JOURNAL OF

THE TRANSACTIONS

OF

The Victoria Institute,

OR,

Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY,
CAPTAIN F. W. H. PETRIE, F.G.S., &c.

VOL. XXIX.

LONDON:
(Published by the Institute, 8, Adelphi Terrace, Charing Cross, W.C.)
INDIA: W. THACKER & Co. UNITED STATES: G. T. PUTNAM'S SONS, *N.Y.*
AUSTRALIA AND NEW ZEALAND: G. ROBERTSON & Co., LIM.
CANADA: DAWSON BROS., *Montreal.*
S. AFRICA: JUTA & Co., *Cape Town.*
PARIS: GALIGNANI.
1897.

LONDON:
PRINTED BY HARRISON AND SONS, PRINTERS IN ORDINARY TO HER MAJESTY,
ST. MARTIN'S LANE, W.C.

CONTENTS.

ERRATA.

Page 47, line 9, *for* ḫul *read* ǵui.
„ 49, „ 14 and 2 from end *for* Tudḫala *read* Tudǵula.
„ 51, „ 4 from end *for* laḫ *read* laǵ.
„ 61, „ 6 „ „ „ gu *read* ga.
„ 70, „ 14, *for* aḫ *read* aǵ.
„ 74, „ 3 from end, comma between central characters.
„ 76, „ 6 „ „ *for* a *read* or.
„ 84, „ 2, title, *read* KUDUR-LAǴGAMAL *and* ERI-EKUA.
„ 86, „ 1, *for* IDE *read* INE.
„ 88, „ 1, „ „ „

*** *The Institute's object being to investigate, it must not be held to endorse the various views expressed at its meetings.*

PREFACE.

NAMED after Her Most Gracious Majesty the Queen, it is fitting that the first words of the preface of this Volume of the Transactions of the VICTORIA INSTITUTE, should contain an echo of that deeply loyal sentiment to which all Her Majesty's subjects have sought to give expression in this year of Jubilee.

The following Address was presented by the Institute :—

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

"MAY IT PLEASE YOUR MAJESTY :

WE, Your Majesty's most dutiful and loyal subjects, the President, Council and Members of the Victoria Institute, gladly embrace the opportunity of once more approaching Your Majesty, and tendering our heartfelt congratulations on the completion of the sixtieth year of Your Majesty's beneficent reign.

We acknowledge with thankfulness that in the growth of the Empire abroad, in large measures of benevolent legislation at home, in Literature and in the investigation of the truths of Philosophy and Science (with which it is this Institute's privilege to be specially connected), Your Majesty's reign may confidently challenge comparison with those of our greatest and most illustrious Sovereigns. But we particularly rejoice to believe that the humblest and poorest classes in these Dominions may identify Your Majesty's reign with a sensible diminution of ignorance, poverty and suffering during the years which have elapsed since Your Majesty ascended the Throne, and that they may gratefully remember that every movement for the greater glory of God and

the improvement of your people has received the impulse of Your Majesty's gracious sympathy and support.

We desire to assure Your Majesty of our dutiful and affectionate attachment to Your Majesty's person, and our loyalty to the Throne. And we earnestly pray that Your Majesty may long be spared to promote the happiness and receive the grateful homage of Your Majesty's subjects.

Signed on behalf of the Victoria Institute, this 22nd day of June, 1897,

G. G. STOKES, *President.*
HALSBURY, *Vice-President.*
FRANCIS W. H. PETRIE, Capt.,
Honorary Secretary.

8, Adelphi Terrace, London.

REPLY.

WHITEHALL,
5 *July*, 1897.

SIR,

I have had the honour to lay before the Queen the loyal and dutiful Address of the President, Council and Members of the Victoria Institute on the occasion of Her Majesty attaining the sixtieth year of Her Reign, and I have to inform you that Her Majesty was pleased to receive the same very graciously.

I have the honour to be,
Your obedient Servant,
M. W. RIDLEY.

This Twenty-Ninth Volume of the *Journal of the Transactions* is a record of the various important questions, treated in papers by competent authors, and carefully investigated, and impartially discussed at meetings by those who have studied the subjects to whose opinions have been added the comments of others whom distance has prevented attending the Institute's gatherings in person.

The papers and discussions in this volume are upon the following subjects:—"The Perception of Light," by Sir G. G. STOKES, Bart., F.R.S., the President; with remarks by the Right Honourable LORD HALSBURY, F.R.S. (Lord High Chancellor), Sir H. BARKLY, G.C.M.G., K.C.B., F.R.S., Sir

CHARLES GORDON, K.C.B., Professor A. H. SAYCE, D.D., Professor E. HULL, LL.D., F.R.S. "Scientific Research and Biblical Study," by the Rev. Canon R. B. GIRDLESTONE, M.A.; the Rev. A. LÖWY, LL.D., and others took part in a discussion illustrating the value of the position the Institute has always sought to maintain, and the ill consequences of attempting to square every passing phase of scientific research with revelation, forgetful of the fact that science is ever-advancing, and therefore ever-changing its aspects. "On certain inscriptions and records referring to Babylonia and Elam and their rulers, and other matters," by Mr. THEOPHILUS G. PINCHES, M.R.A.S., of the Department of Oriental Antiquities at the British Museum. This paper is rich in the light thrown by the author and other leading scholars upon the history of the past. The difficulties attendant upon critical research among Babylonian records have in this case been not a whit less than usual; but whilst they have caused delay, that has been taken advantage of to include in the paper the results of further valuable researches up to the present autumn, 1897, on the part of the author, Professors SAYCE and HOMMEL. "China's place in Ancient History," by Surgeon-General Sir CHARLES A. GORDON, M.D., K.C.B., Q.H.P., in other words the contemporaneous history of nations. "The Polynesians and their plant-names," by Dr. H. B. GUPPY, an inquiry, by means of the plant-names of Polynesia, into the origin of its inhabitants. A note from Professor MAX MÜLLER emphasises the importance of this paper, and Dr. JOHN FRASER, of New South Wales, contributes valuable matter. "On the evolution of the Natural and the Artificial," by Dr. ALFRED T. SCHOFIELD, to the discussion on which Professor LIONEL S. BEALE, M.B., F.R.S., Dr. GERARD SMITH, and others contribute. "On the causes of the Ice Age," by Mr. WARREN UPHAM, of the United States; the discussion on which includes the last communication received from the late Sir JOSEPH PRESTWICH, D.C.L., F.R.S., and remarks by Sir G. G. STOKES, Bart., F.R.S.,

Professors J. GEIKIE, LL.D., F.R.S., LOGAN LOBLEY, F.G.S., JOSEPH BROWN, Esq., C.B., F.G.S., and others. "On specimens in the Peter Redpath Museum of McGill University, illustrating the physical characters and affinities of the Guanches, an extinct people of the Canary Islands," by Sir J. WILLIAM DAWSON, C.M.G., F.R.S., with remarks by Professor PUTNAM, Professor CLELAND, M.D., F.R.S., Dr. LAMBERT of Cairo, and others. "On Miracles and Science," by the Rev. Chancellor J. J. LIAS, M.A. To all who have taken part in the work done the best thanks of the Members and Associates are due; they have contributed to make the Journal, not a mere record of the formal proceedings of meetings, but of the well-considered opinions of the many both at home and abroad who have studied the subjects taken up.

FRANCIS W. H. PETRIE, *Capt.*,

Hon. Sec. and Editor.

1897.

JOURNAL OF THE TRANSACTIONS

OF THE

VICTORIA INSTITUTE,

OR

PHILOSOPHICAL SOCIETY OF GREAT BRITAIN.

TWENTY-NINTH ANNUAL MEETING.

HELD AT THE HOUSE OF THE SOCIETY OF ARTS.*

The President,

Sir GEORGE GABRIEL STOKES, Bart., LL.D., Sc.D., F.R.S.,

IN THE CHAIR.

Captain FRANCIS PETRIE, F.G.S., &c., Hon. Sec., read the following Report :—

Progress of the Institute.

1. In presenting the TWENTY-NINTH ANNUAL REPORT, the Council is glad to be able to state that the Institute's practical work has advanced effectually and decidedly. Members and Associates have accorded steady support, and the increase in the number of those in the highest walks of science who have co-operated with the Institute has been of much value, giving solidity to the Institute, and strengthening its power for work.

2. Many leading home and foreign societies exchange Transactions with the Institute, and an increasing number

* The President's important address on this occasion, July 25th, 1895, was delivered mainly extempore, being afterwards arranged and printed. Submitted for final review and correction, September, 1897.

of Universities, Colleges, Royal and Public Libraries in various countries subscribe for its Transactions.

3. The Library of Reference needs special support in order that it may be maintained in the efficient condition necessary considering the important uses it has to serve.

4. The following is the new list of the President and Council:—

President.

Sir George Gabriel Stokes, Bart., LL.D., Sc.D., F.R.S.

Vice-Presidents.

The Rt. Hon. Lord Halsbury, P.C., F.R.S., The Lord High Chancellor.
Sir H. Barkly, G.C.M.G., K.C.B., F.R.S.
Sir Joseph Fayrer, K.C.S.I., F.R.S.
W. Forsyth, Esq., Q.C., LL.D.
Alexander McArthur, Esq., J.P., D.L.
The Venerable Archdeacon Thornton, D.D.
W. H. Hudleston, Esq., M.A., F.R.S., *Past President of the Geological Society.*

Trustees.

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Rev. Preb. H. Wace, D.D.
W. N. West, Esq., F.R.G.S., F.R.Hist.Soc.

Hon. Auditors—J. Allen, Esq.; Colonel T. A. Le Mesurier.

Council.

Hon. Treas.—W. N. West, Esq., F.R.G.S., F.R.Hist.S.
Hon. Sec.—Capt. F. W. H. Petrie, F.G.S., &c.

*E. J. Morshead, Esq., H.M.C.S. (*For. Cor.*)
William Vanner, Esq., F.R.M.S.
S. D. Waddy, Esq., Q.C.
Rev. J. H. Rigg, D.D.
H. Cadman Jones, Esq., M.A.
Rev. W. Arthur.
Rev. J. Angus, M.A., D.D.
J. Bateman, Esq., F.R.S., F.L.S.
*D. Howard, Esq., D.L., F.C.S.
Professor H. A. Nicholson, M.D., F.R.S.E.
The Bishop of Wakefield.
Rev. F. W. Tremlett, D.C.L.
Surg.-Gen. C. A. Gordon, M.D., C.B., Q.H.P.
His Excellency Dr. R. H. Gunning, F.R.S.E.

*Rev. Preb. H. Wace, D.D.
Rev. J. J. Lias, M.A.
*Gen. G. S. Hallowes (*Cor. Sec.*).
Rev. A. I. McCaul, M.A.
Capt. Creak, R.N., F.R.S., &c.
Rev. F. A. Walker, D.D., F.L.S.
T. Chaplin, Esq., M.D.
Admiral H. D. Grant, C.B.
Rev. Canon Girdlestone, M.A.
Professor E. Hull, LL.D., F.R.S.
T. G. Pinches, Esq. (Brit. Mus.)
The Ven. Archdeacon Sinclair, M.A.
Dr. Gerard Smith, M.R.C.S.E.

* *Ex officio.*

5. The Council regrets to announce the decease of the following supporters of the Institute:—

J. K. Barton, Esq., M.D., F.R.C.S.I., *A.*; Arthur Brown, Esq., *M.*; R. H. Bromby, Esq., *L.A.*; Sir George Buchanan, M.D., F.R.S. (*Member of Council*); M.-General the Rt. Hon. Sir J. C. Cowell, R.E., K.C.B., P.C., *A.*; C. M. Cresson, Esq., M.D., *A.*; Professor J. D. Dana, F.R.S., *H.C.M.*; the Rev. Frank P. Du Sautoy, B.D., *A.*; the Rev. E. W. Fenwick, M.A., *A.*; the Rev. W. R. Fletcher, M.A., *A.*; Bisset Hawkins, Esq., M.D. F.R.S., a *Vice-Patron and Member of Council*; the Rev. Canon C. A. Heurtley, D.D., Margaret Professor of Divinity at Oxford University, *A.*; the Rev. Canon E. Hoare, M.A., *A.*; Mrs. F. J. Hughes, *M.*; the Honourable John Jay, *A.*; the Very Reverend Dean H. B. Macartney, D.D., *M.*; the Rev. Principal O. McCutcheon, D.D., *A.*; the Rev. James

MacGregor, D.D., *A.*; Admiral H. B. Phillimore, C.B., R.N., *M.*; P. W. Reinmuth, Esq., *H.C.M.*; the Very Reverend Dean R. Payne Smith, D.D., *M.*; the Rev. Cassidy Travers, *A.*; the Rev. H. F. Wright, M.A., *A.*

L. Life. *M.* Member. *A.* Associate.

6. The following is a statement of the changes which have occurred:—

	Life Members.	Life Associates.	Annual Members.	Annual Associates.
Numbers on June 20, 1894	62	47	361	861
Deduct Deaths	—	1	7	12
„ Retirements, &c.....			6	25
	—	—	— 13	— 37
			348	824
Changes	—	2	2	—4
	—	—	—	—
			350	820
Joined to June 30, 1895....	—	—	18	62
	—	—	—	—
	62	48	368	882
	110		1240	
Total	1350			

Hon. Correspondents number 142. Total .... 1492.

Finance.

7. The Treasurer's Balance-sheet for the year ending December 31, 1894, duly audited,* showing total receipts £1,109 1*s.* 3*d.*; expenditure £1,051 1*s.* 11*d.*; leaving a balance creditor of £57 19*s.* 4*d.*, after the payment of all liabilities, with the exception of the printer's bill for the last quarter of the year. The amount invested in 2¾ per Cent. Consols is £1,365 18*s.* 9*d.*

8. The Council desires to urge the very great importance of all subscriptions being remitted during the first half of the year (Bye-law III, 3). Adherence to the rule on this point would remove a difficulty in the management of the Institute. Forms for the payment of the subscriptions through a banker are used by a large number, and may be had at the office.

9. The arrears of subscriptions are as follows:—

	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Members	1	2	1	0	1	3	3	5	5
Associates	6	1	3	2	8	8	5	5	4

* Colonel T. A. Le Mesurier was elected additional auditor at the Annual Meeting of 1894.

Meetings.

10. It was mentioned last year that the Council was specially desirous that, so far as possible, no Member or Associate wishing to take a part in considering the subjects brought before the Institute, should be prevented by distance from so doing, and to this end arrangements were made whereby all those interested in the various subjects brought forward—but unable in consequence of distance to be present at the meetings—might, *by intimating their wish, receive proof copies of the papers to be read*, and send in any comments they might see fit, within three months; such comments being brought before the Council with a view to being read at the Meetings, and included in the discussion published after each paper in the Journal. It will be remembered that in consequence of the small attendance of members at the 8 o'clock meetings, the home members were canvassed, and five-sixths being in favour of the meetings being held at half-past four, that hour was fixed. A great increase in the number of members attending has been the result, and the value of the discussions has been proportionately increased.

HALF-PAST 4 O'CLOCK MEETINGS.

MONDAY, DECEMBER 3, 1894.—"On Ancient Languages; being notes upon the Geneva Orientalist Congress, with especial reference to the work of the Semitic Section." By THEOPHILUS G. PINCHES, Esq., Department of Egyptian and Assyrian Antiquities of the Brit. Museum.

MONDAY, JANUARY 7, 1895.—"Notes on Physical Geology, the origin of earthquakes, &c." A Lecture, by Professor LOBLEY, F.G.S.

MONDAY, JANUARY 21.—"On the Botany of Australia, Fossil and Contemporary." By the (late) Rev. Dr. WOOLLS, F.R.S. (N.S.W.)

In considering this subject and its relation to the botany of India and other countries, further light has been thrown on the migration of both flora and fauna. Baron Sir F. VON MUELLER and other distinguished Botanists contributed largely to the discussion.

MONDAY, FEBRUARY 4.—A Lecture by Dr. GERARD SMITH, M.R.C.S.E., on Insect Anatomy (with notes in regard to the doctrine of Evolution, &c.) The whole being illustrated by micro-photographs.

MONDAY, FEBRUARY 18.—On "The Evolution of the Natural and the Artificial." By ALFRED TAYLOR SCHOFIELD, Esq., M.D.

A popularly written and timely paper.

MONDAY, MARCH 4.—"The Philosophy of Comte re-considered." By J. W. SLATER, F.C.S., F.E.S.

It was deemed desirable, considering the tendency of modern thought, that this subject should be discussed.

MONDAY, MARCH 18.—"The Worship and Traditions of the Aborigines of the Islands of the Pacific Ocean." By Dr. M. EELLS. *Univ. of Pacific.*

In this paper Dr. Eells has sought to gather the results of the researches of all explorers and inquirers, and has shown that in no case was a people found that did not possess some belief in a Deity and practise some form of worship.

MONDAY, APRIL 1.—Remarks—on Professor HUXLEY'S, F.R.S., Address on the "Past and the Present," in reference to the doctrine of Evolution—by Professors E. HULL, LL.D., F.R.S., J. CLELAND, F.R.S., DUNS, F.R.S.E., PARKER, Ph.D., Rev. G. F. WHIDBORNE, F.G.S., Mr. J. W. SLATER, F.E.S., F.C.S., with a communication from Sir J. W. DAWSON, F.R.S.

The tendency of the remarks was to show that all naturalists admit that Evolution as a working hypothesis has, as yet, proved insufficient to account for Man's place in Nature; and that even Professor Huxley himself confessed to "mutual contradictions and intrinsic weaknesses" in the Darwinian theory of natural selection.

MONDAY, APRIL 8.—On "Theosophy." By the Rev. R. COLLINS, M.A.

This erroneous system, first propagated in India, having spread of late, both at home and abroad, and especially among the less educated, it was felt desirable that the system should be analysed.

MONDAY, MAY 6.—1. "The Physical Characters and Affinities of the Guanches or Extinct People of the Canary Islands," illustrated by specimens in the Peter Redpath Museum of McGill University. By Sir J. WILLIAM DAWSON, C.M.G., F.R.S.

2. "On the supposed Missing Link." By Professor HULL, LL.D., F.R.S.

In dealing with the latter subject it was shown that all known scientific evidence demonstrated that in no case had a so-called missing link proved to be other than a human being with a lesser developed brain than usual.

MONDAY, MAY 20.—"The Changes in the Mediterranean which have led to a community of some forms of life in the African Rivers and the Jordanic Basin." By Professor E. HULL, LL.D., F.R.S.

MONDAY, JUNE 17.—"The crossing of the Red Sea," being light obtained on this subject during a Government survey in Egypt lately carried out, by M.-General A. B. TULLOCH, R.E., C.B., C.M.G.

Also, communications throwing light on ancient trade routes between the East and West of Asia by land and sea.

THURSDAY, JULY 25.—*The Annual Address.* "On the Perception of Light." By *the President*, Sir GEORGE G. STOKES, Bart., F.R.S. (By kind permission at the House of the Society of Arts.)

Publications.

11. The twenty-eighth volume of Transactions is now in course of publication.

From time to time the Members of the Institute and others have expressed their high sense of the value of the Transactions of the Institute, inasmuch as they *contained not the opinions of any one person only, but of many*, resident in various and even distant parts of the world. That a system like this carried on by a competent body or Society gives a value to

the treatment of the several subjects beyond that which any individual author could give is evident.

The Special Fund.

12. The Special Fund is used :

I. To extend the Library of Reference, the composition of which is of great importance.

II. To print and organise the publication of the People's Edition at home and abroad.

13. The People's Edition consists of twelve papers—written by men of eminence in such a style that they may be comprehended by all—reprinted from the *Journal of Transactions*. The Edition was started by some members in the year 1873, and first attracted attention in other quarters to the importance and need of works of the kind. The papers in this edition are often accompanied by the objections and criticisms urged in discussing the subjects, many home and foreign correspondents having urged the value of including these. The papers are published in neat covers, and are sold at a nominal price (sixpence). Single copies are supplied *gratuitously* or at cost price to all individual lecturers against infidelity applying, including those of the London City Mission, the Christian Evidence Society, and similar bodies at home and abroad.

14. The acknowledged importance of the objects for which the Special Fund is used is such as to commend it to wide support.

On the Uses made of the Institute by some of its Members.

Many members have found that their connection with the Institute has proved more than a mere personal advantage to themselves. They have realised that the Institute meets a need felt both at home and abroad, especially in our Colonies and India, where imperfect appreciation of the actual results of philosophic and scientific inquiry has led many of the less informed to credit such statements as that "Science and Philosophy are alike opposed to Revelation," or that "the progress of Science has given a death blow to all belief in the truth of the Bible"—misapprehensions which in some cases have led even to systems of Education divorced from Religion.

A few of the many instances in which members find the Institute of use may be cited:—

Many Home and Colonial members have used the papers in the Journal as lectures, or to lecture from, in their respec-

tive localities, or have corresponded with the Institute as to the preparation of such lectures—have published translations of its proceedings—or have urged Local Associations and Public Libraries to subscribe for the Journal.

The extensive home and foreign correspondence is of much importance, and refers to subjects of the most varied and diverse kinds connected with the Institute's work. A few instances may be given.

From India the Institute was officially urged to place a copy of its paper on Buddhism with the discussion thereon, in the hand of every clergyman in the East.

From Persia has come a request for a large supply of the discussion on Islâm.

An Indian member sent a set of the Institute's volumes to the "Anjuman Punjab," of which he was President, in order that the subjects useful to India might be translated into the five leading dialects.

A distinguished member of Council recently reported that a friend, on returning from a tour of inspection in India, had informed him that he often met educated natives of India who knew of the Institute and its proceedings.

Another member in India wrote at the end of last year describing the steps taken to place the Journal in the local library attended by intelligent natives who were acquainted with English, adding "Such floods of infidel literature are poured into this country that such subjects as 'Human Responsibility,' 'The Reality of the Self,' and others, are particularly valuable."

At Bagagem, South America, a member, head of a mission, established a Portuguese paper, which regularly made translations from the Journal, and had a weekly circulation of 5,000 copies.

Similar work is going on in other countries.

It will be remembered that the late Emperor of Brazil accepted all the Institute's Journals with a view to the translation of portions for the benefit of his subjects, and a letter dated May 27, 1895, from a member of the Institute who is the talented native king of an African state says, "The Transactions sent are just the kind of books I need."

Thus it will be seen how many are the uses made of the valuable work done by the Institute, "work" which—as

a leading member has well expressed it—is "done for the best of causes," and is due to the voluntary efforts of many, and the support and encouragement of all the members.

Conclusion.

The importance of the work done by the Institute has been the cause of its receiving loyal support from its members in all lands. They realise that the spirit which makes such men as the President—Sir G. Stokes, the Lord High Chancellor (Lord Halsbury), Lord Kelvin, and other leaders of thought, and the members of Council, etc., combine in devoting their time voluntarily to superintending the Institute's work, is a spirit which deserves support, the object being, in the words of the Institute's motto, "*Ad Majorem Dei Gloriam.*"

Signed on behalf of the Council,

G. G. STOKES, *President.*

THE SPECIAL FUND, p. 6.

His Excellency R. H. Gunning, F.R.S.E., F.R.C.S., B. Hawkins, Esq., F.R.S., and others, sent contributions to this important fund during the year.

ANNUAL BALANCE-SHEET, *from 1st January to 31st December*, 1894.

RECEIPTS.	£	s.	d.	£	s.	d.
Subscriptions :—						
2 Life Associates				21	0	0
1 Life Associate, 1889	2	2	0			
1 Member, 1890	2	2	0			
2 Members 1891	4	4	0			
3 „ 1892	6	6	0			
6 „ 1893	12	12	0			
183 „ 1894	384	6	0			
5 „ 1895	10	10	0			
7 Entrance Fees	7	7	0			
1 Associate, 1889	1	1	0			
1 „ 1890	1	1	0			
3 Associates, 1891	3	3	0			
10 „ 1892	10	10	0			
44 „ 1893	46	4	0			
428 „ 1894	449	8	0			
28 „ 1895	29	8	0			
1 „ 1896	1	1	0			
1 Associate for 10 years	10	10	6			
Extra	3	15	0			
				985	10	6
Div. on £1,365 18*s.* 9*d.* 2¾ p.c. Consols				36	7	8
The Gunning Fund..				20	0	0
Donations to Special Fund*				6	1	0
Sale of Journal, &c.				40	2	1
				£1,109	1	3

EXPENDITURE.	£	s.	d.
Balance, Dr. from 1893	3	19	10
Printing	123	2	11
Postage and Parcels	103	2	1
Binding	55	9	5
Reporting	25	4	0
Typewriting	7	4	9
Stationery and Lithography	32	18	1
Advertising	21	14	4
Expenses of Meetings	24	1	10
Travelling	14	19	1
Salaries and assistance for year	93	8	1
Rent	180	0	0
Housekeeper	1	3	0
Coal and Light	11	14	3
Library and Furniture	30	12	9
The Hon. Sec. for Expenses, presented	315	0	0
Insurance	0	12	0
Bank Charges	0	17	0
Sundries	5	18	6
Balance	57	19	4
	£1,109	1	3

We have examined the Balance-Sheet with the Books and Vouchers, and find a Balance Cr. of £57 19*s.* 4*d.*

JOHN ALLEN,
T. A. LE MESURIER, } *Auditors.*

W. N. WEST, *Hon. Treas.*

* H. C. Dent, Esq., £1 1s. 0d.; B. Hawkins, Esq., M.D., F.R.S., £5.

Sir HENRY BARKLY, G.C.M.G., K.C.B., F.R.S.—Mr. President, my lords, ladies and gentlemen, in moving the adoption of the report which has just been read to you by the Hon. Secretary, I shall not detain you long, for doubtless all desire to hear that Address which our President has been kind enough to promise for this occasion. You have heard from the report the satisfactory progress that has been made during the past year. Now, we all know that this could not have been effected, and that the work of the Institute could not have gone on satisfactorily, without the constant exertions of the members of the Council and of our indefatigable Hon. Secretary—(cheers)—and I am sure you will support the resolution which I now move: "That the report be received and the thanks of the Members and Associates presented to the Council, Honorary Officers, and Auditors for their efficient conduct of the business of the Victoria Institute during the past year."

Surgeon-General C. A. GORDON, C.B., M.D. (now Sir C. A. Gordon, K.C.B.)—I have much pleasure in seconding this Resolution. It must be a source of no little gratification to all who take an interest in this Institute to hear, from the report, that the sphere of our operations has much extended during the past year.

The resolution was carried unanimously.

Professor E. HULL, LL.D., F.R.S.—I have very great pleasure in returning you the thanks of the Council for the resolution that has been so kindly accorded. The Council value the privilege of carrying on the very varied and important work of this Institute. It is, as you will note from the report, a work requiring special care. It includes the association of earnest cultured minds in the investigation of questions of importance, the right use of the results, and in encouraging the wide circulation of the records of those results as contained in the *Journal*, some instances of which are noted in pages 6 and 7 of the important report.

The President then delivered the following "Address":—

THE PERCEPTION OF LIGHT.

THE Report that has just been read shows that the Institute fully maintains the position it occupied at our last Anniversary Meeting—might I not even say that it indicates a general and increasing interest? The utility of the Institute depends, in my opinion, very largely on the maintenance of an impartial, truth-loving spirit in the investigation of questions on which the conclusions to which we appear to be led by observation and experiment, and those which seem to us to be inferences from what we believe to have been communicated to man in a wholly different manner, are both involved.

I regret that the Anniversary Meeting of the Victoria Institute had to be postponed this year to a date later than usual, which I fear may be less convenient to some of our Members, because unforeseen circumstances prevented us from having an important paper which we had intended to bring forward at the Anniversary. In default of that paper, I propose to invite your attention for a short time to a subject of great interest, though I am sorry to say it lies in great measure outside the line of my own researches.

At a former Anniversary I brought before the Members of the Institute the subject of the Luminiferous Ether. It is one of great and growing interest. I mentioned on that occasion how discoveries of very recent date have led us to attribute continually increasing importance, and a widening range of function, to that medium—substance can I call it?—the existence of which was originally assumed as a hypothesis in order to account for the phenomena of light. It is in connection with this last aspect that it relates to what I propose to bring before you to-day.

The wonderful sense of sight, which, to use an expression of Sir John Herschel's, confers upon us to some extent the character of ubiquity, requires two things: in the first place, some means by which those distant bodies which we see are

able to affect our own neighbourhood; in the second place, some provision in our own bodies for receiving that influence, and transmitting some sensation to the conscious being.

In my former address I considered the first of these two subjects; to-day I mean to confine myself to the second. This second, even by itself is, however, far too wide for a single address; selection of some kind is imperatively demanded. Moreover, there are some parts which are accurately known, and may even be made the object of mathematical calculation, while there are others which not merely lie beyond our existing knowledge, but beyond any that we can hope to attain to, at least in this life. Wonderful as is the construction of the eye in all its parts, so far as relates to the formation of images on the retina it acts simply like an optical instrument, like a telescope or microscope, or more correctly like the objective of such an instrument, and we may apply our mathematics to tracing the course of the rays through it. On the other hand, even if we knew accurately, which we do not, the nature of the effect which the external agent produces on the ultimate structure of our bodies, there would still remain, shrouded in impenetrable mystery, the nature of the process by which some change in the bodily organism causes a sensation to the conscious being.

Between these two extremes lies a region which has been to some extent explored, and in which a gradual and perhaps at last a very substantial increase to our existing scientific knowledge may be looked upon as probable. The investigation of this region possesses the keen interest which belongs to the discovery of new truths, and the addition thereby made to the stock of human knowledge. It is to this borderland lying between the well known and the unknown, and to certain parts of the structure of the eye having relation to it, that I would for a short time direct your attention to-day.

As I have already intimated, I propose to pass by entirely the functions of the eye acting as a simple optical instrument in forming images on the retina. The explanation of that may be found in all the ordinary text books, and I will not weary you by repeating what is there to be found, and which is generally familiarly known.

The phenomena of vision show that distinctness of vision is dependent somehow or other in the first instance on the

formation of distinct images of external objects on the retina. In that formation, as I have said, the transparent portion of the eye, the cornea, the aqueous humour, the crystalline lens and vitreous humour, plays the part of a lens in an optical instrument. I have said the "formation of the images on the retina"; but the retina is not a mere surface, it has a certain amount of thickness, although it is, on the whole, very thin. We may further enquire on what part of the retina, considered at different depths from the place where it first commences, on which of the various layers into which histologists have divided it, is it that we have reason to think that light first acts on the organism of our bodies in such a manner as ultimately to give us the sensation of vision?

I have said that the retina, as a whole, though very thin, is not a mere surface. If we go from the centre of the eye-ball outwards, *i.e.*, towards the back of the body, we have first a plexus of very fine nerve-fibres which run along the front of the retina, and ultimately unite in the optic nerve, which runs into the brain. We have also minute blood-vessels, which are essential, apparently, for the growth from its original state, and for the nutrition of the eye-ball, and for the carrying on of the process for which it was designed, viz., that of enabling us to see. Then we have several layers of pulpy transparent substances which have been called ganglions, nuclei and molecules, mixed with very fine fibres. Some of these are nerve-fibres, others are believed by anatomists to have relation to the fixing of the various parts of the structure to one another, so that they shall not fall to pieces in the rapid motions of the person using the eye.

Outside all, at the back surface of the retina, there is what is called the choroid coat; but between that and the coats I have spoken of is a very remarkable structure which I shall have to say more about. It is called the *bacillary* layer. In this part of the retina we have a vast number of elongated bodies placed closely, side by side. In the human eye, and in the eyes of most animals, they are of two shapes, and have been called accordingly rods and cones. The rods, as the name implies, are cylindrical, and the cones are tapering and are somewhat of the shape of slender peg tops, the sharp side being turned inwards as regards the way you look, so that the light, in coming from the outside, first meets the bases of the peg tops, and then goes on towards

the point. About the point of these rods and cones, just close to the choroid coat, is a layer of pigment cells which absorb the greater part of the light falling upon them. The rods and cones are transparent, and allow the light to pass through them, passing lengthways. I said the extremities reached to the layer of pigment cells forming a black lining immediately inside the choroid coat. That is true of the rods, but the cones do not reach quite so far, *i.e.*, when the eye is in a state of repose, as in darkness; but under the stimulus of light these pigment cells come down, *i.e.*, forward, in the direction in which you look, so as to reach the tops of the cones as well as of the rods. I have said that these elements (remember, please, that they point radially in the direction in which you are looking and lie side by side) are exceedingly numerous. When they are looked on lengthways from the back of the eye when the pigment is removed, they form a sort of mosaic. You may imagine the general structure of them by thinking of the head of the common sun-flower in seed. They are arranged side by side something like the seeds of the sun-flower; but they lie so close that the distance between the neighbouring rods or cones, as the case may be is only about (it varies somewhat from one part of the eye to another) $\frac{4}{1000}$th part of a millimetre or say about $\frac{1}{60}\frac{1}{00}$th part of an inch. So numerous are they that a square with sides the tenth of an inch would cover nearly half a million of them.

Now something more about these rods and cones. They are found to be composed of two members or limbs, an inner (nearer the centre of the eye-ball) and an outer. The inner is a transparent-looking body, very much like the other bodies in the neighbourhood. The outer is transparent too; but it is found to be highly refractive. It is longer in the rods than in the cones. The outer segment of the cones may be represented to the mind's eye by thinking of the metallic point of a peg top. These outer limbs are in both cases readily detached (when the eye is dissected) from the inner, and they separate after a little into laminæ lying one on the top of the other, perpendicular to the axis of the rod or cone. At the outer end they do not appear to have any continuation, the structure stops. At the inner end (corresponding in the case of the cones with the bulbs of the peg tops) there come nerve fibres from each of them. These pass through the various layers that I have spoken of; and although the course of them has not actually been traced the whole

way, on account of the difficulty of examination of this pulpy structure, it is pretty certain that they join on to those nerve-fibres which line the front surface of the retina, and so pass on, through the optic nerve, to the brain. When I say "pass on" I mean of course as you trace them along; there is no motion in the case. This is a very remarkable structure. Has it any object? What is its object? Now we know by experience that if we have a single point of light exposed to us, the impression is that of a single point of light in the field of view. If there be two such points we have the impression of two luminous points occupying different positions in the field of view. Now two such points may be very close to one another, and yet we still see them as two. It is found that the limit of closeness, beyond which we are unable to distinguish two objects as two, is such that a line drawn between them subtends at the eye an angle of about one minute, or an angle of about $\frac{1}{3\,0}$th part of that subtended by the diameter of the moon. Yet although they exist as close as that, the impression of the two is distinct, and we might have a number of points, each giving a distinct impression. It appears, therefore, that for the purpose of vision it is necessary that stimulations coming from a vast number of independent points, having different bearings from the eye, should somehow or other, give rise to distinct impressions.

Now if by calculation we trace inwards, to the retina, the course of the axes of two pencils coming respectively from two distant points not far from the centre of the field, it is found that those axes intersect, not exactly in the centre of the eye-ball, but in a point (called the optical centre) a little in front of it, the position of which we can calculate; and the place of either image may be found by joining the external point with the optical centre, and producing the joining line to meet the retina. It is an easy matter now to calculate the distance on the retina of the images of two external points which subtend at the eye a known angle; and it is found that when the external points are so close as only just to be seen as two, the distance of the two images is about the $\frac{4}{1\,0\,0\,0}$th of a millimetre, just about the distance apart of the cones and rods from one another, lying so closely as I have explained they do. Here, then, it would appear, in this remarkable layer of the retina, we have a provision enabling us to have distinct sensation of a vast number of distinct points in the field of view; and consequently we have

reason to suppose that the effect of light, whatever it be, on one of these elements (be it cone or be it rod) gives rise to the sensation of a point; and that the position of that point in the field of view depends upon the position of the element of the bacillary layer which has been affected by the light coming from the point. Moreover in the nerve-fibres which come from the anterior ends of the rods and cones we appear to have a provision for communicating, through the optic nerve, to the brain, the influence, or an indication of the influence, which light exerts on one of these elements.

Now I have mentioned one argument for believing that this remarkable bacillary layer is that in which light, which previously merely passed through the eye as it would through an optical instrument, acts in some manner on the organism so as to give rise to stimulation of the nerves which convey to us the sensation of vision. The argument, so far, is a sort of *a priori* one, but it has been remarkably confirmed by an experiment of H. Müller's, made by means of Purkinje's figures.

When in a room which is not quite dark we look with one eye towards a moderately illuminated wall with uniform surface, and holding a candle to one side of the eye move it up and down, there is seen in the field of view a figure branching like sea weed. This is the shadow of the blood vessels of the retina. That the candle requires to be moved in order to show the figure, is explained by the consideration that the shadow is not black, but only darker than its neighbourhood, and when the light is steady the exhaustion of the eye for that part of the field which lies beside the shadow tends to equalise the apparent illumination of the parts in and out of shadow; whereas when the candle is moved the shadow falls on a new place which had been in full light and therefore partially exhausted, and the previous exhaustion and the new partial interception of light falling on that place contribute to make the shadow sensible.

The existence of a shadow shows already that the percipient layer of the retina must lie behind the blood vessels. But we may go a step further. By suitable methods of illumination we may cause two spots on the surface of the eye-ball, whose positions can be determined from the circumstances of the experiment, to be alternately virtually the sources of the light which casts the shadow, and the places in the field of view of the shadows of the same vessel in the two positions of the illuminating source

can be marked. It is then only a question of similar triangles to determine how far behind the blood vessels lies the percipient layer, and the distance thus calculated is found to agree, within the limits of errors of observation, with the distance of the bacillary layer as determined by microscopic examination of a dissected eye.

I have said as you go backward from the centre of the eye-ball, you have, in front of the rest of the retina, a plexus, as it is called, of nerve-fibres lying side by side, something like the threads in a skein of silk, but gradually leading onwards to the optic nerve. Light passes across these, but it does not excite the nerves in passing through them. The nerves are transparent, and the light produces no effect upon them directly. If it did, your whole field of view would be confused, because it is known that when a nerve is excited the sensation is referred to a particular part no matter where the nerve may be affected. Suppose you could isolate, say in the thigh, a particular nerve leading to the great toe, and pinch it without hurting its neighbours, you would feel the pinch not where the nerve is pinched, but in the great toe. So, here, if these nerve-fibres were excited by the passage of light through them, then the sensation corresponding to the excitement of a particular nerve-fibre, which would be that of a definite point in the field of view, would be excited by an external luminous point lying anywhere in the curve in which the surface generated by a straight line passing through the optical centre and intersecting the fibre in question would cut what we may call the celestial sphere, and the correspondence between the subjective points in the field of view and objective external points would be lost. And the fact that the visual nerves are not affected by light which passes across them is further shown by the well-known experiment of the blind spot, where the optic axis passes out of the eye-ball, not in the axis of vision but to one side. towards the nose, so that an object whose image falls on the blind spot of one eye is seen by means of the other.

But now comes a question, and here we enter on uncertain and debated ground—How is it that the nerves are stimulated by the light at all?

We have reason to believe that these rods and cones form the means by which the light, acting on them, causes the stimulation of the nerve. As I have said they consist of two elements, an inner and outer; the outer from the centre of the eye, *i.e.*, the inner as regards the body, being of that

remarkable structure which I have described. It has been questioned which of these two elements it is that you are to regard as the percipient organ. I do not know that physiologists have decided that question. I have looked into a paper of Max Schultze's—in fact I have it on the table—and he inclines to the opinion that it is the outer element. Now is there anything in the outer element which can conceivably form a means of stimulation of the nerve, when that element is acted on by light?

I have spoken of the way in which it is composed of laminæ which come to pieces when dissected, after a certain amount of maceration. I do not know whether it may not be rash to say what I am about to say, because I do not know that physiologists have suggested it—it is merely an idea which occurred to myself, so you must take it for what it is worth. I was reading an account of the electric organ of electrical fishes, such as the torpedo. It is a very remarkable organ, occupying a considerable space in these fishes. It has a columnar structure, and the column again consists of laminæ placed one over the other. It has a structure which may roughly be compared to that of the basaltic columns in the Giant's Causeway, only here you must think of laminæ as more numerous and not having that curved surface which my friend Professor Hull is familiar with in the Giant's Causeway. Now nobody questions that somehow or other this is an organ by means of which these fishes are enabled to give a shock, and the idea, of course, is suggested, are not these laminæ like the plates of a battery? Is not one of these columns, roughly speaking, something like a galvanic battery? But how the battery is charged and discharged we do not know. In this case it depends, no doubt, on the will of the animal as to what he does, and nobody knows how he brings that about.

Now it strikes me that there is a remarkable apparent analogy between the outer member of the rods and cones, and these columns in electrical fishes. This gives rise to the suspicion that possibly these outer members may act the part of a microscopic battery, being charged somehow or other. But how are they to be charged? Well, before I go on to enter into any speculation on that I may mention that some years ago Professor Dewar and Mr. McKendrick made some remarkable experiments, the results of which are given in a paper published in the *Transactions of the Royal Society of Edinburgh.* When an eye is dissected out, and the

cornea is connected through a wire with non-polarising electrodes to the middle of the section of the optic nerve, the wire being led through a delicate galvanometer, it is found that there is a certain amount of electric current passing. Now it was found that when the eye (having been in darkness) was allowed to have light shining upon it, there was a change in this current, and a change again when the light was cut off. It is true that the total change was only a small fraction of the whole; but still that there should be any change at all produced by the action of light is a remarkable thing. It looks very much as if the stimulation of the nerve had something or other to do with the production of electric currents; but those, if they are produced, we must suppose to be produced in some way by the action of light. How may we imagine light to act so as to produce them? It has been discovered that in the layer of pigment cells in the retina there is a substance, called visual purple, of a purple colour, which is acted on by light, and is made first yellow and then nearly colourless. We have thus a substance that is capable of being acted upon by light, as very many substances are. I do not say that it is by any means proved that that is the substance, or even that there is any substance, which is acted upon by light in the way demanded; yet it seems very probable that the change produced by the action of light, whether it be on visual purple, or some other substance associated with it, may give rise to something which may, so to speak, charge this microscopic battery and stimulate the nerve-fibre which is attached to it. We know the rate of the vibrations of light of various kinds; and the rapidity of vibrations is so enormous, ranging about 400 millions of millions of vibrations in a second, that we can hardly imagine that the organism of our bodies is calculated to be set in vibration in a corresponding period. In that respect the sense of sight differs notably from the sense of hearing. In hearing the tympanum of the ear is thrown into vibration, and the vibrations are not so enormous in number in such a time as one second but that the corresponding nerves may actually be mechanically agitated, and thereby in some way stimulated. We can hardly imagine that the visual nerves are acted upon in this sort of way directly by the luminous vibrations, but they may be indirectly. Here, again, I may throw out a possible conjecture, though I am less disposed to receive it myself than that which I have just mentioned. We know there are

substances which when acted upon by light continue to shine in the dark. In some cases the action ceases almost instantly after the exciting light is cut off, for instance a solution of the salts of quinine, where the rapidity of cessation of the effect is amply sufficient to tally with the rapidity of cessation of visual sensation when light is cut off.

There are various other matters connected with the perception of light which are of great importance to our well being and to our enjoyment which I have not ventured to touch upon at all. It would take a great deal too long to go into two which I will only just mention. One is the provision in the two eyes, and in the muscles which move them, which enables us to obtain single vision notwithstanding that the two eyes are at work. Nothing is easier than to obtain double vision in which the images seen by means of two eyes occupy different positions in the field of view. There are very remarkable contrivances for bringing about singleness of vision in the habitual use of both eyes.

Then, again, we do not see light merely as light, but we see a great variety of colour. We can distinguish one light from another light by its colour, and not by its intensity only. It would take me a great deal too long to give you any idea of what is known (which after all is not much) as to the way in which that is effected.

I will conclude by calling your attention to the remarkable structure which is called the bacillary layer, and to what is, to my mind, the overwhelming evidence it affords of design in construction—design in order to bring about a pre-determined end. But when I say that, I do not mean at all to deny that there may be, and in all probability doubtless are, what we are in the habit of regarding as secondary causes leading up to this final end. Let me take Paley's old illustration of the watch. If a person who had never heard of a time-piece were to pick up a watch or other time-piece, and were to notice the way the hands went round and measured time, he would naturally be led to suppose that there was design in the thing, and that it was constructed to mark time, though he might have no notion how that was brought about. But suppose he opened the time-piece, he would see a lot of wheels and so forth, and the motion of the hands which he had noticed in the first instance would be the inevitable result of the motion of the wheels actuated by the main-spring in the first instance; and he might notice the

balance wheel, or the pendulum, as the case might be, regulating the motion so that the motion of the hands should be the proper measure of the time elapsing. But supposing he had found that out, that would not lead him to imagine there was less design in the thing than when he first picked it up. On the contrary I think his idea that there was design about it would be only the more strengthened. And so as regards the eye. We have in the first place the marvellous sense of sight itself, answering I may say to the turning round of the hands of the watch, then when we go a little deeper, and find those most remarkable structures apparently designed to bring about distinct vision, though we are very imperfectly able to see how it is brought about, certainly our idea of design is not thereby weakened, but it seems to me it is much strengthened. Supposing we could go a step further, and find out how the formation of these various rods and cones was brought about by vessels involving the growth and nutrition of the organs, I do not see how that would weaken our sense of design at all, but it might strengthen it rather than otherwise.

But I fear, my lords, ladies, and gentlemen, that I have already detained you too long. The subject is so large that I might speak on it at far greater length than I already have. (Applause.)

The Right Honourable Lord HALSBURY (Lord High Chancellor).—Ladies and gentlemen, I have to discharge a very pleasant duty. No one present could have listened to the very interesting Address which we have just heard without being thankful; and, speaking for myself, I should have liked to have heard more of it. One of the first impressions given to us must be, I think, that we are, indeed, "fearfully and wonderfully made"; and the inference drawn by Sir Gabriel Stokes is, I think, one that everybody will draw for themselves from his mere statement of facts; not only that it is design, but design that can only be directed to human

creatures, to adapt them to the kind of life that their Creator intended them to pass.

I could not help feeling also, when the Address was being delivered, somewhat of the sensations which I believe are attributed to every medical student when he begins to study his subjects. He is supposed to undergo the sensations of every disease he reads of, and I began to have the horrid sensation that I should like to feel my eye and know what was going on there—(laughter),—but that is one of those things that one has to overcome!

Further, I should have liked to have heard more on the subject of Colour. It is a subject that possesses a great deal of interest for us all; for when we remember that our life very often depends, when we travel by railway, on the power of the perception of colour, and indeed when we travel in the great vessels that traverse the ocean, viz.: whether it is the red or the green light of the port or starboard bow that is exhibited? For very often confusion in that respect leads to the occurrence of those ghastly collisions which make us tremble when we hear of them. I confess I should have heard with great interest some reference to colour vision or colour blindness. But I hope on a future occasion we may hear more about it.

At present I have to express (and I am sure you will all join with me) our very hearty thanks to Sir Gabriel Stokes for the very interesting Address that he has been good enough to give us —(applause); also to those authors who have read papers during the past session.

Rev. Professor A. H. Sayce, D.D.—I have very great pleasure in seconding this resolution. There are two reasons that make me doubt whether I am a fit person to whom this responsible office should be assigned. On the one hand, owing to my absence in another portion of the world during a great part of the year, I have not had the pleasure of hearing the papers read before the Institute, and have had to be content, therefore, with reading them; and, on the other hand, though I am a University Professor, I am unacquainted with physical science. Last summer I had the pleasure of hearing the Address delivered by Lord Salisbury

before the British Association, and I gathered from it, as I think all must have gathered to-day from our President, that the ablest and most profound disciples of modern science have come to the conclusions or principles which this Institute has endeavoured to maintain.

In the beginning of the present century scientific discovery, more especially in its practical application to life, made its followers believe that it was able to grasp all knowledge—that nothing was impossible for it—that it was destined to solve the problems not only of the Material, but also of the Spiritual world. With the close of the century have come wiser ideas. We have begun to realise and learn that after all Science cannot go beyond that middle region,—which the President has told us of, which lies between the known and the unknown. Beyond that there is still, and must always be, impenetrable darkness—darkness like that beyond the furthest point of space to which we can trace light.

The resolution was passed *nem. con.*

The PRESIDENT.—My lords, ladies and gentlemen, I feel grateful to you for the kind way in which you have expressed your appreciation of my humble services to the Institute. I regret that during the last year my attendances were not so numerous as I should have wished, but you must please remember that I live—not so very far, but still some way—from London, and I have also duties in the place where I live, connected with my Professorship.

I have to apologise to you for this Address, and I confess I feel that I ought to have written it beforehand. However, you will, I hope, kindly excuse the imperfections in it. I believe our shorthand writer is present, and has taken it down, so that it will be in the hands of all of the members, even though I did not write out beyond the first few pages. (Cheers.)

ORDINARY MEETING.*

THE PRESIDENT IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

ASSOCIATES :—Rev. Stuart H. Clark, B.A., London ; J. Trant Fischer, Esq., Australia ; Rev. L. W. Kip, D.D., China ; Rev. I. W. Tapper, London.

A paper on "Theosophy" was then read by the Rev. R. Collins, M.A., and a discussion ensued. (The publication of this paper has been delayed pending its completion.)

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* 9th of 30th Session.

ORDINARY MEETING.*

THOMAS CHAPLIN, ESQ., M.D., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

MEMBERS :—Rev. W. A. Bird, F.R.M.S., Bahama Islands ; Rev. J. H. Enders, United States.

ASSOCIATES :—M.-General C. G. Robinson, R.A., London ; Rev. N. J. Warner, B.A., Ireland ; Rev. C. J. Wood, B.A., S.T.B., United States ; Courtney K. J. W. Tyndall, Esq., London ; Rev. D. R. Breed, D.D., United States ; R. B. Armour, Esq., United States ; G. M. Weaver, Esq., United States ; Aquila Dodgson, Esq., Yorkshire.

The following paper was then read by the author :—

ON SCIENTIFIC RESEARCH AND BIBLICAL STUDY. By the REV. CANON R. B. GIRDLESTONE, M.A.

THERE is a rumour current among certain classes that scientific men have dropped their belief in Christ, in the Bible, and even in God. This, as stated broadly, is not true ; though doubtless there may be some slight ground for the assertion. The Bible contains at first sight some things which run counter to the principles on which modern natural science acts, and persons who do not profess to be scientific, but who have watched with interest the researches of the last fifty years, have had their faith sorely tried, and have seen the need of reconsidering their attitude towards the Bible from time to time.†

On the whole, however, the tendency of things seems hopeful rather than otherwise, and I propose to enumerate the points in which there has been an approximation between scientific research and biblical study, and to

* 1st of 1896 Session. Discussion finally arranged 1897.

† See note, page 42.

indicate certain desiderata which must be supplied before complete harmony is established.

I take the word science in a large sense. I include all investigations of the natural world, and I do not exclude the phenomena of human nature, the higher as well as the lower, the past as well as the present.

1. The scientific man by no means ignores the Bible. He recognises that it is a factor not to be overlooked, and its utterances are considered with a certain respect.

Few would deny that the facts recorded in its pages have been a stimulus to research during the past few centuries.

Whereas a large proportion of the Bible was a *terra incognita* to the historian of the past, it is so no longer. Not only have the books of the New Testament been pushed back on strictly historic and literary grounds to the century whence they professedly spring, so that their contents may no longer be regarded as mythical; but also the facts recorded in the Old Testament are taking their places among the materials which the historian of antiquity must digest and reckon with. The historic framework of the Old Testament, so far as it is not purely internal, is established in the main as historical, though not yet confirmed in all its details. Egypt and the East are rapidly yielding up their secrets, archæology and linguistic lore are contributing their testimony, and with rare exceptions, if any, it is confirmatory of the genuineness and antiquity of the biblical narrative.

2. The scientific man is increasingly conscious of the limitation of his powers and functions.

Every addition to the known opens a new vista into the unknown. Specialisation is the order of the day. Physical science is itself only a specialised branch of universal science.

Many things are given up which were the delight of old times. Men no longer hunt for the philosopher's stone, for the secret of renewal of youth, for a method of attaining perpetual motion. The investigator of nature has ceased to look for *Power*, and is content with *Process*; he does not peer into a gland with his microscope in the hope of finding the *ego* there. Intent on the secret of the origin of life, he has given up—or seems to be on the point of giving up—the idea that the living proceeds from the non-living without the intervention of preceding life.

3. The scientific man no longer stumbles at some of the old difficulties which have called out the ingenuity of so many "reconcilers."

He no longer measures human history by untold myriads of years, for the physicist steps in and forbids it. The longevity of primæval man is not now scouted as an utter impossibility, thanks to the investigations of the anthropologist. The story of the Flood is to him a matter of serious study, as the debate on Prof. Prestwich's interesting paper read before the Institute has shown. The student of comparative philology is prepared to detect in the simple story of Babel some strange intervention which may account for what is otherwise unaccountable—the remarkable divergence of human languages viewed in connection with the unity of the race. The crossing of the Red Sea has been recently discussed by this Society, and was regarded as a fact, not as a fiction. I would also call attention to the correspondence now going on in the pages of the *Palestine Exploration Quarterly* on the stoppage of the Jordan when Israel crossed.

The ancient biblical law of heredity has emerged as a scientific discovery.

Parthenogenesis is a familiar topic to the naturalist, and perhaps supplies an illustration of one of the most mysterious facts of Christianity, whilst another mystery—that which concerns the Triune God—may at least be symbolised by the presence of several sense centres in one organism in what are usually regarded as among the most primitive kinds of animated life.

4. The scientific man no longer regards his conclusions as final. So many theories have been advanced and withdrawn, so many that looked like solutions of difficulties have proved unworthy of the task, so many that seemed to account for phenomena have needed themselves to be accounted for, that men of science have ceased to compare their dicta to the laws of the Medes and Persians which altered not.

Ideas and speculations when sufficiently tested are rightly put forth as discoveries or as working hypotheses leading in the direction of finality though not in themselves final. This might be easily illustrated from Whewell's *History of the Inductive Sciences*, or by modern speculations concerning ether, or by the discovery of argon.

A theory which fits all the facts, *e.g.*, gravitation, may fairly be propounded as a law or rule, *i.e.*, it is a technical or mathematical formula which expresses the rule and measures the facts, and which contains within itself the suggestion of

finality, and of universality, but that is all. These laws are demonstrated as true, or as being in harmony with the universal truth of things, by tests and by discoveries made on the strength of them. Sometimes the intangible can be turned into the tangible, and so demonstrated, as in the case of oxygen. If ether could be captured and condensed into (say) argon, and if argon could be exhibited in a flame or a sound, we should acknowledge these discoveries to have received the topstone of demonstration.

I am inclined to inquire, in passing, whether evolution has reached this stage. Is it final? Is it a law? or is it an *ad interim* speculation, helpful and suggestive, and calculated to lead up to something which may have more of finality about it? I venture to think that the latter is the true view.

Accidental variations in animals of the same kind tend to aid or hinder the struggle for life and to reproduce themselves in the next generation. To advance from this suggestive speculation to the hypothesis that all sub-species, all species, and all genera of the animal world might, in the course of untold ages, have sprung from one beginning, —well, it would take a good deal of persuasion. To suggest further that the same theory may be argued by analogy in the case of the vegetable world, and that having got so far we may safely take the next step and amalgamate these two worlds into one, as being analogous in their course and therefore identical in their beginning; this is a splendid conception, and betrays a brilliant imagination, and provides a wide scope for investigation. Ordinary people, however, cannot but regret that a few experimental illustrations of the automatic development not only of species but of genera should not be forthcoming.

We all recognise the fact of gradation, though we cannot all accept the theory of automatic evolution based on accidental and inherited varieties. We may believe in an ever advancing stream of life embodied at certain stages in new species and even in new genera, but while some regard the embodied types as lineal though modified descendants of heterogeneous predecessors, others decline to do so without more definite proof than is forthcoming at present.* I can imagine a theory which would regard each type as a *terminus*

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* See Professor Huxley's paper in *Nature*, November, 1894.

which has been from its first appearance what it is now, while the stream of life which has led to it tends to advance further to form new kinds. This may seem ideal, far-fetched, and platonic, and I say no more about it. The question of questions is, Whence comes the stream of life, and the tendency to vary, to inherit, and to evolve or develop? Is it from above? or from below? or is it really capable of being regarded from both standpoints?

After all, evolution is no cause, it is only a formula designed to express the processes of nature. It presupposes creation, *i.e.*, intelligent, originative force; and the more extensive, complicated, harmonious, and age-long these processes of nature, so much the more do they indicate some unity of method and design in the background, which call for an eternal, overruling, designing—and therefore personal—Cause, and which I am content to call, so far as science is concerned, Ἄγνωστος θεός—a God whose nature cannot be comprehended by the unaided intellect of man.

I have been showing that so far as I can see there is some approximation between modern scientific ways of putting things and the convictions which a biblical student holds dear. Much, however, remains to be done, and I venture to call attention to some *desiderata* bearing on the subject before us.

(1) There is a great deal of dogmatism on both sides, especially among the lesser lights. I have heard it said that young ladies rush in where professors fear to tread, and many things are ardently thrust forth on the "all or none principle" by young enthusiasts on both sides, who thus hinder rather than help the cause which they have at heart. Verbal inspiration is claimed, now for the Bible, now for the Professor. Perhaps the voice of those who hold that there are degrees of inspiration and consequently of authority, ought to be heard not only in the biblical world but in the scientific.

(2) There is a tendency in Bible readers to disregard the processes of nature on the ground that the Scriptures claim all nature as under direct Divine administration; and there is a counter tendency of science to economise the Divine action to the uttermost, to push it back into the region of the prehistoric and mythical, whence it fades from view altogether. We ought to come to a mutual understanding on this matter, and a little reflection will show that it is possible. A careless student might imagine that by the discovery of the law called the Conservation of energy, there was neither

room nor need left for God in the universe. But those who first announced this law, did not drift to an atheistic conclusion.

Imagine if you can a fixed amount of equally diffused homogeneous matter in its raw or primary condition in the universe, the amount of energy in the whole remaining the same now as in the beginning, still the question—perhaps I ought to say the provoking question—will arise, Whence came it? Who and what first caused differentiation to begin? By what marvellous fate or fortuity did the varieties of the animal, vegetable and mineral kingdoms spring into existence in this little planet? and, notably, how do you account for those chief centres of energy, human personalities? For these cannot be classified with heat, light, and other physical forces, and when they die they give no sign of being under the law of conservation of energy in any real sense.

The more one speculates on these things, the more one sees that conservation of energy simply means conservation of *physical* energy, and only applies to one side of existence; the same being the case with the earlier discovery of the correlation of the physical forces, and its offspring, the continuity of physical force.

The substitute for creative action is automatic action. But automatic action, which by-the-bye in its true sense is as old as the Greek Testament, by no means dispenses with preceding intelligence and force. It would be vain to put a penny in the slot if there were no carefully constructed machinery and no chocolates within. All machinery, even the machinery of the universe, is the product of intelligence and of power.

(3) This leads to a third desideratum, viz., a more full discussion from a strictly scientific point of view of the mental and spiritual side of human nature.

The world has been interested if not agitated by Mr. Balfour's late volume on the *Foundations of Belief*. With all due respect to the author, I confess that he seems to shine more as a critic than as a constructor. He is skilful in pointing out the serious failure of "naturalism," *i.e.*, materialism, to satisfy the needs and demands of human nature as a whole.

I have no sympathy with him when he attacks the verdict of our senses. If I mistake not, he has not even touched or broached that about the senses, which makes

them so safe for the practical purposes of life, viz., that we are provided not with one sense only, but with many, and that they work in harmony, and confirm or correct each other, whilst reason, or the inner man, interprets and re-interprets all the phenomena which they bring to it. Nor am I altogether satisfied with his theory of nervous transmission, which indeed is the ordinary one, that the image on the retina is carried along to the brain, and thence to the *ego*. Why should not the *ego* run to the retina, and thus come into immediate contact with that which the light has brought there. Nor do I find his own final view of things one which I can grasp clearly and use effectively. I prefer a view which he mentions and dismisses with doubtful approbation. I believe that every human being is on the border of two worlds; he belongs to both, and both belong to him; he is the true meeting place between them.

Personally (if I may say so) I owe a great debt to the school of Kant as embodied in the teaching of Sir W. Hamilton and Mansel (whose Oxford lectures I had the privilege of attending). I also owe a debt to the school of Mill, whose "unknown possibilities of sensation" are discussed somewhat unsympathetically by Mr. Balfour. But there is a third school, which may be called Scotch, but whose most worthy representative was the late Dr. McCosh, formerly of Belfast; in the kind of teaching to be found in his "intuitions of the mind," I see a better prospect for sound mental philosophy than in Mr. Balfour's *Foundations*. It is vain to attack the school which puts its faith in the senses as interpreted by reason. But it is equally vain to ignore that the *ego* is a denizen of a sphere of being which the senses alone tell us nothing about.

Descartes' celebrated dictum, "*cogito, ergo sum*," which is graven on his statue at Tours, is the true basis of a sound philosophy of human nature. It will have its physiological side, but it must also have its psychological and intuitional. Consciousness—not *self-consciousness*, which seems to me an utter misnomer—is the basis of a true philosophy of human nature; and there is plenty of room within its boundaries for the dialectic of a Balfour and the analysis of a Spencer.

(4) Another desideratum is a free and full historical inquiry into the original nature and position of man.

Whilst the tendency of geology is to reduce the time needed for man's first appearance to a comparatively modern period, the archæologist is pushing up the age of literature

and civilisation until it is almost within sight of the era of primæval man.

It would be strange if, after all, the earliest evidences of the existence of man should point to a time when the traces of his mental powers were particularly conspicuous. And yet such a conclusion is within the bounds of possibility. It is, to say the least, conceivable that the special force which caused the first real man to be—whether that force worked through slow gradations, or in the twinkling of an eye—may have prepared him for his unique position as a master upon earth, by making him inventive and adaptive, long-lived and strong, to a degree which we cannot now easily comprehend.

The materials in the hand of the anthropologist are not as yet sufficient for the solution of this problem, but it is an intensely interesting one, and must be kept steadily to the front in the coming century.

Nor must it be forgotten that we are in the midst of geographical discussions as to the position of Paradise; whilst the last word has not yet been said on the original language of man, and on the dissemination of primitive written characters in their simplest forms, east and west.

(5) The scientific criticism of the books which culminate in the mission of Christ has yet to be perfected. I am not speaking of the so-called "higher criticism," but of something quite different. The criticism which I desiderate has its archæological side and its linguistic. Nor is this all, for the Bible presents a large field of inquiry; its records include matters which touch the domains of physics, astronomy, and natural history.

The exploration of ancient cities is being rapidly reduced to a science, thanks in a large degree to the unwearied enthusiasm and patient skill of Prof. Flinders Petrie. He has shown that what geological strata are to the pre-human period, that layers of pottery are to the human, and to read their message rightly is as much a branch of science in its true wide sense as is the interpretation of the fossil remains beneath our feet.

As the scientific student sees a great deal more in nature than the casual observer, so does the student of archæology find increasingly that the Bible is a living book. Its vivid historical and local colouring makes it what no other collection of sacred books even professes to be.

On the linguistic side of biblical study I desire to call

special attention to those sections in the Hebrew Books which specially contain provincialisms. These provincialisms in the Bible appear to me to be a mark of age and of originality. They demand a far more careful examination than they have hitherto obtained, and recent discoveries, especially the Tell Amarna tablets, are contributing materials for their comparative study.

There are other phenomena in the Bible, such as its way of putting things, its selection of topics, and its systematic tracing of everything back to the First Cause, which are replete not only with interest, but with philosophy. Its statements concerning natural phenomena need to be interpreted with extreme accuracy, both on their positive and on their negative side; whilst the series of marvels it records are to be read alongside of its theology and its central teaching, and not as a collection of isolated curiosities or fables. They are signs; and the thing signified by them takes us to the very heart of the Creator.* Inductive principles which are the keys to nature are applicable *mutatis mutandis* to the Bible on all the topics now enumerated; and if these are applied, there will not be any need of far-fetched and ingenious "reconciliations" between the Bible and science.

If nature must be studied as a whole, so must the Bible. It is a collection of books by writers who unwittingly contribute to a scheme the key to which is to be found in one historical Personage. To discuss the books without reference to the Personage is like anatomising a body without reference to its head. We can hardly expect the scientific man in the ordinary sense of the term to study the Bible scientifically unless the theologian does so. Ordinary versions do not always bring out the technical sense of Hebrew words and idioms, and even such a man as Professor Huxley sometimes failed in his criticism of the Bible through an ignorance of biblical science which was very pardonable in his case.

(6) The greatest desideratum of all is that Theism should be approached with steady steps from two sides, the Biblical and the scientific.

It is manifest to everyone who thinks at all that God must be reached in some other way than by the telescope or the microscope. The forces and processes of the material universe do not affect His nature or touch His Being.

* See De Quincey's *Essay on Miracles.*

Space and time, which are the very warp and woof of our existence, are not to Him what they are to us. We can no more see Him or comprehend Him than we can see or comprehend a molecule or an atom. How then can we study His ways?

It is to human nature—its most spiritual part—that we must turn if we want to catch even a whisper of His real nature.

"Show me thyself," said a Bishop of Antioch more than seventeen centuries ago, "show me thyself, and I will show thee God." And so Descartes said, "Nature conceals God, man reveals God." Here then is the call to the man of science. If the existence of a planet can be inferred from the movements of other bodies, may not the existence of the Great Spirit be gathered from certain perturbations of the human spirit.

I am persuaded that the phenomena of human life and history may be studied far more scientifically than has been done hitherto in order to find illustrations of the Divine character and methods. It is true that these are not always patent; they do not lie on the surface; for He is One who hides Himself and what is still more remarkable, He restrains the use of His own power and permits Himself to be resisted and apparently thwarted by man or by some evil power behind man.

At times we stand abashed and silenced as we realise that there are vast regions of existence of which we know next to nothing. I do not speak of the stellar but of the spiritual heavens. The Bible possesses a uniform system of psychology, of morals, and (I think) of metaphysics. Its writers are convinced that we live on the borders of two worlds whose laws are analogous—I will not say identical—and that the material world is a nursery for the spiritual. May not scientific men look into this spiritual world? Do they not recognise psychology as science? May they not investigate on scientific principles its immaterial side, where three empires meet, the psychological, the ethical, and the spiritual? Both parties now recognise the impassable gulf in nature between body and soul, and both agree that these two are marvellously blended into one in human life. We cannot even be conscious of the material without exercising the immaterial.

I am not pleading for metaphysics, though I for one do not think they are yet played out, and I see no reason why the words "subjective and objective" should not be baptized

afresh in the twentieth century. I plead rather for a more careful inductive survey of the special phenomena of the universe as detected in human nature and revealed in certain phases of human consciousness, and especially in the Will.

Modern popular theologians are apt to pride themselves on steering clear of what is called Calvinism, in spite of the warning voice of the late Prof. Mozley.

Shutting their eyes to another side of truth, they affirm the freedom of the will; though they have learnt that this freedom is limited, a fact admirably set forth by the Bishop of London in his 3rd Bampton lecture. Scientific men on the contrary seem to draw in the direction of physical fatalism; at least this is an inference frequently fathered on their writings.

Yet the Will after all is the chief known factor in the universe; and with the Will we must associate the *ego*, and with the *ego* the law of Right; and whence are these? are they the fortuitous products of matter, or are they the outflow of the original personal Mind? Scientific men need not be deterred from giving the true answer through fear of playing into the hands of religion. Let them speak out their deepest and most abiding convictions on this supreme question. Surely they are prepared to affirm that the Theistic hypothesis will account for certain observed facts in the universe, and that a consideration of the spiritual side of human nature turns this hypothesis into a conviction. They are then within measurable distance of the Christian Faith, which invites the Theistic conviction to become a personal experience.

The CHAIRMAN (T. CHAPLIN, Esq., M.D.)—I am sure we owe our best thanks to Canon Girdlestone for his valuable and timely paper. I speak of it as timely, because I believe the Victoria Institute is now just thirty years in existence, and this paper may, in a certain measure, be regarded as a report of scientific progress during these thirty years. When this Institute was first founded such a paper could not have been written, and we have surely cause for thankfulness that so much progress has been made in this

direction. For myself I cannot help thinking that one reason why so much progress has been made, is that those who desire to reconcile science and religion have been bold in grappling with difficulties. Now there is a very great difference between boldness and rashness, and I think we all feel, as members of this Institute, that while we should be very bold in grappling with difficulties and very bold in carrying our investigations into various departments of science, we should ever be strictly on our guard against drawing rash conclusions, whether those conclusions be in favour of the Word of God or whether they seem to be opposed to it.

Mr. D. HOWARD, D.L., F.C.S., &c.—I think we must all agree with our Chairman in what he has said as to the great value of this paper. The chief difficulty which one feels in discussing it is that one agrees with it so entirely, and it is always easier to attack than it is to agree.

It is a wonderful thing to look back thirty years and to see that certainly the course of thought has not made against but for a sound religious faith. I do not say that nothing has been changed. One cannot view any branch of science without remembering a good deal of change. There is hardly a matter of physical science upon which we have not more or less altered our opinions; but progress from immature to maturer knowledge has tended not to increase, but to diminish the gulf between religious and scientific modes of thought. There has been always that ancient though certainly not commendable habit of mind that has regarded any new discovery as a weapon with which to attack religion. It is a very old habit of mind, in fact almost as old as scientific thought, and the very fact that it still exists is nothing to make one anxious. We have passed through a great change in modes of thought, scientific and otherwise.

Looking back upon the "confused noise" that is necessarily associated with battle, we find that in a large measure the confusion has been in the rival armies and has not belonged to the real progress of thought. Scientific and religious thinkers have learnt to understand one another as far as they have been willing so to do.

There is nothing more easy than not to understand—but where there is willingness I think I may say that reconciliation has followed.

We look back with deep thankfulness to the fact that progress has been in the right direction, and that the ancient foundations of our belief have stood without the smallest shadow giving way under the storm of the last thirty years, as they have done under the storms of centuries before this.

The Rev. W. S. LACH-SZYRMA, M.A.—I think during the last thirty years there has been an approach of science to religion. The attitude of scientific men generally is better than it was thirty years ago. It seems to be a little more courteous, and they speak with a little more reserve than they used to in the past.

It seems to me that science and religion are not altogether on parallel lines, but in many matters they are on converging lines, and we have had this to some extent illustrated by the instance which the reader of the paper gave of a sheet of paper seen by the eye on the table and afterwards touched by the hand.

There is much cheap wit spread about by sceptical people, who think themselves clever, to show that science and religion are two distinct things, but when they get to know a little more they will find that what the Christian Church has taught in ages gone by will ultimately be proved to be the truth, even from a scientific standpoint.

Rev. A. LÖWY, D.D.—There are a great many points on which I totally differ from the author; but we are not assembled here in order to indulge in controversy, and therefore I will not occupy your time with a single observation regarding matters on which every man and woman will form opinions peculiar to themselves.

There is one thing that I would ask the learned lecturer which interested me very much, because it is the first time I had heard about it, and that is the provincialisms in the Old Testament. It is a thing to which my attention has never been called in the Bible. I consider there are certain books in the Bible which have quite a different style of expression, and evidently the original was composed in a part where Hebrew was spoken in a very peculiar way; for instance, in Job and in Isaiah there are certain phrases which are quite unintelligible and create differences even between Christians themselves sometimes. For instance, in the 34th chapter of Isaiah you find that the deserted places shall be inhabited by the bittern and the cormorant, and in the new version it is the porcupine and the pelican. Now you see this interpretation shows that we do not always understand certain terms. I do not call them

provincialisms, but I account for it by our individual ignorance. We are no longer in contact with those who used the language, and our ignorance is therefore just as honourable as our knowledge. We have no power of investigation of those things where the lexicons do not guide us. I will also refer to the point mentioned by the author, as to the expression used by Balaam. I know the Hebrew of the passage to which the lecturer referred; but I cannot agree with him that the expression he used was "Kobab" (קבב). I say it is "Nakab" (נקב). That occurs several times in the Bible.

Canon GIRDLESTONE.—But "Kobab" only in the Book of Numbers.

Dr. LÖWY.—In many cases it is "Kobab," and at other times it is "Nakab." Also in the case of "Eliezer," who went on his mission to Rebekah, a certain expression is used which is very curious, but if I may take the liberty of saying so, I think the expression is not peculiar; it means magnitude, and other expressions of that kind occur in the time of Moses, which do not occur often, because they were not often required. Sometimes it happens in our own life that we do not use every day the same expressions, but we use an extraordinary word on a special occasion. There is a special language for the drawing room, and a special language for the kitchen; but I believe, nevertheless, we are greatly indebted to the lecturer for calling attention to these expressions. We find differences of that nature in various books of the Bible. The Canticles are extremely beautiful, but nevertheless there are expressions in them of which we do not know whence they come. I believe there is in every human heart a certain foundation of belief, only we believe sometimes in different ways.

Professor H. L. ORCHARD, M.A., B.Sc.—The author has brought before us certain approximations between the truth of the Bible and the truth of science, and has also pointed out certain *desiderata* which might lead to further approximations. I could have wished that amongst approximations, at the beginning of the third page, the author had mentioned a few more; for instance, it is a very remarkable fact that graphite has been found in the earliest geological region, thus testifying to the truth of the Biblical statement of vegetable life (from which alone this substance could be supposed to be derived) preceding animal life. As we see, year after year, one testimony after another to the truth of the science

and history in the Bible, I think we must come to the conclusion that if there are any difficulties still remaining it becomes all to be exceedingly careful how they put them forward. It is certain in every case that scientific *fact* has never conflicted with Bible fact. What has conflicted has been scientific *inference;* but that must be received with very great caution. One must remember that science is for ever altering, but the Word of God never alters; that in every conflict knowledge has tended to do away with apparent opposition, and that there is not a single *proved* contradiction between the Bible and science.

With regard to the testimony of the senses I must say I very much agree with what the author has said. The testimony of the senses, however, depends on the testimony of consciousness. The author remarked that the substitute for creative action is automatic action, in which I agree.

The Rev. E. SEELEY.—In discussions of this kind one sometimes hears that we have had to give up a good many things. It seems to me that we should pay attention to what is said on this point, for such words are taken hold of by unbelievers, and they think that we have had to give up important truths of the Bible. But is it really so? Can it be shown that any positive statement of fact in Scripture in its original language has been necessarily abandoned as the result of scientific research? Opinions have been given up over and over again; interpretations have been given up. But does that signify? As we go on we must be prepared to change our interpretations of many statements; but that does not mean giving up the truths of Scripture. If we take the record of God's dealings with His creation, and find certain statements made which either were misunderstood in ages gone by or have been misunderstood by ourselves, until new evidence of science has come and cleared away the misunderstanding and enabled us to see them in new light, surely we may say that such changes of interpretation make the Scriptures not weaker but stronger. There are many points which we may understand now, in the light of science, which we could not do thirty years ago. Any of us who read Scripture can mention many points which we do not understand yet, and upon which we require further light, and there are many expressions in the Hebrew and Greek which at present are difficult to interpret accurately.

There is one thing that struck me while listening to the author's

treatment of man in his early days. Like himself I am not disposed to believe all we are told about evolution, but the evolutionists tell us we may see in the development of an individual an analogue of the development of the human race. If so let us answer the evolutionists from their own point of view. When is man most ready to learn, most adaptable, most easily changed and developed in certain special directions? Surely in his childhood. As we get older our powers of adaptation get moderated and we lose them to some extent. We have not the same power of acquiring a language, even, that we had in childhood. Let us go back to the childhood of mankind. Is not it very likely, even from the evolutionist's point of view, that in those years man could adapt himself more easily to climatic and other influences, and also may have been much more ready to take advantage of the peculiar state of the world as developed before his eyes than he is now? But in his early days man had not that accumulation of science and discovery that we have now.

The Rev. R. C. KIRKPATRICK, M.A.—There is one aspect of the question, viz., that if man was three or four thousand years ago, as some would have us believe, an ignorant savage, then the African has had seven or eight thousand years more savagery, perhaps than the white man, and yet if we educate him we find very little difference between the two. I was shown an instance the other day of a man who was perfectly black who was sent over here to a training college. He was head and shoulders above the others in certain acquirements. He said his ancestors had, for thousands of years, been distinct savages, and here you had a man of marked scientific attainments. How does that bear out the theory of evolution? To my mind it is rather an awkward fact to get over.

The AUTHOR.—I thank you for the attention with which you have listened to my paper, and the appreciation which you have shown. One does not like to be too long in a paper of this kind.

With regard to what Dr. Löwy has said, there may be a relationship between the two words "Kobab" and "Nakab" which he has referred to with regard to the curse in the story of Balaam, but the difference is there, nevertheless, even though the roots may be related. It is just as if a particular English writer were to say "buk" instead of "book," so that although the two roots "Kobab"

and "Nakab" may converge occasionally, I feel sure he will find that the words "Kobab" and "Nakab" do not converge at all.

Then as to the Canticles, as Dr. Löwy said, nobody knows where the words come from, and a very happy suggestion has been made that Solomon, who is the supposed author of the Canticles, and I am not disposed to give that up yet, had a great number of outlandish wives, and it would be very odd if he had not picked up some of their outlandish expressions! We are always learning from our wives, and why should not he have learned from them? Besides provincialisms there are certain foreign words which were introduced, whether from Egypt or other sources, for various things. Ivory, apes, and peacocks are certainly names that are foreign, and are supposed to come from South India.

Dr. Löwy.—Yes.

Canon Girdlestone.—If so, that is a very interesting point to notice.

I am glad that Professor Orchard referred to graphite and carbon as marking vegetable probably preceding animal life, as Professor Prestwich says in his book on *The Chemistry of Geology*.

I imagine by automatic action, in the Biblical sense, we mean non-human action; man may till the earth and plant seed, but man cannot make it germinate or vegetate. It is really the earth doing that work, and one is drawn back finally to the one presiding Being who provides the materials from which the automatic action takes place.

I feel interested in the challenge that has been put forth upon questions between science and the Bible. Is there anything we really have to give up? It is because I feel it so strongly, that I plead for a more scientific interpretation of the Bible. I do not feel that the English clergy, for example, devote enough study to the Hebrew technical terms in the Bible. I believe they deserve great study, and that the more they are looked into, the more we shall find there is room left in the record for the final expression of fact. Science has not said its last word, neither has the Bible. As one of the speakers has said, there are many things in the Old and New Testaments, about which we are not clear, but when the last word of the Bible has been spoken, and the last word of science has been spoken, as was said in this room some ten years ago, the two will not only converge, but be in harmony.

The meeting was then adjourned.

COMMUNICATION RECEIVED.

Mr. HASTINGS C. DENT, F.L.S., writes:—

Referring to the author's remark, "Every human being is on the border of two worlds," I would say, or as has been said, "Man has a body, but *is* a spirit."

Referring to the author's words, "The Bible is a living book," I would say:—all will perhaps agree that this is one of the most valuable remarks in this very important paper. It is perhaps this fact—that the Bible *is* a living book, with its daily influences on the lives of hundreds of millions of people, which perhaps more than anything else proves its inspiration. Its natural evidence is perhaps its surest *apologia*. There is no other religion of which this can be said as to its sacred books.

In conclusion there is only *one* item in the paper I regret, the latter half of its first paragraph. The author would appear to refer to such as Professor —— "who threw over his faith to worship a scientific fetich."*

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* Or perhaps to such as, *e.g.*, regard the word "day" (in Genesis) as meaning a day of 24 hours.

NOTE.

There are many in the present day who seek to square every passing phase of scientific research with Revelation, and are alarmed if they are unsuccessful, quite forgetful of the fact that Science is ever advancing and therefore ever changing in its aspects; as was ably and most opportunely illustrated by Lord Kelvin (in his 1897 Annual Address before the Victoria Institute), when he showed that the Science of 40 years ago is not the Science of to-day.—ED.

ORDINARY MEETING.*

PROFESSOR E. HULL, LL.D., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections took place :—

MEMBERS :—Rev. Professor Milton G. Evans, A.M., D.D., United States
Rev. C. H. W. Johns, M.A., Camb., Cambridge.

ASSOCIATE :—R. Anderson, Esq., C.B., LL.D., London.

The following subject was then taken up by the author :—

CERTAIN INSCRIPTIONS AND RECORDS REFERRING TO BABYLONIA AND ELAM AND THEIR RULERS, AND OTHER MATTERS. By THEOPHILUS G. PINCHES, M.R.A.S.

I.—THE EARTHLY PARADISE.

THE question of the position of the Garden of Eden is an attractive theme that will always, in all probability, find exponents to come forward with their ideas upon the subject, and far be it from me to find fault with any of them —there are probably but few that do not help the cause of science, either directly or indirectly. It is not with any new theory, however, that I now come to you—there is little or no fresh material for that. What I now refer to is the Babylonian idea of the position of Paradise, and wherein it agrees with, or differs from the Biblical account.

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* January 20, 3rd meeting of Session 1896.—The investigation of the subject taken up at this Meeting has been delayed on account of the usual difficulties attendant on critical research among Babylonian records. The study of the texts was ended, so far, and the matter passed for press October 1, 1897, see also p. 90.—ED.

The important text for this is the large tablet published in the W.A.I., v. pl. 15 (*), lines 25–67, which was first referred to, I believe, by Prof. Sayce, who has given translations of it. My excuse for again mentioning it is, that I have found some rather important additions nearly completing 2 (= 4 bilingual) lines of the inscription, and referring to the rivers, which, in this case, are an important indication of the spot where the Babylonians located their home of the blessed, called by them Eridu, a corruption of the Akkadian *guru-duga*, "the good city." This text reads as follows:—

1. In Eridu there grew a dark vine—in a glorious place was it brought forth;
2. Its form bright lapis-stone, set in the world beneath.
3. The path of Aê in Eridu is filled (with) fertility;
4. His seat is the centre-place of the earth;
5. His couch is the bed of Nammu.
6. To the glorious house, which is like a forest, its shade is set—no man enters its midst.
7. In its interior is the sun-god, Tammuz,
8. Between the mouths of the rivers (which are) on both sides.

There is no doubt that this highly poetical description is that of the Babylonian paradise—the name Eridu, mentioned above, is a sufficient indication of that, for it is the name of a city, a "good city" which, at the time the Persian Gulf extended farther inland than now, stood upon its shore. Within it grew "the dark vine," probably so called from its shade-giving branches, which, according to the line numbered 6, extended like a forest to "the glorious house" (*ana bîti êllu*), or, as the Akkadian has, "its glorious house" (*é-azaggānita*). Eridu was regarded by the Babylonians as being the place which the path of Êa, the god of rivers, streams, etc., filled with fulness of fertility, the "place of the eye of the land" (Akk. *ki îgi kuram*), where Nammu, the river-god, had his bed, which formed also the resting-place of Aê. Here, too, was the abode of Tammuz—"Tammuz of the Abyss," who dwelt between the mouths of the rivers that were on both sides (*ina birit pî nârā[ti] . . . kilallan*).

The Babylonian paradise had, therefore, the tree, either of knowledge or of life, and the picture they give of it is grand in its way—a wide-extending vine, gloriously bright like unto beautiful lapis-lazuli, blue and white (*uknû êbbi*)

in colour and appearance. Once, probably, accessible to man, it was afterwards forbidden to him, for "no man enters its midst" (*ana libbi-šu manma lâ irrubu*). It was a well-watered place, for the river-gods seem to have had it under their special protection and to have devoted to it their special attention, for on each side of the abode of Tammuz flowed two rivers—beyond a doubt the Tigris and the Euphrates. The remarkable likeness of this account to that of the Hebrews differs in this last circumstance, namely, that the Babylonians pictured their Paradise as having two rivers only (*ida-ka-mina*, "river mouth two") and not four, as the Hebrews. As in the Flood-stories of the two nations, also, there is a great difference, for the monotheism of the Hebrew account is replaced, in that of the Babylonians, by their picturesque and interestingly symbolical polytheistic system. It will probably now take its place as one of the most charming which excavations in Babylonia and Assyria have restored to us.

II.—Chedorlaomer and his Contemporaries.

I now come to what many will probably regard as the most interesting part of my lecture—namely, the tablets which seem to refer to Arioch, Tidal, and Chedorlaomer.* In speaking of these tablets I have decided to treat of them in the order in which they came to my notice, and shall begin with Sp. III. 2, which contains all three names. This text is the lower left-hand part of an unbaked clay tablet about $3\frac{3}{4}$in. wide by $2\frac{3}{4}$in. high, the obverse giving part of 16 and the reverse part of 12 lines of writing, mostly in a very mutilated condition. The earlier lines contain a reference to "work" (*ipšetu-šu*), and have the word *ḫammu*, in which Prof. Hommel sees the beginning of the name Ḫammurabi, who is identified by Prof. Schrader with

* At this stage I purposely say, "seem to refer," and I wish it to be noted that I have never spoken of these names without a note of interrogation, though this was probably an excess of caution. My audience will be able to judge whether three names so similar to those in the 14th chapter of Genesis are, or are not, those of the personages mentioned in that chapter. I do not ask them, however, to express an opinion as to the magnitude or the strangeness of the coincidence if they should decide that the names given by the tablets are *not* those of Arioch and his allies. The other Assyriologists are now adopting the views regarding these names held by Prof. Sayce, Prof. Hommel, and myself.

Amraphel (of this king I shall speak more fully farther on). Whether the name of Ḫammurabi be really here or not is, however, doubtful, because the word is incomplete, and the determinative prefix for the name of a man is wanting.

Sp. III. 2.

. . . .
. . . .
. . . . su . . . .

3\. . . . . ip-še-tu-šu la . . .
. . . . *his work not* . . .

. . . . ṣu ḫa-am-mu . . .

. . . . pan (?) îlāni nab-nit . . . .
. . . . *before (?) the gods, the creation of* . .

6\. . . . . lu U-mu . . . Šamaš mu-nam-mir . .
. . . . . *day* . . . . *Šamaš illuminator of* . .

. . . bêl bêlē D.P. Marduk (?) ina kun-nu lib-
. . *the lord of lords, Merodach, in the faithfulness of his*

bi-šu
heart

. . . ardu (?)-uš kip-pat kali-šu ma-al-ku la
. . . *his servant (?) the region, all of it, the ruler not*

za-nin
nourishing

9\. . . . . . -pa u-šam-kit. ⸢ Dûr-ṣîr-îlāni ablu ša
. . . . . *caused to be slain. Dûr-ṣîr-îlāni son of*

⸢ Eri-→⊬[Ê]-a-ku
Arioch

10\. . . . . -na-a-tam iš-lul mê êli Bâbîli D.S. u
. . . *goods (?) he carried off, waters over Babylon and*

Ê-sag-gil
the temple Ê-saggil

11. . . . mâri (?) - šu ina kakki ḳâta - šu kima (?) as - lu
. . . *his son* (?) *with the weapon of his hands like* (?) *a lamb*

u - ṭa - bi - iḫ - šu
slaughtered him

12. . . . bil iḳ - bu (?) ši D.P. šêbu u mâru ina
. . . *spoke* (?) *to her* (?), *the old man and the child*

kakki
with the sword

. . . . . mâru ik - ki - is ⸢Tu - ud - ḫul - a mâr
. . . . . *the child he cut off.* *Tidal* *son of*

⸢Gaz - za . . .
Gazz[*āni*?]

. . . . - a - tam iš - lul mê êli Bâbîli D.S. u
. . . *goods* (?) *he carried off, waters over Babylon and*

Ê - sag - gil
the temple E - saggil

15. . . . mâri - šu ina kakki ḳâta - šu muḫ - ḫa - šu
. . . *his son with the weapon of his hands upon him*

im - ḳut
fell

. . . . be - lu - u - ti - šu a - na pa - an bêt
. . . . *of his dominion* *before* *the temple*

An - nu - nit . . .
of Annunit . . .

Sp. III, 2.

Reverse.

. . . E - lam - mat âl Aḫ - ḫi (?) - e ana (?)
. . . *Elam* *the city* *Aḫḫê* (?) *to* (?)

mât Rab - ba - a - tum iš - lul
the land *Rabbatum* *he spoiled*

. . . - ku a - bu - ba - niš iš - kun ma (?) - ḫa - zu
. . . *in ruins* *he set* *the* *fortress* (?)

mât Akkad D.S. gab - bi Bar - ši - *
of Akked *the whole of Borsippa* (?)

3. . . . ik-lu ⸢Ku-dur-laḫ-mal mâri-šu ina
. . . *ended.* *Chedorlaomer* *his son* *with*

paṭri parzilli šibbi-šu lib-ba-šu it-ta-*
the *steel sword* {*of his girdle*} *his heart* *pier[ced]*

. . . D.P. nakri-šu il-ki-ma ab-' šarrāni
. . . *his enemy* *took and the will* (?) *of these* (?)

'a-nu-tu bêlē ar-[ni]
kings, *lords* *of sin* (?)

. . . ru-tu ka-mu-tu ša šarri îlāni
. . . *rebellions* (?) . . . *who* *the king of the gods,*

D.P. Marduk i-gu-ug-šu-nu . . .
Merodock *was angry against them*

6. . . . . mar-ṣa-a-tu^{m} i-rat-su-nu
. . . . . (*with*) *sicknesses* (?) *their breast*

ar-rat u-ṣur-ta . . .
was oppressed [*their*] *place*

. . . . mar (?)-ru ana na-me-e is-*-me-ni
. . . . *to* *ruin* *was reduced* (?)

kul-lat-su-nu ana šarri bêl-i-ni (?)
All of them *to the king* *our lord*

. . . . di-e lib-bi îlāni riin (?)-nu-u
. . . [*kn*]*owing* (?) *the hearts of the gods,* *the gracious* (?)

D.P. Marduk ana zi-kir šumi-šu
Merodach *for the renown* *of his name*

9. . . . . u Ê-sag-gil ni-bu ana
. . . . . *and* *Ê-saggil* *proclaimed* (?), *to*

aš-ri-šu li-tur
its place *may he return.*

. . . . . -bi-ka liš-kun an-na-a šarru
. . . . *thy* . . . *may he make.* *This,* *O* *king*

bêli-ia niš-taš- . . .
my lord *we* . . . . . .

. . . . limutti (?) - šu lib - ba - šu
. . . . *his evil* (?) (*from*) *his heart*

îlāni âb[ê] (?) . . . . .
the gods father[*s* ?] . . . .

12. . . . . bêl (?) ḫi - ṭu la
. . . . *lord of sin shall*

i - . . . .
not [*exist* ?]

The Probable Contents of Sp. III, 2.

After the reference to the work of some one whose name is not preserved, to the gods, and to "Šamaš (the sungod), illuminator of [the earth ?]," Merodach, "the lord of lords," is spoken of as having, "in the faithfulness of his heart," devastated (?) some region, "all of it," and, perhaps, "caused to be slain" (obv., l. 9), the ruler who did not nourish (*malku lâ zanin*, l. 8), that is, in all probability, "patronize" [the temples]. Dûr-ṣîr-îlāni, son of Eri-[E]aku (l. 9), is then spoken of, and the spoiling of some place and devastating (?) by water (𒀀𒈨𒌍) of Babylon and the great temple Ê-saggil. This is followed by a reference to the slaughtering of some person "like(?) a lamb," a deed committed (judging from the traces on the edge) by the son of some one whose name is lost. Old and young, too, [were slain] by the sword (l. 12), and some person or thing "cut off" (l. 13), and the writer immediately afterwards refers to Tudḫala (Tidal), son of Gazzā[ni ?], and to the spoiling of some place and the devastating by water of Babylon and the temple E-saggil l. 14)—a statement which would lead one to suppose that Tidal had imitated Dûr-ṣîr-îlani (see lines (9, 10), and this supposition is strengthened by the following line, where we are informed that his (? Gazzā[ni]'s) son "fell upon him with the weapon of his hand (l. 15), and then [proclaimed ?] his dominion (?) before the temple of Anunit (l. 16).

The reverse begins with a reference to the land of Elam, the city Aḫḫê (?), and the land of Rabbatum, and I at first thought that the latter two were spoiled by the king of the former, but one may just as easily refer this line to Tudḫala or Tidal—"he spoiled [from ?] Elam and the city of Aḫḫê (?)

to the land of Rabbatu^{m}." Whether, however, it was he who made some district like ruin-heaps (l. 2), and captured(?) the fortresses of the land of Akkad and the whole of Borsippa (?) (l. 2), is more than doubtful. This line refers with more probability to Kudar-laġmal or Chedor-laomer, whose name occurs in the next line (3), with the addition that "his son, pie[rced] his (? his father's) heart with the iron sword of his girdle," probably stamping him (like Tudġula or Tidal, obv. l. 15) as a parricide. In line 4 of the rev. the person who "took his enemy" was probably the legal ruler, referred to lower down as "the king my (our) lord," the kings who were "lords of si[n]" being apparently the seeming parricides, Tudġula, and Kudur-laġmal, with whom Merodach, king of the gods, was angry (l. 5), whose breasts were oppressed with sickness, whose faces [were bowed down in the dust?] (l. 6). and whose territory (?) was reduced (?) to ruins (l. 7). All these to the king recognised by the people [were compelled to submit?], by the power of him who "knows the heart of the gods, the gracious Merodach, for the renown of his name" (ll. 7, 8). The inscription finishes with a reference to [the writing, the contents of which were then] proclaimed in E-saggil, [and which the future prince who should restore that temple] should, [when he found it], restore to its place (l. 9) [after taking note of its contents], as was the custom in those days. The sense of the 10th line is uncertain, but the 11th and 12th seem to contain a pious hope that the gods might [keep all] evil (?) from the heart [of the ruler?], and that "a lord of sin (*ḫitu*) might no longer exist."

The above is an attempt to form a connected narrative from this mutilated text, the great importance of which is that it gives the three names which so closely resemble those of the two Babylonian kings and one Elamite king of the 14th chapter of Genesis. At present I will not speak of the readings of these names, nor the variant characters in them—that will be best done afterwards, and in the notes. I will merely remark that the finding on one document of three names that we should *expect* to see mentioned in close connection, is a thing which anyone bringing objections will have to explain away. Unsatisfactory as the condition of this text is, it would nevertheless be hard to exaggerate its interest and importance.

The next document is a rather thin fragment of a tablet in the same style of writing, but of baked clay, the obverse being fairly well preserved, and therefore giving a fairly con-

nected narrative, notwithstanding that the end of every line is broken away. The reverse of this text, however, is so mutilated as to be practically worthless. The nature of the text is historical, and very detailed, and it is of importance in that it gives the names of two of the personages who are apparently mentioned in the inscription of which I have just given a description, namely, Kudur-laġgamal (as he is apparently called here), and Eri-E-kua, or Eri-Akua, evidently a variant of Eri-[E]aku), whose son is spoken of. The following is a translation of this text:—

Sp. II, 987.

Obverse.

. . . . . ilāni . . . . . .
. . . . . *the gods* . . . . .

. . . . . ta-at ur-ra(?) .
. . . . . .

3. . . . . ki mar-kas šam-e ša ana ir-bit
. . . . . *The bond of heaven which to the four*

im-ru . . .
regions (?) . .

[i]-šim-šu-nu-tu^{m} šar-ta^{m} ša ina Bâbîli âl
he set them *the fame which in Babylon the city*

ta-na- . . .
of [his] glo[ry] . . .

i-sim-šu-nu-tu^{m} nam-kur šu-ud Bâbîli
he set them *The property of the possession of Babylon*

ṣa-ḫar u ra- . . .
small and gre[at] . . .

6. ina mil-ki-šu-nu ki-ni^{m} ana Ku-dur-laḫ-ga-mal
in their faithful counsel to *Chedorlaomer*

šar mât E-la[-mat] . . .
king of the land of Ela[m] . . .

u - kan - nu u rid - di ga - na ša êli - šu - nu
they said (?) "Descend." The thing that unto them (was)

ṭa - a - bi . . . . . .
good [he performed, and]

ina Bâbîli âl Kar - (D.P.) Dun - ya - aš šarru - ta^{m}
in Babylon, the city of Kar-Duniaš sovereignty

ip - pu - uš . . . .
he exercised . . . .

9. ina Bâbîli D.S. âl šar îlāni (D.P.) Marduk
in Babylon, the city of the king of the gods, Merodach,

id - du - u is (?) . . . .
they had overthrown, he . . .

su - kul - lu^{m} u kalbē bît ḫab - ba - a - ta^{m}
the herd and the dogs of the house of the dens (?)

i - ma - ag - ga - . . . .
he favoureth (?) . . . .

iḫ - tar - ku ki - i - nu a - ri - bi mut - tab - ri - šu
he captured constantly. The raven having wings

i - ra - mu . . . .
he loveth . . . .

12. i - nak - kar a - ri - bi ṣir - ḫu tab - bi - ik
changeth, the raven, the loud crying, which pours out

mar - tu^{m} . . . .
gall . . . .

kalbu ka - si - is NER - PAD - DA i - ma - ag - ga - ar
The dog who crunches the bone he favoureth.

D.P. Nin - . . . .
Nin - . . . .

i - nak - kar ṣir - ḫuššu amelu ḫab - ba - a - tu^{m}
changeth the great snake of the man of the dens,

ta - bi - ik . . . .
which pours out . . .

15. [I?] a - u šarri mât É - la - mat ša
What (?) king of the land of Elam (is there) who

D.P. nun - nu Ê - sag - gil u - . . .
the chapel (?) (on) Ê - saggil has [built ?]

. . . u (?) âblē Bâbîli iš - ku - nu - ma šip - ru -
. . . *the sons of Babylon made and their work*

šu - nu i - . . . .
he . . . .

. . . e - tu^{m} ša taš - ṭu - ru um - ma Ana ku
[the let]ter (?) that thou hast written thus I am

šarru mâr šarri NU (?) . . .
a king, the son of a king . . . . . .

18. . . . - u mâr mârat šarri ša ina D.P. kussî
. . . *the son of the daughter of a king who on the throne*

šarru - tu u - ši - bu (?) . . .
of dominion have sat . . . .

. . . Dûr - ṣîr - îlāni mâru ša Eri - ê - ku - a ša
. . . *Dûr - ṣîr - îlāni the son of Eri - êkua who*

šal - lat . . . .
the spoil of . . . .

[ina] D.P. kussî šarru - tu u - ši - ib - ma ina ma - ḫar (?)
[on] the throne of dominion sat and with the sword (?)

di - i - ku (?) . . . .
was killed (?) . . . .

21. . . nu šarru lil - lik ša ultu û - mu da - ru - u - tu
. . *the king may he go who from remote days to*

kun (?) . . . .
set (?) . . . .

. . in - nam - bi bêl Bâbîli D.S. ul i - kan - nu
was proclaimed lord of Babylon prepared not

še - . . . .
. . . .

[araḫ] Kisilimi u araḫ Du'uzi ina Bâbîli
[*month*] *Kislev and* *month* *Tammuz* *in* *Babylon*

in - ni - ip - pu - . . . .
was ma[*de*] . . . .

24. . . . še - e - a kalû (?) sa - pi - in - nu mâti
my . . . *the priest* (?) *who destroys* *the land*

kali - [šu ?] . . .
all of [*it* ?] . . .

. . . - bi(?)-u^{m} ina mil - ki - šu - nu ki - nu - um . . .
. . . . . *in their faithful counsel* . . .

. . . . nu - a kalû (?) ku(?)um a -
my . . . *the priest* (?) *instead* *of* *a*

bu - bu (?) . . . .
flood . . . .

27. . . . . rabûti (??) ina šal - lat u - še - iṣ -
. . . *the great ones* (??) *with the spoil* *he caused to be*

bi (?) . . . .
taken (?) . . .

. . . . . ša - ri - ṭi dam - . . .
. . . . . *ravaging* (?) *the* . . .

. . . . . .

Sp. II, 987.

Reverse.

. . . . . .

1. . . . . - nam (?) la ša - ma - * . . . .
. . . . . *unrivalled* (?) . . . . .

2. . . . . šarru šakkanaku ul . . . .
. . . . . *the king* *the ruler without* (*rival*?). . .

3. . . . . tu^{m} nap - šat - su ta (?) . . . . . .
. . . . . *his* *life* . . . . . .

4. . . . . di . . . . . .
. . . . . .

5. . . . . lu^{m} D.P. Šamaš . . . . . .
[*lo*]*rd* (?) *Šamaš* . . . . . .

6. . . . . da - ab . . . . . .
. . . . . .

7. . . . . ku (?) . . . . . .
. . . . . .

8. . . . (pl.) ku (?) . . . . . .
. . . . . .

9. . . . . še . . . . . .
. . . . . .

10. . . D.P. nam (?) . . . . . .
. . *the officials* (?) . . . . . .

11. Û - mu ma - la . . . . . .
days, as many as . . . . . .

12. bêlē ar - nu . . . . . .
lords (*of*) *sin* . . . . . .

13. kal - la mar - ṣa . . . . . .
all (?) *the sick* (?) . . . . . .

14. gab - šu ut - ta . . . . . .
the power (?) . . . . . .

15. ' - ir - šu man - nu . . . . . .
the wise whoever . . . . . .

16. damak Bâbîli Ê - sag[- gil] . . . . . .
the good of Babylon (*and*) *E - saggil* . . . . . .

---

17. . . . . Duppi Ṭu - * . . . . . .
. . . . . *tablet of Ṭu - ** . . . . . .

18. . . . . Nabâ (?) . . . . . .
. . . . . *Nebo* . . . . . .

. . . . . .

Sp. II. 987.

(*A free rendering.*)

. . . . . the gods . . . . . .
the rule of the heavens which he set for them in the four regions . . . . . the renown that in Babylon, the city of his glo[ry], he had set for them . . . . . the goods of Babylon, small and gre[at], ... in their faithful counsel to Chedorlaomer, king of the land of Elam, they said (?) "descend" (and) the thing that unto them was good [they performed and], he exercised sovereignty in Babylon, the city of Kar-Duniaš, [and] he placed [his throne?] in Babylon, the city of the king of the gods, Merodach. . . . . the herd (?) and the dogs (?) of *bit ḫabbātu* he favoureth (??) . . . . . he captured constantly. He loveth the winged raven . . . . . he changeth. The loud-crying raven, pouring out the bitterness . . . . . the dog who cruncheth the bone, he favoureth. Nin- . . . . . changeth. The great snake of the man of *ḫabbatu* who poureth forth . . . . . What (?) king of Elam (is there) who has [erected] a chapel (?) on E-saggil? [That?] the Babylonians made, and their work [they have perfected?]. [The let]ter (?) that thou hast written thus: "I am a king, the son of a king, a pr[iest?] . . . . the son of the daughter of a king, who on the throne of a dominion have sat." Dûr-maḫ-îlāni the son of Eri-êkua, who [had carried off?] the spoil, sat [on] the throne of dominion and in the presence of . . . . . Now let the king go, who from remote days has been ordained (?), [whose name?] has been proclaimed. The lord of Babylon prepares not . . . . . [in the month] Sivan and the month Tammuz (there) was made in Babylon . . . . . my . . . . . a high-priest (?) who destroyeth the land, all [of it?] . . . . . in their faithful counsel . . . . . my . . . . . the high-priest (?) instead (?) of destruction . . . . . he has caused the great ones to be taken (?) with the spoil . . . . . ravaging the . . .

What I have just read is only a free rendering of the text, the connection of which is, in many cases, very doubtful. Nevertheless there are points that are certain enough—that Kudur-(laġ)gamal ruled over Babylon, and was a great lover of animals. He seems to have claimed to have built a

part of the temple of Saggil or Sagila at Babylon, and the Babylonians apparently revolted against him when the son of Eri-êkua laid claim to the throne.

The third document is much larger and much more complete than the other two, though still sufficiently mutilated. This inscription is very long, the obverse having 41, and the reverse 39 lines of writing more or less complete, the text of the latter being divided into seven paragraphs. Its poetical form will readily be recognized.

Sp. 158 + Sp. II, 962.

Obverse.

. . . . . - ma - . .
. . . . . .

. . . . . kur -ra
. . . . . *the temple* (?)

3. . . . . E - lam - mat
. . . . . *Elam*

. . . . . bu - šu - šu
. . . . . *its goods*

. . . . . zi - mi - šu - nu
. . . . . *their faces*

6. . . . . - am - ma u - kal - lam D.P. Šam - ši
. . . . . *and exposes to the sun*

. . . . . me (?) is - ni - ḳa a - na bâbi ṣîri
. . . . . *and they pressed on to the supreme gate*

dalat Ištar is - sik is - suḫ - ma it - ta - di
the door of Istar he threw down, he removed and he cast down

gišgal - li - niš
in the holy places

9. kima D.P. Ur - ra la ga - mil i - ru - um - ma Dû - maḫ - iš
like Ura the unsparing he descended also to Dû-maḫ

iz - ziz - ma ina Dû - maḫ i - na - aṭ - ṭal ê - kur
he stayed also in Dû-maḫ, he saw the temple

pî - šu ipuš - am - ma itti D.P. mârē i - dib - bu - ub
his mouth he opened, and with the children he spake,

12. ana kal-la ḳu-ra-di-e-šu u-šaḫ-miṭ ma-ag-ri-tu^{m}
to all his warriors he hastened the message

šu-ul-la-' šal-lat ê-kur li-ḳa-a-ma
Carry off the spoil of the temple, take also

bu-šu-šu
its goods

suḫ-ḫa-' u-ṣur-ta-šu šup-ri-sa-a
destroy its barrier, cause its enclosures

sak-ki-e-šu
to be cut through

15. a-na iki šu-. . . . is-ni-ḳa . . .
to the channel . . . . . they pressed on (?)

i-bu-ut mal-ki . . . . . ma (?)-ḫar-šu (?)
he destroyed the ruler (?) . . . . . before (?)-him (?)

. . . . . Ê-šar-ra
. . . . . *Ê-šarra*

18. . . . . ur-rid še-du-uš-šu
. . . . . *there came down his winged bulls*

u (?)-saḫ-ḫi . . . . it (?)-bal par-ṣi-šu
he destroyed . . . . carried away its ordinances

i-ru-um-ma pa-kid (?) AT-GI-GI is-suḫ
he drove away also the overseer of the ruler, he took away

ka-tim-tu^{m}
the vail

21. a-na D.P. En-nun-dagal-la D.P. nakru (?) is-ni-ḳa
to Ennun-dagalla the enemy pressed on

lim-ni-iš
evilly

ina pani-šu îlāni il-la-biš nu-u-ri
before him the gods were clothed with light

kima bir-ḳa ib-riḳ-ma i-nu-uš aš-ru-ti
like lightning he lightened and he shook the (holy) places

24. ip (?) - luḫ - ma D.P. nakru uk - kiš ra - man - šu
feared also the enemy, he hid himself

. - rid (?) - ma D.P. ni - sak - ka - šu a - mat i - ḳab-bi - šu
descended (?) also its prince a command he speaks to him

. . . man - di . . . - i îlāni il - la - biš nûri
. . . . . *the gods were clothed with light*

27. [kima bir - ḳa ib - riḳ -] ma i - nu - uš aš - ru - ti
[like lightning he lightened] and he shook the (holy) places

. . . . . En - nun - dagal - la suḫ - ḫi âgê - šu
. . . . . *En-nun-dagalla, remove his crowns*

. . . . . bîti (?) - šu ti - iṣ - bat ḳat - su
[enter into ?] his house, seize his hand

30. . . . . ul i - du - ur - ma ul (?) iḫ - su - su na - piš - tu^{m}
. . . . *he feared not and he regarded not (his) life*

. . . . . En - nun - dagal - la ul u - saḫ - ḫi âgê - šu
. . . . . *En-nun-dagalla, he removes not his crowns*

. . . . . D.P. Elam (ki) -u iz - kur ma - ta (?) - tu^{m}
. . . . . *the Elamite proclaimed (to) the lands*

33. . . D.P. Elamu D.P. ṣi - e - nu iz - kur pa (?) - a - a * - niš
. . *the Elamite, the wicked man, proclaimed far and wide (?)*

. . ša - na kat - te - e u - ša - an - na - a na - pa - al - tu^{m} (?)
. . . . *the* kattê *repeated the matter (?)*

. . . šu (?) ba . . is man - di lib - ba lu - bil - lu - u
. . . . . *numerous (?) within (?), may they bring*

ana ê - kur
to the temple

36. . . . . ina du - maḫ lu a - šib a - ' - il ni - sak - [ku]
. . . . *in Dû-maḫ then dwelling, staying (was) the chief.*

. . . . . - u it (?) - bu (?) - uš D.P. kat - te - e
. . . . . *there came (?) to it the* kattê

. . . . . a (?) - al D.P. ni - sak - ku
. . . . . *stayed (?) the chief*

39. . . . . mu - um eli - šu
. . . . . *over him*
. . . . . - tu^{m}
. . . . . .
. . . . . - ku
. . . . . .

Sp. 158 + Sp. II, 962.

Reverse.

mi . . . aḫ (?) - ḫi (?) D.P. paššuru ša . . . .
. . . . . *dish of* . . . .

I - nu - um ra - bi - ṣu šu - lum i - dib - . . . .
When the guardian peace spake (?) . . . .

3. ur - rid še - du - uš - šu ša ê - šar - ra . . . .
there came down his winged bulls, who the temple . . . .

D.P. nakru D.P. Elam(?) (ki) - u ur - ri - iḫ lim-ni-e-tu^{m}
the enemy, the Elamite, multiplied evils

u Bêl ana Bâbîli (ki) u - šak - pi - du li - mun - tu^{m}
and Bel against Babylon caused to be planned evil.

---

6. I - nu - um la - ša - si (?) mi - ša - ri
When (there was) absence (?) *of righteousness,*

iz - ziz - zu - ma a - ḫi - tu^{m}
there was set also the destruction (?)

ša ê - šar - ra bît kiš - šat îlāni ur - rid
of the temple, { *the house of* / *the multitude of* } *the gods, there came*

še - du - uš - šu
down his winged bulls,

D.P. nakru D.P. Elam (ki) - u il - te - ki bu - šu - šu
the enemy, the Elamite, took its goods—

9. Bêl a-sib (?) e-li (?)-šu ir-ta-ši [ki-]mil-ti
Bel dwelling upon (?) it, had displeasure.

I-nu-um ša-bu-ru-u iš-ta-nu lim-nam (?)-šu-un
When the magicians repeated their evil (?)

D.P. Gul-lu^{m} u imi-ḫul-lu^{m} u-pa-as-si-ḫi (?)
Gullu^{m} and the evil wind performed (?)

[lim?]-ni-šu-un
their evil (?)

12. ur-ri-du-ma îlāni šu-nu u-ri-du-ma na-ḳab-bi-iš
come down also their gods, they have come down like a torrent

me-ḫi-e šâru lim-nu il-ma-a ša-ma-mi-iš
the storm (and) evil wind went round in the heavens

D.P. A-nu^{m} pa-ti-ik-šu-nu ir-ta-ši ki-mil-tu^{m}
Anu, their creator, had displeasure

15. un-ni-iš zi-mi-šu-nu u-na-a-ma man-za-as-su
he made pale their face, he made desolate his place

[ina?] ni (?)-ib-ḫi Ê-an-na u-saḫ-ḫi uṣurta-šu
in the shrine (?) of E-anna he destroyed its enclosure

. . . . a ê-šar-ra i-nu-uš ki-gal-la
. . . . *the temple, shook the platform.*

---

18. . . . . iz-kur šaḫ-lu-uḳ-tu^{m}
. . . . . *he decreed destruction*

. . . . . ir-ta-ši ki-mil-tu^{m}
. . . . . *he had disfavour*

iḫ (?)-pu (?)-un (?)-nat Bêl [E-] zi (?)-da
Barred (?) the people (?) of Bel of E-zida (?)

ḫarran Šu-me-ri-iš
the road to Sumer

21. a-a-u Ku-dur-laḫ-gu-[mal e]-piš lim-ni-e-tu^{m}
Who (is) Chedorlao[mer], the maker of the evils?

id-kam-ma D.P. umman ma-an-[da? . . .] un (?)-
he has gathered also the Umman-Man[da] the people (?)

nat Bêl
of Bel,

u - na - am - ma - am - ma . . . . ina a - ḫi - šu - nu
he has laid in ruin . . . . by their side.

---

24. I - nu - um ša Ê - zi - da . . . . . ta - šu
When of Êzida . . . its . . . . .

u D.P. Nabû pa - ḳid kiš - šat ur - ri [- id še - du - uš] - šu
and Nebo ruler of the host, { *there came down* } *his [winged bulls].*

šap - liš ana Ti - amti (ki) iš - ku - [nu pa - ni - šu] .
down to Tiamtu he se[t his face]

27. I - ne - D.P. Tu - tu ša ki - rib Ti - amti (?) iḫ - muṭ
Ine-Tutu whom within Tiamtu hastened

D.P. Utu - gišgalu (?)
the Sungod (?)

i - bir - ma Ti - amtu (ki) ir - ma - a la šu - bat - su (?)
he entered also Tiamtu he set (that which was) not his seat

ša Ê - zi - da bîti ki - nim šu - ḫur - ru - ur
of E-zida, the everlasting temple, was the enclosure

sak - ki - e - šu (?)
caused to be broken through

---

30. [D.P. nakru D.P. Elam (ki) - u u - še - šir ṣi - in - di - šu
[the enemy] the Elamite { *caused his yoke (team of horses)* } *to be directed*

šap - liš ana Dûr - si - a - ab - ba iš - ku - nu pa - ni - šu
down to Borsippa he set his face

ur - ri - [da - am] - ma ḫarran da - um - mat - tu ḫarranu
he traversed (?) also the road of darkness, the road

Me - eš - ki - iš
to Mešku

33. D.P. ṣi - e - nu D.P. Elam (ki) - u u - nab - bil e - ma - aḫ - šu
the wicked man, the Elamite, destroyed its palace (?)

D.P. rubûti . . . . . i - na - ri ina kak - ki
the princes . . . . . subdued with the sword

ša Ê - kur - (ati), ka - la - šu - nu [iš] - lul (?) šal - lat - su - un
of the temples, all of them, he carried off (?) their spoil

36. [bu] - šu - šu - nu [il?] - ḳi - e - ma u - tab - ba - la
their goods *he took and* *carried off*

E - lam - mat
(*to*) *Elam*

. . . . . mal - ku i - bu - ut mal (?) - ki - šu
. . . . . *ruler,* *he destroyed* *its ruler*

. . . . . im - lu - u - ma ma - a - tu^{m}
. . . . . *filled also* *the land*

39. . . . . si . . . . . .
. . . . . .

Sp. 158 + Sp. II, 962.

(*Free Translation of the Legend of Chedorlaomer.*)

Obverse.

1. . . . . .
2. . . . . the temple (?)
3. . . . . Elam
4. . . . . its goods
5. . . . . their faces.
6. . . . . and exposed to the sun.
7. . . . . and they pressed on to the supreme gate.
8. He threw down, removed, and cast down the door of Istar in the holy places,
9. He descended also, like Ura the unsparing, to Du-maḫ;
10. He stayed also in Du-maḫ, looking at the temple;
11. He opened his mouth and spake with the children (of the place).
12. To all his warriors (then) he hastened the message:—
13. "Carry off the spoil of the temple, take also its goods,
14. Destroy its barrier, cause its enclosures to be cut through."
15. To the channel . . . . . they pressed on, . . .
16. He destroyed (?) the ruler (?) . . . . . before him
17. . . . . [from the temple] É-šarra
18. . . . . there came down his winged bulls
19. He destroyed . . . . . he carried away its ordinances
20. He drove away also the director's overseer, he took away the vail.
21. The enemy pressed evilly on to Ennun-dagalla
22. The gods were clothed with light before him
23. He flashed like lightning and shook the (holy) places

24. The enemy feared, he hid himself
25. There descended (?) also its chief man, and he spoke to him a command
26. ". . . . . the gods were clothed with light
27. "[He* flashed like lightning] and shook the (holy) places.
28. "[Draw near unto?] Ennun-dagalla, remove his crowns!
29. "[Enter into?] his temple, seize his hand!"
30. . . . . he did not fear, and he regarded not (his) life
31. [He approacheth not (?)] Ennun-dagalla, he removeth not his crowns.
32. . . . . the Elamite proclaimed (to) the lands (?).
33. . . the Elamite, the wicked man, proclaimed far and wide (?)
34. . . . . the *kattê* repeated the matter (?).
35. . . . . numerous (?) within (?), may they bring to the temple
36. . . . . the chief then dwelt and stayed in Dû-maḫ.
37. . . . . there came to it the *kattê*.
38. . . . . the chief stayed.
39. . . . . over him.
40. . . . . .
41. . . . . .

REVERSE.

1. . . . . dish of . . . . . .

---

2. When the guardian spoke (?) peace [to the city?]
3. There came down his winged bulls, who [protect?] the temple.
4. The enemy, the Elamite, multiplied evils,
5. And Bel allowed evil to be planned against Babylon.

---

6. When righteousness was absent (?), there was decided (?) also the destruction
7. of the temple, the house of the multitude of the gods. (Then) came down his winged bulls.
8. The enemy, the Elamite, took its goods—
9. Bel dwelling upon †(?) it had displeasure.

---

10. When the magicians repeated their evil words (?).
11. Gulu^{m} and the evil wind performed (?) their evil (?).
12. There came down also their gods, they came down like a torrent.

---

* Probably Ennun-dagala.

† The characters in the original can hardly be anything else than  , *e-li*, "upon," and this would indicate that the "temple" spoken of was a tower in stages—probably that described by Diodorus as having statues of Zeus, Hera, and Rhea—the temple of Belus.

13. Storm and evil wind went round in the heavens—
14. Anu, their creator, had displeasure.
15. He made pale their face, he made desolate his place,
16. He destroyed the barrier in the shrine of Ê-anna,
17. [He overthrew ?] the temple, (and) the platform shook.

---

18. . . . . he decreed destruction,
19. . . . . he had disfavour.
20. The people(?) of Bel, of Ê-zida(?) barred(?) the road to Sumer.
21. Who is Chedor-lao[mer], the doer of the evils ?
22. He has gathered also the Umman-Man[da against(?)] the people(?) of Bel—
23. He has laid in ruin . . . . . by their side.

---

24. When the [enclosure ?] of Ê-zida (was) [broken down ?].
25. And Nebo was ruler of the host, there came [down] his [winged bulls].
26. Down to Tiamtu he se[t his face].
27. Ine-Tutu, whom the Sungod(?) hastened within Tiamtu,
28. Entered Tiamtu, (and) founded a pseudo-capital.
29. The enclosure of Ê-zida, the everlasting temple, was caused to broken through.

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30. [The enemy], the Elamite, caused his yoke of horses to be directed, (and)
31. Set his face (to go) down to Borsippa.
32. He traver[sed] also the road of darkness, the road to Mesech.
33. The tyrant(?) Elamite destroyed its palace(?).
34. He subdued the priuces of . . . . . with the sword,
35. He [car]ried off the spoil of all the temples,
36. [He] took their goods, and carried them away (to) Elam.
37. . . . . ruler, he destroyed its ruler (?),
38. . . . . filled also the land.
39. . . . . .

Mutilated as it is, this text is nevertheless more satisfactory as to its condition than the other two published in this paper, and its nature is, therefore, not so difficult to determine. The obverse tells us what "the Elamite," "the evil man" (lines 32, 33), "the enemy" (lines 21, 24) did in Du-maḫ ("the supreme seat"), where, like Ura (= Nergal, god of war and pestilence), he spoiled the temple of Istar and destroyed that of Du-maḫ, turning his attention especially to the deity Ennun-dagalla. If there be anything of truth in the narrative (and in all probability it indicates what

really took place, treated poetically), there must have been a severe thunderstorm, when "the gods flashed like lightning and shook the (holy) places," so much so that the enemy moved by superstitious fears, did not carry out his intention of carrying away the crowns of the statue of the god. He seems, however, to have taken and retained possession of the place.

The reverse seems to state why all these misfortunes came, and what further happened. It was because they accepted a foreign ruler (so it would seem from line 2); because there was denial of righteousness or justice (line 6), upon which the Babylonians set great store; because the *šaburū* repeated evil (words)—the winged bulls of Bêl came down, causing "storm and evil wind." The house of the host of heaven, "the temple of the multitude of the gods" (l. 7), apparently in Babylon, was destroyed, and the Elamite plundered it; the barrier of the shrine of Ê-anna (probably the temple of Nanâ at Erech) was broken down, and the platform shaken (16 and 17), it is to be supposed by some convulsion of nature.

This is followed by the reference to Chedorlaomer and the Umman-manda, whom he seems to have led when invading Sumer or Shinar (lines 18–23 of the reverse).

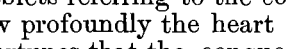
The next paragraph or stanza has a reference to Ê-zida, the great temple-tower of Borsippa, the enclosure of which was broken through. At this time Ine-Tutu, probably a *patesi* or viceroy of this district, fled to Tiamtu, the region of the Persian Gulf, where he founded a temporary capital (lines 24–29). The invader thereupon seems to have proceeded to Borsippa, and afterwards took the road to the north, to Mesech, probably the region north of Babylonia, unless we are to read, with Prof. Sayce, *Šiškiš*, "To Sheshach" or Babylon, as already stated.

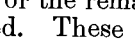
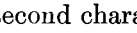
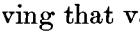
It is noteworthy that, in the reference to Ê-anna (reverse, l. 16), there is no mention of the carrying away of the image of the goddess Nanâ by Kudur-Nanḫundi. The date given by Aššur-banî-âpli for the invasion of Akkad (Babylonia) by this ruler is 1635 or 1535 years before his own time, that is, about 2260 or 2180 B.C. Now the date of Ḫammurabi, who was a contemporary of Chedorlaomer, was about 2220 B.C., so that we ought probably to regard the earlier of Aššur-banî-âpli's two dates for Kudur-Nanḫundi's inroad as being the more correct.

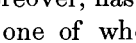
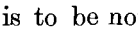
In the foregoing pages, I have treated of the three texts

referring to Chedorlaomer and the other kings in the order in which I identified them, but this is probably not their true order, for the determining of which we must wait for further material.

They refer to a very powerful ruler and conqueror of ancient times, who overran Babylonia, spoiling its cities and temples, which latter, from their great wealth, naturally excited his cupidity. The history of this conqueror seems to have been told at great length by the scribes, possibly on account of the circumstances attending his expulsion, as seems to be indicated by the second document (Sp. II., 987), which mentions the claim of a prince who is evidently the son of Arioch, who there (apparently) calls himself "a king, the son of a king, the son of the daughter of a king." Naturally these texts all refer, for the most part, to Babylonia, that being the country most affected by the conqueror's warlike zeal, though his conquests in other parts may possibly be spoken of in the first text (Sp. III., 2). The existence of portions of three tablets referring to the conquests of Kudur-laġgamal show how profoundly the heart of Babylonia was stirred by the misfortunes that the conqueror brought upon their land, and their gratitude at final deliverance must have been proportionately great.

It is necessary, in view of the criticisms that have been made, to say something about the names. We will therefore take that of the chief personage, Kudur-laġgamal, first. This name is written, as I have elsewhere remarked, in a very fanciful way, namely, with the character *ku* four (or three) times repeated, and *mal*, thus  . Now there are probably none who will deny that the group has the value *Kudur*—that is regarded, by all who have seen the text, as certain. For the next character (again) I had suggested the value of *laġ* (the polyphony of the Assyrian syllabary obliges the student to be constantly on the outlook for new values). For the fourth the bilingual lists suggested the value of *gi* or *gu* (a softening of the common value of the character, *ku*), and the syllabaries indicated for the last character, , the value of *mal*. Now the name Tudġula in the first text (Sp. III., 2) corresponds, as far as the consonants are concerned, with the Tidal of Genesis xiv., and Eri-Eaku or Eri-Ekua corresponds very well with Arioch (of this name I shall speak later on). For

our fancifully written name, therefore, a form corresponding with the Biblical Chedorlaomer was suggested, for which Kudur(laġ)gumal gave, with little or no doubt, the first two and the last two syllables—those corresponding to *Chedor* and *'omer*. For the remaining character the value of *la* or *laġ* is required. These values are indicated by the syllabaries and bilingual-lists, and will be given in full in the notes. For the present we may simply say that the characters  (the second component is slightly doubtful, but can hardly be anything else than here indicated, as a parallel passage shows) have the variant  , *pa-h-iḫ*, showing that the second character has the value of *iḫ* (*iġ*), and characters having that value (and ) can also be read *laḫ* and *luḫ* (*laġ*, *luġ*), as is shown in Brünnow's "Classified list."  , moreover, has the meaning of *êllu*, as has also the character  , one of whose values is, as already remarked, *laḫ* (*laġ*)—indeed, the value of *laġ* for seems to be clearly indicated by W.A.I. III., pl. 3, lines 51 and 52, where, as I have elsewhere pointed out, we must read  , *laġ*, for  . It is to be noted that Prof. Hommel's reading of *dug* is a very suggestive one.  , as is well known, has that value, as well as that of *tug*, and *t* and *l* interchange in Akkadian, as shown by  , *utaġ*, and  *ulaġ*, which are given as the Akkadian values of  (W.A.I. V., pl. 38, lines 35 *b* and 61*c*). Here, then, are three aguments for the values of *laġ*, *liġ*, and *luġ* for  , besides the intrinsic probability of the tablets themselves, for it is in the highest degree unlikely that tablets containing the name of Tidal and others closely resembling Arioch and Chedorlaomer, the last designated "king of Elam," and "the Elamite," should not, after all, refer to those personages.

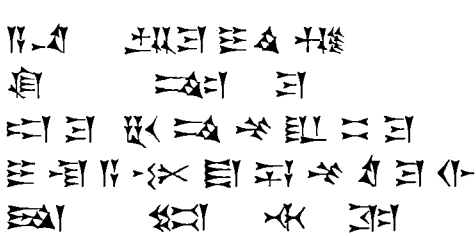
The name identified with Arioch is written  , *Eri-E-a-ku*, and , *Eri-e-ku-a*, the latter form showing that the character to be restored in the first form is  . The question naturally arises whether, in the form *Eri-e-ku-a*, the last two characters are not transposed ( for ), as the final does not seem to belong to the word which follows, though that is certainly possible. The equivalence of the above forms, 

 and , is placed beyond doubt by the fact that the son in both cases is , variant , *Dur-maḫ-ilāni* (? or *Dûr-ṣîr-îlāni*), a name meaning "the great" (or "supreme") "fortress of the gods."* The equivalence would not have been absolutely provable otherwise. With regard to the name Eri-Eaku, or Eri-ekua, an extremely important suggestion by Prof. Sayce is worthy of notice. In a communication that he has made to me upon the subject, he says: ", *Ea*, must have been pronounced *á* in late Babylonian, as is shown by the Ἄος of Damascius." This is a suggestion that would indicate that Eri-Aaku and Eri-akua are better transcriptions than those indicated above, and probably explains the variant of , *A-e*, for the name of the well-known deity , *E-a*, or, as we should probably transcribe in both cases, *Aa* = Ἄος, as mentioned in the note of Prof. Sayce already referred to.

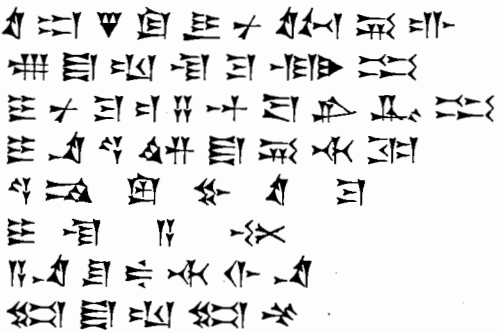
Further Texts bearing on the above.

The letters of Ḫammurabi discovered in the Museum of Constantinople by Father Scheil are three in number, and are addressed by that ruler to a certain Sinidinna[m], to whom he makes certain communications concerning the affairs of his kingdom. The text referring to Chedorlaomer I reproduce here after Father Scheil's copy, which I venture to retranscribe into the Babylonian character.

Text.



* At first, influenced by its meaning, I regarded this as the name of a city, but the text of Sp. II., 987, when brought to bear upon Sp. III., 2, precludes the possibility of that.



TRANSCRIPTION.

A - na Sin - i - din - nam
ki - be - ma
um - ma Ḫa - am - mu - ri - bi - ma
I - la - a - ti^{m} ša E - mu - ut - ba - li^{m}
ed - li - ti - ka
um - u^{m} ša Ku - dur - la - aḫ - ga - mar
u - ša - al - la - ma - aḳ - ḳu
I - nu - ma iṣ - ṣa - an - ba - ni - iḳ - ḳu
i - na umman - i^{m} ša ga - ti - ka
umman - a^{m} lu - pu - ut - ma
i - la - a - ti^{m}
a - na šu - ub - ti - ši - na
li - ša - al - li - mu

TRANSLATION.

1. *To Sin-idinna^{m}*
2. *speaks also*
3. *thus Hammurabi*
4. *The goddesses of Emutbalu*
5. (*for*) *thy heroism*
6. (*on*) *the day of Chedorlaomer*
7. *I shall deliver to thee.*
8. *When they ask them back from thee*
9. *with the people of thine hand*
10. *overthrow the people, and*
11. *the goddesses*
12. *to their seats*
13. *let them deliver*

FREE RENDERING.

"Ḫammurabi sends thus to Sin-idinna^{m}. I shall hand over to thee the goddesses of Emutbalu (on account of) thy heroism on the day of Chedorlaomer. When they demand them back from thee, overthrow thou their people with the people who are with thee, and let them restore the goddesses to their shrines."

In other words, this was a gift to Sin-idinna^{m} which he would have to renounce if there were difficulties connected with its retention, for the people might demand their goddesses back. Should this take place, Sin-idinna^{m} was apparently to chastise the people, and then restore the images to their ancient shrines, in order that the conquered might see that the conqueror, though he would not be dictated to, was merciful.

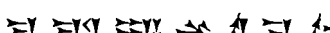
Father Scheil seems to have found the true key of the situation. Sin-idinna^{m} was, as is well known, king of Larsa, and he points out that he must have been the last ruler before the two Elamites, "princes of Emutbal," Kudur-Mabug and his son Rim-Agu or Eri-Aku (Arioch), dispossessed him, and the latter became king of Larsa. Sin-idinna^{m} of Larsa is very probably the same person as the Sin-idinna^{m} to whom Ḫammurabi writes, and to whom Ḫammurabi, if he did not actually replace him upon the throne of Larsa, at least gave considerable authority, and helped to drive out the Elamites from his territory.

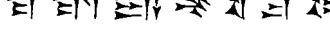
As, in Gen. xiv, Chedorlaomer is called king of Elam, it is to be supposed that he had no authority in Babylonia itself. In all probability he simply invaded the country to help his countrymen and possibly kinsmen, Kadur-Mabug and his son Rim-Agu, Eri-Eaku, or Arioch, and it is to be supposed that they were all driven out together by the allied native princes of Babylonia, Ḫammurabi or Amraphel, and Sin-idinna^{m}, the rightful king or viceroy of Larsa.

Fortunately there exists what may be regarded as the official record of the victory gained by Ḫammurabi. It is the colophon-date of the tablet B. 64, which records the sale of a plantation by Ana-Sin-emida to Muḫaddu^{m} for 2⅔ shekels of silver. This important entry is as follows:—


Iti Aš-a uda niš-eša-kama

Mu Ḫa-am-mu-ra-bi lugala

 * ma-da Ya-mu-ut-ba-lu^{m}

 u lugala Ri-im-Agu

 † šu-ni sa-ne-du.

Month Sebat, day 23rd,
Year Ḫammurabi the king
the land of Yamutbālu
and king Rim-Agu
his hand captured.

Judging from S^{p}. III., 2, and S^{p}. II., 987 (see above, pp. 4–14), Dûr- ṣir-îlāni, son of Arioch, took part in certain political events, and even seems (p. 14) to have laid claim to the throne of Babylon. The history of that period will only be known, however, after the records here printed are completed by further discoveries in Babylonia, and possibly, in Assyria as well.‡

Notes to S^{p}. III, 2 (pp. 46 ff).

OBVERSE.

4. Prof. Hommel here restores the name Hammurabi, as does likewise Prof. Sayce, who completes also at the beginning [*ina tar-*] *ṣu*, making this part read "[In the] time of Hammu[rabi]," "whose praises," he adds, "are sung in the following lines."

8. *Zanānu*, from which *zanin* comes, mean "to rain," and "to nourish," or "be patron of," as in the expression *zanin*

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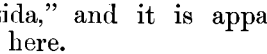
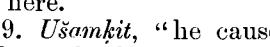
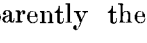
* The envelope here adds , the determinative suffix indicating a place-name.

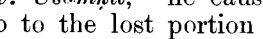
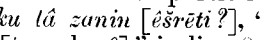
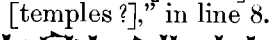
† The envelope has , *šu-ni sa-ne-in-du*. The root of the Akkadian verb is  *sa-duga*, which is translated in W.A.I. II., pl. 15, l. 46*a*, by a form of the word *kašādu*, "to capture."

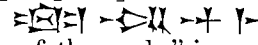
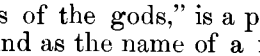
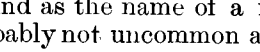
‡ Another text regarded as referring to Rim-Agu is that published in W.A.I. iv., pl. 35, No. 8, in which the name is spelled  *Ri-im-D.P. A-gam-um* or *Rim-Agau^{m}*. Prof. Hommel, at the Orientalist Congress lately held in Paris (1897), suggests, however, that  is possibly a mistake for  , *nu*, and that the whole is to be read *Rim-Anu^{m}*, the name of a king of Larsa recently found on tablets from Senkārah. Whether Rim-Agu^{m} and Rim-Anu^{m} be the same or different rulers is at present uncertain.

Ê-sagila û Ê-zida, "patron of (the temples) Ê-sagila and Ê-zida," and it is apparently the meaning which *zanin* has here.

9. *Ušamḳit*, "he causes to be slain," is apparently the verb to the lost portion of the line, and perhaps refers to *malku lâ zanin* [*êšrēti?*], "the ruler who was not patron of the [temples?]," in line 8.

 , *Dûr-ṣir-îlāni*, "the supreme fortress of the gods," is a phrase that one would hardly expect to find as the name of a man. Such names, however, were probably not uncommon at the time, for we find such expressions as  , *Aššur-dûr-pani-ia*, "Asshur is a fortress before me," etc., used as names of men. The transcription of the first syllable of Dûr-ṣîr-îlāni is confirmed by the variant  for in S^{p}. II, 987, line 19 (plate II). *Cf.* page 69.

For  , *Eri-(D.P.)[Ê]-a-ku*, variant  , *Eri-(D.P.) E-ku-a* (apparently a mistake for the first form) and Prof. Sayce's remarks upon the pronunciation of  , see p. 69.

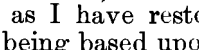
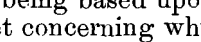
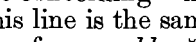
10. *Išlul*, "he carried off," "spoiled," seems to belong to the words at the beginning of the line, now lost. The phrase "waters ( , *mê*) over Babylon and Ê-saggil" is obscure. The character has so many meanings besides that of "water," that it is difficult to choose between them. As, therefore, the meaning here adopted is by far the most common, it seems best to retain it, regarding the word as probably used as a poetical expression for "destruction." *Ê-saggil* was the name of the great temple-tower at Babylon, and it is noteworthy that the spelling  , *E-saggil* (probably pronounced *Ê-sangil*) is late. The earlier texts generally give  , *Ê-sagila*, which is more correct.

13. The name Tudḫula corresponds very well with that of Tidal (Heb. תִּדְעָל), the Greek form of which is Θαργὰλ, showing that the ע had the guttural sound similar to the Arabic غ, represented in Assyrian, as a rule, by ḫ (= ח = غ), which was the nearest that those who used the wedge-writing could get to this sound. The LXX. had the disadvantage of an incorrect reproduction of the name (ר for ד)

in the copy of the Hebrew text which they used, hence the form Θαργὰλ for Θαδγὰλ. The Babylonian scribes seem to have given it an Akkadian etymology, Tudḫula apparently meaning, in that language, "the evil offspring," or (if we regard *ḫula* as another form of *gula* or *gala*), "the great offspring." The vowel of this name (if it be Akkadian) is probably incorrect in both the Hebrew and the Greek forms. How his father's name (of which we have only two syllables, namely, Gazza- . .) is to be completed, is uncertain, but the full form, as I have restored it, may be regarded as very probable, being based upon what is probably the same name on a tablet concerning which I hope to speak elsewhere.

14. This line is the same as line 10, which see.

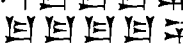
15. The form *muḫḫa-šu*, "upon him," for the more usual *muḫḫi-šu* is noteworthy.

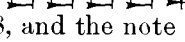
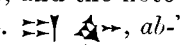
16. The last word, the name Annunit, is interesting on account of the archaic writing of the first syllable, the name being found at 2200 B.C. and thereabouts, spelled as above, but with the ending u^m ( (*An-nu-ni-tu*^{m}). The late style of writing is  , *D.P. A-nu-ni-tu*^{m}. Of course it is possible that the form in the text originally had this ending, but if so, it probably had double *t* ( , *An-nu-nit-tu*^{m}).

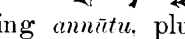
REVERSE.

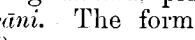
1. The name of the city, Aḫḫê, is doubtful with regard to the latter part, notwithstanding that the traces of characters and the needs of the text require some such character ( , *ḫi*) as is here restored. As the character  , which the tablet has, seems to be impossible, I have regarded the horizontal wedge as accidental, and read simply , *ana*.

2. Here the scribe seems to have written  , *zu*, for  , *ma*, in *maḫazu*. Prof. Sayce completes the last word as the name of Borsippa, which is possible, in which case the whole was probably written  , *Bar-ši-ip*, D.S. The common way of writing it is  , *Bar-šip*, D.S., but the forms  , *Bar-šip*, D.S., and , *Bur-šip*, D.S., are also found, as well as , *Ba-ar-zi-pa*, D.S.

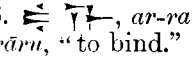
3.  , *Ku-dur-laḫ-mal*, is defectively written for  . For another way of writing it, see p. 28, and the note to Sp. II, 987, ll. 6–7, below.

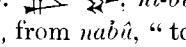
4.  , *ab-'*. The translation of this word is a conjecture.  , *'a-nu-tu*, is possibly an old way of writing *annūtu*, plural masc. of *annū*, this, agreeing with *šarrāni*. The form with one *n* occurs in Aššur-naṣir-apli I, 90.

6.  , *ar-rat*, is apparently 3rd pers. fem. permansive of *arāru*, "to bind."

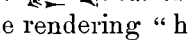
9.  , *ni-bu*, seems to be a byform of the permansive *nabû*, from *nabû*, "to proclaim."

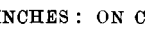
NOTES TO Sp. II, 987. (pp. 51 ff.).

4.  , *šar-tam*. The translation "fame" is a conjecture —the rendering "happiness" would also make good sense. The reading *sartam* is also possible.

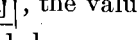
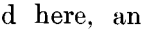
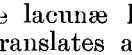
6–7. Prof. Sayce here translates (*ana Kudur-laḫgamal*, etc.) "To Chedorlaomer the King of Elam they answered, 'Descend!' thereupon that which seemed good unto them [he performed]." The reading Kudur-laḫgamal in Father Scheil's tablets is also given as  , *Ku-dur-la-aḫ-ga-mar*, agreeing very closely with the , *Ku-dur-laḫ-ga-mal*, of this tablet. For the shorter form, see above.

8. Kar-Duniaš would appear from this to be the district in which the city Babylon was situated, confirming Delitzsch in *Wo lag das Paradies?*, p. 134.

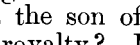
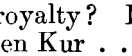
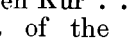
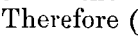
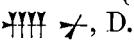
10.  is apparently for , the character for "dog" followed by the plural sign.  is a doubtful expression, but it would seem, from its connection, to be a "house" where wild animals are kept, *bît ḫal-ba-a-tam*. I regard *ḫabbatam* as being the plural of a feminine noun, the singular being possibly *ḫabbu* or *ḫabbatu*, and possibly derived from the Akk.  , *ḫaba*, "hollow place," "den." See the *Journal of the Royal Asiatic Society*, 1894, p. 850, cuneiform text, line 18, (*ḫabbu*) and 25 (read *ḫab*[*bu*]). The "house of robbers" does not seem to suit the context,

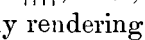
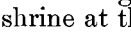
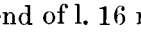
and we should not expect the form *ḫabbāta*^{m}, but  , *ḫabbatē*.

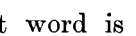
11. *Iḫtarku* is the secondary form of the kal of *ḫarāku*, the meaning of which, Delitzsch suggests, is "to engrave." This, however, can hardly be correct, as such an expression would come in rather suddenly here. As it is animals that are referred to in this passage, this verb ought to express something relating to them, and in this connection we may perhaps compare the Heb. דָּרַךְ, not with the meaning of the A.V., "to roast," but with that of the LXX., Chald. and Syr. "to take," "catch." The *ḫ* should be =  , not  . The word *kînu* may belong to what follows, and, if so, must be rendered "faithful"—"he loveth the faithful winged raven."

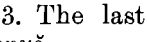
12. The character  here is equivalent to the Assyrian  , the values of which are *mu* and *sub*. It is evidently used here, and in line 14, for , Assyrian  , *nak*.

15–21. The lacunæ here make the text very difficult. Prof. Sayce translates and completes thus: "Who (*âu*) is the king of Elam who has [removed?] the woodwork of Ê-saggil [which] the sons of Babylon had erected, and has [destroyed] their work? [These are the] words which thou has sent saying: "I am a king, the son of a king un[rivalled?]. Who ([*â*]*u*) is the son of a king's daughter who has sat on the throne of royalty? Dûr-ṣîr-îlâni, the son of Eriâku, the son of the queen Kur . . . has sat on the throne of royalty, and in front of the sanctuary (*dî*) has [worshipped] (*iplakhkhu*). Therefore (*ênu*) let the king march," etc.

In l. 15  , D.P. *nun-nu*, is the difficult word. If from the Akk.  , *nuna*, it should mean "the great woodwork." In my rendering I have regarded it as referring to the chapel or shrine at the top of Ê-saggil. The part of a word at the end of l. 16 may be restored as  , ruler," a  , *nisakku*, "ruler," "prince." Prof. Sayce has apparently completed this  , *lâ ša-na-an*, "unequalled."

The last character of l. 21 is apparently to be completed as  , *i.e.*,  , Assyr.  , *kun*. The full word was possibly *kunnu*.

23. The last word is probably  , *innippuš*.

24.  would seem to be a variant, for the Assyr.  , *zur-ra* = *kalû*, W.A.I. II., 21, 46*e*.  in l. 26 seems to be also a variant of this group.

27.  is apparently not equivalent to *amtu*, "female servant," but to  , *šal-lat*, "spoil."

Reverse.

This is very mutilated indeed, in fact, remains only of about 18 lines (including the colophon) exist, and profitable commentary upon these is impossible. All that may be said with safety is, that it probably gave a continuation of the historical narrative of the obverse.

Sp. 158 + Sp. II, 962. (pp. 57 ff.)

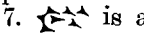
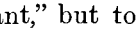
Obverse.

1–3. Prof. Sayce suggests that these lines should be completed in accordance with the rev. lines 33–36: [The Elamite destroyed] its pa[lace, he subdued the princes (and) . . . . . with the sword, he carried off the spoil of] the temple(s), [all of them, he took their goods, and carried them off] (to) Elam."

4. Here, possibly, we have to complete: "[The enemy, the Elamite, took] its goods."

5. Prof. Sayce suggests the completion: "[he made pale] their faces, as in line 15 of the reverse.

7. The difference between  and  is not observed by the scribe. In *isnika*, we must, of course, read the latter.

8. For  , *niš*, we ought, perhaps, to read  , *eš*, making the word *gišgalleš*. The adverbial *-eš* or *-iš*, in this text, is frequently used to express "in," "to," or "from," like *Dû-maḫiš* (l. 9), *naḳabbiš* (rev., l. 12), *šamamiš* (rev., 13), *Šumeriš* (rev., l. 20), *Meškiš* (rev., l. 32).

11. Prof. Sayce suggests that , *mârē*, "children," here refers to the soldiers. They are, in fact called *ḳuradē*, "warriors," in the next line.

12. *Magritum*, from the context, "message" or "command," as the thing to be obeyed. Probably from *magāru*, "to obey."

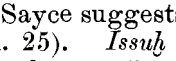
13. *Šulla'*, imperative plu. kal. of *šalālu*, "to spoil," whence also *šallat*, "spoil of."

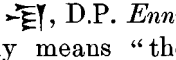
14. *Suḫḫa'* is imperative plu. piel of *saḫû*, meaning "to destroy." *Šuprisā* is imperative plu. shaphel of *parāsu*, "to divide." *Sakkē* I have rendered as plural, but it may be singular (see rev. l. 29). The meaning "enclosure" seems to be that required by the context.

17. Prof. Sayce regards a fresh paragraph beginning *Inum*, "when" (*cf.* rev., lines 2, 6, etc.), as having begun with this line.

18. *Urrid* is from *ârādu* (= *warādu*), probaby aor. of the pael. *Šeduššu* is apparently for *šêdū-šu*, and, if so, is probably the plural of *šêdu*, with suffixed pronoun. This phrase occurs also in lines 3, 7, and (25) of the reverse.

19. *U-saḫ-ḫi* is the most probable completion of the word, after which Prof. Sayce suggests the restoration *uṣurta-šu* ("he destroyed its barrier").

20.  , *at(d)-gi-gi* is the Akk. equivalent of *maliku*, "ruler." Prof. Sayce suggests that *pakid* refers to the god Nebo (*cf.* rev., l. 25). *Issuḫ* is from *nasāḫu*, "to remove," and *katimtu*^{m} from *katāmu*, "to cover."

21.  , D.P. *Ennun-dagalla*, or, better, *Ennuna-dagala*, apparently means "the watchman of the broad place."

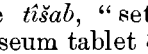
22. The singular *illabiš* with the plural noun *îlāni* here and in line 26 is noteworthy.

23. *Inûš* is apparently from *nâšu*, "to totter," "shake," and seems to be transitive, though its noun *may*, possibly, be *aššūti*, and, if so, we have here another example of a singular verb with a plural noun.

24. *Ukkiš*. This can hardly be the *âkāšu* (אכשׁ), "to put an end to," of Delitzsch's *Handwörterbuch*, but must be from וכשׁ, the Arab. وَكَسَ, "to diminish," the noun from which, وَكْس, is explained as "the station where the moon is eclipsed." It is with this meaning that the Babylonian word is apparently connected.

25. The first word should apparently be completed *urrid*. *Nisakku* is of Akkadian origin, and means "he who (*ni*) is head" (*sag*).

29. The form *tiṣbat* is interesting—it is an imperative like *tîšab*, "set" in the American portion of the British Museum tablet 85–4–30, 48 (see my article upon this text in *Hebraica* for Oct., 1886, p. 17, l. 9).

33.  , D.P. *ṣênu*. This word generally means "good," and in this agrees with the Akkadian ideograph expressing it, *nig-a-zi* (for *nig a-zi-da*), "he who" or "that which is right" (lit. "on the right hand"). This rendering, however, clearly fits neither here, nor in line 33 of the reverse. We have, therefore, to regard this word as the same as the *ṣênu* or *ṣînu* which translates the Akkadian  , *ǵab*, and is a synonym of *bi'išu* (or *bîšu*), "bad." (See J.R.A.S. for 1894, p. 830). Prof. Sayce translates similarly, "wicked man," and suggests the placing of *inum*, "when," at the beginning of the line (*cf.* rev. ll. 3, 6, etc.).

34. *Napaltu*^{m} may be from *napālu*, or (if *l* represent a sibilant) from *napāšu*, *napāsu*, or *napāṣu*.

36. *A'il* in this line and *aal* in l. 28 are possibly from the same root, and may be connected with the word *âlu*, "city," as "dwelling-place."

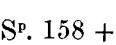
Sp. 158 + Sp. II, 962. (pp. 57 ff.)

Reverse.

Prof. Sayce suggests, as an alternative rendering of *Inum raḥiṣu šulum idib*[*bub*], "When he said 'Rabiṣu, peace!'"

6. The character  are doubtful, but are more probable than any others. *La-šasi* may be a compound word meaning "non-pronouncement" (like *lâ-šubat-su*, "his pseudo-capital" in line 28). *Aḫitu*^{m} is the fem. of *aḫu*, "foreign," here used, apparently, like *aḫita* (acc.) in W.A.I. IV., 48, obv. l. 3, for "untoward" "contrary" (fate). (See Delitzsch, *Handwörterbuch*, p. 41*b*).

10. *Šaburū* seems to be preferable to *aburū*. I have regarded the word as possibly a variant of *šabrū*, "magician," "seer." Further material is required to find out the true meaning.

11. , or, giving the second character its earlier form,  , D.P. *Gul-lum*, the god Gullu^{m} or Ḳullu^{m}, is probably from the Akkadian, and would mean

"the god of destruction" (*gul* = *âbātu*, "to destroy"). The next word, *imi-ḫullu*^{m} (*mer-ḫullu*^{m} and *tu-ḫullu*^{m} are also possible readings) is likewise from the Akkadian, and means "evil wind" (*imi*, *mer*, or *tu*, "wind," *ḫul*, "evil").* *Upassiḫi* is for *upassiḫu* (sing. for plu., as in obv., ll. 22, 23, etc.), from *pasāḫu*, probably *not* a variant form (with *s* for *š*) from *pašaḫu*, "to cease," "be quiet," as this meaning does not seem to suit very well. The Heb. cognate of *pašāḫu*, however, has *s* for *š* (פָּסַח), as in the present text.

18. Prof. Sayce suggests the completion of this line as *Inum nakru Elamū*, "When the enemy, the Elamite (decreed destruction)."

28. *La šubat-su*, "not his seat." This curious expression is not without its parallel in Assyrian, as in *lâ kêttu*, "not right," "wrong;" *lâ-annu*, "unsin," "innocence;" *lâ-bêl-kussî*, "a not-lord-of-the-throne," "a usurper."

29. *Šuḫurrur* is shuphul permansive of *ḫarāru*, "to hollow out," "dig through," whence *ḫurru*, "hollow," "hole;" *ḫarru*, 'canal," and *ḫarranu*, "road" (probably originally a dual). The expression *šuḫurrur šakkē-šu* is a parallel to *šuprisa šakkē-šu*, "came its enclosure to be cut through" in l. 14 of the obverse.

32. *Meškiš*. Prof. Sayce suggests here 𒅆, *ši* (*Šiškiš*) for 𒈨, *me* (*Meškiš*), which would mean "to Babylon" (שֵׁשַׁךְ, Jer. xxv, 26; li, 41). The character 𒈨, however, is certain, and, if correct (as we are bound to assume it is) it implies a further extension of the Elamite conquests spoken of, and furnishes an interesting explanation of Psalm cxx, 5: "Woe is me, that I sojourn in Mesech," *i.e.*, in the land of darkness, the *ḫarran daummata* "road of darkness" of this passage. Prof. Hommel regards 𒆠 (*ki*) as a determinative suffix, and reads "to Mish."

Postscript.

In the foregoing pages an attempt has been made to give fair renderings of three very difficult texts, one of them of considerable length. Their mutilated state has prevented the author from making translations which may be regarded

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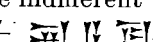
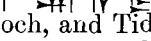
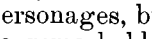
* *Gullu*^{m} *u imi-ḫullu*^{m} seems to be parallel to the *mehê šâru limnu*, "storm (and) evil wind," in line 13.

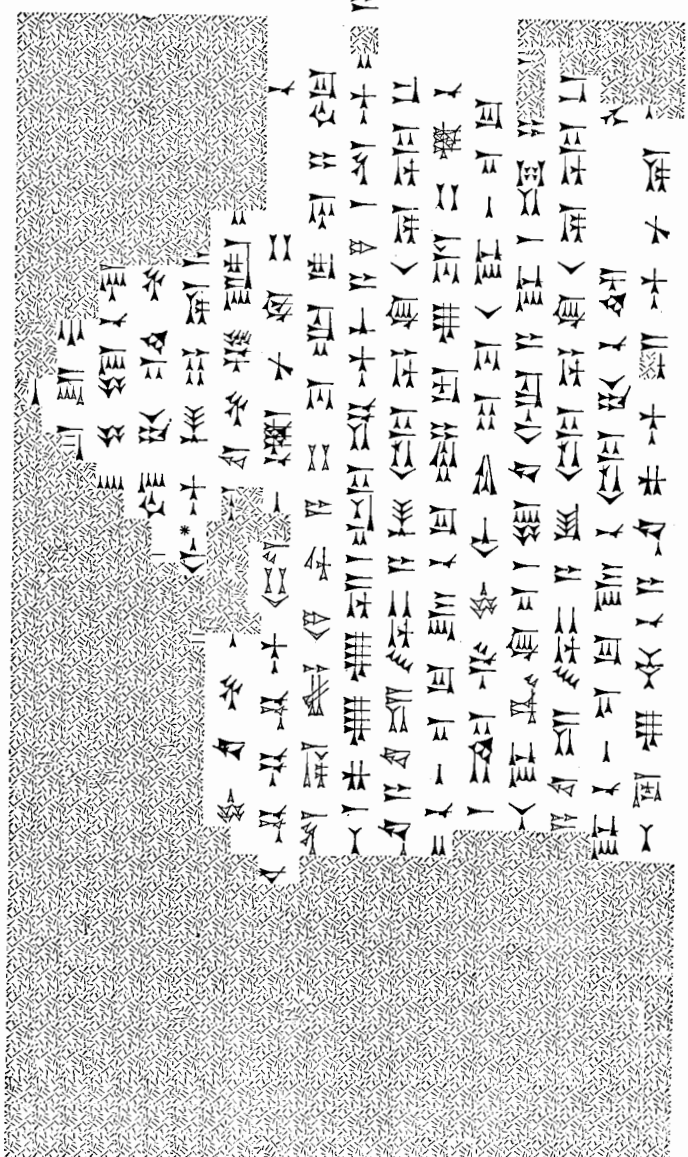
as really satisfactory; improvements will doubtless be made as time goes on, and there is always the hope that perfect, or at least, more perfect copies than those here given, may come to light, changing much of what is uncertain and lacking, and giving us, instead, really trustworthy documents.

The author has not thought it necessary to reply specifically to the various criticisms that have been made, the critics having commented upon the texts without taking into consideration all the facts, even when they knew them, and he could, he thinks, place his finger upon at least one case of deliberate suppression. These critics it would be absolutely impossible to convert, even if the author had any desire to do so. With such imperfect texts as these, however, dogmatising is impossible, and the author disclaims any such intention. It is quite indifferent to him whether  ,  , and  be Chedorlaomer, Arioch, and Tidal respectively—they may be entirely different personages, but if they are not what they seem to be, it is a remarkable historical coincidence, and deserves recognition as such.

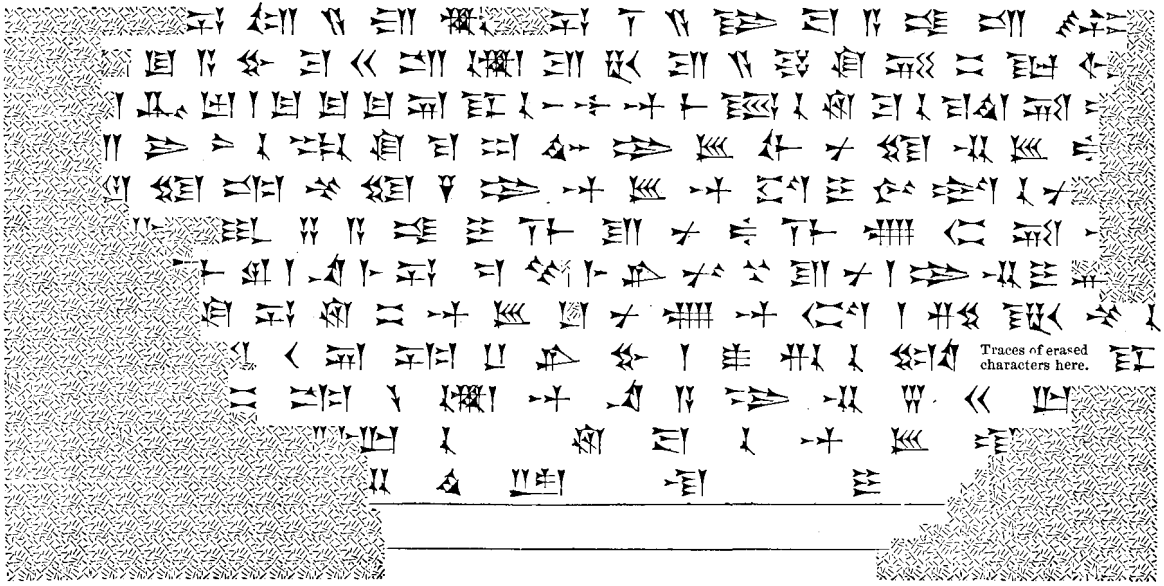
The author greatly regrets that he was not able to refer so much to Professor Hommel's *Ancient Hebrew Tradition* as he would have liked, this paper having already assumed its present form before that work came to hand. He here takes the opportunity, however, of publicly thanking Professor Hommel for the kind way in which he has mentioned his name, and referred to the texts here published, and he recommends to the reader desiring the opinion of another specialist and earnest student of Assyrian, the striking work of the well-known and eminent professor of Oriental languages in the University of Munich.

Sp. III, 2. Obverse.

DUR-MAĞ-ILANI (SON OF ERI-[E]AKU), TUDĞULA, AND KUDUR-LAĞMAL.



Sp. III., 2. Reverse.



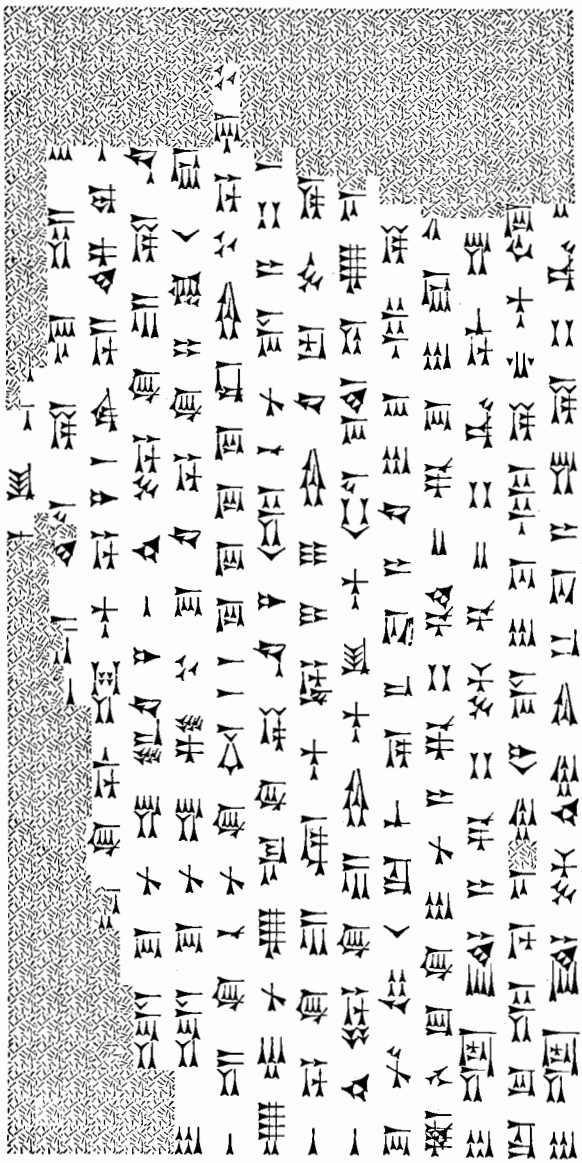
* Or

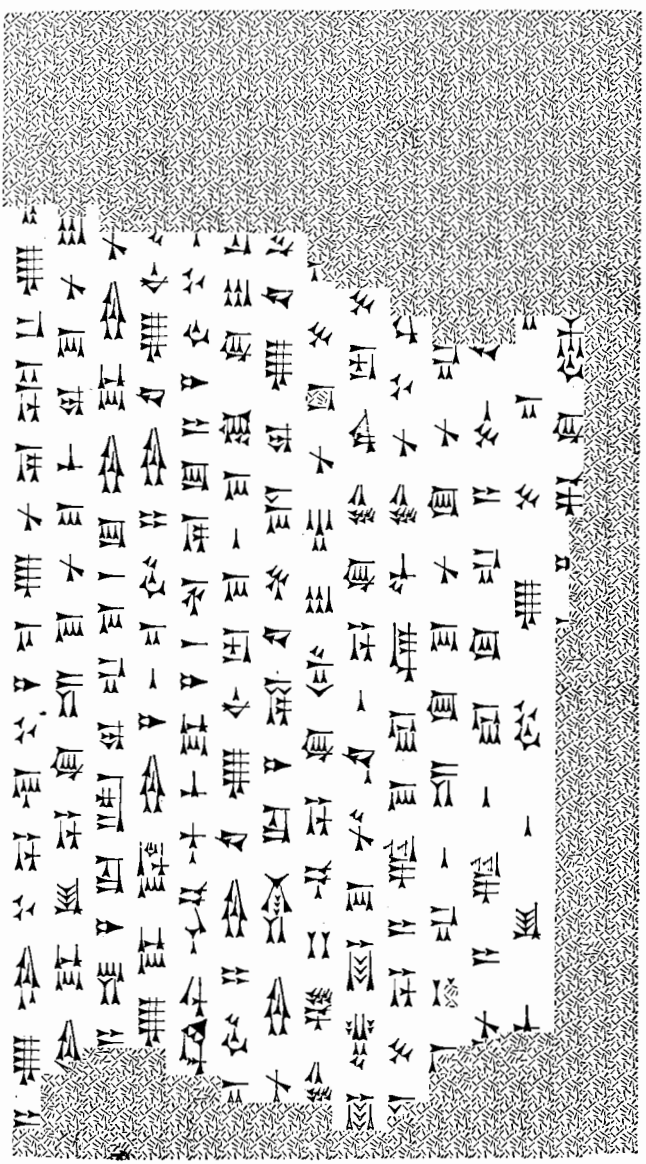
For the transcription and translation, see pp. 46–49.

Sp. II, 987.

KUDUR-LAĠGUMAL AND DUR-MAĠ-ILANI, SON OF ERI-EAKU.

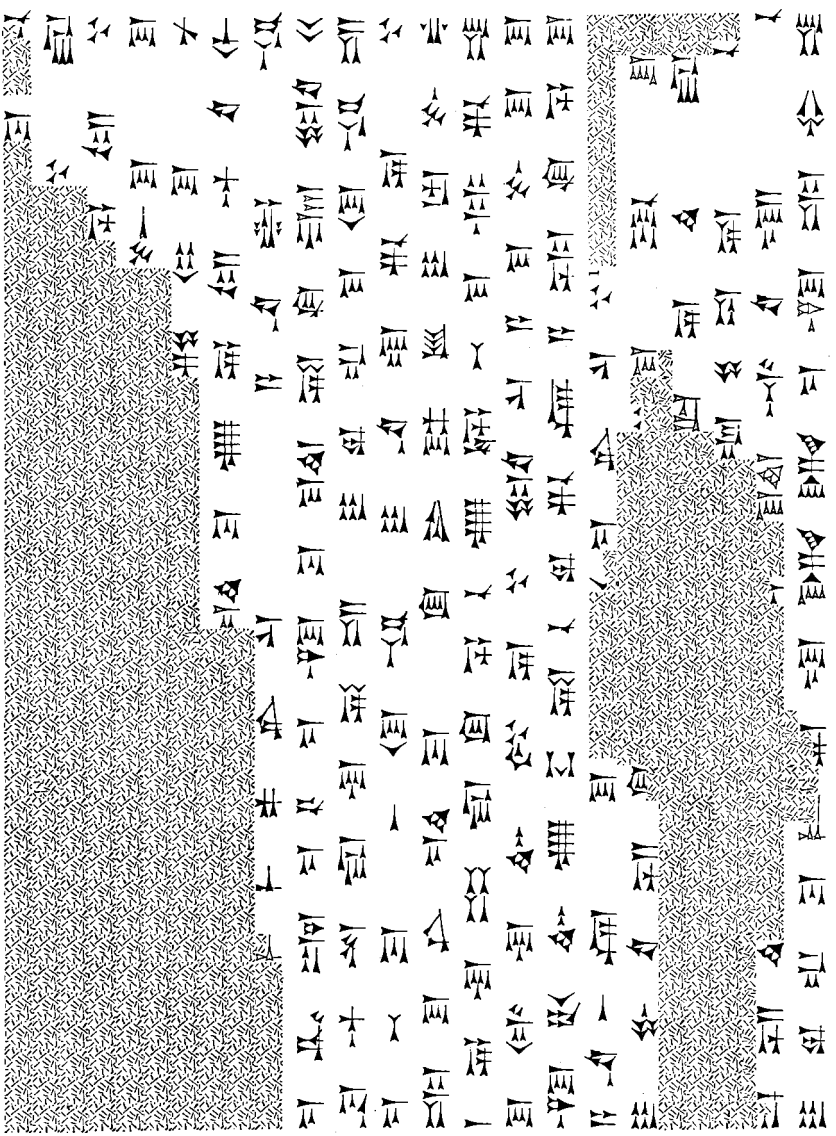
OBVERSE.

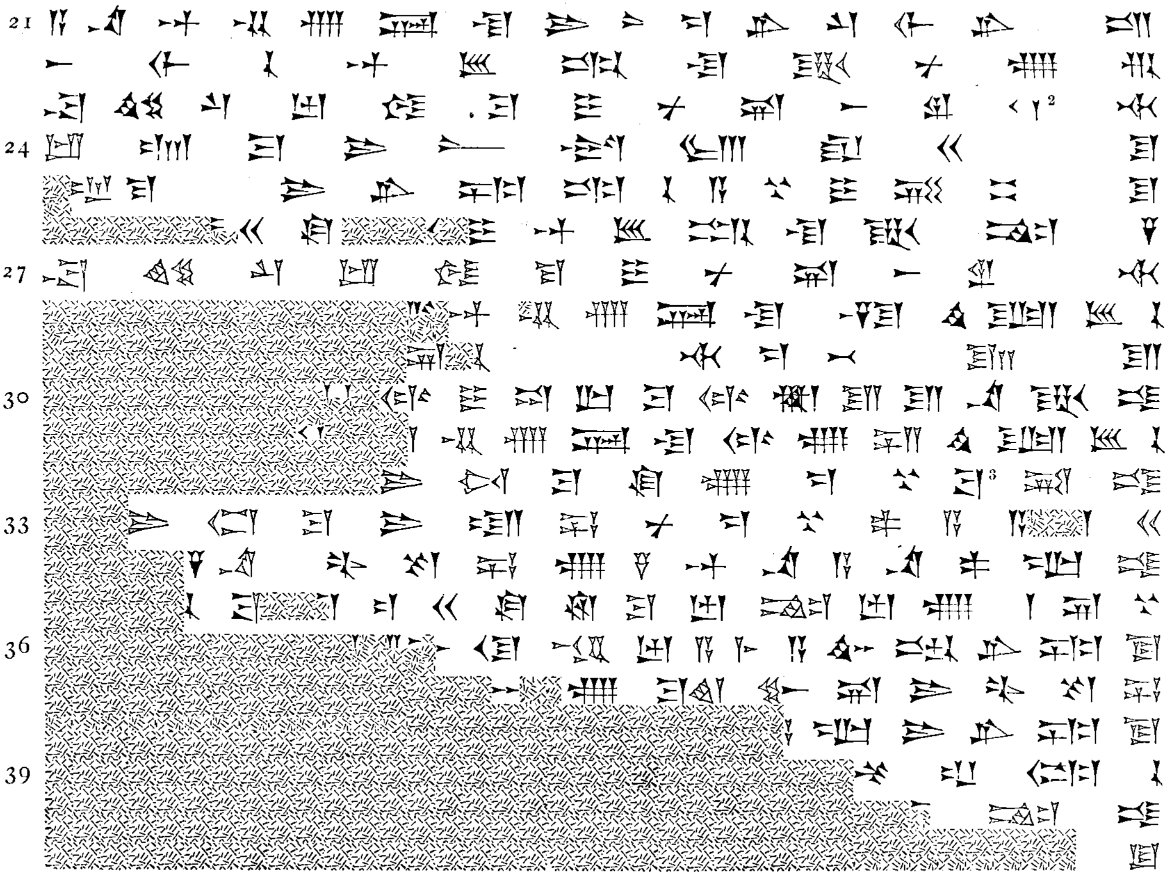




It has not been thought worth while to print the text of the reverse, that portion being too mutilated to give any connected sense. A transcription and translation of the whole tablet, including the reverse, will be found on pp. 51–55.

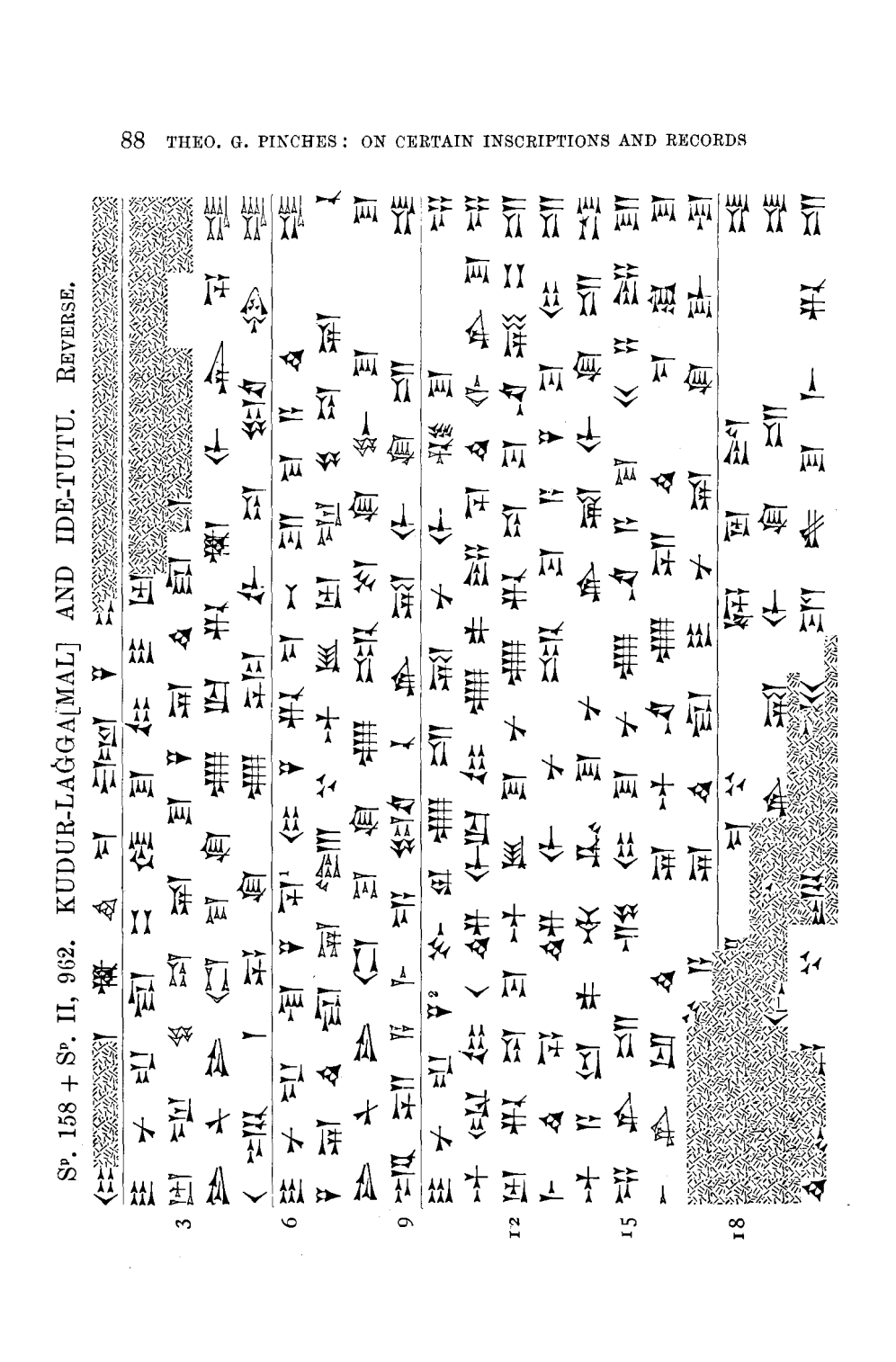
Sp. 158 + Sp II, 962. KUDUR-LAĞGA[MAL] AND IDE-TUTU. OBVERSE.

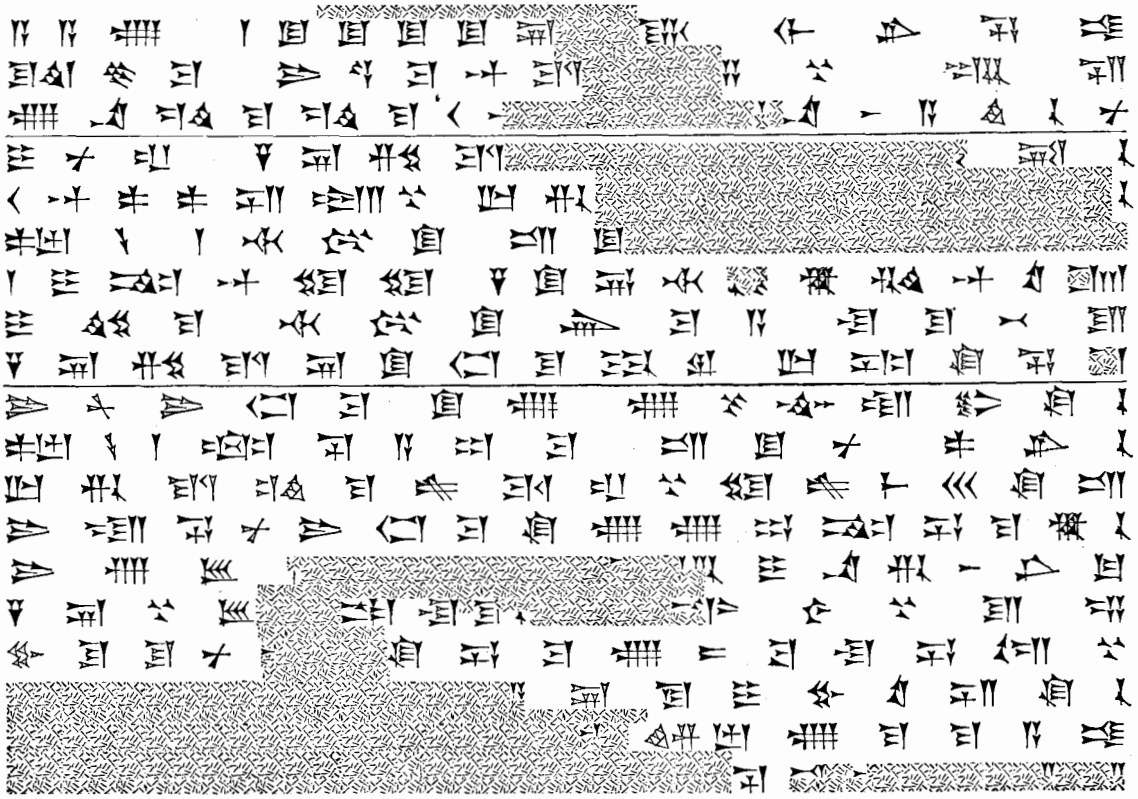




[1] Part of [cuneiform sign] (?)   [2] Erasure.   [3] Or [cuneiform sign].

Sp. 158 + Sp. II, 962. KUDUR-LAGGA[MAL] AND IDE-TUTU. REVERSE.





[1] Or [illegible]. [2] Or [illegible].

For the transcription and translation, see pp. 57–65.

At the Meeting of the Victoria Institute at which the investigation of this subject was commenced the discussion was of a conversational character. Proof copies of the first eight pages of the paper were sent to members, especially known Assyriologists, among these Professors Hommel, Sayce, and others whose co-operation was desired.

The following letter, written by the Rev. Professor A. H. Sayce, D.D., refers to one of the very interesting points involved in the matter investigated.

Assuan, February 18, 1896.

I believe that we have at last an explanation of the enigmatical title given to Tidal in the 14th chapter of Genesis, "Tidal King of Nations." Mr. Pinches read a very interesting paper on the important Babylonian texts recently discovered by him which relate to Kudur-Lagamar or Chedor-laomer, Tudkhula or Tid'al, and Eri-Aker or Arioch. They are, unfortunately, all more or less mutilated; but one of them states that Kudur-Lagamar "assembled the Umman-Manda" or "nomad hordes" of the East when he "did evil" to the people and land of Bel. The Biblical *Goyyîm* "nations" would be the Hebrew equivalent of the Babylonian Umman-Manda; and in Tidal, therefore, I see a king of the nomad hordes who adjoined Elam on the north. This throws light upon a passage in the great Babylonian work on astronomy which runs as follows:

"The Umman-Manda come and rule the land; the mercy-seats of the great gods are removed; Bel goes to Elam. It is prophesied that after thirty years the vanquished (?) shall be restored, and that the great gods shall return with them."

As Kudur-Lagamar was King of Elam, we can understand why the consequence of the incursion of the Umman-Manda was that Bel should go to Elam. I may add that the texts discovered by Mr. Pinches seem to be oracles addressed to the Babylonian King Khammurabi.

ORDINARY MEETING.*

W. N. WEST, ESQ. (*late*), IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

ASSOCIATES :—James Gloster, Esq., A.B., M.B., M.Ch., London ; Rev. J. W. Ewing, M.A., London.

A paper on the "Ethics of Buddhism," sent from America by Mrs. E Reed, was then read by Mr. Theo. G. Pinches. A discussion ensued, which was commenced by the reading of communications from Sir M. Monier Williams and the Rev. R. Collins, M.A., after which the following spoke :—Colonel Alves, Mr. David Howard, the Chairman, and Mr. Theo. G. Pinches. The meeting was then adjourned. (The subject being one of special interest will be further considered.)

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* 2nd of 1896 Session, Jan. 6.

ORDINARY MEETING.*

T. CHAPLIN, ESQ., M.D., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, after which it was proposed by the Council, and unanimously approved, that the following Address be presented to Her Majesty the Queen :—

"MAY IT PLEASE YOUR MAJESTY,

"We, the President, Vice-Presidents, Council, and Members of the Victoria Institute most humbly beg leave to assure Your Majesty of our deepest sympathy in the grievous loss that Your Majesty has sustained in the death of His Royal Highness Prince Henry of Battenberg, while on active service with Your Majesty's forces in Africa.

"That Your Majesty may be mercifully sustained in health and strength under the great bereavement, and that Your Majesty may long be spared to rule over Your Majesty's loyal and affectionate subjects is our most earnest and heartfelt prayer.

"(Signed) G. G. STOKES,
President.

"Given under our hand this
6th day of February, in the year 1896."

An appropriate and almost similarly worded Address was arranged to Her Royal Highness the Princess Henry of Battenberg.

A paper entitled "Where is Mount Sinai?" by Professor E. Hull, LL.D., F.R.S., was then read, and a discussion took place in which Sir Charles Wilson, W., R.E., K.C.M.G., K.C.B., F.R.S., Canon Girdlestone, M.A., and others took part. The enquiry is not yet in complete form.

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* 4th of 1896 Session, Feb. 3.

ORDINARY MEETING.*

PROFESSOR E. HULL, LL.D., F.R.S., IN THE CHAIR

The Minutes of the last Meeting were read and confirmed.

The following paper was then read by the author :—

CHINA'S PLACE IN ANCIENT HISTORY: A FRAGMENT. By Surgeon-General Sir C. A. GORDON, M.D., K.C.B., Q.H.P., Officier de la Légion d'Honneur, etc., etc.

TWENTY-SIX centuries B.C. an office of Historiography was established by order of Hwangti, "the yellow emperor," then ruler of the Chinese people. From that date to the present the current of history in relation to them is for the most part accepted as correct and continuous, although the circumstance is acknowledged that during the two or three centuries immediately following, a remnant of tradition gave colouring to records of actual events.

In accordance with the custom of the time Hwangti† was elected to rule over the united tribes of immigrants engaged in consolidating their organisation and government in the limited territory then occupied by them on the borders of the Yellow River in Shensi. His first task completed, namely, the subjugation of his enemies, he devoted his attention to the improvement of conditions educational and

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* Subject introduced 17 February, 1896 (5th Meeting of the Session), finally arranged and passed for press 1 September, 1897.

† B.C. 2632 ? The assigned date of Deluge B.C. 3155. (Hales.) See Note 1 before Appendix.

*** The Author desires to express his thanks to Mr. Theophilus G. Pinches, of the British Museum, for having enabled him to arrange the references to Babylonian and Assyrian History in accordance with the results of modern research up to the present date, September, 1897. —C. A. G.

social, relating to his people. Among the subjects to which his attention was directed the following brief record must here suffice, namely:—He established the cycle of 60 years in accordance with which Chinese chronology has ever since continued to be reckoned. That cycle would appear to have been little if anything more than an adaptation of a mode of reckoning time adopted nearly two centuries before the date of his accession, by means of the numbers 10 and 12, the characters of which gave a cycle of 60 years,* and formed also the rule of the hours, days, months, and years—a formula so commodious that it has been preserved in China, even from the time of Fohi to the present period.† He introduced the decimal system of notation.‡ He encouraged the study of astronomy and meteorology; being able, "by means of making experiments, to foretell the changes of the weather and air." He established methods of measurement by length and by weight, and made stringent enactments that both should be just; the art of cooking in furnaces prepared for the purpose; the erection of houses instead of bowers formed by branches of trees. He caused roads, chiefly for military purposes, to be made and bridges erected throughout his dominions.§ It is related that while they were as yet unfinished, he invented a carriage on which was arranged a gallery surmounted by a little figure that pointed to the *south*, thereby indicating the direction in which on the occasion of an Imperial progress he desired to wend his way through primeval forest land. The same instrument served to determine the four cardinal points without considering the aspect of the heavens. This could have been no other than the compass, the discovery of which in China is usually assigned to a date long subsequent to that

* The sexagenary cycle seems to have been perfectly arbitrary, for no explanation now exists of the reasons which induced its inventor Hwangti, or his minister Nao the Great, to select this number. It is in fact nothing more than a method of reckoning chronological periods, though restricted to China, the century being adopted for the same purpose by Western nations. Du Halde, vol. i, p. 135; Williams, vol. ii, p. 69 China opened—Gutslaff, vol. i, p. 296.

† *China*, by Hugh Murray, vol. iii, p. 234.

‡ The notation of the Chinese is based on the decimal principle; but as their figures are not changed in value by position, it is difficult to write out clearly the several steps in solving a problem. Williams, vol. ii, p. 66.

§ Which extended from near Shachow in the province of Kansu on the west to the sea on the east, and from Pechli on the north to the Kiang on the south.

of Hwangti. The introduction of money dates* from this period, the Chinese term for which, namely, Tsyen, signifies "the water of a fountain that runs without ceasing." A system of *polymetallism* existed; gold, silver, and copper were in use, and subsequent emperors are said to have permitted the use of foreign coins of gold and silver throughout their dominions. There came also to be used money made of tin, lead, iron, baked earth; also cowry shells.† To him also is assigned the introduction of written characters, his idea in that respect having been derived from observing the markings on the shells of tortoises; the systematic rearing and management of silkworms‡; the manufacture of the fibre produced from them into robes of different shapes and colours, were among the numerous advances connected with that reign.

He created six ko-lau or Prime Ministers§ to assist him in governing his empire. He appointed a professor of music, whose duty was to explain the order and arrangement of the different tones. He taught the way of making flutes, fifes, and organs, trumpets that imitated the voice of the dragon, and drums that made the noise of thunder. He divided his country into principalities, in each of which he caused cities to be erected. He introduced the use of wheeled carriages, and the training of horses to draw them. Lastly, he ordered that coffins should be made in which the dead were to be interred.

Nor were such subjects as in our day pertain to medicine, hygiene, and physiology neglected. It was pointed out that

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* Neither gold nor silver has ever been coined to any great extent in China, although in 1835 and 1856 some attempts were made.

† Cyprea moneta.

‡ *The Silkworm Classic* was published during the reign of Hwangti, B.C. 2640–2600. The methods of rearing silk worms introduced and described at the very distant date of forty centuries ago is that still followed in China. Only a few months ago the papers of the day stated that a delegate had been sent from France to study that method.

§ The supreme government consists of:

(*a*) Ayko, or cabinet.

(*b*) Tsing-jin-foo, or board of control of imperial family. The six tribunals are:

1. Tribunal of selection and degradation of civil officials.
2. Hoo-poo, board of reverence.
3. Lepor, board of rites and ceremonials.
4. Ping-poo, tribunal of war.
5. Hing-poo, tribunal of punishments.
6. Kung-poo, the board of works. (Gutslaff, vol. i, p. 39.)

"men suffered from without by the rigour of the seasons, and from within by the passions which disturb their minds; they died before their time." Hwangti directed that "the five elements," namely, air, earth, fire, wood and water, should be examined, no doubt in accordance with the "science" of that day; also that "seasons of the year, and the nature of man should be investigated." Three experts* were charged with what would now be called physiological investigation with reference to the circulation of the blood, namely, "to examine the blood." For the better administration of his kingdom he divided the people into families and communities, to each of which a definite system of rules and orders was applied. A system of therapeutics was devised, in accordance with which proper remedies for every distemper were detailed, the general result of the several reforms and advances pertaining to his era being that "men lived out their time according to the due course of nature."

The personal characters and more important events connected with the reigns of the four succeeding monarchs may be epitomised thus:—The first,† governing with equity, carrying on improvements previously begun, and initiating others; reconciling the two classes high and low, patrician and plebeian classes, into which the people had already become divided; at a later period, voluptuous, superstitious, neglecting the duties of his high position, his death unregretted by his people. The second,‡ energetic, extending the confines of his possessions; autocratic in his "religion," declaring that he alone possessed the right to offer sacrifices in the Temple of Heaven. The third,§ the institution of State schools and professors; a lover of music; appointed masters to teach his people virtue; loving his subjects, and by them beloved. A man of devout sentiments, he worshipped the Sovereign Lord of Heaven, and "reformed himself." His grand and august air drew veneration; his virtue was eminent; he did nothing amiss, and kept a just medium in all things. With all the virtues so recorded of him, history relates that he became the husband of four

* Named respectively Kype, Yeufou, and Leyking. With reference to this point it is important to notice the record B.C. 4366, that Teta, a monarch of the 1st Egyptian dynasty, wrote a book on anatomy; that is 1666 years prior to the Chinese reign just mentioned.

† Chao-how, B.C. 2577.

‡ Chwen Hio or Hu, B.C. 2457.

§ Tico or Caosin, B.C. 2397.

wives, and so set the first example of polygamy. The fourth,* dissolute in habits; making use of his authority only to serve his brutal passions; disappointing expectations, the tributary princes (or barons) combining in rebellion, dethroning, then sending him into exile, electing in his place a younger brother, to become known in history as Yao† the Great. It is related of him‡ that he believed in the existence of a definite relation between our globe and the other heavenly bodies; that he devoted himself to a study of the laws of their respective movements, in order that in accordance therewith human affairs might be regulated throughout his kingdom. The views so expressed were to be resuscitated some forty centuries thereafter as an outcome of advanced science of the present day, namely:—"One chain of causation connects the nebulous original of suns and planetary systems with the protoplasmic foundation of life and organisation. Pathology is the analogue of the theory of perturbation in astronomy."§ The ancient Chinese monarchs appointed "tribunals of astronomy and religion." The erection of sepulchral monuments dates from this reign.‖ Among important events connected with it was an overflow of the Hoang-Ho—a river ever since known as "China's Sorrow"; the systematic introduction of engineering methods to remedy the misfortune in question, and to guard against a repetition of similar catastrophes.

¶Yao promulgated among his people "The Five Rules of Duty," namely:—1, Between the king and his subjects; 2, parents and children; 3, old persons and young; 4, husbands and wives; 5, friends. The rules then published continuing (theoretically) in force at the present day, more than four thousand years after the date of their original issue. Many other rules and orders are assigned in history to this monarch, the general result proceeding from which was that "peace reigned among families, good order among officers, union among principalities, the evil-disposed corrected their own conduct, peace reigned everywhere."

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* Ti Chi, B.C. 2366.

† B.C. 2356, Medhurst. Died, B.C. 2238. Gutslaff, vol. i, p. 131.

‡ Pauthier, p. 33.

§ Prof. Huxley, 1881.

‖ Namely, from the year 2350.

¶ See paper on "Chinese Ethics" read before the Victoria Institute, p. 2.

The successor of the great and estimable monarch so alluded to, namely, *Te Shun* or *Chun*, is stated to have had only one title to advancement to the throne over the hereditary heir to that dignity, namely, his integrity. His early life was rendered the reverse of happy by reason of the conduct towards him of his step-mother and half-brother;* nevertheless, his demeanour under such trying circumstances was so correct that philosophers derived therefrom two great principles of morality: the first, that however wicked parents may be, their children are none the less bound to show them respect and obedience; the second, that there is no man so bad but he may be reclaimed by good offices. Throughout his reign† he was rigid in his religious observances. "A prince," said he, "who desires to fulfil his obligations, and longs to preserve his people in the way of peace, should watch without ceasing that the laws are observed with exactitude." To the advance of agriculture he paid special attention; he established various colleges, and endowed a *hospice* for the aged.‡

An allusion in this place to some contemporary events elsewhere than in China may serve to indicate the vast distance by which the present time is separated from the periods to which, so far, our attention has been directed, namely, that described as the Mythological or that of "the Five Emperors," of uncertain duration, but usually reckoned as extending from B.C. 2637 to B.C. 2208. But as with regard to the one series of events, so in respect to the others there are difficulties in drawing a definite line between what is actual history and what traditional.

In Egypt, great obscurity prevailed over the history of the land and people. The sacred island of Meroe, as it is called, formed by the confluence of the Astraboras and the Astrapus, otherwise the Tacasze and Blue River, appears to have been the first nucleus, whence sprang "the civilisers of mankind." Thence they spread their industrious colonies downwards along the course of the Nile, displacing the earlier inhabitants as they advanced. In their progress, B.C. 4400 to B.C. 2200, the cities of Thebes or No-Amon, On (Heliopolis) and Memphis were erected by them. Great improvements had already been made in respect to the

* Persecutions to which Shun was subjected. See Gutslaff, vol. i, p. 131.

† From B.C. 2254 to 2204.

‡ Pauthier, p. 67.

country itself; special attention bestowed upon the rise and periodic fall of the Nile; the nilometer established; canals and sluices for irrigation constructed, the great reservoir, the lake Moeris, formed*: the labyrinth made, certain colossal figures constructed within the area of, and in the vicinity of that reservoir; the great pyramids of Sakkara and of Ghizeh raised.

In Chaldea the descendants of Cush, who did not follow the rest of the children of Ham into Africa, seized upon the fertile fields of Shinar, otherwise Babylonia, where under Nimrod and Ashur, they erected various cities, including Babylon and Nineveh,† the assigned date of the former city being B.C. 2247. The foundation of the Assyrian monarchy was probably laid about this time. At the same early period it is recorded that there learning flourished; astronomy was in a considerably advanced condition. According to the Greeks, about B.C. 1968 Ninus succeeded his father Belus; his wife Semiramis, in one account, being the real foundress of Nineveh. She resigned in favour of her son Ninyas, after whom for 1350 years or more Assyria was ruled by his descendants until Sardanapalus‡ immolated himself and so put an end to the first empire. It would be useless to reconcile the contradictory accounts which the ancients have transmitted to us of the last days of Sardanapalus. It seems, however, to be established by modern critics that Sardanapalus was Assurbani-pal, and that this name was applied by the Greeks to Sin-sarraiskun or Saracos, the last king of Assyria. Nineveh was destroyed by the Medes and Assyrian power came to an end about 607 B.C.

With the accession of Yu the Great, B.C. 2208, and the institution thereby of dynastic succession, history became disconnected from mere tradition, being thenceforward itself

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* Its formation is assigned to Amenophis III, sixth monarch of the twelfth or Theban dynasty, B.C. 2300 to B.C. 2084; also to Amenheme III, of the thirteenth dynasty B.C. 2120. But it is impossible to reconcile discrepancies between different dates given. A continuous chronological record will no doubt be the outcome in due time of investigations by Flinders Petrie and other distinguished Egyptologists. See Note 2.

† Of Babel, supposed to exist in the Birs Nimroud. By some authors the tower was connected with Fire-worship, *i.e.*, Sun-worship.

‡ *Ancient History*, Schmitz, pp. 73, 75; White's *Universal History*, p. 47; Rollin, vol. i., p. 279. (From Greek sources.)

definite and reliable. The first dynasty of China, or that of Hea, becomes established, the period of ancient history properly so called begins, and is to continue till B.C. 263. Of the precepts attributed to that monarch, the following are a few examples:—"He" (that is, the ruler) "who would govern a people must do so in accordance with public opinion; he must be careful not to alienate the suffrages of his people" (*vox populi vox Dei*); "virtue is the foundation of government"; "Government consists in procuring for the people all things necessary for its preservation, and protection against whatever is injurious to health or life.* National songs were encouraged for the double purpose of animating and exhorting the people."† Doubtless, therefore in those far-off days Chinese patriots had their own equivalents for "Rule Britannia," "The British Grenadiers," "Scots wha hae," "Mourir pour la Patrie," etc.

Public works of drainage and reclamation were vigorously conducted. He devoted much attention to what would now be called scientific agriculture, including drainage, the methods of tilling and sowing, the levelling of irregularities on fields, and the application of suitable kinds of manure. He instituted a class of feudal chiefs, and of tributary princes, a system out of which in after years very serious troubles to the empire arose. Certain crown-lands were reserved for the maintenance of the Court; others for the public, and others for "the habitation of barbarians." Yu committed to his tributary princes full powers of government within their several principalities‡; but held all of them subject to military service, compulsory in all ranks.

He directed that his subjects, whatever their rank or position, should have free access to, and so lay their grievances before him for redress. Government was carried on by means of nine departmental offices.§ Unhappily, the introduction of

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* Thus ndicating the recognised importance of State Medicine.

† Psalm 137, B.C. 1063–1015, is a "national song." Spartan boys, under the system of Lycurgus, B.C. 884, committed to memory patriotic songs.

‡ Home government in fact.

§ Those under Yu were :—

1. President of the Council.
2. Minister of Agriculture.
3. Minister of Education.
4. Minister of Justice.

strong drink among the people took place in this reign. It is related than when the emperor tasted the newly discovered spirit he declared that "this drink will be the cause of the greatest trouble in the empire," that he caused Y-tih, its discoverer, to be banished, and that down to the present day the name of the latter is reprobated. Duke Chau strongly condemned its use, his address on the subject, B.C. 1120, being the oldest "temperance speech" on record, not excepting the words of Solomon in the Proverbs* (B.C. 1015–975). Like many others subsequently delivered, it had little if any result.

From the death of Yu, B.C. 2197, to the extinction B.C. 1765 of the dynasty he had founded, sixteen monarchs occupied the imperial throne, of whom history relates that "individually they were tyrants, seekers after pleasure, and as a consequence hated by their subjects." The chief events within the four centuries so comprised may be enumerated thus: Rebellions by "Barons"; remonstrances by the people; depositions; mistrust and contentions between feudatory chiefs; an occasional interval of happy rule, and awakening content among the people, to be followed by a repetition of occurrences of the nature already enumerated. An amiable and unsuspecting monarch,† against the warnings of his father was betrayed into placing an unjustifiable degree of power and confidence in the hands of a designing minister‡; a revolution, successful for the time being, was brought about by the latter, a period of close upon half a century having to transpire before legitimate sovereignty was re-established, scenes of bloodshed and of cruelty having prevailed the while, and for some years thereafter; indeed it is recorded that nearly a century after the rebellion in question abuses which had then arisen were not then eradicated. Then came a period including five reigns, during which prosperity and happiness prevailed, to be followed in its turn by one

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5. Minister of Public Works.
6. Minister of State Lands.
7. Minister of Ceremonies and Rites.
8. Minister of Music.
9. Public Censure. (Pauthier, p. 42.)

* Four centuries before the date of Solomon, namely, about B.C. 1452, the Five Books of Moses were written. In them various allusions occur alike to the use and abuse of strong drinks, namely, Levit. x, 9; Numbers vi, 3; Deut. xiv, 26; xxix, 6; Prov. xx, 1.

† Namely, Te Seang, B.C. 2146–2118.

‡ *I.e.*, in the reign of Te Chou, B.C. 2057–2040.

of decay, culminating in the ignominious cessation of the dynasty. Of the five monarchs whose downward course so culminated, it is related that the debauches of one* rendered him odious and contemptible to his people; a second† abandoned himself to vice and dissipation, selected bad men to be ministers and other officials; a third‡ made his palace the seat of the most infamous pleasures, and shortened his days by debauchery; a fourth§ though perhaps not actively wicked, has not assigned to him any particular virtue or capacity for governing; the fifth and last‖ "naturally vicious, without one redeeming quality." The cruelty and infamy of his acts continue even at the present day to render his name odious in China, as that of Nero is in western nations. In all these respects he was equalled by his empress.

The brief summary so given of events connected with the first Chinese dynasty, or that of Hea, comprises the period from B.C. 2208 to B.C. 1776,¶ namely, 432 years, during which important advances took place in various branches of knowledge, including those to which in subsequent years the term *science* came to be applied; progress also took place in respect to art and agriculture, the last-named industry being that in which from time immemorial the Chinese have excelled. Corresponding advances were meanwhile taking place in other regions of the ancient world, some of which, together with other circumstances, may be here enumerated in their chronological order, namely:—

During this period commerce of Egypt much extended; divine honours came to be paid to a host of divinities, obelisks and columns were erected as memorials. In consequence of a famine in Canaan, Abraham, accompanied by Sarah his wife, proceeded to Egypt to buy corn,** the latter country being even then known as "a land of plenty."

A colony of Aryans, otherwise of the Indo-Germanic stock, having started from their primitive home, supposed to have been on the borders of the Caspian Sea, proceeded eastward; they entered the north-western region of India, defeated the

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* Ti Kin, B.C. 1899–1879.
† Kung Kia, B.C. 1879–1847.
‡ Te Kaou, B.C. 1847–1836.
§ Te Fah, B.C. 1836–1818.
‖ Kya, or Kea Kwa, B.C. 1818 to B.C. 1766.
¶ Or, according to Medhurst, B.C. 2204 to B.C. 1765 = 439 years.
** Gen. xii, 10; to sojourn there, A.V. Born B.C. 1996; called B.C. 1921.

aboriginal tribes then known as Dasyu or Dasa, who are said to have fought against their conquerors with all the obstinacy and skill of barbarians.* The Aryans then established their own city of Hastinapore, and gradually became masters of the district situated between the Ganges and the Jumna, the wars in question being subsequently celebrated in the great Hindoo epic, the Mahabarata.†

From the same primeval Aryan stock a western offshoot spread to Greece, where they built Athens and Sparta, and became the Greek nation; another to Italy reared the city on the Seven Hills, which grew into Imperial Rome. Another colony of the same race excavated the ores of prehistoric Spain; and when, long subsequent to the date with which we are now concerned, we first catch a sight of ancient England, we see an Aryan settlement fishing in wattle canoes, working the tin mines of Cornwall,‡ and there is every reason to believe worshipping at the shrines known as Druidical deities of the Vedic age as their distant cousins the Brahmins and Rajpoots of India continue to do at the present day.

Within the same period the cities of the plain were destroyed§; Hagar and her son Ishmael‖ driven out; and having retired to "the desert," the youth married an Egyptian woman, and so became progenitor of "the Arabs," whom in subsequent ages the Persians, Greeks, Romans, Tartars, and Mongols vainly endeavoured to subdue. From Ishmael, through the Hejazite kings of Arabia, the lineage of Mahomed may, it is said, be traced.¶ According to Arab legend Ishmael settled in the district of al-Hijāz, where, on the site subsequently occupied by Makka (Mecca), Hagar died and was buried, the Ka'bah erected by Abraham. Ishmael became prince and high priest of Makka. After his death, B.C. 1774, he was succeeded by his eldest son Nebat, though it is through his younger brother Kedar that the pedigree of Muhamed is traced, with what degree of truth is a subject beyond the scope of these remarks.

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* *Ancient India*, by R. C. Dutt, p. 13.

† The date of the Mahabarata was about the commencement of the Christian era; that of the story itself B.C. 1400—B.C. 1000.

‡ *Brief History of the Indian people*, Hunter, p. 52.

§ B.C. 1897.

‖ B.C. 1910 Ishmael born.

¶ White's *Universal History*, p. 9; also Hughes's *Dictionary of Islam*.

The measures by which the change from the Hea dynasty in China to its successor was brought about were briefly after this manner. Among the tributary princes, one, namely, Ching Tang, traced back relationship to "the Yellow Emperor," with whose reign* the present paper begins; thus in his particular instance family descent was traced through upwards of eight and a half centuries. Ching Tang gave asylum to all faithful ministers and others who were forced to flee from the presence of Kea, their monarch, and last of his line. At their solicitation he took up arms. After a time spent in war and negotiation, "the imperial troops threw down their arms and fled. Kea escaped, and, forsaken by the whole world, died an ignominious death in exile."† His son also, the heir apparent, and last scion of the Hea dynasty, retired to the northern deserts, where he ended his life amongst savages.

In the year B.C. 1766 Chin Tang accordingly came to the throne of China as first emperor of the second dynasty, to which he gave the name of Chang, from the province of which he had been feudal chief. That dynasty was to consist of twenty-seven monarchs and to continue till B.C. 1121, namely, a period of 645 years.

During the reign of Chin Tang "there occurred a drought which lasted seven years.‡ Streams and rivers were dried up, and the whole soil was parched. Notwithstanding the scantiness of the harvest none were reduced to starvation, for there was always a quantity of grain remaining in the store houses"; taxes were diminished; the people encouraged to cultivate the arid ground, the produce being entirely their own. In other respects his acts of benevolence were numerous, the people were astonished at his tender consideration for them, and called him "the well beloved sovereign."

During the reigns of the fourth, fifth, and sixth monarchs of this line,§ administrative power decayed. Then came a revival during the long period of 75 years embraced in the reign of the seventh.‖ He set himself to govern well; he directed that almshouses for the aged should be established in

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* Dated from B.C. 2637.

† Gutslaff's *History of China*, vol. i, p. 150. Also Du Halde, vol. i, p. 151.

‡ From 1766 to 1760 B.C.

§ B.C. 1690 to 1636. ‖ Tai Wou, or Tai-Sŭh, B.C. 1636–1561.

towns and cities, and supported by communities, thus instituting a Poor Law, such as still continues in operation.

It was while the eighth monarch* of this line was on the throne that mention was for the first time made in Chinese history of the Tartar tribes of the desert situated north-west of China, who, ethnically related to themselves, were thenceforward to be sources of trouble to them. Then also it was that on account of repeated and frequent inundations of Shensi by the Yellow River, it was deemed advisable to remove the imperial capital from that province and establish it first in Honan, then in Pe-cheli, upon the site of the modern Peking.†

Somewhere about this period the Shepherd kings are considered to have invaded Lower Egypt, namely, about B.C. 2233–1800; the duration of their rule to have continued 260 years; various other dates are however assigned to the former event, but that now given may suffice for present purposes of comparison with reference to the second Chinese dynasty.

During the same period the birth took place of Isaac (B.C. 1896); of Esau and Jacob (B.C. 1836); Joseph‡ was sold by his brethren into Egypt; his family, then a nomadic tribe, settled in the land of Goshen, he himself became minister to Amosis or Thotmosis, the then reigning Pharaoh, and by his foresight preserved the country from famine during the seven years of sterility.§

It was during the reign of the Chinese monarch Wae-jin, B.C. 1549–1534, that disaffection which for some time previous had been gradually rising with regard to the order and manner of succession to the imperial throne culminated; brother had succeeded brother to the detriment of sons of deceased rulers, so that sovereign power was looked upon less as a hereditary right than as a prize to be won by the ambition of members of the Royal Family among themselves, constant wars being the accompaniments of such conditions. Through several successive reigns civil war of that kind continued, while rebellions among tributaries further disturbed the empire. By way of compromise the ministers of state in the year B.C. 1433 elected their own nominee‖ as emperor. But the result

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* Chung Ting, B.C. 1562 to 1549.
† And so remained till the reign of Pwan Kong, B.C. 1401–1373.
‡ Joseph sold, B.C. 1730 (Haydn).
§ From B.C. 1708 to 1702; Gen. xli, 54; xlvii, 13–26.
‖ Namely, Naknang, fifteenth emperor.

was unfortunate in a double sense; the selection was not in accordance with public opinion, and the monarch proved to be himself unworthy of the choice that had fallen upon him.

A state of general anarchy was the result. But as on many other occasions before and since, opportunity brought to the front the suitable man, this time in one of the imperial princes,* though not the lawful heir to the throne. Throughout his reign of twenty-eight years he devoted himself to advance the well-being of his subjects. Among the principles laid down by him for the guidance of his high administrative officers were these:—"The care of the people, not the enriching of one's self should be their object. They should repair to Court from time to time to learn the wishes of the emperor, to receive his approbation or otherwise of their public behaviour. They should strive to maintain peace and tranquillity in their respective administrative districts. They should themselves in their conduct be examples to the people in respect to virtue and rectitude."

But the good effected during that reign was destroyed by the conduct and example of the monarch who immediately followed,† an impulse at the same time given to conditions which were already threatening the destruction of the dynasty. Unhappy as conditions were, however, ten more sovereigns in succession reigned, and a period of one hundred and ninety-eight years had to elapse before matters culminated in the abolition of this dynasty.‡

It unfortunately happens that available records contain little more than personal details relative to emperors, ministers and feudal chiefs, the general conditions of the country and inhabitants being seemingly passed over as of no importance. An exception to this rule occurs in connection with the final reign of the dynasty. It was then recorded of the Chinese people that "they were still few in number, and relatively feeble in power." To the eastward of them were territories occupied by foreigners (Mongol Tartars?) numerous and powerful, while in the west various tribes of aborigines held possession. But the Chinese proper gradually

* Pwan-keng, B.C. 1490–1373.

† Seau Sin, eighteenth emperor, B.C. 1373–1352.

‡ Namely, B.C. 1121. History relates that towards the Hea dynasty Japan and the neighbouring islands were peopled from China owing to the tyrannical oppression of the rulers, which drove their subjects from the soil.

established their military power in the midst of their surroundings, and from that circumstance adopted for themselves the name of Chung Kwoh, or, "The Middle Kingdom."*

Here are a few characteristics of Chow-sin, the last of his dynasty, and no wonder that he was so: "Of strong mind and passions, he excelled in all kinds of wickedness, his vices nourished by his empress, an infamous but beautiful woman, every vice found in her an advocate and promoter."† The atrociously wicked deeds perpetrated by Chow-sin are detailed in works on Chinese history, though unfit for mention here. The tributary princes combined their forces to rid themselves of the monster; under one of themselves, Wou Wang, the confederates marched their forces against him, and speedily overcame the Imperial troops. Thereupon Chow fled to his palace, which being set on fire, he perished in the flames.

Thus hastily have the events in China's history during close upon five centuries‡ been glanced at. In a similarly hurried manner must a summary be made of those recorded in other regions of the then civilised world, namely:—

The several nations of Greece§ rose in power; wandering tribes from the north (Scythians) migrated to that country, and to others more favoured by climate and in soil than their own. Troubles in Egypt led to further emigration therefrom, chiefly to the land of Ion.‖ The Phœnicians had established Tyre, and themselves became an important maritime power; their name among the early Greeks, synonymous with fraud, deceit, and treachery. In Egypt the Israelites had increased in numbers and strength, and so excited the fears of the reigning monarch.¶ The Exodus took place B.C. 1491; the hosts of Manephtah were destroyed in the "Red Sea"; the Israelites spent forty years in the desert, during which period the Ten Commandments were

* To the empress Ta Kia, wife of Chow Sin, the last monarch of the Shang dynasty, is said to be due the method of contracting the feet of Chinese girls, which has continued to the present day. She also is said to have introduced what has ever since been known as "the Feast of Lanterns." Du Halde, vol. i, p. 292.

† Gutslaff's *History of China*, vol. i, p. 162.

‡ Namely, from B.C. 1636 to B.C. 1122 = 514 years.

§ Mentioned in Scripture under the name of Javan, son of Japheth Gen. x, 2.

‖ Ion, *i.e.*, Javan, Greece.

¶ Rameses II. In the space of 215 years from about 70 persons the family of Jacob had increased to 600,000 fighting men, or a gross population of more than two millions.

promulgated from Mount Sinai; and Moses having committed the Book of the Law to the priests, he ascended Mount Pisgah, ten miles north-east of the Dead Sea, there died B.C. 1451; leaving Joshua* and Caleb as leaders. During their wandering in the desert Moses established the Jewish Republic.† In B.C. 1471 fire from heaven destroyed their camp, and pestilence 15,000 of their numbers.

The legislation of Moses embodied in the Pentateuch‡ was promulgated at a time when the word *law*§ was unknown to other nations. This code is divided into five parts, namely, religion, morals, and civil, military, and political affairs. Its wisdom is acknowledged at the end of nearly forty centuries, while the more recent institutions of Minos, Lycurgus, Numa and Solon have fallen into desuetude.

Sesostris or Rameses II, the great founder of the nineteenth Egyptian dynasty‖ liberated his country from the Hyksos,¶ who had renewed their invasions under his father.** His own conquests extended over Libya, Ethiopia, Media, Persia, and Asia Minor, trophies being brought to him from kingdoms extending from the Danube on the west to the Ganges on the east.

The origin of Sidon is lost in antiquity. Towards the end of the period now under review, Tyre was erected, but for a considerable time held a position second in importance to its elder rival. The people by whom they were established, and the adjoining territory occupied were described in the Mosaic account as descendants of Ham, whence they would belong to the same race as the Egyptians, and other southern nations. Numerous cities and towns were erected along their line of coast, these becoming celebrated for their various industries and manufactures, as also for maritime enterprise. Even at this early date they excelled in the

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* Adverting to the miracle of the sun standing still in the time of Joshua (Josh. x, 12), the Chinese have a tradition that in the time of Yao (B.C. 2356–2254), the sun did not set for ten days. The Egyptian priests told Herodotus (about B.C. 450) that within a period of 341 generations, *i.e.*, about 11,000 years, the sun had deviated four times from his usual course. White's *Universal History*, p. 18.

† Theocracy (?)

‡ "The Book of the Law of Moses," Ezra vii, 6; Neh. viii, 1.

§ In a forensic sense.

‖ Or Arabians. (Rollin.) White, p. 18.

¶ B.C. 1326, according to Manetho. Achmes I, B.C. 1703-1700.

** Seti I.

manufacture of glass, and were famous for the art of dyeing purple.*

During the Shang dynasty of China, Athens is said to have been founded by Cecrops† (B.C. 1571); the court of Areopagus established; Thebes erected B.C. 1453, by the Phœnician Cadmus,‡ by whom also the fifteen letters of the Greek alphabet which go under his name were introduced; the oracle of Delphi became a central point of union of different tribes.

In Judea the Council of twenty-three Judges to govern the people was established after the death of Joshua (B.C. 1443). Each city had its special magistrates and ministers of justice; their place of audience the gates of the city. To this period belongs the narratives of Sisera (B.C. 1285), of Ruth§ (B.C. 1312), the story of Jephtha's vow (B.C. 1188), that of Jason and the Argonauts (B.C. 1263), and Trojan war (ended 1184).

To the same period is referred the Vedic portion of India's history, when Vishnu was a name for the sun, the luminary at his rising, in the zenith, and setting representing the three steps of Vishnu while striding across limitless space. To the latter part of the same period are referred the events real or mythical, or partly both, which form the subject of the Ramayana commemorative of Rama, Seeta, and Ravanu, King of Lunka, or Ceylon.‖

The advent of the third dynasty, or that of Chow,¶ was the commencement of a period the duration of which was destined to extend to 873 years,** and to become the most remarkable era of China's history. At the date when it was first established the maxims of politics and government laid down by the sages of antiquity had been to a great extent forgotten. They were in part revived, in part modified so as to be applicable to the "advanced" condition of affairs brought about during the continuance of this dynasty. It is asserted that the state to which the arts, science and policy of China

* The Purpura patula is believed to have yielded the Syrian purple.

† According to tradition Cecrops was no Egyptian, but an autocthon of Attica. Schmitz, p. 144.

‡ Did such a person ever live? *Id.*

§ Ruth, by whose marriage with Boaz was born Obed, from whom descended Jesse, father of David, the royal progenitor of the Messiah. White, p. 21.

‖ Ramayana. The poem so named narrates the advance southward of the Aryan invaders of India.

¶ B.C. 1122

** *i.e.*, till B.C. 249; it comprised 35 monarchs.

were severally brought at the date in question has persisted down to our own time. But notwithstanding the advances so made, it occupied one of the most distracted and calamitous periods in the annals of the Chinese empire, political and warlike troubles arising on the one hand from combinations among the feudal princes,* on the other from invasions threatened and actual by the Tartars, the rebellious wars continuing at intervals during the long period of five hundred years.† At length the turbulent potentates were reduced, but in the general condition of anarchy prevailing the reigning emperor at the time was defeated at the head of his army by the Tartars, who "growing more daring by repeated successes, and profiting by the internal divisions of the country, no longer confined their inroads to sudden invasions, but carried on a regular war of plunder against the defenceless Chinese."‡ Finally, the thirty-fifth emperor§ under the irresistible pressure of events abdicated, and retired into private life. With him the dynasty came to an end.

Among the more important events connected with the Chow dynasty, the following are selected in chronological order, namely :—A colony of Chinese took possession of Corea.‖ Sea-going ships were constructed; long voyages, even across the Indian Ocean, and as far as to Egypt, undertaken.¶ Metal money brought into use, such as continues current at the present day,** *i.e., cash.* Palaces and numerous public buildings erected.†† At a later date‡‡ mining for copper is for the first time mentioned, and also the coining therefrom of money. The use of family names was introduced during the same period.§§

With regard to the general conditions of the people, very little transpires in available literature. That little indicates that they were partial to athletic exercises, and to games, some of the latter requiring great mental calculation. Luxury had increased among them; they rode on horses, sat on chairs,

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* See Gutslaff's *Hist. of China*, vol. i, p. 202.
† Read *Historical Account of China*, by Hugh Murray, 1836, vol. i, p. 59.
‡ *China opened*, by Gutslaff, 1838, vol. i, p. 315.
§ Chwang-seang-wang, B.C. 245. He reigned one year only.
‖ Sent by Wu Wang, founder of the dynasty, B.C. 1122–1115.
¶ B.C. 1113. (Pauthier, p. 85.) See Note 3.
** B.C. 1115–1078. See Du Halde, vol. i, p. 331.
†† B.C. 1001–946. ‡‡ Namely, B.C. 571–519.
§§ In England the use of surnames dates from 12th century A.D.

partook of meals served on tables, made use of bath tubs; as parts of their costume wore shoes and stockings, and as a beverage drank the infusion of a leaf supposed to have been tea.

Literature had made great advances, universities were established; the *Peking Gazette* published for the first time B.C. 911. A system of land division and tenure was promulgated*; a legal code, extreme in its severity, laid down. Rules were drawn up relating to composition and rhythm in poetry; the *Sheking*, a book of Odes, published. A mode of writing designated "The Great Seal Characters," was invented, the object being to establish a recognised centre of unity between feudatory tribes whose language or dialects differed widely among themselves.

Astronomical science was zealously cultivated, and had made considerable advances; an observatory was established, and a work on mathematics published. Time was measured by means of the sun-dial, the science of navigation understood, an instrument of the nature of the mariner's compass used at sea, as it had already been on journeys on land.†

Agriculture and horticulture were progressing towards the conditions in which through many centuries they have continued to be sources of wonder, admiration, and often of imitation throughout the western world.

Many works, believed by their authors systematic, had already been written on curative medicine; a college was established at Peking for its cultivation. As examples of "science" pertaining to the healing art which had come down from distant times previous to this dynasty, and was then gravely taught, the two following must here suffice; "There are two natural principles of life, the *yang* or vital heat, the *yin* or radical moisture, of which the spirits and the blood are the vehicles. As out of these two names they have made that of man, called *jin*, so by joining together the strokes which compose these two words they have formed the character or figure which stands for the name of man, so the separation of these two strokes destroys the figure of the name of man, so the division of these two principles destroys the life of man."‡

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* B.C. 544–519.

† See *China*, by H. Murray, 1836, vol. iii.

‡ *Du Halde*, vol. ii, p. 183.

According to what may be called the musical theory of pathology, the body, by means of the nerves, muscles, veins, and arteries, is like a kind of lute or musical instrument, the different parts of which emit various sounds, proper for each, and suited to their figure, situation, and particular uses, and that its different pulses, which resemble the different tones and notes of those instruments, enable one to judge infallibly of their situation and state in the same manner as a cord more or less tense touched in one place or in another, in a stronger or gentler manner, sends forth different sounds, and discovers whether it be too much stretched or too much relaxed.*

Under the reign of the twenty-third emperor of this line,† Confucius was born (B.C. 552) of whom let it suffice here to say that in a vicious age he desired to teach the people and their rulers "the art" of becoming virtuous, and the principles of good government, with the result to himself that he became an object of scorn to many, who hated his rigid principles, puritanic as they would be called in our own advanced and progressive day.

Contemporary with, but senior to him, was Laotze,‡ the primary object of whose teaching was to refine human nature, and so lead it to the utmost perfection. But it is said of him that he was too abstruse, and moreover, so wedded to this mortal life that he endeavoured to find out the liquor which confers immortality. Nor has he been without his proselytes to that extent even within very modern times.

Mencius also belongs to this period.§ In his teachings he condemned self-interest and war, inculcated care of the aged and the poor. "He feared lest a system of general philanthropy should do away with innate love of kindred." He declared that "the bent of the human mind towards virtue is as strong as the law of *gravitation*,"‖ the expression so employed by the Chinese philosopher preceding the

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* *Description of China*, by Abbé Grosier, vol. ii, p. 481.

† Ling Wang, who ascended the throne B.C. 570. See *Sketch of Chinese History*, Gutslaff, vol. i, p. 189 *et seq.* Contemporary with Ling Wang was the era of Craesus, Solon and Æsop.

‡ *Id.*, p. 201. The date of birth of Laotze is said to have been 14th August, 604 B.C. Herodotus, born B.C. 484; died B.C. 413.

§ To the reign of Li Wang, 31st emperor, B.C. 375–368.

‖ *Chinese History*, by Gutslaff, vol. i, 208. See Note 4.

period in which Newton* lived by upwards of two thousand years.

A fourth philosopher may be alluded to as pertaining to this dynasty Chwang Tsei† argued that "if all laws were abrogated crime would cease; if weights and measures were abolished the people would not cheat each other in the exchange of commodities." His doctrines found but few supporters, and speedily fell into disrepute.

The summary of events contemporary with the Chow dynasty‡ in China, recorded in history relating to other civilised countries of the then known world which is now to follow, must be even more brief, and it is feared, even more imperfect than have been the remarks already made. Suffice it to observe that the particulars to be given may serve as a framework, to be filled in according to available pursuits and studies of those to whom the present remarks are with much respect and deference submitted.§

1. With regard to scripture records the period under consideration includes the whole history of the Israelites from the date of Saul their first king; their division into the kingdoms of Israel and of Judah,‖ and finally the conquest (B.C. 721) of the former by Salmanasar the Assyrian; the latter with the capture of Jerusalem by Nebuchadnezzar, the Babylonian captivity; the capture of Babylon by Cyrus. It comprises the period of all the prophets, from Samuel to Malachi, down to the conclusion of Old Testament history.¶

2. *Chaldea and Assyria.*—The Chow dynasty was in the fourth century of its existence when (B.C. 747) the second Assyrian empire was established by Pul,** whether a legitimate ruler or an adventurer matters not for the purpose of this paper. In 747, Tiglath Pileser III, as Pul seems also to have been called, invaded Palestine, destroyed the city of Damascus, and carried its inhabitants to his own states. On his death, B.C. 728, he was succeeded by his son Shalmaneser, and he, about B.C. 714, by Sennacherib, the son

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* Newton, born December, 1642; died March, 1727.

† B.C. 330. Contemporary with him was Euclid, B.C. 374-300. See *Life of Mensius*, by Professor Legge, p. 51.

‡ *I.e.*, as already stated, B.C. 1122 to B.C. 255 = 867 years.

§ They are given in greater detail in the Appendix.

‖ Israel = ten tribes; Judah two, namely, Judah and Benjamin.

¶ See Williams, vol. ii, p. 159.

** *Assyria.* Professor Sayce. *Records of the Past*, vol. v, 115.

of Sargon of Isaiah,* who having invaded Judea, lost in one night 185,000 of his troops before Jerusalem from pestilence.

B.C. 604 till 561 included the period of Nebuchadnezzar's reign. On three different occasions he laid siege to and captured Jerusalem, on the last, carrying many of its illustrious men, among them Daniel, as captives to Babylon (Jerem. xxiv, 8; xxvii, 12; Ezek. xii, 13). Twenty-three years after the death of Nebuchadnezzar, Babylon was taken by Cyrus, by whose decree, B.C. 536, the Jewish captivity came to an end. Five years thereafter, Babylon, together with its vast treasure, fell to Alexander, B.C. 331; its empire and power were ended. But the great Chinese dynasty of Chow had still seventy years of its course to run.

3. *Egypt.*—The Egyptian dynasties from and including the 21st to the 31st,† with which ended the line by conquest of the country by Alexander, rose and passed away, while this, the third dynasty of China, held sway. The power of Ethiopia came and went; the invasion by Sennacherib of Egypt B.C. 712, Phœnicia, Judah, and neighbouring countries took place; Pharaoh Necho instituted many public works, including an attempt at a maritime canal ninety-six miles long and the completion of various other canals; his ships manned by Phœnician sailors circumnavigated Africa; Apries conquered Phœnicia and a portion of Egypt,‡ a Persian province under Cambyses; his failure against the Ethiopians or Soudanese; the destruction of an army (527) sent by him towards the oasis of Ammon;§ afterwards Egypt conquered by Alexander.‖

4. *Persia.*—The whole period of the Persian empire from its foundation by Cyrus to its end by defeat by Alexander of Darius III at Issus, B.C. 333, and Gaugamela, B.C. 331, comes within that of the third Chinese dynasty.

5. *Media.*—Also from the early period of subjugation of Media by the Assyrians to the date when five hundred years thereafter it recovered its independence, and had its own capital city¶ established, its subsequent combination

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* Isaiah, B.C. 786–696.

† Manetho's list.

‡ Presently invaded by Assyrians; subdued and divided into twelve provinces or Governments.

§ Ammon, his wife Mut, and son Chesiu form the divine triad of Thebes, No-Amon.

‖ For record of historical events, see *Ancient History*, by Schmitz.

¶ Ecbatana, near the modern Hamadan.

with Babylon, subjugation of the Assyrian Empire, and finally its union with Persia under Cyrus.

6. *Bactria.**—It includes the greater part of the history of Bactria, beginning about six centuries prior to the conquest of that kingdom by Cyrus, then by Alexander, and extending to within a century and a half of the time when it was subjugated by the Scythians.

7. *Phœnicia.*—For a thousand years, from the fourteenth to the fourth century B.C., a great and remarkable nation occupied the country so-called. Egypt, Judea, Syria, Babylon, Persia, Greece, Rome, came successively into contact with it and its inhabitants. The most prosperous era of its history from B.C. 1000 to 332. In the early years of that period vessels were being sent out therefrom, and navigation extended in various directions; down by the Red Sea to Arabia and, it is believed, Western India, supposed to have been alluded to under the name of Ophir; they circumnavigated Africa, discovered some of the islands along its coast, traded with the Cassiterides or Scilly islands for tin, and, it is believed, with the Baltic for amber.

The country was invaded and partially subdued by Shalmanasser, king of Assyria, against whom however New Tyre successfully withstood a siege of five years' duration. At a later period Nebuchadnezzar besieged the same city during thirteen years, also without result; he however sent many Phœnicians and Jews captive into his own kingdom. Soon thereafter Tyre as well as the rest of Phœnicia was forced to submit, and the country became a Persian satrapy. Once in the reign of Ochus, oppression drove the Phœnicians into rebellion, but the attempt failed, the noblest citizens were put to death; the inhabitants of Tyre set their city on fire, and burnt themselves and all their treasures. Finally Phœnicia being conquered by Alexander, its importance speedily passed away.

8. *Carthage.*—Three centuries after the Chow dynasty came to power, Carthage was founded by Eliza or Dido, sister of Pygmalion, king of Tyre, about B.C. 890. During the six centuries of the Chinese dynasty which were still to run, the Phœnician city rose to marvellous power, being formidable alike by land and sea; it extended commerce to distant regions, raised armies of mercenary troops, established a

* The modern Balkh.

navy, the models according to which the ships composing it were built being speedily adopted by Rome, its great rival. Then came a period of war for the possession of Sicily and of Sardinia. This republic became connected with the Persian monarchy, extended its colonies along the shores of the Atlantic, concluded a treaty with Rome, but the alliance with Xerxes in his attack upon Greece led to the rout and disgraceful peace of Himera. Various treaties were made with Rome. War against Sicily renewed and continued many years; Hamilcar defeated at Syracuse and died in captivity. Afterwards persistent wars against Rome culminating in the defeat of Appius Claudius in the very year in which the Chinese dynasty now being considered came to its end (B.C. 249).

9. *India.*—Nearly contemporary with the advent of the Chows in China, the Vedas* were arranged in their present form. Five or six centuries elapse, and India became subject to Persia. First, the Hindoos, departing from primeval simplicity of worship, made to themselves images; then long subsequently, became divided into castes. Then arose (B.C. 543) the reformer Gautama Buddha, against whose system of philosophy in subsequent years persecution prevailed. The customs of the Brahmins were reduced to definite form, described as the Code of Manu. Next, the imperial city of Delhi is founded, though five centuries after the most ancient Hindoo capital, Canouj,† had been established. The secession among the Buddhists‡ and their division into the northern and the southern sections took place, followed by the expedition of Alexander, arrested at the Jhelum (Hydaspes),§ and, lastly, the rule of Sandracottus, otherwise Chandragupta, King of Behar (Magadha), the capital of which was Palibothra the modern Patna.

10. *Greece.*—The war against Troy (B.C. 1194–1184) had ended sixty years before the advent of the Chow dynasty. Contemporary with that dynasty Greek colonies emigrated to Asia Minor. Olympic games were instituted; a constitu-

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* Vedas—the sacred hymns of the Hindoos. The *Rig Veda*, the great literary memorial of the early Aryan settlements in the Punjab.

† Canouj: in Furrukabad district.

‡ B.C. 377. The northern Buddhists, *i.e.*, those of Nepaul, Thibet, China, and Japan are the successors of the seceders. The southern Buddhists, *i.e.*, those of Ceylon, Burma, and Siam, represent the other side. See *Ancient India*, R. C. Dutt, p. 103.

§ B.C. 327.

tion and laws established; a Corinthian colony founded Syracuse; the Draconian system of laws promulgated at Athens; then abrogated by those of Solon. Among other important events were the invasion of Greece by the Persians; their defeat at Marathon, and death of Xerxes; the retreat of the ten thousand; the defeat of Darius at Issus by Alexander as already stated; and, lastly, the break up, B.C. 301,* of the empire founded by the last-named great conqueror.

11. *Rome.*—Four centuries after the third Chinese dynasty began Rome was founded. During the four centuries then to follow the events to be specially noted include the union of the Romans and the Sabines; the administration of Numa; the war against the Albans; the duel between the Horatii and Curatii and defeat of the latter; the war against, and overthrow of the Sabines; the expulsion of Tarquin; the proclamation of an aristocratic republic, B.C. 509; the capture of Rome by the Gauls under Brennus; the first Punic war; the formation of the Via Appia, and of canals through the Pontine marshes.

12. *Britain.*—Youngest of nations of antiquity becomes alluded to, and takes its place in history.

Such then, in brief, are some of the landmarks by which an attempt is made in this paper to indicate the position, in contemporary history within the periods mentioned, held by that of ancient China.†

NOTES.

Note 1, *page* 1.

The Deluge.—Various dates are assigned thereto, there being much difference of opinion as to its precise epoch. It is fixed by the learned author of *l'Art de vérifier les Dates* B.C. 3308; by the Septuagint text at B.C. 3246. Besides that given in the note here referred to, there are others, among them B.C. 2348 (*Helps to the Study of the Bible*) and B.C. 2400 (Schmitz's *Ancient History*). All these have only an approximate value, and in so far as they are now referred to, that is the sense assigned to them. On this subject, in relation to Chinese Chronology, see Du Halde, vol. i,

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* As a result of the battle of Ipsus in Phrygia. See *Ancient History*, by Schmitz, p. 340.

† See Note 5.

pp. 130–135; also the paper by Professor Legge read before the Victoria Institute.

Note 2, *page* 6 (*Egypt*).

Thebes.—Supposed to have been established about B.C. 4400, by Menes. During the early dynasties no mention is made of it, but B.C. 2500–2466 it became the capital city of Egypt.*

Heliopolis.—The obelisk of, set up by Usertsen I about B.C. 2433.†

Memphis.—Supposed to have been established by Menes as above; but the point is conjectural.

Nilometer; Canals.—B.C. 2300–2266. In the reign of Amenemhat III, sixth monarch of the XII Dynasty, special attention was paid to the rise of the Nile, canals made of length and breadth proportioned to the different situations and wants of the lands, and sluices made for irrigating the country. The rise of the Nile was marked on the rocks at Semneh about thirty miles above the second cataract.‡ The early kings had placed at Memphis a Nilometer. Strabo speaks of a well on the banks of the Nile near the town of Syene made for that purpose. At the present day there is a Nilometer at Cairo, namely, on the island of Rodda, but it is of comparatively modern date, having been erected by the Kaliph Suliman A.D. 715–717. In the days of the early Roman emperors, dating from B.C. 27, there was a Nilometer on the island of Elephanta; but in consequence of the rise of the river bed, the high scale of that instrument is now below the level of the ordinary high Nile. A Nilometer also exists on the island of Philae.§

Lake Moeris.—Constructed under the same reign as the Nilometer. Its extent, about one hundred and eighty French leagues, and three hundred feet deep. It had a communication with the Nile by a great canal more than four leagues long and fifty feet broad.‖

The Labyrinth.—Stood on the shore of Lake Moeris. Also erected at the same date as that in which that lake was constructed.

Pyramids.—B.C. 3733–3333. Those of Ghizeh and Sakkara raised.

Note 3, *page* 18.

Communication with Western Nations.—In or about B.C. 1113 an embassy from Egypt is said to have arrived at the court of Ching Wang, they having made their journey in "a floating

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* Ezek. xxx, 14; Nahum iii, 8.
† Gen. xli, 45; Jerem. xliii, 13.
‡ Rollin, vol. i, p. 13.
§ *The Nile.* E. A. Wallis Budge
‖ Rollin, vol. i, p. 9.

habitation"; Pauthier, p. 85. About B.C. 1001 allusion is made to a voyage having been undertaken by Chinese to a country described under the name of *Si-Wang*, believed to have been either Persia or Syria; that a queen of the former country visited China, carrying presents to the emperor Mou Wang (B.C. 1000–945); also that he himself visited some Western nations, but whether India, Chaldea, or Persia is uncertain, *id.*, p. 94.

Note 4, *page* 20.

Mencius.—He believed that in man nature is originally good; that all men are naturally virtuous, as *all water flows downward;* all men have compassionate hearts, all feel ashamed of vice; shame is of great moment to men, it is only the designing and artful that find no use for shame; human nature must be tried by suffering, and to form an energetic and virtuous character a man must endure much. *Middle Kingdom*, Williams, vol. i, p. 671; also *Life and Work of Mencius* by Professor Legge, D.D., p. 58.

Note 5 (*General*), *page* 24.

Historical dates given in the text of the preceding "Fragment," more particularly those referring to the more distant periods, must be looked upon as tentative and conditional. Discrepancies with regard to several of them exist in works referred to; nor has it been practicable in the text to enter upon a critical analysis of data in accordance with which those discrepancies have come about. The Rev. R. Cooper has kindly revised and commented upon the paper as originally drafted, and is hereby thanked for the trouble he has been so good as to take in so adding to it the results of his own technical knowledge. As the outcome of his revision certain additions to footnotes and others are made in the hope of thereby enhancing whatever value may be assigned to the "Fragment of Comparative History" now given.

APPENDIX.

CHOW DYNASTY.

Contemporary Chronology.

B.C. 1122–255.

1. *Scripture events.*

B.C.

1117–16. Death of Samson; apparently the original of Hercules, Rustum, and Antar. Samuel the first of the prophets; the twelfth and last judge of Israel.
1096. Saul made first king of the Israelites; anointed by Samuel.
1085. David born.
1063. He slays Goliath; defeat of the Philistines.
1048. Jerusalem captured by David from the Jebusites, and made the seat of his kingdom.
1033–975. Rich trade with Ophir and Tarshish, Egypt, India, Persia, Arabia.
1015. Death of David. Solomon began to reign.
975. Revolt of the ten tribes; division of the kingdom into Judah and Israel. A system of direct taxation imposed.
972. Shishak invades Judea and plunders Jerusalem.
941. Zerah, the Ethiopian, with 1,000,000 men, totally defeated by King Asa in the valley of Zephathah.
895. Judah invaded by an army of Moabites, Edomites and Arabians. At Engedi dissension arose among them, and they turned their arms against each other.
825. The prophets Jonah, Hosea and Amos flourished.
810–771. Story of Azariah, struck with leprosy.
807. Ahab killed by the Syrians in the battle of Ramoth Gilead.
806. Jonah preached to Nineveh; Pul being king at the time.
804. Damascus captured by the Assyrians.
787–778. Amos, Hosea, Isaiah, Habbakuk prophesied.
730–721. Samaria subdued by Shalmaneser; an end put to the kingdom of Israel. The ten tribes sent into Media, being replaced by Medians and Assyrians, subsequently called Samaritans.
717. Tyre besieged in vain for about five years by Shalamaneser, king of Assyria.
710. Sennacherib appeared for the third time with an army before Jerusalem; 185,000 of his troops perished by pestilence in one night.
677. Manasseh, king of Judah, taken prisoner and carried in chains to Babylon.
629–625. Zephaniah–Jeremiah.

B.C.
617–608. Wars of Pharaoh Necho against Josiah, king of Judah.
587. Jerusalem captured by Nebuchadnezzar after a siege of eight months. Commencement of the captivity which lasted till B.C. 538. Jer. xxiv, 8; xxxvii, 12; Ezek. xii, 13.
582. Daniel in Babylon, Ezekiel in Chaldea.
569. Nebuchadnezzar's golden image. Capture of Babylon by Cyrus. Belshazzar's feast and death. Is. xlvii, 12, 13; Dan. v, 1–29.
538. Cyrus, after conquering Babylon, allows the Jews to return to their own country.
538–322. All Palestine subject to Persia.
520. Building of the second temple.
458. Ezra. Nehemiah.
440–430. The walls of Jerusalem built by Nehemiah.
Malachi, the last of the prophets.
The history of the Old Testament finishes about this time.
332. Alexander the Great at Jerusalem, to whom Palestine is subject until his death B.C. 323.
323–301. Palestine subject to Syria.
301–203. Palestine subject to Egypt.

2. *Chaldea. Assyria.*

1120. Tiglath Pileser I. established in Nineveh a kind of botanical garden which he filled with strange plants brought from his campaigns.
1230. Ninus, founder of the Assyrian empire, and of Nineveh, with the aid of Semiramis took Bactria.
911–889. The armies of Rimmon-nirari overran Western Asia.
883–858. Those of Assur-natsirpal repeated that invasion; impalements, and pyramids of skulls marked his track.
854. Campaign of Shalmaneser II against the tribes of Kurdistan; his destruction of a confederacy including Ahab of Israel at Karkar.
841. Defeat by Shalmaneser of Hazael, king of Damascus.
834. Revolt of twenty-seven cities, including Nineveh and Assur, put down by his son Samas Rimmon, who succeeded him on the throne B.C. 823–818.
810–781. Rimmon-nirari III compelled Damascus, Phœnicia, Israelites, Elamites and Philistines to pay him tribute.
763. Revolt in the city of Assur, which lasted three years.
753. Assur-nirari, the last of his line, ascended the throne. Ten years later the army declared itself against him, and he and his dynasty fell together.
747–5. Second Assyrian empire established by Tiglath Pileser III, whom the Babylonians called Pul. He endeavoured to unite Babylonia with Assyria; to overthrow the Hittites of Carchemish, and to render Syria and Phœnicia

B.C.

tributary; the northern part of Babylonia was annexed to Assyria; conquest carried through Kurdistan and Media.*

742–732. The siege of Arpad (Tel Erfâd) the fall of which (B.C. 740) rendered Pul master of Northern Syria (2 Kings xv, 19). Damascus captured; its inhabitants transported to Kir. Tyre fined £400,000 (2 Kings xvi, 10).

731–727. Babylon and other great cities of Chaldea taken by Pul, who in 729 assumed the title of King of Sumer (Shinar), and Accad. In 727 he died, and then the crown was seized by Shalamaneser IV, called by the Babylonians Ululâa or Elulæus.

722–717. Shalamaneser died, and was succeeded by Sargon, another usurper. Samaria subdued and placed under Assyrian government. Babylon, Elam, Kurdistan and Carchemish rebel against Sargon, but are subdued and an Egyptian army defeated by him.

711–700. Capture of Ashdod by Sargon (Is. xx, 1). He overran Phœnicia and Judah; captured Babylon; Merodach Baladan driven therefrom. Murdered, his son Sennacherib succeeding him. The latter marched into Phœnicia and Palestine; his armies overthrown before Jerusalem.

694. By means of a fleet manned by Phœnicians he destroyed the settlements of Merodach Baladan and his followers at the mouth of the Eulaeus.

690. The combined Babylonian and Elamite power overthrown by Sennacherib, who, entering Babylon, gave it up to fire and sword. Subsequently he constructed various canals, aqueducts, and embankments.

681. He was murdered by his two elder sons. Esarhaddon, the younger son, defeated the forces of the two elder, and was proclaimed king. He subsequently rebuilt Babylon, residing alternately there and at Nineveh. His forces penetrated 280 miles into the desert of Northern Africa.

675–647. Esarhaddon invaded Egypt, captured Memphis, and subdued the country, which he divided into twenty satrapies. In B.C. 667 he died, and was succeeded by his eldest son Assur-bani-pal, *i.e.*, Sardanapalus. His brother Samas-sum-ukîn, who was under-king of Babylon, was leader of a rebellion in B.C. 652; Babylonia, Egypt, and Palestine, as well as other nations, made cause

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* *Assyria.* Professor Sayce, p. 35, *et seq.* A great part of the data in this section are taken from that learned work.

B.C.

against the common oppressor. Babylon was reduced by famine; Samas-sum-ukîn immolated himself.

625–606. Nineveh destroyed by a combined Babylonian and Median army; the latter under Cyaxares.

604–561. Nebuchadnezzar captures Jerusalem, and led the Jews captive to Babylon.

538.* Under its last king, Nabonidus, Babylon is captured by Cyrus. Jewish captivity ended. Dan. v.

516. Revolt of Babylon; but reconquered by the Persians.

331. As a result of the battle of Gaugamela, Babylon and its territory became subject to Alexander.

268. Berossus, the Chaldean historian, flourished.

3. *Egypt.*

978–71. The twenty-second dynasty or Bubastides began (?)

971–966. Shishak or Sesonchis marched against Jerusalem and plundered that city.†

941. Zera, king of Ethiopia (and of Egypt) marched against Asa, king of Judah, but was defeated by the latter.

770. Under Sabachus the Ethiopians rose to great power, and took possession of that country.

720–710. The twenty-fifth or Ethiopian dynasty under Sabachus or So, flourished.

719–712. Sethos, a priest of Hephaestus, usurped the sovereignty; he neglected and slighted his army, so that on the occasion of Egypt being invaded by Sennacherib the soldiers refused to fight against the latter; but with suddenly raised volunteers he obtained victory at Pelusium over the invaders. (2 Kings, chap. xix.)

700–670. After two years of anarchy the Dodekarchy was established, the kings composing it having been elected by the people. To these twelve rulers has been assigned the building of the Labyrinth, near Lake Moeris, to serve as their common place of burial. Wars among themselves were followed (B.C. 656) by the accession of Psammetichus of 26th dynasty as ruler over all Egypt. Historical uncertainty now ended; writing came into use; hieroglyphics were gradually forgotten.

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* *Ancient History*, Schmitz, p. 600. Babylon captured B.C. 538, the Jews being permitted to return. In B.C. 536 the Decree on the subject was issued. See also *Helps to the Study of the Bible.*

† 1 Kings xiv, 25–28. 2 Chron. xii, 2–13. Dates differ by authorities referred to.

B.C.

616. Nechao, or Pharaoh Necho, attempted to connect the Nile and Red Sea (at Suez) by means of a navigable canal. The work was abandoned after 120,000 workmen had died on it.

In 608 he defeated Josiah at Megiddo and took Jerusalem. In 604 he was himself defeated by Nebuchadnezzar at Carchemish Circesium. He caused ships to be built both on the Mediterranean and Red Sea. His ships, navigated and manned by Phœnican sailors, having sailed from the Arabian Gulf, rounded Africa, returning to Egypt *viâ* Mediterranean.

594. Apries, or Pharaoh Hophra, sent an expedition against Cyprus, besieged the city of Sidon, and made himself for a short time ruler of nearly all Phœnicia and Palestine. Ezekie'ls prophecies against, xxix, 3; xvii, 15; xxx, 1–3. His subjects revolted against him, and offered the crown to Amasis, who was popular alike with the people and the army. The king retired to Upper Egypt, where for a time he maintained his power while the usurper was acknowledged by the rest of the country. Nebuchadnezzar availing himself of the state of civil war, invaded and devastated Egypt, defeated Apries, who was strangled by order of the conqueror.

570-526. Amasis conferred considerable privileges on the Greeks. In his reign Egypt enjoyed a prosperity greater than it had done under any of its native rulers. When he died the Persians were about to invade Egypt.

526. Psammenitus. His army pursued to Memphis by Cambyses, defeated, and thus Egypt overcome. An army sent by Cambyses against the Ethiopians (Soudanese), perished in the desert. Various revolts against the invaders took place, the first in B.C. 487, in the reign of Darius Hystaspes; but in B.C. 484 it was suppressed by his successor Xerxes; a second which lasted from B.C. 460 till B.C. 453, also proved unsuccessful. From circumstances not known, Egypt for a short time regained its independence under Amyrtaeus, the only king of the twenty-eighth dynasty. The last revolt occurred in about B.C. 358, but in B.C. 350 the country was reconquered by the Persians. Thenceforward Egypt remains during 286 years a portion of Persian dominions till—

332. When it is conquered by Alexander the Great.

287. Ptolemy Philadelphus began to repair the fresh-water canal made by Necho. Egypt powerful—famous for its flax.

284–246. Under Ptolemy II, Philadelphus Manetho, an Egyptian high priest and keeper of the sacred archives of Egypt,

B.C.

was ordered to transcribe into Greek the historical records contained in the Egyptian temples; the Greek version of the Old Testament (Septuagint) to be made.

4. *Persia.*

586–546. Period of Hystaspes.
559–531. Persian monarchy founded by Cyrus.
538. Cyrus conquers Babylon.
530–526. Cambyses succeeds Cyrus. He conquers Egypt.
521–486. Darius, son of Hystaspes, is king.
498. Persians again masters of all Asia Minor.
490. Persians defeated at Marathon.
485–465. Xerxes.
480. Is defeated at Artemesium and Salamis.
479. His general Mardonius defeated at Platæa, and on same day Persians defeated at Mycala.
334. The Persians defeated by Alexander on the Granicus.
333. Battle of Issus.
331. Battle of Gaugamela. End of the Persian empire under Darius III.

5. *Media.*

1230. First mentioned in history. Subdued by the Assyrians, under whom it continued 500 years.
713. Threw off the yoke of Assyria.
709–656. Under Deioces their king, the Medians founded Ecbatana (Hamadan).
656–634. Phraortes made war against the Assyrian empire; he was killed in battle.
634–594. Cyaxares reigned. Media invaded by Scythians. After twenty-eight years of subjection to them they were expelled. He allied himself with Nabopalassar, king of Babylon, and so captured Nineveh and subdued the Assyrian empire, extending conquest to Persia and Bactria.
559. Cyrus usurped the throne of Media, and so became founder of the Persian empire, of which it became a province.

6. *Bactria.*

1230. Ninus, the Assyrian, marched an army into Bactria and took the country. (According to the Greeks.)
1000. Period of Zoroaster.
540. Submitted to Cyrus. One of his sons was appointed satrap. Thenceforward it was part of the Persian empire.
328. Alexander conquered Bactria with other parts of Persia.

B .C.
256. The governor, Antiochus Theus, threw off the yoke of Alexander's successors, and proclaimed himself independent king of Bactria.
100. The overthrow of the Bactrian kingdom by the Scythians.

7. *Phœnicia.*

1255. About this period Tyre founded. Josh. xix, 29. The date of Sidon is lost in antiquity.
1100–800. Colonies from Tyre founded Gades (Cadiz), Corcyra, Carthage, and Utica, traded with Cassiterides (Scilly Islands); and Cornwall.
870–727. Tribute paid by Phœnicia to Assyria.
730–725. Shalamaneser IV, king of Assyria, invaded Phœnicia, but failed to subdue it.
720. Sennacherib captured various cities; he appointed Assyrian governors over Phœnicia, but did not annex it.
681. Phœnicia rebelled; the rebellion suppressed by Esarhaddon, king of Assyria.
672–668. The tributary king Baal rebelled against Esarhaddon, and became feudatory of Egypt under Tirhakah. In the latter year, together with twenty-one other kings, he submitted to Esarhaddon.
664. Another expedition sent by Assurbanipal against Tyre and other Phœnician cities, in which rebellions had arisen against Assyrian tyranny.
640–630. Phœnicia took decisive steps to cast off the Assyrian yoke, the latter power being moribund. Ezek. xxxviii, 2–7. In the latter year Phœnician independence was declared.
630–585. Its independence continued, and great prosperity attained. Ezek. xxvii. Meanwhile, for a short time it was tributary to Egypt.
605–595. Tyre besieged by Nebuchadnezzar; Phœnicia accepted suzerainty of Babylon.
585. Tyre surrendered upon terms. Line of Phœnician kings ended.
540. Phœnicia submits to Persia.
532. Western Asia, including Phœnicia, passed from Assyria to Persia.
332. Tyre taken and destroyed by Alexander. From that time the importance of Phœnicia decayed.*

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* *Story of the Nations. Phœnicia.*

8. *Carthage.*

B.C.

819–814. Carthage founded by Dido, a Tyrian princess.
550–480. Established colonies in Sicily, Sardinia, and Africa. Had become formidable at sea and on land.
546–533. Carthage declared a free republic; formidable alike by land and sea. Contest with the Syracusans for Sicily.
509. First commercial treaty with Rome when the latter had become a republic. Carthage commerce extended to Balearic Isles, Egypt, Britain, and coast of Guinea.
480. The fleet defeated at Himera by the Greeks.
410. War renewed in Sicily.
348. A second commercial treaty with Rome.
310. Carthage invaded by Agathocles.
306. The ancient commercial treaty with Rome renewed for the second time.
281. Mercenaries revolt and take possession of Messina.
279. Carthage and Rome form a defensive alliance against Pyrrhus.
264–241. First war of Carthage against Rome.
264. Hiero concludes peace with Rome.
262. Carthaginians in Agrigentum besieged by the Romans. Roman ships built after Carthaginian models.
260. Roman fleet under Duilius defeated Carthaginians off Mylae.
258–255. Various other defeats of Carthaginians by the Romans, at sea and on land. In the latter year, the Carthaginian army commanded by Xanthippus of Sparta, routed the Roman forces under Regulus.
241. Sicily evacuated by the Carthaginians; it becomes the first Roman province.

9. *India.*

1100. The Vedas arranged in their present form.
1000. Image worship by Hindoos began. The city of Canouj built.
600. India tributary to Persia.
559–480. The system of caste introduced among Hindoos.
558–478 (as also 623). Assigned era of Gautama Buddha.
512. Darius subdued the country of the Indus. India became the 20th province of the Persian empire, with the Indus as its frontier.
500. Menu's code originally arranged.
400. Delhi founded.

B.C.

377. A schism among the Buddhists. The northern Buddhists of Nepaul, Thibet, China, and Japan, are the successors of the seceders; those of the southern division, namely, Ceylon, and Burmah, represent the other side.
357. Asoka ruled in Behar.
327. Alexander's expedition.
323. At Taxila (Rawul Pindee) a colony of Scythians founded.
312–306. Chaudragupta, *i.e.*, Sandracottus, repelled a Scythian invasion of India.

10. *Greece.*

1184. Greek war against Troy.
1068. The first great Ionian emigration took place, led by Neleus.
1044. Further migration of Greek colonies to Asia Minor.
1000. Grecian states became gradually formed into city republics.
900–800. Age of Homer and Hesiod.
884. Olympic games instituted, or revived, by Iphitus and Lycurgus.
880. Lycurgus, the first legislator in continental Greece, established the constitution of Sparta.
814. Kingdom of Macedon founded by Caranus, a descendant of Hercules.
743. The first Messenian war began. It continued nineteen years.
732. Syracuse founded by a colony from Corinth.
682. The second Messenian war began. It lasted fourteen years.
623. Draco furnished the Athenians with a code of laws, the severity of which led to his own flight from that city.
594. Salamis recovered by the Athenians. Legislation of Solon.
570. Pythagoras, the philosopher.
562. Solon, Pisistratus, Lycurgus.
548. Thales of Miletus established the Ionian school of philosophy.*
535. Tragedy first performed in Athens by Thespis.
531. Pisistratus established in Athens a public library and public garden.
490. Invasion of Europe by Persians, and battle of Marathon.
480. Xerxes invaded Europe. Battles of Thermopylæ, Artemesium, and Salamis.
479–473. Socrates, Sophocles, Euripides, Aristophanes.
440–430. Thucydides, Aristophanes, Hippocrates.

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* He maintained that water or some liquid was the origin of all things. That there was one supreme mind distinct from the visible world, to which it imparted form and motion.

B.C.
434. Peloponnesian war.
430. The great plague at Athens.
414–413. Siege of Syracuse; defeat of the Athenians.
404–401. Capture of Athens by Lysander. Battle of Cunaxa. Retreat of the ten thousand.
355. Birth of Alexander the Great.
335. He invades Persia.
332. Tyre taken and Egypt subdued.
327. Alexander invades India.
306. Naval battle of Salamis in Cyprus.
301. The battle of Ipsus, which led to the break up of the empire founded by Alexander.

11. *Rome.*

753. Rome founded.
746. Rhegium founded.
665. War against Alba. Duel between Horatii and Curiatii.
509. Tarquinius driven from Rome; regal power abolished; an aristocratic republic established. First treaty between Rome and Carthage.
390. Rome taken by the Gauls.
304. Via Appia, aqueduct, and canals through Pontine marshes begun.

12. *Britain.*

1100. About this time Phœnicians traded with the Scilly Islands and with Cornwall.
484. Britain mentioned by Herodotus.
480. Mentioned in relation to Carthaginian vessels sent for tin.

The CHAIRMAN (Professor E. HULL, LL.D., F.R.S.).—I am sure you have already expressed, by your applause, the gratification you have had in listening to this very interesting communication, which shows us through what a vast and interesting period of time these wonderful people and their historic record can be traced back. I will invite discussion thereon after some communications have been read.

Captain F. PETRIE, F.G.S. (Hon. Secretary).—The first letter is from the President, who greatly regrets that he is detained at Cambridge and is therefore unable to be present.

The second is from the Rev. Dr. Legge (Professor of Chinese at Oxford), who says :—

"Many thanks for the proof copy of the interesting paper on 'China's place in Ancient History.' I wish it were in my power to be present on Monday, but I am suffering from a persistent cold, which has kept me for several weeks almost entirely indoors. May I ask you to say to Surgeon-General Gordon how sorry I am not to be able to be present, to hear him read the paper."

The third is a letter from a student of ancient history. He says:—

"In regard to this paper I would venture to remark that the mention of the law of Gravitation by Mencius 500 years B.C., and 2,000 years before Newton, may not necessarily imply that Newton's theory of gravitation had been anticipated by Mencius."

A MEMBER.—It may interest some present if the author will kindly give a sketch as to in what form and how the records referring to the early portion of Chinese history have been conveyed to us? Research is showing this in a special manner as regards the Babylonian and Egyptian records.

A VISITOR asked if there were many ancient records referring to Chinese intercourse with other nations.

The AUTHOR.—Of course a paper on so large a subject as mine must be but a summary and entirely tentative. The difficulties I had in arranging and formulating such data as I have given, I think will be understood by all scholars. One speaker asked as to how the ancient records were preserved. An account of that is given by many writers on China—first and foremost by our respected friend, Dr. Legge. The earliest form of Chinese writing is described as that of the "tadpole" character; the first idea of "writing" assigned to Fohi, who conceived it from observing the markings on the shell of a tortoise. About the time of Confucius, it appears that the records

of China extended to something like, if I remember rightly, 30,000 volumes. A short time before the date of Confucius, an Emperor came to the throne, who like a certain Egyptian monarch, desired it to be understood that history should begin with him; he gave stringent orders that all the existing records should be burned, and that all scribes and literary men should be put to death. I am speaking from memory; but many hundreds of the *literati* were put to death, and wherever any literature could be laid hold of it was burnt; but there were in China many men, as amongst ourselves, partial to literature and historic records. According to history, fragments and portions of old books in the possession of private individuals, were secretly preserved—many of them by being built up in the walls of houses and thus preserved for some centuries; when Confucius lived, and for some time after him, these records or fragments were got possession of, and from them the history of China was reconstructed. I believe that the treatises on the subject so conveyed to us were reconstructed with very great perfection. The whole story of the books which perished is related by Du Halde in his *History of China*, also by Gutzlaff in his history, and these authors also give the particulars under which the records of China were preserved and the history of this wonderful people reconstructed.

It seems to be a very suggestive circumstance, that dealing as Chinese historians have with Chinese history, through such enormously distant periods, how wonderfully reliable it is as compared with the history of other nations. There is less doubt—and in fact no difference of opinion among authorities on Chinese history that I have consulted. As regards Du Halde, Gutzlaff and others—Pauthier particularly—there is an absence of all difference in their statements, with regard to historical events in China. Certainly amongst authorities on history in connection with Western countries, including Egypt, Babylonia, and Assyria, there is no such clear concord; the more we enquire into these histories the more numerous are the great differences we see; but as I have stated, one intention of my paper is to bring about a re-study or re-comparison of the data, by the great authorities, and if in any way it has this effect, I shall be very well satisfied.

A visitor asked a question as to China's intercourse with other nations. I think I mentioned that about 1113 years B.C. the

navigation of the Chinese is considered to have extended as far as Egypt. If it extended to Egypt we may assume, I think, with good ground, that it included the countries between Egypt and China, that is to say, India and so on. When communication between China and the Western nations began has been the subject of a very interesting and learned work recently published. As evidences of this intercommunication it has been alleged that a great many of the silks used by the ladies of ancient Rome were imported from China; and we lately had a specimen of a small jar or bottle with a Chinese inscription which had been found with an Egyptian mummy. As to the letter asking about the word "gravitation," those who desire to see what I have stated are referred to Gutzlaff's *History of China*, vol. 1, page 208. It is simply the word that is there made use of. Gutzlaff does not discuss the application of the word though he italicises it. So far as I know, that is the first occasion on which the word itself has been used in literature.

May I conclude these remarks by mentioning a statement alleged to be historical that may be of interest to others. I daresay those who know it will bear me out in what I say.—It is related that about 600 years after the Christian era, the then reigning Emperor of China heard that there was a new religion of extreme excellence in the far west. Accordingly, an embassy was sent to the west in search of this new religion, which the then Emperor expressed a desire to introduce into his dominions. The embassy proceeded to its task, and having arrived in India they found the persecution of the Buddhists by the Brahmins was in full force. On being questioned the persecuted Buddhists were only too glad to say that they were the representatives of the new religion; indeed, as compared with the Hinduism, they are, and to put it briefly, the story is that these missionaries who were sent to the west in search of what we have every reason to believe was Christianity, returned to China in a sort of triumph carrying with them the Buddhist priests. It is an interesting speculation what China might have been to-day, if Christianity had been taken back, as we may believe was intended, instead of Buddhism.

Captain F. PETRIE, F.G.S. (Hon. Sec.).—The question of intercourse among nations in early times has been referred to, and the Chinese seem to have borne their part in such intercourse. I may

mention that in his work, *Western Origin of the Early Chinese Civilization*, by the late Professor Terrien de Lacouperie, that author refers to having discovered that, during the Chow dynasty, China had a trade to India from two ports on the Shantung promontory. As regards the efforts made at such intercourse by more Western nations, many ancient authors throw light on a considerable overland intercourse with India, etc., and research has already tended to prove that Egyptian and other ships manned by Sidonian sailors went eastward at least as far as the Malabar coast. In his reply the author of the paper has kindly referred to a Chinese bottle found in a mummy, of which I spoke at a late meeting. Since that meeting I have had communications on the subject of such bottles. So far as I have investigated, these bottles appear to be of three kinds, glass, delf, and porcelain; all have Chinese inscriptions, and are reputed to have been found in mummies or elsewhere in Egypt. The glass ones are modern, those of delf are of a coarser make, and may owe their origin to the fact that several hundred years ago a small colony of Chinese potters arrived in the capital of Persia, and in default of a better material made all their goods of delf; the bottle of which I showed the photograph is made of fine porcelain, and is in the collection of a correspondent living in the South of England, one well acquainted with Egypt, having had much to do with the natives during twenty years' residence there, and hence about the last person to be imposed upon. It was found as follows, a few years ago: he and two archæological friends discovered a mummy of early date. On carefully unrolling this the bottle in question was revealed and taken possession of by its present owner; the inscription upon the bottle is archaic, which is not the case with the other bottles referred to, and I conclude refers to the contents, which seem a dried-up pigment; for these reasons I think we may safely venture to say that this bottle helps to support the author's remarks as to the extent of Chinese intercourse with other nations in early times.

The CHAIRMAN.—The author of the paper has done valuable service by bringing together so many points in ancient history, and any that may criticise his work adversely will doubtless remember that he cannot be held responsible for mistakes and errors which other Chinologists—if I may use the word as regards his authorities—may have fallen into. I think we are all very much indebted to him for his interesting paper.

The meeting was then adjourned.

ORDINARY MEETING.*

ALEXANDER MCARTHUR, ESQ., J.P., D.L., V.P., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following replies to the Institute's Address to Her Majesty the Queen and Her Royal Highness the Princess of Battenberg on the death of His Royal Highness Prince Henry of Battenberg (see page 92) were received and read :—

"*Whitehall,*
"18*th February*, 1896.

"I have had the honour to lay before the Queen the loyal and dutiful address of condolence from the Victoria Institute on the occasion of the death of His Royal Highness Prince Henry of Battenberg, K.G., and I have to inform you that Her Majesty was pleased to receive the Address very graciously.

"I have the honour to be,
"Your obedient Servant,
"M. W. RIDLEY."

"*Osborne,*
"18*th February*, 1896.

"Lord William Cecil, Equerry-in-Waiting, is desired by Princess Henry of Battenberg to convey to the President, Vice-Presidents, Council and Members of the Victoria Institute, Her Royal Highness's thanks for their kind message of sympathy in her great sorrow."

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* 6th of 1896 Session.

The following elections were announced :—

ASSOCIATES :—C. K. Marr, Esq., London; Alex. Leslie, Esq., London; Robert Gordon Orr, Esq., Madras; Rev. Granville R. Pike, M.A., United States.

The following paper was then read by the author :—

THE POLYNESIANS AND THEIR PLANT-NAMES. By H. B. GUPPY, M.B.

IT is possible that we may find in the plant-names of Polynesia a clue to the mystery that hangs like a cloud over the origin of its inhabitants. Yet such an inquiry is beset at the commencement by many difficulties, not merely linguistic, but also botanical and ethnological, and a number of questions at once present themselves.

We ought at first to inquire into the worth of the materials at our disposal, and into the extent to which they can be legitimately employed. Then after discussing the methods of employing such data, we ought to define with some precision the particular view we entertain of the vexed question relating to the ethnological position of the Polynesians amongst the other Pacific peoples. It would then be requisite to determine to what extent the Polynesians at the time of the early voyagers were isolated from the rest of the world, and to notice the amount of intercourse that then prevailed between the different groups. But even then we would only be on the threshold of the inquiry. It

would be necessary to attempt some distinction between the parts man and the other natural agents have taken in stocking this region with its plants; and this would involve us in discussions as to the geographical distribution, the uses, and the antiquity of the plants concerned. Coming to the plant-names, we would deal first with those of individual plants, making each plant tell its own story anent the Polynesians in the light of varied general, historical and botanical data. Then we would proceed to compare the vernacular names of the different sub-regions with the object of ascertaining the direction of the stream of migration over this large area. All these are very large questions, and it would be barely possible to do them justice, even in a single volume, and much less in an ordinary paper. It will therefore be only practicable to deal with the subject in an illustrative fashion; but even then the matter is not free from difficulty, as it is not easy to select the facts that are at once the most pithy and the most weighty from the abundant materials that I have been gathering for years.

When we come to consider whether the plant-names of the Polynesians can afford any indications of the unknown history of this race, either by supplying us with the means of determining the locality of their ancient home or of following the line of their migration, we are led to ask whether they can be fitly employed for this purpose. We have only to turn to the works of Hehn, Kern, Schrader, and other philologists, to learn that when subjected to the test of strict linguistic principles they can be thus used. On the other hand, amongst botanists, who look to a vernacular name for information, not as to the home of a people but of a plant, there is much difference of opinion as to their value on account of the frequent confusion of species. This is a real danger to the botanist. The ethnologist, however, has to recognise the fact that all the world over the history of plant-nomenclature has been too often a story of fancied resemblance and occasionally of grotesque imagination. Botanical classification has often no place in vernacular nomenclature, and through some resemblance in habit or in utility plants are often placed together that to the botanist lie far apart. Thus to take an example; amongst the food-plants of primitive man in these regions were doubtless *Tacca pinnatifida* and *Amorphophallus campanulatus*, which bear the same generic name of "Takka" in Malay. This is occasionally repeated in Polynesia; and in Fiji, "Ndainga,"

the equivalent of the Malay name is applied only to *Amorphophallus*. Then, again, I will subsequently show that the Tacca plant, as the source of the Polynesian arrowroot, has carried the Malayan name of the Sago Palm into the most distant islands of the Pacific. Thus *Tacca pinnatifida* is linked on either side by means of its vernacular names with such dissimilar plants as *Amorphophallus campanulatus* and the Sago Palm: in the one case, the resemblance is concerned with the foliage and habit and the edible character of the tuber; in the other, with the production of a farina.

It will thus be seen that in following up the names of a particular plant we often stumble upon a set of names that includes plants of very different characters. It may be some archaic word for tubers or edible roots applied here to the taro, there to a fern-root, as in New Zealand, and again, in a third place, to the yam, or the sweet-potato, a subject to which I will again refer. In order, indeed, to find the affinity of a plant-name we have not infrequently to cast our net rather widely. For instance, in the case of *Pritchardia pacifica*, the Polynesian Fan Palm, as the genus does not occur in the Indian Archipelago, we look for the equivalent of the Polynesian name of "Piu" in connection with other fan palms in that region, and we find it in "Wiru," the Sundanese generic term for *Licuala*. Then, again, the names of Pandanus are sometimes traced solely through the mat-words. For a long time I was puzzled by a Malagasy name for these trees, viz., Vakoana. At length I came upon "Bangkoan" as a term for large mats in the Philippine Islands, and subsequently the word came under my notice as a Pandanus name in other languages of the Archipelago. We have only to turn over a few pages of Tregear's Comparative Dictionary of the Maori language to perceive how wide may be the range of the affinities of a Polynesian plant-name.

That the vernacular names of this region can afford a trustworthy basis for such a discussion as this there can be no doubt; but this can only be the case by compliance with the laws of linguistic comparison. De Candolle, in his work on the *Origin of Cultivated Plants*, starts with the assumption that a naturalist possessed of an ordinary general education can recognise the connection or the fundamental difference between plant-names in different languages. "It is not necessary," he adds, "to be initiated into the mysteries of suffixes or affixes, of dentals and labials." This depreciation

of the special labours of the philologist led this celebrated botanist into some grave errors,* and it is evident that without a special study of the phonetic laws of a region any conclusions based on its plant-names are often likely to be erroneous. For instance, an inquirer not versed in these laws would never imagine that "Ahia" and "Nagveg," the names of *Eugenia malaccensis* in Tahiti and the Banks Group, are both forms of the Fijian "Kavika" (see Table appended). On the other hand, he would fall in with the suggestion thrown out by Nadeaud, that there is a connection between "Ahi," the Tahitian name for Sandal-wood, and "Ahi," the Tahitian word for fire, on account of the wood making fire readily when struck with an axe. When, however, we look for these two words in other Polynesian languages, we find, according to the letter changes, that the original forms occur in Samoa as "Asi," Sandal-wood, and as "Afi," fire, both words being radically distinct.

With regard to the particular standpoint from which I will view the relation of the Polynesians to the other peoples of the Pacific, there is, I think, no serious difference of opinion as to the contrast in physical characters presented by an Australian, a Solomon Islander, a Tahitian, and a Ponapean. In the present distribution of the Australians, the Melanesians, the Polynesians, and the Micronesians, we have clearly exhibited the stratification of race-varieties which are arranged, owing to the peculiar geographical conditions, in chronological order. Regarding Further India as the ancient home at different periods of all these peoples, I infer that each in its turn left the Asiatic mainland to find a home where best it could. Along the highway of the Indian Archipelago travelled successively the ancestors of the present Australian, Melanesian, Polynesian, and Micronesian peoples; and it may be assumed that it was not the exercise of any deliberate choice that led them to their several homes. In their movement southward through the Archipelago, the Australians came in contact doubtless with an earlier race, a stratum in man's history that has suffered the fate of most old formations by being largely concealed by those more recent in the series. Shunning the open sea, the Australians followed the trend of the Archipelago and

* This is especially true of his uncritical use of the Sanscrit names. *Vide* also Schrader's *Prehistoric Antiquities of the Aryan Peoples*, Eng. edit., p. 21.

arrived at their present home. The Melanesians, as I take it, took the same road, and, on finding Australia already peopled, they occupied New Guinea, and their course became diverted into the archipelagoes of the Western Pacific. The Polynesians, in their turn obstructed by their Melanesian predecessors in the Indian Archipelago, took the path of least resistance, and trusting their future to the waves they ultimately reached the distant isles of the Pacific by way of the Philippine Islands and through the Caroline, Marshall, and Gilbert Groups. Last of all came the Micronesians, the scouts of the great host of Mongolian peoples that has since appropriated Eastern Asia, and intruded itself into the Archipelago. These pioneers of a new race made but a short sojourn in the Archipelago. Before them lay a region already occupied by their predecessors, and, retreat being impossible, they followed the footsteps of the Polynesians and took up their abode in Micronesia.

Now, I assume that no retrograde movement was possible in any of these migrations. The same *vis â tergo* acting through the ages urged them on, and we appear to have in the distribution of these peoples successive deposits of the different varieties of the human race resting unconformably on the Negrito stratum and illustrating seemingly man's racial development in this portion of the globe. Yet it is but reasonable to suppose that we have here but indications of a general ethnic movement from the north which we might expect to find indicated in the distribution of the varieties of man in other parts of Asia. Looking at the Indian Peninsula and Ceylon we seem to find in the arrangement of the Kolarians, the Dravidians, and the Aryans, etc., a repetition of the phenomenon of racial migration which appears to be clearly recorded in the ethnic history of Further India and Australasia. With the appearance of the Dravidians, the aborigines found a refuge in the hills. The Dravidians were in their turn pushed by the incoming Aryans to the southern part of the Peninsula, and on the flanks of the Himalayas, in the rear of the Aryan, the Mongolian appeared.

Coming to the bearing of these views on the subject proper of this discussion, I assume that the Melanesians of the Indian Archipelago were the original possessors of that language which has given birth to the Malayo-Polynesian family of speech. They have carried to the distant islands of the Fijis those linguistic characteristics which we find

amongst the spoken tongues of the later settlers in the Archipelago—to wit, the Malays proper and the Javanese. From them, during a long sojourn in the Archipelago, the Polynesians derived those common characters in language which now link together peoples that in physical characters stand far apart. The Melanesians in their turn had, doubtless ages before, been influenced by contact with the aboriginal Negrito population of the Archipelago. Probably enough they in this manner became possessed of the names for wild roots and tubers employed by the aborigines, and it is likely that the Australians before them carried away with them some similar linguistic mementoes of their sojourn in that region. Thus, on *à priori* grounds, we might expect to find similar terms for edible roots and tubers amongst the Negritos, the Australians, the Melanesians, the Polynesians, the Micronesians, the later Malayan immigrants in the Archipelago, and even in Further India. Professor Kern, in his *Stamland der Maleisch-Polynesische Volken*,* if I understand him rightly, regards the Malayo-Polynesians as taking the part that I have here ascribed to the Melanesians. It is, I venture to think, unlikely that a people so long adapted to the conditions of tropical life could have received their words for the staple articles of their vegetable diet, such as those for the yam, the taro, the banana, etc., from the Malayo-Polynesians, who were more recent sojourners in the tropics. The view I here uphold as to the relation of the Polynesians to the other peoples of the Pacific is based therefore on their geographical position. As regards the argument from language, I infer that after the passage of the Australians the Melanesian speech has acted as a linguistic leaven on the numerous languages that have come in contact with it.

With regard to the conditions of isolation in which the Polynesians were found by European navigators, it is well known that although they were provided with numerous varieties of the banana, breadfruit, yam, taro, etc., the inhabitants of the different groups had but little communication with any but their immediate neighbours. The conditions that provailed in the time of Bougainville, Cook, and others could only have led to the local distribution of useful plants, but not to their extension over the Pacific. They would

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* *Versl. en Mededeel. der Koninkl. Akad. v. Wetensch: Afdeeling Letterkunde*, 3de Reeks, Deel vi. Amsterdam, 1889.

explain the limitation of the shaddock to Tonga and Fiji, but not the wide distribution of the banana, the bread-fruit, the tubers, the Malay apple, and the turmeric over the length and breadth of the tropical Pacific. Yet there is sometimes an element of exaggeration in the accounts that have been given of the extent of the isolation in which they lived. We have all read the interesting account given by Williams, in his *Missionary Enterprises*, of his discovery of Rarotonga, how the Raiateans who accompanied him were greeted by the Rarotongans in style truly Homeric and in language that would have fitly come from the lips of an inhabitant of the Cyclades. They inquired as to the removal of Rarotonga to its present position by the gods and as to the place of abode of the god Tangaroa himself. Yet I find from the journal of Barela, the pilot of the Spanish expedition despatched from Peru in 1772, that the Spaniards were acquainted with the existence of the island half a century before the time of Williams. These islanders seem reticent on the subject of previous visitors to newcomers. It is well known that Captain Cook was not acquainted with the fact that between his second and third visits to Tahiti some Franciscan priests had spent nearly a year on the island.* Then again Cook, when he re-discovered Easter Island in 1774, imagined that since the arrival of Roggewein in 1722 no Europeans had visited the island. I have, however, come upon a short description of the island, its monuments, and its people, as they appeared to the Spaniards four years before the time of Cook. Facts of this kind make us a little suspicious of the accounts given of the extreme isolation of some of these islanders, whether as regards their neighbours or with reference to the outside world. The Spaniards have exercised such a miserable spirit of jealousy and mystery in these seas that their part in plant-distribution will always remain an unknown element in such discussions as these. There is a curious story told of an American sailor wrecked in the Pelews, who in the full conviction that he had for years lived amongst natives entirely cut off from the world presented a vocabulary to Hale containing the Spanish and French words for a hat.

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* These devoted men were certainly the first missionaries in Polynesia. I am now translating their journal, which presents a terrible picture of Tahitian life, not that, I would scarcely add, which was presented to the navigators, Bougainville, Wallis, and Cook.

We have now to answer the question as to the manner in which the Polynesian Islands became stocked with plants. It is frequently not at all difficult to distinguish between the parts played by man and other natural agents in the dispersal of plants in this region. The low coral islands and the shores of the more elevated and mountainous islands are occupied by plants such as *Barringtonia speciosa*, *Calophyllum inophyllum*, the Mangrove, *Morinda citrifolia*, the Pandanus, *Thespesia populnea*, etc., that are known to be dispersed by the currents; and they are all plants that are widely distributed over the Indian and Pacific Oceans.* The only doubt arises as to the particular route along which the floating seed were drifted, and if that can be established we may obtain a clue as to the route pursued by the Polynesians. Now a species that, like *Barringtonia speciosa* or *Thespesia populnea*, is almost universally distributed in the tropical islands of the Pacific can scarcely aid us in the matter. If, however, we can find a littoral plant that has only partly performed the traverse of this region, then we shall possess in the interrupted operation an important piece of evidence. The Mangrove (*Rhizophora*, *Bruguiera*, etc.) is absent, or very rare, in Eastern Polynesia, but unfortunately for our purpose this is in great part explained by the lack of a suitable station on the precipitous shores of the larger islands. We have, however, in *Nipa fruticans* a plant well fitted for our object, and one well known to be dispersed by the currents. For a littoral species it has a limited range. It is found on the tropical shores of Asia east of the Ganges and in the Indian Archipelago, where it abounds; and there is no question as to its great antiquity in this region. Now, the Nipa Palm, as it is sometimes termed, has attempted to reach Polynesia by two routes from the Indian Archipelago, viz., by Melanesia and Micronesia. Along the first route it has in the course of ages reached the Solomon Islands, where I found it in 1884. Along the second route it has extended its range to Ualan or Kusaie, at the eastern end of the Caroline Group, where it was observed by Kittlitz about seventy years ago. Since its intrusion so far into the Pacific seems to have escaped the notice of later botanists, and as no reference is made to it by Hemsley in his account of the floras of oceanic

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* *Vide* a paper by me on the "Dispersal of Plants," published by this Society in 1890.

islands, given in his *Botany of the "Challenger,"* I may here remark that it is described in general terms in the narrative of Kittlitz,* and is figured in his *Views of the Pacific Vegetation*, where it was also identified and noted by Dr. Seemann in his English edition of the *Views*. Now, the island of Kusaie lies in the course of the Pacific Counter Current which runs to the eastward from the Malay Archipelago right across the Pacific between the parallels of about 4° to 8° N.† Here the Nipa Palm has reached the last spot where it could find a station. Beyond lie the coral atolls of the Marshall Group that could afford no home to a plant that frequents the extensive coast swamps and lines the mouths of large rivers in Asia and in the Archipelago. Most of the familiar littoral plants of Polynesia have probably reached their present home by the path attempted in vain by the Nipa Palm. Since they for the most part frequent coral islands, the atolls of the Marshall, Gilbert, and Ellice Groups would form so many stepping-stones by which, in the season of the north-west winds, they would be able to find their way to Samoa and Fiji in spite of the westerly drift of the Equatorial Current. The Polynesian, I assume, has entered the Pacific by the route followed by the floating seed, or, in other words, by Micronesia.‡

Passing from the agency of the currents we turn to those of birds. The fruits of species of *Eugenia*, *Ficus*, and of plants like *Kleinhovia hospita* and of some of the palms, like *Kentia*, are known to be eaten by pigeons, parrots, and other birds, and probably in many cases birds have stocked these islands with such plants.

With reference to man, there can be but little doubt that he was first instrumental in introducing into this region the cultivated plants, all, or almost all, of which have their home in the Indian Archipelago. We may safely postulate the fact that Nature unassisted has not laid herself out to provide the Polynesian with the fruits he there enjoys. The fern-root was the principal spontaneous offering of New Zealand to the Maori, who brought the sweet-potato and the taro

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* *Reise nach russische Amerika, nach Mikronesien*, etc. Gotha, 1858, vol. ii, p. 35.

† Bedford's *Sailor's Pocket Book*.

‡ It is of course possible that floating fruits like those of *Barringtonia speciosa* have been carried by the Counter Current across the Pacific and back again by the Equatorial to Polynesia.

with him. Nor is there reason to suppose that Nature has acted differently in the warmer latitudes. Aboriginal man could have found but poor sustenance in the virgin forests of Fiji and of Tahiti; and, as far as I know, there are no accounts of any island possessing the banana, the yam, the taro, and the breadfruit, which can be shown to have been never occupied by man. In lat. 20° 30′ in the South Atlantic, South Trinidad presents us with an island, in all probability never inhabited, which when discovered was clothed with tree-ferns and arboreous vegetation, but possessed, as far as is indicated in Hemsley's *Botany of the "Challenger,"* none of the useful edible plants of the adjoining mainland of Brazil. It is probable that the seeded mountain plantain, *Musa troglodytarum*, is truly indigenous in Polynesia; but no one has ever suggested that the seedless cultivated bananas have been produced by man's art in this region from an indigenous plant. In truth, in the light of the fact that Mendana in 1595 found not only bananas, but also pigs, hens, and pumpkins in the Marquesas, such a supposition seems quite gratuitous. It has been suggested by Dole in the case of the Breadfruit of Hawaii, though I do not remember that he is countenanced by Hillebrand, that the cuttings necessary to propagate the tree in that group would not have withstood a long sea voyage. This difficulty, however, was surmounted by the Maoris when they carried the paper-mulberry to New Zealand. Excepting perhaps in the case of *Tacca pinnatifida*, which is a common littoral plant, I have little doubt that all the tuber-plants and other edible plants which are cultivated both in Polynesia and the Indian Archipelago have been introduced by man into the former region; and here I would include the banana, and the breadfruit; the sweet-potato; amongst the yams, *Dioscorea alata*, *D. sativa*, *D. pentaphylla*, *D. aculeata*, etc.; amongst the aroids, *Amorphophallus campanulatus*, *Colocasia antiquorum* or the common taro, *Alocasia macrorrhiza* (Sch.), etc.; and amongst the fruit-trees *Spondias dulcis*, *Eugenia malaccensis*, etc.

Of the antiquity of the cultivated plants in Polynesia and in the other regions of the Pacific the number of varieties is sufficient evidence, even although many of them are not varieties in the eye of the botanist. Taking the banana in its most general sense, it may be noted that Banks and Solander enumerated as many as 28 varieties in Tahiti. Ellis, who takes the native view of the matter, places the number at about 50. Seemann distinguished 18 kinds of bananas in

Fiji. Lesson in Kusaie and Forster in Tonga found several varieties under cultivation. The natives of Kiwai in British New Guinea, according to Thompson, name as many as 36 kinds of cultivated bananas. The numerous varieties of the breadfruit afford similar evidence. Cuzent and Ellis mention the occurrence of nearly 50 varieties and sub-varieties in Tahiti, and Kubary observes that the inhabitants of the Hogoleu Islands in the Caroline Group distinguish nearly 60 varieties. Seemann refers to the great number of varieties in Fiji, and gives in 13 cases the names. Turning to the tubers, we learn from Jouan that in New Caledonia there are at least 21 varieties of taro under cultivation: in Fiji, as Horne states, there are 18 varieties, and in Tahiti, according to Cuzent, at least 13, whilst Ellis says that 33 kinds are named. As regards yams, there are 20 kinds cultivated in Fiji (Horne). Facts of this kind abound; but those here given are sufficient for the purpose.*

Having thus shown that we have to deal with an ancient culture in these regions, I pass on to consider very briefly the plant-names. Professor Kern some few years since in his brilliant paper on the home of the Malayo-Polynesian people, before quoted, drew up a list of some of the plants and animals, the knowledge of which the several peoples took with them from their early home. He included here the coco-nut, banana, sugar-cane, pandanus, yam, taro, and one or two other useful plants, and expressed the conviction that a large number of additional plant-names would be found surviving in the original language. If there is nothing else of any value in my paper, I claim to have shown in the accompanying table the correctness of this opinion; and since this has been accomplished by only a very partial use of the abundant data that exist in the Dutch publications relating to the Archipelago, it follows that there is a promise of results greater still.

This table has been compiled from materials obtained from

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* A list of authorities for the various facts given in this paper and in the appended table would have been far too lengthy for a paper of this kind. The authorities for the statements in this paragraph are Seemann's *Flora Vitiensis;* Ellis' *Polynesian Researches;* Lesson's *Voyage autour du Monde;* Forster's *Catalogus Plantarum Esculentum Australiæ;* Thomson's *British New Guinea;* Cuzent's *Tahiti;* Kubary in *Ethnogr. Anthrop. Abtheil. des Museum Godeffroy* of Schmeltz and Krause; Jouan in *Mém. Soc. Sci. Nat. de Cherbourg,* tome xi; Horne's *Year in Fiji.*

a great variety of sources during several years.* It does not aim at completeness in any one respect, nor can it be claimed to be always free from error. It presents, however, a more extended view of the subject than, I think, has ever been presented before. And yet to draw up a mere list of names without further comment, and without any critical observations on their nature, is not a very satisfactory method of dealing with the subject. The names, for instance, of the sweet-potato only awaken curiosity, and it is obvious that in order to learn the true meaning of the term "kumara," we must discuss the history of this plant over the whole Pacific, and extend our inquiries to the Indian Archipelago, and even to Mexico and Peru, or even to India, if we follow Tregear, though I think in that respect he is wrong. We must indicate the localities where it is mostly used. We must look into the antiquity of its culture, and we must be sure of its uniform specific identity. De Candolle has pointed out the uncertainty that surrounds its origin. From a large number of facts I have formed the opinion that the sweet-potato is like the yam, a very prosaic vegetable; that it neither bears the name of an Aryan deity, nor find its home in the heights of Ecuador; that it has been for ages cultivated in the Pacific, and has found its way there from the Archipelago in a matter-of-fact fashion, in the sober society of the taro. The history of the sweet-potato in the Pacific is the history of its name "kumara," and a great deal more; and the same may be said of many other of the plants included in the table. The discussion of the various questions connected with the origin of the bananas in the Pacific must precede any inquiry into their names, and the demarcation of the great "Vundi" region is itself a task of no small labour.† In order to deal at all satisfactorily with plants like *Morinda citrifolia* and the turmeric we have to open up the question of colour-names, to inquire into the history of dyeing processes amongst savage peoples, and in the case of the turmeric to mark out the range in time and space of an ancient ceremonial custom whilst we are investigating the distribution of its names.

One curious result, which is but slightly illustrated in the

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* For the Indian Archipelago I have made free use of Filet's *Plantkundig Woordenboek voor Nederlands Indie*, Blanco's *Flora de Filipinas*, Kern's *Stamland* paper before quoted, etc., etc.

† This was first attempted in Codrington's *Melanesian Languages*.

table, is the frequent crossing of the tuber or root names. This carries us back to that distant epoch when plants with edible roots or tubers were known under a very few general terms to primitive man over a wide region of the tropics. The word "taro" in the form "tara" is applied by the Tasmanians to *Pteris esculenta*, and according to Mitchell "tao" is the name of a cichoraceous plant the root of which was commonly eaten about the Darling. With the Maoris "roi" is the general word for edible fern roots. In Cochin China "ray" is a generic word applied to the edible *Colocasiæ* and *Alocasiæ*. Then again "mamagu" or "mamaku," the name of an edible fern in New Zealand is a name of *Tacca pinnatifida* in the Solomon Islands, and apparently also in the Marshall and Caroline groups. In the dialects of British New Guinea we find the connecting link between the names of the sago palm in the Indian Archipelago and those of *Tacca pinnatifida* in Fiji and Polynesia, both farina-yielding plants. There is also a singular group of tuber or root names typified in the words "koko," "kuka," "kuku," "kakau," etc., which are commonly applied to plants of this description in different localties. Thus "koko" in the Solomon Islands is a word for the taro. In the Loyalties it is given to the yam. Kuka is the Maori word for the edible roots of the bulrush and of the Cordyline. "Kuku" is the general term for ferns in Fiji. "Kaukau" is the Tongan word for a kind of yam, and "Kakau" is the ancient name of the Maories for the sweet potato. "Kokau" is a Pelew word for the taro. "Lau'o'o" in Samoan is a species of Alocasia, and "'Au'o'a" a yam. It is difficult to believe that we have not here some primitive word for a wild edible tuber or fern-root, although the direct linguistic connection, as far as the vowel-changes are concerned, is often now not possible. We will no doubt be able in time, from the evidence of language alone, to frame the dietary of primeval man in this part of the world.

Before concluding this paper I would point out that by giving a numerical value to the data in the table we can obtain some interesting indications of the affinities of the plant-names of each region taken collectively. I will first take the Malagasy words. Out of 26 that admit of comparison, 22 occur in the Indian Archipelago, 15 in the West Pacific, 15 in Fiji, 12 in West Polynesia, 8 in East Polynesia, and 5 in Further India. It would appear from these figures that as far as the names of several of the cultivated and littoral

plants are concerned, the Malagasy may be referred to Melanesian stream of migration rather than to the Polynesian. Nearly half of the names are to be found in the Philippine Islands, and there is nothing in these data to connect the Malagasy offshoot with any particular part of the Archipelago, except, perhaps, with the Philippines.

In the subjoined table I have given some rough results of the numerical treatment of the subject. We notice there that Malagasy contains the largest proportion of Indian Archipelago plant-names and East Polynesian the smallest. This appears at first sight not to be consistent with the inference that Malagasy is more closely connected by its plant-names with Fiji, or in other words with the Melanesian migration, than it is with East and West Polynesian; but it must be remembered that whilst Malagasy was carried direct to Madagascar in the course probably of a few weeks, the Melanesian and Polynesian migration must have covered many generations, and their peoples must have been exposed to many vicissitudes on the way. That mere geographical propinquity may count for little is shown in the case of the Micronesian region which is less connected with the Philippine languages by its plant-names than Malagasy.

	Indian Archipelago.	Philippines.	Further India.	
Fiji	60 p.c.	29 p.c.	11 p.c.	*Note.*—The Indian Archipelago is here regarded as including the Philippine Islands.
West Polynesia ..	55 „	37 „	10 „	
East Polynesia ..	50 „	28 „	9 „	
Micronesia ..	60 „	35 „	12 „	
Malagasy ..	85 „	46 „	19 „	

"LIST OF PLANT-NAMES."

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Aleurites moluccana	Saketa (T.)	..	..
	..	..	..
Amorphophallus campanulatus.	Takka (M.)	..	..
	..	? Tavulu (Tacca)	..
Bamboo ..	Bokavi (Tg.)	..	..
	Kavayang, Kauayan (P.) ..	..	..
	Bĕtung (M.)	..	..
	Bĕtong (D.)		
	Batong (L.)		
	Botung (Bs.) ..		
	Pĕtung (J. Bl.) ..		
	Patung (Sg. Mo.) ..		
	Patang (Slo.)		
	Tiling, Tiring (Ph.) ..	Teri (Tall grass)	..
	(Dendrocalamus) ..		
Banana ..	Punti (J. Lm. Su. B. Sn.)	Funtsi Untsi	Fugi, Fudi, Wegi (NG.)
	Unti (Mk.)		Un (NI. DY.)
	Uti (Bu.)		Vudi, Huti, Hugi, Fuki, Wunti (Sol.) ..
	Vuri, Fud (Ce.) ..		Futi (Sik.) ..
	Hudi (Tm.)		Fusi, Butsh, Nobos, Nandi (NH.)
	Huni (Rt.)		Nandi (Lo.) ..
	Udi (Lt.)		Puin (NC.), etc.
	Ure (Am.), etc. ..		

PLANT-NAMES."

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Sikethi.				
Tuitui	Tuitui (Fu.)	Tutui (Ta.) Tuitui (He.) Kukui (Ha.)		
Ndainga				
? Tivoli (Dioscorea)	Teve (To.)	Teve (Ta. He.)		
.. ..	Kofe (To. Fu.) 'Ofe (Sa.)	Kohe (Mq.) Ohe (Ta. Ha.)		
Bitu.				
..	..	..	..	Tleri, Tre (CC.) (Dendrocalamus.)
Vundi	Fuji (To.) Futi (Sa. Fu. Ne. Ke)	..	Une, Ush (U.) Ut, Uc (Pn.) Uut (SD.) Us (Ml.) Ush (St.)	Chuoi (CC. An.) Tsiao Tsiu Dzio Pa-tsiao Pa-tsiu Po-tsiu (Ch.)

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Banana—(*cont.*)	Muk (Te.)	..	Mukle (MC.) ..
	Mu (TL.)		Mogar (MC.)
	Muu (Ks.)		
	Mah (My.)	..	..
	..	..	..
	Saguing (Tg.) ..	..	..
	Saing (Ph.)		
	?Pisang (M. Ph., etc.)		
Barringtonia speciosa	Buton (M.)	Futu-be (be = great)	Puputu (Sol) .. ..
	Butun (S.)		
	Putun (Bn.)		
	Hutum (Am.) ..		
	Botong (Tg. Bs.) ..		
	Bitung (Bs.) ..		
	Bitun		
Batatas edulis	Kamotas (Ph.) ..	..	Kaemadahu (Mt.) ..
	Kamoti (Tg.) ..		
	..	..	Kumara (Ma. Au.) ..
Bread-fruit ..	Kolo (Tg.)	..	Kuru (Fe. Ft.)
	Kaluwi (M.) ..		Ulu (Na.) ..
	Kluwi		Kŭru (Sik.) ..
	Kulor		Kununu (Bm.)
	?Umare (Am.) ..	..	Mei (V.) ..
			Miuue
			Inma (NH.)
			Nemar
			Nemara
			Nime
			Noho-anma

PLANT-NAMES "—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
..	Mo'e (Sa.) Muka (To.) (the bud)	..	..	Hakmuk (Sm.)
..	..	Meka (Ra.) Meika (Mq.) Meia (Ta.) Maia (Ha.)	Mei (G.)	
..	Fa'i (Sa)	Fei (Ta.)		
Soanga	Soa'a (Sa.)			
Vutu	Futu (To. Fu. Sa.)	Hutu (Ta. Mq.) Utu (He.)	Kubary says that the Samoan name occurs in Nukuor Islands, Caroline group.	
..	..	..	Komuti (Or.)	Kamotli (Az.) Kamote (NM.Pa. Qui.) Kamicha (Cr.)
Kumara	Kumala (To. Fu.) 'Umala (Sa.)	Kumara (NZ. Mg. Pau.) Kumaa (Mq.) Umara (Ta.) Uala (Ha.)	..	Kumar (Qui.)
..	'Ulu (Sa.) Ul (Ro.)	Kulu (Ra.) Kuru (Pau.) Uru (Ta.) Ulu (Ha.)		
..	Me (Ne. To.) Mei (Fu.)	Maiore (Ta.) Mai (He.) Mei (Mq.)	Mai (Fn. Mr. Pn. Sl. SD. Mey (Ml.) Mosse (U.) Mailles (LM.) Mei (G.) Mah, Me (Mrs.)	

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Bread-fruit—(*cont.*) ..	..	..	..
Broussonetia papyrifera ..	Saai (S.)	..	Sihi (Mt). .. ..
	..	..	..
	..	..	..
	Mala (Ce.)	..	..
	..	..	..
Calophyllum inophyllum ..	Bintangor (M. J.) ..	Vintanina ..	Pit (N. C.) ..
	Bitangur, Bitau, Betau (M.) ..		
	Bitaog (Bs. Pm. Y.)		
	Bitanhol (Tg.) ..		
	Fitaku (T.)		
	Hatau, Hutaula (Am.) ..		
	Tamauyan (Ph.) ..	..	..
	..	..	..
Casuarina ..	..	..	..
	..	Filau	..
Coco-nut palm	Niyur (M.)	Vua-nihu	Niu (BNG. Lb.)
	Nur (Aru.)		Niu (Ast.) ..
			Niehm (HB.)

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Uto				
Masi	..	..	..	Kaasi, Sjo, etc. (Jp.)
..	..	Aute (Ta. He. NZ.) Ute (Mq.) Wauke (Ha.)		
..	Uka (Ne.) U'a (Sa.)			
Malo	..	..	Meo Mo (G.)	Ma-hlaing (Bh.)
..	Tutunga (Sa.) Tutu (To.)			
Vetau (another species of the tribe Calophylleæ)	Fetau (Sa.)..	..	Ijau (Pn.)	
Damanu	Tamanu (Sa. To. Fu.)	Tamanu (He. Ta.) Temanu (Mq.) Kamani Kamanu (Ha.)		
Dilo	Tilo (Fu.) D'lolo (Ke.)			
Thau	Toa (Sa. To. Fu.)	Toa (He. Ta. Mq.) Aito (Ta. Ra.)	Tog (G.)	
Velau ..	..	..	..	Bela (JB.)
..	..	..	Ni (Pn. Mrs. SD. Sf. G.)	Nuok (the Nipa palm in Cochin China and Annam.)

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Coco-nut palm—(*cont.*) ..	Niog (Ph.)	Vua-nihu	Niwi (Ar.) ..
	Nyu (J.)		Niu (Lou. Sol. V. Tc.)
	Niu (Ba.)		Nu (Ni) ..
	Enuh (Bl.)		Niu, Naniu, Neing (NH.)
	Enjoh (D.)		
	Niyo (Bu.)		
	Niwe (Br.), etc., all over the Archipelago		Nu, Wanu (Lo.)
			Nu (NC.), etc.
	..	..	..
Colocasia antiquorum	Talö (N.)	..	Talo. Mt. V. ..
	Tales (J. Md.) ..		Taro, Ntal, Tal, etc. (NH.)
	Talös (S.)		
	Talung (Bs. Tg.) ..		Natali (Lo.) ..
Large Alocasiæ	Bira (M. Rw. S. Mk.)	Viha	Biako, Biagka, Buagk (NH.)
	Bia (S.)		
	Biga (Bs.)		Piya (Lou.) ..
Coloc. antiq. and large Alocasiæ	Kaba (T.)	..	..
	Gaby, Gavay (Tg. Bs. Pm.)		
	Gabing (Ph.) ..		
Cordia	Totebo, Toteho (T.) ..	..	..
Cycas circinalis	Paku (M. S.) ..	Fahu	
	Pakies (J.)		
Cucumbers, gourds, etc.	Tabogo, Tabayag (Tg.) ..	Tavu	..
	Tabu-tabu (Bt.) ..		
	Tabu (Wg.)		
	Katimun (J. Bl. Tg.)	Tsimundry	Temai (HB.) ..
	Atimun (Bs.) ..		
	Timun (M. J. S.) ..		
	Ansimum (Bt.) ..		
	Tantimon (D.) ..		
	Hantimon (M.) etc.		

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Niu	Niu (Sa. To. Fu. Fa. Ne. Ro. E.)	Niu (Ta. He. Ha.)	Nu (U. Ml. Rk. LM.) Niu (Yp.) Naine (Eb.) Nidjiu (Gu.) Niale Allewis Ljus Le (Pe.)	Nuok (the Nipa palm in Cochin China and Annam.)
..	..	Erei (Mg.) Haari (Ta.) Akari (Ra.) Ehi (Mq.)		
Ndalo	Talo (To. Sa. Ne. Fu. Fa. E.)	Taro (Ta. He. NZ.) Tao (Mq.) Kalo (Ha.)	Jaua (Pn.)	Ray Tlang (CC.) Taya (Tp. Cr.) Taia (Gal.)
Via ..	..	..	..	Ray Bacha (CC.)
..	Kape (Fu.) Kabe (To.) 'Ape (Sa.)	Kape (He. Mq.) Ape (Ta. Ha.) Apii (Ha.)		
Tou	Tou (Sa.) To (To.) Toe (To.)	Tou (Ta. Mq.) Kou (Ha.)		
..	..	..	..	Dap (Cm.)
Timo				

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Cucumbers, gourds, etc.—(*cont.*) ..	Fenga (TL.) ..	..	..
	Tungu-tungu (F.) .. ?Bonteng (S.) ..	Vuatangu	..
	?Opo (Tg.)	..	..
Erythrina indica	?Gelala (M.).. ..	..	..
	..	..	..
	Kăne, Kanur (Mk.) ..	..	..
Eugenia malaccensis..	..	..	Kafika, Keviga, Gaviga, Geveg, Gevig, Avika, Havih, Nagveg, Nigauvug (NHB.)
Hibiscus tiliaceus	Baru (M.) .. .. Waru (M. J.) .. Haru (Am.) ..	Baru, Varu	Inbul (Ant.) .. Paui (NC.) ..
Inocarpus edulis	..	..	Te-ifi (Ft.) .. If (NG.) ..
	..	..	Mamape (Fe.).. Mabue (Mal.).. Tumup (NB.)

PLANT-NAMES "—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Vango	Fangu (Sa. Fu.)	..	..	Feng (Sm.)
..	..	Paoteni (Ha.)	..	Tëng (Sm.)
..	Ipu (a cup or vessel).	Ipu (Ha, Mg.) (NZ.)		
Ndrala				
..	Ngatae (Sa. Fu.)	Atae (Ta.	..	Ka-thit (Bh.)
..	..	Kenae (Mq.)		
Kavika	Kafika (Fu.) Fi'afia (Sa.) a specific name.	Keika (Mq.) Ahia (Ta.) Ohia (Ha.)	..	Apiga (Gd. Apega Tr.)
Vau	Fau (Sa. To. Fu.)	Fau (Ta.) Hau (Mq. Ha.) Au (He.)	Gili-fa Gili-fau (Ml.) Gili-fey (Sl.) Sili-fa (Rk.) "Gili" signifies skin or coat. Kubary says that the Samoan name occurs also in Nukuor Caroline Group	Known as "Mahu" in Galibi, British Guiana, and the Honduras.
Ivi	Ifi (Sa. To. Fu. Ro.)	Ihi (Ta. Mq.)	Hi (U.)	
..	Mape (Ro.)	Mape (Ta.)	Marap (Pn.)	

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Mangrove ..	Tongog (Bs.) .. / Tongkir (Bc.) ..	Honko	Tongo (Mt.) .. / Tu-onga (Lou.)
	Tangkal (Tg.) ..	Tanga	..
	Tehi / Tahi (Am.) ..	..	..
Morinda citrifolia	Nino / Anino / Lino (Tg. Bs.) .. / Nenu (Am.)	..	Nĕnehah (NC.) ..
Palms (Fan) of the genera "Licuala" and "Pritchardia"; see text.	..	..	..
	Wiru (S.) (Licuala)..	..	Firo (Sol.) (Licuala)
	..	..	..
Pandanus ..	Pandan (Am. Ph. M. Bt.) .. / Pandan (Bl. J. S. Md.) / Pandang (Mk. Bu.).. / Pangdan (Tg. Bs.) .. / Pandal (F.) .. .. / Paddan (Ib.) .. / Panda (Sb.) .. .. / Panrang / Parang (Mk.) ..	Fandrana / Fandren	Pan (NC.) .. ..
Small species of Pandanus used for mats.. ..	Keker / Kekel (Am.) ..	..	Gerekere (Mt.) ..

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Ndongo	Tongo (Sa. To.)	..	Jon (Pn.)	
..	..	..	..	Taga (Ko. Tr.). Tŭga (Ko.). Teng-gunya (Gd.) Tagon-tagon (Rk.). Ba-taga (Ad.).
Tiri	..	..	..	Zi (EM. Mi.). Dea (CC.).
..	Nono (Sa. To. Fa. E.) Nonu (Sa. Fu.)	Nono (Ta. He. Mg.) Noni (Mq. Ha.)	Non (G.) Nane (Car.) Nin (a tree name in Pn.)	Nhau (CC.). Nyau (Ten.). Nyah (Bh.) Nuna } (Tl.). Nona }
..	..	Loulu (Ha.) (Pritchardia).		
Viu (Pritchardia)	Biu (To.) Piu (To. Sa. Fu.) (Pritchardia.)			
..	..	Vahana } (Mq.) Vaake } (Pritchardia) Hawane } (Ha.) Wahane }		
Vandra	Fala (Sa. Fu. Fa. E.) Fa (To.) Fala (mat in Tonga)	Fara (Ta.) Ara (He.) Hala (Ha.) Haa (Mq.)	Fara } (Car.). Farara } Paun (Ld.) Parr (mat in Pelew Is.)	
Kiekie	..	Ieie (Ha.) Freycinetia. Kiekie (Ra. NZ. Pandanus and Freycinetia).		

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Mat words ..	Kihu, Kiel (Ce.) ..	..	..
Pandanus ..	Bangkoan (Ph.) (large mats) .. Mengkuwang (M.) .. Bakkuwang (TS.) (Pandanus) ..	Vakoa, Vakoana (Pandanus)	..
Spondias dulcis ..	..	..	..
Sugar Cane ..	Tĕbu (M. J. Md. Bl. Bu. Su.) .. .. Tepu (Br. Ce.) .. Tobu (Bt. Bs. Tg.) .. Tiwu (S.) .. .. Tewu (Sn. Lt.) .. Tevu (Tm. Rt.) .. Tohu (Ce. Am.) .. Tavuss, Tĕbong, etc. (F.)	..	Tov, Tou, Natuv, Natu, Neto, Toro (NHB.) Tolo (V.) Toro (Tc. Sik.) To (NI.) Tup (DY.) Tou, Tohu, Towu, Tobu, Tepio (NG.) etc.
	..	Fari, Far	Parai na parai (Fe). Poria (Er.)
Wild Sugar Cane of Fiji and Samoa	..	Fisika	..
Sago Palm and Sago	Sagu (M. Gil., etc.)..	..	..
	Rambia (M.) .. Lapia (Am.).. .. Pihir (Sw.)	Rofia	Bia (Sol.) Rabia (Mt.) Iabia (BNG.) Abi (Adm.)
Tacca pinnatifida and Arrowroot	..	..	Rabia (Mt.) .. Pia (Sik.) ..

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
..	Kie (Fa. E. To.) Gie (To.) 'Ie (Sa.)	Ie (Ta.)	Kie (G.) Kiekey (Rk.)	Chieu Chiec-chieu (An.)
Wi	Vi (Sa. To. Ro.)	Vi (Ta. Mq.)	? Afusz (Ml.) ? Apyt (Yp.)	
Ndovu	Tolo (Fu. Sa.) To (To. Ne.) Thou (Ro.)	To (Ta. Ra. Mq. He.) Ko (Ha.)	Ta (U) Jeu (Pn.) Thip (Or.) Adep (Pe)	Taboka-eem (*i.e.*, sweet reed in Tp.) Taupanna Tupanna Tubanna (Cor Pur.)
Vitho	Fiso (Sa.)			
Songo	..	..	..	Sakhu (Sm.) Sacu (Cm.)
Yambia	Pia (Sa.) ..	Pia (Ta. Ha. Mq.)		

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Tacca pinn. and Amorphophallus camp. ..	Takka (M.)	..	..
Tacca pinn., Arrow-root, and Fern-root	..	..	Mamago (Sol.) (Tacca).
Thespesia populnea ..	..	..	..
Terminalia ..	Talisay (Tg. Bs.) .. Dalisay (Ph.) .. Dalasa (Bs.) .. .. Teliu (Bd.)	..	Talia (DY.)
	Katapang (M. S. J. Katepeng Am. Cel.) Adappo (A.).. ..	Hatafa Atafana Ataf	..
Turmeric plant, Turmeric powder, Ginger ..	Angai (Pm.).. ..	..	Igag (Mkl.) .. ..
	..	..	Ano (Lp.) .. ..
	Leka-leka (T.) ..	..	..
	Halia (M.) .. .. Alea Aliya (Mol.) .. Lea (Cel.)	..	..

PLANT-NAMES "—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Ndainga (Amorphophallus).				
..	Mago (fern in Sa.)	Mamaku (a fern and taro in NZ.) Mamau (fern in Ta.)	Mokamok (Pn.) Mogemok (Mrs.) Mogamog (Car.) Nogonog (SD.) All denoting Tacca or its product.	
Mulomulo	Milo (Sa. To.)	Milo (Ha.) Miro (Ta. Mg. Ait.) Mio (Mq.)	?Loa (Mrs.) ?Lo (U.) Kubary says the Samoan name occurs in Nukuor, Caroline Group.	Milola (Hibiscus used for cordage on the Zambesi.)
..	Talie (Sa.Fu.) Telie (To.)	E-Tara Au-Taraa (Ta.)		
Tavola				
..	..	..	..	Nge Ngai (CC.)
Thango	Ango (Sa.Fu.) Enga (To.)	..	On Eon (Pn. Rk.) Ano (Nk.) Ceneon (Pn.) Teneon (Kd.)	Gung (CC. Gang An.) Khing (Sm.) Kenhey (Cm.)
Rerenga	Lenga (Sa.)	Renga (Pau.) Erea Rea (Ta.) Lena Olena (Ha.) Eka (Mq.)	Ren (Yp.)	
..	..	Erea Rea (Ta.)		

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Turmeric—(*cont.*)	Tommo (M. J. Bor.) Temu (J.)	Tama-tama	Temuli (Sol.)
Yam	Ubi (At. Bt. Bl. Ib. Tg. Bs.) .. .. Obi (M. Md. Br.) .. Uwi (J. Sg. Sn. Bm.) .. Huwi (S.) .. .. Uhi (Ce. Am.) .. Owi (D.) .. .. etc.	Uvi	Uhe (Mt.) Op (NB. DY.) Opie (V.) Ufi Uf Yubi Ta-ufi (NH.) Niobu Nup Nuh Ubi Ufi, etc. (NC.)
	Kaao (Bl.)	..	..
	..	..	..
	Keli Heli (Am.) ..	..	..
Yam, Tacca, Amorphophallus ..	..	? Tavolo (Tacca)	..
Dracæna	..	..	..
Banyans and other species of Ficus	Ara (M.) .. .. Awar-awar (J. S. Bl.) Haiuwara (Bt.) ..	Ara Vuara	T-aoa (Ft.) .. ..
Banyans	..	..	Baka Nebuk Nempagh Namaga Burumbaku Botmbagka (NH.)

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
Uvi	Ufi (Sa. To. Ne. Fa. Fu. E.)	Uhi (Ta. Mq.) Ui (He.) Hoi (Ha.)	..	Kŭbeai Guweai (Km.)
..	..	Kawau (sweet potato in NZ.)	..	Karo Kowar (Que.) Kara (Tp. Oy.)
Kawai	'Ave'ave (Sa.)	..	..	Khoai (CC.) Kywæ (Bh.)
Kaili Kaile				
?Tivoli Tavoli (yam)	Teve (To.) (Amorph.)	Teve (Ta. He.) (Amorph.)	..	Taole (Sch.) Tahula (Ts.) T'owla (CN.) (All yams.)
Ti	Ti (Sa.) Chi (To.)	Ti (Ta. NZ. He. Ha. Mq.) Ki (Ha.)		
..	Aoa (Sa. Fu.)	Aoa (Ta. He. Mq.) Oraa (Ta.) Aoaoaoa (He.)	A-uan (Car.)	
Mbaka.				

"LIST OF

Note.—The names in the last column

	Indian Archipelago.	Malagasy.	West Pacific.
Banyans—(*cont.*)	Nuno (Am.) .. .. Nonok (Ph.) .. Nunu (Wg.) ..	Nonoka	Nunu (DY.)
Ficus sp. sp., with rough leaves used for polishing	Ampelas (MS.) .. Ampaleh (SC.) ..	Ampali	

ABBREVIATIONS EMPLOYED IN

A. = Alfuros of Minahasa.
Ad. = Andaman Is.
Adm. = Admiralty Is.
Ait. = Aitutaki.
Am. = Amboyna.
An. = Annam.
Ant. = Aneityum.
Ar. = Arimoa, New Guinea.
Aru. = Aru Is.
Ast. = Astrolabe Bay, New Guinea.
At. = Atcheen.
Au. = Aurora I., New Hebrides.
Az. = Aztec.
B. = Bulusch in North Celebes.
Ba. = Bima.
Bc. = Banca.
Bd. = Banda.
Be. = Bentenan in North Celebes.
Bh. = Burma.
Bl. = Bali.
Bm. = Brumer Is.
Bn. = Bantam.
BNG. = British New Guinea.
Bor. = Borneo.
Br. = Buru.
Bs. = Bisaya.
Bt. = Battak.
Bu. = Bugis.
Car. = Caroline Is.
CC. = Cochin China.
Ce. = Ceram.
Cel. = Celebes.
Ch. = China.
Cm. = Cambodia.
CN. = Car Nicobar.
Cor. = Coroados of Brazil.
Cr. = Carib.
D. = Ngadju-Dyaks.
DY. = Duke of York I.
E. = Ellice Group.
Eb. = Ebon.
EM. = Errub and Maire Is.
Er. = Eromanga.
F. = Formosa.
Fa. = Fakaafo.
Fe. = Fate.
Fn. = Fananu in Caroline Is.
Ft. = Futuna in New Hebrides.
Fu. = Futuna in West Polynesia.
G. = Gilbert Is.
Ga. = Galela.
Gal. = Galibi (S. America).
Gd. = Gudang, Cape York.
Gil. = Gilolo.
Go. = Gorontalo.
Gu. = Guaham.
Ha. = Hawaii.
HB. = Humboldt Bay, New Guinea.
He. = Hervey Is.
Ib. = Ibanag, Philippines.
J. = Javanese.
JB. = Jervis Bay, Australia.
Jp. = Japan.
K. = Kisar.
Kd. = Kadogube (Carolines?).
Ke. = Keppel or Cocos Is.

PLANT-NAMES"—*continued.*

are provisional comparisons as a rule.

Fiji.	West Polynesia.	East Polynesia.	Micronesia.	General.
..	..	..	..	Noaña (Tur.)

THE FOREGOING TABLE.

Km. = Kamilaroi, Australia.
Ko. = Kowrarega, Torres Sts.
Ks. = Ke Is.
L. = Lawangan.
Lb. = Lobo, New Guinea.
Ld. = Ladrones.
LM. = Los Martieres in the Carolines.
Lm. = Lampong.
Lo. = Loyalty Is.
Lou. = Lousiades.
Lp. = Leper I., New Hebrides.
Lt. = Letti.
M. = Malay.
Ma. = Mota, Banks Is.
Mal. = Malo, New Hebrides.
MC. = Maclay Coast, New Guinea.
Md. = Madura.
Mg. = Mangareva.
Mi. = Miriam, Torres Sts.
Mk. = Makassar.
Mkl. = Malikolo.
Ml. = Mortlock Is. in Caroline Group.
Mo. = Mongondou in North Celebes.
Mol. = Moluccas.
Mq. = Marquesas.
Mr. = Morileu (Carolines).
Mrs. = Marshall Is.
Mt. = Motu, New Guinea.
My = Mysol.
N. = Nias.
Na. = Niua, New Hebrides.
NB. = New Britain.
NC. = New Caledonia.
Ne. = Niue, West Polynesia.
NG. = New Guinea.
NHB. = New Hebrides and Banks Is.
NH. = New Hebrides.
NI. = New Ireland.
Ni. = Nifilole in the Santa Cruz Group.
Nk. = Nukuor, Carolines.
NM. = North Mexico.
NZ. = New Zealand.
Or. = Orulong, Pelews.
Oy. = Oyampi (S. America).
P. = Ibanag, Tagalog, Bisaya.
Pa. = Panama.
Pau. = Paumotus.
Pe. = Pelew Is.
Pel. = Pelelew.
Ph. = Philippines.
Pm. = Pampango in Philippines.
Pn. = Ponape.
Ps. = Ponosakan.
Pur. = Puris, Brazil.
Que. = Queensland.
Qui. = Quichua.
Ra. = Rarotonga.
Rk. = Rockhampton, Australia.
Ro. = Rotuma.
Rt. = Rotti.
Rw. = Riouw.
S. = Sundanese.
Sa. = Samoa.
Sb. = Sumba.

ABBREVIATIONS EMPLOYED IN THE FOREGOING TABLE—*continued.*

SC. = West Coast of Sumatra.
Sch. = Schowra, Nicobar Is.
SD. = St. David, Carolines.
Sf. = Suf, Carolines.
Sg. = Sangir.
Sik. = Sikyana.
Sl. = Sonsol, Pelews.
Sla. = Sula.
Slo. = Solok.
Sm. = Siam.
Sn. = Sangar.
So. = Society Is.
Sol. = Solomon Islands.
St. = Satawal (Carolines).
Su. = Sumbawa.
Sw. = Sarawati.
T. = Ternate.
Ta. = Tahiti.
Tb. = Tobelo.
Tc. = Tucopia.
Te. = Teor.
Ten. = Tenasserim.
Tg. = Tagalog.
TL. = Timor-laut.
Tl. = Tamil.
Tm. = Timor.
To. = Tonga.
Tp. = Tupi, Brazil.
Tr. = Saibai, Torres Sts.
TS. = Toba, Sumatra.
Ts. = Teressa, Nicobar Is.
Tur. = Turribul, Brisbane.
U. = Ualan or Kusaie.
V. = Vanikoro.
Wg. = Waygiou.
Y. = Ylocano, Philippines.
Yp. = Yap, Pelews.

Explanation of the construction of the Table.—The names are grouped in the vertical columns according to regions, which may be geographical, *e.g.*, the Indian Archipelago, or linguistic, *e.g.*, East Polynesia. The letters in brackets indicate the island, language, or dialect, and are explained in the list of abbreviations. The horizontal lines are employed to separate the names according to their linguistic affinities; thus, there are five sets of names given for the banana and two for the sweet-potato. The laws of the letter-changes for the Indian Archipelago and Polynesia may be found illustrated in Prof. Kern's "*Stamland*" paper and in his *Fidji-taal*, etc. For Polynesia only, see Tregear's *Comparative Maori Dictionary*.

The CHAIRMAN (A. McARTHUR, Esq., D.L., Vice-President).—I am sure we all concur in presenting our best thanks to Dr. Guppy for his interesting paper. (Applause.) We shall be glad to hear remarks upon it after some communications have been read.

The HON. SECRETARY (Captain F. PETRIE, F.G.S., &c.).—Two communications have been received from authorities upon the subject, to whom proof copies of the paper had been sent. The first is from Professor Max Müller:—

"Dear Captain Petrie,—I wish, indeed, I could be present to hear Dr. Guppy's paper, but I am too busy to spare a day. I am much obliged to you for having sent me the proof. It seems an excellent paper written in the right spirit. Such researches, if continued, ought to lead to very important results, and I hope Dr. Guppy will continue them."

The second is from Colonel C. R. Conder, R.E., D.C.L., LL.D., who, in expressing his approval of Dr. Guppy's paper, adds, "it is both interesting and sound."

Mr. W. F. KIRBY, F.L.S., F.E.S., referred to the view advanced by some that Polynesia was peopled from a great southern continent, which, it is alleged, once stretched across a great part of the Southern Pacific. He also referred to the voyagings of Asiatic navigators in the past.

The Rev. H. B. HYDE, M.A., spoke of the high interest attaching to the subject of the paper.

The CHAIRMAN referred to his long acquaintance with, and voyagings among, the islands of the Pacific, especially alluding to the food-producing plants found in them; also to the characteristics of the various Islanders; and trusted that the author would, as suggested by Professor Max Müller, soon add to those obligations under which he had placed the Institute.

Captain F. PETRIE, F.G.S. (Hon. Sec.) alluded to the paper of the Rev. S. J. Whitmee,* F.R.G.S. (Vol. XIV.), who had been for some

* This author, referring to the Ethnology of the Pacific, says, "There are three classes of peoples inhabiting those islands of the Pacific Ocean which I include under the term Polynesia. In the western islands, from the east end of New Guinea and Australia eastward, as far as and including Fiji, we find a black frizzly-haired people. In all the Eastern islands there are large brown straight-haired people (these are found also in New Zealand); and in the western islands north of the equator there are smaller brown straight-haired people.

forty years among the Pacific Islands, and an essay on "The Botany of Australasia" by the Rev. Dr. Woolls.

The AUTHOR, in reply, said: With reference to the remarks which Mr. Kirby has kindly made concerning my paper, I may observe that the evidence of language does not support the idea that Polynesia may have been peopled from a southern continent; for myself, I think we are scarcely warranted in introducing great movements of upheaval or subsidence as factors in the distribution of the races of man. The endemic element in the flora of Polynesia is comparatively small, and the geological structures of such islands as those of the Fijis and of Tahiti are not what we would expect to find in the highest peaks of a continent. In conclusion, I have to thank those present for the kind way in which they have received my paper.

The meeting was then adjourned.

COMMUNICATION RECEIVED ON THE FOREGOING SUBJECT.

Mr. JOHN FRASER, LL.D., New South Wales, writes:—

Everyone who has examined the Oceanic languages—from K. W. von Humboldt and Gabelentz down to the present hour—notices the fact that there are many words, both root words and derivatives, which the Malays, the black Melanesians, the brown Polynesians, and the Micronesians have in common. Some writers have ascribed this to the influence of the wandering Malay; but I hold that the Malayo-Polynesian theory is utterly wrong, for the Malays are a recent people in Indonesia; the eastern Polynesians are quite unlike them in physique and temperament; and it is impossible that the fierce Papuak natives of New Britain, the Solomon Islands and the northern New Hebrides should have adopted so many essential elements in their daily speech from the Malays. I have long maintained that the true

solution of this linguistic and ethnic problem will be got by regarding the black races as the first occupants of India, spreading thence into Further India, Indonesia, Australia and the whole of Oceania; then a light-coloured race came into Indonesia, and, uniting with the blacks there, became the ancestors of the brown Polynesians of the eastern isles; and, lastly, a race of Mongolian origin, the Malays, invaded the Archipelago and adopted much of the Polynesian language which they found there. Thus I see in the Archipelago an amalgam of black, brown, and yellow elements which, however, show themselves to us, independent and yet cognate, in Melanesia, Polynesia and Malaysia. Mr. Guppy's view of the matter is much like this, as I judge from the sixth paragraph of his paper.

These views are also supported by the plant-names which our author has collected from so wide an area. All over the Oceanic area, the name for "banana" is formed from the same root syllable, *bu, pu,* "white," represented in the Indian languages by *bha, ba, ma,* "to shine," "to be bright in colour," as in the Pâli *pandu, pandaro,* "white," "light-yellow," of which the Indonesian forms are *pūtih, ma-pūti, ma-bida,* "white." Hence come the varying forms of the name for "banana" in the black, the yellow, and the brown areas. And this name is sufficiently descriptive to prove its own antiquity. The Fijian *vundi* is so near the Pâli *pandu* as to make it unnecessary for anyone to say that the Fijians borrowed it from the Malays. And since New Britain has *vudu, wundu* and the Solomon islanders have *vudi*—black regions to which the Malays never penetrated—it seems almost certain that the Melanesians, when they were in sole possession of the Archipelago, had that word for "banana," and that *they* gave it to the Polynesians. The Malayo-Polynesian theory asserts the kinship of the brown Polynesians to the Malays on the ground of similarity of some word in their languages, but, on the same principle, I might declare that the Microsians came from the New Hebrides; for their word *ush, us* "banana" is the same as no-*bos* in Tanna and *ves* in Malekula—corruptions of *fusi, fudi.*

Another of Mr. Guppy's examples—*koko, kuka, kakau*—is also a descriptive word. It must have a general meaning in its origin, for it is applied, as he tells us, to *taro, yam, ferns, sweet potato.* The original root is *ka* "to eat," as in Sanskrit khād, *ad,* Latin *edo,* English *eat.* Maré Island (Loyalty Islands) says *kaka,* "to eat,"

the Maori says *kai*, the Samoan *'ai*, Fiji *ka-na*, New Britain (k)*an* and various islands of the New Hebrides have the same root in the forms *ca-ig*, *ka-ni*, *ga-ni*; the Malay word is *ma-kan*. Indeed, this root is so widely spread in all Oceania that it is impossible to believe the Malays—the most recent comers—brought it there; it must belong to the speech of the earliest occupants, the blacks. And further; in Oceania there is the frequent interchange of *k* and *t*; hence the root *ka* is also *ta*. From these two roots come many of the plant-names in Mr. Guppy's lists; they mean merely "that which is edible," "that which is used as *food*"; *e.g.*, *ka-ba*, *ka-pe*, *kaka-u*, *ta-ka*, *ta-lo*, *ta-ro*, etc., qq.v. The earliest forms of the name for "sweet potato" lead me to think that *ku-mara* comes from this root ka, with *mara* added to mean "sweet," for there is in some of the islands the word *mada*, *mala-ri*, "sweet."

ORDINARY MEETING.*

THE REV. CANON GIRDLESTONE, M.A., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following paper was then read by the author :—

THE NATURAL AND THE ARTIFICIAL. By ALFRED T. SCHOFIELD, Esq., M.D., M.R.C.S.

NO one can be more conscious than myself of the impossibility of advancing Science, in the narrow sense of the word, one step by means of metaphysics or any form of *a priori* reasoning. But there are so many questions connected with science and there is so much in the wider aspect of the word that is as yet unknown, that although such questions may not be resolvable by experiment or by the chemist's test tube and balance, they are yet of such wide interest and great importance as to be well worthy of the attention of this Society.

It is now generally admitted that all questions as to origins and first causes are in their nature only to be approached by deductions and inferences and methods of *a priori* reasoning; and scientists themselves, though allowing nothing within the narrow range of their text books to be asserted without proof, are not at all slow to affirm and deny on many subjects that are outside demonstration.

It is true that of late years the sceptic as well as the believer have been partially displaced by the agnostic, and

* 5th Meeting of 30th Session.

more caution is certainly observed in making unprovable statements, and probably in future such utterances will become still more guarded.

Not being a scientist I must be pardoned, however, if I do not strictly observe this caution, and state, somewhat strongly, the conclusions at which I have arrived, even though they be in their nature incapable of scientific demonstration and be often rather matters for faith.

It is astonishing after all how much faith there is in those who often repudiate it. Most sciences rest ultimately on faith in the unknowable or at any rate the unknown. The phenomena are pursued further and further back by experiment and investigation; for the belief in causation is a primary conviction of the human mind. We instinctively feel that no phenomenon can be causeless, and travelling backward by scientific methods we invariably reach a point where demonstration is no longer possible, and where inference and theory, and belief in such theories must begin. We find that the assumption of a first cause is a necessity of thought and also that the first cause must itself be uncaused, in other words that the relative must spring from the absolute or—in Christian phraseology, which is at least as intelligible—that the Creation must spring from the Creator.

Human reason is surely degraded by declaring the existence of God or creation by Divine power to be *unthinkable*. It is of course in its detail unknowable, inasmuch as the finite can never reach to the infinite, the relative to the absolute, the conditioned to the unconditioned. But we succeed in thinking of and believing in a large range of existences that are unknown and probably unknowable; for the limits of thought and belief are not those of knowledge. Ether is as incomprehensible (in one sense) as the Deity—a supposed medium of indefinite extension, of inconceivable tenuity and yet transmitting vibrations according to the laws of solid bodies. Light is, if possible, more incomprehensible still, for though we may postulate the waves, we have not even a working theory as to the moving agent.

But we must not now pursue this point. As a matter of fact we know nothing in its essence, and matter is now seen to be as unknown to us as mind: nevertheless, the moment the agnostic says "I am" he commits himself in faith to the unknowable.

I have selected the two words at the head of this paper rather because I think their consideration may afford food

for thought and profitable discussion than because I have anything strikingly original to offer to this learned body with regard to them.

The exigencies of science are so increasing with its extension, that it is said now to require fourteen years merely to become acquainted with what is now known in chemistry. The span of life not being augmented, the range of knowledge in the individual is being constantly narrowed as its depth is increased, and multiplying subdivisions in science are become a necessity, with the unfailing result that the horizon is contracted, and the scientist resembles rather a miner at the bottom of a pit than an explorer of new territories. The philosopher with his broad generalizations is transformed into a specialist of narrow accuracy, who ill conceals his contempt for his former self.

The "natural" means in its etymology that which is about to be, or that which is so unfailing in its occurrence as to be confidently predicted; being the production of constant laws. What the word means in its use it is impossible to say, the word "nature" being used as a synonym for God in one breath, and for a man's habits in another.

Nature may not be unfairly described as the impersonal deity of many scientists, who invest it with law-giving power; all observed principles of force being called "laws of nature."

We would, however, to avoid confusion, use the word mainly in its contrast to "artificial," as meaning that which is expected to occur; whereas the artificial is the result of the capricious art or artifice of man. "Natural" may of course be contrasted with "spiritual," and with other words accordingly as we look at some of its many sides; but at present we will confine our attention to its use in this one aspect. It will be necessary, however, to clear the ground as we approach our subject, by a brief consideration of the inorganic and organic world, relatively to which these words are used.

It has been beautifully said, "God in eternity eternally sees time, space, the universe. In *time* He sees the finite expression of His eternity; in *space* He sees the finite expression of His infinity; while in the *universe* He sees the finite expression of His being."

Time and space, however, are merely duration and extension, they are not "things" but impressions or projections of

mind, known to us only by matter and motion, without which they could not exist.

Turning to the third, "the universe," we find something more than a mere projection of mind, we find "a thing"—consisting of, some say, three, and some, two parts—of ether, matter and force, or of ether and force only.

Matter is believed now by many to be resolvable into ether, but ether is a creature of faith, not of demonstration. Disciples of this school therefore arrive at the somewhat startling conclusion that the foundation substance of all sciences is to them at present little more than a projection of their own minds.

The matter on our earth is composed of some seventy-one elements, the mass of the world being however built up of about a dozen, the remainder being apparently little used. Life itself has a physical basis of but four or five, and water and air two each.

These elements consist of molecules, formerly supposed to be composed ultimately of hard indivisible atoms. Although these atoms are merely "believed in," nevertheless some attempt has been made to guess their size, and it is asserted that 100,000,000,000,000,000,000,000,000 are contained in each drop of water, a statement we are not in a position to deny.

Some more modern scientists, feeling sure that even an atom might be divided, were there a knife thin enough to cut it, commit themselves to points or centres of force (of Boskovitch) having no magnitude, being the ultimate constituents of matter; or in short that matter has no objective existence at all, but is merely a form of force. Others again, to whom we have already alluded (Helmholtz and Thomson), occupy an intermediate position, and believe matter ultimately to consist of what is a little less than matter, and yet a little more than force, and that is ether. Finding that air coloured with smoke, by rapid rotation in the form of rings, can be made to move through air, as a foreign and independent body, they said why should not ether, if formed into vortex or rapidly whirling rings, move independently in ether as of it, and yet not of it; ether at rest having, it is allowed, none of the qualities of matter, save perhaps inertia.

Having got thus far in metaphysical physics, and found, moreover, that the contact of rings of air produced vibrations, and agreed in their behaviour with the supposed movements of the imaginary atoms, it was comparatively a

simple matter to find out that each of these imaginary ether ring vortex atoms would be $\frac{1}{500}$ millionth of an inch in diameter, or in other words if a drop of water were the size of the earth each component atom or ether ring would be the size of a golf ball. It was also "found" that each could exist in a solid, liquid and gaseous state, and that in the latter each ring would be $\frac{1}{7000000}$th of an inch from its neighbour, which in the case of hydrogen it would strike some 17,700 times a second.

Now all this may or may not be so. Its mere consideration is a valuable exercise in mental gymnastics, even if it leads to nothing more; but at any rate, though the result is rather difficult of conception, the ingenious methods by which it is reached are logical and fairly coherent. When we turn, however, from matter to force many of the theories we are expected to believe are far otherwise.

Matter and force are both objective, but it is well to remember, in passing, that many of the phenomena of the former are purely subjective, We talk of light and sound, the former consisting of supposed waves of ether of an average length of $\frac{1}{50000}$ inch, and the latter of waves of air averaging about a foot, but light and sound are nevertheless both subjective phenomena, and do not exist outside consciousness; as a stick travelling through the air is not "pain" till it strikes. These waves are not in themselves either light or sound.

To return. When we compare the carefully considered though startling statements of Helmholtz and Thomson on matter with such a sentence as the following: "Energy is always associated with matter and probably *is* matter in motion," we feel that the latter clause essentially confuses cause and effect, and must therefore be rejected, whereas the former is at any rate not contrary to reason.

What then is force or energy? We talk of the laws of nature, but these laws are not made by nature nor are they even in themselves the origin of power. They are merely the expressions of a power that acts uniformly.

Professor Tait, in a close chain of reasoning that cannot be too highly valued, points out that the fact of motion and the determination or direction of motion are essentially different. The forces of nature are heat, light, electricity, gravitation, chemical affinity, etc. The mystery is not what are the forces that move particles, but what is it that guides and determines the manner and direction of the movements; for

we cannot conceive force acting apart from manner and direction. It has been well said that the laws of nature are not causes but courses. Force cannot be self-directing. Moreover, and this cannot be too strongly insisted on, neither can matter, direct force, or matter, or motion, or anything else; for its primary property is INERTIA.

The movement of a body is not determined by the action of a force, but by the manner of its application. It is easy to say bodies move in the direction of least resistance, or in a direction determined by the resultant of the forces applied; but who applied the forces, and what determined their direction, on which the movement of the body depended?

At any rate it was not another force, for that only carries us a stage further back in the inquiry, and a careful consideration will make the following statement perfectly clear, "That the action of a force cannot be determined by a force, nor can motion be determined (that is directed) by motion."

Look again at the results of these forces; their action may be blind, but their results are not, and therefore what determines them is not.

No force can possibly account for the objective idea in nature.

Every atom or vortex ring must be made with forces or affinities determined in definite directions and amounts, so as to form the definite and exact compounds that compose this universe; indeed, we may go further and say no vortex ring is conceivable without the conception of a determining force that causes its revolutions.

Sir John Herschell said, recognizing the quality of mind in force, "The exact likeness of all molecules of each sort to each other gives them the essential characteristics of a manufactured article;" and it must be remembered that as far as can be ascertained matter everywhere in the universe is alike, and is divided into the same elementary bodies.

Moreover, the laws and properties and forces we observe and so dogmatically tabulate in the various sciences may not after all be fully understood, for although the forces of nature seem to be always determined in the same direction and intensity, it may not really be so. Philosophers in the summer might formulate laws from observing the properties of water, all of which would be found to be modified unexpectedly when the winter brought the first snow or ice; and it is quite possible that our little summer existence on this globe, as

compared with the eternity of the Infinite, may not have reached into the winter before and behind us! Indeed, there are indications, in the impossibility of accounting at present for the source of the sun's heat and other problems, that the laws of heat and light observed by us may not always have applied.

Seeing then that no force can act without determination or direction and that this ultimately can depend neither on matter or force, we are driven to what after all is the only rational conclusion, and that is that determination is the result of mind, and if we ask whose mind, the answer can only be the mind of the Infinite.

Professor Tait reaches this conclusion when he says, after elaborate arguments extending over hundreds of pages, "The determination of all things can come from God alone."

Lord Brougham says, "The evidence for the existence of mind is more certain and more irrefragable than for that of matter."

Dugald Stewart sums his arguments up thus:—

1. Every effect implies a cause.

2. Every combination of means to ends implies intelligence (*i.e.*, mind).

Let us then cease to attribute this intelligence to nature, as for instance, "Nature's cunning contrivance stores up coal and reveals it to men when needed."

This nature is a fiction and a fancy and is only such a favourite inasmuch as it offers a superficial escape from the necessity of recognizing a supreme Being. The reality is a great creative mind of omnipotent power; above, but in sympathy with his whole creation: in other words, God.

That mind is the cause of force-action is, however, denied; for we find such men as Tyndall (*Fragments of Science*) saying in a comparison between the pyramids and rock crystals, "While the blocks of Egypt were laid down by a power external to themselves, the molecular blocks of salt (matter be it remembered, whose first quality is inertia) were self-posited; being fixed in their places by the forces with which they act on each other." He here advances the amazing idea of a self-determining power as the attribute of a molecule.

Dr. Nicholson, in a paper read here some time ago, says that force is or may be an affection of matter, an idea to my mind equally confused and confusing.

Herbert Spencer takes the other side and sees nothing in

the origin of the universe but "mere" force or energy, and in the progress of the universe nothing but spontaneous evolution. The word "mere" is so admirably out of place in this sentence that its bias stands self-revealed. Are not bigotry and partiality as great dangers for the agnostic scientist as for the Christian philosopher?

And yet in another connection Herbert Spencer truly says, "By the persistence of force we mean the persistence of some power that transcends our knowledge and conception. The manifestations do not persist, but that which persists is their unknown cause." And this is so invariable that the manifestations can be tabulated and called laws; and scientists, however sceptical, are so sure that the universe is the work of the highest intelligence that they set to work in faith on observing a phenomenon to discover its fixed laws; for the reason that a law is fixed must be because it is perfect for all time. This shows perfect fore-knowledge, power, goodness, and wisdom. It has been beautifully said that if we throw dice the same twelve times we do not attribute it to chance, but say they are loaded. So is the fixed order of the universe "loaded" with Divine wisdom and the same law acts uniformly in the awful distances of the starry depths as in the component atoms of a molecule of water.

The merely material conception of the universe is truly unthinkable, for we only know matter by mind, the natural by the spiritual, and such a conception necessarily excludes "force" which is not material.

Dr. Reynolds shows it is absolutely inconceivable that C O H N should be otherwise than indifferent to their position in matter past, present, or future, and even if we advance a step and allow the question of non-material mechanical forces and regard the universe as a mechanical toy, we still have to consider its construction and the mind required to produce such a result.

Cicero very well rebukes the modern philosopher. He says, "The man who believes that the world was made by the chance meeting of atoms will believe that the letters of the alphabet shaken out on the ground will form the annals of Ennius (or Socrates or Plato)!" And yet, as we shall see, men do believe regarding *natural* phenomena what they regard with scorn in *artificial*.

Dr. Reynolds ably sums up the question. "The consciousness of an inscrutable power manifested to us through all phe-

nomena has been growing clearer, and must eventually be freed from its imperfections. The certainty that on the one hand such a power exists, while, on the other hand, that its nature transcends intuition, and is beyond imagination, is the certainty towards which intelligence has from the first been progressing. To this conclusion science inevitably arrives as it reaches its confines, while to this conclusion religion is irresistibly driven. And, satisfying as it does the demands of the most rigorous logic, at the same time that it gives the religious sentiment the widest possible sphere of action, it is the conclusion we are bound to accept without reserve or qualification."

When from the discussion of matter and force we turn to the phenomena of life we find curiously enough as the unseen directing mind becomes more plainly revealed so is its existence denied with increasing assurance and vigour.

One way of doing this is by word conjuring, and in definitions of life, describing its phenomena; as previously "force" and the "direction of force" were hopelessly confused.

For example, speaking really of the phenomena of life, but ostensibly of life itself, Herbert Spencer says in his classic definition, "Life is an integration of matter and concomitant dissipation of motion, during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity; and during which the retained motion undergoes a parallel transformation." Those trained minds who have fully mastered this sentence must confess that the word "Life" in all this polysyllabic tangle does not mean "life," but its phenomena and their results.

Again, for this point is important, the philosopher says "Life is the continual adjustment of relations in the organism to relations in the environment." Surely such a statement is misleading. It is not life that is spoken of at all, but one of its attributes or functions. Professor Huxley pushes the matter still further, and plainly asserts that life is one of the properties of protoplasm. He asks in his *Lay Sermons*, "What justification is there for the assumption of the existence in the living matter of a something which has no representation or correlation in the non-living matter which gave rise to it? If the phenomena exhibited by water are its properties, so are those presented by protoplasm, living or dead, its properties.

If the properties of water may properly be said to result from the nature and disposition of its component molecules, I can find no intelligible ground for refusing to say that the properties of protoplasm arise from the nature and disposition of its molecules. . . . . We know that the phenomena of vitality are not something apart from other physical phenomena but one with them: and matter and force are the names of the one artist who fashions the living as well as the lifeless." Elsewhere Dr. Huxley says, "It is as ridiculous to speak of life apart from protoplasm as to speak of the 'aquosity' of water."

Observe where we arrive. Life is a property of a special form of matter, and matter and force are the names of the one Artist who fashioned it!

Bûchner, bolder and bolder still, actually says, "The facts of physical science *prove* (*sic*) that all organic beings owe their existence solely to the conjoined action of natural forces and materials. Organic beings are derived by spontaneous generation by the combustion of inorganic elements."

Now the facts of physical science prove nothing of the kind, and such assertions by men of science surely tend to bring many of their so-called "facts" into discredit.

Protoplasm has long been made to do duty for a God; but what is protoplasm? Our latest scientists are beginning to see that it is not a simple substance at all, but a very complex one; and that very probably not it, but the granules it is seen to contain under a power of 4,000 diam., may be the so-called physical basis of life. In fact we are hearing less and less of protoplasm; and the granules themselves, had we power to investigate them, might turn out to be very worlds of complexity, so that dogmatic postulation on such ricketty premises is to the last extent undesirable.

Unbelief and Atheism both live by faith that the origin of life will yet be accounted for, but we do not need to wait for the advent of that day to see that such statements as that "organic forms are built up by the play of molecular forces" are pernicious rubbish. Rubbish, because without meaning, and pernicious, because trifling with a great subject.

In 1885, Dr. Nicholson says, "I do not say that it may not be ultimately proved that dead and living protoplasm are one and the same substance, with no other difference than that dead protoplasm is in a statical, and living protoplasm in a dynamical condition," a statement which seems to

ignore the existence of life apart from protoplasm almost as strongly as Dr. Huxley. It is only right to say Dr. Nicholson adds that at present there is not a shadow of proof to support such a theory. Once more, then, we reach the old, old question. Are we to consider protoplasm an essentially vital substance? Is life its motion or its mover? Protoplasm is a "vital substance" only when acted upon by life; but when it is not, it is still protoplasm. Life cannot be its motion, for motion is a phenomenon, and life is not a number of phenomena, but a power that originates and directs them. The phenomena exhibited by living beings are clearly largely physical and chemical, and produced by natural laws. The question is whether the directing agent is also a force in the common sense of the word. Now Tait has shown that force cannot direct force, therefore the director of the phenomena of life must be life itself, or in other words mind, which is the only directing agent we know of, or can conceive. Life then is not protoplasm in any condition in which it may be found; neither is it any sort of force that moves it, such forces not being vital, but physical and chemical; but it is in its essence the directing power that sets them in motion, or in other words, mind; for the phenomena of life are clearly the phenomena of mind and not of matter.

In a leaf the question is, not what moves the molecules to form it (this is a force) but what guides this motion to produce a leaf. And purpose is everywhere displayed by life besides other qualities of mind. An amœba shows volition, appetite, and passion. Sir J. William Dawson watched one trying to swallow a one-celled plant as long as its own body. It was evidently hungry, and eager to devour it, and stretched itself to its full extent, trying to envelop the plant. It failed again and again; but renewed the attempt, until at length convinced of its hopelessness, it flung itself away, and made off in search of something else.

In a lower form of life still, not even a cell, but a shapeless mass of protoplasm without wall or nucleus (the protomyxa), we find that whenever any particle of nutritive material comes in contact with it it has power to recognise it, and to throw out of its own mass long filaments to grasp it, and then by their contraction and withdrawal to lodge the food within its own body. This undifferentiated protoplasm, destitute of all organs and yet having life, exhibits purpose,

and may we not say, instinct—both properties of mind, and distinct from any known quality of matter.

Professor Huxley, in his *Lay Sermons*, and in spite of his materialistic views, beautifully paints the action of mind on matter, or life on protoplasm; as follows:—"Examine the recently laid egg of some common animal, such as a newt or a salamander. It is a minute spheroid, in which the best microscopes will reveal nothing but a structureless sac, enclosing a glairy fluid holding granules in suspension. But strange possibilities lie dormant in that semi-fluid globule. Let a moderate supply of warmth reach its watery cradle, and the plastic matter undergoes changes so rapid, and yet so steady and purposelike in their succession, that we can only compare them to those operated by a skilled modeller upon a formless lump of clay. As with an invisible trowel, the mass is divided and subdivided into smaller and smaller portions, until it is reduced to an aggregate of granules not too large to build withal the finest fabrics of the nascent organism. And then it is as if a delicate finger traced out the line to be occupied by the spinal column, and moulded the contour of the body; pinching up the head at one end, and the tail at the other, and fashioning flank and limb into true and salamandrian proportions in so artistic a way that after watching the process hour by hour one is almost involuntarily possessed by the notion that some more subtle aid to vision than an achromatic would show the hidden artist striving with skilful manipulation to perfect his work."

Nowhere could we find the action of mind more graphically delineated, or the hidden finger of God more beautifully described, and yet Professor Huxley neutralises all the passage by declaring that matter and force are the names of the hidden artist! To call matter and force an artist is a contradiction in terms, for matter is inert, and force is blind.

Life, as a product of natural laws or forces, is a pure assumption; and is contradicted by the fact that although often in opposition to them it yet works by their aid.

The protozon at one end of the scale and ourselves at the other, alike show this.

A protozon can swallow, digest, and assimilate food, using the albuminous part for its own tissue, and burning away the rest or rejecting it just as we do; all in opposition to and yet by the aid of natural laws. Like us it can only subsist on food a plant has produced. Like us food is

expended in animal force. A muscular act is as simple and unconsciously performed as sending out a pseudo-pod; and digestion is as unconscious in a stomach as if performed in a temporary vacuole.

Calcareous shells grow up from within the protozon bodies, as do our bones; and are formed as unconsciously as the skeleton of an average Englishman. The power within this particle of jelly guides its physical and chemical force so as to give rise to the most exquisite formation and arrangement of the particles of lime.

The smallest living being is said to be $\frac{1}{29400}$ inch and yet moves with grace, eats, and multiplies. As if to exclude, moreover, the inanimate clay which we call protoplasm from any active share in the wonder that life produces, Herbert Spencer expressly shows that no germ, animal or vegetable, contains the slightest rudiment, trace, or indication of the future organism, since the microscope has shown us that the first process set up in every fertilised germ is a process of repeated spontaneous (?) fissure, ending in the production of a mass of cells not one of which exhibits any special character!

To sum up then; the inorganic part of the universe consists of matter and force, the directing and determining agent being mind—the mind of God. In the organic world we have protoplasm and life, which latter is the name we give to the determining and directing power that moulds the protoplasm by means of the forces of nature to certain definite ends. Life thus stands revealed as mind, and this mind the mind of God.

The natural we have seen is matter as formed by the hand of God (that is, by forces which are His laws) in accordance with His mind.

It is called natural because it is what is known, what is expected, what is usual, from the simple fact that His mind changes not, and that therefore forces are always determined in the same directions, giving definite shapes and properties to leaves, flowers, and fruit, to crystals, dewdrops, and planets.

If the natural be matter moulded by the mind of God, the artificial is matter moulded by the mind of man.

Clay is a natural product, that is, it is matter held together by certain natural laws, the expression of mind—the mind of God. A brick is an artificial product, that is, it is matter in a form impressed on it by the mind of man.

The moment you see a brick you see matter + mind, human mind—an artificial product. You know there is mind in it, for its shapes and proportions betray a purpose, and that purpose means mind is nowhere denied save in nature. Not all the philosophers or scientists that ever lived could persuade you that clay could shape itself and bake itself into bricks.

Walk down an old river bed, or hunt in a heap of drift. You pick up two flint stones, both chipped; one you say is a natural product, the other artificial; for in the latter you notice the chips have a purpose you can grasp, forming the stone into a rude arrow head. You are as quick as lightning to discern the faintest trace of human mind on matter; rude scratchings on bones, sherds of broken pottery, bits of battered bronze are all eloquent with what we delight to honor—the great mind of man—they are all artificial.

How we glorify this mind, and rightly enough too! We wonder at St. Paul's, and St. Peter's, at the Parthenon and the Colisseum, and honor the great minds that created them.

A watch, a steam engine, a type writer, all excite our admiration of the mind that is stamped upon the brass, steel, and iron, in such large capitals: and were anyone so idiotic as to attempt to show that such were self-made, or the result of the interaction of blind forces, or of that mysterious variety—molecular force—we should promptly put them in an asylum under the care of Her Majesty's Commissioners.

And yet all these artificial products are clearly evolved. A cathedral was not the first building—nor a watch the first timepiece made by the mind of man. Through long centuries the evolution of the watch dragged on, and indeed is still progressing, and so with every artificial product, down to the very pen that writes these words and the paper on which they are inscribed. We find no difficulty here in the union of evolution and purpose, indeed we cannot conceive the one without the other. So clear are we as to the artificial and as to any imprint of the mind of man, that to us in these matters fortuitous or spontaneous evolution is the most drivelling folly; and we are prepared to stake our reason on the statement that in all things artificial all evolution implies an evolver, or in other words a directing mind.

When, however, we consider our attitude towards the natural and the artificial the contrast is striking. The very philosopher who sees mind in the three chips of an arrow head

or the three parallel lines on a bone, sees nothing but spontaneous evolution or the action of molecular forces in the production of the savage who made them.

In short it takes a great mind to make a machine, but the mechanic is spontaneously evolved; none but a clever man can make a watch, but any one can make a watchmaker, or rather it requires no one; for he is derived from the "spontaneous combustion of inorganic elements."

All see mind in the artificial, while too many seek to deny it absolutely in the natural; and the reason is not far to seek. For it is as natural to glorify the mind of man as to seek to deny the mind of God.

Does not the extraordinary nature of such reasoning strike us? Turn it round for once, and say a watchmaker is evidently the product of matter acted on by the mind of God, but a watch is the result of the "spontaneous combustion of inorganic elements"; or an architect requires a great Designer to make him, but St. Paul's is the natural outcome of the molecular force in stone—the folly is now apparent to all. The quiet ignoring and even denial of mind in the natural so common with our scientists could not be tolerated one moment with regard to the artificial.

Surely the architect is a greater work than a cathedral, a brickmaker than a brick, and *a fortiori* if the one cannot be even conceived without involving the action of mind, how much more the other: and if we are quite clear the watchmaker is not artificial or made by the mind of man, it is clear that in saying he is natural we imply he is made by the mind of God.

The artificial is capricious as the mind that makes it. It cannot be foretold, it is not that which is to be—"natural"—because of the difference of a petty finite mind as compared with the All-wise and Infinite.

The very words used to describe the product of the two minds illustrate their difference.

But we may carry the inquiry one stage further back and ask whence came the mind of man? Is it eternal, self caused, or itself a product? It cannot be eternal, for man is only recent, nor can it be self caused. It is therefore a product. But of what? We read, "God made man in His own likeness, and breathed into his nostrils the breath of life," but I suppose even in this assemblage I must not quote Scripture as an all-sufficient answer to a scientific question. No other answer is however possible, and it is as self-evident on reflection that the

First Cause caused the mind of man, as that He caused the heavens and the earth.

We therefore come to this, that the natural is matter immediately fashioned by the mind of God; and the artificial is matter immediately fashioned by the mind of man, this itself being the product of the mind of God.

Nature therefore necessarily expresses "the glory of God and sheweth His handiwork," for it is the transcript of His mind; whereas in the artificial we generally forget the reflected glory of the One who formed the human mind, in our adoration of our own intellect and skill. All this is natural enough, but rather childish. That French critic had a keen vision who said, "God is still generally acknowledged in England, save by the street boys and the higher philosophers."

Turning to evolution there is no doubt a difficulty even if in both cases we postulate an evolver. For while we perceive that the finite mind of man cannot see at once a watch in a sundial, or a steam engine in a kettle, but has slowly to evolve the one out of the other; when we come to an infinite mind we cannot see why imperfect products should precede the perfect. But were they imperfect? We can see in the first rude engines and clocks their great inferiority to the locomotives and chronometers of to-day, but in geology and zoology we surely see equal perfection throughout all ages, each product being as truly adapted to its environment then as now: an amœba in its way being as perfect as a man, a fungus as an oak. So that evolution in natural things is not stamped with the imperfection of a finite mind as in artificial, but is due to some other reason, which I may not now pursue. Indeed the time has not yet arrived to consider the subject impartially, for the strife of battle has hardly yet died away.

To repeat then—the natural everywhere, from a molecule of water formed by the chemical affinities of atoms to the most distant nebulæ, as well as all living things, are the product of matter moulded by the mind of God, immediately; whereas the artificial is the product of matter moulded by the mind of man immediately, his mind being the product of the mind of God.

There yet remains the question of animal products—What is a bird's nest? What is a beaver's dam? What are the actions and works of animals? Are they natural or artificial? Our answer depends upon whether we recognize a mind in an animal apart from the mind of God as seen in nature.

Let us consider one or two instances of so-called instinct.

Du Bois Raymond says: "With awe and with wonder must the student of nature regard that microscopic molecule of nerve substance which is the seat of the laborious construction, orderly, loyal and dauntless soul of the ant!"

Huber says: "On the visit of an overseer ant to the works when the labourers had begun the roof too soon, he examined it and had it taken down, the wall raised to the proper height, and a new ceiling constructed with the fragments of the old one."

Romanes shows the sphex wasps provide animal food for their young which they paralyze but do not kill. Crickets have three nerve motor centres to be paralyzed; one behind the neck, which has to be stretched to get at it and two in other minute points in the body, yet all these are unerringly punctured by the wasp. He adduces this as a specimen of supposed "lapsed intelligence."

A spider with a big fly could not secure it, so bit one of its legs, and as the fly stooped its head to its leg, at once secured it with cords thrown over it.

Birds go through elaborate dramatic performances when their nests are approached, and insects often simulate death.

Some jackdaws tried to build a nest on a sloping window sill outside a church, but the sticks all slipped down, so in five days they constructed a pyramid of sticks resting on a step six feet below and reaching up to the sill to support the nest on which they built it.

These instances suffice to show that when nerve centres exist how much the actions we loosely term instinctive resemble the results of human reason. No doubt when no nerve centre whatever exists the actions are purely reflex or automatic, but close observers find it hard to believe this is so in higher animals.

Even if they possess a mind however it is only in its lower qualities. Of self-consciousness, independent will, and moral purposes there is no clear evidence; and in the absence of free will, there is of course no responsibility. We therefore call the work of animals, however clever and ingenious, as a rule, natural; thereby implying that if they have a mind it is not free to act entirely on its own initiation, but that its action can be foretold sufficiently to term its products "natural" rather than "artificial." At the same time occasionally the product appears to be so connected with reason and thought

as to be highly "artificial," particularly when it resembles human work. Once more then in the inorganic part of the universe we see matter acted on by determined force, or by the mind of God; in plant and lower animal life the same, hence the phenomena in these spheres are natural. In many of the actions of higher animal life it is not quite clear as to how far a derived intelligence with a narrow range of liberty may not be the agent, the phenomena on this level are therefore sometimes called natural and sometimes artificial; while in the surroundings of man we see matter acted on by a fully emancipated self-conscious mind, His own bodily life being still unconsciously carried on as in the lower animals; hence we term all products of will action artificial, while the physical functions are still called natural.

I am afraid I have wearied my audience with this long paper, in which after all I have succeeded in saying so little; but that little was worth saying if it has emphasised the fact that the natural world bears as truly the stamp of the mind of God as the artificial world does the mind of man; and that it is futile to deny the presence of mind in the formation of man, if we admit it in his handiwork. Inasmuch also as instinct implies purpose, and purpose mind, it is admitted equally in the work of animals; only as such work is generally uniform in each species, and can therefore be predicted, is it called natural rather than artificial.

I cannot of course expect that in my remarks I have carried all my hearers with me, but I thank them for the patient hearing they have accorded me, and trust they will deal leniently with any errors they may detect, both on account of the difficulty of the subject and the very busy life of the speaker, which has not allowed him the time that such weighty questions require.

The CHAIRMAN (Rev. Canon GIRDLESTONE, M.A.)—I am sure you will allow me to thank Dr. Schofield in all your names for the very interesting paper which he has given us.

Dr. GERARD SMITH, M.R.C.S.E.—Upon the main thesis of Dr. Schofield's paper I have no remark to make except to express my appreciation of the value of what he has said; but the major portion of the paper is a preamble leading up to the main thesis, and in that he dealt more or less with the great theories held by materialists which are supposed to be so essentially tangible as against those held by members of this Society, which are regarded as so very intangible. But I notice that Dr. Schofield has quoted, as far as he could possibly quote, those arguments on the materialistic line of thought, commencing only with vortex motion. I claim that we should be allowed the fullest right of search, which should go far behind this, and that when we come to vortex motion we have skipped over a great deal that should have gone before, and which we must go into if the theories are to be consistently held. In following out the materialistic argument everyone rightly suggests a series of infinite causes, one behind the other, and I hold that the consistent following out of what used to be called the atomic theory brings us precisely to this position. It is very difficult to get a materialist to go with you, and not to fly off at some point when things are getting a little difficult. I have asked questions as regards whence comes energy (not force) residing in original atoms; and have been told, constantly, that it is the result of their inherent properties, and I have asked whence come their inherent properties and have been told "that they are the result of the inherent energy"! That is cause behind cause, and we cannot get behind that when we go in that direction. Now the simple monistic assumption is said to be given up—the one idea of starting from equi-distant atoms all spread equally in space—but it is not given up if we still follow Spencer's polysyllabic expression that "matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity," passes, that is from a state of equal separation of atoms in space, to unequal sized masses. We will not go behind that; but I ask, are these atoms at rest or moving? They must be one of the two. If they are at rest, I want to get at where the vortex motion comes in? If not at rest, whence came the primary movement? The answer is "Gravity—every atom as a centre of gravity and therefore the atoms would come

together of themselves." When you come to think of it, the only thing that gravity would do, under those circumstances, would be to keep everything at absolute rest eternally. It is the *reductio ad absurdum* behind which one cannot get. If you will permit me I will follow that out a little further. If they are moving, where are they moving—round, up or down, or right or left, in space? Gravity cannot get to action until some larger mass is formed—until the "definite coherent heterogeneity" has been formed. For gravity cannot be the cause of its own antecedent conditions. Besides which I might remark if these atoms are moving, they are moving in parallels and they would never go out of the parallel, and gravity would not account for that. Now I will just say this also—that there is another resource and that is that the atoms are free-will atoms. Since you and I are only made of organic matter, and since it is certain that you and I have got free will and go here and there and do what we wish; therefore it is only fair for the materialist to say that the atoms of which the body is composed are free-will atoms. Professor Clifford said that "every atom has a piece of mind stuff in it"!—another *reductio ad absurdum* I would ask you to take notice of.

Finally, I would like to state that which I think is held by most members of the Society—that the "I know" of science leads us into so many unthinkable notions that I think we may say the "I believe" of religion satisfies the reason in a far more satisfactory and perfect way.

Professor E. HULL, LL.D., F.R.S.—I would refer to one point that Dr. Gerard Smith has mentioned, and that is with regard to gravitation. Gravitation is a force; but the effect of gravitation by itself would, I think, go even further than he stated. It seems to me that if matter had been universally disseminated in that manner, and the force of attraction had been universally present with each particle of matter, the result of that would have been to produce one single solid mass of immovable matter in the centre of the universe. You require something more than the force of gravitation, you require motion, which, in the solar system is opposed to gravitation, *i.e.*, a centrifugal motion, acting in conjunction with gravitation, in order to keep the whole system in its normal and natural condition. But gravitation, by itself, would have had the effect of causing every particle to draw every other particle to itself, and thus form a centre round which all

these particles would collect, producing one solid motionless mass in the centre of the universe. I have listened to this paper with great interest and satisfaction.

The CHAIRMAN.—There are two or three points in the paper to which I desire to call attention. On the second page there is a sentence which I think is of great importance:—"Human reason is surely degraded by declaring the existence of God, or creation by Divine power to be unthinkable." That is a point which you will remember the late Charles Bradlaugh often used to call attention to. He used to say, "I will not believe what I cannot conceive—I cannot conceive God; therefore I will not believe in Him." At first sight this seems very simple, but suppose we put it thus: "I cannot conceive the nature of God; but I can conceive that there is a Being which we may rightly call God," then we see the matter is quite different. It means "I conceive that a Being exists whose nature I cannot fully comprehend," and this at once saves you from the difficulty that he was in the habit of propounding. There are many things that exist that I cannot fully understand, but I would not say they did not exist because I do not nnderstand them. I would rather say, "I am certain that they exist, for I cannot get on without them; but why these exist, or how they exist, is quite another matter." So we may say "I conceive there is a God, but I cannot conceive the full nature of God." That distinction will help us, perhaps, in considering that subject.

I note that the author defines "artificial" as a product of the mind of man, and "natural" as constituting the attributes of the Divine mind itself.

Then on page 188 you have a case of an artificial product such as a brick which is matter plus mind, evidently, and the question rises whether the human heart, for instance, is matter plus mind. Cases are given of a watch, a steam engine, and a type-writer. Take the case of a type-writer, or of some automatic machine, which I would prefer even to a type-writer, because in the case of a type-writer a man's hand is manifestly used—but take an automatic machine in the ordinary sense. Remember what it is—it is simply compressed mind; and in providing yourself with a piece of chocolate out of an automatic machine you do not annihilate mind. So with God—you do not annihilate God by saying a tree brings forth beautiful fruit. "A telescope is a

wonderful thing, but the mind that constructs it is far more wonderful"; and I think we may say the same of the series of things which we call Nature. But I suppose the great difficulty which is felt by the materialist lies here—I refer to page 189, about the middle paragraph where St. Paul's is spoken of;—we have no doubt that St. Paul's is constructed by human beings, because we are in the habit of seeing human beings make buildings. If no human being had ever been seen to make a building, construction would be a very different thing to us, and we might think it the work of nature; but you see here, we appeal to the eye. We have seen the thing done and therefore we know it is done by man.

Now God is invisible, and at every stage of this discussion we realize that the invisibility of God is one of the great difficulties—a difficulty which any of our working men in East London would take hold of at once and say, "If I could only see God I should believe at once—seeing is believing." They do not realize that the highest position of man is to lift himself up above the senses—to draw inferences from that which is above and beyond the senses.

Another thing which I think should be borne in mind is this—that nature is constant, and the more constant it is the more we take it as a matter of course, and the less we expect to find a reason for it. The sun rises, we say, every day, and so we cease to philosophise about it and its properties which give to us light, heat and force. But how different to remember that this is the work of a Being whose mercies are renewed every morning is this training of the human mind which is such a help, and it seems to me that the materialistic view tends to reduce the mind of the believer in it to a minimum and to an animal condition instead of training him up to see the things which are invisible and which are the secret of all human life.

The Author.—With regard to the Chairman's remark referring to the difficulty some profess in believing in God, because they have never seen Him work. "We have seen buildings erected," he says, "and therefore we know that a building like St. Paul's is the outcome of man's constructive power"; but to my mind the force of this argument goes the other way. If we had never seen a carpenter making these tables, for instance, we should be logical in saying, "These are the natural outcome of wood, as man

is of protoplasm," and in denying the action of mind in both cases. But it seems to me, when we have an actual exhibition of mind in the one case of making a table, our denying it in the greater work of making a body is absolutely unreasonable. What I complain of is this—that those who are so ready to acknowledge the ingenuity of the human mind, and to see the artificial where it is difficult for the ordinary observer to see anything but the natural, such as in the three chips in a flint arrow's head—these very men who are so keen to see mind in the direction of a chip are those who are most persistent in denying it in the creation of the man who made the chip, and there I think there is no possibility of excuse. I do not know whether I carry the audience with me, but it is impossible for me, from my particular point of view, to understand such an acceptance of mind in the production of the artificial, and such a denial of it in what I call the natural, unless there be behind it a bias that leads a mind, otherwise keen and acute, to deny those things which seem so plain to others; but I fear that there is that bias, unconsciously acting, in men who deny mind in the one case and accept it in the other.

I thank you for the very kind way in which you have listened to me.

The Meeting was then adjourned.

COMMUNICATIONS RECEIVED ON THE FOREGOING PAPER.

Professor LIONEL S. BEALE, M.B., F.R.S., writes:—

I venture to think that already we possess incontrovertible evidence in favour of the view that *living* and *non-living* are entirely distinct and incomparable—that the living state is *absolutely* separated from every other known state for condition of matter—that between the two conditions there is no gradual transition—that the difference is not of degree only, as has been unreasonably affirmed—and that although living and non-living matter may be in contact, in no case does the matter alive shade

into or gradually pass into that which is not in the living state, or which may have just ceased to live. Hence I think it justifiable to give a definite name to the matter which is in the temporary *living state*, and the word *bioplasm* seems to apply. To talk of *living protoplasm* and *dead or lifeless protoplasm* can scarcely be helpful, for by so doing we assume that protoplasm may cease to live and still be protoplasm, that in fact we may have protoplasm in two states—living and dead protoplasm. To speak of living and non-living or dead *bioplasm* would be contradictory, for when bioplasm ceases to live, we have no longer bioplasm, but *only lifeless substances which result at the death of bioplasm*, in fact non-living compounds formed when bioplasm ceases to live. These may differ much in composition and properties according to the conditions under which the death of the bioplasm or living matter occurs, and the substances thus formed cannot live again, unless they are taken up and appropriated by matter already living.

During the living state of the matter its ordinary properties are suspended—the affinities of its constituent elements cease to operate for the time—while they are moved, and rearranged and made to take new positions with respect to one another. To subject matter in the living state to chemical analysis is impossible, because in the attempt to do so, the living matter is killed, and we have no longer the actual living matter to deal with, but only the substances formed at its death. Matter weighs exactly the same in its living and dead state. It must, I think, be admitted that life or living power is not due to the matter itself, or to its properties, or to the properties of any substances which can be obtained from it.

As is well known, of the many elements discovered, those which contribute to the matter alone capable of living, are but very few, and these same elements have been, are, and there is reason to think will continue to be the essential constituents of every living organism belonging to this world—whether the living organism or organisms, of the first beginning, or the very last that may survive without leaving descendants.

Life then is not a property of mere matter, but a power or

agency of a kind with which nothing can compare. It orders, directs, enforces, compels. Gravitation, attraction, affinity, yield for the time to its sway. It seems to directly influence the matter itself, not to act upon it from a distance however slight. Elements seem to be separated, rearranged, and grouped in a manner inexplicable and effected by no other means known. It works according to definite plan, according to design predetermined and repeated over enormous periods of time, and without impairment. Organs, structures, actions of which there is at first no evidence seem to be anticipated and prepared for, it may be years before their actual formation or occurrence. Vital power seems to be transferred from particle to particle, sometimes without modification during vast periods of time; sometimes on the other hand leading to the production of new forms that never existed before.

To attribute all the marvellous and unceasing vital activities to the passive properties of material particles seems most unreasonable, for is not obviously the *power* which influencing the same *material particles* for a very short time, soon subjects new ones to its influence, being in fact transferred from one set of particles to another, that is the real cause? This activity, this vital directive agency, without loss, change, or conversion into anything else may spread and increase for ages, or be made to cease for ever at any moment of its progress. The evidences of its action may be patent for æons after the period of its active operation and extinction, and the very organisms depicted from the study of their imperishable remains—or on the other hand not a vestige of the operation of vital power may be demonstrable, a very short time after enormous amounts of matter have been caused to live.

For all these wonderful vital phenomena, the matter actually concerned in the early changes of the living being, may be so minute as not to be discernible with the aid of the highest magnifying power at our disposal, and its weight may be hundreds of times less than a particle just sufficient to affect the most delicate balance. But such invisible structureless, colourless particle may be the repository and carrier of vital power that may be transferred to tons of matter within a very short period of time, and an

immense area be thus peopled with new and lasting or transitory and evanescent living forms.

Dr. D. BIDDLE, M.R.C.S., writes:—

This paper, a proof of which I have had the privilege of reading, is one of the most powerful aids to Faith that I have met with, and comes as a great refreshment after a perusal of Professor Bradley's highly metaphysical work, "*Appearance and Reality*," touching as it does on many of the same questions. It may be impossible to deny that "reality is sentient experience," but it is equally impossible to deny that whole worlds of possible experience lie beyond the actual experience of any individual. Moreover, the experience of the individual convinces him that in some part of it he is active and in the rest passive, that events are rarely determined by himself, but follow a law in the laying down of which he had no part.

I quite endorse Dr. Schofield's assertion that although evolution in art is marked by imperfection in the earlier stages and indeed throughout, such is not the case in the earlier products evolved by the Creator. But I fail to see that protoplasmic "life" involves intelligence which is lacking in inorganic nature. In the human being there are many processes of life which are uncontrolled by his intellect, and yet work according to laws as fixed as those of gravitation and the like, although we regard them as of a higher kind. So-called "natural selection" is never capricious but strictly governed by laws.

Professor H. WEBSTER PARKER, LL.D., New York, writes, suggesting that in discussing the subject the use of the term animal in contradistinction to human would have made the author's argument clearer.

Professor Parker's remarks are of unusual length; it is hoped that they may shortly form a basis for a paper.

ORDINARY MEETING.*

THE PRESIDENT, SIR G. G. STOKES, BART., IN THE CHAIR.

The PRESIDENT.—The author of this paper being resident in the United States, it will be read in his absence. Professor E. Hull, LL.D., F.R.S., has kindly undertaken to do so.

The following paper was then read :—

CAUSES OF THE ICE AGE. By WARREN UPHAM, of the New Hampshire, Minnesota, and United States Geological Surveys.

IT is universally recognized that the century now nearing its end has been one of most rapid intellectual and material progress. Not less grand and beneficent than the inventions of the steamship and locomotive, of photography, the telegraph and the telephone, have been the investigations through the natural sciences revealing the chemical constitution and relationships of matter, the long and varied history of plant and animal life on our globe, and the gradual processes by which God has worked to create, and to bring into their present condition, the stars, the sun, and the earth. Though it was not His purpose in the Bible to reveal and teach science, there is given as the portal of approach to that Book a very brief chronicle of the creation of this place of man's abode, which, if regarded according to Hugh Miller's suggestion, is so completely in accord with the history made known by the rocks to the geologist that Dana, the most eminent of Americans in this science, declares the record of Genesis "profoundly philosophical . . . .

* 14th of 29th Session. The consideration of the subject was concluded and the author's reply received September, 1897.

true and divine . . . . a declaration of authorship, both of Creation and the Bible."*

2 The science of geology has produced a vastly enlarged understanding of the six days, with the work therein done, which in this most ancient record represent the very long eras of the earth's development, succeeded by God's crowning work, man and woman, endowed with the lofty capabilities of the human mind.

3 Ushering in the Human or Psychozoic present era, at the end of the geologic ages of the long past, and upon the threshold of the period known to us by written history, was the marvellous Glacial period or Ice age, with envelopment of large land areas by continental glaciers or ice-sheets. Far the greater part of the earth's surface, however, then as now, had a kindly temperate climate. The succession of the Creator's work in the evolution of plants and animals, and of man, moulded intellectually into a likeness with the Divine Mind, was continued in other regions during this reign of cold, and snow, and ice, in the high latitudes surrounding both the north and south poles.

4 When the ice-sheets occupied their greatest area, at the culmination of the effects of the extraordinary climatic conditions of the Glacial period, the southern border of the ice crossed the northern United States from Nantucket, Martha's Vineyard, Long Island, and northern New Jersey, through Pennsylvania into south-western New York, thence west-south-westerly to southern Illinois and St. Louis, thence westward nearly to the junction of the Republican with the Kansas river, thence northward through eastern Nebraska, and north-north-west through South Dakota, bending from this course about thirty miles west of Bismarck, thence passing westerly through northern Montana, Idaho, and Washington, reaching the Pacific ocean not far south of

* Hugh Miller's suggestion was a series of separate representative visions granted to a *Seer* upon the earth's surface. In obedience to the Creator there came, in the first Mosaic vision, light, and the division of day and night; in the second vision, a world-wide ocean, and the gathering of a dense cloud-bank above a stratum of open air; in the third vision, areas of land, clothed with vegetation; in the fourth, the appearance of sun, moon and stars, when rifts were first made in the previously continuous envelope of clouds; in the fifth, swimming and flying animals; and in the sixth and last vision, lowly and higher land animals.

[In regard to the "suggestion" in the foregoing note, Mr. Upham writes, August 21st, 1897:—"It seems to me desirable thus to state, indirectly, my belief in the harmony of *The Book* with geology."—Ed.]

Vancouver island. It extended beyond the Ohio river only for short distances in the vicinity of Cincinnati; but the Missouri river lies mainly within the glaciated area. On the Mississippi, 300 to 450 miles north of the boundary of the ice-sheet, where it reached farthest south, a large driftless area, including south-western Wisconsin and parts of adjoining states, escaped glaciation. In the Rocky mountains, the Cascade range, and the Sierra Nevada, ice-fields of great extent were accumulated along distances of 700 to 800 miles south from the border of the continental ice-sheet to latitude 37° S.; but no evidences of such local glaciation south of the ice-sheet are found in the Appalachian mountains.

Upon British America the directions of the glacial striæ and transportation of the drift show that there were two areas of glacial outflow, one reaching from Newfoundland and Labrador to the Rocky mountains and the Arctic ocean, having its greatest thickness of ice, probably about two miles, over the Laurentide highlands and James Bay, with outflow thence to the east, south, west, and north; and the other west of the Rocky mountains, covering British Columbia, where the ice-sheet attained a maximum thickness of about one mile, outflowing south into the United States, west into the Pacific ocean, and northward to the upper part of the Yukon basin. The portions of the ice-sheet pouring outward respectively from these two areas have been named by Dr. George M. Dawson the Laurentide and Cordilleran glaciers. Toward the south, west, and north-west, the Cordilleran outflow extended to the boundaries of our glaciated area; but eastward, pouring through passes of the Rocky mountains, and in the Peace river region probably overtopping the highest summits, which there are only about 6,000 feet above the sea, the Cordilleran ice pushed across a narrow belt adjoining the mountains, to a maximum distance of nearly 100 miles, and there (on land about 2,500 feet above the sea) became confluent with the Laurentide ice, the two united currents thence passing in part to the south and in part to the north from the interior tract where the confluent ice was thickest. At the time of maximum extent of the North American ice-sheet, it was continuous from the Atlantic to the Pacific, covering approximately 4,000,000 square miles of this continent.

5 Nearly half as large an area was ice-covered in Europe, with the basins of the Irish, North, Baltic, and White seas, the principal centre of outflow being the plateau and moun-

tains of Scandinavia, whence the ice moved west and north into the Atlantic, southward over northern Germany, and eastward over a large part of Russia. Smaller ice-sheets were formed upon Scotland and Ireland, and these became confluent with each other and with the Scandinavian ice which crossed the present bed of the shallow North Sea to the borders of Great Britain. Glaciers also were far more extensive than now in the Alps, Pyrenees, Caucasus, and Himalayas; but no large portion of Asia is known to have been overspread by ice. A most remarkable feature of the accumulation of the ice-sheets was their absence from Siberia and northern Alaska, while so heavily massed in the same and more southern latitudes of British America, the northern United States, the British Isles, and north-western Europe.

6 In the southern hemisphere, at about the same time with the northern glaciation, but whether alternating or contemporaneous with it we cannot know, a similar but less extensive sheet of land-ice covered Patagonia, and the mountains and highlands of the middle island of New Zealand bore immense glaciers far exceeding their still magnificent remnants of the present day.

7 The Ice age yet lingers upon the Antarctic continent, as also in Greenland, and to less degree in the St. Elias region of Alaska and British America, and in Norway. Land-ice surrounds the south pole to a distance of 12° to 25° from it, covering, according to Sir Wyville Thomson, about 4,500,000 square miles. Its area is thus slightly greater than that of the Pleistocene ice-sheet of North America. Whether the Antarctic ice covered an equal or greater extent in the Pleistocene period, contemporaneous with the glaciation of now temperate regions, we have no means of knowing. Along a portion of its border of perpendicular ice-cliffs, Sir J. C. Ross sailed 450 miles, finding only one point low enough to allow the upper surface of the ice to be viewed from the masthead. There it was a smooth plain of snowy whiteness, extending as far as the eye could see. That this ice-plain has a considerable slope from its central portions toward its boundary is shown by its abundant outflow into the sea, by which its advancing edge is uplifted and broken into multitudes of bergs, many of them tabular, having broad, nearly flat, tops. As described by Moseley in *Notes of a Naturalist on the "Challenger,"* these bergs give strange beauty, sublimity and peril to the Antarctic ocean, upon which they float away northward until they are melted.

Many parts of the borders of the land underlying this ice-sheet are low and almost level, as is known by the flat-topped and horizontally stratified bergs, but some other areas are high and mountainous. Due south of New Zealand the volcanoes Terror and Erebus, between 800 and 900 miles from the pole, rising respectively about 11,000 and 12,000 feet above the sea, suggest that portions or the whole of this circumpolar continent may have been recently raised from the ocean to form a land surface, which, on account of its geographic position has become ice-clad.

8 What were the causes of the accumulation of the ice-sheets of the Glacial period? Upon their areas warm or at least temperate climates had prevailed during long foregoing geologic ages, and again at the present time they have mostly mild and temperate conditions. The Pleistocene continental glaciers of North America, Europe, and Patagonia, have disappeared; and the later and principal part of their melting was very rapid, as is known by various features of the contemporaneous glacial and modified drift deposits and by the beaches and deltas of temporary lakes that were formed by the barrier of the receding ice-sheets. Can the conditions and causes be found which first amassed the thick and vastly extended sheets of land-ice, and whose cessation suddenly permitted the ice to be quickly melted away?

9 Two classes of theories have been presented in answer to these questions. In one class, which we will first consider, are the explanations of the climate of the Ice age through astronomic or cosmic causes, comprising all changes in the earth's astronomic relationship to the heat of space and of the sun. The second class embraces terrestrial or geologic causes, as changes of areas of land and sea, of oceanic currents, and altitudes of continents, while otherwise the earth's relations to external sources of heat are supposed to have been practically as now, or not to have entered as important factors in the problem.

10 It has been suggested that, as the sun and his planets are believed to be moving forward together through space, the Glacial period may mark a portion of the pathway of the solar system where less heat was supplied from the stars than along the earlier and later parts of this pathway. To this suggestion it is sufficient to reply that the researches of Prof. S. P. Langley, now Secretary of the Smithsonian Institution, show that at the present time no appreciable measure of heat comes to us in that way, and that probably

not so much as one degree of the average temperature of the earth's climates was ever, within geologic times, so received from all other sources besides the sun and the earth's own internal heat. Concerning the latter, also, it is well ascertained that during at least the Mesozoic, Tertiary, and Quaternary eras, it has affected the climatic average by no more than a small fraction of a degree.

11 Others have suggested that the sun's heat has varied and that the Ice age was a time of diminished solar radiation. To this we must answer that during the centuries of written history, and especially during the past century of critical investigations in terrestrial and solar physics, no variations of this kind have been discovered. Such a cause of the glacial accumulations would have enveloped Alaska and Siberia with ice-sheets and their drift deposits. The anomalous geographic distribution of the drift forbids this hypothesis.

12 Among all the theories of the causes of the Glacial period, the one which has attracted the most attention, not only of geologists, but also of physicists and astronomers, was thought out by Dr. James Croll, and published in magazine articles, during the years 1864 to 1874, and is most fully stated in his work entitled, *Climate and Time* (1875). His answers to criticisms and more full elucidation of some portions of the theory are given in his later volumes, *Discussions on Climate and Cosmology* (1885), and *Stellar Evolution and its Relations to Geological Time* (1889).* Dr. Croll's theory, which also has been very ably advocated by Prof. James Geikie in *The Great Ice Age* (1874 and 1877), and recently by Sir Robert S. Ball in *The Cause of an Ice Age* (1891), attributes the accumulation of ice-sheets to recurrent astronomic cycles which bring the winters of each polar hemisphere of the earth alternately into aphelion and perihelion each 21,000 years during the periods of maximum eccentricity of the earth's orbit. Its last period of this kind was from about 240,000 to 80,000 years ago, allowing room for seven or eight such cycles and alternations of glacial and interglacial conditions. The supposed evidence of interglacial epochs therefore gave to this theory a wide credence; but the uniqueness of the Glacial period in the long geologic record,

* A full list of Dr. Croll's scientific papers and works is appended to an interesting biographical sketch, with portrait, in *Transactions of the Edinburgh Geological Society*, vol. vi, pp. 171–187, for Feb. 19, 1891.

and the recent determinations of the geologic brevity of the time since the ice-sheets disappeared from North America and Europe, make it clear, in the opinions even of some geologists who believe in a duality or plurality of Quaternary glacial epochs, that not astronomic but geographic causes produced the Ice age. From the meteorologist's standpoint this astronomic explanation of a formerly glacial climate in now temperate latitudes has been alternately defended and denied,* just as geologists have been divided in respect to its applicability to the history of the Glacial period.

13 Many eminent glacialists, as James Geikie, Wahnschaffe, Penck, De Geer, Chamberlin, Salisbury, Shaler, McGee, and others, believe that the Ice age was complex, having two, three, or more epochs of glaciation, divided by long interglacial epochs of mild and temperate climate when the ice-sheets were entirely or mainly melted away. Professor Geikie claims five distinct glacial epochs, as indicated by fossiliferous beds lying between deposits of till or unstratified glacial drift, and by other evidences of great climatic changes. Mr. McGee, in the United States, recognizes at least three glacial epochs. On the other hand, the reference of all the glacial drift to a single epoch of glaciation, with moderate oscillations of retreat and readvance of the ice-border, is thought more probable by Dana, Hitchcock, and Wright in America, Prestwich and Lamplugh in England, Falsan in France, Holst in Sweden, and Nikitin in Russia. To myself, though formerly accepting two glacial epochs with a long warm interval between them, the essential continuity of the Ice age seems now the better provisional hypothesis, to be held with candour for weighing evidence on either side. The arguments supporting this opinion are well stated by Prof. G. Frederick Wright in his works on the *Ice Age in North America* (1889), and *Man and the Glacial Period* (1892), and especially in articles in the *American Journal of Science* for November, 1892, and March, 1894.

14 In accordance with Dr. Croll's astronomic theory, glacial periods would be expected to recur with geologic frequency, whenever the earth's orbit attained a stage of maximum eccentricity, during the very long Tertiary and Mesozoic eras,

* One of the most adverse criticisms is by the Russian meteorologist and geographer, Dr. A. Woeikof, in the *Am. Jour. of Science*, third series, vol. xxxi, pp. 161–178, March, 1886.

which together were probably a hundred times as long as the Quaternary era in which the Ice Age occurred.* But we have no evidence of any Tertiary or Mesozoic period of general glaciation in circumpolar and temperate regions, although high mountain groups or ranges are known to have had local glaciers. Not until we go back to the Permian period, closing the Paleozoic era, are numerous and widely distributed proofs of very ancient glaciation encountered. Boulder-bearing deposits, sometimes closely resembling till and including striated stones, while the underlying rock also occasionally bears glacial grooves and striæ, are found in the Carboniferous or more frequently the Permian series in Britain, France and Germany,† Natal,‡ India,§ and south-eastern Australia.‖ In Natal the striated glacier floor is in latitude 30° south, and in India only 20° north of the equator. During all the earth's history previous to the Ice age, which constitutes its latest completed chapter, no other such distinct evidences of general or interrupted and alternating glaciation have been found; and just then, in close relationship with extensive and repeated oscillations of the land, and with widely distant glacial deposits and striation, we find a most remarkable epoch of mountain-building, surpassing any other time between the close of the Archean era and the Quaternary.

15 Alfred Russel Wallace therefore concludes that eccentricity of the earth's orbit, though tending to produce a glacial period, is insufficient without the concurrence of high uplifts of the areas glaciated.¶ He thinks that the time of increased

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* *Climate and Time*, chap. xix, with plate iv, representing the variations in the eccentricity of the earth's orbit for three million years before A.D. 1800, and one million years after it. Compare *Am. Jour. Sci.*, III, vol. xx, pp. 105–111, with plate, Aug., 1880.

† *Climate and Time*, chap. xviii; Wallace's *Island Life*, chap. ix.

‡ *Quarterly Journal of the Geological Society*, vol. xxvi, 1870, pp. 514–517; vol. xxvii, 1871, pp. 57–60.

§ *Manual of the Geology of India*, part 1, pp. xxxv–xxxviii, 102, 109–112, 229.

‖ *Quart. Journ. Geol. Soc.*, vol. xliii, 1887, pp. 190–196. *Die carbone Eiszeit*, by Dr. W. Waagen, in *Jahrbuch d. k. k. geol. Reichsanstalt*, Vienna, 1888, vol. xxxvii, part 2, pp. 143–192 (reviewed in the *Am. Geologist*, vol. ii, pp. 336–340, Nov., 1888). *Carboniferous Glaciation in the Southern and Eastern Hemispheres, with some notes on the Glossopteris Flora*, by C. D. White. *Am. Geologist*, vol. iii, pp. 299–330, May, 1889, very fully discusses the evidences of this exceedingly ancient Ice Age, with citations of its literature for Africa, India, and Australia.

¶ *Island Life*, chaps. viii, ix, and xxiv.

eccentricity 240,000 to 80,000 years ago was coincident with great altitude of north-western Europe, North America, and Patagonia, which consequently became covered by ice-sheets; but that such previous times of eccentricity, not being favoured by geographic conditions, were not attended by glaciation. The recentness of the Ice age, however, seems to demonstrate that eccentricity was not its primary cause, and to bring doubt that it has exerted any determining influence in producing unusual severity of cold either during the Pleistocene or any former period.

16 In various localities we are able to measure the present rate of erosion of gorges below waterfalls, and the length of the postglacial gorge divided by the rate of recession of the falls gives approximately the time since the Ice age. Such measurements of the gorge and Falls of St. Anthony by Prof. N. H. Winchell show the length of the Postglacial or Recent period to have been about 8,000 years; and from the surveys of Niagara Falls, Mr. G. K. Gilbert believes it to have been 7,000 years, more or less. From the rates of wave-cutting along the sides of Lake Michigan and the consequent accumulation of sand around the south end of the lake, Dr. E. Andrews estimates that the land there became uncovered from its ice-sheet not more than 7,500 years ago. Prof. G. Frederick Wright obtains a similar result from the rate of filling of kettle-holes among the gravel knolls and ridges called kames and eskers, and likewise from the erosion of valleys by streams tributary to Lake Erie; and Prof. Ben. K. Emerson, from the rate of deposition of modified drift in the Connecticut valley at Northampton, Mass., thinks that the time since the Glacial period cannot exceed 10,000 years. An equally small estimate is also indicated by the studies of Gilbert and Russell for the time since the last great rise of the Quaternary lakes Bonneville and Lahontan, lying in Utah and Nevada, within the arid Great Basin of interior drainage, which are believed to have been contemporaneous with the great extension of ice-sheets upon the northern part of the North American continent.

17 Prof. James Geikie maintains that the use of paleolithic implements had ceased, and that early man in Europe made neolithic (polished) implements, before the recession of the ice-sheet from Scotland, Denmark, and the Scandinavian peninsula; and Prestwich suggests that the dawn of civilization in Egypt, China, and India, may have been coeval with the glaciation of north-western Europe. In Wales and

Yorkshire the amount of denudation of limestone rocks on which drift boulders lie has been regarded by Mr. D. Mackintosh as proof that a period of not more than 6,000 years has elapsed since the boulders were left in their positions. The vertical extent of this denudation, averaging about six inches, is nearly the same with that observed in the south-west part of the Province of Quebec by Sir William Logan and Dr. Robert Bell, where veins of quartz marked with glacial striæ stand out to various heights not exceeding one foot above the weathered surface of the enclosing limestone.*

18 From this wide range of concurrent but independent testimonies, we may accept it as practically demonstrated that the ice-sheets disappeared only 6,000 to 10,000 years ago. It is therefore manifestly impossible to ascribe their existence to astronomic causes which ceased 80,000 years ago, as is done by Croll's theory. Instead, I now believe, with Prestwich,† that the whole duration of the Ice age, probably 20,000 to 30 000 years, more or less, was not only terminated but begun after the end of the last period of maximum eccentricity of the earth's revolution around the sun.

19 Another astronomic theory, which assigns a date and duration of the Glacial period from about 24,000 to 6,000 years ago, agreeing nearly with the estimate by Prestwich, has been brought forward by Major-General A. W. Drayson, who first published it in the *Quarterly Journal of the Geological Society* for 1871, and later in successive books, of which the earliest is *On the Cause, Date, and Duration of the Last Glacial Epoch of Geology, and the probable Antiquity of Man, with an Investigation and Description of a New Movementof the Earth* (1873), and the latest, *Untrodden Ground in Astronomy and Geology* (1890).‡ This theory asserts that the earth's axis

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* For more ample statements of many of these evidences of the recency of the Glacial period, see the following papers in this *Journal of the Transactions of the Victoria Institute: The Lapse of Time since the Glacial Epoch determined by the date of the Polished Stone Age*, by J. C. Southall, vol. xiii, 1880, pp. 109–132; and *On the Recency of the Close of the Glacial Period in England and Wales, as shown by the limited depth of Post-glacial Stream Channels, the small Extent of Denudation of Limestone Rocks, and the fresh aspect of Moraines*, by D. Mackintosh, vol. xix, 1885, pp. 73–92.

† *Geology*, vol. ii, 1888, p. 534.

‡ In the *Journal of the Transactions of the Victoria Institute*, vol. xxvi, 1893, pp. 259, 260, Major-General Drayson concisely states his theory in a letter commenting on Prof. James Geikie's paper.

during a cycle of about 31,000 years varies 12° in its inclination to the plane of the ecliptic or path of the earth around the sun. In this long cycle the axis and poles of the earth are thought to describe a circle in the heavens with its centre 6° from the pole of the ecliptic. At present the obliquity of the ecliptic or angle between its plane and that of the earth's equator is about 23½°, which therefore is the distance of the arctic and antarctic circles from the poles; and this, according to General Drayson's computations, is nearly their minimum distance. He claims that this obliquity of the ecliptic, which gives the distance of the arctic circles from the poles and of the tropics from the equator, about 5,000 years ago was some 2° more than now; that 7,500 years ago it was increased 6½° more than at present; that its maximum, nearly 12° more than at present, was about 13,500 B.C.; and that the beginning of this latest cycle of variation in the widths of the intertropical and polar zones was about 31,000 years ago. During the middle portion of the cycle, General Drayson affirms that the Arctic circle reached approximately to 54° north latitude, and that the resulting climatic changes caused the Ice age.

20 It is true that the obliquity of the ecliptic varies slightly and is at present decreasing about an eightieth part of a degree in a hundred years. Sir John Herschel computed, however, that its limit of variation during the last 100,000 years has not exceeded 1° 21′ from its mean, although for a longer time in the past, as millions of years, it may range three or four degrees on each side of the mean. The portion of the present cycle of variation which is used as the basis of this theory seems insufficient to establish its conclusion of a wide range of obliquity; but, even if this were true, the same arguments forbid its application to account for the Glacial period as are urged by Gilbert, Chamberlin, and Le Conte, in their dissent from Croll's theory.* These objections consist in the absence of evidence of glaciation during the long history of the earth previous to the Ice age, excepting near the end of Paleozoic time, and the unsymmetric geographic areas of the ice-sheets, northern Asia and Alaska having not been ice-enveloped. According to General Drayson's astronomic conditions capable of producing an ice age have recurred every 31,000 years; but geologists have recognized no other time of glaciation of

* See Wright's *Ice Age in North America*, pp. 439, 440.

large areas besides the Quaternary and Paleozoic ice ages, which were divided probably by ten or fifteen million years.

21 The only remaining theory dependent on the earth's astronomic relationship which we need to examine is the suggestion first made in 1866 by Sir John Evans,* that, while the earth's axis probably remained unchanged in its direction, a comparatively thin crust of the earth may have gradually slipped as a whole upon the much larger nucleal mass so that the locations of the poles upon the crust have been changed, and that the Glacial period may have been due to such a slipping or transfer by which the regions that became ice-covered were brought very near to the poles. The same or a very similar view has been recently advocated by Dr. Fridtjof Nansen, who writes: "The easiest method of explaining a glacial epoch, as well as the occurrence of warmer climates in one latitude or another, is to imagine a slight change in the geographical position of the earth's axis. If, for instance, we could move the North Pole down to some point near the west coast of Greenland between 60° and 65° N.L., we could, no doubt, produce a glacial period both in Europe and America."†

22 Very small changes of latitude which had been detected at astronomical observatories in England, Germany, Russia, and the United States, seemed to give some foundation for this theory, which in 1891 was regarded by a few American glacialists as worthy of attention and of special investigation by astronomers, with temporary establishment of new observatories for this purpose on a longitude about 180° from Greenwich or from Washington. During the year 1892, however, the brilliant discoveries by Dr. S. C. Chandler‡ of the periods and amounts of the observed variations of latitude, showing them to be in two cycles respectively of twelve and fourteen months, with no appreciable secular change, forbid reliance on this condition as a cause, or even as an element among the causes, of the Ice age. This theory is now entirely out of the field. Sir Robert S. Ball, after reviewing Dr. Chandler's investigations, estimates that

* *On a possible Geological Cause of Changes in the Position of the Axis of the Earth's Crust, Proceedings of the Royal Society of London*, vol. xv, pp. 46–54, Feb. 28, 1866.

† *The First Crossing of Greenland* (1890), vol. ii, p. 454.

‡ *Astronomical Journal* (Boston, Mass.), vol. xii, pp. 57–62, 65–72, and 97–101, Aug. 4 and 23, and Nov. 4, 1892.

the place of the pole since the Glacial period, and from even earlier geologic times, has been without greater changes of position than would lie inside the area of a block or square enclosed by the intersecting streets of a city.*

23 We come now to the wholly terrestrial or geologic theory of the causes of the Ice age, which, in terms varying with increasing knowledge, has been successively advocated by Lyell, Dana, Le Conte, Wright, and others, including the present writer. This theory is called by Professor James Geikie the "earth-movement hypothesis," and is adversely criticized by him in a paper which forms, with its accompanying discussion, pages 221–264 in vol. xxvi (1893) of the *Journal of the Transactions of the Victoria Institute.* According to this explanation, the accumulation of the ice-sheets was due to uplifts of the land as extensive high plateaus receiving snowfall throughout the year.

24 Geology is indebted to Gilbert in his U.S. Geological Survey monograph, *Lake Bonneville*, for the terms *epeirogeny* and *epeirogenic* (continent-producing), to designate the broad movements of uplift and subsidence which affect the whole or large portions of continental areas or of the oceanic basins. This view, accounting for glaciation by high altitude, may therefore be very properly named the epeirogenic theory.

25 In the first edition of the *Principles of Geology* (1830), Lyell pointed out the intimate dependence of climate upon the distribution of areas of land and water and upon the altitude of the land. In 1855 Dana, reasoning from the prevalence of fjords in all glaciated regions and showing that these are valleys eroded by streams during a formerly greater elevation of the land previous to glaciation, and from the marine beds of the St. Lawrence valley and basin of Lake Champlain belonging to the time immediately following the glaciation, announced that the formation of the drift in North America was attended by three great continental movements: the first upward, during which the ice-sheet was accumulated on the land; the second downward, when the ice-sheet was melted away; and the third, within recent time, a re-elevation, bringing the land to its present height.† But with the moderate depth of the fjords and submarine valleys then known, the amount of

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* *Fortnightly Review*, new series, vol. liv, pp. 171–183. Aug., 1893.

† *Proc. Am. Assoc. for Adv. of Science*, vol. ix, for 1855, pp. 28, 29; *Am. Jour. of Science*, II, vol. xxii, pp. 328, 329, Nov. 1856.

preglacial elevation which could be thus affirmed was evidently too little to be an adequate cause for the cold and snowy climate producing the ice-sheet. The belief that this uplift was 3 000 feet or more, giving sufficiently cool climate, as Professor T. G. Bonney has shown, to cause the ice accumulation, has been only reached within the past few years through the discovery by soundings of the U.S. Coast Survey, that on both the Atlantic and Pacific coasts of the United States submarine valleys evidently eroded in late Tertiary and Quaternary time reach to profound depths, 2,000 to 3,000 feet below the present sea level.

26 Professor J. W. Spencer has very impressively reviewed the evidences of the formerly higher altitude of the North American continent, immediately before the Ice age.* Though he has not proceeded to interpret these observations as revealing in continental elevation the probable cause of the colder climate and accumulation of ice-sheets during the Glacial period, I believe that this is a legitimate conclusion, and that it strongly reinforces the arguments long ago advanced by Lyell and Dana and recently emphasized anew by Wallace. The submarine border of the continental plateau of North America to depths of more than 3,000 feet is cut by valleys or channels, which if raised above the sea level would be fjords or cañons. These can be no other than river-courses eroded while the land stood much higher than now; and its subsidence evidently took place in a late geologic epoch, else the channels would have become filled with sediments.

27 According to the Coast Survey charts, as noted by Spencer, the bottom of a submerged valley just outside the delta of the Mississippi is found by soundings at the depth of 3,000 feet. This valley is a few miles wide and is bounded by a plain of the sea bed from 900 to 1,200 feet above its floor. It thus appears that the country north of the Gulf of Mexico has been raised for a short time to a height of not less than 3,000 feet.

28 The continuation of the Hudson river valley has been traced by detailed hydrographic surveys to the edge of the

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* *Bulletin of the Geological Society of America*, vol. i, 1890, pp. 65–70, with map of the preglacial Laurentian river; vol. v, 1893–94, pp. 19–22, with map of submarine contour in the West Indies region. The first of these papers was also in the *Geol. Magazine*, III, vol. vii, 1890, pp. 203–212.

steep continental slope at a distance of about 105 miles from Sandy Hook. Its outermost twenty-five miles are a submarine fjord three miles wide and from 900 to 2,250 feet in vertical depth measured from the crests of its banks, which with the adjoining flat area decline from 300 to 600 feet below the present sea level. The deepest sounding in this fjord is 2,844 feet.*

29 An unfinished survey by soundings off the mouth of Delaware Bay finds a similar valley submerged nearly 1,200 feet, but not yet traced to the margin of the continental plateau.

30 Again, the United States Coast Survey and British Admiralty Charts, as Spencer states, record submerged fjord outlets from the Gulf of Maine, the Gulf of St. Lawrence, and Hudson Bay, respectively 2,664 feet, 3,666 feet, and 2,040 feet below sea level. The bed of the old Laurentian river from the outer boundary of the Fishing Banks to the mouth of the Saguenay, a distance of more than 800 miles, is reached by soundings 1,878 to 1,104 feet in depth. Advancing inland, the sublime Saguenay fjord along an extent of about fifty miles ranges from 300 to 840 feet in depth below the sea level, while in some places its bordering cliffs, one to one and a half miles apart, rise abruptly 1,500 feet above the water.†

31 Greenland is divided from the contiguous North American continent and archipelago by a great valley of erosion, which is estimated from soundings and tidal records to have a mean depth of 2,510 feet below sea level for 680 miles through Davis Strait; 2,695 feet for 770 miles next northward through Baffin Bay; and 1,663 feet for the next 55 miles north through Smith Strait.‡

32 On the Pacific coast of the United States Professor Joseph Le Conte has shown that the islands south of Santa Barbara and Los Angeles, now separated from the mainland and from each other by channels twenty to thirty miles wide and 600 to 1,000 feet deep, were still a part of the mainland

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* A. Lindenkohl, *Report of U.S. Coast and Geodetic Survey* for 1884, pp. 435–8; *Am. Jour. Sci.*, iii, vol. xxix, pp. 475–480, June, 1885. James D. Dana, *Am. Jour. Sci.*, iii, vol. xl, pp. 425–437, Dec. 1890, with an excellent map of the Hudson submarine valley and fjord.

† J. W. Dawson, *Notes on the Post-Pliocene Geology of Canada*, 1872, p. 41; *The Canadian Ice Age*, 1893, pp. 71–74.

‡ *Smithsonian Contributions to Knowledge*, vol. xv, pp. 163, 164.

during the late Pliocene and early Quaternary periods.* In northern California, Professor George Davidson, of the United States Coast Survey, reports three submarine valleys about twenty-five, twelve, and six miles south of Cape Mendocino, sinking respectively to 2,400, 3,120, and 2,700 feet below the sea level, where they cross the 100 fathom line of the marginal plateau.† If the land there were to rise 1,000 feet, these valleys would be fjords with sides towering high above the water, but still descending beneath it to great depths.

33 Farther to the north, Puget Sound and the series of sheltered channels and sounds through which the steamboat passage is made to Glacier Bay, Alaska, are submerged valleys of erosion, now filled by the sea but separated from the open ocean by thousands of islands, the continuation of the Coast Range of mountains. From the depths of the channels and fjords Dr. G. M. Dawson concludes that this area had a preglacial elevation at least about 900 feet above the present sea level, during part or the whole of the Pliocene period.‡

34 Le Conte has correlated the great epeirogenic uplifts of North America, known by these deeply submerged valleys on both the eastern and western coasts, with the latest time of orogenic disturbance by faulting and upheaval of the Sierra Nevada and Coast Range in California, during the closing stage of the Tertiary and the early part of the Quaternary era, culminating in the Glacial period.§ In the Mississippi basin, from the evidence of river currents much stronger than now, transporting Archean pebbles from near the sources of the Mississippi to the shore of the Gulf of Mexico, Prof. E. W. Hilgard thinks that the preglacial uplift, inaugurating the Ice age, was 4,000 or 5,000 feet more in the central part of the continent than at this river's mouth.‖

35 Although the adequacy of the preglacial epeirogenic elevation of this continent to produce its Pleistocene ice-sheet was tardily recognized, it was distinctly claimed by Dana in 1870 that the Champlain subsidence of the land beneath its ice-load, supposing it to have been previously at a high

* *Bulletin of the California Academy of Sciences*, vol. ii, 1887, pp. 515–520.

† *Ibid.*, vol. ii, pp. 265–268.

‡ *Canadian Naturalist*, new series, vol. viii, pp. 241–248, April, 1877.

§ *Bulletin Geol. Soc. of America*, vol. ii, 1891, pp. 323–330; *Elements of Geology*, third edition, 1891, pp. 562–569, 589.

‖ *Am. Jour. of Science*, III, vol. xliii, pp. 389–402, May, 1892.

altitude, must have brought climatic conditions under which the ice would very rapidly disappear. The depression would be like coming from Greenland to southern Canada and New England. In Prof. Dana's words: "Such an extended change of climate over the glacier area was equivalent in effect to a transfer from a cold icy region to that of a temperate climate and melting sun. The melting would therefore have gone forward over vast surfaces at once, wide in latitude as well as longitude."*

36 Such explanations as these accounting for the gradual accumulation and comparatively rapid dissolution of the North American ice-sheet are also found to be applicable to the ice-sheets of other regions. The fjords of the northern portions of the British Isles and of Scandinavia show that the drift-bearing north-western part of Europe stood in preglacial time 1,000 to 4,000 feet higher than now, while on the other hand late glacial marine beds and strand lines of sea erosion testify that when the ice disappeared the land on which it had lain was depressed 100 to 600 feet below its present height, or nearly to the same amount as the Champlain depression in North America. Mr. T. F. Jamieson appears to have been the first in Great Britain or Europe to attribute the ice accumulation to altitude of the land, and to hold the view, which I receive from him, that the submergence of glaciated lands when they were loaded with ice has been caused directly by this load pressing down the earth's crust upon its fused interior, and that the subsequent re-elevation was a hydrostatic uplifting of the crust by underflow of the inner mass when the ice was melted away.† Just the same evidences of abundant and deep fjords and of marine beds overlying the glacial drift to heights of several hundred feet above the sea are found in Patagonia, as described by Darwin and Agassiz. On these three continental areas, the widely separated chief drift-bearing regions of the earth are found to have experienced in connection with their glaciation in each case three great epeirogenic movements of similar

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* *Trans. Conn. Acad. of Arts and Sciences*, vol. ii, 1870, p. 67. Compare the *Am. Jour. of Science*, III, vol. x, pp. 168–183, Sept., 1875.

† *Quart. Jour. Geol. Soc.*, vol. xviii, 1862, p. 180; vol. xxi, 1865, p. 178. Later discussions of this subject by Mr. Jamieson are in the *Geological Magazine*, II, vol. ix, pp. 400–407 and 457–466, Sept. and Oct., 1882; III, vol. iv, pp. 344–348, Aug. 1887; and III, vol. viii, pp. 387–392. Sept., 1891.

character and sequence, first, a comparatively long continued uplift, which in its culmination appears to have given a high plateau climate with abundant snowfall forming an ice sheet, whose duration extended until the land sank somewhat lower than now, leading to amelioration of the climate and the departure of the ice, followed by re-elevation to the present level. The coincidence of these great earth movements with glaciation naturally leads to the conviction that they were the direct and sufficient cause of the ice-sheets and of their disappearance; and this conclusion is confirmed by the insufficiency and failure of the other theories which have been advanced to account for the Glacial period.

37 The epeirogenic movements of the countries which became glaciated were only a portion of wide-spread oscillations of continental areas during the closing part of Tertiary time and the ensuing much shorter Quaternary era. Not only was north-western Europe uplifted thousands of feet, but probably all the western side of Europe and Africa shared in this movement, of which we have the most convincing proof in the submerged channel of the Congo, about four hundred miles south of the equator. From soundings for the selection of a route for a submarine cable to connect commercial stations on the African coast, Mr. J. Y. Buchanan* found this channel to extend eighty miles into the ocean to a depth of more than 6,000 feet. The last twenty miles of the Congo have a depth from 900 to 1,450 feet. At the mouth of the river its width is three miles, and its depth 2,000 feet. Thirty-five miles off shore the width of the submerged channel or cañon is six miles, with a depth of about 3,450 feet, its bottom being nearly 3,000 feet below the sea bed on each side. Fifty miles from the mouth of the river the sounding to the submarine continental slope is nearly 3,000 feet, while the bottom of the old channel lies at 6,000 feet. This very remarkable continuation of the Congo valley far beneath the sea level is like those of the Hudson and St. Lawrence rivers, and like the submerged valleys on the coast of California; but the Congo reaches to a greater depth than those of North America, and even exceeds the Sogne fjord, the longest and deepest in Norway, which has a maximum sounding of 4,080 feet. Another deep submarine valley, called the "Bottomless Pit," having soundings of 2,700 feet, is described by Buchanan on the African coast 350 miles north of the equator, and he states

* *Scottish Geographical Magazine*, vol. iii, 1887, pp. 217–238.

that a similar valley exists in the southern part of the Bay of Biscay. These observations show that within very late geologic time, probably almost the entire Atlantic side of the eastern continent has been greatly uplifted, attaining as high an altitude as that which A. C. Ramsay and James Geikie conjectured as a possible cause of the frost-riven limestone-agglomerates of Gibraltar.*

38 Likewise the tropical portions of the western continent, the West Indies, and the smaller islands of the Caribbean region, appear to have shared the epeirogenic disturbances which were associated with the glaciation of the northern and southern parts of this continent, as is well brought out by the recent studies and discussions of the geology of Barbados island by A. J. Jukes-Browne and J. B. Harrison,† and by the close relationship of the Pacific and West Indian deep sea faunas on the opposite sides of the Isthmus of Panama, made known through dredging by Alexander Agassiz.‡ This testimony, indeed, with that of Darwin, L. and A. Agassiz, and others, of very recent, extensive, and deep subsidence of the western coast of South America, apparently however continuing for no long time, lends much probability to the supposition that the low Panama Isthmus was somewhat deeply submerged for a geologically short period contemporaneous with epeirogenic uplifts of the circumpolar parts of this continent both at the north and south, whereby the effects of great altitude in covering the northern and southern high areas with ice-sheets were augmented by the passage of much of the Gulf Stream into the Pacific Ocean.

39 The end of the Tertiary era and the subsequent Glacial period have been exceptionally characterized by many great oscillations of continental and insular land areas. Where movements of land elevation have taken place in high latitudes, either north or south, which received abundant precipitation of moisture, ice-sheets were formed; and the weight of these ice-sheets seems to have been a chief cause, and often probably the only cause, of the subsidence of these lands and the disappearance of their ice.

40 In an appendix of Wright's *Ice Age in North America*, I have shown that, between epochs of widely extended

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* *Quart. Journ. Geol. Soc.*, vol. xxxiv, 1878, pp. 505–541.

† *Quart. Journ. Geol. Soc.*, vol. xlvii, 1891, pp. 197–250.

‡ Bulletin, *Mus. Comp. Zool.*, at Harvard College, vol. xxi, pp. 185–200, June, 1891.

mountain-building by plication, the diminution of the earth's mass produces epeirogenic distortion of the crust, by the elevation of certain large areas and the depression of others, with resulting inequalities of pressure upon different portions of the interior, and that these effects have been greatest immediately before relief has been given by the formation of folded mountain ranges. There have been two epochs pre-eminently distinguished by extensive mountain-plication, one occurring at the close of the Paleozoic era, and another progressing through the Tertiary and culminating in the Quaternary era, introducing the Ice age. During the last, besides plication of the Coast range, of the Alps, and the Himalayas, a very extraordinary development of tilted mountain ranges, and outpouring of lavas on an almost unprecedented scale, have taken place in the Great Basin and the region crossed by the Snake and Columbia rivers. With the culminations of both of these great epochs of mountain-building, so widely separated by the Mesozoic and Tertiary eras, glaciation has been remarkably associated, and indeed the ice accumulation appears to have been caused by the epeirogenic and orogenic uplifts of continental plateaus and mountain ranges. Since the disturbances, with glaciation, closing Paleozoic time, the same combination of events has not recurred until the Quaternary era, which is not only exceptional in its accumulation of ice-sheets, but also in its numerous and widely extended movements of elevation and subsidence, and its mountain-building and renewed upheavals of formerly base-levelled mountain belts. The earth's surface is probably now made more varied, beautiful, and grand, by the existence of many lofty mountain ranges, than has been its average condition during the past long eras. This explanation appears to me entirely consistent with Dana's teaching that the great continental and oceanic areas have been mainly permanent from very early geologic times. We may also, I think, be encouraged to the hope and belief that a long time will probably pass before the recurrence of epeirogenic conditions producing extensive glaciation. As the rainbow is a promise of recurring fruitful seasons, we see no reason for expecting the return of an Ice age desolating the present most populous and prosperous parts of the world. It may be as far hence to its return, if it shall ever come again, as the ten or fifteen million years since the Coal period and the Permian Ice age.

41 Two formidable objections to this view that the accumu-

lation of the Pleistocene ice-sheets was preceded and caused by great epeirogenic elevation deserve careful attention. The first consists in an approximate identity of level with that of to-day having been held by many drift-bearing areas at a time very shortly preceding their glaciation. This is clearly known to have been true of Great Britain and of New England. Near Boston, Mass., for example, my observations of fragments of marine shells in the till of drumlins in or adjoining the harbour prove for that tract a preglacial height closely the same as now at so late a time that the molluscan fauna, of which we have a considerable representation, comprised only species now living. In respect to this objection, it must be acknowledged that the preglacial high elevation which I think these areas experienced was geologically very short. With the steep gradients of the Hudson, of the streams which formed the now submerged channels on the Californian coast, and of the Congo, these rivers, if allowed a long time for erosion, must have formed even longer and broader valleys than the still very impressive troughs which are now found on these submarine continental slopes. But the duration of the epeirogenic uplift of these areas on the border of the glaciation for the Hudson, beyond it for the Californian rivers, and near the equator in western Africa, can scarcely be compared in its brevity with the prolonged high altitude held during late Tertiary and early Quaternary time by the Scandinavian peninsula and by all the northern coasts of North America from Maine and Puget Sound to the great Arctic Archipelago and Greenland. The abundant long and branching fjords of these northern regions, and the wide and deep channels dividing the many large and small islands north of this continent attest a very long time of preglacial high elevation there. At the time of culmination of the long continued and slowly increasing uplifts at the north, they seem to have extended during a short epoch far to the south, coincident with the formation of ice-sheets in high latitudes. But when these lands became depressed and the ice burden of the glaciated countries was removed, they in some instances, as in Great Britain and New England, returned very nearly to their original levels, beautifully illustrating the natural condition of equilibrium of the earth's crust, which Dutton has named *isostasy*, that when not subjected to special and exceptional stresses it acts as if floating on a heavier plastic and mobile interior.

42 Somewhat analogous with the foregoing is the second of these objections, namely, the fully proved low altitude of the glaciated lands when the ice-sheets attained their maximum extent and during the diversified and fluctuating history of their recession. It must be recognized, however, that we have in the complex series of drift deposits left for our examination only a representation of the later and closing phase of the Ice age, while the land was low or near its present level. In North America the comparatively much longer early phase of high altitude leading to the accumulation and slow extension of the ice-sheets is not clearly represented by the drift and numerous moraines of the glacial retreat or of the extreme limit of glaciation, but by the earlier fluvial Lafayette formation, in which, according to Hilgard, coarse gravel from the Archean areas near the head of the Mississippi was carried down by that stream quite to the shores of the Gulf of Mexico.

43 The wane and departure of both the North American and European ice-sheets have been marked by many stages of halt and oscillation, whereby the flora, including forest trees, and less frequently traces of the fauna, of the temperate areas adjoining the melting and mainly receding ice were covered by its drift at the times of temporary re-advance of the ice-border. No better illustration of conditions favourable for the burial of forest beds in the drift can be imagined than those of the Malaspina glacier or ice-sheet, between Mount St. Elias and the ocean, explored by Russell in 1890 and 1891, and found to be covered on its attenuated border with drift which supports luxuriant growing forests. Let a century of exceptional snowfall cause a thickening and re-advance of that ice-sheet, and sections of its drift exposed after the glacial recession will show a thick forest bed of chiefly or wholly temperate species. Such re-advances of the continental ice-sheets, interrupting their retreat, are known by well marked recessional moraines both in North America and Europe. Near the drift boundary in the Mississippi basin some of these glacial fluctuations have involved long stages of time, measured by years or centuries, with important though minor changes in altitude, as shown by the excellent analytic studies of Chamberlin, Salisbury, and Leverett; but farther north, as in the large region of the glacial Lake Agassiz, the withdrawal of the ice-sheet and formation of successive moraines marking slight halts and re-advances due to secular

changes in temperature, humidity, and snowfall, were demonstrably very rapid, the whole duration of this glacial lake being probably only about 1,000 years.* The vicissitudes of the general glacial retreat seem to me to have been due thus chiefly to variations of snowfall, some long terms of years having much snow and prevailingly cool temperature, therefore allowing considerable glacial re-advance, while for the greater part other series of years favoured rapid melting and retreat.

44 Under this view we may, I think, account for all the observations which have been held in America and Europe as proofs of interglacial epochs, without assuming that there was either any far re-advance of the ice-border or any epeirogenic movements attending the glacial retreat of such magnitude as to induce the fluctuations of which the forest beds and marginal moraines bear witness. The Ice age seems to me to have been essentially continuous and single, with important fluctuations, but not of epochal significance, both during its advance and decline.

The PRESIDENT (Sir G. G. STOKES, Bart., D.Sc., F.R.S.).—I will ask you to return your thanks both to the author of this paper, and also to Professor Hull for so ably reading it. (Applause.) I now invite remarks on the subject, which presents considerable difficulty.

Professor E. HULL, LL.D., F.R.S., F.G.S.—I think this is one of the most interesting and valuable contributions, to account for the production of the Ice Age of the Quaternary Period, that we have had for a long time.

There is a great freshness about it—a quality which applies to many of the American papers. Fortunately America has produced

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* *Geol. and Nat. Hist. Survey of Canada*, Annual Report, new series, vol. iv, for 1888–89, p. 51 E.

a grand array of geologists who have been quite equal to dealing with the magnificent phenomena with which that great continent abounds, and we in Europe—in the old country—are now deriving the benefit of these new ideas coming across the Atlantic to us, and getting us a little out of the rut into which we were falling.

The two principal points that the author deals with in the paper are, I think, briefly these. The first is as regards the length of time—so many thousands of years—which was necessary to bring into existence the great Ice Age, and to see it to its close; and the second is the question, on what phenomena are we to base our conclusions as regards the origin of that great Ice Age. You will have seen from the paper that there are two extreme views as regards the length of period—the one astronomical, of which Dr. Croll may be considered the author, and the other geological, of which I think I may say Lyell, followed by Dana, Le Conte and equally by the author of the paper, are the exponents. You have seen that the differences in periodic lengths are enormous between these two extremes; and if I might be allowed, as an old geologist myself, to some extent to give my own view, I might say I entirely concur with the author of this paper as regards the length of time.

I have visited, explored, and described glacial phenomena over a very large portion of the British Isles, and it is impossible, I think, to observe the freshness of the glacial striæ and terraces, and the polishing of the rock surfaces, without coming to the conclusion that the geological epoch is, comparatively speaking, exceedingly recent. Just consider for a moment;—the phenomena that have been left by the old glaciers of the British Islands have not yet entirely disappeared, nor have those of the former enormous glaciers of the Alps and other ranges. They consist of boulders and moraines on the one hand, and polishing of the rock surfaces on the other; and it seems to me unquestionable that if the period since the disappearance of glaciers were of the enormous length held by Dr. Croll and his followers Professor James Geikie and others, that the whole of these evidences of the glacial period would have entirely disappeared. The streams, torrents, and atmospheric agents would have swept away these accumulations, and also have completely obliterated the beautiful striations which we find on the rock surfaces. In some districts, in fact, you have only to take the sod off, lift it off carefully, and there you find the surface beautifully glaciated; and if the period had been of such vast

duration since these ice sheets disappeared, it is impossible to suppose that those surfaces would have remained in all their freshness down to the present day.

Then as to the cause of the glaciers, I think it is exceedingly interesting to observe that Lyell's view—which had been partially, at any rate, eclipsed by the more attractive, and probably less understood, views of Croll (because they are entirely astronomical)—is now again rising to the surface, and that fresh evidences have been brought to light by the deep sea dredgings. This is, I think, a most valuable part of Mr. Upham's paper. He has accumulated and brought into this contribution to our Society a large number of instances where the valleys and fjords which dissect the various mountainous ranges of Europe, Asia, and even Africa can be tracked out under the ocean for a great distance; and, as I explained when reading the paper, *no channel of this kind could be cut under the ocean.* As long as the land is under the ocean it is preserved from erosion or denudation of that kind. Channels running out into deep water must have been cut when the area was elevated out of the ocean. This subject has been more recently investigated by Professor Spencer in his papers on "The Reconstruction of the Antillean Continent."

Owing to the depths of these submerged valleys it involves the supposition that the lands bordering the ocean had been elevated 1,000, 2,000 or more feet at the time of these river valleys being eroded. So that there is strong evidence coming to light that Lyell's view, which was based on the supposition of the elevation of the land surface over a large part of the northern hemisphere, as accounting for the glacial period, was in the main the true one. Therefore I think this contribution is of great value as bearing on Lyell's original hypothesis.

Mr. JOSEPH BROWN, C.B.—Although I cannot pretend for a moment to be a scientific geologist, my walk in life having led me in another direction, I certainly have been, I may say, an amateur geologist for the last sixty years, and during many journeys on the Continent I have taken every opportunity I could get of observing geological phenomena, and have frequently been struck by the very significant fact mentioned by Professor Hull, that these striæ and marks of glaciation found on the rocks in many places are a great deal too fresh to admit of the supposition that they were made 20,000, 30,000 or 50,000 years ago. I do not

believe it, certainly. I observed in the valley of Aosta, on the south side of Mont Blanc, where I went to find some of these enormous boulders, the most distinct marks of striæ, as they are called, made on the rocks that flank the valley, and they were so fresh that I said to myself, "It is impossible that these marks could have been made 50,000, 40,000, or 30,000 years ago." They looked to me as if they had not been made more than 100 years; and I made exactly the same observation in regard to the extensive valley that leads from Reichenbach up to the Gemmi Pass. There are portions of that valley, where the guide books point out there are strong marks of glaciation along the rocks and polished surfaces, and I venture to say that nobody could see those marks and believe that they were 50,000 years old, or one-fifth part of that age. I made some observations also in regard to some glacial striæ on what are called the glacial rocks in Cumberland, on the plain that lies not far from the church at Ambleside.

Professor HULL.—Yes, I think I was the first to describe it, about thirty years ago; it is reproduced in Lyell's *Antiquity of Man*—from my original drawing in the *Edinburgh New Philosophical Journal.*

Mr. JOSEPH BROWN, C.B.—It is not possible to suppose that the marks are anything like 20,000, or even 10,000 years old. Rocks wear away too fast for that, although some of them are the hardest things in Nature. For that reason, I cannot bring myself to believe that the Ice Age was so far back as some geologists consider. I have held my mind in suspense all the time I have been investigating the question, some fifty or sixty years, and I cannot bring myself to believe that these marks and indications are anything like so old as they are reputed to be. Although I consider the paper which has been read to-day has thrown more light on this very difficult question, as to the rocks and the cause of the Ice Age, and how many thousands of years back it dates, than any paper I have read for a long time, yet I find myself unable to agree with one suggestion made by the author, whose opinions on the subject are worth a great deal more than mine, (for I do not put forward my observations as more than those of an amateur), and it is this:—I heard the Professor say that these great submerged valleys that have been eroded outside the edge of the great North American Continent, as well as some that appeared to be eroded outside the African Continent, must have

occurred when the sea bottom was elevated and that they had been eroded by some great rivers.

Mr. A. Ent. Gooch, F.G.S.—I should like to refer to paragraph 11 of the paper:—"Others have suggested that the sun's heat has varied, and that the Ice Age was a time of diminished solar radiation." It is well known that many astronomers, and those who are best qualified to speak on the matter, including Sir Robert Ball, admit that we know very little of the present condition or past behaviour of the solar body. Supposing a large portion of the body of the sun to have been gaseous, his temperature would have been lower, and the radiation-rate less. The other point is "Concerning the latter (*i.e.*, the earth's own internal heat);" it is well ascertained that during at least the Mesozoic, Tertiary, and Quaternary eras, it has affected the climatic average by no more than a small fraction of a degree. Many of us would like to know what explanation is given for that, and why such knowledge of the earth's internal heat is assumed.

Rev. John Tuckwell.—Professor Tyndall, in his book on *Heat a Mode of Motion*, draws attention to the singular conditions required of an Ice Age, by saying that it is often overlooked that a large amount of ice accumulating on one part of the earth's surface would necessitate a large amount of evaporation caused by intense solar heat at another part of the earth's surface. The quantity of water on the earth is limited, and if there be a great accumulation of snow at some places, there must be a proportional amount of evaporation at another part of the earth's surface, which would mean very great heat. I should have liked to have had some further information on that point.

The President.—No doubt it implies evaporation; but we do not know what length of time that may have been spread over. Therefore I do not see that we can infer that the temperature must have been very great. It may have been going on slowly.

Rev. John Tuckwell.—Would it not be that if the period of the Ice Age was brief, then the temperature must have been very great, for large accumulations of the frozen vapour to form at the poles of the earth? The shorter the period of the Ice Age, it seems to me, the greater the amount of heat that must have been at other portions of the earth's surface.

The President.—No doubt, but even taking the period that

geologists suppose to represent the glacial period, it would not require a very great temperature if the thing went on gradually.

Professor J. LOGAN LOBLEY, F.G.S.—Mr. Gooch expresses his anxiety to know on what grounds the author of the paper stated that there was no evidence in the Mesozoic, Tertiary and Quaternary eras, of the sun's heat having been much less than at present. I would go further and say that it appears to me there is no evidence of the sun's heat having been much less than now, even during the Palæozoic times; for I find the same organisms in the Cambrian rocks as live at the present time. The same genera are found in many formations living on without more than specific change to the present time. That, I think, is sufficient proof, apart from vegetable remains (which afford strong evidence of the fact) that the sun's heat has been, practically, unchanged from the earliest geological times to the present. Mr. Tuckwell stated that the production of an enormous quantity of snow round the North Pole must have required an enormous amount of evaporation. That is true; but is there not, under present conditions, an enormous amount of evaporation? It is actually so in tropical portions of the globe. Supposing land to be elevated 2,000 or 3,000 feet above its present level there would be the conditions required to produce a greater condensation of vapour in the atmosphere in the form of snow and less in the form of rain. The normal snow line is a little more than 5,000 feet above the level of the sea in the north part of the British Isles. If the North Sea were turned into dry land with other geographic changes, which would lessen the warmth of the Atlantic waters, there would be a greater amount of cold in this country to produce greater precipitation of snow, and the retention of that amount of snow which produces the glacial conditions. But it might be asked, "What is meant by the Ice Age?" One means one thing and another something different—one may mean the land surface, at its present level north of the 50′ parallel covered with an ice cap, and another may mean the elevated regions only of the northern hemisphere covered with great glaciers that glaciated the lower portions of these regions, and not that the great plain, extending far to the south, was covered with one great ice cap. On the plains of Siberia and Alaska there is no evidence of glaciation; and we can only surmise that, by the rapid melting of accumulated snow and ice, great floods may have been pro-

duced, which would wash away the *débris* caused by glaciation, and this would spread over the plains considerably beyond the fringe of the northern ice. Thus we may, I think, get a very rational conception of what is commonly called the Ice Age, without drawing upon our imagination for that extraordinary state of things which is pictured by so many, and we can do this without requiring an increase of the cold or heat of the globe taken as a whole, which I do not believe to have practically altered from the time of the Cambrian period. An elevation of a portion of the earth's surface to the extent of 3,000 feet may seem enormous; but what is it compared with the diameter of the globe? It is just $\frac{1}{1400}$th, which is really a very slight swelling of the surface, and might be produced in certain cases by the expansion of the substance of the globe by altered local thermal conditions. As to the pressure of ice producing depression, I do not consider that the pressure of any possible accumulation of ice would produce depression on the surface of the globe; cold however causes contraction, and heat expansion. And it is to these agencies I look as having caused changes of level in the past; similar changes are occurring at the present period.

The meeting was then adjourned.

REMARKS ON THE FOREGOING PAPER.

Sir Joseph Prestwich, D.C.L., F.R.S.,* wrote:—

Two questions of great interest are raised by Mr. Upham's paper—the cause of the great Ice Age and the date measured from our own time at which it came to an end. In this country, owing to the prevailing belief in Croll's hypothesis, the date of the last event was placed at 80,000 years ago. My own opinion has long been that 10,000 to 12,000 years was a more probable estimate. The American geologists, upon entirely different and independent data, have arrived at a similar conclusion. Among the reasons assigned by the author, one is the rate of erosion of some of the great water-falls on that continent. Exception

* The last communication received from this author ere his decease.—Ed.

might be taken at this as the rate is known to vary considerably. This estimate would show that the Ice Age came to an end not more than 7,000 to 8,000 years ago. This may give a minimum measure, but it serves at the same time to render more secure the other estimates which are somewhat in excess of this, and which would extend the time to 10,000 years. I cannot but consider these estimates which are founded, as is also my own, upon available geological data as more probably true than that assumed on the astronomical hypothesis. That hypothesis is also entirely discordant with geological facts. It involves the recurrence of a succession of cold periods at geological times of which we have no evidence.

I do not, however, agree with the author in his opinion as to the cause of the great Ice Age, which he considers due to great continental elevations which would make the glaciated areas of North America to have been 3,000 to 4,000 feet higher than they now are. That there has been a submergence apparently to that extent on the coast of that continent, whereby old glaciated valleys and fiords now form great submarine depressions, are very striking facts. But if it is difficult now to account for the glaciation of mountains 5,000 to 6,000 feet high, what will it be if we have to add to this 3,000 to 4,000 feet more, and to imagine an ice-sheet 9,000 to 10,000 feet thick. The author also somewhat damages his case by extending his argument to the tropical regions of Africa and elsewhere. The European area affords no sufficient corroboration. The Rhine, the Thames, and the Severn show no deep submarine valleys. The old Yare is submerged to the depth of 500 feet at Yarmouth, but the Thames and Severn valleys at their entrance show no greater difference of level than 60 to 70 feet, and the smaller rivers on the Cornish coast of 40 to 50 feet. Still the cause of the great Ice Age cannot be different in Europe from what it is in America. That cause has yet, in my opinion, to be discovered.

Prof. J. Geikie, LL.D., F.R.S., writes:—

It is a pity that Mr. Upham should have devoted so little space in his paper towards the explanation of what I have termed the

"earth movement *hypothesis*," but which he prefers to designate by the title of "the epeirogenic *theory*." Well, there is not much in a name, but, to be quite accurate, the view in question has not advanced to the stage of being a theory. To my mind it is only a conjectural explanation, which, as I endeavoured to show in a paper lately read before this Society, has no geological evidence to support it. To the arguments I have advanced, Mr. Upham has not replied, save in the most cursory manner; and, as I shall presently show, his reply practically implies the condemnation of the hypothesis. As to the drowned river-channels which geologists have known about for many years,—their existence is admitted. They and the fiords of N.W. Europe and N. America have long been recognised as yielding evidence of a former wider and more elevated condition of those regions. It has also been long known to geologists that the excavation of those now submerged or partially submerged valleys took place and was practically completed in ages long anterior to the advent of the Glacial Period. I must express my astonishment, therefore, that Mr. Upham should cite the existence of fiords, etc., in support of his "epeirogenic" hypothesis. So far from lending that hypothesis any support, the fiords and drowned river-channels supply most convincing evidence against it. What they show us is that a wide and elevated land-surface existed for a protracted period of time in temperate latitudes without inducing extensive glaciation. The fiords occupy valleys cut by rivers in elevated plateaux of erosion. During that period of elevation, rain and rivers, not snow and ice, were the chief denuding agents. It was not until long after the fiord valleys had come into existence that the great *mers de glace* of the Glacial Period made their appearance. To appeal to the existence of fiords as testimony in favour of a great continental elevation in glacial times is, to my mind, an instance of putting the cart before the horse.*

In my paper already referred to I have drawn attention to the fact that the only direct evidence we have of the geographical conditions that obtained immediately prior to

* Professor E. Hull, LL.D., F.R.S., remarks on this, October, 1897 :— "Yes, but all the while the gradual elevation of the lands may have been preparing the way for the commencement of the glacial conditions."—Ed.

the appearance of massive ice-sheets in Europe and North America shows that the relative level of land and sea in those regions was much the same as it is now. Mr. Upham cannot but admit this, but would fain minimise the admission, which is, in fact, fatal to his hypothesis. He says, "it must be acknowledged that the pre-glacial high elevation which I think these areas experienced was geologically very short." I do not see on what definite geological evidence Mr. Upham bases this statement, and would regard it as a conjecture resting on a predilection for a particular hypothesis, which would vanish if a prolonged period of pre-glacial elevation were to be admitted. And a little further on I note that he admits that the fjord regions of North America and North-West Europe must have experienced a very long time of pre-glacial elevation.

In reply to my argument that the frequent occurrence of marine deposits intercalated amongst and associated with the glacial deposits proves that, during the Ice Age, the land could not have been greatly elevated, he says that "in the complex series of drift-deposits" we have only the records of "the closing phase of the Ice Age, while the land was low or near its present level." This statement will not stand examination. I do not believe it is true of the glacial deposits of North America, and it is certainly not true of their European equivalents. The very earliest of the glacial accumulations of North West Europe are marine clays, etc., with Arctic shells.

Mr. Upham is aware that the existence of inter-glacial deposits is another stumbling-block over which his hypothesis must come to grief. He, therefore, explains them away by referring to the phenomena seen in the neighbourhood of the Malaspina glacier. Can Mr. Upham really think that the phenomena he refers to have been overlooked by those who have specially studied inter-glacial deposits? That glaciers advance and retreat periodically, and that now and again organic remains and alluvial deposits may become intercalated amongst moraine *débris*—are facts which I venture to say have never been overlooked by glacialists of any school whatever. But such considerations entirely fail to explain the occurrence of what are known as inter-glacial beds. Take, for example, the inter-glacial peat and lignite-beds of Schleswig Holstein and North Germany. These contain a flora indicative of more genial conditions than now exist

in the regions where those inter-glacial beds occur. They rest upon the ground-moraine of an ice-sheet which flowed south to the hills of Middle Germany: and they are overlaid by the ground-moraine of another ice-sheet which flowed south to the region lying between the valleys of the Elbe and the Aller. The interpretation of the evidence is obvious. The inter-glacial flora could not possibly have flourished in the vicinity of a *mer de glace*—at the time of its growth snow and ice could not have been developed in Europe on a larger scale than at present.

I need not prolong these remarks. My argument against the author's "epeirogenic" hypothesis has been set forth in the paper I recently gave to the Society, and remains unanswered by Mr. Upham in his present communication.

Major-General DRAYSON, F.R.A.S., writes:—

Mr. Warren Upham has done me the honour of referring to some of my books, in which I have given geometrical proofs of a movement of the Earth, which movement had never before been defined in detail.

It was the certainty of the accuracy of geometry, that caused me to state, 22 years ago, that the Ice Age lasted only about 18,000 years, terminated not longer than 7,000 years ago, and that the glaciation of the two hemispheres was contemporaneous.

Mr. Upham states:—

Sir John Herschel computed, however, that its limits (*i.e.*, the obliquity) of variation during the last 100,000 years has not exceeded 1° 21′.

All Herschel did was to copy the opinions of M. La Place, that the *Plane of the Ecliptic* could not vary more than 1° 21′ according to accepted theories. But the variation in the obliquity is dependent mainly on the course traced by the Earth's axis; and this course M. La Place failed even to examine.

In my book, *Untrodden Ground*, I devoted chapter 8 to showing this oversight of La Place, and how error had been repeated and promulgated by the repetition of the incorrect statement, that because the plane of the ecliptic was supposed to vary only 1° 21′, therefore the obliquity could vary only 1° 21′.

Again, Mr. Upham says:

The portion of the present cycle of variation, which is used as the basis of this theory, seems insufficient to establish its conclusion of a wide range of obliquity.

As a geometrician, I am at once at issue with Mr. Upham. I have stated that the radius of the circle now traced by the Pole is 29° 25′ 47″. If I were even half a degree in error, I could not calculate accurately the position of a star for even ten years in advance. The error would be manifest. But I, and others, can now calculate for 150 years in advance to within a fraction of a second. I should like to know whether Mr. Upham has formed his conclusions on opinion or on calculation. If the latter, I shall be happy to compare our two calculations to see who is in error, and I would submit that some star, say Alpha Draconis, should have its right ascension and declination taken from Bradley's Catalogue of 1755, and from this one observation calculate its right ascension and declination for 1850 and 1890. I can predict that if Mr. Upham makes this calculation, he will soon find that the slightest error in his radius will produce a considerable error in his results. But we have Ptolemy's Catalogue of 140 A.D. for reference, so that 1750 years gives us a check on our work.

Again Mr. Upham says:—

The same arguments forbid its application to account for the Glacial epoch. . . . . as against Croll's theory. According to General Drayson, astronomical conditions capable of producing an Ice Age have occurred every 31,000 years.

This may be Mr. Upham's theory, but it is not mine; see chapter 17 of my book. I fear, however, I cannot quite agree with his logic. The daily rotation of the Earth fully explains the rising and setting of the various celestial bodies, but it fails to explain the changes in the Sun's midday altitude from summer to winter. Hence we ought to reject the daily rotation as an explanation of the rising and setting of celestial bodies, because it fails to explain summer and winter. I will give a few quotations from chapter 17 of my book. I have there pointed out that the present position of the Pole of second rotation is probably due to the position which the centre of gravity occupies relative to the Earth's centre. I then refer to the elevation or depression of land, or even of continents, causing the waters of the ocean to be distributed differently from what they are at present, and hence causing the centre of gravity of the Earth to slightly alter its

position, and hence causing the Pole of second rotation to alter its position. At page 258 I state :—

Now, a comparatively slight change in the position of the Poles of second rotation may produce a very great change in the climatic conditions during a second rotation.

At page 259 I state :—

To conclude, however, that because the Poles of the second axis of rotation are now 29° 25′ 47″ from the Poles of daily rotation, they must always have been so, no matter how much or how little the position of the centre of gravity of the Earth has varied, is unsound and is impossible.

At page 260 I state (with the aid of a diagram), that a small change in the position of the Pole of second rotation would cause an uniform climate on the Earth during many thousand years; and at page 261 I point out that the formation of coal beds, with sandstone and shale intervening, would be the results of a change in the position of the Pole of second rotation, yet Mr. Upham says, "According to General Drayson astronomical conditions capable of producing an Ice Age have recurred every 31,000 years."

It must be borne in mind that when the summer midday altitude of the Sun was 12° greater than at present, the heat in summer in *Polar regions* would have been much greater than at present. If more ice were formed in winter than could be melted in summer, there would be an annual increase of ice. If, however, the whole of the ice formed in winter were melted in summer, there would be no ice annually accumulated in high northern regions, especially where the ground was flat. Siberia and Alaska seem to meet these conditions, and it is probable that during the height of the Ice Age the regions *close to the Poles* were more free from ice than they are at present.

I refrain from venturing any remarks on the geological statements put forward by Mr. Upham. If I did so, I might soon show that I was writing on a subject with which I was only superficially acquainted. It does, however, seem to me that confirmation is required to prove that the Earth's surface was forced up 4,000 feet to cause the Ice Age, and that the weight of this ice pressed down the Earth's crust upon its "fused interior."

Professor James Geikie, at the end of his paper, vol. 26, page 248, *Journal of the Victoria Institute*, states :—

There are many other objections to the Earth's movement hypothesis which the limits of this paper forbid me entering upon. But those

already indicated may suffice to show that the hypothesis is not only baseless, but wholly fails to explain the facts, most of which in fact tell strongly against it. It accounts neither for the wide-spread phenomena of the Ice Age, nor for the remarkable climatic conditions of interglacial times.

Somewhat similar objections are apparent to me.

An important question for geologists to decide is whether one, two, or more second rotations occurred under such conditions as now prevail, viz., with a radius at, or near to, 29° 25′ 47″, or whether only one such second rotation took place, with no interglacial conditions. For my own part, I place more dependence on a geometrical proof, corroborated by recorded observations, and which states the dates when certain phenomena *must have occurred* long before these dates were suspected to be even approximate, than I do on any hypothesis framed to explain effects, when it has been found that these effects occurred at certain dates.

THE AUTHOR'S REPLY.

Respecting the greater part of the criticisms and questions brought forward in these discussions, no detailed reply seems to be needed. In part the different comments and communications sufficiently answer one another; and in other instances a careful reading of the paper will make my views more clear and perhaps more acceptable.

To Mr. Gooch it may be answered, in addition to the remarks of Professor Lobley, that the transmission of the earth's internal heat through the cooled crust appears to me certainly to have been so slow and of such small amount as to be quite unimportant in its influence on the mean temperature of the atmosphere during the late eras of geologic time mentioned, which far antedate the Ice age.

Professor Geikie's objections to my explanation of the causes of accumulation of continental ice-sheets were elaborately presented in his valuable paper in the twenty-sixth volume of this journal: and in the ensuing pages 254–256 of that volume, my answers to his arguments are stated, but less fully than here. It is my belief that the long continued pre-glacial uplift of the far

northern lands was attended, in its culmination, by a less prolonged high uplift of the more southern drift-bearing regions of North America and Europe, and of portions of the continents reaching much farther south, and that then the great ice-sheets of the Glacial period were amassed. But the elevation was followed by subsidence. Under the weight of the snow and ice, these lands were finally depressed somewhat below their present altitude, whereby, as I think, a warm temperate climate was restored, and the ice was gradually, and in a geological sense rapidly, melted away. Moderate fluctuations of the ice-front during its general recession, like those of alpine glaciers or of the Malaspina ice-sheet in Alaska, seem to me an adequate explanation of the inter-glacial beds. No more surprise need be occasioned by the occurrence of remains of warm temperate floras and faunas in these beds than we must feel in seeing tropical and temperate plants and animals at the foot of the Himalayas and the Alps. These extensive mountain ranges, frigid and largely snow-covered, doubtless exert as much influence on the climate of the contiguous valleys and lowlands as could be due to the waning ice-sheets of North America and Europe. Each of these ice-sheets, in its time of retreat, being wasted by a warm climate at its edge, probably rose to an altitude of 5,000 feet above the land within 100 or 200 miles back from the ice-border, which, therefore, might considerably re-advance during any series of exceptionally cool years, with plentiful snowfall.

Since my paper was written, Dr. George F. Becker, of the United States Geological Survey, has published the results of his recent mathematical investigation of the effects of the unequal amounts of solar heat received by different portions of the earth's surface, under varying astronomic conditions.* He cannot accept the theory of the late Dr. Croll, but agrees with General Drayson that increased obliquity of the ecliptic must favour snowfall and ice accumulation. The greatest possible obliquity, however, Dr. Becker believes to be 24° 36′, or only 1° 9′ more than now. His conclusions are stated as follows :—

> "I began this enquiry without the remotest idea as to what conclusion would be reached. At the end of it I feel com-

* *American Journal of Science*, III, vol. xlviii, pp. 95–113, August, 1894.

pelled to assert that the combination of low eccentricity and high obliquity will promote the accumulation of glacial ice in high latitudes more than any other set of circumstances pertaining to the earth's orbit. It seems to me that the Glacial age may be due to these conditions in combination with a favourable disposition of land and water. This theory implies, or rather does not exclude, simultaneous glaciation in both hemispheres. It does not imply that the Ice age should last only ten or twelve thousand years. . . . The date at which a minimum of eccentricity last coincided with a maximum of obliquity can almost certainly be determined. According to Stockwell, the obliquity has been diminishing for the past 8,000 years, and was within 21 minutes of its maximum value at the beginning of that time. According to Leverrier, the eccentricity passed through a minimum 40,000 years ago, the value being then about two-thirds of the present one. So far as I know, the obliquity has not been computed beyond 8,000. This can, of course, be done for Stockwell's value of the masses of the planets, or for newer and better ones. All the indications seem to be that within thirty or forty thousand years conditions have occurred, and have persisted for a considerable number of thousand years, which would favour glaciation on the theory of this paper."

After a careful consideration of Dr. Becker's investigation, and bearing in mind the difficulty of reconciling any astronomic theory with the uniqueness of the Glacial period, it seems to me that the ice accumulation was due chiefly to the pre-glacial high altitudes of continental areas, of which we have undeniable evidence in the fjords and submerged continuations of river valleys. To a less degree, as I think, the areas of glaciation were probably increased, or the boundaries of the ice-sheets may at times have retreated and re-advanced, because of varying astronomic conditions.

MEETING.

T. CHAPLIN, ESQ., M.D., IN THE CHAIR.

The following paper was read in the author's unavoidable absence by J. W. Slater, Esq., F.L.S., F.E.S. :—

ON SPECIMENS IN THE PETER REDPATH MUSEUM OF McGILL UNIVERSITY ILLUSTRATING THE PHYSICAL CHARACTERS AND AFFINITIES OF THE GUANCHES OR EXTINCT PEOPLE OF THE CANARY ISLANDS. By Sir J. WILLIAM DAWSON, C.M.G., F.R.S., &c.*

(ABSTRACT.) The paper relates to the following subjects :—

1. General notice of collections presented to the Museum by Mr. R. S. Haliburton and Dr. E. J. Lambert.
2. Notice of the historical facts as to the Canary Islands and their people.
3. Characters of Crania in the collection ; their affinities.
4. Objects of art in the collection.
5. General remarks and conclusions with reference to the relationship of the Guanches to ancient peoples of Western Europe and Africa, and possible connection with the colonisation of Eastern America.

1*st. General Notice of the Collections.*

THE Peter Redpath Museum has been so fortunate as to obtain, through the kind agency of friends, a collection, perhaps the best at present in North America, of the remains of this remarkable extinct people. It was hoped that the late Sir Daniel Wilson, our leading Canadian archæologist, would have prepared an account of this collection, which he visited and studied with that purpose in the spring of 1892. It might have been expected that his wide knowledge of the cranial characters of American and other races would have enabled him to determine more certainly than heretofore, the relationship of the Guanches with other peoples. Unfortunately his lamented death prevented the fulfilment of this intention, and the present paper is intended, however imperfectly, to render the specimens as useful as possible to those interested in the subject, though without entering as

* This paper is the latest published in regard to the Guanches.—ED.

fully into their general anthropological relations, as might have been done by my late friend, Sir Daniel.

The first specimens obtained for the Museum were presented by Mr. R. S. Haliburton, and were collected by him in a visit to the Canaries in 1881. They consisted of a skull, a lock of hair, some earthenware beads; also photographs of additional skulls, of earthenware objects known as stamps or seals, of a vase or jar, of stone mortars, hooks and piercers or bodkins; with a few flakes of obsidian or pitchstone. These objects were noticed in the annual report of the Museum for 1883, and some of them were figured in the author's work, *Modern Science in Bible Lands*, in 1888.

In presenting the specimens, Mr. Haliburton stated that the ornamented clay discs were from Gran Canaria, and were supposed to be seals of chiefs. The beads were actually found in Guanche tombs or sepulchres, but there was no certain evidence that they had been used as money, or for records, in the manner of the American Indians. They may have been merely for ornament. Polished greenstone axes are sometimes found, but he was not able to obtain an example of these. In addition to human mummies he had been informed that a specimen of a large lizard preserved in the same way had been discovered, possibly, a sacred animal.* With reference to the alleged want of knowledge of navigation on the part of the Guanches, he remarks:—

"If these islands were settled by a maritime people, the memory of vessels, boats, or rafts would have been preserved. But, strange to say, though these seven islands are in sight of each other, and one can be seen from the African coast, the natives have always apparently been isolated from each other by not knowing that the sea may be traversed by boats or rafts. So long has this isolation continued that the natives of the Canaries were almost distinct from each other in languages, religion, etc.

"It is possible that by an odd accident, in one island, the natives may have forgotten the use of boats (and also of bows and arrows), but how can this have occurred in all the islands?

"It seems to be, in my judgment, a strong proof that this people are the survivors of a very ancient agricultural race,

* According to Wallace there are no truly indigenous reptiles in the Canaries, and the only mammals were two European species of bats.

that at a very remote period were isolated from each other by being forced to take shelter on the summits of mountains by a submergence, probably more or less rapid." This possibility will be discussed in the sequel.

A larger donation was made in 1892, by Dr. E. I. Lambert, who being about to visit the Canaries, kindly offered to procure additional specimens illustrating the primitive inhabitants. In a letter accompanying the specimens Dr. Lambert says:—

"I have been able to procure a Guanche mummy and ten Guanche skulls, in the selection of which I was assisted by Dr. Wilson, late demonstrator in University College, London. I also visited Las Palmas, and was received with much courtesy by Don Gregorio Chil, the founder of the Museum and author of the most important work on the history of the Guanches. From him I received the skull specially marked as from the Island of Gran Canaria, I procured together with the mummy some beads used by the Guanches and specimens of the awls with which they sewed, as well as a supposed fish-hook. I was unable to procure an example of the mill in which they ground their corn, or any pottery, these objects being scarce."

The collection is accompanied by a certificate from the German Consul at Santa Cruz that the objects were obtained from an old Guanche cave in the Barranco Santos.

The mummy referred to in Dr. Lambert's letter is in fairly good preservation, and swathed in the prepared goat-skins in which it was originally wrapped. The skins are sewed together apparently with tendon, and are wrapped around with bands of skin neatly knotted. The process of preservation applied to the body has been very imperfect. The brain has not been removed. The viscera appear to have been taken out and the body dried, seemingly without any preservative substance. Little, therefore, remains of the soft parts except ligament and skin. The body is apparently that of a man of moderate stature, and in its present shrunken condition, only five feet in length, so that it does not bear out the statement of some writers that the Guanches were of great stature. It lies on its back on a plank of dark-coloured wood, somewhat split and broken, but which has been slightly hollowed and has two projecting handles at the head and one at the feet, so as to permit it to be used as a bier. This plank seems to have been shaped by stone implements. The mummy is not fastened to it.

The mummy and ten of the skulls are from the Island of Teneriffe and therefore represent the typical Guanches, since the name is said to have originally been *Guanchinail*, and to have meant "men of Teneriffe." The skull originally sent by Mr. Haliburton has no precise locality indicated; but it closely resembles the specimen obtained by Dr. Lambert from Gran Canaria. The lock of hair which accompanied this skull is fine, straight, and of a rich brown colour.

2nd. The Canary Islands and Their People.

I present here a short summary of the more important facts which seem to be certainly known respecting the Guanches.

The Canary Islands appear to have been peopled in very ancient times, and to have been visited by early voyagers.* Strabo mentions them under the name "Islands of the Blest," and attributes their discovery to the Phœnicians, who must have seen them in their voyages, from the Strait of Gibraltar along the west coast of Africa. Later notices of them under the name of "Fortunate Islands," occur in Pliny. They are said to have been visited in the reign of Augustus by an expedition sent out by Juba, King of Mauritania. At that time it is stated that no inhabitants were seen, but as remains of buildings were found as well as large numbers of goats and dogs, there must have been inhabitants; and either these were for a time thinned off by some plague, or they had retreated into the interior to avoid the strangers. The name "Fortunate Islands," seems to have been due to their climate and productions, and to the primitive condition of their people, reminding their visitors of the golden age, just as similar conditions seem to have impressed early visitors to the islands of the Pacific in more modern times.

The islands were re-discovered by the French, Portuguese and Spanish voyagers of the fifteenth century, who found them well peopled and abounding in goats, sheep, grain and fruits. At this time the number of fighting men in the different islands was estimated at from 12,000 to 17,000, but their weapons were only clubs, stones and wooden lances with the points hardened in the fire or tipped with

* Boutier and Le Verrier, *Conquest of the Canaries*, translated by R. H. Major, F.S.A., Hakluyt Society, 1872; Glas in Pinkerton's *Voyages*, vol. xvi, p. 808, give useful summaries of information.

horn. For knives they used chips of obsidian. They were naked or clothed only with their long hair or with scanty garments of palm leaf, woven grasses, or skin. In some of the islands there were houses and other buildings of stone. In others, they lived in huts or caverns. Monogamy prevailed, but it is said there was polyandry in some of the smaller islands, one woman having as many as three husbands. As in many primitive peoples, descent was reckoned in the female line. They had a tribal government of kings or chiefs, and had also a priesthood or class of "Medicine Men," or Shamans. In some islands there were communities of nuns or vestals. In one of the temples or sacred buildings an image of stone is mentioned. In some of the islands the people are said to have spent much time in singing and dancing.

There are believed to have been two races of men in the islands; one of brown complexion, the other white. The brown race was the ruder, but the taller in stature, and predominated in the islands nearest the African coast, and it was in these that polyandry occurred. This distribution would seem to indicate that the whiter and more civilised people were the earlier colonists. The greater part of the specimens in Dr. Lambert's collection being from Teneriffe, would represent the lighter coloured and smaller people of the central and western islands. The single Gran Canarian skull may belong to the other race. It seems to have been in the central and western islands that the practice of embalming the dead prevailed. There were professional embalmers who were also physicians, but their art was very rude and imperfect, compared with that of Egypt in the time of its highest civilisation. The mummies were sometimes deposited in caverns, and where these were not readily accessible in cists or sepulchres of stone.

The languages of the islands, though said to differ from each other, would seem to have been dialects of a common tongue, differing just as we find among the American aborigines, where the want of writing and intercourse allows languages originally the same to become in a few generations distinct from each other. In so far as the few words I have had access to can give information, the general language would seem to have been Turanian rather than Aryan. The dialect of Teneriffe seems to have been more distinct than any of the others. Father Abreu Gelindo, and Webb and Berthelot, *History of the Canaries*,

compare the Canarian words preserved to us with the Berber language. There is said to have been a system of hieroglyphics, but I have seen no examples of these, and the marks upon the so-called clay seals are apparently merely ornamental.

The absence of canoes has led to the theory already referred to, that the islands are the remains of a submerged continent; but their volcanic character and the depth of the ocean round them are adverse to this conclusion on physical grounds, while the distinctness of the fauna from that of Africa would seem to indicate long isolation.* At the same time, if the inhabitants were colonists from the mainland, it is very extraordinary that they should lose all knowledge of navigation in islands holding out so many inducements to seafaring habits. If the objects regarded as fishing hooks are really of that character it would be interesting to know in what way they could practise sea-fishing without the aid of some kind of boat or raft. They are known, however, to have fished with drag-nets from the shore.

By the Portuguese and Spanish, the islanders were not only plundered but hunted and sold as slaves. This led to wars of extermination, in which the unhappy natives perished, except in so far as traces of their blood may remain in the present inhabitants. Thus this interesting people became extinct, and the valuable information which might have been derived from a scientific study of their languages, physical characters and habits, was lost to the world. This is the more to be regretted, as we shall see in the sequel that the aborigines of the Canaries may have been a survival of the so-called Neolithic peoples of Europe, and may have served to connect these with certain of the populations of Eastern America. Fortunately some attention has recently been given to the scanty remains still extant, and the accumulation of a museum of Guanche objects in the Canary Islands themselves, is an important step in advance, which it is hoped may be very successful, and may be accompanied by such publications of the objects obtained as may bring them more prominently under the notice of archæologists.

3*rd. Cranial Characters.*

Of the eleven skulls which we owe to Dr. Lambert, one was presented to Sir Daniel Wilson for his collection in the Tor-

* Wallace, *Geographical Distribution of Animals*, chap. x.

onto University. The remainder, as well as that attached to the mummy, are in the Peter Redpath Museum. Thus our collection consists at present of nine detached skulls and a complete mummy from Teneriffe, one skull from Gran Canaria, and the original skull presented by Mr. Haliburton, twelve in all. I shall here refer to the collection of Dr. Lambert alone, though the remaining skull is similar in general aspect, but its precise locality was not stated by the donor.

As a whole the skulls are of a more refined type and texture than is usual with those of barbarous peoples. This fine type of the crania at once attracted the attention of Sir Daniel Wilson on his examination of the collection, and he expressed himself as doubtful of any close resemblance to certain Palanthropic skulls they have been said to resemble. On more close inspection, however, we recognize some of the characteristic appearances seen in the crania of rude and primitive people, as for instance, somewhat pronounced superciliary arches, a narrow forehead somewhat retreating, a certain angular character in the vertex, a tendency to occipital protuberance, and a strong development of the lines of attachment of the temporal muscles; but these characters are on the whole of a subdued type.

Most of the skulls are those of males, but two are probably females and are smaller and more delicate in form. They fully vindicate the reports of the regular features and prepossessing appearance of these people. The length of the single Gran Canarian specimen is 7·37 inches, its breadth 5·62 inches. The mean length of three male skulls from Teneriffe is 7·27 inches, their breadth 5·41 inches. One of the specimens figured is that from Gran Canaria, the other is an ordinary example of those from Teneriffe; but some of the others approach nearer to the Gran Canarian type.

The whole of these Crania, particularly the ten from Teneriffe, are somewhat uniform in type—more so than we usually find in a miscellaneous collection of native North American skulls of one tribe. They are oval in form and mesito-cephalous, with fairly developed foreheads, but the superciliary ridges somewhat prominent in most. The nasal bones are prominent and not wide but much depressed at the junction with the forehead. The cheek-bones are not unduly prominent, the jaws orthognathous, the chin prominent and sometimes pointed. The teeth are usually regular and well developed though there are exceptions to this. They are not much worn on the crowns. Some have one large Wor-

mian bone, others two smaller lateral ones, and others mere traces of these bones.

The skull from Gran Canaria presents some slight differences from the others. It is thicker and heavier, the eyebrows more prominent, the eye sockets with a tendency to squareness; the chin is very pointed; the Wormian bones are small, the muscular impressions are strongly marked; the teeth are more irregular than in the specimens from Teneriffe. On the whole this skull has one of the best developed foreheads, and the brain-case is wide above.*

One of the Teneriffe skulls has three cervical vertebræ attached, showing it to have belonged to a mummy.

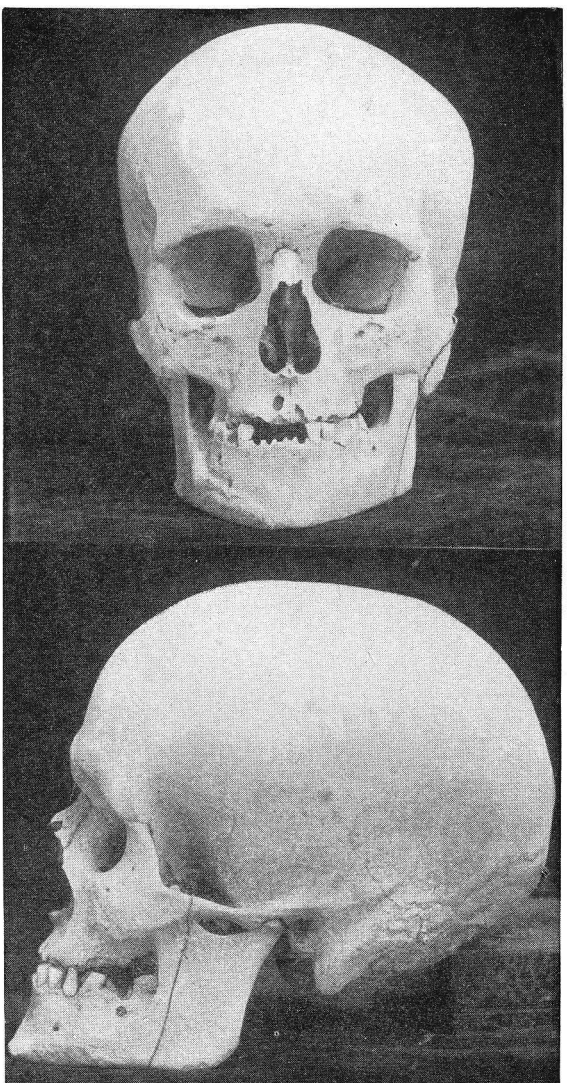
The following are the measurements of the several skulls in centimetres, the length being taken from the base of the frontal bone to the occiput, and the breadth being that between the most prominent parts of the parietal bones.

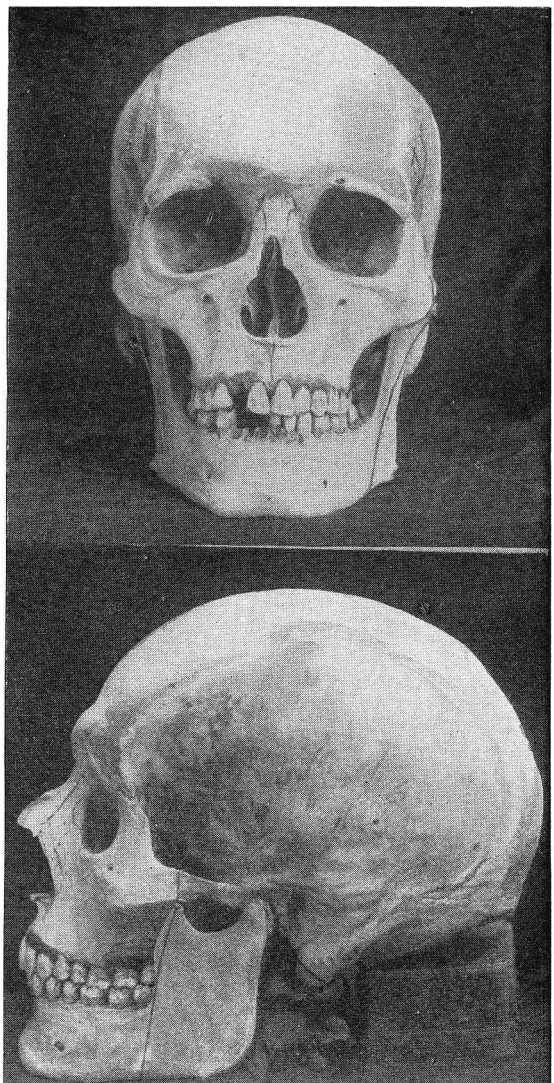
No. of Skull.	Locality.	Length.	Breadth.	Remarks.
1	Teneriffe	19·0	14·0	The largest skull.
2	„	18·1	14·2	Has a fracture on vertex, post-mortem.
3	„	17·3	14·0	Probably a female.
4	„	17·9	14·2	Indented behind by injury or disease.
5	„	17·8	13·3	Probably a female.
6	„	18·7	13·8	Seems to have been trepanned.
7	„	18·6	14·2	Slightly flattened behind.
8	„	18·8	14·4	„ „
9	„	18·6	13·6	Has cervical vertebræ attached.
10	„	18·3	14·3	On mummy.
11	Gran Canaria	18·8	14·3	Slightly different from the others.

The cephalic indices and averages are as follows.—

Index of ten Teneriffe skulls	·764
Index of one Canarian skull . ..	·758
Average length of ten Teneriffe skulls	18·30 c.m.
Average breadth of the same.. ..	14·00

* In the history of the islands, the inhabitants of Gran Canaria would seem to have excelled those of the other islands in energy and military prowess.





The somewhat greater difference in the relative lengths compared with the breadths is due in part to the varying projection of the front of the frontal bone, and to certain protuberances or flattenings of the occiput. Some of the skulls show a marked occipital protuberance, while others are so much flattened behind as to suggest the possible use of a cradle-board in infancy. One of the skulls is remarkable for a large irregular opening at the junction of the frontal bone with the left parietal. It has evidently been made during life, and is probably the result of trepanning, or some similar process.*

The Guanche crania have been stated by certain writers to be similar to Palanthropic skulls found in European caverns, and notably to those of Cro-Magnon and Engis; but this is evidently an error, as the above measurements show, and as I have satisfied myself by comparison with good casts of the skulls of Cro-Magnon, Laugerie-basse and Engis in our collection in the Peter Redpath Museum.

The skull of the old giant of Cro-Magnon measures 7·9 inches in length, and that of the probably younger man from the same rock-shelter nearly eight inches. Their breadths are the same, or about 6·1 inches. The Laugerie-basse skull measures 7·65 inches by 5·75. The Engis skull measures 7·95 inches by 5·7. They are thus all larger and of somewhat greater proportionate length. That of Laugerie-basse approaches nearest to the Canarian skulls. A comparison of the specimens placed side by side brings out however their differences much more strongly than measurements. In general form, taking the skull of the old man of Cro-Magnon as an example, the massive proportions, the long flattened parietal bones, the great length of the frontal bone and its tendency to form a vertical ridge in front, which owing to an erosion of the forehead of the old man's skull is best seen in the second skull from the same cave, the contrast of the shortness and breadth of the face with the length of the skull, the orbits lengthened laterally, the broad and heavy lower jaw, and its somewhat prognathous character; these peculiarities along with the great stature of the skeleton and the remarkable development of the bones of the limbs separate the Cro-Magnon and allied tribes from the Guanches by a

* Trepanning is known to have been practised among the ancient Peruvians, Dr. Muñoz, exhibited at the World's Fair Congress of Anthropology, in 1893, nineteen crania from Peru, which had been subjected to operations of this kind

wide interval, and indeed distinguish markedly these primitive men from any modern races known to me. These characters are well illustrated by Pruner Bey, Quatrefages, and Christy and Lartet, and we cannot doubt that, with the Canstadt, Neanderthal, Spy, and Grenelle remains allied to them in some respects, though exaggerating some of their peculiarities, this group of peoples, contemporary with the mammoth and Tichorhine rhinoceros in Western Europe, stands by itself as a race or group of races markedly distinct from those of later periods. The solitary skull from Truchére referred by Quatrefages to the Palanthropic period, is the only one of that age which can bear any proper comparison with such remains as those of the Guanches.

On the other hand our Guanche skulls may be better compared with those of the so-called "Neolithic" age in Europe, the men of the polished stone and early bronze ages, of the long barrows and cromlechs, and of the Swiss lake habitations, as well as with the Iberian races of France and Spain and the Berbers of North Africa. The crania of these races, as tabulated by Quatrefages,* are those which most nearly approach to our specimens from the Canaries, and their arts and habits and state of civilization in early times are also those which afford the best terms of comparison.

It may be useful to illustrate these points by the following measurements of the whole series of Palanthropic crania from Europe in our collection, in comparison with those of the Guanches :—

	Length.	Breadth.
Neanderthal skull	20·8 c.m.	15·0 c.m.
Cro-Magnon (old man) skull	20·3 ,,	15·3 ,,
,, (2nd skull)	20·5 ,,	15·3 ,,
Engis skull	20·1 ,,	14·1 ,,
Laugerie-basse skull	19·2 ,,	14·3 ,,
Largest Teneriffe skull	19·0 ,,	14·0 ,,
Gran Canarian skull	18·8 ,,	14·3 ,,

It will be seen that all the old cavern skulls are larger than those of the Guanches and that four of them are remarkable for their great length. Some of the older skulls are also noteworthy for the elongated form of the orbits, the peculiar vertical ridge on the frontal bone, the prominent

* *The Human Species.*

eyebrows, the short face compared with the long head. These characters are especially marked in the old man of Cro-Magnon. The Laugerie-basse cranium has more resemblance to that of Truchére, has less of these peculiar characters, and consequently approaches more nearly to the Guanche skulls. We do not certainly know the relative ages of the cave skulls. The Canstadt or Neanderthal type is generally supposed to be the oldest. At Spy in Belgium and at Grenelle on the Seine, it certainly appears in the oldest deposits, though the Cro-Magnon type is accompanied by the same fauna and belongs to the same geological period. The fauna of Laugerie-basse is also the same, but it is possible that while all are post-glacial, Palanthropic, or Quaternary, as distinguished from recent, this series of skulls may represent different phases of the period. Another view however, is possible. There may have co-existed in Europe two races of men, that of Canstadt, Spy, and Neanderthal and that of Truchére, the latter being essentially similar to the men of the Neanthropic age, of the Iberian type which still exists. The gigantic race of Cro-Magnon, Laugerie-basse and Mentone may have been the result of mixture of these races. If so, this would account for the considerable diversity of cranial form, as mixed breeds are apt to present various intermediate forms and also to revert toward the pure races.

These are facts patent to ordinary observation; but actual measurements are not wanting. Dr. Franz Boas has investigated the facts in the case of half-bloods between the American Indian and the European.* He finds that the stature of the half-blood is greater than that of either parent, and this especially in the case of the men, and that the half-bloods are more variable in this and other physical characters than either of the pure races. Another remarkable peculiarity is that the height of the face tends to become diminished relatively to the size of the head in the half-bloods. Thus we have good reason to believe that the giants of the Palanthropic age were half-bloods. I have treated this question in some detail, and in its relation to history, and have suggested the above explanation, in a little work lately published.†

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* *Popular Science Monthly*, October, 1894.

† *The Meeting place of Geology and History*, London, 1894, also *Fossil Men*, London, 1880.

On this hypothesis one may regard the Guanches as a comparatively unmixed race, but in the Gran Canarian variety approaching more nearly to the more delicate type of the Palanthropic age, while of the latter the types of Laugerie-basse and Truchére approach nearest to the Guanche and Iberian forms. On the whole, however, the Guanches cannot be identified on physical grounds with the Cro-Magnon or other Palanthropic races, and their nearest affinities would seem to be with the Neanthropic or "Neolithic" peoples of Western Europe and with the modern Berbers and Basques.

I may add here that the study of many skulls and skeletons leads me to the conclusion which I have elsewhere maintained that the bones of men known as those of Canstadt, Neanderthal, Spy, Cro-Magnon, Laugerie-basse, and Mentone,* which were contemporary in Western Europe with a land fauna now in large part extinct either wholly or locally, and with geographical conditions which have passed away, are distinguishable by well-marked physical characters from any modern races, including the Guanches; and that the characteristics of these extinct tribes appear only occasionally by atavism, or locally and partially in individual cases, especially in some of the more rude races of modern men.

It thus appears that our Guanches are racially, as they are geographically, connected with the older peoples of the western Mediterranean area, and with these as they existed in the post-diluvian period, after the continents had attained to their present forms. It remains, however, to inquire to what extent, the Guanches may approach to the aboriginal peoples of Eastern America. Here there can be no question that their crania distinctly resemble those of the Huron and Algonquin peoples. This can easily be seen by comparison of the Guanche skulls in our collection with those representing American tribes of these races, and it appears also from the extensive series of measurements published by the late Sir Daniel Wilson.† The index of thirty-nine Huron skulls as given by him is ·744, and that of thirty-two

* M. Louis Jullien, who has made some excavations at Mentone, has kindly communicated to me photographs of a skull found by him in the cave of Bamio Grande. Its measurements are 19·2 c.m. by 14·1 c.m., or very near to those of the Laugerie-basse skull, but it is more prognathous.

† *Prehistoric Man*, chap. xx.

Algonquin skulls is ·769, so that the average Guanche skull falls between those of these two great American races, and the general character and appearance of the two groups of skulls corresponds with these measurements.

Wilson has shown that this dolichocephalic or mesitocephalic type prevails along Eastern America from the West Indies to the Gulf of St. Lawrence, and there are various indications in tradition and in buried remains that these peoples, of whom the Huron-Iroquois and Algonkin stocks are northern extensions, made their way to the north in times not very ancient, and locally replaced feebler brachycephalic tribes which had preceded them. This process seems to have been proceeding up to the European discovery of America. The full significance of this relatively to the Guanches will be noticed in the conclusion of this paper.

4*th. Objects of Art, &c.*

These are not numerous, and the subjoined list may serve to indicate their nature.

Beads.—A thin flat bead or disc, being a small circular plate of laminated or pearly shell with a somewhat large central perforation. There is also a photograph of a string of shell beads very like a string of North American wampum. Cylindrical beads of brown baked clay of different lengths. The ends of each bead are cut squarely across.

Flakes of black obsidian or pitchstone, very little modified, and perhaps used for knives or scrapers.

Bodkins or *piercers* neatly made of the leg bones of birds.

Hooks.—A large hook of some horny substance. It has a knob at the top of the shank and a few notches to aid in fastening it to the line. The point is gnawed away by rodents, so that it is uncertain if it had a barb. There is also a photograph of a large stout hook reminding one of those used by the Pacific Islanders and in the Queen Charlotte Islands. It is made of two pieces lashed together, and has a strong barb.

Goatskin probably from the swathing of mummies. It has been deprived of the hair, but is not tanned, and has the texture of parchment. In some places it is sewed together with tendons or strips of skin. Bands of skin used on mummies are neatly knotted.

Earthenware.—A few fragments only of a brown colour

and unglazed, also photographs of other objects. One of these is an oval vase, suited to stand on its end, quite unornamented. Its form is similar to that of the jar found by Dupont in the cave of Frontal, in Belgium, and perhaps one of the oldest known. Several others represent the so-called seals, which are flat discs or squares of clay, marked with radiating or concentric rows of dots, and concentric and spiral bands. One of them has what appears to be the remains of a handle at the back. These objects may have been ornaments or distinctive badges, or may have been used for stamping with colour, or on soft bodies; but they do not seem well adapted for this. None of them show any appearance of characters or imitative forms.

Mortars.—One of the photographs represents two mortars, probably for grinding corn. They are made of round stones hollowed out on one side.

5th. General Remarks.

In so far as the facts above stated give any evidence, it would seem that ethnologically and probably historically the Guanches were most intimately related to the early populations of Northern Africa and Western Europe in the Neanthropic or early post diluvian period. We may imagine them to have been derived from the ancient Berber tribes of Northern Africa or from the Iberian race of South-Western Europe, and to have remained at the stage of culture of these people in what has been called the Neolithic or later stone age. There is nothing novel in this suggestion, as Humboldt and Pritchard long ago compared these people with the Berber races of North Africa, their nearest neighbours on the mainland in ancient times. They present also in their physical character and in their arts, resemblances to aboriginal America peoples, particularly to those of the East Coast. Some of the Hochelagan or Algonkin skulls in our collections are closely allied to those of the Guanches, and their bodkins, wampum beads, and pottery are very similar, while the systems of kinship, and of religion controlled by medicine-men, seem to have been allied. I have placed in our collection the skull originally presented by Mr. Haliburton beside those from Hochelaga and from Central America as the most nearly related to it. Sir Daniel Wilson has already referred to these resemblances in connection with the possible migration of man from the Mediterranean region or

its islands to the islands or shores of America, and has mentioned the accidental discovery of Brazil by De Cobral in the fifteenth century as an illustration of the possibility of canoes or vessels having been drifted across to America.

That the natives of the Canaries were not navigators is perhaps no evidence against this conjecture, as it is plain that the original colonists of the islands must have come by sea, unless indeed there was a land connection in early times, in which case there may have been greater facilities for still further excursions to the westward. In any case there is warrant for the belief that they afford some evidence of kinship in the aboriginal populations of the two sides of the Atlantic.

Gaffarel in his curious book *Rapports de l'Amerique et de l'Ancien Continent*, thus sums up the American affinities of the Guanches.

1. Their brown colour, want of beard and long hair.
2. Their use of pictographs or hieroglyphic writing.
3. Their disposal of the bodies of the dead.
4. The erection of pyramidal or round shaped tombs.
5. The institution of vestal virgins.
6. Their public and solemn dances.
7. Their addiction to song and oratory.
8. The use of beads or wampum.
9. The recognition of descent in the female line.

These resemblances are no doubt somewhat vague, and might apply to other peoples besides those of America. But to these may be added their cranial characteristics and the probable affinity of their language to that of the early Turanian peoples of Western Europe, as the Basques or Euskarians, which according to Hale, a very competent authority, have distinct resemblances to those of America. All these points of coincidence apply most strongly to the peoples of the West Indies and Central America, and of the East Coast of America, while Asiatic or Mongoloid and Polynesian features are more prevalent on the west coast.

With regard to the distance intervening between the two sides of the Atlantic, Hale reminds us that this is much less than the spaces of ocean intervening between the islands of the Pacific which are known to have been traversed by the Polynesians in their canoes. The same veteran ethnologist has recently collected traditions among the Wyandots, supposed to be descendants of the peoples who inhabited the

ancient towns of Stadacona and Hochelaga found by Cartier in the St. Lawrence in the sixteenth century, and which have been replaced by the cities of Quebec and Montreal. It would appear from these traditions that the tribes of the Huron-Iroquois stock whose cranial resemblance to the Guanches has been already stated, believed that their original seat was on the Atlantic coast.* It would thus seem probable that the resemblance of their crania to those of the Guanches may have arisen from a common origin at no very remote period, as the westward migration of these tribes was still in progress at the time of the discovery of America.

Mr. Hyde Clarke was, I believe, one of the first to direct attention in England to the connection of the language of the Guanches and allied peoples with those of the natives of Brazil and the West India Islands. In America as well as in Europe, Dr. Retzius has ably maintained a similar connection on the basis of cranial characters. The latter says:—"With regard to the primitive dolichocephali of America, I entertain the hypothesis that they are nearly related to the Guanches of the Canary Islands and to the Atlantic populations of Africa which Latham comprises under the appellation of Egyptian Atlantidæ. We find one and the same form of skull in the Canary Islands, in front of the African coast and in the Carib Islands on the opposite coast which faces Africa. The colour of the skin on both sides of the Atlantic is represented in both these races as being of a reddish brown."†

In all such comparisons the question occurs whether the analogies observed are mere accidental resemblances arising from like conditions of existence, or depend on migrations; and it may be very difficult to attain to any certain conclusion. In the case of America, I have summed up in my work *Fossil Men*, the evidence to show a threefold resemblance pointing to Northern Asia and Polynesia in the west, and to the Mediterranean region and the Atlantic islands on the east. This threefold indication, I think, greatly strengthens the argument for migration.

In Canada, Wilson and Hale have advocated this view. In the United States opinions seem divided, since, at the Chicago Congress of Anthropology in 1893, the adven-

* *Journal of American Folk-lore*, 1894.
† *Smithsonian Report*, 1859, p. 266.

titious or accidental theory was strongly supported by Brinton and Cushing, while that of migration was maintained by Putnam and Mason,* who showed that the resemblances were so marked and the conditions of their occurrence so peculiar, as to preclude the accidental theory, while there was actual evidence in some cases to show repeated connections recurring at intervals, though the predominant indications pointed to very early historical periods.

Writers who have discussed the tradition handed down from Egyptian priests, through Solon and Plato, of a lost Atlantis, have often connected it with the population of the Canaries.† If, however, we attach any historical value to this tradition, we may, as the writer has already done,‡ regard it as a reminiscence of the antediluvian period, when lands existed in the west of Europe now submerged, and were probably peopled by a formidable race of men who, when pressed by the increasing cold of the period, or by the progressive submergence of the land, may have invaded the countries farther east, as recorded in the Egyptian story. In this case the Guanches could have no connection with the matter, since their affinities, as we have already seen, are with Neanthropic peoples; and in any case the depth of water between their islands and the mainland is so great§ as to render it improbable that these islands formed a portion of the continent even in that second continental period when Great Britain and Ireland had not yet become islands. If on the other hand we suppose, with the late Sir Daniel Wilson, that the lost Atlantis represents vague intimations reaching Egypt in early times of a great western continent beyond the Atlantic, it is not impossible that these may have been derived from early Phœnician voyagers to the Canaries and from hints conveyed to them of lands still farther to the west. In this case we may also connect these traditions with those found by early explorers among the Central Americans and Mexicans, in regard to visitors alleged to have reached their shores from the east, and may regard both as lending some countenance to the idea that a

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* Report by Holmes, *American Anthropologist*, 1893.

† Wilson, *The Lost Atlantis.*

‡ *Meeting Place of Geology and History*, p. 156.

§ The depth of the channel between the Canaries and Africa is stated at 5,000 feet.

portion at least of the American aborigines reached America from the eastern side of the Atlantic.

Nor should we omit to notice that volcanic islands like the Canaries, rising from great depths in the ocean, may not be of long duration in geological time, and that in the early human period there may have been chains of such islands connecting the Mediterranean volcanic belt with that of the West Indies, and which have since disappeared by erosion or by subsidence. The existence even in comparatively modern times of such insular connection would be in no respect contradictory to the known facts as to the ancient insularity of the Canaries already stated. Even the supposition that the Canaries may in the early modern period have belonged to a much larger insular region is not excluded by the facts of physical geography already referred to, since there may have been subsidence correlative to the great elevation of the mountains of these islands; a consideration which has not been sufficiently attended to by inquirers as to the fauna and flora of the Atlantic Islands.*

The conclusions of this imperfect study of an extinct people may be summed up in the following statement:—

1. The Guanches present the characters of a primitive and little mixed race; and their rudimentary civilization corresponds with this, and assimilates them to such peoples as those of the early Swiss Lake habitations, and the early Iberian races of Western Europe and the earliest colonists of Egypt and other parts of North Africa.

2. They are not closely allied either in physical characters or in arts and habits of life to the Palanthropic or antediluvian peoples of the river gravels and caves of Europe; and their nearest analogues among them are the somewhat exceptional types of Truchére and Laugerie-basse. On the other hand they have closer physical affinities with the earlier or postdiluvian peoples of Europe and Northern Africa and with the Basque and Berber populations of more recent times.

3. There are sufficient resemblances between them and native American races of the eastern part of that continent, to render it not improbable that there was early intercourse between the two sides of the Atlantic, in which the Guanches or peoples allied to them may have borne a part.

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* The Peak of Teneriffe is 12,000 feet in height.

In conclusion, the points referred to in this paper may be sufficient at least to excuse geologists and archæologists on the Western side of the Atlantic for interesting themselves in the extinct people of the Canaries.

NOTE ON GUANCHE SKULLS IN THE PEABODY MUSEUM OF ARCHÆOLOGY, CAMBRIDGE, U.S.

PROFESSOR PUTNAM, the director of the above-named museum, has kindly communicated to me the measurements of two Guanche skulls in his collection, which were measured for him by the late Miss Studley, one of his assistants.

Of one of these (No. 122) the length is 18·3 centimetres, or exactly the average of our ten Teneriffe skulls, but the maximum breadth is only 13·3, which is near to that of the narrowest of our male skulls. The other (presented by Miss Dabney, and said to be from an ancient cemetery in the island of Gran Canaria) is in length 19·0, which is the same with our largest Teneriffe skull, but its breadth is 14·8, which is greater by ·4 than that of any of our Teneriffe skulls. It is larger in both dimensions than our skull from Gran Canaria, but is somewhat less dolichocephalic.

Along with these Miss Studley has tabulated the average of 25 crania of New England Indians, which amounts to 18·6 in length and 13·5 in breadth; of 14 Florida skulls with 19·1 in length and 13·5 in breadth; and 9 Coahuilan (Mexican) with length of 18·3 and breadth of 13·4, which comes very near to the average of the Teneriffe skulls. These measurements tend to confirm the con-

clusion deduced above from Canadian crania as to the resemblance of Guanches to Eastern Americans in certain at least of their physical characters.

The following are some of the other dimensions of one of the Cambridge Guanche skulls (No. 122)*: Capacity 1,225; *Longitudinal diameters*—glabello-occipital 18·3, ophryo-occipital 18·2; *Transverse diameters*—minimum frontal 9·4, stephanoid 10·0, bimastoid 12·1, biauricular 11·9, temporal 12·9, maximum 13·3, asteriac 10·6; *Height*—basi-bregmatic 12·6; *Index of breadth*—glab. occ. ·727 oph. occ. ·783; *Index of height* ·689; *Horizontal circumference* 507; *Angle* (Daubenton) 90°; *Intermalar*—superior 5·9, intermalar inferior 10·2.

Professor Putnam informs me that at the International Exhibition at Chicago a large number of measurements of American heads were obtained; but they have not yet been published.

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* It is not known to which of the Canary Islands this cranium belongs.

The CHAIRMAN (Dr. T. CHAPLIN).—I am sure you will all agree that the Institute is greatly indebted to Sir William Dawson for his most valuable paper, and also to Mr. Slater, who has so ably read it.

Probably at no previous period have questions relating to primitive man been of higher interest and more importance than at the present time. Questions relating to his origin, his physical conformation, his social customs, his religion, his relation to races which still exist—all these are of the very highest scientific and social importance. We are therefore the more indebted to the author of this paper. There are doubtless many here who, having made the subject of the paper their special study, will favour us with their opinions thereon.

Professor E. HULL, LL.D., F.R.S.—Mr. Chairman, I desire to echo your words expressing special gratitude to the author of this most valuable paper.

A VISITOR.—The author has undoubtedly shown the importance of a study of the anthropology of Northern Africa, which is one of the many reasons why this paper is of such use; it has brought up to the present time all the leading points relating to this people. They have entirely disappeared as a race, and it is important that we should have all the information that can be gathered in regard to them. This paper collects together much matter that might otherwise have been lost to us, and no doubt it will be the basis of further study by others.

Rev. Dr. A. LÖWY.—I would venture to make one short remark, namely, that although the Guanches have disposed of the subject, so to speak, for themselves, the museums may have something to say bearing on the question of departed spirits. I mean to say, that considering the Guanches were so anxious to preserve the body after the death of the individual, they must have had some ideas about a life after death. Those nations that are anxious to preserve the identity, if I may say so, of the dying individual, have, at the same time, always connected with it the idea that there is something to live for hereafter—another life; and therefore, a museum tells the story of—life after death. It is a very interesting point.

The meeting was then adjourned.

REMARKS ON THE PRECEDING PAPER.

From Professor J. CLELAND, M.D., D.Sc., LL.D., F.R.S.:—

The McGill University is to be congratulated on having such an interesting collection of specimens relating to the extinct inhabitants of the Canary Islands, as that which Sir William Dawson brings under the notice of the Victoria Institute. To Americans and Canadians there must doubtless be a special charm in endeavouring to trace affinities of islanders in the Atlantic with races on both sides of the ocean; and it is interesting to find that the well-known Principal of the College at Toronto is disposed to consider that the Guanches are related to the Berber tribes, as Pritchard and Latham have held, and have also characters in common with American peoples.

The skulls brought under notice form a most valuable collection, and it is to be hoped that they will be carefully preserved, and that they may some day be individually described at greater length. I am glad to note that Sir William Dawson gives the length and breadth of each; for these are of far greater meaning than the so-called cephalic index (the proportion of the breadth to the length taken at 1,000), both because they afford some guide to total size and because the index is a proportion between two measurements, which have no particular dependence one on the other. Indeed the index owes the undue importance with which it has been invested to the mistaken supposition that the recognised classification of skulls into brachycephali and dolichocephali by Anders Retzius, took into consideration this proportion and nothing else. The skulls treated of in this communication are all of considerable absolute length. It may be added that to give a proper idea of the dimensions of a skull or any other body, not only the length and breadth, but the height, should be given, and that in the skull from Gran Canaria photographed, the height appears to be very decidedly above the average.

A detailed account of the face-bones would be interesting—indicating the length of the face, the orbito-nasal angle or position of the face relatively to the anterior fossa of the base of the skull, and the shape of the nares. Most of all one would like some precise measurements bearing on the question of savagery or refinement. I hold, as I put forward in the *Philosophical Transactions* twenty-five years ago, that bearing on this question there are two points of much importance, namely, the position of greatest breadth, and the length of the base-line from the back of the foramen magnum to the fronto-nasal suture. Savage races are liable to have the zygomatic breadth equal to or greater than the cranial breadth, and to have the position of the greatest cranial breadth high up on the parietals; and a greater length of base-line from the back of the foramen magnum is found among savages than is ever found in civilised forms, a circumstance exceedingly interesting as showing that civilisation never lengthens the base, however much it may inflate the arch of the skull.

It is interesting to note that the zygomatic breadth is obviously less than the greatest breadth of the cranium in both the skulls photographed, and I suppose that it is to this character that the author refers when he states that the cheek-bones are not unduly prominent; for prominence forwards of the cheek-bones is a feature giving character not at all of a debased kind, while zygomatic breadth depends on development of muscles of mastication. Another noticeable point is that in both the skulls photographed the mental prominence or chin, a purely physiognomical decoration, is well developed. This, together with the orthognathous dentition, is confirmatory of Sir William Dawson's view that these Guanche skulls are of a more refined type than is usual among barbarous peoples. Carefully made vertical sections would not injure the value of the specimens, and would be of great use in determining the basal characters, both linear measurements and angles, without which, as has been pointed out by Professor Huxley as well as by me, the construction of no skull can be adequately known.

From Dr. LAMBERT, of Cairo:—

1. All the long bones alluded to were flattened.
2. The olecranon was perforated.
3. The Guanches had no writing, but used geometrical sculpture.
4. They had the custom of drawing the kids from their mothers, in order that, by their bleating, rain might come.
5. Another method for bringing rain was to lash the sea.
6. The Guanches were a highly moral race.

ORDINARY MEETING.*

SIR G. G. STOKES, BART., IN THE CHAIR.

The following paper was read by the Author :—

MIRACLES, SCIENCE, AND PRAYER. By the Rev. J. J. LIAS, M.A., Chancellor of Llandaff Cathedral, Rector of East Bergholt, Colchester.

I REJOICE to find myself once more addressing the Institute, after an interval of some years. If I have chosen an altogether different subject to those which I have treated on former occasions, I may at least claim that it has received from me some attention. I published a small volume on the subject of miracles in 1883. I fear I can at present add but little to what I have there said, but if I should seem to repeat myself on this occasion, I can at least claim that when I then wrote, I was working on new lines. At that time the question of miracles had hardly, so far as I knew, been approached from a scientific standpoint, yet the scientific was the side from which the most formidable objections proceeded. The discoveries of the last two hundred years in the department of physical science had largely extended the domain of law in relation to phenomena. Therefore the conception of miracle as a violation or suspension of the laws of nature had become discredited. It had become necessary to restate the argument for miracles in a form not incompatible with the progress of science. It should

* The preliminaries of the meeting have been published, but the final arrangement of the paper and discussion has only now (1897) been possible.—ED.

be observed, however, that the modification of the argument for Christianity, which has been found so absolutely necessary of late in various departments of theological thought, does not necessarily involve, as some have hoped and others have feared, a surrender of any part of the Christian position. Thus in the case of miracles, if it could be proved beyond a doubt that they were not, and could not be, violations or suspensions of the laws of nature, not one single presumption would be thus raised against the fact of their occurrence. The confutation would apply simply to the customary definitions of them. In days when scientific principles were unknown, it was by no means surprising that unscientific explanations should be given of observed facts. If, in days of scientific knowledge, those explanations have to be abandoned, it would not only be illogical, but highly absurd to contend that the alleged facts themselves were thereby disproved. An unscientific explanation of miracles when discovered no more compels us to abandon our belief that they occurred than the utterly mistaken conceptions in relation to physical science before the days of Bacon and Newton involves, when discarded, an abandonment of our belief in the reality of phenomena. Thus the question of the credibility of miracles remains exactly where it was, and it must be discussed now, as ever, on historical grounds. The modern apologist for miracles has only to modify his argument so far as to meet the *à priori* assumptions of the impossibility of their occurrence, and to explain their nature on sound scientific principles.

Accordingly, in the volume to which I have referred, I endeavoured first of all to frame a theory of miracles which was not incompatible with the principles of science. It is obvious that if such a theory can be found, the whole attack from the scientific side is repulsed, and the argument resumes its original form—that of an examination of the credibility of testimony. I therefore abandoned the language of earlier apologists, which described a miracle as a "violation or suspension of the laws of nature," because we have no evidence before us that it is anything of the kind. I defined a miracle as "an exception to the observed order of nature, brought about by God in order to reveal His will or purpose." *How* brought about I did not presume to say, because nobody can possibly know how it was done, and if we did know how it was done it would cease to be a miracle. I then proceeded to discuss the scientific objections to the miraculous. These

are based upon the supposed uniformity of natural forces. But it is by no means difficult to show that however uniform natural *forces* may be, the *results* of such forces are not only not uniform, but infinitely various: and that it is to the interaction of forces themselves invariable in their mode of operation that the infinite complexity which we observe in natural phenomena is to be ascribed.

This assertion will hardly be disputed. The motions of the heavenly bodies are regulated in the simplest possible manner. The interaction of two forces only directs those motions—the so-called "law" or observed characteristic of nature which impels every body to move straight on in the same direction in which it is moving at any given moment, and the force of gravitation, which varies directly as the mass, and inversely as the square of the distance, of the bodies which exert it. Yet how infinite are the results of the combination of these two opposing forces! It has been observed that, regular as is the revolution of the moon round the earth, it never returns a second time to the precise place in the heavens it occupied on previous occasions. But this is not all. The place of the moon in the heavens, as viewed from the earth, is merely relative. But astronomers now tell us that the whole solar system is in motion round some unknown centre of force. Therefore it is certain that the moon not only never returns to the place she occupied before, but is each month, at the end of her revolution round the earth, at a distance at present immeasurable from her position at the end of the previous one. Add to this the fact that all the countless orbs we see in the skies are continually modifying each other's motion in an infinity of ways, and we find that the mutual action of two simple laws in the universe is capable of producing variations infinite in number. If we turn to the more complex forces at work upon the earth—those that influence the weather, for instance, we shall find the same infinite variety in a far less extended sphere. One reason is, that new forces are here brought into play. Not only are the two laws of force of which we have spoken in action here also, but other forces beside, such as heat, light, electricity, chemical affinity, and the like. So that although the course of the seasons is uniform, and their general character well ascertained, there is, nevertheless, room for endless variety of detail. No one season is exactly like another. Heat and cold vary year by year in intensity and duration. It is impossible to predict accurately beforehand the rainfall or amount

of drought likely to occur in any given year. Cyclones, typhoons, tornadoes, and other violent phenomena, defy calculation, while earthquakes and volcanic eruptions add an additional element of uncertainty to the problem.

In fact, the further we examine into natural phenomena, the more we see that however invariable forces may be in their action, in their results they vary even to infinity. Therefore all arguments drawn from the invariability of the natural order must be abandoned. Invariable laws of force produce any amount of variation in their results. And if it be possible for other laws of force to be brought to bear upon natural phenomena beside those whose action has been observed, and whose laws have been ascertained, so that additional variations are thus introduced, this can take place, as will hereafter be shown, without the collapse or overthrow, or even serious derangement, of the order of nature.

The next step was to inquire into the nature of force. It was shown that here science must confess that it has no answer whatever to give. The effects of *some* forces at least are evident, and can be computed with mathematical accuracy. But the *modus operandi* of force utterly transcends our powers, and one of our most distinguished men of science feels that he can give no other account of it than as "the effect of consciousness or will."*

For who can tell us what force is, how it is generated, and how it acts? Take the force of gravitation, for example. What do we know of its *modus operandi?* We understand the "law" of its action, we say. But the word "law" is itself ambiguous. As the Duke of Argyll has said in his *Reign of Law*,† the word is used in many senses. It means, he says, (1) an observed order of facts; (2) such observed order in relation to force; (3) the observed order of action of any particular force; (4) combinations of force with reference to fulfilment of purpose or discharge of function; (5) it is used of abstract conceptions of the mind, necessary to our comprehension of phenomena. These distinctions are not clear. But at least the Duke says enough to shew that care must be taken to understand what we mean by the word. In its ordinary acceptation it means none of these things. In popular language, and even in some departments of exact thought, it means a rule imposed on us from without, which we are under the necessity of obeying. Thus the

* Sir John Herschel, *Astronomy*, Sec. 440. † Pp. 64, 35.

term law of force itself in the ordinary use of language, involves a possible misconception.

What is usually called the "law" of the force no doubt represents the results which necessarily follow from the employment of the force. But it in no way explains those results, or indicates the reason of that necessity. It simply indicates the fact that a certain class of results invariably follows when it is put in operation. We have, however, by no means explained all about the force of gravitation, when we have proved that the attractive force a body exerts through its operation always varies inversely as the square of the distance of the bodies attracted by it. This fact leaves us in as much ignorance as before in regard to the way in which the force is exercised. If I take a piece of string and cause a body to revolve round my hand by attaching it to the string, the motion of the body is explained by the cohesion of the particles of the string, and their consequent influence on the body attached to it. So, if I attach a body to an iron bar, the cohesion of the particles of that iron bar will determine the motions of the body. But the force of gravitation must act through the particles of what was once called the "luminiferous ether." And those particles are not only of infinite tenuity, but are infinitely more easily disturbed, offer infinitely less resistance to the passage of solid bodies than the atmosphere of the earth. How is the immense force of gravitation exerted by the sun over the planets transmitted through this medium? If I forced a body to revolve round my hand *without* the intervention of a string or iron bar, I should be regarded as working a miracle, because I should be exerting powers above or beyond the natural order. Does not the action of the force of gravitation introduce us into a region equally above and beyond the sphere of the known? Has any satisfactory explanation ever been given to it than that it is the result of a Mighty Will existing somewhere outside the natural order of things? We get so much accustomed to secondary causes, to noting and experimenting on their effects, that we forget to ask ourselves the very natural and simple question, How are these causes themselves to be explained? Nothing is easier than to attribute the motions of the heavenly bodies to the action of the force of gravitation. Nothing is harder than to account for the existence and *modus operandi* of that force.

But if will be the origin of force, then we are next con-

pelled to ask, *whose* will, and how governed and directed? And this leads us to the idea of a reason or mind, the ultimate cause of all that is, of the existence of which even the course of physical nature affords no slight presumption. Thence we rise to the conception of a higher order than the physical, an order which the whole course of the visible universe is intended to subserve. This order is the moral order, an order which can only have reference to intelligent and thinking beings such as man. But this order has reference almost entirely to conduct, and must be administered under the influence of *purpose*, that purpose being presumably the ultimate perfection and happiness of the rational beings who live under the dominion of moral law. Moreover, on scientific principles alone we are entitled to claim that the existence of forces outside the visible order has been actually demonstrated. The human will is a force of this kind. It most demonstrably exercises power over nature,* and it is an intrusion into the realm of nature of a force which, if not *super*natural, is certainly *extra*natural, the law or laws of which no scientific observer has been able to discover. Life is another such force, the source of which is utterly unknown, and the laws of its action only very partially discovered. That will is a force not natural simply, but largely moral, *i.e.*, that it has to do with questions of right and wrong, is a scientific fact which cannot be disputed. That life is largely influenced by conduct, and is therefore a force belonging at least to some extent to the moral order, is another undeniable fact. Thus the intrusion of extranatural forces into the realm of nature is no mere hypothesis. It is simple, demonstrable fact, and fact, moreover, of every-day experience. There is therefore the strongest probability, amounting to practical certainty, that if there *be* an ultimate cause of all that is, and if He *have* subordinated physical laws to moral principles, there will be, whenever His purposes may seem to need it, modifications of the ordinary results of physical forces, brought about in precisely the same way as man's will brings about such modifications.

* Since writing my paper, I have read our President's Gifford Lectures on Natural Theology. I select from them some most valuable confirmations of my argument. "I feel I have the option of moving my hand to the right or to the left. . . . of course I may wish to do a thing which I have not the power to do, but that is a different matter altogether. . . . Such an inability does not in the least militate against our consciousness of free will. We cannot deny to man's Maker this power which man himself possesses" (p. 23).

Thus what has been referred to (p. 266 of paper) as a possibility, comes before us now as a demonstrated scientific fact. Forces, the laws of which science is unable to ascertain, are intruded into the realm of nature from outside, and exercise a marked and appreciable influence upon the natural order. They distinctly and largely modify it, and yet they do not in the least destroy it. On the contrary, they in many ways give new freshness, variety, interest, value, to the order of nature. One of these forces, life, physicists may claim to have reduced to a certain extent to law. But they must admit that it is a force of a different kind, and far more complex in its action than any of the ordinary forces with which they have to deal. The other force, will, defies their investigations. It belongs to another branch of science, metaphysics, which, as the term itself implies, is outside the range of physical science. There is but one objection to this line of argument. The materialist, of course, claims that thought and will are but the function of brain. But materialism is an hypothesis, a creed, not a principle scientifically established. And it has difficulties to face which it has never yet settled to the satisfaction of mankind. Most men who are not materialists are ready now to admit, (1) that the order of nature is not invariable, (2) that it is not unaffected by influences of an order outside or above it.

I say most men are ready to admit this. For the force of these arguments has been admitted by the highest and most respected authority. Professor Huxley, one of the most trenchant antagonists of the miraculous, admits in his essay on Hume that Hume's well-known argument against the possibility of miracles cannot be sustained. He speaks of its "naked absurdity." So completely has he abandoned the old scientific position, that he, on a recent occasion, attacked the Duke of Argyll and the late Canon Liddon with much vivacity for continuing to demonstrate the unsoundness of the theory which he had given up. But Professor Huxley is not the only scientific opponent of revealed religion. Exploded scientific objections to Christianity are apt, unfortunately, still to make their influence felt, not only among the half-educated, but among that large class of persons who seem to feel that any argument is fair so long as it may be used against Christianity. Therefore we are driven to something like wearisome iteration in our assertion of the fact that science has nothing whatever to say for or against miracles.

The question, as Professor Huxley sees, is one of evidence

alone. And in this he is but a follower of one more celebrated than himself. Kant has also seen that no such assumption as that of the impossibility of miracles can reasonably be made. Into the evidence I do not propose, on the present occasion, to enter. The question of evidence, however, is not outside the province of the Institute. It falls within the domain of historical science, and the historical evidence for the miraculous is a question of the most interesting character, which I trust may one day be discussed here.*

What I desire to do this evening, is to give a short sketch of the argument for the existence of what is called the supernatural, but which might with greater propriety be called the spiritual. Some years ago a treatise appeared which attracted much attention, called "Natural Law in the Spiritual World." It has always seemed to me that the principle thus enunciated should have been reversed. The philosophic inquirer might with advantage devote himself to the evidence for the working of spiritual law in the natural world. That there are such spiritual forces at work, Mr. Myers† claims to have demonstrated as a result of psychical research. Such a statement as his, coming as it does from one who is not a professed believer in Christianity, is worthy of the utmost attention. But we need not wander in the dubious paths of telepathy in order to demonstrate the existence of supernatural or spiritual forces. They meet us at every step. First of all we are everywhere confronted with two incontestable and yet most mysterious facts, closely related to one another, yet standing apart from all properly natural phenomena, the existence of *will*, and the existence of *evil*. These are facts, not of the natural, but of the supernatural or spiritual order. Yet their effects are most widely traceable on the physical world. Take the first, leaving out of consideration for the present the will of every being higher than man. Will is clearly an extra-natural force. That is to say, it belongs to an order the laws of which cannot be exactly ascertained, and its exercise is conditional on a faculty which is incontrovertibly extra-natural, except on materialistic principles, namely, the exercise of the reason. For that a species of reason conditions the action even of the brute creation can hardly be denied, though in their case it is of course of a very rudimentary kind. But no one would deny that the lower animals possess the power

* See Vol. xxvii., p. 267. † *Nineteenth Century* for April, 1891.

of choice, and if they possess that power, it must be exercised under the influence of a reasoning faculty, though doubtless of a low type. And that the course of the world may be largely affected even by this power of choice is an undeniable fact. A mad dog, to take the exercise of reason in the lowest possible form, may choose to bite one man rather than another, or may communicate the virus of hydrophobia to one or to twenty animals of his own species, and thus diffuse it more or less widely abroad, to the great danger and misery of mankind. An infuriated elephant or tiger may choose to attack a person of low degree, or the heir apparent to the throne, and the most important consequences may result to thousands of people from this act of choice. Yet can it be said to be the result of a simply natural law? If so, can science formulate that law? Has it given us any reason to believe that it ever will be able to do so? Are we not, even in the case of volition in the lower animals, face to face with the action of a power we cannot define or measure, and are we not thereby brought into contact with realms which are beyond the power of man's intellect to penetrate?

But if we find that even in the case of the lower animals a force of a nature not purely physical is able to intrude into the physical order, and to produce their effects incalculably great, how much more is this true of the will of man. What extraordinary physical and climatic changes have been wrought on the earth by cultivation alone! The clearing of forests has, it is now well known, an immense effect upon the amount of rainfall. We are told that it is to the recklessness of man alone, in destroying the forests by fire, that the conversion of a large part of Australia into a sandy and uninhabitable desert is attributable. The notorious unhealthiness of some parts of Italy is similarly attributed to the desolating wars which have robbed the plains of that country of their inhabitants, and have for centuries rendered cultivation a hazardous and unprofitable occupation. Who can trace what the results of the extirpation of one species, or the introduction of another—witness the recent introduction of the rabbit into Australia or the sparrow into America—may produce upon a country? The chance act of a botanist in casting a few sprigs of an aquatic plant into an English river bade fair, it was said, to choke up all the rivers in England, and we were further told that we only escaped that calamity by the fact that the plant in question was not monogamous. And Professor Sedgwick was wont in

addressing his class to dilate on the tremendous consequences which would ensue to the inhabitants of this planet if the isthmus of Panama were to be cut through, the Gulf Stream diverted, and the climate of this country thereby assimilated to that of Labrador.

Again, take the existence of evil. Evil is the result of the misuse of will. It is the necessary consequence of the power of choice vouchsafed to man. But the conditions of the exercise of that power belong to the spiritual order. No one knows what they are. Even the man himself cannot explain why, on a given occasion, he preferred evil to good. Some, no doubt, would lay down a theory of necessitarianism, or determinism, as it has become the fashion to call it. But determinism cannot claim to be more than an hypothesis, and an hypothesis which is beset by many and serious difficulties of its own. If evil is decreed, we must proceed to ask why it is decreed, a question which has never received a satisfactory answer. As Bishop Butler has shown, the moment we attempt to deal with practical questions on this theory we are forced to act as though it were false. On the basis of determinism, human society becomes an impossibility. So we return to our assertion that the laws of human action are unexplained and unexplainable; that they are facts of a mysterious and supernatural order; that they are altogether outside the region of physical science. And yet what amazing results they have produced on the visible world! From the determination to do evil, to misuse the mighty force of will, comes war and famine, and pestilence: the desolation of once fertile tracts of land, cruelty, oppression, violence, crime, with their fearful consequences, the baneful results of ignorance and poverty, the overcrowding of great cities, the stuggles between labour and capital, the various and accumulated miseries of civilised and uncivilised life. These effects are capable of being measured by a physical standard, but they are not due to physical causes. Still less are the effects of the conflict with evil due to physical causes—the noble efforts made to grapple with and to destroy all that is prejudicial to the welfare of mankind, the resistance to moral wrong, whether in ourselves or others, the struggle to promote all that may elevate the character and ameliorate the condition of man. To what natural causes are these facts owing? The inquiry is a purely scientific one. The facts are undisputed and indisputable. It is the province of science to note them, group

them, and assign to them their origin. Let science do so. If it can be proved that they are reducible to purely physical laws, by all means let us know what those laws are. Let us begin, as with other physical laws, to assume their truth, and to calculate results from them as we do in the case of the heavenly bodies. Has this been done? Can it be done? The answer is, Certainly not. Therefore we are not only unable to disprove the existence of supernatural forces intruding into the natural world, and profoundly modifying, without in the least destroying, the natural order, but we find, so far as our present knowledge goes, that such forces are actually at work among us. The utmost the opponents of miracles can say is that when science has sufficiently advanced, these facts, which at present defy analysis and classification, will be ultimately found to be of the same character as the rest. Until this is done, however, the presumption lies the other way.

From this point of view it appears that the miraculous, regarded as the interference of supernatural* with natural forces is not only not a deviation from the ordinary course of things, but in truth, so far as our present knowledge can guide us, forms part of it. This argument may be further extended by a reference to the course of nature itself. As Bishop Butler has said,† there was no course of nature at the beginning of the world. Consequently, even if we admit the eternity of matter, we shall still be forced to confess that the first introduction of organic life into the world was an interposition from without, or in other words was the result of the action of other than natural forces. The same may be said of the origin of species. In the last paper read before this Institute, it was shown that the theory of natural selection, the struggle for existence, and the survival of the fittest, does not satisfactorily account for the evolution of vegetable and animal life. Moreover, it has been frequently observed that no evidence has as yet been dis-

* If the expression "supernatural force" be thought to involve too large an assumption, it should be borne in mind that no more is meant than this—a force outside the natural order, yet exerting power over it. The word natural in the present paper is regarded as referring to inorganic matter—as including all visible phenomena whose laws are capable of being ascertained. Without definitions argument is interminable. Spinoza, for instance, defines the natural order as relating, not only to the visible universe, but to an infinity of things beyond. It is obvious that on such a ground miracle would simply be a part of the course of nature.

† *Analogy*, Part II, chap. ii.

covered which shows one species in the act of passing into another. On the contrary we see that peculiarities introduced into species by the will of man begin to die out as soon as the external influence is removed, and that the tendency under those circumstances is not towards the formation of new species, but towards reversion to type. We see, too, that any attempt to form new species by coupling together individuals of existing species, how near soever to one another, is invariably defeated by the sterility of the offspring. It appears, therefore, still scientifically probable that the production of new species is due to the action of a supernatural force, in other words, of the will of a supernatural being, and that it is therefore a fact of the same supernatural order as the first appearance of life upon earth. This supernatural order has no doubt its laws. The Creator seems, if we may say so with reverence on the strength of patent facts, to be incapable of using action which can be described as purely arbitrary. The whole history of animal life proves this. Each creation of species seems to have proceeded on a plan—to have been superinduced on former acts of creation—to have been a kind of grafting of new forms upon an old stock. But the scientific evidence points, it may be fairly contended, not in the direction of *chance*, but of the deliberate exercise of *Will*. This exercise of Will—and not of Will pure and simple, but of Will under the guidance of Reason and Purpose—is marked yet more clearly by the adherence to type, which we have just observed. The same truth applies with even yet more force to the introduction of man upon the earth, since in his case the rational intelligence seems to be different not merely in degree, but in kind, from the intelligence of all beings previously existing. Moreover, in man we are brought into contact with a fact of an altogether new order.* The existence in him for the first time of spiritual organs brings the visible universe into touch with the spiritual world beyond. Nor is this all. Even in the ordinary phenomena of life it is reasonable to believe that supernatural forces are at work not occasionally, but continuously. Take the case of the entrance into the world of each individual of whatever species. Can it be said that this depends to any appreciable extent

* "The evidence appears to be utterly insufficient to establish, on scientific grounds, the derivation of man by continuous natural transmutation from some different form of living thing." Sir G. Stokes, *Natural Theology*, p 73.

on the will of their progenitors? The fertilisation of the *ovum*, the sex of the offspring, depend upon causes which are entirely beyond the parent's control. And even the conversion of food into living tissue follows the same miraculous law. No one can tell by what process it is that, within the living organism, dead food is converted into living matter. He may point out the moment at which this inscrutable change takes place. But the forces which effect it are altogether beyond his ken.

We have so far argued that the physical world is very largely under the dominion of forces which are of a supernatural or at least extra-physical nature, and that there is evidence for the fact that a Divine Mind and Will is incessantly at work, guiding and developing and modifying the physical order, and never leaving it to itself. We come next to ask to what order these truths belong. We reply, to an order of which the visible or physical in every shape is subordinate—the moral order. And if we are asked the meaning of that word, we must explain it as an order which concerns itself with the happiness and perfection of rational beings. In such an order, as we have seen, Purpose and Will have a very definite place. To the materialist all is pure, unintelligent, invariable sequence. But the universe is thus reduced to a mere machine, and life, under such dull mechanical conditions, were not worth living. It is the play of Purpose and Will, the hope of progress, the struggle towards perfection, that are as the mighty suns which irradiate the universe of mind. As Newton has said, *"the first cause is certainly not mechanical." And it is equally certain that in an universe called into being at the fiat of God, what is mechanical cannot possibly be the highest part. The physical, the natural, the mechanical, call it by which name you will, is but the handmaid to that higher order where reason, and thought, and conscience come into play. Man himself is a standing demonstration of the truth of this principle. He has unquestionably, as we have seen, power over nature. And though this power is confined within narrow limits, yet it stamps him as belonging to a higher order than nature itself. If his power is limited, it is limited so far as he himself is a part of the order of nature. So far as he rules nature, he derives his power from some source above and beyond nature. Again, the moral order to which he unquestionably belongs, displays

* *Optics*, p. 384.

its superiority to the physical by another fact. We may and do conceive of the possibility of the destruction of the natural order, but we feel that the destruction of the moral order is an absolute impossibility. The order of nature, it is conceivable, might be swept away, and its place supplied by a new order, with new laws of force, new arrangements of material phenomena, new groupings and modes of grouping of material particles. But we cannot imagine an order for sentient beings where duty, justice, righteousness, mercy, truth, love, shall be replaced by other principles calculated to produce a moral order as good as or better than the present. Moreover, the idea of the supremacy of the moral to the material is inseparable from all rational thought. He would indeed be a lover of paradox who would contend that the laws of attraction and repulsion, of gravitation, heat, light, conservation of energy and the like, were of more importance to the world than the moral conceptions just referred to, not to speak of those still higher ones which flow from the relations of the human spirit to God. On the materialistic theory we feel, as regards man, that "dragons of the prime that tear each other in their slime, were mellow music matched with him." From the moral and spiritual stand-point alone do we obtain any conception of man which can be regarded as adequate. It is from that point of view alone that we come to regard the world around us as a vast training school where man is being educated for his true place in an universe which will for ever be the organ of Eternal Love.

I might also draw an argument from the last paper I read before the Institute, in corroboration of the view for which I have been contending. Mr. Herbert Spencer has shown that all the facts with which we have to deal in physical science, matter, motion, force, space, time, individual existence, are ultimately unthinkable. What is this but to say that all forms of existence whatever in this physical world have their roots in an order above and beyond it—that the idea of existence cannot be expressed in terms of the visible order, but must be referred to that mysterious spirit-land which encompasses us, and to which all forces at work here around us may not improbably be found ultimately to belong? Thus so far from supernatural and spiritual forces being an intrusion into the natural order, and calculated to disturb its exquisitely poised equilibrium, the natural order presentsitself to the mind simply as the lowest and most mechanical portion of that larger Divine order of which we human beings are permitted

only to see the fringe. And thus the mind ascends in imagination from the facts ascertained by the senses and the reason, to a grand conception of an universal cosmos, as far transcending the visible order of things as the distance of the furthest fixed star exceeds the diameter of the earth on which we live.

Thus, then, we are encompassed on all sides by forces which do not belong, strictly speaking, to the natural order, and yet which are constantly profoundly modifying that order. These forces, unlike forces simply physical, are not invariable in their action, and their laws therefore cannot be ascertained. Moreover, these forces are demonstrably part of an order which transcends in importance the physical order which has been subjected to their influence. What reason can be given, then, against the possibility of an occasional introduction into the visible universe of yet higher laws, designed to subserve a yet more important purpose? That there is sufficient reason to account for such interpositions can hardly be denied. The fact of the Fall, and of human depravity and human misery in consequence of it, is a cause quite adequate to explain them. The remedial agency, as described in the Christian creeds, is in complete accordance with the course of development up to the time of Christ's coming. A second Adam appears in order to regenerate the children of the first. Like all other beings since life was first introduced upon the earth, He is grafted upon the former creation. Then, by a spiritual process, not essentially different to or even more miraculous than those of generation and nutrition to which we have just referred, His life is mysteriously transmitted to those who will accept it. But if, as the Christian scheme presupposes, the humanity of the second Adam is consecrated by personal union with the Divinity, it is impossible that the Divine power residing in this new and Divine Man should not have evidenced its presence by control over the powers of nature admittedly subject to its sway. Hence the miracles recorded in the New Testament. Granted that spiritual forces overflow into the natural world, and it at once becomes eminently reasonable that the history of Jesus Christ, if He were what He claimed to be, should be occasion for an unusual display of their activity. And the fact of the Resurrection, which is not and cannot be disproved, is a sufficient historical warrant for the narratives of the Gospels. With the spiritual importance of that fact we are not now concerned. But its occurrence is supported by a chain of other facts of immense, of overwhelming importance. It cannot be denied that it was the starting

point of a new development of humanity. From the time of the appearance of Jesus Christ in human flesh a regenerating power has been at work in the world altogether out of proportion to any other that has ever influenced mankind. It is therefore eminently reasonable, eminently scientific even to contend that the supernatural forces demonstrably overruling the forces of the natural world received their highest embodiment in the supernatural life and work of Jesus Christ.

Nor is this all. Not only is the miracle of the Incarnation of Jesus Christ a fact in full harmony with the evolution of living beings up to the moment of His appearance on the earth, but there was also a moral and spiritual necessity for such an Incarnation. The fall of man, if it is to be reconciled with the justice and beneficence of God, presupposes his restoration. Yet such restoration is not conceivable, except through the regeneration of his nature, and the bringing him triumphant out of the conflict with the evil influences that environ and even permeate him. What method more natural than the Incarnation of the Son of God, His conflict with and victory over all the malign powers which encompass and enthral mankind, and His infusion of His own Divine Spirit and character into each individual of the race? And this regenerating principle follows the laws of all Divine action. It is progressive, and it is elevating. It does not lay hold first of the spirit of man, the most utterly lost and degraded of the elements of his nature, and thereby gradually impart new energy to the rest. It ascends, according to the universal character of the Divine plan, from the lower to the higher. It appeals, in the first instance, to man's senses and his intellect. The Divine life principle which is to save him appears in human shape in the Man Christ Jesus. The Divine power inhabiting Him cannot be hid, but breaks through the veil of His humanity, and thus attracts the attention of men. That attention is enhanced by the beauty of His moral teaching. Last of all, "In the Spirit He speaketh mysteries," He tells of the marvels of regeneration, of redemption, of life in Him. Then the spirit of man comes into contact with the Spirit of God, the rudiments of the higher life are communicated, and man passes from the psychical* to the spiritual state, enters into that new life which ends in his complete transfiguration into the Image of Christ. From this point of view miracles are

* Our language has no word but this to express St. Paul's ψυχικός, which is sometimes translated "natural" sometimes "sensual" in A. and R.V. Each translation is quite inadequate.

not merely in harmony with the higher laws we find at work, modifying the order of nature, but were necessary steps in the moral and spiritual evolution of man. With a spirit reduced to the condition of a rudimentary organ which had almost ceased to perform its original function, with a soul degraded and enslaved to the body, it was needful that the senses themselves should be first appealed to, in order to waken the higher elements of his being into life. Thus by a gradual chain of demonstration we proceed from the possibility of miracles to their harmony with the forces at work in nature, and from that harmony to the conception of their moral necessity in the work of the salvation of man.

Our demonstration, it will be seen, confines itself to the Gospel miracles alone. Even if the progress of scientific and Biblical criticism should tend to diminish the evidence for some other miracles which our forefathers devoutly believed, we need not concern ourselves very seriously about it. We may believe that Moses and Elijah, as well as Jesus Christ, needed the support of miracles on behalf of their Divine Mission. But their work and His differed widely, both in its object and in its results. We cannot therefore predicate miracles of them, in the same way that we can of the Incarnate God, the Saviour of mankind. We can but contend that in their case the possession of miraculous power was not unreasonable. If the story of the Exodus, of the passage of the Jordan, of the falling of the walls of Jericho, of the swallowing up of Korah and his company, be accounted for by natural causes—that is to say, be removed into the category of special providences from that of miracles—even if this view be accepted, our faith in the overruling providence of God need suffer no diminution. I have always felt that the history of the siege of Leyden is as miraculous in one sense, that is to say, it affords as distinct an evidence of a superintending Providence overruling the ways of man, as anything in the history of the Jews. The mighty strong west wind which brought the relieving fleet to the walls of the beleagured city just at the last moment when help was possible, the fall of the city wall, leaving the whole city at the mercy of the Spaniards, the unaccountable panic which seized those hardy soldiers at the very occurrence which had placed victory within their grasp, and the fact that these marvellous events formed the crisis of the conflict between religious liberty and ecclesiastical terrorism, are as indubitable proofs as any in Holy Writ, that God "ordereth

all things according to the counsel of His Will," are demonstrable evidences that we are surrounded on all sides by supernatural forces, which are working every moment "for us men and for our salvation," and to which the operation of natural laws is invariably and inevitably subject.

It is here that prayer finds its legitimate sphere. We are not in the midst of an universe where everything proceeds in an invariable sequence. We are in an universe ruled according to the most generous and elastic principles consistent with justice and right. The Great Moral Governor is not a despot, governing us by the iron rule of the "Medes and Persians which altereth not"; He is a Father Who listens to the lightest cry of a creature's anguish, and hastens to relieve it, or give him strength to bear it. Forces, with their invariable laws of action, are the most plastic of instruments in the Hand of the Framer of the Universe. We may liken the Lord of heaven and earth to an operator placed at the point of convergence of innumerable telegraph wires, in which precisely the same force, electricity, acting by invariable laws, is yet the obedient vassal of will, and can produce the most wide-spread and the most contrariant results on the same mechanical principles. The illustration of course falls infinitely short of the reality, but so do all our conceptions of God. Yet they are nevertheless extremely useful to us, if they tend in the right direction. The miraculous, on this view, is but a further development of a principle continually in action—the power of God over Nature, exerted for the welfare of the beings He has created. Therefore we need not fear to lift our petitions to the Giver of all good for anything of which we may suppose ourselves to stand in need. If it be good for us, it will be vouchsafed in answer to our requests. If it be not good for us—so we may argue from the analogy of good earthly parents—it will be withheld, and something better will be given us instead.* We need not fear to ask even for fair weather or for rain, as though we were doing something illogical or absurd. The forces of nature, we may well believe, are under the absolute control of Him Who called them into being. If He thought fit, He could cause it to rain on half a field, and leave the rest of the country dry. That He is not likely to

* "He may ask to have them granted . . . but it does not follow that they will be. There may be reasons why the granting of what seemed to him to be advisable may be the very reverse. Hence his request is to be subject to the condition, expressed or understood, that the granting of it is in accordance with God's will." *Gifford Lectures*, p. 60.

see fit to do so does not interfere one whit with the principle of prayer. "In *everything*, by prayer and supplication, with thanksgiving, let your requests be made known unto God." The question of giving or withholding rests entirely with Him. But even prayers which are selfish or foolish are better than forgetfulness of God. We may learn wisdom in our prayers by experience. But if it be folly to pray unwisely, it is far greater folly not to pray at all—far greater folly to assign limits to God's power other than His Wisdom and His Love. Even hair-breadth escapes from death are due not to chance, but to His control over the countless forces of nature. If you are saved by one inch from deadly peril, it is by His Providence that you were guided to that particular spot.* No single event happens which is not referable to a countless variety of causes, and the Will of the All-Father superintends them all. In truth, prayer is a practice inseparable from the doctrine of a moral Governor of the world, to Whose will all the forces of nature are necessarily subject.

Science has not demonstrated the impossibility of the existence of such a Being. Nay, we may venture to predict that when science is sufficiently advanced, it will make the existence of such a Being a self-evident truth. The miraculous, which is identical with the supernatural and spiritual, will be seen not only to be not impossible, but to be universal—a manifestation of the working of the one final cause to which all phenomena must ultimately be ascribed, the origin of Force, the source of Will, the fount of Reason, the supporter and upholder of man and human society, the first principle which underlies the world and all that is therein.

The PRESIDENT (Sir G. G. STOKES, Bart.).—I will ask you, in the first instance, to return your thanks to Mr. Lias for this interesting paper, and then invite discussion thereon after some communications have been read.

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* I may be allowed on this point to refer to p. 240 of the *Miracles Credible.*

The Hon. Secretary (Captain Francis Petrie, F.G.S.).—The communications from absent members are as follows:—

The Rev. H. J. Clarke writes:—

I have been greatly pleased with this masterly paper in which Mr. Lias treats of "Miracles, Science, and Prayer." In particular I was struck with the suggestion he makes in alluding to the work which appeared under the title "Natural Law in the Spiritual World." I quite agree with him that the principle thus enunciated should have been reversed; and the words "Spiritual Law in the Natural World" appear to me to embody the gist of his argument.

At the same time, I venture to hold the opinion that much confusion of thought on grave questions would be obviated if, as the antithesis to *spiritual*, *physical* or *psychical* were invariably substituted for *natural*. The latter in its ordinary acceptation is a term of wide meaning, and has come to be freely applied to moral attributes and sacred affections, when they are regarded as being conformable to Divinely established order.

Mr. Lias has, I think, given a very convincingly clear exposition of the truth that the so-called forces of nature are but varied manifestations of a Power which cannot be conceived of otherwise than as being volitional—in short, that, whether the order which is thereby upheld be physical or spiritual, and whether it be to us familiar or unfamiliar, the "Power belongeth unto God."

The Rev. R. Collins, M.A., writes:—

I have read Mr. Lias's paper with much interest and appreciation. The proper use of the terms "natural" and "supernatural" is a matter of some difficulty, and has not unfrequently been discussed. Mr. Lias emphasises the difference between them, as though it were a difference in kind, whereas it appears to be rather only a matter of difference as regards human experience. The main point is reached in this essay—and it is a very important point—namely, that there is, in fact, no hard and fast line between the (so-called) natural and supernatural; but Mr. Lias reaches this by seeing the "spiritual" (or, supernatural) "forces overflow into the natural world." May it not be asked, whether it be not better to put it thus—that the horizon of what we have called the natural is not fixed, but is capable of extension into what has been called

the supernatural; in other words, that what seems to us supernatural to-day, may on better acquaintance seem natural to-morrow? Indeed, hardly otherwise can we really understand "the harmony" of miracles "with the forces at work in nature," as we now experience it.

The extreme difficulty of drawing any real boundary between the natural and the supernatural comes out in the discussion of "will." Why should "will" be put down as "extra-natural"? (see p. 270). It would at least be a most unnatural thing for a man to exist without a "will." No doubt the "will" belongs to the spiritual order, as Mr. Lias observes. But does not the spiritual belong to the etherial side of the universe? And the functions and energies of the etherial universe—as, for instance, light and heat and electricity—are parts of nature, as viewed by science—that is, they must be ranked in the natural order. The "will" is certainly a part of nature, as well as the actions it governs.

There is an expression on page 277 to which I think perhaps exception might be taken, where the writer speaks of the "introduction into the visible universe of higher laws." Would it not be better to say, the *manifestation* to us of laws not yet comprehended and recorded by us? Also the word "law" in science is not used to indicate a cause introduced for the sake of some result to come, but only as an expression of our conviction of the uniformity of different lines of work, so to speak, in the machinery of the Universe. We may well recall Professor Huxley's clear scientific exposition of this subject in his remarks on one of Dr. Liddon's sermons in the *Nineteenth Century* some time ago. There will, no doubt, be laws discoverable in the constitution and functions of the spiritual body described by St. Paul in 1 Cor. xv.; but we have no warrant for saying that they are, or will be, "introduced," as for instance in connection with the Christian Dispensation. They may have been in existence, though not yet fully perceived by us.

The will and power of God must indeed be regarded as above the energies and forces and laws of the whole universe, and as "overflowing," so to speak, into it. But when the scientist speaks of the supernatural, he includes much more than the attributes of Deity; and bounds what he calls the natural with a very arbitrary boundary.

Is it so, that "the natural order presents itself to the mind simply as the lowest and most mechanical portion of that larger Divine order of which we human beings are permitted only to see the

fringe?" Why "lowest," and "most mechanical"? What should lead us to suppose that the mechanics of earth, in this sense, are in any real degree inferior to the mechanics of the unseen universe? Rather, surely, we arrive at the "grand conception of an universal cosmos" by refusing to see any boundary between the natural and the supernatural, except what the mere ignorance of man causes him to imagine. Is not, in fact, the real drift of Mr. Lias' arguments this?—that, as the etherial side of the universe, and with it the intellectual and moral, is better understood by science, much that has been regarded as supernatural (or, as perhaps some scientists in their own sense of the word ought to express it, unnatural) will be brought into the sphere of the evidently natural; nature, as we know it at present, being only part of an universal whole, each part of which is related to, and is in harmony with, every other part, as the members of the body are with each other.

The Rev. Canon S. GARRATT, M.A., writes:—

For the most part, I greatly admire Mr. Lias's paper. The passage, including the words quoted from Sir John Herschell on the fourth page, contains in itself the whole thought needed to answer the objection to miracles from the uniform action of laws of force. If force resolves itself into will, such uniformity cannot be necessary, however apparently universal. And the so-called laws of Nature are broken by our own will whenever we lift a weight. A miracle is the observed exertion of a will acting in a sphere above our own.

Supernatural is, as used in this paper, the right word to use, because it does not follow necessarily that the will which interferes with the usual course of events is Divine or good. If it effects what we cannot conceive ourselves effectory, it must be a will belonging to an order of being above our own. But if all force is "the effect of consciousness or will," every exertion of force outside man's powers must be the effect of a will outside man's will; and if that will produces an unknown phenomenon, there is a miracle.

I do not see that Mr. Herbert Spencer's views as to the transcendental origin of the phenomena of space and time do really bear on the question. There is, to my mind, a confusion in them between the impossibility of conceiving what is a Divine attribute —timelessness, with the impossibility of explaining what is a primary human conception—time. Herbert Spencer considers

that time and space are not realities at all, but mere symbols to our mind of realities of quite a different order. I do not think this helps in the explanation of miracles, or is true in itself. These are primary facts, of which time and space are examples, beyond which, because of their simplicity, we cannot grasp and which admit of no explanation, not because too mysterious but because too elementary—incapable of further resolution. Therefore I do not think the sentence beginning "I might also draw an argument" (page 276) bears on the subject of the paper.

The paper, as a whole, appears to me in the highest degree satisfactory and useful.

Mr. DAVID HOWARD, D.L., F.C.S., writes:—

The paper provides an admirable remedy for the, too common, habit of mind, which would, in nervous dread, throw overboard every difficult passage at the first breath of criticism.

We can afford to wait in full confidence that what is really revealed of the supernatural will certainly stand the test of biblical and scientific criticism alike.

The Rev. C. V. HULL writes:—

To my mind the miracles of the Old Testament bear the stamp of reality as plainly as those of the New, and no doubt fulfilled their part in God's great plan, so beautifully explained by Mr. Lias, quite as fully.

The Rev. J. W. REYNOLDS, D.D., writes:—

It is with much regret that I cannot be present at the discussion to-night. I have read the proof of the paper by the Rev. J. J. Lias with great interest. It unites two merits—it is comprehensive and accurate.

Mr. Lias states—"We are encompassed on all sides by forces which do not belong, strictly speaking, to the natural order, and yet which are constantly profoundly modifying that order."

I quite agree with the meaning of this sentence. It is time that we cease to be merely defensive, and advance with a challenge to our enemies—"To prove that any, even the commonest thing or event, is not a miracle." They say "a miracle is impossible."

They will not even discuss it as reasonable, asserting it to be wholly unreasonable; nor will they fairly consider historic evidence. Let us, therefore, cease endeavouring to convince the unwilling by enforcing the fact—that these very men who deny that there was or is any miracle are not able to exhibit one fact, in heaven or earth, that is not miraculous.

Briefly I put it thus—Nature, on the whole and in every part, is a miracle. Nature, I mean the universe, if we speak of mechanical principles—began, if accepted science is correct, where and when the laws known to us were not in being, and could not have been originated except by energy from without. Hence, the whole of nature is miraculous in every part.

The proof is easy. No sooner do we examine matter, force, and the various combinations of matter and force, than immediately below their surface we find matter and forces resting upon eternal energy. All phenomena represent that energy can only be explained by it, and are therefore natural temporal forms of the supernatural and eternal.

To be rid of this, the exponents of physical science refuse to deal with essence—with cause; indeed, can only partially explain modes. Now, these modes are neither more nor less than forms in nature of that which causes and transcends nature.

It may be answered—"The Laws of Nature, so soon as they are laws, are uniform, universal, and unchangeable." Such statement is unproveable, therefore unscientific. Indeed, the contrary is shown by Mr. Lias in his last two pages.

The argument is fully stated in *The Mystery of Miracles*.

If all and everything is miraculous, it is peculiarly weak to challenge the same principle when it appears in Revelation and Redemption.

The Rev. J. P. SANDLANDS, M.A., writes:—

I have read this paper with very much interest and pleasure. I think it calculated to do great good in counteracting the influence of the "clever people," and it should be circulated far and wide. Personally, I am very grateful for the opportunity of reading it.

If I may, I should be glad to put his arguments in another form. We cannot understand Law apart from Lawgiver. A Lawgiver must have a Will. This Will accounts for the working of the Law. But also we cannot think of Law without thinking

of Grace. And this alone is sufficient to explain the rationale of Miracles. Hence—Prayer.

I am glad to see that the writer makes so much of evidence. This is the main point, and it is invulnerable.

Some time ago I was discussing a kindred subject with an Austrian Professor—a leading spirit at one of the Universities. I plied him with all sorts of arguments drawn from Nature, but with no good result. I then tried to get at him through his soul; but he soon barred the way to reasoning by saying, "*Ich habe keine Seele*"—I have no soul. This is the logical outcome of the "new notions."

The Rev. WILLIAM ST. CLAIR TISDALL,* M.A., writes from Ispahan:—

For the general contents of the paper nothing but praise is due. I consider it a most valuable contribution to the Institute, and certainly the writer has dealt with this important subject most ably.

Dr. WYLD (a Visitor).—I take exception to the definition of miracles given by the author. He has said that miracles are contrary to nature, and therefore impossible; but I think he has only shifted the question one step, for, if I understand him, he says on the intervention of a Divine Being there is a suspension of the course of nature. I do not hold that. My view of miracles is that they are caused by the direct action of the spiritual on matter. I define miracles not as that which is contrary to nature and not as that which is a suspension of the laws of nature, but an acceleration of the laws of nature.

Professor H. LANGHORNE ORCHARD, M.A., B.Sc.—I think the lecturer has done good service in drawing attention to the fact that man has modified nature by the force of his will; and if he has done so, shall the Creator be debarred from modifying nature by His will? The old standpoint of objection to miracles was that miracles were impossible, but I believe that position has now been pretty generally abandoned.

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* Author of *Islam, its origin, strength and weakness*, Journal, Vol. xxv.

Professor E. HULL, LL.D., F.R.S.—I think we may regard miracles as direct interpositions of Almighty power; that is, outside the ordinary course of nature. One great fact is the production of life upon the globe. We know, as geologists, that there must have been a period in our globe's history when organic life could not have existed on its surface, and, therefore, there must have been a time when, after the surface of the crust had cooled sufficiently, the germs of life were implanted on its surface and endued with those laws of development which have been implanted in organic life ever since, both in the animal and vegetable world.

Now I say it is impossible by any reasonable hypothesis to account for the origin of life on the globe without calling in the interposition of an Almighty outside power.

I might add as another clear instance of Almighty power, gravitation. I might ask, as the author of the paper has asked—what do we know about that wonderful force of gravitation by which the whole planetary system is held together? What do we know about it?—Absolutely nothing, except the law which governs its operation; but of its origin or source we really know nothing whatever, and that has always appeared to be one of those great facts, the physical history of the universe, on which we may fall back for evidence of an extraneous Almighty power.

I do not wish to add to this. I consider, for myself, that the whole physical universe is a standing continuous miracle. I do not consider that these two or three great prominent effects in the history of the physical universe are at all exceptional. They are merely portions of one great physical system, or, as has been well said—

> "All are but parts of one stupendous whole,
> Whose body Nature is, and God the Soul."

The AUTHOR.—I shall not occupy the time of the meeting very long. One thing strikes me in looking back, and that is, every time I come here I see a greater earnestness to find out the truth and a less desire to merely criticise. When I first joined the Institute and took part in these debates I used to be in doubt whether the Victoria Institute would do any good—there was so much hypercriticism and desire to show that one man was cleverer than the one before him that I hesitated to continue my subscription; but every time I have come lately I have seen a

strong desire to advance the cause of Truth without neglecting honest criticism and to rather develop the teaching of a paper than to cut it to pieces.

Having made this preliminary remark I will say one or two words on what some of the speakers have said.

I cannot quite understand why Dr. Wyld should have criticised me, for, as he says, declaring that a miracle was a suspension of the laws of nature; when on the principle I have gone I have distinctly said that I did not think anything of the kind. I do not think we ought to say that a miracle is a suspension of the laws of nature, and that is the whole principle on which my reasoning has gone, both in the book I have referred to and this paper. It would be committing ourselves to a very unwise and unsound position. Then, when it comes to a question of miracles being the direct action of spirit on matter, I think that loses sight of one particular point in Christianity and Bible miracles generally.

Then as to the definition of a miracle as being an acceleration of the process of nature, it appears to me that is pretty fairly disposed of. There is no necessity for a miracle to be an acceleration. There are instances in our Lord's miracles, I agree, where they often were accelerations of the laws of nature, because they were designed to do good and all of them were beneficent.

A friend of mine made a very telling remark about the origin of the whole of the Solar system. He said it was supposed to have come from matter (even on scientific hypotheses), equally diffused through space, gradually collecting by the action of gravitation and then great heat, and so on; but if matter were equally diffused through space, I imagine that would be a miracle to start with, even if that scientific hypothesis were accepted.

Allusion is made to the use of the word *natural* in Mr. Clarke's letter, but he has not noted that I defined what I meant by natural—

"The word *natural* in the present paper is regarded as referring to inorganic matter—as including all visible phenomena whose laws are capable of being ascertained. Without definitions argument is interminable. Spinoza, for instance, defines the natural order as relating not only to the visible universe, but to an infinity of things beyond."

The meeting was then adjourned.