fever, in another house with the malarious rheumatic fever, was an indication that, in some way or other, there was an associated causal condition for the three different diseases.

At Kimberley I am assured, on the best of authority, that of Miss Schreiner, a lady of the most remarkable powers of observation, who devotes her entire energies to the care of the sick, and charitable work of a like kind, that the natives almost invariably develope "pneumonia" after a heavy fall of rain.

Now it is well-known that natives, almost everywhere, are not extremely susceptible to ordinary malaria, and the thought occurs that here, under circumstances unfavourable in the native to the development of an ordinary malarious fever, conditions which are known to be favourable for the development of the malarious germ become favourable for the production of pneumonia. I mention this by way of additional evidence in support of my hint as to the probable identity

of casual relationships for some forms of pneumonia and malarious fevers.

Now I do not positively say that this casual relationship exists, but if so, and if all three are, as we have every reason to believe they are, germ diseases, then we may fairly assume that my Worcester cases were a practical indication of the possibility of germ transmutation.

In other words, the conclusion is suggested that germs bred under certain related conditions, finding dissimilar circumstances in different subjects, might be assumed to possess the potential power to develope in different directions, and cause in different individuals different results.

This is a wild speculation, it may be said, and so perhaps it is. Facts, however, are facts, and from the facts I have above adduced, my deduction is, I maintain, rendered probable. At least, it will be conceded that there may be truth in it, and if true, a very different realisation of the relationships existing between disease phenomena, hitherto regarded as having no relationships, will be opened up.

I maintain that with the advantages of this country for clinical study, questions of this sort are of a kind which ought to come up, and if some thought be induced in the direction I have indicated, I shall not have come forward with my theories, crudely developed as they are, in vain. The whole subject is full of practical application, and it would require more time than I can give, or than it would be right to expect you to give, if I were to enter fully into this aspect of the matter. I may, however, briefly be allowed to show by a single illustration the kind of application possible. To pursue this matter exhaustively is not necessary.

All medical men in practice will have come across many cases which, as they go on, change their type.

For instance, in the course of an ordinary pneumonia, a typhoid condition supervenes, or in the course of an ordinary fever a sudden pneumonia developes, and perhaps carries off the patient. How perfectly explainable this becomes when we assume the possibility of a change in the organisation of the germ which constituted the original infecting factor. For various reasons, the *pabulum* in the body at the time of infection preferred by one germ may become modified, or may become exhausted.

One of two results must follow, either the germ must die or develope an aptitude for changed circumstances of life. This in so low an organism as Pasteur has shown does not occur without some change in its character, and change in character creates modified result. As I have said, the subject is full of practical application, and I venture to predict that in this direction lies the greatest possiblity and probability for future pathological advance.

It would be out of place for me to burden my communication with an enumeration of clinical observations. I must not forget that I am addressing a mixed audience, whose indulgence I may tempt too much. To some extent I could not avoid doing this, however, and I may be allowed to express a hope that the slight technicalities adduced may not have been without sufficient general interest to justify them.

It will be noticed that I have in my remarks touched upon the "evolution hypothesis" only in as far as it bears upon the external agencies in disease.

I have left untouched its application as regards the internal mechan-

ism. The mechanism by which "predispositions," hereditary or otherwise, are determined, and the agencies by which "resisting power" to infection is developed, would fall under this head. The living body, it must be remembered, is made up of living cell elements.

These obey the same laws that living matter elsewhere does, and a constant adaption to surrounding circumstances goes on. That this is so is beautifully illustrated by the "official documents" upon the annual mortality in the thousand inhabitants at Sierra Leone from 1829 to 1836.

From these it appears that while 410·2 per 1,000 Europeans annually die from "marsh fever," only 2·4 Negroes succumb. This will amply demonstrate what I mean. On no assumption can the disproportion in mortality be explained but that by which the Negro is credited with a special resistance to miasmatic infection.

This power of resistance can only have resulted from a gradual adaptation to their surroundings of the living cells in successive generations of Negroes, an adaptation which in transmission from father to son became intensified sufficiently to create ultimately an almost absolute immunity from marsh fever.

On the assumption of such adaptation can almost be explained the occurrence of acute fevers in epidemic form, such as, *e.g.*, small-pox. It is reasonable to assume that when a series of laws, climatic or otherwise, come into operation to favour the development in certain directions of germs outside, that the same laws, reacting upon the human organism, create an adaptation of parts, which for the time determines a susceptibility to infection.

When these laws change, a reverse process may be assumed to go on, and the epidemics disappear.

If this were not so, then it would be quite unexplainable why such epidemics as our last small-pox outbreak should ever disappear entirely. We know that every person attacked increases in a positive ratio the quantity of poison. When, therefore, an epidemic is at its height, the quantity of infecting material must also be at its maximum.

Instead of going on, however, a retrogressive development occurs, and the epidemic dies out not only, but also remains away for perhaps a period of years, and then appears again. If this retrogressive development were not there, we should be at an entire loss to account for the fact that there was no spread of small-pox in Cape Town last year when cases from Kimberley were imported, especially when we take this fact in connection with what happened in 1882, when a single case created in the most rapid manner an epidemic which raged over the whole of the Western Province almost. It must be remembered that there are always unvaccinated persons in large towns.

M. Boudin, in an interesting work on ethnological pathology, writes as follows:—"Elephantiasis, that affection by which certain parts of the body are sometimes deformed in so strange a manner, is found in the Indies and at Barbadoes.

"In the latter island negroes alone were attacked by this hideous disease till the year 1704. *One white* was in that year affected by it for the first time. But the disease made way, and in 1760 it had extended to the Creole population.

"Whites of *European origin* have as yet escaped.

" The elephantiasis of India is found in Ceylon. There, again, it only attacks natives, Creoles, and individuals of mixed blood. Hindoos and Europeans are exempt from it. *Only one case* of this disease had been observed in a European white.

" But this individual had inhabited the island for thirty years." Acclimatisation, he adds, had been carried so far in his case as to cause him to lose his ethnological immunity. In other words, this acclimatisation in some way or other must have modified the internal mechanism of this European sufficiently to create a susceptibility to disease for him which before did not exist. Only on this assumption can this fact be explained.

It would be interesting to pursue this part of my subject further. I have already, however, exceeded the time I have a right to expect you to give me. I shall, therefore, content myself with the hope that I have said enough to demonstrate how important it is for us to recognise in pathology, as in other sciences and departments of thought, the great fundamental principle indicated by the " Law of Evolution," and how, on the assumption of its applicability to questions of disease, what we now regard as abnormal processes may be brought into normality and unity with everything around them.

AN ADDENDUM TO A PREVIOUS PAPER ENTITLED "PATHOLOGY," FROM AN "EVOLUTION POINT OF VIEW."

(Read at the May Meeting of the South African Philosophical Society, 1885.)

By J. H. Meiring Beck, M.B., C.M., M.R.C.P., Ed.

It was not my intention this evening again to bring forward the subject which at the last meeting of this Society I had the honour to introduce. One or two of the members present then, who were interested in the remarks I made, however came to me after the meeting, and requested me to write an addendum to my paper, inasmuch as it was thought that by so doing I should sustain, or at any rate revive whatever little interest was roused then. I hope therefore that you will bear with me, and that if I demand from you what may be considered perhaps too much indulgence, you will kindly lay the blame not so much at my door as at that of the gentlemen responsible for my communication of this evening. I shall try to be as brief as possible.

* * * * * *

It will be remembered that I divided my subject into two parts. In the first I dealt with the " Exciting factors "—the germs of disease, and endeavoured to explain how I thought the law of evolution influenced them, as I believe it influences other living organisms, and how as clinical students we were fortunate in having phenomena to observe, associated with living forms so low in the scale of life, and possessing so remarkable and rapid a power of multiplication.

In the second portion I endeavoured to shew briefly how the same laws acting upon the living human organism, and its component cells, might also be inferred to influence *them* so as to establish as it were a receptivity for, or resistance to, this exciting factor.

To make clear my position I quoted cases which had occurred in my own practice which seemed to me to present features bearing upon my ideas. I have since taken the trouble to look into published records from others, and I have been both surprised and pleased at the mass of evidence which has accumulated in support of the views expressed by me. Some of this evidence I propose to bring forward, restricting myself as far as possible within bounds, which in a mixed Society like this it is necessary to observe. I propose again to follow the plan before laid down, and to take up briefly the consideration of my subject from the side taken in my last paper.

Firstly, then. The consideration of cases which seem to indicate the fact of *germ* transmutation. About a year ago was published a very remarkable book by Dr. Kenneth Millican, which to a great degree expresses what I have often thought.

I should in passing observe that prior to the publication of the book I had written and read to various colleagues of mine views so similar to Dr. Millican's that I was in many cases quite startled at the similarity of our ideas. I mention this to define my position with regard to my theories, and at the same time that I may be enabled to express my appreciation of the completeness and originality with which the author has worked out the subject. In the book in question a case is reported which occurred in Dr. Millican's practice, and which I give in his own words as far as I can conveniently do so. He writes:—

"I first saw my patient, a strong healthy farm labourer, twenty years of age, on the third day of a severe feverish attack, when I found the evening temperature 102° F. He had been 'out of sorts' some week or ten days previously. * * * He lay prostrate, at times delirious, and had two or three '*Diphtheritic*'-*looking patches* on the tonsils. I succeeded with difficulty in detaching a small portion of the membrane from the tonsils, but found on my next visit that the patch had been renewed. On the twelfth day of the fever a crop of '*rose spots*' were visible on the body. These both in their character and appearance resembled the rash of typhus. The temperature had risen to 105° F. * * On the fifteenth day, three days after this extreme temperature, it fell again to 100° F., and the patient seemed easier. The mother called my attention to some shotty *papules* on the body.

"The seventeenth day, two days later, saw the first crop of rose spots almost entirely replaced by new ones.

"By the twenty-first day of the fever, or six days after the appearance of the papules, he looked, as the mother remarked, for all the world as if he had been vaccinated. The papules ran the course of an ordinary small-pox eruption, and after the thirtieth day of the fever he began to mend rapidly." Dr. Millican adds:—

"The combination of symptoms here was remarkable. But for the astounding nature of the assertion one would have felt inclined to say that the patient was suffering from a combination of typhus fever, with diphtheria and small-pox. It was found quite impossible, after the most careful search, to trace any source of contagion for any one of the diseases which were here presented or counterfeited. There was no possible chance of ordinary infection, for the patient lived in an isolated village, from which he had not been so far as four miles for many months.

"There had been no contact with any person labouring under any kind of infectious disease. There were *no cases of infectious disease* of any kind existent at the time in the village or neighbourhood." * * * * * * It will be readily admitted that the above case offers ample food for reflection, and suggests strongly that by some subtle influence existing at the time in the body there was a struggle for development in different directions of the infecting factor. Either this must be inferred, or the conclusion arrived at of infection simultaneously and separately by the specific germs associated with the diseases named—none of which diseases in the most clear manner possible Dr. Millican asserts were anywhere to be found at the time. But other anomalies are also recorded, which strengthen me in my convictions. For instance, in the *British Medical Journal* for February 1, 1879, Dr. Holland records a case where a pupil at a school contracted "decided scarlatina" from two new pupils, who "though doing ordinary school duties had a nasal discharge and excoriation of the lips, attributed to cold."

During the second week the pupils fell ill in rapid succession to the number of 24 or 25, and the school was broken up. The invalid presented—and this is the remarkable point—every conceivable variety of *diphtheria and scarlatina.* In other words, from an anomalous indeterminate infecting source common to both, seemed to arise two diseases hitherto regarded as specifically distinct from each other. The explanation suggests itself that an indeterminate germ originally finding dissimilar conditions in the various pupils developed in some in the direction of diphtheria, in others of scarlet fever; and curiously coincident with this explanation of these cases are some remarks made by Professor Hueter, of Grufswold, at the International Medical Congress at London, 1881. He spoke as follows :—

"Practically, the question of the specific functional activity of micro-organisms and their relative unity may be stated something in this way :—'Is it necessary that a person who falls ill with scarlatina, measles, or small-pox must have received the infection from another individual affected by scarlatina, measles, or small-pox? I for my part answer the question with No! while the defender of the theory of absolute specificity must answer it in the affirmative. I consider it possible that at any spot the putrefactive processes may take on such a course that micro-organisms arise from them which produce scarlatina. The disease might then originate at this spot without there having been any absolute continuity of infection from another case of scarlatina.'" (*Vide* Transactions Int. Med. Cong., vol. 1, p. 329). Coming from an authority and observer like Hueter, these words are entitled to respect, and if the cases I have quoted above are worth anything they exemplify in a marked manner the truth of his assertions.

Writing in 1872 Professor Stokes remarks (*Vide British Medical Journal,* April 13th, 1872—A Discourse on State Medicine) :—

"No one who has not had a lifelong experience of epidemics can estimate the difficulties which exist as to their origin. * * * * * The appearance of epidemics at irregular periods, while their supposed exciting causes remain constant; their disappearance though the causes continue in full operation; their outbreaks in all latitudes, climes, and seasons; their different modes of spreading; the want of constancy in their symptoms and history (for every great epidemic

has its own character); the varieties as to the extent, nature, and effect of the secondary affections which arise in their course; the varieties of the mode of subsidence and behaviour under treatment; their degree of mortality and contagiousness,—all these things constitute the difficulties which surround us in our investigations as to zymotic diseases. They bear on the supposed specific or constant origin of disease, on the error of drawing hard and fast lines between essential affections, *and are with difficulty* reconcileable with the Germ Theory." * * * * * * Reconcileable with difficulty indeed, *I* would add, if we regard with Professor Stokes our disease germs as independent and fixed entities. Reconcileable with the greatest ease if we once allow our doubts and perplexities to be illuminated by the light of "Evolution," in as far as it exercises a modifying influence on our disease germs. Illuminated by this light Professor Stokes' difficulties disappear not only, but so perfect a resolution of all perplexity is suggested that one is irresistibly compelled to fly to it in order soundly, practically, and philosophically to clear up doubt, and as irresistibly compelled to accept its application in association with the Germ Theory, as one of the grand *facts* of Pathology. It would be utterly impossible to quote here all the evidence at hand which seems to me to bear upon my subject matter.

I have been content with quoting more or less typical illustrations, and I hope that I have supplied in this connection additions which will not be regarded as unimportant. * * *

It remains for me only to add a word regarding the second portion of my subject. That portion which deals with the internal mechanism of the body, and with its adaptation to outward circumstances.

What I said in my last paper will be remembered, and need not be repeated.

In the *Lancet* of December 16th, 1882, appeared a remarkable lecture by Sir James Paget "on some New and Rare Diseases," in which a passage occurs so admirably emphasising what I would like to express that I shall quote it *verbatim*.

This is the passage:—"Perhaps the brilliant success which has been achieved by the recent studies of disease-producing organisms or other materials acting on us from without—a success not equalled in any other field of medical enquiry—has made some think too little of those changes within ourselves which occur in such ordinary conditions of life that they may be called spontaneous.

"Yet these are not less important in the production of diseases, and these must be studied—just as in agriculture *soils* must be studied as well as *seeds*. This is true even in respect of those diseases whose essential causes are most evidently external, even of those which are due to specfic contagion, their germs or seeds, if I may so speak, will not germinate in an unfit soil. I suppose there is not a day in which most of us do not inhale or come into contact with the germs of some frequent or contagious disease; but they do not germinate in us any more than do the seeds of tropical flowers in our streets, or in the fields to which the wind scatters them; we do not offer the fitting soil. And even among those in whom they do germinate the product varies according to the soil. And the study of this soil, *this living* soil, is yet more necessary in respect of diseases which come in part or wholly by inheritance; for it is in each as personal and distinct as any

other constituent of personal character, and the study of it must be ultimately personal."

This question of soil, then, is an element not to be disregarded, and associated with its adaptations in various directions are the questions of "*Predispositions in Disease*," the establishment of "*Diathesis in Disease*," "*Immunities from Disease*," &c.

Each one of these developments I touched upon in my last paper, and I endeavoured to shew by concrete examples, how marked adaptations could demonstrably be shewn to have taken place in various directions, of living cell elements *in* the body *to germs* outside.

It would have afforded me much pleasure to go more fully into this aspect of the matter to-night. Want of leisure, and shortness of time however force me to content myself with what I have said. In conclusion, let me hope that I have succeeded in making clear my views, and that I have supplied a few thoughts which are worthy the consideration of the members present.

Of necessity it is not possible to avoid technicalities in a communication of this sort, but I have tried to be as careful as possible to express in general terms my meaning. Whether I have in consequence appealed as forcibly to you as I should have liked is a subject of doubt to me. At any rate I shall, I hope, be credited with good intentions, and if I have excited even the smallest amount of interest I shall consider myself amply repaid for my slight trouble in preparing these notes.

ON FOSSIL PLANTS FROM INDWE AND CYPHERGAT COAL BEDS.

By Dr. John Shaw, F.L.S., &c.

Mr. R. W. Murray, of the *Cape Times*, handed over for my inspection specimens of shale from the coal beds of Indwe and Cyphergat, having impressions of plants. Unfortunately they had been subjected to barbarous treatment during transit, and I have only been able to make out three. These are ferns, and one cycadaceous plant.

Pecopteris odontopteroides. Morris.
Cycadites pectinoides.
Sphenopteris Murrayana. Nor. Spec.

Diagnosis of the last: Frond dichotomously divided; each division irregularly pinnate; pinnae bi-pinnate, segments linear recurved.

This plant is very different from *Sphenopteris elongata* of Carruthers in being altogether more robust and rigid in habit.

Remarks on the probable horizon of the coal beds:—The coal of these fields is, according to Professor Green, sub-aqueous and not a land or sub-aerial formation like that of the carboniferous age in England. It probably belongs to the Jurassic age. Carruthers has referred one coal field with similar fossils, of Queensland, to that age; and the other coal field to the carboniferous age as having fossil remains similar to those of the true carboniferous horizon. Professor Owen has come to the same conclusion from examination of the reptilian remains of these Upper Karroo coal-bearing beds.

The old idea that coal was confined to the carboniferous age has long been exploded: it has been found in many ages. As has been

stated, there is workable coal in Queensland in two horizons. The coal-fields of Virginia are of Triassic age. Workable coal is found in Queensland of the Miocene period. As far as we know the greatest development of the mineral called coal is in connection with rocks of the carboniferous period. The view that there must have been a greater amount of carbonic acid (carbon dioxide) in the atmosphere, then, is only held now by imaginative chemists. The presence of carbonic acid gas in the air to any considerable extent would prevent the heat of the sun from penetrating it to the soil.

The absorptive power of the atmosphere as at present constituted is 1,

As compared with that of carbonic acid, which is as much as 972.

A proper knowledge of Elementary Physics would keep such men from views so diametrically opposed to the true spirit of uniformitarianism in geology. There are, as Lyell states, in New Zealand and in Scotland processes going on now which would furnish material for a great coal deposit, and doubtless there have been parts of the globe similarly favoured in all geological ages. It has been observed by geologists that the coal-fields of Britain occur in troughs and hollows protected by volcanic outbursts; and therefore to the upheavals and igneous energy subsequent to the deposits of coal that country owes its possession of great riches in this mineral. In other periods it must have been similarly situated geographically, but on account of the absence of protection by volcanic outbursts the vegetable deposits have been washed away and scattered and dissipated.

The position of the coal-bearing beds of South Africa, which have produced the fossils referred to and described may be graphically represented as follows, taking a diagonal section from Table Bay to the Stormberg:—

Tertiary Deposits.

Meagrely represented by surface gravels, &c.

Mesozoic Rocks.

Cretaceous.—Stormberg and Diamond Fields. Volcanic vents.
Jurassic.—Molteno, Cyphergat, and Indwe. Coal-bearing beds.
Triassic.—Upper Karoo. (Bain).

Palaeozoic Rocks.

Permian.—Lower Karoo (Bain) and Ecca beds (southern slope of the Roggeveld and Kimberley Reef).
Carboniferous.—Witteberg, &c., but without workable coal.
Devonian—Upper.—Warm Bokkeveld.
Devonian—Lower.—Table Mountain Sandstone.
Silurian.—Clay slate of Lion's Rump.

SOME REMARKS ON THE TAXATION OF THE CAPE COLONY.

By Mr. John X. Merriman, M.L.A.

It is more than five years ago since I was permitted to lay before this Society some figures regarding the statistics of the Colony. I think that few will dispute, that at the present time a somewhat similar examination into our resources is peculiarly needed; and I am sure that there are none who will not join me in deploring that our material at hand for doing anything of the kind is so lamentably scanty. We stand almost alone among the more important British Colonies in our neglect of statistics, and in our lack of that kind of information without which it is almost impossible to discharge many of the functions of Government. We have no census or bare enumeration even of the population, that has the faintest pretension to accuracy, to say nothing of any means of forming any estimate of the value and the sources of our productions; and quotations are often made in support of legislation, and perhaps measures are founded on data, which are worse than merely valueless, in being positively misleading. Such ignorance might be tolerated at a time when our burdens were light, and when we were advancing so fast along the high road of prosperity that a mistake here or there was of little consequence; but at a time like the present, when the hand of taxation is heavy upon us, and when the question of ways and means is most uncomfortably prominent, a neglect of statistical research increases to a very sensible degree the inconvenience and distress which result from burdens badly adjusted, or from financial measures undertaken in haphazard ignorance of their probable effect.

I make these remarks, not with any intention of imputing blame; for I am afraid that a distribution of it would be pretty impartial; but because I wish to take the opportunity of recording the opinion, which will, I hope, be endorsed by the Society, that one of the most pressing necessities of this Colony, and one of the measures that is indispensable to its recovery from the present depression, is a more careful attention to statistics of every kind, and especially to comparative statistics, which will enable us to measure, not only our own position with regard to the past, but also our relation to other countries and colonies. The present time is very notable as marking a transition stage in the economical progress of the Colony which has affected, and must affect it in every direction commercially, financially, and perhaps more than either in that branch of Government which consists in adjusting the burdens of taxation. I will try to explain briefly what I mean. We have now just finished those great public works begun in 1873, which, while there will be very few found to contest their utility and necessity, have undoubtedly added enormously to the public liabilities of the country. It is to be hoped that we have also come to an end of those wars which form the other great cause of our debt. Speaking generally, we may say that the era of borrowing, which has been so marked a feature of our economical progress, has come to an end; and that in the immediate future we shall have to do without that fictitious addition to the colonial resources which springs from borrowed money, and we shall have to set ourselves resolutely to the more unpleasant task of providing for

the interest on our liabilities. The effect which our wars have had on the Colonial Exchequer is easily estimated from a brief statement of the figures involved. Ten years ago, the debt, including the money raised for local bodies under the guarantee of the general Government, stood at £2,484,000—rather less than 2½ millions. At the end of 1884 it stood at £20,804,000 or nearly 21 millions, in other words, during ten years the sum of 18 millions sterling has been added to the purchasing power of the country during that period by means of borrowed money—and when it is added that more than half of this amount, or £9,400,000, was raised and expended between 1880 and 1884, in four years, it will afford no matter for surprise that the cessation of this adventitious aid should create a wide-felt economical disturbance. In connection with the expenditure of this money another point deserves notice. As is well known, the greater portion of our loans has been contracted for expenditure in the construction of our railways. Valuable, nay, indispensable as these means of communication are to a Colony like ours, their completion has effected a great revolution in the distribution of wealth and of purchasing power in the country. We know that a sum of more than one million sterling is now collected as railway revenue, for carriage of goods and passengers; and even allowing for the natural increase arising from the improvement and the regularity of transit, it is possible that a sum not far short of this amount, which used to be paid for carriage and bullock-wagon, and the purchase of oxen, horses, mules and forage, has been diverted from the pockets of the farming community. No one will dream of putting forward the construction of railways as a matter of regret, or of undervaluing the great part which they will play in the development of the country; but, in estimating the causes of depression, it is necessary to take into account the transference of this large sum from a certain class of the agricultural community who find their purchasing power seriously reduced. The consumer benefits but for a time, and, until matters have adjusted themselves, there is a most undoubted pinch, to say nothing of the change in the mode of business, arising out of regular and rapid communication, which has also caused a disturbance in the older centres of trade. Added to the causes of depression, arising out of the increased burdens on the Colonial Exchequer, the cessation of the influx of borrowed capital, and the transference of purchasing power from a large class of the community, we have the very serious and general fall in every staple product of colonial export. There is no need to enlarge on this painful subject, which is only too well known to all of you. Any one of the causes mentioned would, pending the restoration of an equilibrium, have caused serious inconvenience and distress; but when all of them have come together "in battalions," it is no wonder that the finances of the Colony, both public and private, have been deranged, and that a crisis has supervened at least as severe as those which similar causes have produced at former times in other communities.

It is now, when the necessity for meeting the public burdens calls for sacrifices from every section of the community, that criticisms may be usefully employed in drawing attention to a subject of which everyone must allow the importance, in the hope that examination and study may result in an apportionment of the public burdens in a manner as little disadvantageous as possible to the general interests

of the community. I am going to call your attention this evening to the branch of the subject which has at the present time a painful interest for everyone of us, I mean the taxation of the Colony; and I shall attempt a comparison in that respect between our condition and that of some other countries. Any deductions from the figures which I shall submit to you, any attempt to describe the effect of our system on the prosperity of the country, or any suggestion for changes in our fiscal measures belong more to the sphere of politics, and would by the rules of our Society be inadmissible on the present occasion. I will venture to add that they are all deserving of far more attention than any one seems to have devoted to them at present.

The first table which I shall lay before you is a return showing the proportion of taxation to the gross revenue of the Colony, and the proportion of revenue raised by Customs, both to the general revenue and the taxation of the country. The second table consists of similar figures for Great Britain and for certain colonies. As you are aware, the revenue of this Colony, in common with every country, and particularly of other colonies, is made up of many items, which can scarcely be considered as imposing a burden upon the community, but are rather in the light of payment for services rendered. Of this class are the Post Office, the Telegraphs and the Railways of the country, which are really commercial departments where the Government, for the general convenience, sells a certain article at a moderate price. The revenue from lands and mines in the same way comes under the head of the National Estate, which is administered by the Government for the use of the people. Taxation in this Colony is comprised under nine heads:—1, Customs Revenue; 2, House Duty; 3, Transfer Duty; 4, Auction Duty; 5, Succession Duty; 6, Stamped Licences; 7, Blank Stamps; 8, Bank-note Duty; 9, Excise Duty. Few British colonies have such a list; and in such matters as Auction Duty and Transfer Duty, I am inclined to think we have a monopoly. The Tables are as follows:—[See Tables A and B.]

It will be noticed that the amount raised by taxation was higher in 1880-81 slightly, and in 1881-2 considerably, than during the subsequent years, the increase being in the amount of Customs Duty, which accrued from the large purchasing power arising out of the influx of borrowed money. The amount of taxation exclusive of Customs was, however, higher last year than on any previous occasion. It is also higher than in any Australian colony, of which I have been able to procure the figures. The percentage of Customs to revenue raised by taxation, it will be noticed, has decreased until it is lower than that of any Australian colony, though it will be noticed that it is more than double that which the same source of revenue bears in Great Britain. The figures contained in these tables cannot alone be taken as a measure of the burdens which are imposed upon any community. Where, as is the case in most colonies, a large proportion of the revenue is raised from Customs duties, it is manifest that the amount of taxation may be swelled from the very prosperity of the country, and that the index of the burdens of the people, as shown by a heavy taxation, may synchronize with a period of extreme prosperity. I shall endeavour to bring out the significance of the Customs revenue in some other tables. Before doing so, however, it may be worth while to quote a return, showing the amount of taxation per head of population. The figures for the Australian

colonies, for the later date, are from the *Australasian*, those for the earlier one are from the Australian Year Book, published by the Government Statist of Victoria. It is worth noticing that in Queensland, which is taken to be a prosperous colony, the taxation per head is higher than the very heavy rate in New Zealand, where the finances exhibit considerable embarrassment. In comparing the figures for Great Britain, it must not be forgotten that a large part of the taxation which in colonies is assumed by the general Government, is in that country thrown on localities; and any comparison of taxation would not be complete without taking this into consideration. I regret that no materials exist in Cape Town for making this comparison, and it is still more unfortunate that there are no figures from which we can venture to estimate our own position as compared with other colonies. We are only able to give a rough guess at the number of our population. I think, including Griqualand West and the Transkei, this may be taken to be 1,250,000, of whom 340,000 are European and 910,000 are native. Taking certain items of our taxation, such as Customs, Excise, and House Duty as common to the whole population, it would for these three heads, dividing the assumed population, give for 1884-1885—

Customs	£1,073,939
House Duty	90,068
Excise	94,671
	£1,258,678

—rather more than 20s. per head, and taking the remainder as being paid exclusively by the European community, viz.:—

Transfer Duty	£93,551
Auction Duty	18,592
Succession Duty	12,999
Stamped Licences	125,542
Blank Stamps	123,993
Bank Note Duty	9,980
Total	£384,657

we get per head of European taxation, £1 2s. 6d., which would work out at a taxation of £2 2s. 7d. per head for each European, and about 20s. for each native. But the assumptions in any attempt to arrive at a result are so large, that I feel I ought to apologise for having taken up your time by this attempt to find a basis for comparison.

I will now go on to a table which shews the proportion borne by the Customs duties to the imports entered for consumption, which is, I think, deserving of careful consideration. I should explain that the column of merchandise only refers to the imports, less Government material, which afford, I think, a more legitimate basis for judging the effect of any tariff than the gross sum of imports, including such material. [See Table C.]

The figures in this table speak for themselves, and set forth, with a clearness which is almost startling, the effect of our taxation through the Customs on the means of the community. It will be noticed that while in 1877 the import amounted to 13·6 per cent. of the value of the goods entered for consumption, in the last financial period this

proportion was raised to no less than 23·4 per cent.; or, in other words, nearly one-fourth of the gross value of the goods had to be paid in taxes—a result without example in any other part of the world except the United States, where percentage amounted in 1884 to 29 per cent., but where in estimating the burden imposed by such a percentage we have to take into account the natural resources of the country, and its marvellous productive capabilities. The only other countries which approach the Cape Colony in the severity of the incidence of their tariffs are Portugal, with 22 per cent., and New Zealand, with 18·3 per cent. In respect to the latter, it will be observed that we have caught up and passed it in the last few years in this respect. In Great Britain, a reference to Table A will show that though nearly one-fourth of the whole taxation is derived from Customs, the burden only amounts to one-twentieth of the gross value of imports, while in the Cape we raise nearly one-third of our revenue by this means, but it amounts to almost one-fourth of the gross value of goods imported. I have selected Victoria and New Zealand as colonies for comparison, as their tariffs are notoriously high; and I have given the last two financial periods in this Colony in detail, in order to show the percentage more clearly.

It is, however, when a closer investigation is made into the details of our Customs and revenue, that the full comparison with other colonies is brought to light. There are certain articles, as you know, which are in every country, except perhaps our own, considered legitimate subjects for taxation, and to which in financial difficulties, the Ministers in charge of the finances naturally turn. I refer, of course, to Drink and Tobacco. In England actually most of the revenue is derived from this source; and in the Australian colonies, a very large portion is so derived, and I have prepared a table showing the effect of the taxation of these articles upon the Customs revenue in our own Colony, as compared with that in Great Britain, New Zealand, and Victoria. I am afraid that the result rather leads one to the conclusion that in the Cape, the ordinary consumer is crushed, while the drinkers and the smokers are treated with a tenderness not usually shown by the tax-gatherer to that fraternity. [See Table D.]

I think that I am justified in saying that the figures contained in this table are striking. The true measure of the burden of our Customs taxation is to be found in the last column, which shows the percentage which the duty collected, less the duty on Intoxicants and Tobacco, bears to the value of merchandise, less the value of such articles. It will be seen that in 1877, this amounted to 12·2 per cent., while in the last financial period, it had reached the large proportion of 21·1 per cent. Comparing this result with Great Britain, it will be noticed that the taxation in that country raised by means of Customs, except that derived from Intoxicants and Tobacco, only amounted to 1·5 per cent. of the articles taxed—as against 21·1 per cent. in this Colony. If, therefore, the British tariff was equal to our own, and the value of the imports remained the same, the revenue derived would amount to the astounding sum of nearly 82 millions, or considerably more than the whole sum now raised by taxation in Great Britain. The comparison with the Australian colonies of Victoria and New Zealand is perhaps even more surprising, as showing that the latter colony raises no less than 40 per cent. of its Customs revenue from the source above indicated, which has the

effect of reducing the burden on the general consumer in this country to 10 per cent. as against 21 per cent. in the Cape. In connection with and following this subject, I have prepared a comparative table showing the amount of revenue raised from Drink and Tobacco in this Colony with the revenue raised in certain countries from the same articles, and also as compared to the whole revenue raised by taxation. For Great Britain and this Colony the figures are complete, and include Customs, Excise, and Licences. In Victoria the figures include Customs revenue and Excise on liquor and licences, the licences being paid to the municipal authorities. In New Zealand the figures include Customs revenue and beer duty. [See Table E.]

It will be seen from the return that, while in Great Britain Drink and Tobacco contribute more than half the taxation, in this Colony they only pay 17·8 per cent. While, as compared with Victoria and New Zealand, not only is the percentage to the revenue raised by taxation infinitely smaller, but the gross amount is extremely small when the number of our population is taken into consideration, for I am afraid that it is a melancholy truth that, whatever may be his producing power as a unit of population, as a consumer of these articles, the black man ranks pretty nearly as high as the European. I have tried to deduce the comparative amount of revenue per head raised from Drink and Tobacco, and for this purpose I have taken our population at one million, excluding the native populatiou in the Transkei. The population of Victoria and New Zealand have been reduced from that given in Table C to correspond with the date to which the returns refer. No reduction, however, which can be made in the figures of our total population on account of the native element will enable us to show any other than a most meagre result as compared with New Zealand, which, with a population far inferior in numbers, raises a gross sum of considerably more than double the amount which the Cape Colony does, from the taxation of Intoxicants and Tobacco.

I have now dealt with one branch of the subject, which I proposed to your attention this evening, and I have only entered, as it were, on the fringe of the great question. To my mind, however, the figures which I have brought forward this evening are deserving of the study of everyone who wishes to see this Colony get richer instead of poorer; for whatever deductions we may make from them—and, as I said at the outset, it is not my desire on this occasion to do so—we must all agree that, from a comparative point of view, we cut rather a sorry figure. It is much to be desired that the questions of what is popularly called "direct taxation" and "local taxation," about which there is a good deal of loose talk, should be taken up by some member of the Society, and worked out on a comparative basis in the dry light of figures and statistics.

I think that the subject would be both important and interesting; and I feel sure that I may venture to add, from the slight acquaintance that I have been able to make with it, that the results would surprise a good many. I have to thank you this evening for the patience with which you have listened to what has been, I fear, rather a dry exposition.

TABLE A.—A Return showing Proportion of Taxation to Gross Revenue, also Percentage borne by Customs to Revenue raised and Taxation from 1878.

Date.	Gross Revenue.	Revenue from Taxation.	Percentage of Taxation to Revenue.	Revenue from Customs.	Percentage to Revenue.	Percentage to Taxation.
	£	£		£		
1877-1878	1,565,418	976,515	63	770,616	49·3	78·9
1878-1879	2,082,887	1,281,928	61·5	911,490	43·7	71·1
1879-1880	2,522,023	1,412,599	56	972,477	38·5	68·8
1880-1881	3,009,962	1,665,825	55·3	1,184,074	39·3	71·1
1881-1882	3,524,858	1,900,428	53·9	1,341,481	37·4	70·6
1882-1883	3,304,017	1,639,547	48·3	1,106,443	33·5	67·4
1883-1884	2,949,950	1,364,882	46·2	898,185	30·4	65·8
1884-1885	3,321,957	1,643,335	49·5	1,073,939	32·3	65·3

TABLE B.—Comparative Return showing Similar Figures for Great Britain and certain Colonies.

	Date.	Gross Revenue.	Taxation.	Percentage to Revenue.	Customs.	Percentage to Revenue.	Percentage to Taxation.
		£	£		£		
Great Britain	Year ended March 31, 1885	88,043,000	73,796,000	83·84	20,321,000	23	27·5
Victoria	1881-82	5,592,362	2,317,706	41·44	1,694,652	30·3	73·12
	1883-84	6,228,242	2,339,267	37·55	1,883,238	30·2	80·5
New Zealand	1881	3,757,493	1,937,715	50·66	1,417,392	37·7	73·14
	1884	3,707,488	1,869,496	50·4	1,375,000	37·1	73·5
Queensland	1881-82	2,102,095	815,765	38·38	641,406	30·5	78·62
South Australia	1881-82	2,087,076	653,864	31·33	538,669	25·8	90·22

TABLE C.—Return showing Amount of Taxation per Head of Population.

	Date.	Population.	Per Head.	Figures for 1881.
			£ s. d.	£ s. d.
Great Britain	31st March, 1885	35,950,000	2 1 1	..
Victoria..	1884	961,276	2 9 10	2 12 8
New South Wales	1884	921,268	2 8 1	2 6 5
Queensland	1884	309,913	3 13 0	3 11 1
South Australia	1884	312,781	1 16 7	1 18 7
New Zealand	1884	564,304	3 7 8	3 16 3
France	1881	..	1 15 0	..
United States	1879-80	..	1 5 7	..

Return showing Proportion borne by Customs Duties to Imports entered for Consumption.

Calendar Year.	Total value of Goods entered for Consumption.	Merchandise only.	Customs collected.	Per cent. to Total.	Per cent. to Merchandise.
	£	£	£		
1877	5,028,141	4,760,180	649,908	12·9	13·6
1878	6,032,136	5,871,046	864,756	14·3	14·7
1879	6,882,605	6,780,858	958,229	13·9	14·1
1880	7,546,779	7,367,048	1,035,130	13·7	14·05
1881	9,029,216	8,778,162	1,291,232	14·3	14·8
1882	9,256,960	8,462,771	1,253,820	13·5	14·8
1883	6,392,481	5,471,008	963,403	15·07	17·6
1884	5,006,021	4,696,143	1,017,667	20·3	21·7

TABLE C.—(*continued*).—Similar Return for last Financial Periods and Quarters of Year.

Date.	Total Value.	Value Merchandise.	Customs.	Per cent. to Total.	Per cent. to Total.
	£	£	£		
Quarter ended 30th September, 1883 ..	1,357,710	1,189,081	213,450	15·7	17·9
31st December, 1883 ..	1,310,186	1,164,668	225,715	17·2	19·4
31st March, 1884	1,285,304	1,160,553	827,162	17·7	19·6
30th June, 1884	1,201,677	1,108,493	231,558	19·2	20·9
Financial Year	5,154,877	4,622,795	897,815	17·4	19·4
Quarter ended 30th September, 1884 ..	1,264,726	1,215,829	278,911	22·0	22·9
31st December, 1884 ..	1,254,314	1,211,268	280,035	22·3	23·1
31st March, 1885	1,184,362	1,144,106	268,372	22·7	23·4
30th June, 1885	1,071,776	997,144	245,374	22·9	24·5
Financial Year	4,775,347	4,568,347	1,072,692	22·4	23·4

	Value Imports.	Customs.	Percentage to Imports.		
	£	£			
Great Britain, year ending 31st March, 1885	390,018,569	20,321,000	5·2		
		Merchandise only.	Customs.	Per cent. to Total.	Per cent. to Merchandise.
Victoria, 1883	17,743,846				
Less Border Traffic.. ..	2,358,834				
	15,385,012	14,618,964	*1,797,792	11·6	12·3
New Zealand, 1883	7,974,038	7,707,038	1,414,182	17·7	18·3

* Less tax on stock collected by Customs.

TABLE D.—Return showing Revenue derived from Customs Exclusive of Dues on Intoxicants and Tobacco.

Date.	Value Intoxicants and Tobacco entered Consumption.	Amount of duty thereon.	Per cent. to Customs Revenue.	Per cent. Customs less duty II, to Imports less value I.	Per cent. Customs less duty to Merchandise less value.
	£	£			
1877	309,983	105,610	16·2	11·5	12·2
1878	300,874	151,601	17·5	12·4	12·8
1879	355,023	150,393	15·7	12·4	12·6
1880	377,879	169,221	16·3	12	12·4
1881	492,533	225,140	17·4	12·4	12·8
1882	471,770	224,863	17·9	11·7	12·8
1883	341,245	195,190	20·2	12·6	15
1884	202,497	154,246	15·1	18	19·2
†Financial period 1884-'85 ..	180,837	145,624	13·6	20·2	21·1
				Per cent.	Per cent.
	£	£			
Great Britain, 31st March, 1885	10,134,132	14,752,549		72·6	1·5
Victoria, 1883 (1)	975,555	665,189		37	8
New Zealand, 1883 (2)	515,000	690,061		40·2	10

(1) Victoria Imports, less Border traffic, £15,385,012. Customs, less stock-tax, £1,797,792.
(2) New Zealand Imports, less Government material, £7,707,038. Customs, £1,414,182.

TABLE E.—Return showing Revenue Raised from Intoxicants and Tobacco, in the Cape and certain Countries.

	Customs.	Excise.	Licences.	Total.	Per cent. to Taxation.	Per Head.
	£	£	£	£		£ s. d.
Cape Colony, 1884-85	154,624	94,671	52,360	292,655	17·8	0 5 10
Great Britain, 31st March, 1885	14,752,549	22,532,221	1,864,803	39,149,573	53	1 1 8
Victoria, 1883	665,189	123,593	..	788,782	33·7	0 17 2
New Zealand, 1883	690,061	55,000	..	745,061	40	1 8 2

A NOTE ON THE *PHYLLOXERA VASTATRIX* AT THE CAPE

L. Peringuey, F.E.S.; F.Z.S., Assistant Curator South-African Museum.

August, 1887.

On the 6th January, 1886, it was officially ascertained that the dreaded *Phylloxera Vastatrix* was at work in some vineyards in the neighbourhood of Cape Town, and a few days later a largely infected centre was found also at Moddergat, in the district of Stellenbosch. The contaminated area was covering some 50 hectares = 125 acres.

A special Commission, consisting of Messrs. R. Trimen, F.R.S., Curator of the South African Museum, Professor MacOwan, F.L.S., Director of the Botanic Gardens, and myself, was appointed by the Government of the Colony in order to ascertain by personal inspection of the vineyards the extent and importance of the phylloxerised centres, and to advise the Government on the measures to be taken against any further spreading of the insect-pest.

Having been since appointed Inspector of Vineyards, I have been able to carry a series of technical observations, which I embody here, having culled them from the official reports made to the Government. The result of these observations, differing in many points from those made in Europe, may be found to be useful later on if the insects were spreading.

THE DEVELOPMENT OF THE PHYLLOXERA AT THE CAPE.—SUBTERRANEAN FORM.

The necessity of ascertaining the time at which the exodus of the female insect takes place, and also if there was or was not a season of hibernation, was very great, since on those observations depended the greater or lesser efficacy of the measures taken against the spread of phylloxera.

For that purpose several vines were planted in large boxes, fixed so as to allow of ready access to the roots, and capped with large glass cases. I operated mainly on 9 vines:—

1 to 6—6 Cape varieties of "*Vitis vinifera.*"
7 to 8—2 American vines, "*Vitis æstivalis.*"
9—1 wild vine, "*Cissus capensis.*"

The object in view was to ascertain:—Firstly, whether the multiplication or evolution of the insect was checked either by cold or extreme heat; and secondly at what time of the year the winged female came out of the ground.

Dr. Cornu has established with certainty that in France a temperature of about 10° C. (or 49° Fahr.) causes the phylloxera to hibernate, that is to say, under that climatic influence the gravid female dies, and the young—the insect before it has shed its first skin—becomes motionless, shrivels up, and may be said to be dormant. No harm is done to the vine at that period, middle of October to middle of November; as soon, however, as the temperature rises above 49° Fahr. a general awakening takes place, and the insect begins its course of destruction. This period of renewal of activity may be said to begin in May in the south of France, and towards the end of it in

the western parts. In a letter which I had the honour to receive from him, Mons. Cornu mentions having also noticed a similar result produced by an excessive drought and heat; his observations have been ulteriorly confirmed by those of Balbiani.

It might have been hoped that the extreme heat and dryness of the climate from November to April would have here acted as the low temperature (10° C.) does in France.

Unfortunately there is no ground for such a hope. The phylloxera does not ætivate, and remains extremely active from September to the middle of April, as shown by the observations—up to date—made not only in my conservatory, where, in spite of all precautions the heat is naturally greater—varying from 66° to 106° Fahr.,—but also in the fields.

In extremely compact argillaceous soil, the surface of which is baked, I have sometimes met with insects, somewhat sluggish in comparison to those at a greater depth, but that was immediately under the surface only, and they were *not* dormant.(1)

I had occasion to examine the roots of one of the vines in the conservatory with a heat of 87° Fahr., and the insects, both near the surface and also at a depth of 24 inches, were equally active; they were, however, more numerous at that depth, and had sought evidently a damper surrounding.

The effect of the rainy season (winter?) has been, however, very peculiar, and produced a result nearly akin to that of the hibernation in France.

After the cold and rainy weather experienced in May last year, I was greatly surprised to find the insect in a semi-comatose state; the body of the gravid female no longer so spheric or pyriform as usual, was not distended with eggs in the majority of cases; the young were not active, and the insect in its different stages had assumed a leaden hue, was motionless, *but not dead.*

When exposed to a little warmth, both female and young revived rapidly; a few hours exposure to artificial heat was sufficient, and a female even gave me three eggs the following day. Towards the end of August the phylloxerae in the conservatory had awakened from their stupor, and on the 10th of September the roots of the vines were teeming with phylloxera-life.

The field observations were made at Mowbray, the only place where I could at that time observe the insect *in situ.*

From statistics kindly supplied to me by the Meteorological Commission the mean temperature recorded at the Observatory has been in May, 63·1; June, 56·9; July, 53·8; August, 55·6; and September, 58·5; the lowest minimum being in May, 47·8; June, 49; July, 44·4; August, 47·8; and September, 49·9. Thus the mean temperature of 49°, which, according to Cornu, causes the phylloxera to hibernate, has not been reached at Mowbray, and the semi-hibernation of the insect observed by myself at the end of May points to a *racial predisposition* in the insect, which leads to the supposition that it has been in the Colony for a short time, and has not been sufficiently acclimatised as yet to be insensible to a period of cold superior to that causing a complete hibernation in Europe. As for the greater period of heat,

(1) These conclusions have since been strengthened by my observations during the winter, for the vines in my conservatory.

I have conclusively shown that it has here no checking influence on the insect. That does not invalidate the theory of recent introduction because it is well known that insects are not so affected by heat as they are by cold.

If we take into consideration the small duration of cold weather experienced on the coast districts, we may conclude that this short period of rest is nothing when compared with the immense advantage the insect derives from the favourable circumstance of a hot and dry climate. Every observer in France had to arrive at a similar conclusion.

Dr. Cornu found that with the temperature varying between 86° and 95° Fahr. (30° to 35° C.) the young hibernant had laid its first egg in twelve days. This gives three days for each shedding of skin. This result corroborates the observation of the late Mons. Lichtenstein. This observer found that a constant temperature of about 76° Fahr. (25° C.) would allow the development of the winged form in eighty to ninety days.

I have been able to obtain the same result here, as will be seen hereafter.

From the foregoing remarks it will be seen that the danger of dissemination of the insect from May to September, while I was unable to do anything against it for want of a disinfecting agent, has been greatly lessened, and also that the application of Bisulphide of Carbon should be made early in September.

AERIAL FORM.

The spreading of the phylloxera takes place mostly in the ground. It has also been found walking on the soil, but the contamination at great distances is due mainly to the winged form.

For a long time the winged form was considered as very rare. But the observations of Dr. Cornu have shown that it was purely due to the fact that it was looked for where it does not easily develope, and that the *nymphs*, which ultimately become winged females, are not to be found generally on the roots, but on the swellings of the rootlets.

These rootlets being of course more numerous on healthy vines, it follows that in a contaminated vineyard the winged female will be produced in large numbers during the first year of infection.

But the rootlets wither generally towards the end of summer, and the nymph, owing to the difficulty of getting more nodosities (as when attacked the rootlet soon rots, and the death is accelerated by the number of phylloxera which derive their sustenance from it) gets probably at that time near the surface of the soil, and there, after a last shedding of skin, emerges as a winged form.

On the ground of these observations, the Commission was led to expect to get the winged form late in the year, although numerous nymphs had been met with everywhere.

Two vines, six months old, well stocked with insects, were deposited in the laboratory. They came from Mr. Kotze's vineyard at Mowbray, and were planted in the original compact argillaceous soil.

On the 23rd of April only I obtained the first winged insect; the exodus continued until the 5th of May, and then ceased; a copious watering of the plants after the first exodus having seemingly increased it. The exodus coincided with the appearance in the open air of numerous other winged forms of *Aphidæ*.

I should here state that the insects flying against the panes of glass which cover the boxes, and on which the vapour from the ground condenses, are glued against them and easily detected.

At the time I placed those two vines in the conservatory [February] there were several nymphs on the rootlets. Supposing that those nymphs became the winged females, which I had collected later on, they have required 56 days to assume the winged form.(2)

On the 6th of December of the same year I brought from Moddergat a large quantity of insects, with which I stocked three Cape vines, 1 wild vine, 2 American *Vitis Aestivalis*, and placed also a small amount of them, among which I could see no nymph, at the foot of the very vine from which the exodus had taken place six months previously. On the 10th of January I got the first winged form from that same vine, which up to date has given me twenty-four; vine No. 2, stocked in December, has given me eight. Two young vines planted this year have given me nothing as yet; neither have the two American vines, nor has the insect taken to the wild species, *Cissus capensis*.

I do not believe that this is the final exodus, which I expect in May or June, when the rainy season sets in. No other *Aphidæ* have yet appeared abroad.

The result of those observations are thus somewhat different from those observed in France. The young vine No. 1(3), which has given me last year fourteen winged females only, has given me twenty-four this year, and it is in the last stage of decay. The two young vines 3 and 4 (which do not thrive very well) have as yet given me none. It might be deduced from this that here the winged form is not produced in greater number during the first year of infection.

Vine No. 2, stocked with insects from Moddergat, has, however, yielded eight winged female from the 13th of January, *i.e.*, thirty-five days after it had been stocked; and I conclude that the measures taken to destroy the centres from which those insects came have been instrumental in checking the first exodus, and in preserving the adjacent vineyards from contamination at any distance.

The life history of the phylloxera presents, however, some difficulties which are not easily accounted for, and the theories of the late Mons. Lichtenstein, which went far towards their solution, have not been accepted by every entomologist. It is therefore with great satisfaction that I record here a similar result to that obtained by that distinguished aphidographist, viz., the development of the winged form in about ninety days, with a nearly constant temperature of 72° Fahr.

I hasten, however, to explain that the observations I have been able to make have been too few to decide decisively the points still obscure which I have been treating of. They must be repeated again and again, under different climatal circumstances. They have only been made in one locality, and atmospheric influence is well known to act in many different ways on *Aphidæ*.

---

(2) It is very probable that a previous exodus had taken place from that same vine before I placed it in the conservatory.

(3) Vine No. 2 being nearly dead was removed from the box in September, three months after the exodus.

Incomplete as they are, they unfortunately lead to a most calamitous conclusion, viz., that the spread of the phylloxera at the Cape, if left unchecked, is more rapid than in any other country where the insect has established its footing.

MEASURES TAKEN FOR THE DESTRUCTION OF THE INSECT.

The Commission could not hesitate with regard to the destructive agents to be employed. Following the recommendation of the *Commission Supérieure du Phylloxera*, and a *destructive*, not a *curative* agent being required, they decided on using Bisulphide of Carbon (C.S.^{2}) The quantity of water available for the use of Sulfo Carbonates being here either insufficient or not easily attainable.

I applied at first 300 grammes of Bisulphide per square metre, in three treatments of 100 grammes each, and with nine holes of injection, but further experiments have shown that 200 grammes per square metre were quite sufficient.

The submersion system has been also resorted to. It being found that a part of Mr. S. Kotze's vineyard could be submerged from the water of the Liesbeek River, the Government authorised the throwing of a dam to put to the test the submersion system, and a surface of some nine acres, divided in two dams, was kept under water for a period of sixty days; the ground which was thrown up for embankments had previously been treated with Bisulphide.

That period of sixty days was not decided upon at random. Owing to the numerous fatty tubercles which cover its body, the phylloxera is not easily wetted; it can be immersed in a liquid without being in direct contact with it, being enveloped in air. Dr. Maxime Cornu has also shown that the new layer which separates the old bark from the new (the very dry exterior part of the new *suber*) is damped with very great difficulty only; and a long period of submersion is therefore required to change the conditions in which this suberose layer remains dry, and meanwhile affords means of subsistence to the insect.

Professor Balbiani has shown also in his admirable researches on the structure and vitality of the egg of the phylloxera, that when immersed in water, at the time the embryo had only begun to appear, or was but little developed, they accomplished their evolution until they were hatched, and that if the embryo was already well developed, the young often died in the egg, but only after a long stay under water.

A submersion of forty days has been found sufficient in Europe, but it has to be repeated every two years, and Balbiani ascribes that necessity to the escape of a few eggs.

The endeavour of the Phylloxera Commission has been to leave as little as possible to chance, and after a submersion of sixty days from the 1st of September—that is to say at about the time of renewal of activity in the part of the insect—I have vainly sought for a phylloxera on the roots of the few vines which have survived that long stay under water.

The importance of this experiment at the Cape is very great. Many farmers would be able, were the contagion to spread, to submerge parts of their vineyards at a comparatively small expense now that a trial has been made which, up to date, has given satisfactory results.

No new centre of infection has been discovered up to the present time, and this year a large area of vines surrounding the original phylloxerised centres has received treatments of cultivation varying from 24 to 60 grammes of Bisulphide per square metre.

These treatments have been given a little late in the year, in order to allow the development of the *winter-egg*—which I have not met with here, but before the exodus of the winged form has begun.(4)

ON THE ORIGIN OF THE DIAMOND-MINES OF SOUTH-AFRICA.—By R. Marloth, Ph.D.

[Read 1886, March 31.]

More than fifteen years have elapsed since digging for diamonds was started on the places still bearing the name of Diamond Fields, although they are surrounded now by well populated cities. This corner of Griqualand West has become of the highest importance for the whole of South Africa, but the more scientific question about the origin of these wealth-producing mines has not been sufficiently answered as yet. I do not pretend to give a new theory which disposes of all the difficulties and all the doubts respecting the formation of the mines, but I hope that the following remarks may contribute a little towards the solution of this problem, so that future geologists, aided by a larger amount of observation, may succeed, where we with our fragmentary knowledge thereof still fail.

All those who take some interest in the question know that the diamondiferous mineral, the blue ground of the digger, is found only in funnel-shaped holes, the bottom of which has not been reached yet. There are four such holes principally worked at present, but as Kimberley Mine, where sinkings have been made down for a depth of 600 feet, is the best explored of all, I restrict myself to this mine.

The general opinion as to its formation is, that the orifice has been formed by volcanic forces, and that the blue has been upheaved from a greater depth, transporting thus the diamonds to their present place. However, this orifice is not the crater of a volcano, as has been stated in various publications, for instance by Mr. Chaper in his book "Note sur la région diamantifère de l'Afrique australe." It is only the pipe which connected the crater with the interior of the globe, and the crater, if there was any at all, has been washed away during the long denudation which altered entirely the surface of South Africa.

So far the question is pretty clear; but a more serious divergence of opinions exists on the state in which the diamondiferous mineral came to its present place. Some geologists, as for instance Mr. Dunn, who is now in Australia, and Professor Cohen from Strassburg, declare it to be an igneous product, a kind of lava, which filled out this volcanic orifice and hardened there. They mention in favour of their theory especially the nature of the mineral, which they class near to the serpentine. But how, I must ask at once, is it then to be explained, that not a single bit of the numerous fragments of the various rocks and shales, embedded in the blue, exhibits a sign of fusion or alteration by heat? This ought to be certainly the case, if the blue stuff,

(4) The exodus of winged females began on the 13th of January, 1887, and this year on the 1st of the same month.

which surrounds these fragments now, was in a fused state. Wherever lava or trap at such a high temperature has filled out cracks or holes in other rocks we find the adjoining rock altered, mostly fused by the enormous heat acting on it. But the minerals of Kimberley Mine show nothing of this kind. And then, how is it to be explained that some fossil remains, as coal-bearing shales and shells have been found imbedded in the blue? To prevent any misapprehension, I beg to state, that I do not mean to say that these fossils had been originally deposited in the blue. They came most probably out of the surrounding shales or from the surrounding country, but they have been mixed with the blue stuff when it was fluid or soft, and they are well preserved, as I have myself seen. Neither the wood nor the shells would have resisted such a high temperature as the melted mass possessed.

These important objections have led to another theory, which considers the mineral to be an aqueous product, it having been upheaved in a muddy state. As this mud-volcano theory appears to be the prevailing opinion among mining men, I think it necessary to examine a little closer the principal points of it, which have been put forth by Mr. Chaper as follows:—

1. The mineral, now called the "blue," has been ejected as an aqueous mud.
2. This mud possessed a low temperature.
3. It was very thin and fluid, having mixed up with it all the garnets, pebbles, fragments of rocks, &c.
4. The stuff which fills out now the interstices between these pebbles is a kind of serpentine, which was dissolved in the water.
5. The whole mass was not ejected at a single eruption, but at several intervals and in thin layers.
6. The hillock which formerly covered the spot, where now Kimberley Mine is, was the cone of ejection of this mud-volcano.

Points number one and two are supported by the occurrence of unaltered fossils and fragments of rocks without any sign of fusion.

The contention under 3, that the mud has been of a very great fluidity, is proved by the fact of its having entered into very thin crevices of some fragments of slate, found imbedded in it and originating evidently from the rocks which form the walls of the mine.

To the fourth point I must object, as the serpentinic matter could not have been *dissolved* in water. It was simply mixed with it, forming a thin mud.

For the support of the fifth point, Mr. Chaper mentions certain lines in the blue, which apparently separate different layers, but I do not think that this conclusion is sufficiently proved.

The assertion under number six I cannot admit at all. But before showing that the formation of the hillock has taken place in a very different way, I may mention another fact, which has remained unexplained to the present day, namely the occurrence of small pebbles, larger stones and huge boulders in the blue, the surfaces of which are smooth, as if they had been for a long time in moving water before they came to their present place. These pebbles are a puzzle to Mr. Chaper as well as to other geologists. I find nowhere an attempt to account for their presence in the mineral. I may therefore be allowed to venture the following hypothesis thereon.

We know that the diamond fields were once covered with water like the greater part or the whole of South Africa. There is nothing to show that this inundation had come to an end when the volcanic eruption took place which formed these orifices. On the contrary, a great deal of denudation has gone on since that catastrophe happened. I think it, therefore, very probable that the eruption took place during the submersion of the country, and that all these water-worn pebbles and boulders were washed in by the water, either immediately after the first eruption or during the time that the fused mass in the orifice was kept boiling. At last the water overpowered the fire and the mass hardened. The immense hydraulic pressure from the overlying water would account at the same time for the highly hydrated state of the diamondiferous mineral, which is therefore neither an igneous nor an aqueous formation, but a child of both fire and water.

In the light of this theory all the objections I had to raise before, vanish, and I may therefore proceed to deal with the last of the six points mentioned by Mr. Chaper.

He and a good many other persons were struck by the fact that, as far as each of the four mines extended, a flat hillock rose above the surrounding plain. These hillocks were therefore supposed to be the cones of ejection of the mud-volcanos. I think, however, that the formation of the hillocks is much more recent than the origin of the mines themselves. I take, again, Kimberley Mine as an example, and I may mention for the sake of those who are not sufficiently acquainted with the geological points I have to refer to that a section through the hillock of Kimberley Mine—the Colesberg Kopje—would have shown the following strata:—

At first a thin layer of red sand, about one foot thick, then a limestone conglomerate, several feet thick, both these layers extending equally over the mine and the surrounding country. Within the orifice came then the diamondiferous ground, which was yellow to a depth of 20 to 30 feet, then becoming blue and much harder.

The yellow ground is evidently nothing but a decomposed blue, which has changed its colour by the decomposition. Now we know that the blue ground in decomposing increases its volume, and a mining engineer states, that 60 loads of blue give 100 loads of decomposed ground. The proportion is therefore 3 to 5. Let us, then, see what the increased volume of this decomposed blue in Kimberley mine would be. Putting down the surface of the blue equal to n square feet, the original height of the decomposing layer at its average to 25 feet, we find its original volume to be $n \times 25$ cubic feet, and its increase after decomposition equal to $n \times 25 \times \frac{2}{3}$ cubic feet. If this process of increase took place in the open air the mass would have formed a cylinder on the top of the mine. But we know that the mine was covered by a solid layer of lime-conglomerate, and although this crust of lime has been formed in a comparatively recent period, it complicates the question a little. The extending forces in the decomposing mass could neither succeed towards the bottom nor towards the sides, and on the top they were resisted by this limestone crust. The pressure in the mass must have accumulated, therefore, to a certain extent, and it did so the most in the centre of it. The highest intensity of pressure prevailing in the centre, it is evident that the overlying crust will have been lifted at first on this spot. Once an

outlet given, the whole mass striving for extension, and being only of a very low elasticity, has balanced this pressure by forming a flattened cone.

For better demonstration of this phenomenon, I may mention an experiment, which is well known to all of us, at least to our lady visitors, although I do not think that the fair experimenters ever became aware of the bearing of their observation. The experiment I speak of, is the baking of a cake in a mould. The bottom and walls of the mould correspond to the underlying blue and the surrounding rocks of the mine, and the crust which is formed at the beginning of the baking process is analagous to the limestone layer which covered once the mine. In both cases there remains inside a mass, elastic to a certain degree, striving for extension and—just as the crust of the cake is almost always lifted at first in the centre, very often cracking thence in several directions—so the decomposing ground of the Kimberley mine formed the little hillock, the late Colesberg kopje.

It might be of some interest to estimate the height of this hillock. The increase of volume was found to be $n \times 25 \times \frac{2}{3}$ cubic feet. This forms a cone, the base of which is n square feet, its height x feet. As the formula for the contents of a cone is $c = \frac{b \times h}{3}$, we come to the following equation: $n \times 25 \times \frac{2}{3} = n \times \frac{2}{3}$ that is, $x = 50$. That means to say, the top of the formed cone would have been 50 feet above the surrounding country, if all had happened in a mathematically correct way. The actual height of the hillock was, however, only twelve or fifteen feet, which is not at all surprising, as the conditions under which the formation took place are very different from those to which the blue ground is exposed on the depositing floors, so that the increase of volume will have taken place only in a smaller degree.

I hope to have succeeded in showing that the little hillock on the top of the mine is not necessarily of volcanic origin, that it is not a cone of ejection, but that it is the result of the forces which were dormant in the blue, and have been set free only to a small extent during the hundred thousands of years elapsed since the time when Griqualand West and the surrounding countries were yet covered by the waters.

TRANSACTIONS

OF THE

SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOLUME V.

1886–1889.

WITH THIRTY-SIX PLATES.

CAPE TOWN:
PUBLISHED BY THE SOCIETY.

1893.

CONTENTS.

PAGE

MINUTES OF PROCEEDINGS, 1886–87 i

" " " 1887–88 xiii

PRESIDENT'S ADDRESS, AUGUST 29, 1888:—THE PROGRESS OF ASTRONOMY DURING THE LAST TEN OR TWELVE YEARS. By W. H. FINLAY, M.A., F.R.A.S. xxv

MINUTES OF PROCEEDINGS, 1888–89 xliii

PRESIDENT'S ADDRESS, AUGUST 28, 1889 liii

THE ORCHIDS OF THE CAPE PENINSULA (36 Plates). By HARRY BOLUS, F.L.S. 1

THE WINTER STORMS OF SOUTH AFRICA, ILLUSTRATING THE VALUE OF CAPE POINT AS A WARNING STATION. By A. G. HOWARD 203

ON VAN WYK'S VLEY RESERVOIR. By T. E. MACNELLAN . 219

THE "!NARAS" (*Acanthosioyos horrida*, Hook.) By R. MARLOTH, Ph.D., M.A. 229

THE ORBIT OF COMET 1886 (FINLAY). By W. H. FINLAY, M.A., F.R.A.S. 234

THE STORMS OF SOUTH AFRICA. By A. G. HOWARD . . 235

ON THE ADULTERATION OF BRANDY. By R. MARLOTH, Ph.D., M.A. 247

APPROXIMATE TIDE-CONSTANTS FOR TABLE BAY AND ALGOA BAY. By W. H. FINLAY, M.A. 253

PAGE

The Barometer; its Reduction to Sea-Level. By A. G. Howard 259

The Acacias of Southern Africa. By R. Marloth, Ph.D., M.A. 267

On the Subjective Causes of Evolution as Illustrated by the Geographical Distribution of Plants. By F. Guthrie, LL.B. 275

Note on the Teeth of the Ziphioid Whale (*Mesoplodon layardi*, Gray). By Roland Trimen, F.R.S. 295

On some Photographs of Lightning Flashes. By C. Ray Woods 298

Photographs of Lightning Flashes taken Sept. 18th, 1888. By C. Ray Woods 303

The Star Lore of the South African Natives. By W. Hammond Tooke 304

A Short Account of the Attacks of the *Teredo navalis* and *Chelura terebrans* upon Greenheart (*Nectandra rodiæi*) and Sneezewood (*Pteroxylon utile*) Timbers. By R. H. Hammersley-Heenan 313

Sea-Levels in South Africa from Barometric Observations. By F. Guthrie, LL.B. 318

The Relation of the Sand Dune Formation on the South-West Coast of Africa to the Local Wind Currents. By H. C Wilmer 326

TRANSACTIONS

OF THE

SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOLUME VI.

1889–1892.

WITH ONE PLATE.

CAPE TOWN:
PUBLISHED BY THE SOCIETY.

1892.

CONTENTS.

PAGE

Minutes of Proceedings, 1889–90 vii

President's Address, Aug. 28, 1890:—Parasitic Bees and Wasps and their own Parasites. By L. Péringuey, F.E.S., F.Z.S. xvii

Some Scientific Results of a Mission to South Africa. By H. G. Seeley, F.R.S. 1

The Modern Weather Bureau. By Cleveland Abbe, M.A. 17

Some Adaptations of South African Plants to the Climate. By R. Marloth, Ph.D., M.A. 31

Description of New Species of South African Eumolpidæ. By E. Lefevre 39

Notes on *Cyphia volubilis*, Willd. (Plate). By Selmar Schönland, Hon. M.A. Oxon, Ph.D., F.L.S. . . . 44

Third Contribution to the South African Coleopterous Fauna; on Beetles collected in Tropical South-Western Africa by Mr. A. W. Eriksson. By L. Péringuey, F.Z.S., F.E.S. . . . . (Part II.) 1

Fourth Contribution to the South African Coleopterous Fauna; Description of New Coleoptera in the South African Museum. By L. Péringuey, F.Z.S., F.E.S. (Part II.) 95

TRANSACTIONS

OF THE

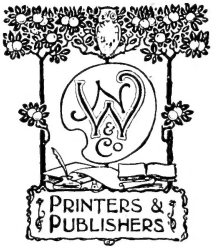
SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOLUME VIII.

1890–1895.

CAPE TOWN:
PUBLISHED BY THE SOCIETY.

1896.


W & Co.
PRINTERS &
PUBLISHERS

CONTENTS.

PAGE

Minutes of Proceedings, 1890–1 i

President's Address, Aug. 26, 1891 xi

Minutes of Proceedings, 1891–2 xviii

Minutes of Proceedings, 1892–3 xxxv

President's Address ("Determination of the Mean Distance of the Earth from the Sun"), Sept. 27, 1893 xlix

Minutes of Proceedings, 1893–4 lx

President's Address, Aug. 29, 1894:—"Means of Distribution of Seeds in the South African Flora" . . lxxiv

Minutes of Proceedings, 1894–5 lxxxix

President's Address, July 31, 1895:—"Progress of Natural Science in Relation to South Africa during the last Ten Years" civ

The Transkeian Territories; their Physical Geography and Ethnology 1

Notes on the Orography and Climatic Conditions of South-Eastern Africa, and on the Migration of the Natives. By H. C. Schunke 12

Mashonaland and Matabeleland—Facts and Figures; a Reply to Mr. Schunke. By J. A. Liebman . . . 16

Note on a Fly which Preys on Human Beings. By L. Péringuey, F.E.S. 23

PAGE

Variable Star Observing and Results from Observations made at Lovedale, South Africa (with diagrams). By A. W. Roberts 24

Van Wyk's Vley. By Garwood Alston 35

Computation of Orbit of the Comes of Sirius. By A. W. Roberts 40

Note on a Supposed New Icerya. By L. Péringuey . 50

Catalogue of Variable Stars South of -30° Declination. By A. W. Roberts 52

On the Repetition of Angles. By H. G. Fourcade . 63

Preliminary Result for Longitude of Bloemfontein, from an Occultation. By W. H. Finlay, M.A. . . . 77

Variation of L. 6887 (*R. Arcæ*). By A. W. Roberts . . 79

Note on Locusts as Propagators of Foot and Mouth Disease. By Kannemeyer 84

Some Scientific Results of an Excursion to the Hex River Mountains By R. Marloth, Ph.D., M.A. . . 86

Central Path of Solar Eclipses visible in South Africa as Total or Annular Eclipses during the Twentieth Century. By A. W. Roberts 93

On Some Human Skulls in the Collection of the Albany Museum. By S. Schönland 120

The Origin of the Nitrates in Griqualand West. By R. Marloth, Ph.D., M.A. 123