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JOURNAL OF THE TRANSACTIONS
OF
THE VICTORIA INSTITUTE.

VOL. XXXVI.

JOURNAL OF
THE TRANSACTIONS
OF
The Victoria Institute,
OR,
Philosophical Society of Great Britain.

EDITED BY THE SECRETARY

VOL. XXXVI.



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

PREFACE.

IN issuing the 36th Volume of the Transactions I have only to impress on Members and Associates the obligation they are under to endeavour to increase the influence of the Institute and to add to the number of its adherents. The Council has never adopted outside means of popularity by advertising in order to attract the public, being satisfied with dependence on the efforts of its friends, the interest and importance of its objects, and the honour of enrolment in its ranks. Nevertheless, efforts are necessary to bring the work of the Victoria Institute to the notice of those whom it is desirable to attract, and with this object a copy of the "Objects Paper" will be issued to those receiving the new volume of Transactions, with the hope that each Member or Associate will endeavour to bring in at least one adherent during the ensuing year.

I would also venture to repeat what I stated in the preface of last year—that the Council would esteem it a favour to receive communications on subjects suitable for discussion and publication, and also to receive the names of persons considered qualified to deal with them.

EDWARD HULL, LL.D.,

Secretary and Editor.

THE ANNUAL MEETING.

HELD IN THE HOUSE OF THE SOCIETY OF ARTS,
JOHN ST., STRAND, W.C.,

ON WEDNESDAY, JUNE 8, 1904.

THE PRESIDENT, THE RT. HON. THE EARL OF HALSBURY, F.R.S.,
LORD CHANCELLOR, IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

Letters of regret for inability to be present were read from the Bishop of Manchester, the Rev. Dr. Ross, Prof. Lionel Beale, F.R.S., and Mr. Charles Odling, C.S.I.

The following letter was also received from Prof. Fridtjof Nansen, D.C.L., LL.D., accepting the office of Hon. Corresponding Member :—

LYSAKER, NORWAY.
3.6.04.

PROFESSOR EDWARD HULL,
THE VICTORIA INSTITUTE, LONDON.

My dear Sir,

Please convey to the Council of the Victoria Institute my most sincere thanks for the great honour which has been shown me by electing me an Honorary Corresponding Member of this prominent Institute.

The death of Sir H. M. Stanley was a great loss. He was one of the first geographical travellers who has ever lived, and it gives me a sad feeling that I shall fill his room.

I remain,

Yours very sincerely,
FRIDTJOF NANSEN.

The Report of the Council was then read by the Secretary, Professor E. Hull, M.A., LL.D., F.R.S., as follows :—

1. In presenting the THIRTY-EIGHTH ANNUAL REPORT, the Council has pleasure in stating that the session which terminated on the 31st May last has been, on the whole, highly satisfactory. The meetings have been well attended, and the papers have given rise to discussions evincing the interest of those present, especially those dealing with subjects bearing on the authority and authenticity of the Sacred Scriptures.

2. As regards finance it will be seen from the balance sheet that while we entered the year 1903 with a credit balance of £33 1s. 9*d.*, we entered the year 1904 with a balance of £73 9s. 8*d.*, all bills outstanding having been paid.

3. The number of members and associates, both effective and honorary, is very nearly the same as that of last year, being 879 as against 884. The Council are anxious that there should be an increase instead of diminution of members and associates, and they venture to suggest that a little effort on the part of those now connected with the Institute to bring in their friends might be attended with good results. They also consider that from amongst the large number of "Honorary Correspondents" there ought to be additions to the subscribing ranks. The Council hope that these suggestions may be cordially received and acted upon.

The following is the statement of the numbers of the constituency of the Institute at the end of May, 1904 :—

Life Members	...	...	...	47	in number.
Annual „	...	...	...	159	„
Life Associates	...	...	...	70	„
Annual Associates	...	...	...	431	„
Hon. Corresponding Members and Associates	...	...	...	172	„
			Total	<u>879</u>	

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

President.

The Right Honourable The Earl of Halsbury, M.A., D.C.L., F.R.S. (Lord Chancellor).

Vice-Presidents.

Sir T. Fowell Buxton, Bart., K.C.M.G.
 Sir Joseph Fayrer, Bart., K.C.S.I., M.D., F.R.S.
 Professor Lionel S. Beale, F.R.C.P., F.R.S.
 W. H. Hudleston, Esq., F.R.S., F.G.S.
 Alexander McArthur, Esq., D.L., J.P.
 The Ven. Robinson Thornton, D.D., F.R.Hist.S., *Archdeacon of Middlesex*.
 David Howard, Esq., D.L., F.C.S.

Honorary Correspondents.

The Right Hon. Lord Kelvin, Past P.R.S.	
Professor A. Agassiz, D.C.L., F.R.S.	Professor A. H. Sayce, D.D., LL.D.
Professor E. Naville (<i>Geneva</i>).	Professor Fritdtjof Nansen, D.Sc.
Professor Maspero (<i>Paris</i>).	Professor Warren Upham.

Honorary Auditors.

J. Allen, Esq.		General Mackinlay, late R.A.
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Honorary Treasurer.

Edward Stanley M. Perowne, Esq.

Secretary and Editor of the Journal.

Professor Edward Hull, M.A., LL.D., F.R.S.

Council.

(*In Order of Election.*)

Rev. Principal James H. Rigg, D.D.	Lieut.-Colonel Mackinlay, late R.A.
Maj. Kingsley O. Foster, J.P., F.R.A.S.	Theo. G. Pinches, Esq., LL.D., M.R.A.S.
D. Howard, Esq., D.L., F.C.S., F.I.C., <i>f.c.</i> (<i>Trustee</i>).	Ven. Archdeacon W. M. Sinclair, M.A., D.D.
Rev. Dr. F. W. Tremlett, D.D., D.C.L., Ph.D.	Gerard Smith, Esq., M.R.C.S.
Very Rev. Dean Wace, D.D. (<i>Trustee</i>).	Commander G. P. Heath, R.N.
Rev. Chancellor J. J. Lias, M.A.	Rev. Canon Tristram, M.A., D.D., LL.D., F.R.S.
Gen. G. S. Hallowes, <i>f.c.</i> (<i>H.S.</i>).	Rev. G. F. Whidborne, M.A., F.G.S., F.R.G.S.
Rev. F. A. Walker, D.D., F.L.S., F.R.G.S.	Lieut.-Gen. Sir H. L. Geary, K.C.B., R.A.
Capt. E. W. Creak, C.B., R.N., F.R.S.	Walter Kidd, Esq., M.D., F.Z.S.
Thomas Chaplin, Esq., M.D.	Edward Stanley M. Perowne, Esq.
Rev. Canon R. B. Girdlestone, M.A.	Martin Luther House, Esq., B.L.
General Halliday.	Rev. R. Ashington Bullen, M.A., F.G.S.
	Rev. John Tuckwell, M.R.A.S.

5. Deaths.

The Council regret to have to record the death during the past year of the following supporters of the Institute :—

Miss Mary Ashley, George Chance, Esq., J.P., Professor F. J. Candy, M.A., Hubert Garbett, Esq., Rev. Canon W. E. Heygate, M.A., General G. C. Hankin, C.B., Rev. Canon J. Hurst, B.D., Rev. A. A. Isaacs, M.A., Rev. S. Kinns, Ph.D., Rev. Canon J. Le Mesurier, M.A., Rev. G. Lake-man, B.D., Rev. R. H. Muir, Col. The Hon. H. M. Monckton, William Payne, Esq., Major A. F. W. Papillon, John Tanner, Esq., J.P., Thomas Ward, Esq., J.P., F.G.S. Some of the above members joined the Institute in its earliest days.

6. MEETINGS.

The subjects dealt with at the ordinary meetings have been of the usual varied character, which may be regarded as one of the special advantages of the Institute as an educational institution to a wide circle of readers in all parts of the world, and spreading religious and secular knowledge into many distant and isolated regions. The subjects may be arranged under the following heads:—

1. SACRED HISTORY.

1. "On the Samaritan Text of the Pentateuch." By the Rev. Canon GARRATT, M.A.
2. "The Samaritan Passover of the Present Day." By the Rev. Canon HAMMOND, LL.B.
3. "Old Testament Chronology." By FREDK. GARD FLEAY, Esq., M.A.

2. GEOLOGY.

1. "Notes on the Volcanic Phenomena of New Zealand." By Miss HILDA BOORD.
2. "Date of the Last Rise of the Land in the British Isles." By Professor EDWARD HULL.
3. "The Thickness of the Ice in the former Glacier of the Lucerne Valley." By the same Author.
4. "On the Tanganyika Problem." By WILFRED H. HUDLESTON, Esq., M.A., F.R.S.

3. BIOLOGICAL.

1. "The Genesis of Nature." By Rev. F. G. WHIDBORNE, M.A., F.G.S.

4. SCIENCE AND RELIGION.

1. "Two Paths, One Goal," being an examination of Archbishop Temple's Bampton Lecture for 1884, by WALTER A. KIDD, Esq., M.D., F.Z.S.
2. "Ancestral Worship." By Rev. ARTHUR ELWIN.
3. "The Conception of the Great Reality." By SYDNEY T. KLEIN, Esq., F.R.A.S.

5. GENERAL.

1. "Observations on the Irrigation of India." By CHARLES ODLING, Esq., C.S.I.
2. "Prehistoric Drawings cut on Glaciated Rock near Tenda." By Cavaliere W. P. JERVIS, F.G.S.

7. *The Journal of Transactions.*

The thirty-fifth volume of the *Journal of Transactions* has been widely circulated in many lands. The Council

may be allowed to repeat what was stated in the Report for last year,—that from time to time expressions of approval are received from foreign countries, while most of the learned societies at home and abroad exchange publications with the Institute. Of persons connected with our Society, about 74 belong to the United States of America, 40 to India, 14 to Australia, 12 to Canada, and about the same number to New Zealand and South Africa.

The Council have the pleasure of stating that Dr. Fridtjof Nansen, the distinguished Arctic explorer, has accepted the position of Hon. Corresponding member in the place of the late Sir H. M. Stanley, and Professor Warren Upham of Minnesota, distinguished for his memoirs on American Geological Science, takes the place of the late Professor Etheridge, F.R.S.

8. *Conclusion.*

While humbly desiring the continued blessing of Almighty God, and the support of its members, the Council wishes to express its thanks to the contributors of papers which are being offered in increasing numbers, and to press upon its friends the duty of doing what in them lies to increase the numbers and extend the usefulness of the Institute.

Signed on behalf of the Council,

HALSBURY,
President.

ANNUAL BALANCE SHEET, from 1st January to 31st December, 1903.

RECEIPTS.				EXPENDITURE.								
				£	s.	d.	£	s.	d.			
Balance from 1902				33	1	9	Printing		71	19	2	
Subscriptions:—1 Life Member		20	0	0			Postage		36	1	2	
3 Members, 1902.. ..		6	6	0			Binding		44	9	11	
133 „ „ 1903.. ..		279	6	0			Reporting		27	6	0	
2 „ „ 1904.. ..		4	4	0			Stationery		12	3	9	
3 Life Associates.. ..		31	10	0			Expenses of Meetings		8	8	0	
1 Associate, 1899		1	1	0			Clerk—Salary		113	1	4	
3 Associates, 1900		3	3	0			„ Insurance		2	11	10	
4 „ „ 1901		4	4	0			Rent		180	0	0	
17 „ „ 1902		17	17	0			Housekeeper		1	5	6	
319 „ „ 1903		334	19	0			Coal and Light		7	17	5	
15 „ „ 1904		15	15	0			Library		23	6	8	
					718	5	0	Secretary		200	0	0
Dividend on £1,165 18s. 9d. 2½ p.c. Consols					28	18	6	„ Travelling		10	0	0
Sale of Books, &c.					36	11	8	Insurance (Fire)		0	12	0
								Bank Charges		0	12	0
								Sundries		3	12	6
								Balance		73	9	8
					£816	16	11			£816	16	11

There is also the Gunning Trust Fund £503, Great Indian Peninsular 3 p.c. Stock invested in the names of the Trustees (The Dean of Canterbury and D: Howard, Esq.); the interest is to accumulate for periods of three years and it is then to be expended on a prize for an Essay. This account stood as under on 31st December, 1903:—

		£	s.	d.
Balance Credit from 1902		7	0	7
January 7th, 1903. Half-Yearly Dividend ..		10	11	2
August 11th, „ „ „ „ ..		7	3	1
Balance Credit 31st December, 1903 ..		£24	14	10

We have examined the Balance Sheet with the Books and Vouchers, and find a Credit Balance of £73 9s. 8d.

May 11th, 1904.

JOHN ALLEN,
G. MACKINLAY, Lieut.-Colonel, } *Auditors.*

Mr. ARTHUR W. SUTTON, in moving the resolution, "That the Report of the Council now read be received and adopted and circulated amongst the members and associates," said—My lord, ladies and gentlemen, I need hardly say that I rise with great pleasure to propose the adoption of the Report which we have listened to with much pleasure and interest.

The Report itself is singularly brief; but the list of subjects that were dealt with during the year by members, and the papers that have been read, show that the work of the Institute has been as valuable as ever; and those who have not been able to attend all the meetings will, I am sure, read the Reports of the Meetings in the *Transactions* of the Institute with the greatest interest.

It is gratifying to know that we close the year with a substantial balance in hand, and, if I might make a suggestion to the Council, it is, that when the funds admit of it, some special effort might be made to secure greater publicity in the daily journals, if possible, of the very valuable papers that are read at our meetings. The papers on subjects of general science have all been most valuable; and especially so as we know they have been contributed by members who are at one with us in their desire to promote the primary object of the Institute, which is investigation of scientific questions bearing on the truths of the Holy Scriptures. I trust that will always be the chief object of the Institute.

There was certainly never a time when research and investigation were so needed, or more helpful, than at the present day. The movement of modern thought is so rapid that we need to constantly bring tests to bear upon it. We may have in some instances, as have our forefathers, also, formed a misconception as to the meaning of certain portions of Holy Scripture; but we still feel, whatever meaning they are intended to convey, they are as absolutely trustworthy as ever. There is one danger which I think has to be guarded against in the present day, viz., the idea that because the agency employed in the compilation of Holy Scripture was human it is therefore fallible, and may be erroneous so far as it may not be in accordance with the science of to-day. It is often advanced that the spiritual truths of Scripture which cannot so readily be put to external test are alone those to which we can give our allegiance, and that the extent to which they can be held is according to how they square with modern thought. This might

be a convenient position for some to take up; but it would leave us no solid ground as to the path which we are to take, or the position we are to occupy in the future life. I believe we shall find that what we call spiritual truths, are of value to us, only so far as the historical events recorded in the Bible are recognised as authentic facts—not only that man was created in the likeness of God—that he fell from his estate—that Christ became incarnate, and died and rose again, and ascended to the right hand of God. How empty the Bible would be, if nothing were left but its ethical teaching! If the Institute could more and more bring into prominence not only those points where the Bible is in touch with modern thought, but those where there is a divergence, I think then our thoughts would be better focussed, and that, by God's help, we should benefit by the illumination of His Holy Spirit. (Applause.)

Colonel T. H. HENDLEY, C.S.I.—My lord, ladies and gentlemen, I have much pleasure in seconding the resolution, and if I may make one suggestion, it is that the members of the Institute should do their utmost to carry out the wishes of the Council, and endeavour to raise the number of members to at least a thousand.

The PRESIDENT.—The question is that the Report of the Council now read be received, and adopted, and circulated amongst the members and associates.

The resolution having being put, was carried unanimously.

Mr. WILFRED H. HUDLESTON, F.R.S.—My Lord President, I have much pleasure in moving that “The thanks of the Members and Associates be presented to the Council, Honorary Officers, and Auditors for their efficient conduct of the business of the Victoria Institute during the year.”

Of course, the mainspring of all societies consists of the working members of the Council, and seeing that the Council itself consists of a great number of members who, like myself, perhaps, do not very frequently interfere with the business of the Society, this vote is more especially directed in favour of the working members who attend the Council and manage the business of the Victoria Institute. I must own that as far as I have any acquaintance with the management, it is very skilful, and it has been well conducted ever since I had the pleasure of being a member of the Institute.

I think, with regard to your volumes of *Transactions*—and we

have now arrived at our thirty-fifth—it reflects very great credit on the management that such an annual volume should be brought out. It is most excellent in type and thoroughly well edited, and would do honour to any public institution whatever. I speak feelingly, having recently contributed a somewhat lengthy paper to the Proceedings, and I can only say that I was surprised at the rapidity with which that paper was brought out in type, and placed in the hands of the members, to enable them to understand what I was talking about, and to join in the discussion. Those matters are certainly highly creditable to the management. Of course this vote of thanks includes all the officers; but I more especially include the name of the Secretary. (Applause.)

The Secretary of a society is like the mainspring of a watch, and on him and his vigilance almost everything connected with that society is dependent. I am happy to say that my friend, Professor Hull, has had long and varied experience and that his ability is very well known. The work he has done in the past is of the highest importance, and the work he is doing now is of the greatest utility. I beg, therefore, to move the vote of thanks.

The Rev. Dr. IRVING.—I have much pleasure in seconding this resolution proposed by my old friend Mr. Hudleston, and especially I feel bound to endorse what he has said about the energy and efficiency with which the Secretary has discharged the business of the Institute. Professor Hull, like Mr. Hudleston, is an old geological *confrère* of mine, of many years' standing, and I feel very happy to-day in finding my name associated with theirs.

As regards the work of the Institute, since I came into the room, I heard a remark made in proposing the first resolution, which reminded me of some words of the great Lord Bacon, and which seem to me to hit off exactly what should be kept before this Institute as to its objects. He says, speaking of the work of the Creator, that His first work was the creation of light, and his last was the creation of light by man's intellect; and his Sabbath work, ever since, has been the illumination of the Spirit.

It appears to me that the author of that statement gathered up in it a wide range of thought and research which an Institute as this ought to keep before itself, remembering always that the illumination of the Spirit is not confined to theologians or even the inspired record; that God's Spirit works and has been working

through the minds and intelligences of capable men to unravel to us that wonderful revelation which He has made of Himself to us in nature. That should always go along with the other revelation which is of a more spiritual and of a deeper kind. The two must be regarded not as antagonistic but as complementary to each other. It seems to me that that defines the real object of this Institute. It was summed up well by the present Bishop of Winchester, when he was a Professor at Cambridge, not many years ago, when he said we have two sources of light, the first consisting of the spiritual in the Person of Jesus Christ, and the second the illumination of the intellect of mankind through the Holy Spirit in teaching us to unravel the secrets of nature.

I have much pleasure in seconding this resolution.

Colonel GEORGE MACKINLAY.—I have been deputed to respond to your vote of thanks to the Council and officers of the Institute. It is a great pleasure to do so and it is a great pleasure for us to work together.

I notice three balances here. There is a favourable balance of money, which is better than last year; and then at the end we have a favourable balance of foreign members, and it is a great benefit that our proceedings do reach our fellow-countrymen in the colonies. Thirdly, there is a balance, which has not been alluded to yet, and that is, with regard to the future. The number of papers for next session which has already been arranged for is large, and no doubt they will be very interesting and instructive. That part of the work is, I may tell you, chiefly due to the Secretary, who has been able to obtain many good subjects for the coming session.

The only adverse balance is that small decrease in the number of members. The Council will do their best to increase the numbers; and we ask you to do your best to add to them, so that they may reach the 1,000 which has already been alluded to.

The PRESIDENT.—I am afraid I must ask you to pass the resolution, though it was not put to the meeting and carried before the last speaker responded.

Colonel MACKINLAY.—I am sorry.

The PRESIDENT.—You will pass it, no doubt, *nunc pro tunc*, and therefore I will put the resolution in the usual way. [Carried.]

The SECRETARY.—Perhaps I may be permitted to express my gratitude to Mr. Hudleston and those members who have so kindly alluded to my services as Secretary to this Institute.

THE PRESIDENT'S ADDRESS.

LADIES AND GENTLEMEN,

I regret that I must announce that owing to the pressure of work, I have not been able to complete the address which I intended to deliver to you, and I must candidly tell you that I do not propose to deliver a formal address to-day, but I hope you will allow it to be postponed, and I will reverse the maxim that has been quoted to-day and say *tunc pro nunc*, if you will allow me to do so.

I might have written to say that I had not completed my address. I had begun it; but I thought it would be an ill commencement of my career as your President if I did not present myself in person to express my gratitude to you for having done me the great honour of electing me as your President; and further I ought, I feel, to express the gratitude of this Society to our late President, whose career as a man of science was one that I should think no one in Europe would doubt, placed him in the very highest rank of scientific men.

I may make an observation about him that is not confined to the gratitude we owe his memory, and not confined to the domination of his genius and his knowledge.

I do not think anything can be found that is more important to this Society, and to similar societies, than to show that men of the highest rank in science, and with the greatest knowledge, do not object to belong to a Society whose charter is to investigate, boldly and thoroughly, all subjects bearing on religion and science with the view of showing that they are not inconsistent with each other. I confess, and you will permit me to say, perhaps, that I believe no time ever existed in the history of the world when investigations of this sort were more required. There is undoubtedly a more subtle spirit of unbelief now than I think has prevailed for some time. The pious and very good people who thought that the best way to preserve the Scriptures and preserve the faith of men was by suppressing scientific investigation made a great mistake. In the first place you can no more suppress the exercise of the intellect by human beings who are intelligent than you can still the tide of the ocean; and the only result was that men were led to doubt, because they were afraid of investigation.

The charter of this Institute, as I understand, is to boldly and fearlessly investigate every problem that bears on those

subjects ; and in a President like the late Sir Gabriel Stokes, we had one, not like men who have already made up their minds beforehand, but a man who was able to discuss a subject with the keen knowledge of an expert. He would be a bold man who could come into this Society and say these difficulties had passed away, and that this twentieth century had overcome the difficulties in Holy Scripture. It was Bishop Butler, quoting Origen, who said if we believed that the creation proceeded from God in which there was so much mystery, and that the Scriptures also proceeded from God, we must expect to find difficulties in the one as in the other ; and if God occupies that position that Christians hold Him to occupy, they must still have to endeavour to account for things that are unaccountable.

I often wonder if those who sought to contrast Scripture with the true teachings of science as they did in the past, ever thought of the difficulties into which they landed themselves in. Supposing the great controversy between Galileo and those who urged him to retract his true notion of the orbit of the earth had ended in their establishing that the earth did not move, and all the other phenomena could be accounted for on their hypothesis ; see what it means. It shows what difficulties you get into if you do not probe things to the bottom. The earth, we now know, goes round in its orbit in 365 days, and that orbit is calculated and the time it occupies. Take the hypothesis that existed, and that Galileo should not question—that the whole solar system and stars out of our sight, billions of miles away, went round the earth in 24 hours. Which is the more marvellous—which is the more extraordinary proposition to reconcile with Scripture ? That is only one illustration. But as I believe and most Christians believe, the further you examine the works of the God of Nature the more clearly do you discern the God of Providence ; and it is that which this Society, as I believe, is founded to investigate and determine.

There is another class of persons I may mention in passing, and those are persons (it is true they do not adopt the formulary that the apostles of error, as I venture to call them them, do) who adorn every proposition with long words ; so that if you do not agree with them, you cannot say why, for you do not know exactly what they mean ! The Unknowable (with a great U) is always spoken of as if you should understand it. It is only a difference of words before us ; for we believe in an Almighty Creator, one who, in the language of one of our creeds, is "Incomprehensible" by human intelligence, because

He is above it ; and, therefore, what you gain by going through part of a proposition and calling it by a new name I am not able to comprehend. Within the last 24 hours I found a very pretentious volume on my table which says that the old scriptural religion is gone—that science has superseded it, that the spade in Egypt and the astronomer have got rid of all the old delusions. I wait to hear the proof of all that. It is very well to say it ; but I think if those words were repeated here in the Victoria Institute, in the presence of some of those I could mention, with university degrees, the cloud of long words would be soon dispersed and we should try to find out what these words meant. All I can say is the charter of this Institute is the investigation of truth to ascertain what that Truth is, and if we believe it is a God of Truth, the nearer we come to the Truth itself the closer shall we be to God.— [Applause.]

The DEAN OF CANTERBURY.—My lord, ladies and gentlemen, I hoped that the Archdeacon of London would have been here to move this resolution, but I am glad to ask you to express your gratitude to the President for two things—first of all, for his kindness in consenting to be President of this Society, and secondly, for his kindness in escaping from the House of Lords in order to come and make the interesting observations to which we have just listened. We are extremely grateful to him also for the promise he has given us to the fulfilment of which we shall look forward with great interest, viz., the address which he has been prevented from preparing at this moment.

I should like to add, my lord, if I may do so without impertinence, that your lordship referred to the great advantage this Society experienced from its late President being a man of eminent scientific position. For that we are grateful ; but I am sure we are not less sensible of the advantage which the Society derives from having, as our President, a person of your lordship's distinction, versed both in law and matters of the world at large. While many difficulties in connection with religion and the discoveries of science present themselves, there are many others, and those are of great importance, viz., those relating to the law of evidence, the question of what is evidence with respect to what occurred in former ages, and also, I venture to say, in connection with that good judgment, that capacity of judging human affairs in a broad light, which is acquired, in a most eminent

degree, by persons who have passed through such an experience as your lordship has. It is a comfort for us to know that men of that description—that a man of your lordship's eminence has weighed the historical evidence of the gospels and of the Christian religion, and is thoroughly satisfied with the consideration of those questions that bear upon it. For all those reasons we regard it as a great advantage to have your lordship as our President, and I am sure, in the name of all, we tender your lordship our most hearty thanks.

Sir ROBERT ANDERSON, K.C.B.—I feel sure, my lord, that no one will look on this resolution as a mere formality; but I feel that my part in seconding it partakes of that character. No words of mine are needed to commend it, and I may content myself with some very brief remarks.

The first of the primary objects for which this Society has been founded is to investigate, fully and impartially, the most important questions of philosophy and science, but more especially those which bear upon the great truths revealed in Holy Scripture. How is it that while, in these days, the very numerous discoveries are all upon the side of Holy Scripture and so tend to confirm its truth, yet that the public at large are led to believe that they discredit the Bible?

I think the answer is this—that in this sphere a practice prevails which would not be tolerated in any other sphere, viz., that the witnesses are allowed to adjudicate upon their own evidence; and it seems to me that if the rising tide of unbelief is to be checked, we are dependent upon the influence of men of admitted and unquestioned capacity for full and impartial investigation; and this being so can a Society, founded to promote these objects, possibly have at the present time a more fit President than one in whom competent scientific attainments are subordinate to the very highest capacity in the judicial sphere? (Applause.) Is not the Victoria Institute, in the strongest way, to be congratulated on having as its President the Lord Chancellor?

I have great pleasure in seconding the resolution that our best thanks be presented to the Lord Chancellor for the address now delivered, and to those who have read papers during the session.

The resolution having been put to the meeting it was carried by acclamation.

The PRESIDENT.—Ladies and gentlemen, I am extremely indebted to you for the way in which you have been good enough

to adopt this resolution, and I am the more indebted to you for it because perhaps it was thought I was about to deliver an address, but after what you have heard perhaps I may be forgiven. I felt that an apology was due, and I am glad that you have been good enough to accept that apology and the reason I have given for it.

The meeting then closed.

ORDINARY GENERAL MEETING.*

PROFESSOR LIONEL BEALE, F.R.C.P., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following elections were announced :—

LIFE MEMBER :—Professor Lionel H. Beale, F.R.S.

MEMBERS :—Robert Bruce Foote, Esq., F.G.S. ; Ronald MacGregor, Esq., H.M.C.S.

ASSOCIATES :—George Herbert Payne, Esq., F.G.S. ; Frederick Gard Fleay, Esq. ; Rev. James Marchand ; Thomas Woods, Esq., M.D. ; Henry Proctor, Esq. ; Alfred Lea, Esq. ; Hugh S. K. Ryan, Esq. ; Rev. Arthur Mercer, M.A.

The CHAIRMAN.—I have now to call on the Rev. G. F. Whidborne to read a most interesting paper on the “ Genesis of Nature.”

The following Paper was then read by the Author, entitled :—

THE GENESIS OF NATURE.

By Rev. G. F. WHIDBORNE, M.A., F.G.S.

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- I. *The problem of the genesis of Nature.*
- II. *The first line of inquiry, i.e., by way of natural facts.*
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 2. Superstitious use of scientific phrases.
 3. Natural facts indicative of effects.
 4. Cause must be adequate for effect.
 5. The relationship of the material and the immaterial.
 6. Search for the Cause in Nature.
 7. Effect of the discovery of God working in Nature.
- III. *The second line of inquiry, i.e., by way of knowledge of the Creator.*
 1. Search for knowledge of the Creator from facts external to Nature.
 2. The fact of the Bible.
 3. The Bible as a revelation of God.
 4. The God shown in Nature and the Bible identical.
 5. The Bible not a scientific text book, but authoritative about God.
 6. The Biblical conception of God.
 7. This conception applicable to explain Nature.

* Monday, 14th December, 1903.

8. Its effect upon scientific phrases.
9. The kind of creation to be expected from such a God.
10. Modification of it required by the Biblical conception of evil.
11. The conception thus formed agrees with actual nature. The limits of its use in its elucidation.
12. Evolution as a method of creation.
13. The Biblical conception of God fulfils all requirements of science.

IV. *The third line of inquiry, i.e., by way of historic narration.*

1. The Biblical account of creation historically true.
2. Its actual, if not apparent, agreement with scientific facts.

V. *Conclusion.*

I. THE PROBLEM OF THE GENESIS OF NATURE.

NATURE-study is nowadays in vogue with teachers. But those who confine it to rural life in distinction to the town, and think to meet Nature only in quiet lanes or bare hillsides, restrict their quest too tightly. Nature is all-pervading, all-controlling. It includes the city and the country, the ocean depths and the mountain tops, the heart of the earth and the remotest stars, the most elaborate of the arts and the paths untrod by man. Around us and within us, in the front of our eyes, and at the back of our science, there spreads out this all-embracing essence, this wonderful environment of human living, that men call "Mother Nature." Even Art is not, as would some call it, the alternative of Nature; it is only the offset and the product of that great Nature which is its source and its basis, its magazine and its model. And to-day men ask more than ever what does all this mighty nature mean? Whence came all this which we sum up in a word and comprehend it not? What is the origin, the history, the language, the interpretation of Nature? Can human knowledge unravel the problem of the Universe? Can *scientia* explain *res naturae*?

II. THE FIRST LINE OF INQUIRY, *i.e.*, BY WAY OF NATURAL FACTS.

We propose to approach our inquiry by two stages; and in each we shall have to start with an assumption. Our first stage must be to seek to obtain from Nature evidence of its central fact—its governing principle—for it is impossible satisfactorily to explain the existing order of things, unless we go to their root. We may illustrate this mathematically. If a complicated curve be given to us to explain, the first thing we have to do is

to find its centre or centres—its foci—its “origin.” Only thus can its intricacy be reduced to order, and its properties be understood. Even so, if we want to learn what nature means and whence it comes, the first step must be to find its origin, to get back to its real starting point, to get down to its very centre.

1. *Only Actual Facts reliable as Evidence.*

And for equipment for this search we must start with this assumption—that the ascertained facts of Nature are true facts. Appearances may be delusive; things, which are only fancies, may be mistaken for facts. But what we claim is, that, where we *do* get down to actual fact, there we have so much that is solid and reliable, and that must be counted by us as a self-consistent truth, whatever its relation with other facts may be.

This opens to us at once a vast storehouse of data for use in our inquiry. All natural facts become available, and these are innumerable, every sided, and infallible. Some are so simple and intelligible that the smallest child can grasp them; but others are so abstruse, so inscrutable, so recondite, that the attempts to understand them strain and overstrain the master-minds of science. But of them all only this one thing must be said—whatever data are used in such inquiries must be actual facts—undoubted facts. We must ever be on our guard against the fascinating temptation to read off facts from theories, or to take explanations as if they were as authoritative as the underlying facts, which they purport to explain.

Another storehouse, indeed, is sometimes drawn upon for data in such inquiries; but it must at once be closed with a caution. Imagination is not a good source for data. It may be most useful in its province; it may guide in the search for facts; but it must bear no part in their production. The not infrequent sequence, “it may be, therefore it must be, therefore it is,” is very useful for arriving at preconceived conclusions; that is, for results, which are as secure as the image that rested on feet of iron and clay.

2. *Superstitious use of Scientific Phrases.*

Before proceeding further it is well to clear the ground by observing a common custom, or habit of expression, in science, which, innocent enough or even helpful in itself, has yet often led to dangerous, and sometimes little realized, confusion of thoughts. Even for scientific students the Ten Commandments

may have a meaning; and certainly the study of the second of these might put them on their guard against an intellectual danger, curiously akin to the materialistic worshipping of graven images. It is a most common practice in scientific language to personify "nature," "evolution," and "the laws of nature." No doubt it is an old practice. No doubt it very often is a useful practice. No doubt it is in itself a perfectly innocent practice. In itself there is no harm in making graven images. Statuary is no breach of the second commandment. But the harm comes when men begin to idolize their statuary; and nothing grows more imperceptibly, more insidiously, more dangerously than idolatry.

Let us look then at this vice of idolizing *Nature*. Philosophers who have begun to speak of it as an impersonation, seem led imperceptibly on to think of it as such, to ascribe to it intrinsic powers, to regard it as the autocrat of its laws, to picture it as a kind of demigod, without intellect or personality indeed, but acting just as if it had both personality and intellect. The result is that Nature is too frequently in scientific writings put in the place of God. It is made to occupy in philosophy exactly the position that an idol occupies in religion; and that with nothing but an idol's power. Nature is assumed to be in its essence the originator of all that goes on within its sphere, and is treated as the legislator of what are called its laws; it is the doer, the causer, the worker of its phenomena. It appears as a great universal undefined potency, which explains everything except itself. Now all this is, to speak plainly, confusion of thought. No one means, in the present state of knowledge, to assert that Nature itself is the *Auctor rerum*, the prime and ultimate cause; no one, we suppose, really imagines that to speak of Nature "doing," "arranging," "ordering," is to give a rational explanation of the cause of the effects described. Such phraseology does not find God in Nature; but it does make an idol, a jujū, an obi, of Nature. And the consequence is this—that, in research for the meaning of things, that is accepted as an explanation of them, which is nothing more in itself than a conventional expression, and means, at least in the sense in which it is thus used, actually nothing at all.

The same may be said with regard to the cognate word, "*Evolution*." We are, in regard to this term, in the still further *a priori* difficulty, that everybody knows it means something exceedingly important, but nobody seems quite able to tell exactly what it means. Passing, however, this protean quality of the term, there can be no doubt that science has

suffered grievous loss from the inscrutable veneration, that has been so frequently bestowed upon it as a mentally-graven image. In the darkness of its shrine it has been worshipped with a liturgical jargon of scientific terms; and stranger and more impossible miracles have been attributed to its mystic oracle, than all the priests of all the false gods of heathendom have invented or produced for the furtherance of their material mysteries. And, when brought out into the light, what does the idol prove to be? Nothing; an instrument, not a god; a process, not an intrinsic potency; not an originating cause.

Let there be no mistake in our meaning here. We are not at present raising the question of the validity of "evolution" as an explanation of the history of nature. Whether it be a fact or not, whether it be or be not true in its extremest form, does not affect our present argument in the slightest. All that is now demanded is that, whatever it is, it be rightly used, that it be not superstitiously regarded, that it be not venerated as men revere an idol, ascribing to it properties and powers which it cannot in its nature possess, attributing results to it which, even if they come through it, could not originate in it, degrading it from a scientific question into a superstitious cult.

The same treatment may be demanded with regard to what are called the "*laws of nature.*" No sane man would dream of denying those laws. They are generally, and for the most part in detail, evidenced by superabundant proof. Discoveries, perchance, like the mystery of radium, may ever and anon seem to challenge the validity of some accepted law. There may be, doubtless, here and there laws, asserted by philosophers, which are not really found in the statute-book of Nature. But that is not the question. Grant to the full the existence, the supremacy of the laws, what is required is to treat them as what they are, and not as what they are not. They are laws governing Nature, not laws ordained by Nature. Ask Nature "where are her laws?" and she reveals them upon every hand. But ask Nature "where is the law-giver?" and the only answer Nature can return is: "Not in me. I obey the laws; I do not originate them. I am their servant, not their mistress." And yet no law can exist without a law-giver.

3. *Natural facts indicative of effects.*

Having thus dealt with these preliminary cautions, having thus attempted to clear away the idol-shrines that block the

pilgrim path of science, we must venture to approach the centre of our subject, to seek with reverent step to explore the Holy of Holies of Nature. We must try how far we can get to see into the very heart of the universe, to discern what is its cause and origin, what has given it the power to be, the energy to become, the potency to progress. Nature, evolution, the laws of Nature, only lead to it; they are not it themselves. They are only pathways to (to our perceptions "to," but in their reality "from") the centre, the focus, the origin of the Universe. To that ultimate goal we must press forward; for, until that be found, the meaning of the universe cannot be discovered, the arcana of nature cannot be revealed.

We proceed, then, first to a survey of our storehouse. We have not yet to deal with its data in detail; that will best be left till we have obtained the key to their interpretation; but we have to take them now in general view, to look round with bird's-eye ken on the vast facts of the existing and historic universe (as far as we may know it), and inquire how it can be that they are what they are. What is their value as facts? What is their scope as a basis for deductions?

The answer is that, without exception, the visible in Nature is the exposition of effect. What it tells us is that there is force everywhere bringing things to pass. The buds swell on the bare tree and transform it into a summer maze of foliage. The spring air is suddenly filled with myriads of dancing insects. The clouds gather in the blue, and roll in majestic masses through the sky. The resistless rivers are stayed in their courses and transmuted into hard and unmovable solids. All these are effects. And we are asked what produces them. We may give in reply most elaborate and scientific answers explaining most beautifully these effects. But these answers will be generally found to be scientifically limited; they do not get to the bottom of the elucidation of force; they do not reach the scientific end of the catena of cause. Thus the question, "How comes the ice?" seems simply answered by saying "by the cold." But that answer is defective. It is trading with the unknown. If we go a step further and ask "what is the cold? what is it? not in relation or modification, but in origin and intrinsic nature?" we find ourselves becoming entangled in those dim marches of science where the roots of things abound and are inexplicable, where to attempt an answer can only result in darkening counsel by words without knowledge. Or again, if we ask "what makes the buds to swell?" the simple answer is "life." But when we

ask "what is life? what is the scientific explanation of its essence and origin?" we have asked a question, which human knowledge cannot answer, and of which curious philosophic definitions and ingenious scientific explanations are nothing but dignified paraphrases for "we cannot tell." But yet as we meet these multiform facts of nature, these effects, profuse and world-long, each one of them has in turn just this one question to ask of us, "Is there not a cause?" And to its question it takes no loose reply. Known or unknown, some primal cause for each effect must be.

4. *Cause must be adequate for effects.*

Further, not only must these effects be due to cause, but cause must be adequate for the whole of the effects. Advance, produced by the interaction of correspondences, does not obliterate the need of a sufficient cause behind. Grant, if you will have it so, that the giraffe's neck grew because it wanted to feed upon high trees! It only grew because it was able to grow. That is, there was a potency, an efficient cause within, which gave it power to correspond to its environment. The measure of that efficient cause was not the original short-necked creature, but the longest-necked giraffe that was produced by circumstances. The sum of the causes that produced first the short-necked creature, and then the giraffe from the short-necked creature, is the same, neither more or less, as the amount of cause required to produce the giraffe instanter. Or again, the ordinary growth of any creature to maturity from the embryo must have a sufficient cause. That cause is not hard to find. It is given, at once, by the antecedent paternal form existing in its maturity. The young grows up to the state of its parent, just as water finds its own level. Thus far, and no further, the effect has found a sufficient cause. But sometimes the young, as it reaches maturity, goes a little further than its parent, is a little finer, better, more advanced. Where is the cause for this effect? Not in the state of the parent itself, not in the amount of force put forth; *per se*, in the proximate progenitor. Here is a modicum of effect which has not found a cause. But the cause must exist. The smallest modicum of effect cannot be causeless; the cause must be somewhere behind, somewhere in pre-existing force that has not been revealed in the parent, and yet potentially exists. Now let us, for the purpose of the present argument, assume the truth of the Evolutionary Theory to its fullest extent. Call this small modicum of effect "evolution," and to account for this

evolution you have a small modicum of unrevealed cause. Next, take a sufficient series of these small effects to produce on evolutionary principles a new genus or family, you have of necessity an equal series of small modicums of cause, which taken together add up to an amount of cause sufficient for the production of that new genus or family. Now, take a birdseye view of evolution as a whole; sum it up in effect, and you find you must not neglect the other side of the equation. You have to answer it an equally large sum of unrevealed cause. The total effect of evolution requires an amount of cause correspondingly great. And as, on the hypothesis, Evolution produces everything, you are left on the other side with an amount of unrevealed cause, sufficient to produce everything. That is to say the existing facts of nature, taken all together, being effects, predicate the same amount of originating cause, by whatever theory their history is explained.

But it may be objected here, that in working out our problem we have neglected most important factors, which in the eyes of evolutionists have themselves, one or more of them, accounted for the effects. Such are Natural Selection, Sexual Selection, the survival of the fittest, the struggle for existence, correspondence to environment, and suchlike. Undoubtedly these questions are most important; and, in specific steps of evolutionary advance, they do require the utmost consideration and careful weight. But yet, if we candidly examine the whole problem, we find that all these terms of it "go out." They are interactions, not self-contained causes. They are viaducts, not fountains of originating force. Whatever potency is in them comes through them from somewhere else, and in its passage it no more grows than does a river grow; the apparent growth of which is simply due to the imperceptible addition to it of fresh supplies of that from which it originally took its source, the rain from heaven. And thus all these, and similar explanations of evolution taken together, however subtle, however important, however true, add up (when we are working out the relation of the effects of nature to the original energy that was needed to produce them) to nothing; and therefore, in spite of them, the existing effects require exactly the same amount of originating cause, whether evolution and its explanations are brought into, or left out of, consideration. Evolution and its explanatory theories may have much to say on the methods by which the originating causes or their forces work, but with their intrinsic amount they have nothing whatever to do. This indeed is, after all, almost a truism; but it is advisable to be clear about it;

because it seems a very frequent impression, that the need of an originating cause is somehow reduced, or even done away with, by evolution and its adjuncts.

5. *The relationship of the material and the immaterial.*

It may be as well, here, to note a point in the history of the Evolutionary Theory. It was first propounded, or at least prominently set forth, as an hypothesis to account for the state of physical animated nature; but, since then, it has been extended to explain both on the one side changes in non-living matter, and on the other hand things that are immaterial, as for instance language, morals, and even religions. Now all that we have to say, at present, is that, if in regard to each of these three spheres the substance of the theory is claimed to be the same, its attributes must in each case also be the same. If the fact, which we have just reached, that the amount of cause required to produce existing effects is unaffected by evolution, holds in the sphere of physical life; then we must equally conclude in the spheres of inanimate physical nature, or of immaterial nature. For any other conclusion would amount to an assertion that the theories were not the same in the three different spheres; and evolutionists would be thereby convicted of employing the same term to express diverse ideas, and in fact, would be acknowledging that the very uniformity for which they were arguing, was non-existent. We may therefore take it as a general principle, that all the facts of nature in whatever sphere predicate the same amount of originating cause, by whatever mediate methods they were brought about.

Returning to our storehouse, we learn another general point about its data. They have to do equally with things material and immaterial. In existing nature matter and non-matter is inextricably mixed up; they cannot be dissevered into independent classes. Everywhere we find matter taking different forms, possessing various qualities, performing diverse functions; but, along with it all, something is persistently present which is not to be accounted for by it. Moreover, this something is not always the same; it is as various in detail as it is consistent in its variety. To class it together as the non-material, is simply to draw a line of exclusive classification round matter. And yet with matter it is sometimes most intimately in union. Thought and the brain, for instance, are impossible to disunite, though one is material and the other is not; but, intimate as they are, they cannot owe their origin to

each other. Certainly the matter of the brain did not come into existence by thinking; as certainly thought cannot owe its origin to the mere mechanical structure of the brain. Just as something must play upon the organ to produce the harmony, so something must play upon the brain to produce the thought. We need not go further into these abstruse subjects; we need not lose ourselves in metaphysical labyrinths. Only thus much is necessary for our purpose; that mind and matter are in constant and intimate connection in Nature, but yet that the framework of all nature, as we know it, is matter: that mind, indwelling animated nature, is an effect which predicates a cause for its existence: and, further, that it is impossible either that matter could have been the prime originator of its endemic mind, for evidently, then, as life is greater than death, the effect would have been greater than its cause; nor on the other hand is it possible that matter could have been the prime originator of itself, for then we should have an effect without a cause at all.

6. *Search for the Cause of Nature.*

We have thus obtained some important landmarks for our guidance, and using them, may make our final start upon our quest. We look once more upon our vast equipment of data. We survey the sky, the air, the earth, the sea, the underground, and find them all teeming with natural facts. We meet them in their myriads—the vast army with its serried ranks—around us in the common objects of the country, or coming constantly in fresh multitudes into view through telescope and microscope, or revealed by the opening up of new and unexpected lines of scientific discovery. And of them, all and each, the question is,—“how did they come to be? what cause do they result from? what power can have brought them all to pass?”

1. They are, as we have seen, effects; therefore they must have had a cause, or causes.

2. That cause or causes must have been sufficiently potent to produce them each and all.

3. Therefore their magnitude and multitude prove that their cause or causes must have been transcendent.

4. They are, in part, material; therefore, unless we acknowledge the eternity of matter, they must have had an origin; their cause or causes must have been prior to themselves.

5. The eternity of matter is unthinkable. It cannot be conceived that matter existed always, because, however far back we conceive it to be, a reason for its being is always still

required. It could no more have been without an origin than it could originally have produced itself. It could not, we have seen, have produced itself; therefore its origin must be sought elsewhere.

6. It must therefore be said, that nature, founded on matter, must have been produced by some anterior thing or things. It must have had an originator or originators.

7. That originator or originators could not be the immaterial part of nature itself, for that is dependent on the material part, and has, as far as we can see, no power or vitality, which is not founded on the material part.

8. What, then, can be the originator or originators of nature? There appear to be only two possible conceptions thereof. Either it must have been chance; or it must have been a being or beings more or less intelligent.

9. Could it have been chance? Could the universe have been produced by accidents? We go back once more to our storehouse of natural data, and look over them to see if this is a possible solution! But one thing we observe in them, which has indeed been observed by all students of nature from most ancient days, and that is the universal prevalence in it of order. In its *ἀνήριθμον γέλασμα* everywhere, there is everywhere orderliness. In its infinite variety there is on every side plan, adaptation, natural law, continuity and correspondence. In nature there are complications endless, but nowhere confusion. But as is the cause so must be the effect. Chance could only have produced confusion. If chance had produced the universe, the existing universe would have been one mighty mass of disorder; and that is exactly the opposite to everything which we observe. And therefore we can positively and logically assert that the universe could not, and did not, originate by chance.

10. We are therefore driven to the conclusion that it must have come by the work of an intelligent originator or originators, one or more. Which was it? Again we go to the storehouse of nature; and at once modern science rushes to our aid. If there is one pre-eminent fact which the advance of science has brought into view it is the unity of nature. Continuity is found in it everywhere. The correlation of natural forces is declared. The uniformitarian theory has left among its ruins abounding exemplars of the age-long congruity of natural laws. Most of all the great doctrine of evolution, whatever else it has done, has at least established the *possibility* of tracing all existing variety back to unity. The more strongly it is asserted, the more emphatic is its proclamation of the uniformity of nature.

That indeed is its kernel-thought, its very mainspring. Realized or unrealized, underlying unity is the only basis upon which any theory of development can possibly rest. Whether the super-structure be sound or not, every worker who attempts to build it must of necessity start from this foundation. If evolution claims continuous supremacy over all kinds of life, it is thereby simply asserting the original unity of animated nature. If it goes so far as to demand the identity of life and non-life, if it claims sway, not only over things material, but over things mental and moral as well, it only thereby the more imperiously proclaims that in all things natural there is an impress of pristine unity. Whether evolution to its full, or indeed to any extent, is to be accepted, is not the question here; the sole point is that its very employment as a working hypothesis, a possible guide to the history of nature, implies the *a priori* acknowledgment of the unity of origin of that nature. Original unity cannot be consistently denied by any evolutionist; but original unity in things made (whether in fact, as the extreme form of the theory requires, or in conception as any form of it requires) must predicate actual unity in the maker; for it would be an absurdity to imagine two originators setting out to produce Nature, and from their diverse starting points independently producing unity or uniformity in their twain productions. Moreover even those who reject the theory of evolution, agree with evolutionists in acknowledging this underlying uniformity, or unity in principle of existing and original nature. And this fact, thus acknowledged on all sides, can mean nothing else than this; that the originator of nature was one, was intrinsic Unity Himself.

11. We have then reached thus far—that Nature, that the universe, had one intelligent Originator, one antecedent Creator. But we must ask one more question of our storehouse of data. What do they predicate to us with regard to His intelligence, and to His moral character? Can it be said that the intelligence to be imputed to Him is only sufficient to distinguish Him from chance, a measure of intelligence enough only to produce the most archaic things? What do we see? One thing we have found to be certain; the cause must be adequate for the effect, for all the effects that have been produced thereby. The measure of the intelligence of the Producer is not His first production, but His last; not His lowest work but His highest, or rather the sum of all His works taken together from the lowest to the highest. If we see in nature, not only unity, but the working out of that

unity into an infinite elaboration of order; if all things natural are so arranged as to form one great *κόσμος* in which power, beauty, adaptation, variety, vastness, utility, correspondence, law, advance, are all in harmony, all in rhythm; if we find through all, not only signs of material harmony, but of moral and beneficent good; if we learn that even the known facts of nature are not its full store, and that science like a householder is still bringing forth from its treasury new marvels with a hand so lavish as to prove an untold wealth behind; then for all these effects there must be an adequate cause. That cause may indeed be indefinitely greater than the effect; it cannot be less than the effect; and therefore we have in all these facts of nature nothing less than a demonstration of the vast, infinitely vast, intelligence, morality and beneficence of the one Creator—God.

12. And thus we have reached the goal of our quest. We have from Nature learned, at least in some degree, to know the one intelligent Originator of it all. We have found the centre, the focus, the origin of nature—its Creator—God.

7. *The effect of the discovery of God in Nature.*

Here we might stop; and with this master-key seek to unlock the meaning of the varied facts of nature in detail. We might examine how the Fact of God, brought down into the purview of science, explains its intricacies and elucidates its mysteries. We might seek to trace out the varied curves of nature, to understand their powers and interpret their properties by starting their detailed examination from the centre we have found. If we did this we should be doubtless well repaid; for, if nature reveals the fact of God, the fact of God explains nature. From the standpoint of the centre of any curve, its nature and meaning, its character and beauty can be perceived in a way that is impossible from any other point of view.

III. THE SECOND LINE OF INQUIRY, *i.e.*, BY WAY OF KNOWLEDGE OF THE CREATOR.

1. *Search for knowledge of the Creator from facts external to Nature.*

But though we have thus reached the end of the first stage of our inquiry; though from the facts of nature we have thus “felt after” nature’s God, and discovered from these His works the dimly grand perspective of the fact of their Creator, to stop at this would be assuredly to stop too soon. Rather, we may

go forward, and enter upon a second stage of our inquiry. The lessons from the effects do not of necessity exhaust the knowledge of the cause. We may ask, if there is not more to be learned about God, than even nature teaches. If God be adequate to have produced nature, may He not be adequate for even more than that? May we not learn from other sources still more about Him; and, if we can arrive at this further knowledge, may it not give us yet further insight into His ways and purposes, His power and His plan in the production of things natural, than that which can be attained from the study of even nature itself? As there is a revelation of God in nature, is there to be found any other revelation of Him elsewhere. And if there is, may we not examine that, and see if it in any way enlarges and defines our conception of the Nature of God?

And here, in starting on this second stage, we claim to make this second assumption, that the words of God are true words. We claim that, where we have an assertion that can be shown to have come to us from God, that assertion must be taken as beyond controversy. It may not be understood, but it must not be denied. It may be capable of bearing more or other meanings than we ourselves may put upon it, but in itself it is a thing which partakes of the nature of God, and demands that we should construe it by the infallible authority of that nature.

2. *The fact of the Bible.*

Our search for a revelation of God outside nature is at once met by the great fact of the existence of the Bible. Whatever be said about it, the fact of the Bible cannot be denied:—that we have in it, a compendium of writings from different pens, and certainly of great but different antiquities, which taken together profess to be, and have been largely acknowledged to be, a revelation from God. There can be no doubt that nothing less than this is its claim. It needs no scholarship to discern thus far. The plain reader as he turns from page to page, cannot avoid coming to this conclusion. He finds it simply full on the one hand of information concerning God, and on the other of sentences which are asserted to be the "*Ipsc Dixit*"* words of God. The question comes therefore: "Is this claim of the Bible to be acknowledged? Is the Bible to be accepted as containing the message of God?" Now it is evident, that to

* "And God said."

answer this question exhaustively would need a treatise in itself. The full proof must go into much detail, which it would be impossible here to attempt. It would from its nature, not only need long historical disquisition; but the examination of the internal evidence of each particular book. But without attempting this it may here suffice to give in outline reasons why this claim must be admitted.

(1) It is to be observed, that, if the claim be not true it is false;—in a large degree it is knowingly false. The words “God said,” “Jesus said,” govern a very large proportion of its pages. The question, therefore, resolves itself into this:—is it thinkable that a book being what the Bible is, and containing what the Bible contains, can be even in part knowingly false; because otherwise it must be true; and therefore its claim to be the Word of God must, speaking generally, be true.

(2) It is also to be observed, that the fact of the historic character of the Bible can be abundantly established. The New Testament can be traced back by external evidence to, or to the borders of, Apostolic times. Not only from Christian, but from heathen, sources the historic character of its facts and incidents may be largely confirmed.* Thus we reach the historic Christ, and through Him, as well as through Jewish (and archæological) sources, we reach the general historic fact of the Old Testament, accepted by them as the authoritative Word of God. Without entering on questions of Higher Criticism, the Bible can be shown to have been, as it is, regarded by the ancient Jewish Church for centuries before the Christian era, as at once a history and a revelation. Its historic facts are still receiving more and more confirmation from archæological discoveries. Its places are being unearthed, and reinstated as the landmarks of its land. Its connections with coeval nations are being verified by the freshly discovered archives of those nations. Very recently a remarkable exemplification of this has occurred. Doubt had been cast upon the Mosaic social laws; it had been argued that they presented too matured a civilization for their asserted age; but now the laws of a Chaldean king, centuries before Moses, have been found†; and some of these social laws so tally with the

* To take one subsidiary instance—it is implied by Roman annals that at Ephesus, at the time of St. Paul's visit, there were “deputies” in power there, as stated in the Acts, whereas the almost universal Roman rule was a single governor; the words “town-clerk” and “worshipper” are found on Roman coins.

† Dr. Pinches, *Trans. Vict. Inst.*, vol. xxxv, p. 228.

enactments of the wilderness, as to fix their correlation, and indicate that Moses might have been in part restoring to his nation, debased by Egyptian bondage, the better economy of their pristine fatherland. The founder of Babylon—a link in the line of Shem—has thus become the oldest alien witness of the historic character of the Pentateuch.

(3) It is also to be observed, that the unity of the Bible, as from a single source, is to be supported internally by numerous undesigned coincidences. These, often almost imperceptible in their individual selves, occur in so great crowds as to bind the whole book together into one organic whole, both confirming its historic truth as a record, and showing all its parts to be, whatever their human authorship, evolved from a single intelligent over-ruling source.

(4) It is also to be observed, that the moral teaching in the Bible has yet to be accounted for, unless its claim to inspiration be allowed. To judge the Bible fairly, as to its moral character, we must take it as a whole. The Gospel fulfils, not destroys, the law. From Genesis to Revelation there is a congruous moral whole, in which is found no more specific difference than is found in nature between the bud, the flower, and the fruit. And how is that whole, that compendium of moral law, to be explained? It may be compared with other human productions; but in doing so from the latter must be of course eliminated whatever is, or may have been, derived from the former. Only by this process from these unassisted human productions can we find the sum of morality of which unassisted humanity is known to be capable. It is this residuum which has to be compared with the morality of the Bible; and comparing this, the vastness of the difference is at once apparent. What remains we may call the special morality of the Bible, and with regard to that (and how great it is) we have this dilemma. It professed to have come from God. Therefore, if its source was merely human, its profession being false, it was not only human but, because false, immoral. Thus the highest morality was derived from immorality, and that may well be said to be absurd. Therefore the special morality of the Bible is a decisive proof of its divine inspiration.

(5) It is also to be observed that the religious teaching of the Bible has yet to be accounted for, unless its claim to inspiration be allowed. What has been said of the moral tenets of the Bible may be said with still greater force of the religious teaching. Unless the Bible be inspired, its whole religion, its whole theology, falls to the ground. If it be true, it

has no other possible source than inspiration. And if it be false, seeing what it is, how is it to be accounted for? Is it a structure which it is conceivable to have been built up by a series of impostors? The dilemma is here again; the authors of the Bible professed to have received its religion from God, and therefore unless that was an actual fact, they were nothing else than conscious, or unconscious, impostors. Now it may be said that the innumerable correspondences in the Bible render the idea of its being an unconscious imposture impossible. Passages from its different books could not have been woven together, in the way in which they are woven together, without definite intention; and if this were not done by the intention of God, it must have been done by the intention of man; that is, if there were imposture, it must certainly have been intentional imposture. Hence we are reduced to the question—could the religion of the Bible be regarded as an intentional imposture? Its nature, its scope, its origin, its structure must be examined on that hypothesis. If it was an imposture, what was its purpose? What good was it to do? Certainly it brought no temporal benefits to its authors; their earthly position was not improved by their writings, often the reverse. Nor could its object have been to bring good to those to whom it was written, seeing that its authors knew it to be a fraud. So, unless the Bible was inspired, its religion was built up without purpose. And the effect it has had upon mankind is the accidental effect of a fraud. That effect has only to be measured to prove the absurdity of such a supposition. Consequently it is evident that the religion set forth by the Bible, is in itself a proof of its inspiration.

(6) Most of all it is to be observed that there exists, over and above all else, a direct proof of the inspiration of Scripture following on a personal knowledge of Christ. This proof is *of course* only available to those who are convinced Christians. To all others, the premises are unknown; and therefore the consequent result cannot be demanded. But even as the want of the knowledge of Greek in some renders the Iliad a closed book to *them*, but does not debar those who do know Greek from understanding the Iliad; so the absence of a personal knowledge of the Lord Jesus Christ in some does not lessen the value of His authority to those who do personally know Him. So this proof must be stated for the sake of those to whom it is available; all others must stand by and only judge its weight, by what they see in those whom it affects. Now it is alleged by no inconsiderable number of mankind that

they do personally know the Lord Jesus Christ. Moreover this asserted knowledge is commonly seen to have a most marked effect on their lives. Their lives, and sometimes their deaths, are proofs that this asserted knowledge becomes the dominant factor in their being. It results among other things in their regarding the teaching of Christ not only as authoritative, but as having infallible authority, based on their personal experience of the infallibility of its Author. They believe Him implicitly; therefore they believe His testimony implicitly. And His testimony concerning the Scripture is that it is the Word of God. Of that he spoke with authority and not as the scribes. His words in St. Mark x, 6, 7, alone mark its first chapters as the authentic records of creation. "From the beginning" (Gen. i, 1) "He made them male and female" (Gen. i, 27) "therefore shall, etc." (Gen. ii, 24). And as the seal of Christ stamps the Old Testament as the inspired word of God, so is the New Testament stamped as such by the fact of Christ, for it is composed either of His own words or of teaching derived from Him.

3. *The revelation of God in the Bible.*

Thus we have found that the Bible can on many independent grounds be definitely proved as a revelation from God; and that this proof may be reached in two distinct ways: (1) by a personal knowledge of the Lord Jesus Christ, who then becomes, to those who know Him, the final authority on its inspiration, and (2) by the ordinary scientific examination of its history and its contents, and of all the facts that are known about it from whatever source. Consequently, as it is given by inspiration of God, its words are true words in regard to that which it is its purpose to reveal. Now what at present we are seeking is to form a conception of God Himself. May we therefore seek to form that from the Bible? Without the slightest doubt the primary purpose of the Bible is this very actual thing—to reveal God to men. Even if we might use the Bible for nothing else, at least we may use it for this. It is the handbook to the knowledge of God. It is a storehouse of data, authoritative for the science of God. It is the revelation of God by God. As the Bible conveys the true word of God, the view which it presents to us of God Himself must infallibly be true.

4. *God, as seen in Nature and in the Bible, identical.*

But before going further, a question may be asked, and a

limitation suggested, which it may be simpler to consider at the outset, although in doing so we may have to use by anticipation some of the evidence about God, which we shall presently draw from the sacred storehouse of Scripture.

First, then, it may be asked, "is the God whom we have found from Nature the same God whom we find in the Bible?" It might be conceived, that, after all, they might be different beings. Gnostic notions might be brought in to suggest a relationship with a difference. But to answer this we have only to compare the two conceptions of God, given to us respectively by Nature and by Scripture. We look in brief to the view of the Being of God which is presented to us in Holy Writ. He is described (to take but three places out of many) as, "the King Eternal, immortal, invisible, the only wise God," "the Lord God omnipotent," "the Creator of the ends of the earth"; and everywhere throughout Scripture the same view of His peerless Majesty is given. If Scripture be true, He is God supreme and God alone. But we have already seen that the God about whom we learn in Nature is single and supreme, its one first cause. Therefore, the God of Nature and the God of the Bible must be one and the same. There is no room in the universe for more than one God, whether as revealed by nature or by Scripture. Therefore, whatever we learn of God in nature is knowledge of the God of the Bible; and whatever we learn of God in the Bible is knowledge of the God of Nature; and, therefore, whatever we know about God is knowledge which applies to either sphere; and more particularly for our present purpose, whatever we discover of the character of God from the Bible may be scientifically used to explain the ways of God in the realms of Nature.

5. *The Bible not a scientific text-book, but authoritative about God.*

Secondly, the limitation may be suggested that the Bible, however true as a revelation, has no scientific purpose, and therefore cannot be consulted as a compendium of Science. It may be said, and very often is said, that its expressions are those of the current state of science at its time, and that later discoveries have accumulated vast stores of natural knowledge of which its human authors were entirely ignorant. We may freely grant all this. We have no wish to turn the Bible into a scientific text-book. Its purpose was certainly not to record philosophic theories, or to chronicle natural research. No one supposes that its ancient writers were versed in the scientific

methods of modern days. No one imagines that Moses, or David, or Paul, were acquainted with the doctrines of evolution or the laws of electricity. But for all that, it is not wise to forget that the Bible has not only a human but a Divine side. If God is indeed the actual Maker of Nature, *He* must have known all about its true laws and methods, even if Moses did not; nay, even if possibly philosophers of the present day have not yet quite fathomed them fully. And the Bible is the Word of God, that is, it is inspired by the Author of Nature; so it is not quite safe for any man, however learned, to scout its science, or to charge it with ignorance or misconception of natural facts; for it is quite possible that its simple statements may go further down into the roots of knowledge than do the most recent researches of current philosophy. Its words of truth, unscientifically stated, yet may antedate the scientific unveiling of the truths which they contain; and the office of science may be not to surpass the natural facts of the inspired record, but to elucidate them and interpret their real unappreciated meaning. What does the idea of inspiration imply? To say the least, it implies that the human authors were not the unaided authors of what they wrote. To assert that they only wrote what they themselves knew by their human learning is simply to rob inspiration of its force. On the contrary, the set claim of the Bible is that its authors did not themselves fully understand "what things the Spirit of God which was in them did testify." They sought, and sought in vain, to measure the ultimate meaning of the words they uttered. Inspiration, apart from its methods, is the assertion of the fact that God gave men His messages to deliver to their fellow men. It does not indicate that His messengers understood the message. Nor does it affect this question whether the message was delivered in the words of the Sender or of the Messenger. If the message was rightly delivered (and that at least is implied by inspiration) it must have carried the Sender's meaning in whatever words the Messenger delivered it. And therefore, it must be concluded that the assertions of the Scripture are in themselves intrinsically true, in whatever phraseology they may be clothed. Consequently the meaning of statements given by inspiration is not to be measured by the amount of knowledge which the writers of the Bible had, or may be supposed to have had; and to set up their personal knowledge as a limitation to the scientific truth of what they wrote, is to strike out the major factor in the equation of Scripture.

But, after all, this suggested limitation does not affect our immediate question. We are not at this stage of our inquiry

attempting to learn any science from the Bible. We are not now intending to examine any statements it makes about natural phenomena. We are only seeking to form a conception of God Himself from what is revealed to us by the Bible about Him. And this, undoubtedly, is the Bible's own peculiar sphere. This is its first object, the keystone to its meaning in all besides. On this question it is paramount; on this it is peerless; on this it is authoritative. If the Bible is not a true revelation of God it could not be a revelation from God.

6. *The Biblical Conception of God.*

What then is the conception of God, which is given to us from Holy Scripture? Thus He is described. He is the one and only God (Mark xii, 32). He is untiring (Is. xl, 28), eternal (Rom. i, 20), infinite (Rom. xi, 33-36), omnipotent (Rev. xix, 6), omniscient (Acts xv, 18), onnipresent (Jer. xxiii, 24), unsearchable (Rom. xi, 33), unapproachable (1 Tim. vi, 16), immutable (James i, 17), patient (Ex. xxxiv, 6), invisible (St. John i, 18), all wise (Rom. xvi, 27), righteous (Ps. cxlv, 17), good (Nah. i, 17), merciful (Ex. xxxiv, 6), bountiful (1 Tim. vi, 17), glorious (Ex. xv, 11), just (Is. xlv, 21), holy (Lev. xx, 26), and true (1 John x, 20). He is love (1 John iv, 8), and the source of love (1 John iv, 7). He is living (St. John i, 4), and life-giving (Acts xvii, 25). He is the first and the last (Rev. i, 8). He is before all things (Col. i, 17). He it is in whom all things consist (Col. i, 17). He knows the end from the beginning (Is. xxvi, 10). He is perfect (St. Matt. v, 48). He made the worlds (Heb. i, 3). He created all things (St. John i, 3). From everlasting to everlasting He is God (Ps. xc, 2).

Yet further of His Being we have three majestic views. He is unapproachable (Ex. xxxiii, 20). He is a Spirit (St. John iv, 24). He "is" (Ex. iii, 14, St. John viii, 58).

Such wonderful truths do we learn from Scripture about God. Much more indeed is told us, which carries our conception further. But the data here given seem enough, and more than enough, for the object before us; always remembering that, where one text has been quoted, it is frequently but one out of many with the same relation; and that in the Bible God is constantly displayed not only by descriptive words but by the portraits of His acts and purposes.

Can anyone consider this manifold revelation without awe? Verily, as we calmly survey it, all other facts in heaven and earth sink into insignificance beside this stupendous con-

ception of divinity as it is unrolled before us from the lines of Holy Writ. Can anyone form a conception of God from these descriptions without confessing that it is clear in its fulness, but that at the same time it is infinitely above the mental capacity of any finite intellect to grasp. It is a mathematical truism that the finite cannot measure the infinite. So can no human intellect measure God. Man may know God, but he cannot measure God.

And, not only in Himself, but in His attributes, is God above the measure of a man. Take one fact of revelation alone. We have seen that matter must have had a beginning. But God is eternally self-existent. In the presence of Jehovah, time itself and duration becomes an episode. Herein to human understanding the things of God have reached the immeasurable.

But there is another side of the revelation of God in Scripture, which we have as yet hardly touched. Revelation is given us, not only of the Being and the Character and the attributes of God, but of the ways of God and His methods of working.

This, too, is a stupendous subject; one which transcends our power to measure or describe. But yet of it a few things may be said. He works with a purpose, an eternal purpose (Eph. iii, 2). He works and controls by the method of law (Deut. xxxii, 4) and order (Gen. i). His ways and thoughts are superhuman (Is. lv, 9). He has perfect knowledge in, and of His works (Acts xv, 18). His conscious care extends, not only to the vastly great, but to the minutest details (St. Luke xxi, 18). There can be no shadow of ground for attempting to explain away as allegories the plain and precise statements of our Lord: "even the very hairs of your head are all numbered," and "not one sparrow shall fall on the ground without your Father." These are quantitative statements of value, used by our Lord to prove an important truth, which He desired His disciples to believe and realize; and if they were only allegorical, His conclusion would be invalidated. Our Lord was not given to loose reasoning. We are obliged, therefore, to take these statements as meant to literally describe our Lord's view of the minuteness of the care and governing oversight of the Almighty; and one thing is certain, that, whether He knew the conclusions of modern science or not, He knew God. We have, therefore, no option but to conclude that the revelation of God, as to His ways, in the Bible is that of a God, who works by law and in order and consistently indeed, but who yet controls with individual

conscious care the minutest details of all His infinitely vast creation.

7. *This Conception applicable to explain Nature.*

Let us now briefly recapitulate, in order that we may see clearly where we are:—

1. We have learned from Nature, alone, the fact of the existence of one God—the Author of Nature.

2. We have formed from Scripture, alone, a conception of God, the same God who is the author of Nature. This conception, as learned from Scripture, is most wonderful and awful; it has shown Him to us in His person and in His work, in His mind and in His methods. It far transcends our powers to grasp in its fulness; but, up to the limits of our capacity, it is clear, definite, and precise.

The problem now presented to us is this, “Does this conception of God explain the fact of Nature? Is this conception the master-key which shall ultimately unlock the inmost secrets of science? Is it a light, which, thrown upon the discoveries of natural research, shall by-and-by reveal their true meaning? Is it a touchstone, which brought to bear upon the demonstration of philosophy, shall gauge their ultimate value?”

No doubt it may be objected, here, that this is a forbidden way to approach scientific questions. It is said that the idea of God belongs to theology, and that theology may not be introduced into scientific investigations. It is said that to assert a directive cause in Nature is “to rob us of all that Darwin has given us at a blow.” Surely such objections are only worthy of the phantasmagoria of the dark ages. Is it true science to erect artificial barriers to research; or to hedge in opinions by refusing to consider facts? No one wants to confuse science with theology; but facts are no less facts in each, if they are common to both. If the fact of God can be proved from Nature, is it common sense to ignore it there, because it is also the foundation fact of theology? If a directive cause may be predicated from the examination of known effects, is it any argument against it to say that it robs us of Darwinism? If it does so, so much the worse for Darwinism; but surely Darwinism ought to be strong enough to take care of itself. Darwin, at all events, was too fair a man to wish his theories to be wrapped up in cotton wool. If Darwinism is to stand it must be ready to answer all the facts. To shut out a fact in order to save a pet theory, is to

take up a position no better and no worse than that of the mediæval judges of Galileo. It is nothing else than clothing modern science in the cast-off garments of the historic *odium theologicum*. If truth is to be reached, the way to it must be blocked by no barriers of preconceived opinions. It is unlawful to erect upon its highway a placard "No road here; this is not a scientific way." The path to truth is the common right of man. The proper method for arriving at scientific knowledge is that of gathering and sorting facts and generalizing from them to conclusions; and this must be done along every line of research in order to obtain a full result, in order to get an all-round true conclusion. We may, therefore, not only argue scientifically from Nature to the fact of God; but, if by any means whatever we have obtained the fact of God, we may use that fact to elucidate and explain the meaning of the fact and history of Nature. Examine this striking *coup d'œil* of science given by a leading biologist.* "The whole order of nature, including living and lifeless matter—man, animal, and gas—is a network of mechanism, the main features and many details of which have been made more or less obvious to the wondering intelligence of mankind by the labour and ingenuity of scientific investigators. But no sane man has ever pretended, since science became a definite body of doctrine, that we know or ever can hope to know or conceive of the possibility of knowing, whence this mechanism has come, why it is there, whither it is going, and what there may or may not be beyond and beside it which our senses are incapable of appreciating. These things are not 'explained' by science, and never can be."

Here is the "mechanism" with the voice of science within it, and the silence of science around it; and that voice re-echoes through its sphere; "it is a mechanism—a network of effect—there must therefore be a cause for all." Science cannot tell us "why it is there," but it does tell us, as we have already seen, who caused it to be there. The ordinary methods of scientific enquiry do not exclude the examination of nature in the light of God. They do not render its importance less. They do not militate against this being the only ultimate way, by which the origin and course of Nature shall at last be fully comprehended and rightly understood. We can learn much about the production of articles of pottery by scientifically examining their character and

* Professor Ray Lankester in *Times*, May, 1903.

analysing their constituents, but the authoritative way to understand their making is to see the potter at his work.

8. *Its effect on scientific phrases.*

Before proceeding further, let us observe what new light is shed by this conception of God upon those three terms which we have found sometimes to be used with a kind of scientific idolatry to the confusion of thought.

First the term "Nature" itself can no longer be used as an undefined potency or controlling principle, from which to legislate on the conduct of discovery. It can no longer be regarded as a kind of talisman, by which to explain anything which cannot otherwise be easily explained. Nature now becomes a synonym for the workmanship of God; it is an equivalent phrase to the "mechanism" of God. To say that "Nature does or permits or requires a thing," is simply to say that "God does or permits or requires a thing in the realm of nature." We may use the old phraseology still; but we must use it with this meaning alone.

Secondly, the term "evolution" must cease to assume any idea of intrinsic power or self-originating energy. It cannot be too emphatically remarked that it is the reading into the theory of Evolution that idea, which is really extraneous to it, which has led to much of the warmth with which it has been debated. much of the intolerance with which it has been asserted or denied. Scientific thought has forgotten, that if it would bar theology from its purview it must not itself intrude on the sphere of theology; if it limits itself to the consideration of secondary causes, it thereby puts not only theology but itself out of court for scientific deductions regarding the origin of Nature. The moment it makes any implication whatever, regarding the *a priori* meaning of evolution, it knocks down its own artificially erected limits, and opens the field not only to its own, but to all other valid evidence on the prime foundation of the edifice of the Universe. The impression has been formed that the explanation of the change of species by slight variations, by natural selection, by the struggle for existence, by the operation of environment, by internal development, somehow reduces or removes the possibility of the action or control of the First cause. The bringing into prominence of a number of minutely working secondary causes has appeared to leave no room for the Will or Working of the Creator. But the flaw in this reasoning is after all remarkably clear. However much the secondary causes producing any particular effect be

minimized and multiplied, the sum of the force of causation required to produce that effect, remains the same. No particle of that force can be originated by the interaction of the secondary causes; it must originate altogether from the First Cause; and, therefore, if (as we have seen) the First Cause of all Nature be God, evolution, assuming it as a fact, however potent, and however extensive, cannot in the slightest degree touch either the power or the will of God. Evolution now can only mean the method (or a method) by which the Creator has chosen and chooses to work.

Thirdly, the term "*laws of nature*" can no longer be supposed to mean independent principles governing the Universe. Their aspect natureward is not changed; but their aspect Godward is explained. They are laws of God, not laws on God. They are laws upon nature from God. He is their law-giver, their supreme controller; and the reason of their existence is His changeless will, and that alone.

Thus the conception of God, which we have obtained from Scripture, must be, if we have rightly understood it, paramount over nature, evolution, and natural laws.

9. *The kind of creation to be expected from such a God.*

We may now proceed to inquire, what, taking the conception of God given to us by Holy Scripture, should we expect the character of His work to be? *And be it clearly understood that this inquiry has nothing to do with the examination of actual natural facts.* We are not at present infringing upon scientific research, but arguing entirely from the scriptural notion of God. This no naturalist can dispute our right to do, for we are moving definitely outside his domain. We have here to consider, not what God's actual works were, but what characteristics in most general outline work, if done by Him, might be expected to present. If God be such as He is represented to us in Scripture, what would probably be the main features of a creation produced by Him?

(1) As the Lord our God is *One God*, His creation would be expected to show a fundamental consistency in all its parts. The action of unity would underlie the whole. However varied, however elaborate might be its results, the impress of one mind would appear right through. Every detail, however individualized in itself, would be capable of being traced back, if traceable at all, to a common origin. Consistency in the work would be the sequel of the oneness of the Worker.

Now it is true that we have already argued from the consistency seen in actual Nature to the unity of its Creator; but our present thesis is quite independent of that. We are not now dealing with actual nature. We start from the Unity of God, definitely revealed to us in Scripture, alone and apart from anything else; and, therefore, from that we may argue *de novo* to the converse of our former proposition, and from the Unity of the Creator, as declared by revelation alone, premise that consistency must be expected to appear all through in His creation.

(2) As God is *untiring*, His creation would be expected to be instinct with ceaseless motion. Movement would be everywhere. Wave after wave of divine impulse would well up over the ocean-face of nature, commingling, dividing, expanding, divaricating, conveying motion to its tiniest particles, surging up into exuberant spray, stirring its molecules, moving its mountains, effecting one universal state of movement, latent, slow, or fast, in all created things. Its very rest would be the rest of unexhausted activity.

(3) As God is *eternal*, His creation would be expected to be æonial—age-long. Time, that by our measure seems vast, is of no account in the measure of the Eternal. Whether the age of the earth were, as supposed of old, 6,000 years, or, as supposed now, hundreds of millions of years, it would be equally an episode in the vastness of eternity. And it is only to be supposed that the likelihood of length of work by the Eternal would be vast; and that, as the earth is small compared with the stars, so the age of the earth, whatever it be, would be small compared with the age of the stars. From the point of view of eternity, time is of no account whatever in creation.

(4) As God is *infinite*, His creation would be expected to be vast in extent. As of time, so of space the work of the limitlessly Great may be expected to be immeasurably great. As we attempt to image the distance of the farthest star, we discover that its magnitude is below the scope of the measure of the infinite. The Infinity of the Creator suggests the presumption of magnitude in His creation—magnitude, perhaps, as yet unimagined by man.

(5) As God is *omnipotent*, His creation would be expected to be majestic. The forces brought into action may be stupendously enormous; the results produced may be unutterably grand. The voice of power thrilling through the universe must find an answer most magnificent.

(6) As God is *omniscient*, His creation would be expected

to be perfect in order and arrangement;—no part overlooked—no part neglected—no part unguarded by His active knowledge. There would remain no room for accident or chance; and the whole structure fitly framed together would grow up into a cosmic master-piece.

(7) As God is *omnipresent*, His creation would be expected to be elaborate in detail. The impress of His power would be felt at every point, the mark of His presence would rest on every particular. Nowhere would there be failure through any lack of strength; nowhere would there be flaw from the absence of His hand.

(8) As God is *unsearchable*, His creation would be expected to be recondite beyond our bounds of knowledge; the roots of it would strike down beyond the limits of our ken; the explanations of it would go deeper than human intellect could fathom; the foundation of every science of it would rest on postulates and axioms to be accepted but not understood.

(9) As God is *unapproachable*,* His creation would be expected to be full of mystery. The lines it took would ever and anon be shrouded in the clouds that veil His presence; the ways it followed would lose themselves in the darkness that is around His Being; the “why” and the “how” of it would ever tend to vanish in dazzling heights of wonder beyond the comprehension of any finite beings.

(10) As God *knows the end from the beginning*, His creation would be expected to proceed on a definite plan to definite ends. There would be in it nothing of chance in its progress, nothing of failure in its design. Each portion, as it went on, would have its reason in its arrangement, which might indeed seem lost for a time, but which would in due season come out to take its proper place in producing the ends for which it had been originally ordained.

(11) As God is *immutable*, His creation would be expected to proceed upon a plan, which was not only definite but undeviating. There would be no deflection in its aim; no variation in its purpose. Its course would not change at hazard, but would only so alter as to form progressive steps in the development of its primitive unalterable plan.

(12) As God is *patient*, that plan would be expected to be worked out slowly, unhurriedly; built up in calm sequence

* This word is substituted for “incomprehensible” according to the suggestion of Dr. Wallace, p. 42. It more clearly expresses the meaning of 1 Tim. vi, 16.

stage upon stage, each given full time for its proper development, each duly prepared for the sequence of its successor. Nothing would be hastened; nothing would be left incomplete; and nothing would be delayed beyond its proper time.

(13) As God is *invisible*, His creation would be expected to be unseen in its inception, and only revealed in its results. His mechanism would have hidden origins, which would come into view only as reflections of its progress towards maturity. The more distant causes producing each effect would be invisible or dimly seen; and to human eyes the results would appear to grow up of themselves, simply because the Hand that was producing them was hid.

(14) As God is *all-wise*, His creation would be expected to display His wisdom at every point. The best course would be adopted to attain the destined end. Adaptations would be found most suitable for all requirements. Devices would be seen most fitted for all emergencies. Arrangements would be continually met with which would prove, when rightly discerned, to be exactly the best arrangements to meet the circumstances under which they occurred.

(15) As God is *righteous*, His creation would be expected to exhibit moral governance. Direction towards right, advance toward perfection would pervade its course. Its laws would be sternly against evil; its retribution for wrong severe; its rewards for right effective. Its controlling forces would ever make for good; and that good, as it developed, would be found to be not the immediate material advantage, but ultimate moral good of the loftiest kind.

(16) As God is *good*, His creation would be expected to be full of the results of goodness. It would display beneficence. It would produce benefits. It would be the shedding forth of goodness throughout the fulness of its course, and the perfecting of goodness in its end.

(17) As God is *bountiful*, His creation would be expected to be rich in all its phases. There would be no niggardliness in its execution; no straining to make two ends meet; but a wealth of resource and a wealth of production, a superabundance of supply for every possible demand.

(18) As God is *glorious*, His creation would be expected to be beautiful. The expressions of His glory would appear in His productions. Beauty would permeate and overlay them all. That beauty would be displayed in infinitely various ways. That beauty would have innumerable ends and uses. But it would exist for itself and not for its utility. It would be the

expression of a consequence and not an aim. Its presence would need no explanation except the nature of its Maker. Its supreme object, displayed on every hand, would be its testimony to the creative glory of God.

(19) As God is *loving*, as God Himself is *love*, His creation would be expected to be replete with fruits of love. It would be joyous, exuberant with happiness, sparkling with joy. It would be tender, meeting the needs of all with gentle effluence. It would be, in its fulfilment, the impression of the smile of God upon the universe, the transformation of chaos into glory by the irradiance of love, the filling of the formless void with the splendour of the love of God.

(20) As God is *the living God*, His creation would be expected to be everywhere controlled and energized by the impulse of His Life. He would not start it into action and then leave it alone to work out from within itself its successive results; but His care, His direction, His active control and sustenance would be ceaselessly felt throughout. His vitality would maintain it, His will would rule it. The pauseless power of His endless life would cause it to progress to its full and perfect consummation.

(21) As God is *the life-giving God*, His creation would be expected to be replete with life. Whatever be the secret of life, it could never be supposed, that He, the fountain of life, would be satisfied with a lifeless creation. It could only be expected that He would make it instinct with life; and further that He would not merely use His life-giving power once for all, but would be continually bringing out into it a fuller and yet fuller effluence of life. It might well be imagined, too, that it would be made rich, not only in abundance of life, but in abundance of forms and phases of life; and that as it advanced to completion those forms and phases of life would be higher and nobler. But it may be noted that from this premise no conclusion could be drawn as to what method He would most probably employ in the production of life. The question whether He would be more likely to work by direct creation, or by divine action upon existing life which He had already created, or by both of these methods, is not here affected, and must be judged by other considerations. Divine creation is doubtless the antipodes of spontaneous generation; but, granted the acts of a life-giving God, the method employed in these acts becomes a matter of detail.

(22) As God is a *Spirit*, it would be not unnatural to expect that His creation would culminate with the type or kind of

life most congruous with, and akin to, His own. If therefore we found life advancing throughout creation, until it was crowned by life that was spiritual in character, and if further that spiritual life could only be accounted for by the presumption of its coming straight from Him, we should feel that the Mind of the Maker was thus most evidently reflected in His work.

(23) And lastly, as we have learnt on the highest authority that God not only produces His creation as a whole, but *knows and numbers its minutest parts*—as instances of this are expressly told us by divinest revelation—it would be expected that the perfection of His creation would go down to its extremest details, go down to the minutest textures that the microscope could display and to the molecules and electrons that can be only observed by means more delicate than sight, go down beyond the utmost power of our ken or the acutest perception of our minds. It would be expected that every atom of it would display the same order, beauty, and perfection, that is displayed in its mass; and that throughout it the inconceivably little would as definitely bear the impress of its wondrous Maker's hand, as does the majestically great.

Here we might stop. The conception of God, given to us in Scripture, would lead us to expect an ideal Creation. It portrays to us a picture strangely and minutely resembling the actual universe of nature, but yet as far above it as heaven is from earth. Its vision is the poetry of Nature's prose. The scene resulting is as sound to its conception as a scientific deduction is to its data; and yet we must confess that science and even common knowledge show many dark lines in the spectrum of actual nature, which are utterly unseen in this picture it has drawn.

10. *Modification of it required by the Biblical conception of Evil.*

But Scripture has other facts to present to us, besides the knowledge of God. It reveals to us the existence of evil. The Origin of evil is confessedly mysterious; it is a thing explained neither by Scripture nor by nature. Of the results of its existence Science has much to tell. It has abundance to say about the struggle for existence, and degradation and suffering; but when called to find their reason it stops dead. It admits the facts, though it can offer no valid explanation of their cause. It cannot, then, refuse any confirmation of its facts that may be found elsewhere. Nor can it object, if from that other source we are carried a step further back in the explanation of those facts than it can go itself. Such an explanation is learned from

Scripture in its assertion of the fact of a Power of evil. In Scripture we are introduced to it, not as originating, but as already existing. We learn, indeed, how it first affected man in his moral capacity; we learn, too, how that moral fall affected his physical condition. We have in set terms the description of how it wrecked the noblest work of God. But doubtless the fall of man was not the first triumph that his tempter had achieved. It may have been that the traces of his trail might be found marring the works of God for many vast ages before. It may have been that it effected pain and suffering and death in the prior stages of creation long before it won its final triumph in the fall of man. God, when He saw His creations, said not that they were perfect, but that they were good. The former of them may have been liable to the assaults of evil, just as was the last. How evil came; why it came; when it came; we know not. There may have been a divine necessity for it among the incomprehensible things of God. But this much we learn—that evil must be an episode in eternity; thus much we know,—that God brings out of evil greater good; and thus, from what is taught us in the Bible, it is to be expected that, in a nature that is a creation of the Bible's God, the evil, where it exists, shall always become subservient to the good. Yet that its origin is unmentioned when first it came in contact with mankind, is almost proof that it existed from of old; and thus, from that, dark lines would be expected in the spectrum of the rising world.

11. *The conception thus formed agrees with actual Nature. The limits of its use in its elucidation.*

If then, very feebly no doubt and faultily, we have formed at all a true conception of what a creation, formed by such a God as is revealed to us in the Bible, but yet infected by some adverse influence, might be expected to be; and if now, in turn we examine the existing world as we see it to be in fact, both in its more familiar aspects, and also in those deeper views which have been displayed to us by modern science; we find that the pictures produced by each upon our minds are to all purposes identical. These two views have been obtained in totally independent ways; the one is wholly based upon deduction from the Bible's revelation of God, together with its indication of the existence of evil; the other is entirely formed from the examination of actual facts, except that any considerations from the fact of God have been excluded; and yet by these two absolutely diverse processes we have found ourselves

reaching results which are distinctly in co-ordinate agreement. The conception of nature, derived from the Biblical conception of God, corresponds in broad outline to a most remarkable degree with the facts of actual nature as far as we are capable of discerning them. Hence we may be justified in using this conception of God in working out the meaning and the interrelationship of those facts of nature. We may not, of course, use it for the accumulation of new facts; we must rigidly exclude it from our scientific investigations; but for discerning the ultimate meaning of those facts, the goal of those investigations, it assumes the first importance. Certainly we cannot expect to arrive at any scientifically true explanation of them if we neglect or ignore so great a factor in the problem. That is, the knowledge of God is the key to the right understanding of the science of nature. If we would see nature in its right perspective, if we would view it from the point where all its lines come straight, where cause and effect are in their proper places, where there is no distortion from position, no confusion from a cross-wise view, we must take our stand-point on our knowledge of God, and view it, as far as may be, as it is viewed by Him.

12. *Evolution as a Method of Creation.*

Let us in this light attempt briefly to examine the question of evolution, regarded now as a method of creation. God's presence is all-extensive and perpetual. He is not as one who makes a thing and goes away. In all the course of nature, and in every part of nature, He is a present active God. If divine immanence* means no more than this it is a truism; if it implies anything different from this it is a misnomer. The existence of nature in its every atom momentarily depends all through upon the present life of God. But, on the other hand, creation is the work, not the growth, of God. He is unchanged, unchangeable, by the progress of nature. He is its independent First Cause. He originated it all. By His Will, and by that alone, it came. He is the final antecedent source from which the entire cycle of nature, material and otherwise, had its origin. He is its continual governor. Its laws are by His ordaining and are completely under His control. He is before all things. He sustains all things. In Him all things consist. How then would "Evolution" fit in as the method—the only method—by which He worked? It is now commonly

* "God's immanence in Nature" seems to be a statement inverted from that of the profound truth of "Nature's immanence in God" (Col. i, 17).

suggested that the old notion of separate creations is impossible; that it is scientifically absurd to conceive new species coming directly into existence as fresh starting-points; that the only scientific explanation of the vastly various kinds of existing life is that life first came into the world as protoplasm, and that thence it developed from within itself until the present order of existing species was achieved. As we have already seen, the old notion that evolution somehow did this by its own potency is absurd. It cannot have any independent power of its own—it can only be a means or order of working adopted by the pleasure of God. Now, undoubtedly, God does work from within. Every created life is a wonderful piece of machinery built up by God from within;—or rather, to be more accurate, from within and from without together; for no living being exists and grows from within alone; things external to it are necessary for its life and growth; and these external things must have been provided for it by a Power without itself. And though God does work from within, the source of His work cannot be described as *intus ab intra*; it must be *intus ab extra*; for the Creator “was,” before any created thing became. The first thing created could not have come by evolution. There is, therefore, no *a priori* necessity that evolution should be the only method of creation. In the elaboration of non-living matter, in the progress of a world, the process must be that of building up, by whatever term it be described. That which has only mechanical or chemical power can only produce mechanical or chemical results. In the mental sphere it is clear that intuitions from within are originated or fed from perceptions from without. In social matters advance is largely caused by experience; and the accumulation of experience has no kin to the evolving of ideas. Something, then, must be added to evolution to obtain a complete description of method.

But as regards living things, it may be well to ask to what the claim of evolution amounts? All intra-specific life is a genealogy. It is admitted, that, within a species, succession of life comes only by descent. No one doubts that each species has an unbroken sequence of ancestry from its beginning to its end, in spite of any variation within itself. The claim of extreme evolution is that all these separate genealogies are themselves genealogically connected; that, in spite of their present utterly diverse aspects, they all form a single long genealogy, continuous by descent from the very first origin of created life. From our present point of view it may be freely acknowledged that this is within the bounds of possibility. There is nothing *a priori*

to render it impossible that the Creator may, if he choose, have ordained to work by this method, and by this alone. Evolution thus becomes a subsidiary theory of method, which requires to be proved by detailed evidence. It cannot be established by assumption; and at present its direct proof is confessedly not complete. No doubt it has claimed a very general acceptance at the present time among scientific authorities. But this is the acceptance of a presumption based on a vast network of facts united by assumptions, not of a consecutive proof definite beyond controversy. There is still much to be said about it on both sides. There are many and great difficulties to it, some of which have been generally ignored, some perhaps hardly as yet generally realized. Moreover, its supporters have been obliged to introduce extensive modifications into its aspect. While they have retained their conclusion, their explanations of its causes have varied, are varying, and are subjects of dispute. Certainly the great hypothesis has been forced materially to change its form; and it has responded with Protean facility. Terms have been imported into it, which would have been regarded as fundamentally antagonistic to it in Darwin's time. Rapid, almost sudden change, has, for instance, been invoked to replace imperceptible variation. It does not come within our present subject to examine any of the facts upon which it is based, or the difficulties and contradictions which appear to underlie it. It is enough to remark, that, in spite of a vast accumulation of apparently supporting evidence, it still rests very largely upon inference and assumption; and that many more facts would be required, and many of those very hard to get, before it could be held, at least in its extreme phase, to be infallibly established.

But at present our question is this:—how does Evolution stand, when viewed from the light of the scriptural conception of God? Does it seem an adequate explanation of the probable methods of His working? As we have tried to realize what kind of creation might be expected to become from such a Creator, can we go a step further and conclude from our idea of Him, that evolution looks as if it was the method—the only method—He employed in its production? We confess that to us it seems, in this light, altogether too narrow an hypothesis, too poor an explanation! He, the all-wise, the all-providing, worked to form the worlds; and, in this world, to form existing nature. Abounding signs of unison in nature point to His Unity; but do they prove a unity in front of Him? Is it probable that He, to whom all methods were possible, should

have restricted Himself to this one method of producing all the phenomena we see? Is it probable that so great, so wise, a Life-Giver should have followed this somewhat roundabout plan of causing every kind of life He gave to earth to pass through the lowest phase of life imaginable? The earth has a handmaid, the moon, which collects the sunlight and reflects it on our globe. But because we know this, should we be justified in arguing that all the sunlight ought therefore to be collected by the moon, before it can reach the earth? Is it not rational for the sun to send us its light (as it does) in other ways as well? Does the moon leave no room for direct radiance? So, assuming for the sake of argument that evolution is one way by which God chose to work, does it therefore exclude all other ways? Might not direct beams of life have come to earth from God throughout the ages? Is it scientific to limit without proof the methods of the Infinite to one alone, and that a way whose aptness for all purposes is liable to doubt? We speak only of probability. His way may have been always so. But, certainly, it is not easy to imagine, that in introducing new elements of creation into the world, in building up new stages of advance throughout the ages, He should have caused them all to come by that single mundane way of evolution. It is not so easy to imagine that in making all the stars He should have caused the one primeval substance, separated to each, to evolve, independently and separately, into the materials which the spectroscope reveals to us now to exist in all. A wider theory of method than evolution seems capable of supplying seems needed adequately to explain the manifold works of the Creator. A larger theory of life than any that has yet been scientifically formed, seems required to fulfil the correspondences implied by the Biblical conception of God.

13. *The Biblical conception of God fulfils all requirements of science.*

We may therefore finally assert, that the Scriptural conception of God fulfils, and more than fulfils, all the requirements of modern science in the realm of nature. Discovery has not yet spread out a result which exhausts the powers of that conception. There are no signs that it can ever do so; indeed it may be said that it has become fundamentally impossible that it ever can. For if it is to rebut it, its only possible line of argument must be to show that the discovered facts of nature are as a whole incongruous with our conception of God; and when, as we have seen, the

known congruities between them are so multitudinous and so vast, the possibility of science ever hereafter finding an overmastering incongruity is absolutely *nil*.

IV. THE THIRD LINE OF INQUIRY, *i.e.*, BY WAY OF HISTORY NARRATION.

1. *The Biblical account of creation historically true.*

One other side of the matter remains. We have concluded that the Scriptural conception of God is congruous with, and adequate to account for, the innumerable facts of existing and historic nature. But we not only have the history of creation written by God in the books of nature; we also have accounts of it given to us by inspiration in that very Book which has taught us about God. No doubt the statements about creation in the Bible may be deemed subsidiary to its main purpose, and may be judged in some degree by their own weight without necessarily affecting the authority of the book with regard to its primary object. Some even strangely explain them as only human concomitants of divine revelation, ignoring their organic connection with the most evident messages of God. The question is raised whether these descriptions are true to the known facts of nature, and tally with what has been discovered about it by science, or whether they are to be treated as allegories, myths, or dreams.

Beginning with the latter alternative of this question, we may firstly inquire, whether there is any reason for regarding the account given in the first chapters of Genesis as a vision or dream. This theory has been put forward to meet the supposed difficulty of the shortness of the creative days. It supposes the course of creation to have been revealed to Moses in a series of visions, each of which lasted through a solar day. All that need be said of this theory is:—first, that it seems unnecessary, for the supposed difficulty of the “days” can be far better explained by other interpretations; and, secondly, that it is altogether gratuitous; for there is nothing whatever in Scripture to suggest it. The accounts in Genesis purport to be plain narrative; and the allusions to the work of creation even in the poetical books are clear-cut and precise, as if they alluded to historical facts. The institution of the Sabbath, moreover, most certainly would not have been made to commemorate the stages of a dream.

But the suggestion that it was *an allegory* or *myth* is far

more serious. It touches not the manner, but the matter of the revelation. It appears to be a veiled assault upon the veracity of the Bible. The acceptance of such an allegation would raise a grave difficulty to its authenticity in its integrity as an inspired book. We fully admit the human element in the preservation of Scripture. We know that our copies have been liable to inaccuracies of transcription, inaccuracies of translation, inaccuracies of interpretation, which may have crept into the Holy text itself. We fully admit the human element in the production of Scripture. We admit that its authors were themselves fallible men and were limited in their own knowledge, while we believe that they wrote all through as they were moved by the Holy Ghost, the controlling Spirit of truth. But if the Bible is anything at all it has more than a human element. Its messages are not to be measured by the minds of its messengers. It was professedly not always given to them to fathom the scope of their own utterances. We are not afraid boldly to assert that all Scripture was given by inspiration of God; and that whatever else inspiration means, it means this, *that the whole Bible, in the state that it came from God, is the word of God, the true word of the true God.* We are quite ready to suppose, if need be, the employment of pre-existing archives and documents. We see no grounds for alleging that the early patriarchs could not themselves have had Scriptures that are gone, nor that old documents could not have been transposed from ancient to more modern language. We know no reason for denying that Paradise and the Flood and Babel were not only actual *experiences, but lingering memories.* But that the first chapters of Genesis, whatever their human source, *were written under the inspiration of God* is as certain as that the Gospels themselves were so given. How different are they from the myths of the Babylonish tablets. These may have caught reflections of early truth, perchance, from some inspired source, from some pristine parts of Scripture, but inspiration is not in them. Can they be compared with the facts of modern science? Beneath that touchstone is not their debased and mythic character at once revealed? Can it be said of them, as it has been said of Genesis, "it would not be easy now, to construct a statement of the development of the world in popular terms so concise and so accurate?" But most of all, the first chapters of Genesis were quoted as authentic records by our Lord, and his view is for us the seal of authority.

2. *Its actual, if not apparent, agreement with scientific fact.*

We have, then, to accept the earliest chapters of Genesis as definite statements of fact as understandable at the age in which they were written; and we must, therefore, examine how far they can be interpreted in agreement with the facts of nature. Yet though interesting, it is quite needless that their harmony should be found. Two mathematical results, reached by different processes, may be identical, and yet not be comparable in terms. But any forcing of them into apparent agreement is to be deprecated most strongly; any confusing of their mutual details is not only unscientific, but misleading. Science must make its own way from its premises to its conclusions. Any attempt to build it up with theses from revelation is fairly certain to result in a congeries of misunderstandings of both, and is likely to produce much the same effect as an equally mixed French and German translation of a Greek author. But yet the fact of their ultimate harmony will rise up behind their respective vistas, as the grand dim shadows of the same eternal hills rise up behind two parallel landscapes. Scripture was certainly never intended to teach science, but yet more science may be contained in it than we know. Its simplest words may reach profounder depths of knowledge, than the most elaborate explorations of philosophers have fathomed. If God indeed inspired the Bible, it most certainly comes from One who knows. It is risky, to say the least, to charge it with ignorance or impute to it inaccuracy. Its accounts may be given in plain unscientific language, suited for the minds of those who knew but the barest surface of nature, and were ignorant of modern philosophy, and still they may be based upon a far more scientific cycle of truth than is ours even yet. A learned father may write to his little child in very simple language; but the child would be foolish indeed, if it concluded that, because its father's language was simple, therefore he did not know as much as it did itself; and if, as it grew older, it still judged its father's learning by its first interpretation of its father's old letter, it would only be more foolish still. Even so it may be with the Bible. Its language may be unscientific to our sense, and yet may mean truths above our research. Most remarkable is the fact that it has fitted in, age after age, with the increasing knowledge of mankind; and that the most recent science does not yet seem sufficient fully to measure the meaning of its description of creation.

V. CONCLUSION.

And what of this great world of Nature now, whose building science has so wonderfully described, and Scripture so graphically in brief set forth? In spite of all the imperfection, pain, and sin it holds; in spite of that marring of it by evil, which is equally predicated both by science and the Book; in spite of its present rest being shown, by both, to be no final rest but a pause before the last great consummation of all things; as it looks upon its beauty and its joy, its vast variety and its teeming wealth, its wondrous adaptations and its all-pervading order, its marvellous minuteness and its unmeasured grandeur, does not science estimate it exactly as it is estimated in Genesis? Can human learning adequately describe it, except it borrow the actual words of God, and pronounce it "VERY GOOD"?

DISCUSSION.

The SECRETARY (Professor E. HULL).—Perhaps I may be allowed at this moment to personally thank the author of this eloquent and able paper, which, when I read it in manuscript, struck me as containing much original matter and thought, particularly in the description of the attributes of God and their resemblance to those of nature, or I would rather say as reflected in nature. That struck me as a part of the paper which, if there were none others in it, would of itself demand the thanks of this Institute. (Applause.)

I therefore, personally, as well as on the part of the Institute itself, thank Mr. Whidborne for giving it to us, because I am aware that the paper was not originally written for the Institute; but, at my suggestion, when he put it into my hands, I saw it was a paper that ought to be brought before the Institute if the author were good enough to allow it to be read here.

There is one point that I wish to refer to. I would call attention to a work by a very distinguished naturalist, Dr. Alfred Wallace, F.R.S., whose name we are all familiar with. He has brought out a work in this present year under the title of *Man's Place in the Universe*, in which he opposes the views of writers, some of whom were men of great eminence, such as Herschel, Chalmers, and Sir David Brewster, all of whom maintained that there are other

inhabited worlds in the solar system beyond our own. Brewster's work, entitled *More Worlds than One*, received, as you are aware, great attention and support when published, but Dr. Wallace shows on purely physical grounds that those views are untenable, and with great elaboration contends that this world alone amongst others of the universe has been the home of such a being as man, and has been, therefore, the object of the Creator's special care and governance. Surely this is in accordance with scriptural doctrine. Nowhere in the Bible are there any references to God's dealings with inhabitants of those celestial bodies as He has dealt with those of this world of ours in the work of creation, supervision, and redemption. Of this world alone it is written, "God so loved the world that He gave His only begotten Son," and again, "The Heaven, even the Heavens, are the Lord's, but the earth hath He given to the children of men."

This subject, I was going to say, hardly bears on that of the paper, but I now think perhaps, to some extent it does, and I thought it would be interesting to you to know the views of such a distinguished naturalist and philosopher as Dr. Alfred Wallace on a question of this kind.

Mr. MARTIN ROUSE.—Three times at least the quotation given by the Secretary occurs in such a remarkable way as to suggest to the mind that the speaker was alluding to the universe containing many such worlds as ours. Twice, at least, it is mentioned in connection with Deuteronomy, Micah, and Nehemiah, "Thou hast made the Heavens and the Heaven of Heavens." Solomon appears, at the dedication of the temple, to have expressed it, "Behold, even the Heaven of Heavens cannot contain Thee," and therefore the words added, "and the host of them," after the expression "the Heaven of Heavens," imply, to my mind, that the vast universe, with its different celestial bodies, was in the mind of the speaker, who, however, might not have known the full import of his words (though God afterwards gave him very great wisdom, and probably he did), and that this was the only world surrounded by its Heaven, while the Heaven of Heavens contained a yet greater host.

Rev. F. A. WALKER, D.D.—May I be allowed, though it is difficult to say anything in criticism of such an admirable paper, to draw attention to a few points of detail?

The author, speaking of the attributes of God, says, "as God is

incomprehensible." I would not venture to impugn the meaning of that expression, but if an equivalent could be found for it in meaning I think it might be desirable, considering that in the Athanasian Creed "incomprehensible" is used as meaning illimitable, "whom the Heaven of Heavens cannot contain," beyond all creation. If some equivalent could be found for that I think it might be as well, as it is used in theology in another sense.

Again he says, "As God is glorious," I note that Mr. Whidborne speaks of beauty existing for itself and not for its utility. I think that is amply borne out by Dr. Wallace in his "Tropical Forest," where no human being had been before to study science. He speaks of the floral world and birds of paradise generating, flourishing and disappearing as unseen objects by man for generations, with no one to enjoy their beauty: showing that these creatures exist for themselves and not for their utility. Some of the most glorious objects of creation have only been seen the last thirty years by man. Some of the most splendid birds of the most varied colours and most gorgeous plumage are amongst these.

Again he says, "As God is righteous." It struck me as I heard that read, that the sting in objects of creation is a very recent thing, and the bite on the contrary (dentition for mastication and offence—the organ of the teeth) is common to all objects, from man downwards. Of course we see adaptations suitable for all requirements in the creation around us in the present day; how moths of the same species are varied in colour according to the country they live in, and the colour and texture of the geological regions in which they are found. The same kinds are very varied in the west of Scotland and the middle of Iceland, because of the different-coloured rocks, and for self-protection their tints will harmonize with the colours of those stones.

WALTER A. KIDD, M.D.—There are many general points I should like to refer to in connection with the paper. It is a most valuable paper, and most courageously and properly maintains the right of religion to have its voice heard on the subject of the Genesis of Nature, which is not often maintained with sufficient courage in discussion. Mr. Whidborne, who is himself a geologist, has as much right to be considered an expert in this matter as other scientists have on their side, for these questions run on converging lines of evidence, and if Mr. Whidborne and his like are

experts on the side of religion and they know what the Bible, broadly interpreted, has to say, we should be ready to listen to that side of the subject, and I think this question of the converging lines of religion and science is a very important one.

Dr. SCHOFIELD.—I think the argument of this paper, in its general terms, as universally accepted, that “In the beginning God created the heaven and the earth,” has long passed from a religious statement into a scientific fact, accepted, in various terms, one may say, by all thoughtful scientists, and therefore I think that the larger part of this paper, beautifully thought out as it is, contains matter generally accepted. Only Mr. Whidborne has shown us, in the way he puts it before us, the steps by which it can be argued out.

There are only three possible propositions—either the world must have created itself, or it must be eternal, or some one must have created it. The first two are generally discredited, and the third leads us to the First Cause, and is accepted by all Christians. When you read Mr. Whidborne’s postulates as to what nature should be like in his twenty-two or twenty-three propositions, of course we are quite aware that nature is not like the picture, so the author gives his reasons for the discrepancy in his section headed “Modification of it required by the Bible conception of evil,” but then you see scientists who do not accept the Bible do not accept that. Mr. Whidborne, myself, and I suppose all of us, believe that the First Cause was a God of love and light. The conception of evil is of course a mystery, and the account given of it in the Bible is not accepted by all scientists. They regard it as a real stumbling block to scientific theology, and I think it must continue to be so to those who do not accept the Bible. I do not think it is possible to reach God without the Bible—you cannot without it discover the first cause of life and the first cause of evil. Mr. Whidborne accounts for this according to us, who *are* Christians by the Biblical conception of evil.

Then I would just like to say that the paper is of particular value, I think, in presenting evolution definitely as a method and not as a force. Mr. Whidborne seems to find a great difficulty when he says, “It is not easy to imagine that in introducing new elements of creation into the world, in building up new stages of advance throughout the ages, He should have caused them all to come

by that single mundane way of evolution." To some of us it is quite easy to imagine that. We can imagine the Divine hand giving the ovum power to evolve to a greater extent its successive stages and to reproduce higher animate forms.

In his definition of inspiration I would ask Mr. Whidborne if he would not like to alter that slightly. I refer to the passage, "Whatever else inspiration means, it means this—that the whole Bible, in so far as it came from God, is the word of God." But supposing it did not come from God. Well, that is the whole point. Inspiration means the whole Bible is the true word of God. What Mr. Whidborne meant to exclude is the human element in it, no doubt, but it rather spoils the weight of that beautiful phrase.

Then the point from which Mr. Whidborne regards creation is a beautifully poetic view; but I do not think it is necessary that everything I make should be like myself. It is wonderfully beautiful to say that the way in which nature may be described is as "the vesture of the living God" in the way it shows itself, but in many ways it does not. Some of the postulates therefore strike me as being a little forced, but on the whole I thank him for his most valuable paper.

Professor ORCHARD.—I wish to express my obligation to the author for this valuable paper, marked, as it is, not only by logical acumen, but by philosophical insight.

I may have misunderstood the meaning of the author, but in one paragraph there appears an assertion that "the immaterial part of nature itself is dependent on the material part, and has, as far as we can see, no power or vitality, which is not founded on the material part." If we look at the top of the preceding page we see, "certainly the matter of the brain did not come into existence by thinking; as certainly thought cannot owe its origin to the mere mechanical structure of the brain." It appears to me there is a little inconsistency in those two statements, and that possibly the author might slightly modify the expression.

I think we shall all agree with the author in his main thesis, which I understand to be that nature illustrates the Bible conception of God. Surely it is fair to say that a workman is known by his work. Anyone making an elaborate piece of machinery will probably show whether he is wise or unwise—whether he is skilled or the reverse—and so undoubtedly a complicated and elaborate

piece of work does bear witness to the attributes and qualities of the worker, and doubtless that is so in nature. "The invisible things of God are clearly seen by the things which are made." That His eternal power—His Godhead, His goodness and providence are all revealed by nature, we must certainly agree. I must concur with the author that anyone unacquainted with nature might have anticipated from the Bible that nature would have the main features it presents to us. It seems to me that is a powerful argument which might be added to the list here for the inspiration of the Bible as being the Word of God. You cannot explain the facts of nature except from the Bible. That, surely, is an argument for the inspiration of the Bible.

I most thoroughly endorse the author's protest against those scientists who endeavour to make out that the Bible and science are opposed to one another. The scientist who really studies the Bible and then says so, is guilty of casting a slur and a slight on science. True science is ever in agreement with the word of God, as the author pointed out. Science investigates facts, but if you want the meaning of the facts, the origin of the facts, the testimony of the facts, you find in the Bible only the explanation.

DAVID HOWARD, D.L., F.C.S.—I think nothing shows the admirable nature of the paper better than the way in which it has borne cutting down in reading without losing the thread of the argument. At the same time I hope that those who heard it somewhat curtailed will not fail to read it at length, for although the fortress was so well defended some of the earthworks were left out to save time, which are most worthy of careful attention.

In regard to the author's remarks on the misuse of words and consequent confusion of thought, I believe it is one of the most difficult things in thought to escape from one's own words. One uses a word and gets used to it, and then it appears to get sacred not only in theology but in science, and argument is carried on about a word, and the meaning is entirely obscured by the fact that the word is used in an entirely different sense. To take evolution, for instance, it is at once a demi-god and a bogey. Some people use it as an expression for what the words cannot possibly include—the prime cause of all things—and others, in their dread of such misapplication, shut their eyes to the evident truths to which the word can be properly applied. I venture to think that this applies

strongly to the word "Darwinism," which is often made to include a great deal that Darwin never said or believed. He was far too cautious for that.

At the end of the paper I thank the author most heartily for his mode of putting the right way of reading the 1st chapter of Genesis. You may use the most accurate and scientific language of 100 years ago, and when you read it in the light of present thought it is inconceivably less accurate than the language of the Bible. At best you cannot escape from the finality of human thought and human words, and if we read not the thoughts, but the interpretations we are pleased to put upon the words, we must remember they are translated from the Hebrew, and we are not using the language from which they are translated.

The CHAIRMAN then called on the Dean of Peterborough.

The Very Rev. the DEAN OF PETERBOROUGH.—The one point that interested me—shall I say most of all?—and which I want to pursue first, as far as possible, is the possibility of there having been a marring of God's creation before the fall. I do not know where my friend first got that idea. Was it originally your own, or is it anything you have derived from another work?

Rev. G. F. WHIDBORNE.—I got it from our Lord's words, "The devil was a murderer from the beginning."

The DEAN OF PETERBOROUGH.—It is your own thought then?

Rev. G. F. WHIDBORNE.—Yes.

The DEAN OF PETERBOROUGH.—If that can be proved and brought home to us all, it will be to me a very great relief, and I hope with your help to pursue it.

I should not venture to speak further in this audience, coming as I have done, unprepared to make observations on the paper; but I rejoice to think that one whom I have known now for thirty years is so competent to write as he has on this matter.

Rev. G. F. WHIDBORNE.—Mr. Chairman and gentlemen, I must thank you most heartily for the very kind way in which you have received my paper.

I have to thank Dr. Walker for his criticism.

I think the only point I need refer to at this late hour is what the Dean of Peterborough said with regard to the existence of evil before the fall. I wrote that paragraph at first without, I may say, referring to any particular opinion. It seemed to come out in

writing; and then some little time afterwards, I was very much struck with these words of our Lord, "He was a murderer from the beginning." The Greek word may be "man-slayer," but it seemed to me as though, very probably, it has a deeper meaning than that which we should naturally place on it, and which, no doubt, was its special meaning. But the words that struck me there were "from the beginning." It seemed to me as though our Lord were pointing right away back; though possibly in His time the people could only have a near view. But now, as we have learnt more about the creation of the world and have gone further back in time than they knew then, so we know there was a point further back than was thought of then; and it certainly does seem to explain to us that a great deal of death and suffering occurred before, in a way that was certainly not then explained to us by anybody elsewhere, and which is remarkable as an explanation given us long before any scientific person raised the difficulty—before the science of the nineteenth century was dreamt of.

The CHAIRMAN.—Every member of the Institute must feel grateful to Mr. Whidborne for his paper. I trust it indicates that a change has taken place in the views that many of us held, and that more papers of the same kind will be brought before the Institute.

The Meeting then adjourned.

COMMUNICATIONS.

The following communications have been received.

From Dr. D. BIDDLE, M.R.C.S.—

There is one passage in this interesting paper which seems to me to need revising. The author says, "Certainly the matter of the brain did not come into existence by thinking, as certainly thought cannot owe its origin to the mere mechanical structure of the brain." In a sense this is true, but only to the same extent that the growth of muscle is due, not to exercise, but to some other cause acting correlatively. The brain of a person who thinks grows in accordance with his thoughts. Every thought is dependent on the structure of the brain for its conception, and in return produces a definite effect upon that structure. Memory, one of the chief elements of thought, belongs almost (if not quite) exclusively to the brain, of which the

association of ideas is one of the chief functions. It accordingly has its periods of keenness and uncertainty, and decays as age advances. Thus, the brain is not a mere instrument on which the spirit plays; on the contrary, it is almost more true that the brain plays upon the spirit. It will occur to everyone that this is the case when sleep is disturbed by nightmare; and the experience of our waking hours differs only in its character, not in respect of its *modus operandi*.

There is a spiritual side to all thought, for the sentient power (or self) is identical with the human spirit. But apart from the body there is, for man, no thought. Hence the need, as well as the promise, of the resurrection of the body—an article of the Creed of the whole of Christendom, east and west. The human spirit *feels* and *wills*; but what it shall feel, if not what it shall will, is determined by causes external to it, though possibly belonging to its immediate environment—that part of the brain in which the memory is located—alone, as during meditation.

The question here discussed is one quite apart from that of creation or evolution, as the origin of all things, and is capable of solution by a regard for facts within the reach of everybody. Moreover, it is decided for us in the Holy Scriptures, which contain innumerable passages indicating that at death it is not only our powers of locomotion and cunning workmanship, but our very thoughts that perish. Christ, however, has said, “I am the resurrection and the life, he that believeth in Me, though he were dead, yet shall he live.” “I will raise him up at the last day.” It is better to rest our hope on these grand statements than to put any trust in a natural immortality.

From the Rev. J. RATE, M.A.—

We are much obliged to the Rev. G. F. Whidborne for his interesting paper.

He says, “Ask nature, where is the law-giver? Not in me; I obey the laws . . . I am their servant not their master; and yet no law can exist without a law-giver.”

May I make one remark. Much confusion of thought is caused by the different meanings in which the word law is used:—

1. It is used to mean the commands or decrees of a *legislative* person or body, as distinguished from the *executive* person

- or body who enforces obedience by sanctions and penalties, *e.g.*, "the law of Moses," "the law of the ten commandments," the "ceremonial law," the "civil law," the "ecclesiastical law," etc.
2. The *order* or *method of operation* of an *external* or *internal force*, *e.g.*, "the law of gravitation," "Kepler's laws," "the law of the spirit of life in Christ Jesus hath made me free from the law of sin and death—I delight in the law of God after the inward man, but I see a law in my members warring against the law of my mind, and bringing me into captivity to the law of sin in my members." (St. Paul.)
 3. The manifestation of the attributes of God as revealed in the order and method by which God governs the material world and the world of life and animated existence, *e.g.*, "The *laws of nature*, are the *thoughts of God*" (Hans Christian Oersted, the Danish philosopher, the discoverer of the laws of electro-magnetism).

There are many other meanings which are often designated by the word "law." It is important, therefore, in entering on any description about law or laws, to *define precisely* the meaning in which the word "law" is used.

From Rev. C. GODFREY ASHWIN, M.A.—

Thank you for sending me a copy of Mr. Whidborne's paper.

Though we may assume that most, if not all, the members of the Victoria Institute will agree with the conclusion of the first part, that the *only* "supernatural" is God, and everything in the universe is *as natural* as the birth of a babe, I think there will not be the same unanimity as to the nature of the universe to be expected from consideration of the attributes of the Deity referred to in the paper. Probably they would be nearly as varied as the imaginations of those who endeavoured to deduce the picture, without the object-lesson of the world, as we know it.

Deformity is as conspicuous as beauty; badness, almost as prominent, if not more prominent, than goodness; and if science and scripture agree in attributing this chaos to evil, do either of them distinctly point us to the *fons malorum*?

And if "the Power of Evil"—emphasised by a capital "P"—is intended to point to a "Power" independent of the One and Only

Everlasting God, how is His existence to be reconciled with that belief?

While welcoming any effort to dispel our darkness, I am sorry to say my eyes are too dim to have become any clearer.

I have seen many strong swimmers enjoying and benefiting by a swim in the sea—but have never seen anyone tall enough to bottom it. But, thank God, we are swimming in an ocean of Love.

P.S.—The conclusion, well worked out, that the original force must be efficient to produce the ultimate manifestation, may perhaps help some to recognise the possibility of miracles—one of the great difficulties to scientists in believing in the New Testament.

ORDINARY GENERAL MEETING.*

REV. F. A. WALKER, D.D., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following elections were announced :—

ASSOCIATES :—Darrell Edmund Figgis, Esq., Rev. Frederick Storrs Turner, B.A., Walter Cornell Fison, Esq.

The CHAIRMAN.—I have now the pleasure of calling on the Rev. Arthur Elwin to read to us his paper.

Rev. ARTHUR ELWIN.—I have two remarks that I should like to make before I begin to read the paper. First with regard to the name “James Long.” I have been asked, what is the origin of the term “Long Lectures” ? It originated in this way. James Long was a member of the Church Missionary Society who died about 1886, and he was convinced that the reason why people did not take much interest in the religions of the East was that they did not know anything about them, and so he left £2000 to Trustees, the income of which was to be applied to lectures on the East ; and this year, for the first time, it is to be about China, and I have been asked to give the lecture. I have divided the subjects into four, Confucianism, Taouism, Buddhism and Ancestral worship, and to-night we will consider the last of these.

The following paper was then read by the Author :—

* Monday, January 11th, 1904.

ANCESTRAL WORSHIP. By the Rev. ARTHUR ELWIN,
"Long" Lecturer on the Religions of China.

CONTENTS.

Introduction—Confucianism, Taouism, Buddhism, united in Ancestral Worship—The chief religion of the Chinese—Universality—Antiquity—Historical Notices—Confirmed by Confucius—Ancestral Worship defined—Its great importance—The dependence of the dead on the living—Food, money, and clothes regularly despatched into the spirit world—Consequences of neglect—The Ancestral Tablet—The resemblance of the spirit world to this both in government and every-day life—The effect of this on the social life of the people—Neglected and destitute spirits cared for by charitable societies—Death, insanity, plague, pestilence, and famine caused by destitute spirits—Foreign Devils—Suicide—The value of the head—Ancestral Worship idolatrous—Its great cost—The cause of polygamy, infanticide, and a hindrance to all progress—A striking contrast. Objects used by the Chinese in Ancestral Worship will be shown to illustrate the lecture.

OUR subject to-day is Ancestral Worship, which has been well called *the* religion of the Chinese, for in the worship of ancestors the whole nation agrees, and Confucianism, Buddhism, and Taouism are united. In introducing this subject I think I cannot do better than give an extract from a book, written by one who has spent many years in China, and who is intimately acquainted with the life of the people. Speaking of the Confucianist, we read: "Intellectually far above them" (that is, the uneducated people), "there is yet one spot of common ground. They, in their multiplied idolatries, he, in his cold agnosticism, have one faith in common, one universal family worship, upon which the heart of the nation rests. From the Emperor in his palace to the poorest countryman in his mud cottage, Confucianist, Taouist, and Buddhist alike, all rear the shrine for the ancestral tablets, and worship at the graves of the departed. Hoary with the veneration of four thousand years, this system has come down to them supported by the authority of the sages, and the example of the throne. Ancestral worship has its deep roots in the life of the nation, resting upon that which is most tender, most honoured, most abiding. Fear also lends its aid to perpetuate what affection and reverence demand, for certain calamity, it is believed, would follow the son so unfilial as to neglect the customary rites.

“In every household a shrine, a tablet, an oratory, or a domestic temple, according to the position of the family, contains the simple legend of the two ancestral names, written on a slip of paper or carved upon a board. Incense is burned before it daily, or at the new and full moons. Parents and children meet and bow before the tablet, and contract no associations with temples, or idols, monasteries or priests. There is nothing revolting or cruel connected with it; everything is orderly, kind, and simple, calculated to strengthen family relationships. Thus appealing to the noblest sentiments, strengthened by love, and reinforced by fear, this most subtle of all idolatries twines itself around the deepest heart of the people. The highly educated Confucianist teaches his son to place the offerings and perform the rites, just as much as the most ignorant of the common people. He believes, as they do, that one of the three souls of the departed inhabits the tablet in the ancestral shrine, while another remains in the grave, and the third goes forth into the unknown. He is familiar with the ancient ode, popular in China ever since the days of Samuel, in which the approval of the departed ancestors is expressed:—

What said the message from your sires?
 “Vessels and gifts are clean;
 And all your friends assisting you,
 Behaved with reverent mien.

“Most reverently you did your part,
 And reverent, by your side
 Your son appeared. On you henceforth
 Shall ceaseless blessings bide.

“What shall the ceaseless blessings be?
 That in your palace high,
 For myriad years you dwell in peace,
 Rich in posterity.”

Before trying to answer the question: What is ancestral worship? let us consider its antiquity and universality.

Almost all heathen nations in one form or another worship or care for their ancestors. In Egypt we find that from the earliest times care for the dead was strictly enjoined, indeed did time permit we might visit Europe, Asia, Africa, and America, and in each continent we should find traces of this most ancient of all religions. I say, “religions,” because we should find that in almost every country and in every age the care of the spirits of the dead has gradually degenerated into worship, and those blessings have been earnestly sought from

them, which can only be bestowed by God ; very much as the reverence given to the saints by the early church has degenerated in our day in certain quarters into actual worship.

But to-day we must confine our attention to China, and first we must notice, that, of all the religions we find in China, Ancestral Worship is by far the oldest. In the Book of History we read that the Emperor Shun, about the year B.C. 2254, that is before the time of Abraham, "was crowned in the temple of his accomplished ancestor;" and after a long and fatiguing turn of inspection, "he went to the Temple of his Cultivated Ancestor and offered one bullock." The title given to this Emperor's Minister of State was the Arranger of the Ancestral Temple.

In the Book of History we are also told that King Woo, who founded the Chow Dynasty, which lasted nine hundred years, from B.C. 1122 to B.C. 235, when going forth to fight, used these words:—"He, the enemy, abides sitting at ease, not serving God or the Spirits of heaven or earth, and neglecting also the temple of his ancestors, and not sacrificing in it." He adds: "I, a little child, have received charge from my deceased father, Wan. I have sacrificed to God, I have performed due service to the great earth." He returned triumphant, and, we are told, he sacrificed in the Ancestral Temple, and three days after he presented a burnt offering to heaven. The Emperor Woo was contemporary with King Saul.

There is also a most interesting account of the dangerous illness of King Woo, and how his younger brother was willing to die for him. We read the Duke Chow (that is, the younger brother), when he heard of the serious illness of the king, immediately erected three altars to the spirits of his deceased father, grandfather, and great-grandfather, and prayed to them as follows:—"Your chief descendant is suffering from a severe and dangerous illness. If you three Kings have in heaven the charge of watching over him, let me be his substitute." This prayer was deposited among the State papers. Five years after this King Woo died, and was succeeded by a youthful heir. Duke Chow was accused of treachery and went into exile, but when this prayer was found among the State papers left by King Woo, Duke Chow was at once recalled, and his former honours restored to him. Both Dr. Legge and an old Chinese commentator on the classics, think that Duke Chow offered this prayer to the three kings as mediators or intercessors.

Confucius distinctly taught the duty of Ancestral Worship, and enjoined it upon his followers. We have only time for

a few extracts from the Confucian Books. "Do the dead," asked one, "have knowledge of our services, or are they without knowledge?" Surely this was a most important question. The Master answered: "If I were to say that the dead have such knowledge, I am afraid that all dutiful sons and grandsons would injure their substance in paying the last offices to the departed. If I were to say that they have not, I am afraid that unfilial sons would leave their parents unburied. There is no urgency on the point; one day you will know for yourself." One of the most celebrated of the disciples of Confucius speaks thus: "When parents are alive, they should be served according to propriety; when they are dead, they should be buried according to propriety; and they should be sacrificed to according to propriety; this may be called filial piety." The same disciple also said: "Let there be careful attention to perform the funeral rites of parents, and let them be followed, when long gone, with the ceremonies of sacrifice; then the virtue of the people will resume its proper excellence."

Confucius sometimes seemed rather doubtful about the spirits. On one occasion in answer to a question he said: "While you are not able to serve men, how can you serve their spirits?" Yet we are told it was his practice "to sacrifice to the dead as if they were present, and to the spirits as if they were before him."

Interesting as the historical aspect of Ancestral Worship is, time will not allow us to pursue this part of our subject further. We must now leave Confucius and history, and coming down to our own day inquire, what is Ancestral Worship as practised by the Chinese at the present time?

The practice has been thus defined: "Ancestral Worship includes not only the direct worship of the dead, but also whatever is done, directly or indirectly, for their comfort; also all that is done to avert the calamities which the spirits of the departed are supposed to be able to inflict upon the living, as a punishment for inattention to their necessities."

The belief of the Chinese with regard to the dead and the future world may be briefly stated as follows:—

1. They believe that the spirits of those who have died and passed into the other world require food, money, and clothes, just as they needed them in this.

2. They believe that these necessary things cannot be obtained in the other world, but must be sent by the friends who are left alive in this.

3. They believe that as the dead have become invisible,

everything intended for their use, except food, must be made invisible, by burning.

4. They believe that those in the spirit world can see their friends in this, and that they have it in their power to return to this world, to reward or punish, according to whether their wants have been attended to or not.

5. They believe that nearly all sickness, calamity, and death is caused by these neglected and destitute spirits, returning from the spirit world, taking vengeance on those who should have helped them, but have not done so.

6. They believe that every one has three souls; at death one remains in the coffin; one goes into the ancestral tablet; and one is arrested and imprisoned in the spirit world. Offerings must therefore be made at the grave, before the tablet, and at the temple of the city god under whose jurisdiction the man is supposed to be undergoing trial and punishment.

7. They believe that the spirit world is very much like this, and is governed in the same way.

We will now notice some of the practices and customs of the Chinese with regard to the dead, which will illustrate what has been already said.

When a member of a family becomes seriously ill, the relatives and friends at once conclude that the illness is caused by some destitute spirit, and without delay offerings are made before the ancestral tablets. If the sick one does not get better, they conclude that the sickness must be caused by some spirit not connected with the family, and in this case paper money and other offerings are burned before the door in the street.

While the man is alive, there may be a little doubt as to what is best to be done for him, but as soon as he dies all doubt vanishes, and the path is quite plain. The following things are deemed absolutely necessary to be done in order to settle the spirit comfortably in the spirit world:

1. The first thing to be done is to place a cup of cold water at the door, in order that the spirit may take a last drink. This is one of the many customs which have been handed down from antiquity; the Chinese can give no explanation of it. This custom is the more strange, because the Chinese do not drink cold water, they prefer hot water or tea.

2. The next thing is to clothe the deceased in a good suit of clothes. This is generally done, if possible, before death. The idea is that the spirit, going into the other world, well clothed,

will be better treated there than if appearing in a ragged condition.

3. The next thing is to burn a quantity of paper money. The relatives know that the spirit will be arrested upon arrival in the other world, and at once be taken off to be judged, but if a good present can be given to the policemen, they will go back and say that they could not find the soul. This is what is constantly done in this world, the policemen (or "runners" as they are called) are always ready, "for a consideration," to allow a prisoner to escape, and the relatives conclude that this can be done in the spirit world also. When a man hears of the death of a friend, it is the proper thing to send some of this paper money to the house, that it may be sent after the soul of the departed. Sometimes this money is placed in the coffin, but generally it is burnt. In one case I myself saw the bank notes tied into the button holes of a man about to be placed in his coffin, in order that they might be quite handy when, in the other world, the policemen came to arrest him.

4. The coffin and the grave have to be carefully attended to. If the man be old, the coffin has no doubt been ready for many years. The first money which a young man earns when he goes into business, is generally expended in the purchase of a coffin for his father; this would be considered a most filial act.

5. The preparation of the Ancestral Tablet.

6. The regular dispatch of the clothes, money, and food, and various luxuries for the use of the spirit of the departed. The clothes and money are burned before the Ancestral Tablet. The food is exposed on a table for a time, and then eaten by the friends who placed it there. The spirits are supposed to have taken all the strength and goodness out of it, so that those eating it will tell you it has no taste.

Food, money, and clothes are absolutely necessary, but other things may also be sent: household furniture, sedan chairs, indeed anything that is in use in this world, may be made into paper and dispatched into the next.

7. The formation of charitable societies to care for the spirits that have no relatives or friends to send them the necessary offerings. There were many charitable societies in the great city of Hangehow in Central China which cared for the poor, but the most wonderful society of all was one formed to care for poor spirits. Three times every year thousands of suits of clothes and other necessaries were dispatched into the other world, for the use of these destitute spirits. Usually the streets of a Chinese city, after the sun has set, are quite dark,

and if we go out in the evening we have to take a lantern, but the night when the offerings are made, lanterns are hung all along the street to give light, so that the destitute spirits may not miss their way, when on the road to the place where the offerings are to be made. It may be mentioned that this society is subscribed to by all the chief men of the city. Fear prompts the gifts. Destitute, neglected spirits may do much harm, but if only they can be kept clothed and fed, they will be quiet.

This fear of the evil spirits is a very real thing with the Chinese. Not a few times, when sleeping in a Chinese village, have I been awoke in the middle of the night by a tremendous noise, caused by shouting, beating of gongs, and the letting off of fire crackers, and I have been told in the morning that the noise was caused by the people driving away an evil spirit. Someone had died, or, as they say, "the evil spirit had run away with somebody's soul," the fear being lest if the spirit were not driven out of the village, someone else's soul might be run away with.

Insanity is nearly always ascribed to possession by a destitute spirit. The speaker has in his possession iron fetters, which were worn for many months by a young woman, who was said to be possessed by a destitute spirit. The friends of the young woman heard that the Christian's God could cast out evil spirits, they therefore asked a member of the new religion to come and pray that the spirit might be cast out of their relative. The prayer meeting was held in a little room far away in the hills. The Christian prayed that, as in time of old the Lord had exercised His power by casting out evil spirits by the shore of the sea of Galilee, so He would now once more exercise that power by casting out the evil spirit that possessed the young woman kneeling in the room. When they rose from their knees, the friends at once removed the chain with which the young woman's feet were bound, and she was free. For three years the young woman was connected with our mission in China, and at the end of that time, to our great regret, her husband came and claimed her, and took her far away into the hills, where we could not reach her.

It is well known that all foreigners are called by the Chinese "Foreign Devils." We hardly ever went out in the streets of Hangchow without hearing someone say: "There goes a foreign devil." It is not a nice name to be called, and it will be well to inquire what the name really means. The word translated Devil, is the name given to the destitute spirits,

which return from the other world, and do so much harm. The Christian religion is often called by the Chinese the Foreign Devils' religion, and the people, when they become Christians, are in their opinion no longer Chinese, but Foreign Devils. The evils which, the Chinese say, are caused by their own destitute spirits, are caused by the foreign destitute spirits also. If plague, pestilence, or famine break out where foreigners are living in the interior of China, it is almost sure to lead to trouble; indeed some months ago an outbreak of cholera led to a rising among the people, in which two foreigners lost their lives.

It has been already remarked that the Chinese think that the spirit world is very much like this, and this belief leads to some strange results. In this country if a man is angry with another man, it is not uncommon for him to do him some injury, and in some cases even to kill him. In China a man very often, instead of killing his enemy, kills himself. He knows if he goes into the other world and becomes a spirit, he can do far more harm to his enemy than he could by remaining in this world. The number of suicides in China is very remarkable. All the mission hospitals have many such cases taken to them every year, with the hope that those near death may be saved. It has been found that a large percentage of the suicides are caused by quarrels. Many years ago the speaker was called in with a friend to try and save two Buddhist monks who had taken opium with a view to pass into the other world. Upon inquiry it turned out that these men had been quarrelling, and one had taken opium, with the intention of getting into the other world that he might injure his enemy. The enemy heard of this, and at once took a larger dose of opium, with the hope that he might get into the other world first. It may be mentioned that neither of these men succeeded in their object. The judicious use of the bamboo, and the administration of a mixture composed of mustard, yellow soap, and hot water, had the effect of bringing them 'round, and restoring them to their wonted health and spirits.

Shortly after the troubles were over in China two years ago the Powers demanded that two mandarins high in office, who had taken a leading part in the slaughter of the foreigners, should be put to death. In the telegram which came home, announcing that these men had been executed, it was stated that as soon as their heads were struck off they were sewn on again by the assistant executioners. Probably very few readers of this last sentence realized the importance of this statement.

The thousands of Chinese who witnessed the execution doubtless said: "These men cannot have done anything very wrong, or they would not be allowed to retain their heads." In order to make the punishment complete, the heads of these men ought to have been brought to England, or at least sunk in the sea. The fact is that the Chinese believe that a man who is beheaded appears in the other world without a head, and spends the rest of his time there in a headless condition, being laughed and jeered at by all his fellow spirits who have retained their heads. The public executioner in Hangchow made a considerable income by the sale of the heads of the people he decapitated to their friends, that they might be sewn on again. The magistrate generally orders the head of the man who has been decapitated to be exposed for so many days. This is done in order that the friends may not be able to obtain it. While I was in Hangchow, a man, who had been embezzling money and cheating the government, was executed. Because it was not an extreme case, and the man had not committed murder, he was allowed to make arrangements about his head before it was cut off. After much bargaining, the friends were to be allowed to have the head upon payment of about £50 in our money. The last thing that this man saw, before he closed his eyes, and his head was cut off, was a man standing by with a needle and thread; he knew his head would be restored, and he would be all right in the other world, and he died happy.

But the important question must now be asked: Is Ancestral Worship as practised by the Chinese idolatrous? After what has been said, one would think that there would not be much difficulty in answering this question, but of course you are aware some have said that the care for their ancestors is a praiseworthy feature in the Chinese character, and ought not to be discouraged.

At the General Missionary Conference held in Shanghai in 1890, Dr. Martin, the President of the Chinese College in Peking, read a paper entitled, "Ancestral Worship: A plea for toleration," the conclusion of which was: "I respectfully suggest that the missionaries refrain from any interference with the native mode of honouring ancestors, and leave the reformation of the system to the influence of divine truth, when it gets a firmer hold on the national mind." After a very full discussion, the Conference of four hundred missionaries passed almost unanimously the following resolution: "Resolved that this Conference record its dissent from this conclusion, and affirms its belief that idolatry is an essential constituent

of Ancestral Worship." The Rev. Y. K. Yen, a Chinese clergyman of great experience, referring to Dr. Martin's paper, said:—"The belief is an idolatrous belief, and the worship is an idolatrous worship. The two ideas of paying human honours and divine honours to ancestors are so combined that we cannot separate them. I think that to allow the Chinese Christians to perform the worship, and at the same time to eliminate every idea of divine service, cannot be done. The two are so associated that if you do the one the other is involved in it. The association has become so hereditary among the Chinese that to prostrate and make offerings bring up in their minds the feeling that the spirits are present to hear their prayers, accept their gifts, and in return will care for them, in short will do for them what God-over-all can do."

A well known Chinese missionary writes: "That the worship rendered to their ancestors by the Chinese is idolatrous cannot be doubted, and it forms one of the subtlest phases of idolatry, essentially evil, with the guise of goodness, ever established among men."

When the Jesuit missionaries reached China about the year 1582, they sanctioned ancestral worship on the plea that it was a civil rather than a religious rite. Ricci, who died in 1610, in the rules which he left for the direction of the Jesuits, says that the Ancestral Rites might be tolerated in the Chinese converts, because these ceremonies were merely civil and secular. In the year 1651, the Dominicans followed the Jesuits to China, and took the opposite view; they declared the rites to be idolatrous and sinful, and absolutely forbade the converts to engage in them. A contest at once began which lasted for many years. The case was of course referred to Rome; but the Popes seem to have found great difficulty in deciding this important question. In the year 1699, the Jesuits appealed to the Emperor Kang Hyi. "We have always supposed," said they, "that Confucius is honoured as a legislator, and in this character alone are the ceremonies established. We believe that ancestral rites are only observed in order to exhibit the love felt for the departed, and to hallow the remembrance of the good received from them during their lifetime." The following year the Emperor's answer was received; it was short and to the point, viz., "The customs of China are political." But this view of the case did not find favour at Rome, and in 1704, Pope Clement XI. issued a Bull absolutely forbidding Ancestral Worship. The Chinese

Emperor was very angry, and in 1718 forbade any missionary to reside in China, unless he conformed to the rules that Ricci had laid down many years before. The Pope on the other hand refused to allow any European missionary to go to China who declined to obey his decision. The Chinese connected with the Roman Catholic Missions are not now permitted to worship their ancestors.

Whatever the conclusion that foreigners interested in the subject may come to, there can be no doubt that the Chinese Christians themselves look upon Ancestral Worship as idolatrous, and as inconsistent with their profession of Christianity, and surely they are the best judges in this matter.

Although there may be much to be admired from one point of view in Ancestral Worship, it must not be forgotten that many evils may be traced to it.

Polygamy is not only allowed but encouraged. It is a religious duty for a man who has no son to take another wife, with the hope that a son may be born to offer the ancestral sacrifices. There can be no greater calamity than for a man to die without an heir.

That Ancestral Worship is responsible for a great deal of the infanticide common in many parts of China there can be no doubt. Daughters are not wanted, because they cannot take part in the ancestral rites. In the great Chu-ki district, about two hundred miles from Shanghai, where infanticide was very common, it was universally believed that a baby without teeth had no soul. Such a little one, dying, was wrapped in matting, and left anywhere in the fields, generally being eaten by the dogs. But if the baby had but one tooth, the soul was supposed to have come, and a box was provided for burial.

The annual cost of Ancestral Worship must be noticed. It has been carefully computed that the expenditure by families to secure the repose of their deceased members, comes to no less than £24,000,000 annually, and to this must be added the sum spent by charitable societies, for the support of the destitute spirits, who have no friends to care for them, which probably comes to about £6,000,000. We believe that we are well within the mark when we decide that the total amount spent by the Chinese on the spirits of the dead, comes to the enormous sum of £30,000,000 annually. It must be remembered that this immense sum expended on the dead is not prompted by true charity, but by servile fear. The living are indeed the slaves of the dead.

But it is time to bring this paper to a close. Very much more might be said on this very interesting subject, but time forbids. I trust enough has been said to make us thankful for the light that shines in England, for we cannot help contrasting this belief of the Chinese with the glorious hope brought before us in the Bible. The poor Chinaman, when leaving this world, can only hope that he will not be forgotten by his friends, that the necessary offerings will be sent after him, that he may not become hungry and destitute in the place to which he is going, but the Christian knows that in that place to which he is going every want will be supplied, and he can look forward without fear to the time when he will join the great company who have come out of great tribulation, and who have washed their robes and made them white in the blood of the Lamb; of whom it is written: "therefore are they before the throne of God, and serve Him day and night in His temple; and He that sitteth on the throne shall dwell among them. They shall hunger no more, neither thirst any more; neither shall the sun light on them nor any heat. For the Lamb which is in the midst of the throne shall feed them, and shall lead them unto living fountains of waters: and God shall wipe away all tears from their eyes."

DISCUSSION.

The CHAIRMAN.—Ladies and gentlemen, I think you have almost anticipated me by the hearty manner in which you have applauded this very interesting paper on ancestral worship in China. I am sure I, for one, have learnt a great deal of a subject of which I was extremely ignorant before. I think we have all got a great deal of information to-night on superstitious and hereditary practices of one of the most ancient nations of the globe, and of their ideas of the future state.

I invite anyone who wishes to speak to take part in the discussion.

Colonel MACKINLAY.—I should like to thank the author and to ask him three questions. Whether he considers that the Thummim mentioned in the Bible resembles the present ancestral worship, and when these tablets are placed in their houses, do they take them

away with them when they move from house to house, and are they used for the purpose of divination or guidance ?

The AUTHOR.—The first question I do not feel in a position to answer ; it is a very deep subject.

Certainly the Chinese take these ancestral tablets about with them, for they think the souls of the departed actually inhabit those tablets, “the throne of the soul” it means. Sometimes the tablet is called “the wooden lord” ; but it is, generally, “the throne of the soul.”

There is great difficulty in colonising with regard to China. A Chinaman, dying in America, cannot get the clothes or offerings that he could in China. The Chinese want to be buried where they are born, and the reason is that they may take part in the ancestral offerings which they are offered from time to time.

Colonel MACKINLAY.—Where are they placed ? In the entrance to houses ?

The AUTHOR.—I do not think there is any special place for them. The Chinese always have a reception room, and sometimes they are placed in the reception room. They have in nearly every village a small ancestral hall, as it is called, arranged with steps half-way up and enough room for each family.

Professor ORCHARD.—May I ask do the Chinese pray to their ancestors ? I suppose the Emperor prays ; but do the common people pray to their ancestors ? Why do the Chinese consider that amongst the necessary things of which the departed spirit is supposed to have need, that food alone must be visible and cannot be vapourised ? Is the idea that the spirit has to come to this world for its food, or what is the explanation of that curious exception to the rule ?

The AUTHOR.—There are so many very interesting questions that can be asked that I should like myself to seek to get an answer to them. The difficulty in dealing with the Chinese is that they cannot answer these questions themselves. So many of their practices have been passed down from ancient times, some for hundreds of years. You may ask a Chinaman a certain thing and all he can tell you is that his father and grandfather did it. He does not inquire why or wherefore, but the very fact that his grandfather did it, seems to settle the whole thing.

With regard to the food, certainly the spirit must actually come to the table. The Chinese say the spirits feed on the steam. The things placed on the table are all hot invariably. They never think of offering anything cold to the spirits. The table is prepared and the food is prepared in the kitchen and taken up and put steaming hot on the table, and the spirits are supposed to inhale the steam from the food, and, as the Chinese say, they have a wonderful power of extracting all the goodness and strength of it although the food remains as before. The only thing is it gradually gets cold, and then the people who put it there come round and eat it. The same in the temple. I have seen idols made of clay or mud and a table with food on it just the same as that of the ancestors. There, again, the food is put there for a time and then the priests, or somebody, would eat it.

Mr. MARTIN ROUSE.—Do they know that the people eat it ?

The AUTHOR.—Oh yes ; the friends know it. The family gather together and offer these sacrifices to those who have passed away.

In regard to the prayers to the spirits, there are most devout prayers on record to these spirits, and they all know of these things that are offered to the spirits, for if they are not offered, then the spirit, it is supposed, has an extraordinary power of coming back to the world and doing an immense amount of harm. It is extraordinary what harm a destitute spirit can do.

Their charitable societies referred to consist of rows of almshouses ; for instance, soup kitchens, blanket societies, coffin societies and burial societies. I remember seeing in Shanghai a house with a large doorway over which was written, *Aun Shen* (Benevolent Institution). I thought it was for the poor, but was told it was a benevolent institution for the spirits of the other world and not for people in this world at all. No doubt the English who lived in Shanghai thought it was an institution for the care of spirits in this world rather than for those of the other world.

Rev. F. STORRS TURNER.—I think I ought to take the opportunity of saying that in a great many respects I could, if time permitted, parallel some of those very interesting points that Mr. Elwin has laid before us.

To begin with, I have at home two ancestral tablets given to me more than forty years ago : I have three in fact. One of them is a clan tablet, but two are family tablets, given to me by a convert of

the province of Canton, and the occasion was one of great joy to me ; for it is well known that it is extremely hard for a Chinaman to part with his ancestral tablets. As far as I know, I was the only missionary at that time, in our part of China, in possession of any tablets at all. Those two tablets have names inside, written plainly in black ink. I could also give parallel cases of what could be called Christian exorcism, very similar to those set before them by Mr. Elwin ; but I must confine myself to the subject of the evening, which appears to me to be of great interest. In the main I entirely agree with the general view that Mr. Elwin has set before us ; but I am not quite sure that we ought to call ancestral worship "an idolatrous" custom. Tablets are not idols, but simply records of the names of the deceased, and I hardly think it can be said that these deceased spirits are deified. Rather is it like the case of the Roman Catholic devotion to saints ; but, any way, it appears to me that the subject has very great interest from a point of view which has not been mentioned.

We all know that the origin of religion was attributed by the late Herbert Spencer to spirit worship. His formula is very simple. Dreams gave rise to the notion of a separable soul. Dreams of dead enemies gave the notion that they were still existing. Dreams of a dead chief who had been in his lifetime of great power, ferocity and cunning, and had made himself feared, produced the idea that he was a powerful spirit in the other world, and this powerful spirit was the first god : from this origin Herbert Spencer teaches that all religion has resulted in the whole world. It seems to me, if we were to study Chinese history, it ought to throw some light on this subject. The worship of deceased spirits is a very important part of Chinese religion, and we should be able, I think, if the theory is true, to find something in Chinese books to support Herbert Spencer's theory.

Now I think we ought to distinguish between three periods : the ancient history of China, what I may call the middle history of China, and that of the present day. In fact, a very large portion of what has been stated this evening about spirit worship in China is unknown in the ancient books. If we go back to the old books of history and poetry, and study the subject, there I think we shall see plainly that worship was paid to the spirits of deceased kings, princes, ministers, and persons of importance ;

what we at least would call religious worship. People were prayed to. Thanks were given to them. I remember that an ode written at the time of great famine and drought over the land, speaks of offerings made to the spirits. The living ruler says, "I have made my prayer to God, and He does not hear. I have worshipped in the proper way all the former rulers and ministers of state, and they do not help." But when we study those ancient books what we find is this, that there are different kinds of worship; but above all there is the one heaven and one God, alone, unapproachable.

Now there is no measuring the gulf between spirits and God. The ancient religion of China certainly is not based on the worship of spirits, and to find any connection whatever between the worship of those spirits and the worship of God is impossible. The more you study the subject the more you will see that to regard one as the result of the other would be a great mistake.

But when we come down to the time of Confucius then we find a different state of things. We find then, in the Confucian writings, no alteration of rites and ceremonies. He says, "I am one who hands down; I am not an inventor." Everything that was done in the old dynasty had to be done in the same way. You cannot find anything like a trace of worship of spirits as gods. On the contrary you find all that Confucius cared about was the homage paid to the ancestors as a token of filial piety.

It seems to me we should find this subject well worth study; but as regards the present day belief of China all I can say is I found it extremely difficult to discover what a Chinaman does believe. It is a mixture of Confucianism, Buddhism and Taouism. He believes everything in a way, but hardly anything in reality. He has a vague belief that something may come after this life that may be judgment, and no doubt they believe in ghosts and in the mischief they do, and their power to do evil. All these things are confused in his mind, which is pervaded by a superstition from which he cannot get himself freed.

Colonel HENDLEY, C.S.I.—I would ask how this worship was arrived at, which seems so old, and how long has the need for offerings extended? Has it extended from father to grandfather, and so on to remote degrees? I should also like to ask whether the Chinese regard their ancestors in the same light as protecting spirits.

and is this the reason why they worship them? The lecturer says in his lecture that their respect for spirits was due to their holding property. There was a discussion about this some years ago, when Dr. Yates said it did not exist, and Dr. Smith opposed, believing it to be a mixture of fear and self-love, and that it is only a gradual process that leads the Chinaman to become one who reveres his ancestors.

Then as to a child being lucky who is born with teeth. A child was brought to me when in India some time ago, who had one tooth when born, and it was considered to be extremely unlucky. I said it did not much matter who thought so; but the tooth was pulled out, and no one would allow their child to marry that child when it grew up.

Then as to the ceremonial in regard to departed spirits in the wards of the large hospitals of India, it is a common thing to perform what they consider the necessary rites before the spirit is disembodied and set free and no longer torments the living. That goes on from generation to generation; so that when a man performs the ceremonial over his own father he also remembers his ancestors.

The CHAIRMAN, in thanking the author for his paper, referred to parallel cases of ancestral worship in India, which were referred to in the Greek and Latin classics. He had himself seen preserved food for the spirits consisting of ears of corn, locusts and dried dates. Their ideas of the spirit world appeared to be much the same—only the Greek idea seemed to have sprung from the vision of Tartarus that Ulysses had, and the idea that Homer must have taken from the western fields of Asia had become the conception in all nations of the future Hades.

A MEMBER.—Can anyone trace how this ancestral worship begun? We are all agreed on this—that all worship begun with a knowledge of the true God, and every form of idolatry and superstition is some corruption of a deviation from the true path, which is not Herbert Spencer's idea of evolution of religion by degrees. Does Mr. Elwin know how ancestral worship began to come in as one of the forms of deviation from true worship?

The AUTHOR.—I do not know that there is anything to go upon certainly in China it is lost in far antiquity. They seem from the earliest times to have had this ancestral worship.

As to the question of expenditure of thirty millions on ancestral

worship it seems an enormous sum, but it has been calculated carefully. We know how many charitable and other societies there are and about how many families. It is supposed that each family spends about 3s. a year on ancestral worship, and taking the population of China at about 400,000,000 we arrive at that figure. Dr. Yates, who has been mentioned, works this out and comes to that conclusion.

It is very interesting to hear of these other places where there are parallel instances of ancestral worship.

Mr. MARTIN ROUSE.—I do not know whether I am unduly prolonging the debate; but that question surely can be precisely answered.

From what I know of oriental antiquity, did not the Assyrians worship Asshur, who the Bible informs us was their first ancestor who began that kingdom, and did not Babylon, as proved by Dr. Pinches, worship Nimrod under the name of Merodach* and Nebuchadnezzar calls him lord of Merodach. So I do not think there can be a shadow of doubt about that. Those men, who were great commanders, and who founded Empires, were doubtless the origin of the worship of ancestors. We heard this afternoon that the first persons we hear of as prayers being addressed to them, were kings and statesmen. That, surely, is only spreading out the first idea.

Mr. STORRS TURNER.—But in China you find no Nimrod amongst the deities.

Mr. MARTIN ROUSE.—But if they prayed to him as the Assyrians prayed to Asshur, surely that is the original form of ancestral worship.

Mr. STORRS TURNER.—I cannot take that view at all. Those are the exceptional cases.

The SECRETARY.—It is clear that there is a difference of opinion between Mr. Elwin, who read this interesting paper, and Mr. Turner, whether ancestral worship is idolatrous or not. Mr. Storrs Turner considers it is not so.

Mr. STORRS TURNER.—It is in a corrupt stage at the present time, no doubt.

The Meeting then closed.

* See *Trans.*, vol. xxxv, p. 27.

ORDINARY GENERAL MEETING.*

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 :—

TWO PATHS, ONE GOAL: Being an Examination of Bishop Temple's Bampton Lectures for 1884. By WALTER AUBREY KIDD, Esq., M.D., M.R.C.S., F.Z.S.

ILLUSTRATION.

THE course of the Ganges-Brahmapootra is without parallel among the rivers of the earth. Rising by two heads from a limited region of the Himalayas it pursues at first two opposite directions. The northern branch flows for 1,800 miles through Tibet, the southern through the great plain of Hindostan on its fertilising course for 1,500 miles, and this greatest of Asia's twin-streams unites to form the Ganges delta and flows into the Indian Ocean. A common origin, a parallel course, and a common destination may fitly illustrate the still more remarkable origin, course, and destination of Religion and Science as forces in human history. The parallel may be further pursued. How well does the long winding course, much of which is still unknown, of the Brahmapootra, resemble that of Science, and the open, long-known course of the Ganges, so important to Northern India that its work as water-carrier and fertiliser entitles it to rank as the foremost river of the globe, that of Religion?

With this illustration in view we may proceed to examine the *Bampton Lectures* of Bishop Temple on "The Relations between Religion and Science," which represent two paths of human progress with one common goal.

* Monday, January 25th, 1904.

The time, the subject, and the writer of the *Bampton Lectures* for 1884 were alike noteworthy. The "Origin of Species" had celebrated its coming of age four years before, and Darwin's greatest champion and swordsman in many an encounter had proclaimed "Evolution is no longer an hypothesis but an historical fact." The challenge of Huxley, for it was no less than a challenge, was couched in his customary trenchant terms, but the saying if it did not then echo the united voice of Science of 1880 fairly well anticipated that of 1903. The year 1884 was one in which it had been recently declared orthodox from the side of Science to hold the general truth of the doctrine of evolution. But for a Bishop of the Established Church to hold this doctrine so publicly announced, still required not less knowledge of the two great subjects of Religion and Science, than of courage. Even so late as 1894 at Oxford, Lord Salisbury, as President of the British Association of Science, made a very powerful attack on natural selection. Here it may be allowable again to state that evolution as now conceived is not Darwinism, or natural selection, though the latter is reckoned as one of its great factors. To the end of his life even Huxley was cautious and slower than many to acknowledge the paramount power of natural selection in organic evolution; too slow for what are called by Weismann "the Hotspurs of biology." So much so that Lord Kelvin, on the occasion of presenting to Huxley in 1894 a medal of the Royal Society, was justified in saying how great was the pleasure all present must feel to have among them the advocate of "the origin of species by natural selection," who once bore down its foes "ready if needs be to save it from its friends." The year 1884 was a critical time for a Bishop to choose for a declaration of his adherence to evolutionary doctrines. To-day such a thing would be received as a matter of course, and probably the accepted views of evolution approach much more closely than ever before the teaching of Scripture as to the origin of the world and the things that are therein.

If the time was critical the writer was noteworthy as the protagonist on the Episcopal Bench of the present friendly and candid claims of Science to be attended to by religious and educated men. Here was the contributor to *Essays and Reviews* of an earlier date, in which he foreshadowed the line of his *Bampton Lectures*, again speaking in advance of his times! When first he came to the See of Exeter he brought with him a certain cloud of suspicion as a churchman too broad to be safe and sound. But suspicion was slowly disarmed by his wise,

strong, and successful administration of his diocese, and a reputation grew up around him for sound sense, clear-headed justice, and energy, and he for long retired from anything of a controversial nature. He appears to have been one of the men who find early in life the conclusions of their maturity, and questions which were burning ones for most religious people in 1884 had been settled by him for himself long before. He lived, and died in 1902, in the intellectual as well as the religious faith of his early manhood. Such a man was well calculated and fitted to deliver these *Bampton Lectures*.

Of the subject itself it is enough to say that all the mental, moral, and spiritual life of man, as well as the physical, is embraced by the two related spheres of Religion and Science. The Lectures are in the nature of an *eirenicon*, and we are well aware that in 1884 this was the needed attitude of a religious teacher. To-day the two friends need hardly more than to know one another better. Except among extreme men on each side estrangement and antagonism should exist no more. The Rev. H. E. Fox spoke some very wise words which are applicable here, and it were well for us if we could keep them in mind as a motto in the discussion of Religion and Science, he said: "*Our duty is to find, if we can, what agreement lies behind our differences, and use the one to get rid of the other.*"

RELIGIOUS BELIEF.

The eight *Bampton Lectures* are marked by openness of mind, great knowledge, and a clear grasp of the principles of both Religion and Science, and by a devout piety. In the first place the origin and nature of Religious and of Scientific beliefs are discussed. The former is traced to the voice within, that moral law which exists and operates apart from, but not in contradiction to, the teaching of Revelation. It is shown that this law in its government of the world reveals itself as possessing the distinctive mark of personality, or purpose and will, giving no countenance to the theories of Hartmann, that the Divine Being is an unconscious Being, or of Schopenhauer which identifies Him with Will. The moral law has final supremacy in the life of man; and later, in Lecture V, it is pointed out with great force that the means of developing and completing spiritual knowledge is Revelation.

SCIENTIFIC BELIEF.

The origin of Scientific belief is traced to the Great Postulate of Science, the Uniformity of Nature, which grows in validity with every advance of knowledge, and which though it is known to be so general, can never be shown to be universal. An important point is brought out in Lecture I, viz., that the process of scientific thought derives its early beginnings and primary sanctions from the exercise of the will. In fact, without these two data, the Human Will and the Uniformity of Nature, Science could not even begin to work, its great superstructure would never begin to be reared.

FREE WILL.

Four lectures are devoted to the "apparent collision" of Religion and Science on three matters. Two deal with the apparent collision or conflict of Religion with the doctrine of evolution, one with the doctrine of Free Will, and one with the claim to supernatural power. These three "conflicts" the lectures show to be apparent and not real. Temple maintains that Free Will conflicts profoundly with rash conclusions of Science, and boldly asserts his conviction that the will of man is free, in despite of all the sophistication to which this deep subject has been subjected at the hands of philosophers and metaphysicians, and latterly of scientists. With his usual moderation he reminds us that interference of the human will with phenomena is always possible, but that the more closely it is examined the more rare is found to be its exercise. In connection with the subject of Free Will we are reminded forcibly of the necessity there is for us to have a fixed Nature in order that our self-discipline may be able to act intelligibly on us, and that from this basis each step upward may be secured before another be taken in the moral and religious life, and that attainment of growth by discipline is impossible without fixity in the thing to be disciplined. Here, as in the cases of the other conflicts between Religion and Science, opposition of Science to Free Will in man is apparent and not real: he says, "Science asserts that there is evidence to show that an exceedingly large proportion of human action is governed by fixed laws. Religion requires us to believe that the will is responsible for all this action, not because it does but because it might interfere. Revealed religion, indeed, has always based its most earnest exhortation on the reluctance

of man to set his will to the difficult task of contending with the forces of his nature, and on the weakness of his will in the presence of those forces."

The doctrine of evolution is discussed in two lectures marked by a thorough knowledge of the leading points of evolutionary teaching; and he proceeds to point out that it is not inconsistent with the account given in Genesis of the formation of the habitable world and its inhabitants, man included. He recognises the very natural difficulty so many religious men were feeling as to the acceptance of this doctrine, and shows with much insight how the great argument from Design is not weakened, indeed, that it is strengthened and widened by that doctrine. He refers to the growing adherence to evolutionary thought which was to be seen in 1884, and which is still more marked in 1903. He wisely commences the discussion of evolution by reminding us that its essential basis is that endless change of events, and flux of all things around us, the old *παντα ρεῖ* of Heraclitus. Evolution or transformation is writ large on the broad face of Nature, and many go so far as to say that it is bound up with every phenomenon, that it extends from star to soul, and ranges through all between; indeed, that it is co-extensive with all existence. Temple, however, accepts the general truth of the doctrine of evolution and its congruity with the teaching of Scripture; reserving the important provinces of the Divine and human will from its unlawful approach.

SUPERNATURAL POWER.

The supreme difficulty of the subject, the apparent collision of Science with the claim to supernatural power is boldly faced, and is dealt with very much as it has been by others in past ages, and latterly especially by the late Duke of Argyll in certain of his works. The claim to work miracles, he maintains, is parallel to the freedom of the will of man. Different aspects are borne by miracles at the time of their performance from that which they bear in the light of modern scientific investigation. The suggestion is made that our Lord's miracles of healing and His Resurrection may have been parts of a great hitherto unknown law by which God works, and which will eventually be ascertained to be in accordance with scientific reason. If Science were at some future time to be able to show that, though the miraculous facts of the Bible history happened exactly as they were reported and yet were the result of natural causes, this would not affect their character

as miracles, or in any way asperse the truth of the revelation of which they form part. He compares the general resurrection of men to the first introduction of life into this globe, and says, with strict truth, if the latter was a miracle, as we believe, it is a miracle precisely similar in kind to the miracle which believers are expecting at the last day. Some minds are sufficiently convinced by beginning with the acceptance of the miracles as proved by external evidence, and going on from this to accept the conclusion that the teaching which was thus attested must be divine. Temple, speaking for himself evidently, says that it is quite impossible for most men to take to pieces in this manner the records in which the Revelation is contained, and to go from external evidence to the messengers, and thence to the substance of their message, by so easy a method of conviction. He shows how to most of us Revelation is a whole, and one which is found to be divine from whatever side it is looked at. He gives a short account, but a very forcible one, of the evidence for New Testament miracles, and replies to anticipated objections, showing the extreme scientific objector the limitations of his mental attitude towards the world as a whole. He bases his strongest line of evidence on the attestation to our Lord's miracles and character by the disciples in their teaching, their lives, and their deaths, and upon the moral and spiritual evidence displayed by His own character, which intentionally overshadows the rest, and declares it inconceivable that He should have made a false claim.

SUMMARY.

The arguments are summed up in the statement that the great Postulate of Science, the Uniformity of Nature, is not demonstrated as universal, but as exceedingly probable, with the exception of two great instances, the Divine will and the human will, that these two exceptions are in no sense barriers to the onward march of Science with her ample powers, her free charter, and extensive field; that the moral law rests on itself, and that it requires no *imprimatur* at the hands of science, that the avowed purpose and the undeniable effects of Theism and its Revelation are manifested phenomena; that the results of Revelation, though not a *demonstration* of God's existence, are a full answer to those who ask, "If God made and rules the world, why do we find no signs of His hand in its course?" This answer is as old as that given by St. Paul on Mars Hill, and its fulness of meaning grows with the passing

centuries. Finally he shows that this moral law exists whether we accept and obey it or not. Our recognition of it depends on our character and free choice. It is personified in Jesus Christ.

OUTWARD RELATIONS OF RELIGION AND SCIENCE.

In the earliest and highest civilisations of mankind such Religion and Science as existed, and were then possible, were embraced by the Chaldeans, both in Babylon and Assyria. This separate and learned caste retained in their own power and transmitted from generation to generation the mysteries which they had inherited. Such a union of Religion and Science could be nothing but barren, for both would be of a traditional and fixed character, and if there be one characteristic more peculiar than any other to Science it is the continual development and change of its methods and results. And this is true to a less extent of Religion, and in a different way. The restless Greek mind, with its ever-active inquiry into new things and principles, introduced about the sixth century B.C. a more hopeful attitude of the learned towards the secrets of Nature and the growth of true Science. Such names as those of Thales, Empedocles, Heraclitus, Democritus, and Aristotle, and the Roman Lucretius, are landmarks in the history of Science. Of these, perhaps, Aristotle, the father of Natural History, is the most eminent, and has contributed a greater share to the impetus of experimental investigation than any of the ancients. But it is enough to mention such names to show that in that fertile period of the human intellect Science worked in a separate orbit from Religion. It were better if it had always continued so, until each of these had reached its maturity in Christianity on the one hand, and modern Science on the other. In the pre-Christian and early Christian times relations between Religion and Science could hardly have been said to exist. From the times of the Ionian philosophers to that of Roger Bacon in the thirteenth century, Science made little or no progress, but took rather a retrograde course, for the chains of authority were settling down more and more deeply on the necks of men. The work of Friar Bacon still did not bring Religion and Science seriously into conflict; still less did it open up the common ground which in modern days each has discovered, though his *Opus Majus* was important enough for Dr. Whewell to describe it as the "at once the encyclopædia and the *Novum Organum* of the thirteenth century." Still for two or three centuries more the astrologer, forerunner of the

astronomer, and the alchemist of the chemist, though frowned upon, were not seriously persecuted. When in the sixteenth century Copernicus reversed the Ptolemaic system, and in the seventeenth, Tycho, Bruno and Galileo completed his work, the theories of orthodox Science and the orthodox religious teaching on points of Science of that day came into serious conflict, and persecution according to sixteenth-century methods necessarily followed. Such a position as this could benefit neither Religion nor Science, and still the relations of the two were slight as a rule, or hostile from time to time. During the Dark Ages before the Renaissance one branch of Science, though it made little progress from the days of Hippocrates and Galen, remained like a small meeting-ground for Religion and Science; for the Church was ever ready to shelter medical science and to promote the practice of the healing art. In this we have a small glimpse of the better days to come, when Religion and Science are beginning to look upon one another as partners in the betterment of man in his whole being.

The work of Francis Bacon in the sixteenth and seventeenth centuries may fairly be reckoned as important an epoch as that of Aristotle in the fourth century B.C. He is one of the greatest pioneers of modern Science, and at the same time a man of profound insight into the truths of Religion, and in this respect a representative of the most modern man of Science. He may have underrated, indeed, the value of deductive science, and rejected too hastily some of the greatest discoveries of his day, such as those of Copernicus and the work of Gilbert on magnetism. But "it was the energy, the profound conviction, the eloquence of Bacon which first called the attention of mankind as a whole to the power and importance of physical research. It was he who, by his lofty faith in the results and victories of the new philosophy, nerved its followers to a zeal and confidence equal to his own. It was he who, above all, gave dignity to the slow and patient processes of investigation, of experiment, of comparison, to the sacrificing of hypothesis to fact, to the single aim after truth, which was to be the law of modern Science." A very significant and courageous exception was made by him in that he refused to include theology in the branches of knowledge contained in his system of Science, though he was the servant of a King whom theological studies especially delighted. He held that the premisses of the Church's teaching, or of Religion, were certain and fixed, and that his method of inductive inquiry was inapplicable to theology. This it certainly was in his day, and in many of her

articles Religion must ever remain outside the province of inductive Science, though it must be seen also that the number of those articles is diminishing as time passes. It would have been well for the relations of Religion and Science if the Church of Rome had recognised in the sixteenth and seventeenth centuries the truths that Bacon saw and taught. A pleasing exception to the strained relations between Religion and Science in the end of the sixteenth, and first half of the seventeenth, century was seen in the work and teaching of Harvey, the great physician who discovered the circulation of the blood.

Science made a great step in advance in the reign of Charles the Second, when the Royal Society was formed; but this in no way affected the relations between Religion and Science at the time. Doubtless as the mysteries of the natural world became more and more unfolded by such men as Isaac Newton, Halley, Linnæus, Buffon, and Cuvier, the ground was being prepared for a deeper and more reverent outlook upon the world around; and yet for a time in France and England there seemed to be a change for the worse in the relations between Religion and Science through the growing achievements of the latter. But such hostility as then existed was neither the fault of Religion nor Science, but of that sceptical spirit of the eighteenth century, which was glad enough to avail itself of the new discoveries of Science if only Religion, as represented by the Church of the day in England and France, could be injured. In the latter half of the eighteenth century Kant and Laplace and Hutton and Herschel opened up new fields of speculation and investigation into the origin of the world, the constitution of the heavens, and the structure of the earth's crust, all these subjects being necessarily such as would touch many of the articles of the Church's teaching, but, as we know now, not such as, in any way, should clash with the teaching of Scripture. A counterblast of great value and power was issued by Paley in the early years of the nineteenth century, in his *Natural Theology* and *Evidences of Christianity*, marking the need then felt by the Church for a reply to her numerous assailants. But then, as in previous generations, the spirit of Science was not that of Religion, and the two spheres remained much apart until again in the middle of the nineteenth century very hot conflict arose out of the work of Spencer and Darwin, and Bishop Temple took his part in it by contributions to *Essays and Reviews*. From those days to the present time the conflict has been growing less and less hot; and such lectures as those of 1884 by Temple have taken their share in

the improved relations which are manifest in the opening of the twentieth century.

From this brief review of the outstanding periods of the lives of Religion and Science, and a knowledge of the previous extent to which the adherents of each so generally misrepresented the cause they sought to promote, we can but be thankful that these two great branches of knowledge were not committed to a union before their maturity. If we imagine the injury to Religion no less than to Science herself which such a premature union must have entailed, we can well be thankful that the orbits of these two great lights have so long remained separated. What incalculable harm would have been done to the tender larval form of Science had it been encumbered with the ecclesiastical, political, and intellectual shackles which were weighing down the Church of the thirteenth century, many of which she threw off at the Reformation! And on the other hand, how the credit of the Christian religion would have suffered from any formal association with the pseudo-scientific teachings of the Science current in the thirteenth, fourteenth, and fifteenth centuries! For Religion to give the *imprimatur* of her great authority to *such* science would have been as disastrous as for Science in her swaddling-clothes to have been under the sway of the current Religion. It was better far that some of the apostles, martyrs, and saints of Science should be burned by the Church than that they should compel their Science to agree with the dogmas of the Church on those matters which concerned her teaching. It is only as a truer light shines upon Scriptural interpretation, and scientific knowledge grows more assured, that any true *rapprochement* can be desired.

The present position of the relations between Religion and Science may be symbolised by the illustration with which this paper opened, and we may fairly claim that, though these two great streams of truth, one in origin, have wandered far apart through the greater part of their remarkable course, they have united in the Ganges-Delta and are nearer to their common goal in the ocean of Truth.

“This convergence in their essentials of Religion and Science is not the least significant fact of modern thought and modern faith.” *

* *Spectator*, June 20th, 1903, p. 970.

THEISM

In considering Religion, Temple necessarily deals with it under the form of Theism, or that doctrine "that the universe owes its existence, and continuance in existence, to the reason and will of a self-existent Being, who is infinitely powerful, wise, and good—the doctrine that Nature has a Creator and Preserver, the nations a Governor, men a heavenly Father and Judge"*; and it is needless to say that the Christian form of Theism is alone considered. We should no more think of discussing as Religion the lower forms of polytheistic faiths than we should classify and describe a butterfly or frog from their larval forms. Whatever the importance of the lower faiths of man, and their interest to anthropologists, the gulf that separates them from Christian Theism is deep and wide. And whatever the ethical importance to mankind or the interest to philosophers may be found in the ancient faiths of Hinduism, Buddhism, and Mohammedanism, their almost complete alienation from modern Science put them at once out of court in such a discussion.

No definition of Science is needed. The simple statement that modern Science, youthful, vigorous, progressive, and yet cautious, is here indicated, suffices for the purpose.

CHARACTERS COMMON TO RELIGION AND SCIENCE.

What are the characters common to Religion and Science? The most prominent and important among these seem to be the following:—

1. Both are concerned with man and his welfare.
2. Both tacitly assume that man is the last and highest inhabitant of this planet.
3. Both contain revelations of mysteries, the first volume is that of Religion, the second that of Science.
4. Both show a slow progressive transformation and growth.
5. As each develops, a shrinking of the province of mystery takes place.
6. Both postulate a realm of order.
7. Both ultimately are based on faith.
8. Both postulate the uniformity of Nature.

* *Theism*, Professor Robert Flint, p. 18.

What are the characters which distinguish Religion and Science from one another ?

1. Science deals mainly with phenomena which are open to the senses of man. Religion with spiritual and moral phenomena.
2. Science proceeds by inductive methods and by experiment when it is possible. Religion makes no experiments with definitely arranged conditions, but observes the undesigned experiments in the sphere of moral law.
3. Science postulates, without attempting to prove, the universal uniformity of Nature, whereas Religion claims two exceptions, the Divine will and the human will.

When these few characters, which join, and the fewer still which divide Religion and Science, are looked at, it is difficult to see where at the present time serious disagreement can arise.

IS SCIENCE BANKRUPT ?

There are certain preliminaries which must always be observed by individuals or nations, formerly unknown to one another or estranged, if any partnership, treaty, or common undertaking is to last. From the time of the ill-fated and hasty compact between the Israelites and the Gibeonites, history is full of the dangers which arise from a failure to base friendship, treaty, or co-operation upon sound lines. This remark applies with special force to the modern reconciliation between Religion and Science and their drawing together for practical purposes in the betterment of man. Religion as the older of the two friends is entitled to ask of her younger auxiliary before anything in the nature of a partnership be entered upon—"Is Science bankrupt" ? We need hardly apologise for the form of this question. It cannot be imagined that the great house of Rothschild would propose to take into equal partnership a younger, great, energetic, and wealthy banking firm without the most searching inquiries. Indeed the question has been asked in this very form for some years in France* and elsewhere, and that in no spirit of impertinence or condescension. Religion as a business concerned with the whole welfare of mankind, and especially with the highest part of man, is entitled to ask this question, "Is Science bankrupt" ? Has Science outstanding liabilities to the world in which she

* *Revue des deux Mondes*, tome cxxvii, 1895, p. 98.

works which some day she must fail to meet? Has she taken into account all the conditions of the phenomenal world, including in this the moral nature of man?

Yes, and no, must be the answer. Science is potentially bankrupt if she demand to grasp with her single hand the three data of real existence, *Ego, External Nature, God*. Science is not and never can be bankrupt so long as she concerns herself with the two first of these primary data, leaving to Religion the task of co-ordinating the three by her expert assistance. It may happen that the department of business hitherto exclusively conducted by the old firm will be encroached upon by the extension of the powers and field of operations of the younger, as the ages roll on, even as we see at present in the great field of psychical research. But when the last word of Science has been spoken on any subject, if that should ever be, Religion must still make heard her voice as to the ultimate meaning thereof. It were almost impertinence in this twentieth century to proclaim the validity of Science in her own great territory, the limits of which no man knows, when so recently Sir William Turner could, from his presidential chair at Bradford, say, uncontradicted: "Great is Science, and it will prevail," or, Sir Michael Foster, at Dover, make even more far-reaching claims for the work of Science. A mere list of the fresh verifications of the data of Science were enough to stop the mouth of any who might raise a suspicion of the financial stability of the new partner. The works of Science have stood the test of constant, able, and often hostile inspection of her assets. Indeed, so convincing to many of her votaries have been the proofs of her wealth, and power to employ that wealth, that a man so generally candid as Professor Huxley was led in a moment of triumph to say that if certain of the branches of the theory of evolution were true, "the frontiers of the new world, within which scientific method is supreme, will receive such a remarkable extension as to leave little but cloudland for its rival."*

Such a statement savours of vapouring, a proceeding so unlike the writer's usual habit of thought and speech that one would not allude to it were it not for the important purpose of showing a truth brought out very forcibly by Professor Campbell Fraser in his *Gifford Lectures*.† Referring to the three primary data of real existence, the Ego, Nature, and God, he points out the

* "Past and Present," *Nature*, 1st November, 1894.

† *Philosophy of Theism: being the Gifford Lectures for 1894-96.*

danger which always exists, and has been abundantly exemplified in human history, of a person being absorbed in the contemplation of one of these data to the exclusion of the others. Hence have arisen from time to time the various forms of Monism which he terms Pan-Materialism, Pan-Egoism, Pantheism, each having its solid substratum of truth, but each inadequate to explain and illuminate the whole of existence. He sums this up by saying, "Unbalanced recognition of one of the three over the other two, in thought, feeling, and action, is the chief source of intellectual error and moral disorder; and that life is good and happy in proportion to the due acknowledgments of all the three. Confused conceptions of the three are an inexhaustible source of two extremes—superstition and scepticism."

We may take it that neither Religion nor Science need for a moment hesitate to make that unwritten, but all the more valid, treaty of peace and interdependence, which shall advance the physical, mental, moral, and spiritual welfare of man and the world over which he finds himself, without his own desire or seeking, appointed vice-gerent.

THE THREE DATA OF REALITY.

In the *Bampton Lectures* before us the three data of the world of reality, the individual, outward things, and God, are dealt with, especially the last. The conviction of personal identity is shortly considered as proof that our knowledge is not all relative, as Spencer would have it. But under the terms Science and Religion, Temple fully considers Nature and God in their relations to one another, and he shows the philosophical bearings of the study of these two greatest of the data, and demonstrates the essential harmony and growing *rapprochement* of their findings.

But it may be well for us to take up one aspect of these two great branches of knowledge, and ask what it is that articulates them, and them with the Ego or the individual; or, to employ another metaphor, what is the cement which must unite them, in our survey of existence, unless the superstructure raised laboriously, and now in process of completion, be doomed to totter at the first strong blast? I submit that nothing less than a teleological conception of the planet on which we find ourselves, and of the universe as far as it can come within the range of our mental vision, is that which alone binds me to Nature as one of her natural products, and Nature and me to

God, whose increasing purpose in the whole grows ever clearer as the clouds of ignorance or error are rolled back.

PURPOSE.

The position here assumed in behalf of Theism against her many assailants is that Purpose links the three essential data of existence, the Ego, External Nature, and God. The precise meaning of the term must be considered before one can expect opponents even to listen to the line of argument.

DEFINITION.

Purpose is a better term for such a discussion than Design, though the latter is an honoured one in Christian apologetics. Design comes from an old French word, signifying a *drawing* or a representation made with pencil, and has been much associated with architecture, though in some of its later and derivative uses it is equivalent to purpose. It was a term that lent itself very naturally to the older views of Divine Purpose, and described even better than Purpose what the teachers of earlier times wished to convey. Plan and Purpose were almost less in their minds than immediate designs, methods, contrivances for certain ends.

Purpose is a wider term as to its primary meaning, "a thing proposed or intended," an object to be kept in view or subserved in any course of action, *an intended or desired effect*. This wider term fits more accurately the wider view of Nature and its origin, formation, and working processes than the older views of Paley and the writers of the *Bridgewater Treatises* could possibly entertain.

CHARACTER OF THE COSMIC PURPOSE.

The ground may be cleared at once by two statements as to the purpose in question. In the first place the character of the purpose can only be of a benevolent nature. Whether with our finite minds we can or cannot recognise benevolence at all the stages of the long-drawn drama of organic existence, it is mere waste of time to discuss any other than a benevolent purpose of a non-human or Divine Mind. In the second place the purpose in question is one, not of methods and details by which ends are arrived at, but of Intention. It is to be hoped that thus we may avoid much misunderstanding.

Purpose, then, or *Intention* is the metaphysical warp and woof of the time-vesture of Nature, or that part of a vast system

which concerns man, as a being with finite powers. We have evidence on all hands that teleological interpretations of existence are permeating the most modern systems of thought, even among those who would declare that the argument from Design for the existence of God is dead and buried. The wider teleology of which Huxley spoke was prophetic of the present views of purpose in the whole.

In this study before us of purpose as articulating God, nature, and the individual, it is not sought to adduce any proof of the existence of God and Providence by more or less evidence which shall demonstrate the theistic position in the same degree as those of mathematics, or by pure logic. Many from the days of Kant onward have found the Design Argument insufficient to bear alone the weight of proof which would compel the atheist once for all to abandon the old cry, "There is no God." They have turned to other lines of evidence, and still the succeeding generation of philosophers have found some hiatus in their chain of reasoning. To refer with any value to these would be to review the contributions of a century of acute intellects ardently applied to the greatest of ever-absorbing themes. But we may profitably see how *Purpose*, benevolent, wise, and finally interpretable, runs through the whole scheme of nature presented to our minds. Though we may not demand assent to this conception of purpose in the whole, as we do to the axioms of mathematics, we may fearlessly claim that its validity as an incomplete induction is as great as any of the natural laws which it has been the glory of modern science to establish, as great as that of the uniformity of nature, of gravitation, the conservation of energy, the indestructibility of matter, the atomic theory, the theory of a universal ether, or the theory of evolution. Indeed, at the very basis of the modern conception of natural law is found the implied element of intelligible purpose. Whether we all know it or not, and whether we like it or not, we are in "a realm of ends."

The very terminology of our sciences, especially those concerned with life, connote purpose or intention of some kind. Even a thinker so far removed from Theism as Mr. Herbert Spencer cannot work without the assumption of what he prefers to call a First Cause, seeing that all the phenomena which a scientific man ranges under the imposing name of "natural causation" are themselves caused causes. Such a universally-used term as "adaptation" is not thinkable apart from the pervading conception of purpose of some kind. The unconscious adaptations made by plants, animals, and man

to their surroundings and the needs of their lives, their unconscious *response*, which affords a field in which selection may work, no less than the conscious adaptations of man to his home, speak irresistibly of a grand scheme of purpose underlying the mechanisms, by which the adaptations are effected. This flow of purpose through the Ego and nature cannot have its source either in that great system of "molecules in motion" which is called nature, or in an individual man who represents but an infinitesimal proportion of those molecules at some particular brief period of the history of a very small planet. The flow can neither start from me nor from nature, but must be of a kind, whether we call it Divine or supernatural, which transcends any purpose which could originate in me or in nature. Looking metaphorically at the trio of existences, may we not consider Purpose under the aspect of a stream which flows *from God to me through nature* as a veritable garden of the Lord, fertilising nature in its passage to me? Such a view of the Cosmos, whether demonstrable or not, does not glaringly sin against the law of the conservation of energy.

It is necessary now to trace through such provinces of nature as are open to our observation the presence of Purpose, remembering ever that this closely resembles a river of which we can never see the whole—we may see the source, we may admire its ocean-mouth, we may follow and lose, and follow again its windings, some of which even seem retrograde, and some of which will even pass underground—but the evidence of its source, progress, and destination we never for a moment question, even though we never have traced and never shall trace its complete course.

EVIDENCE OF PURPOSE.

The evidence for the existence in the world around us of a purpose, which pervades the whole, may be summed up under five heads:—

1. The general order of Nature (the depth and extent of which grows with advancing knowledge).
2. The existence of life on the globe.
3. Special adaptations of means to ends in organisms.
4. Anticipation, preparation, and production of environments suited for the lives of organisms.
5. Earthly life a training-ground for the moral nature of man.

1. *General Order of Nature.*—In spite of much that conflicts with our limited knowledge of what is best for the existing world, in spite of seeming waste of life, and failure to live among lower organisms, in spite of the long-drawn tale of human woe so strangely mingled with human triumphs and happiness, it is impossible to contemplate the spectacle of the course of this world, illumined by the increasing light of Religion and Science, without a conviction which no arguments can shake, that order is the essential feature of the unfolding drama. The ancients required to describe this scheme of things, and they called it by a name which signified order; tacitly reasoning that, from the immense preponderance of order observed by them among natural phenomena, the remainder was certainly also governed by the same principle. It may be said that they knew so little of what modern Science has established, so little of the mode of production, the geography and geological history of this planet, to say nothing of the vast host of Heaven, so little of the structure and life-history of plants and animals, or of the laws of chemistry and physics, that we are not compelled to give much weight to their views of things. Nevertheless, for clear, deep thinking on the data presented to them the Greek and Eastern sages were giants to men of modern times. The whole course of discovery since the early philosophers has been to display a marvellous extension of the world of purpose, in the orderly development of the conditions of life, and of the inhabitants to require them, the interdependence of plants and animals, the regular march of the seasons of the year, the recurring round of day and night, varying climates of the globe, the due proportions of land and water, the fixity of the composition of the terrestrial atmosphere, and the general uniformity of nature. The very fact that with the exceptions of the Divine will and the human will the course of nature is uniform, that every new discovery only adds one more tittle of evidence to the overwhelming bulk which confronts the modern scientist; that a small group of human beings, existing during a few paltry hundreds of years on this particular small planet, are able to formulate laws of nature, which, whether invariable or not, are nearly so, and which dictate terms of existence and motion to the furthest stars—such a fact alone is an irrefragable proof that order, and calculated order of a transcendent kind, is immanent in the existing state of things. If it were really true that the globe and its inhabitants were pictured by the evolution of an individual ovum to a full-

grown organism, human or other, the argument for purpose that order affords would be the weaker thereby. But no such mechanical, fixed development of the world and its inhabitants as this much-vaunted picture is supposed to exhibit, is found in the world around. This fallacious conception of the picture of the phylogeny of living things which the ontogeny of a particular organism is held to illustrate might easily be dragged in by the teleologist as an aid to proving the agnostic evolutionist wrong out of his own mouth, when he denies the existence of order and purpose in the world. But for those who prefer to think for themselves, and only to avail themselves of the well-tryed and matured conclusions of modern Science, it is a very dangerous thing to trust to the armour of Saul when the five smooth stones of the brook are at their service. The development of the individual organism is very interesting to the embryologist, and even to the biologist in general, and the history of the development of the race of plants, animals, and man is of still greater interest, but let us beware of resting any argument for the latter upon any supposed analogy afforded by the former. The general rational order of the world is also further illustrated by the slow process of mental development found to have taken place, until modern man has found himself surrounded, as in a fairy palace, with a profusion of beautiful, useful, mysterious, and yet progressively interpretable phenomena.

It was a foremost physicist, Professor Larmor, who proclaimed at the British Association of Science in 1900 the *rationality of natural processes*, and every notable man of science to-day will claim that Science has much more to do with phenomena than to observe, describe, record, and admire them, and that is to interpret them. I speak not here of final causes so abhorrent to the agnostic, and supposed, but wrongly, to have been entirely banned by Francis Bacon (as a matter of fact he only condemned the study of final causes as a barren one when it led the student to take his mind off the natural and discoverable links of causation), but it must be acknowledged by all that the final business of Science is to arrange in the order of nature the phenomena which they can reach; in other words to interpret their meaning with the powers of finite minds. This would be a fruitless or certainly most fallacious pursuit if there were no meaning in them; and, if an increased knowledge of nature were to reveal to them the fact that confusion and chaos had taken the place of that cosmos which they once had more or less clearly perceived; it were disastrous indeed to have been

heir of all the ages foremost in the files of time. Were it not better not to have been, or to have passed from the reptile to the bird stock rather than along the tedious, often painful course of mammalian development up to man, to end in this cruel fraud!

This great conception of order in the world is as essential to the scientific worker as to the far-seeing Slavonic tribes in the ninth century, who sent to Ruric, a Swede, the momentous message: "Our land is large and rich, but order in it there is none. Do ye come and rule over us." Ruric came, the kingdom of Russia was evolved, and his descendants ruled for seven centuries.

2. The existence of life on *this* globe, whether it exists in Mars or any other planet, is a stupendous fact which demands to be heard in open court as to its evidence for purpose in this small corner of the universe. It is not here our business to inquire how and when life arose, or what is its destiny; but that at a certain past epoch life was introduced into a habitable globe, and that this became increasingly habitable and life increasingly complex, are facts eloquent of purpose.

Desperate attempts have been made to show that it is possible that, under certain past conditions of existence, protoplasm may have been endowed with life by the combination of certain chemical and physical laws. These attempts will doubtless continue, and will perhaps help to keep certain people out of mischief, but few persons now doubt that the further development of synthetic chemistry in pursuit of this object will resemble that long day's frantic work on Carmel of those 450 prophets of Baal who from morning until midday, up to the offering of the evening sacrifice, cried, "O Baal, hear us," but there was neither voice, nor any to answer, nor any that regarded. If life did at a certain epoch and under certain unique conditions arise from a combination of causes, the fact is a miracle none the less, and an incontrovertible argument for purpose, if we are prepared to acknowledge the growing orderly sequence of events which has issued from that primeval fact. To suppose that life, with all its consequent phenomena pregnant with meaning, and in the main with benevolent results, was the result of a series of happy accidents which only once in the history of this globe came into the necessary conjunction, is certainly not according to the principles of modern Science, according to which an intelligible fact must have an intelligible cause, whether or not we are able at present to discover it. Such notions are much too like the fairy tales

of childhood, where imagination runs riot. But if we recognise that there was purpose in a Mind which foresaw, calculated, and prepared the conditions of the origin of life, we are working at any rate in a rationally-conceived system of things.

Taking the lowest view of the purpose implicit in terrestrial life, we can affirm that life must have come into being in order to be *lived*, *propagated*, and *terminated*. Such an apparent truism cuts away the ground from under the feet of the agnostic in this second line of evidence, except he be an avowed Pyrrhonist.

3. The special adaptations found among organisms occupied most of Paley's natural theology, and his exposition of them remains most valuable. Temple recognises their value, and holds that the force of Paley's argument is strengthened by viewing adaptations in organisms as solved slowly rather than produced in the mechanical and more crude way believed in his day. No detailed reference can be made here to the amazing wealth of purpose enwrapped in the plants and animals of the globe. We may well conceive how vast it is when Weismann could say, "All animated nature is adapted, and has been so from the beginnings of life." Though he said once, in reply to Lord Salisbury, that we must not assume the existence of a designing force, for by so doing we should surrender the pre-supposition of our research, viz., the comprehensibility of nature; he also admitted that "there is nothing to prevent our conceiving of a Creator as lying behind or within the forces of nature, and being their ultimate cause."

We may briefly refer to plants and animals, and a few specimens of the adaptations found in them. In plants the innumerable special adaptations may come under three heads, those concerned with *relation* to the earth, air, or water in which they live, with their *nutritive* functions, their *reproductive* functions. Under the first consider the *root*, *stem*, *branches*, *leaves*, and *bark*, with the immense varieties of these, and their special adaptations to many differing environments. Under the second, what various processes subserving the nutrition of the plant are contrived and carried out in diverse ways, the absorption of nutriment through root-hairs and rootlets of the root to the stem, and its passage through the minute vessels of the woody fibre as sap to the leaves and other parts of the plant, the delicate chemical processes of elaboration of the sap in the leaves under the action of sunlight, where it meets with the carbon dioxide absorbed from the atmosphere. What important manufacturing processes are carried on in the leaves of plants,

and when the finished product has been reached, how wonderfully is this again distributed through the downward system of tubes contained in the veins of the leaves! Consider the importance to the life of the plant of the minute stomata or mouths for the respiration of the plant, and surrounding each of, generally, two special or "guard-cells," for the purpose of closing or opening the stomata, by means of which the discharge of moisture from the leaf is regulated!

Under the third head the *reproductive* parts of plants present a wealth of marvellous and diversified means to ends, the flowers and their parts, the fruit, the seed, each with their many forms of protection and means calculated to ensure their dispersal. In addition to all the incalculable numbers of individual adaptations coming under these heads, what ingenious defensive mechanisms are presented by plants for the general protection of the organism?

But any educated person has sufficient knowledge of elementary botany to appreciate the extent, variety, and value as evidence for purpose in the adaptations among plants. Yet this again does not exhaust the evidence, for not only is each species a witness, but each sub-species, genus, sub-genus, family, sub-family, order, sub-order, and class gives its independent and separate testimony that different adaptations appropriate to the needs of each have been produced. Further still does the testimony extend when we remember that each individual plant and each structure of each individual at all periods of its life, and every plant in all parts of the world, which has existed since the dawnings of vegetable life arose in the warm primeval seas, supplies potential evidence for the existence of purpose. The incalculable *repetition* of the evidence, and all of this harmonious in its tendency, is not often taken into account when the value of adaptations as evidence for design or purpose is assessed. In a human court of law when the object is to arrive at the substantial truth of the question at issue, a frequent repetition of the same evidence from credible witnesses could not fail to convince.

It may be mentioned that the number of the existing species of plants has been calculated roughly at 500,000.

Among *animals* a mere mental survey of the fringe of the subject of adaptations and their meaning is enough to bewilder. It may be taken as generally true that the variety, number and complexity of adaptations among animals vastly exceed those among plants, and there is no need for surprise at this when we consider the more complex life, especially arising from the

development of a nervous system, found in an animal. The greater number of animal adaptations is in proportion to their higher scale of being. Again, the three elementary groups of structures subserving *Relation*, *Nutrition*, and *Reproduction* suffice to group simply the bulk of adaptations found in the animal world. Here, again, most of the evidence is too familiar to need more than a brief reference, and so familiar also as to make one commonly omit to observe the vast potential evidence for purpose comprised in any individual and well-known animal. We may allude to—first, the bones, muscles, skin, hairs, feathers, scales, spines, claws, teeth, horns, any single group of which would afford material for a short treatise; second, the nutritive functions of animals necessarily require much more complicated contrivances and structures to carry them out than the simpler processes sufficient for plants. Between the absorption of nutritive matter by a protozoon through its ectosarc from its watery surroundings and the digestive apparatus of man, we have to take a mental journey which is indeed immense. Thus the whole ascending series of animal forms shows so simple an arrangement as that of the sponges, and so complicated a group of mechanisms as the fourfold stomach of a ruminant. But in addition to the absorption and comminution of nutriment in the mouth, gullet, stomach, and intestine, there are such important structures in all degrees of development as salivary glands, liver, spleen, pancreas, and kidneys, their perfection rising with the general ascent of the individual form, organs for excretion and assimilation being in some cases put to work of both kinds. But nutrition in the proper sense of the word includes the process of obtaining the required amount of oxygen from air or water for the due maintenance of the purity of the blood, and this brings in the wondrous groups of mechanisms by which, for example, the insect will absorb gases from the air through its trachea, the fishes from the water through gills, the amphibia by gills at one period and lungs at another period of their lives, the mammal by a varied and ascending scale of respiratory arrangements culminating in those of man. Third, the methods by which the propagation and perpetuation of the species in animals is secured are not less varied or wonderful than those to which allusion has been made. The former were primarily for the benefit of the individual, these are for the benefit of the succeeding race. They include the gemmation and fission of the protozoon and the myriads of forms of reproductive apparatus intervening between such primitive contrivances and those of the higher mammals. To

touch on these at all fully would overweight the argument without rendering the general drift of all the lines of proof more clear. It is enough to remark that purpose is implicit in each and all of the vast number of plans adopted in different ranks of animal life for the one object. To imagine that these or any of the two preceding groups of adaptations could be the results of clumsy gropings at the best apparatus, with here and there a successful discovery, and that the former were eliminated and the latter perpetuated by a purely mechanical selection, the most generally fitted organism surviving, is to stultify imagination not less than reason.

The number of species of animal forms has been but roughly estimated and, perhaps, may reach 2,000,000. But to take one group out of the whole animal kingdom, we know that there are not fewer than 50,000 species of mollusca.

When such approximate calculations are made and we reflect that each individual out of the species of animals, or of the 50,000 species of mollusca, has teeming evidence of purpose in each part of its body, we still have not sounded the depths of the matter; for, as was observed in the case of plants, there is *potential* evidence for purpose in every dead, destroyed, or fossil animal that has lived and died since the first division of the living world into plants and animals took place. Such evidence as this may be "taken as read." It is not direct evidence, but its value depends upon an inference so cogent that it can only be ignored for the sake of getting the case into Chancery, so to speak, and thus putting off the real question at issue till a more convenient season—which will never come. The evidence afforded by one particular species of animal, highest of the Anthropeidea, man, is, if possible, more weighty, because the physical and mental contrivances of this "paragon of animals" are more familiar and perhaps more deeply understood, and themselves more subtle, than any to be found in the lower ranks of animal life. The twin sisters of anatomy and physiology, which might philosophically be termed biology, are even at the present time profoundly occupied with problems at present mysterious, but whose margin of mystery is slowly and surely receding before inductive research, as at a falling tide the solid shore encroaches upon the waters. A life time and the highest mental faculties directed by modern methods is all too little to enable man to say of human physiology anything more than "now we know in part." Every year adds to the immense mass of physiological knowledge (much of which has first to be unlearning) based upon scientific experiment. And

this wealth of learning and labour is but for the unravelling of mysteries locked up in the functions of one animal species. There are some 1,500 millions of this species at the present time inhabiting this planet, and every tissue and organ of each of these individuals might be subpoenaed as a witness for the immanence and universality of purpose in the world of man. Surely a staggering mass of testimony for purpose is forthcoming and must be estimated!

4. Great as is the strength of the chain of evidence for purpose in Nature, it is but half of what we may adduce in open-court. It is impressive to see how organisms are adapted to their needs and surroundings, but we double the strength of the evidence at one stroke if we show the close correlation between the environments and the organisms which inhabit them. We may take as an illustration, but not as a proof, of purpose, the making of a garden. It may require a few months or many years to bring a garden to its particular kind of perfection. It may be a piece of ground reclaimed from primeval waste, and no more than a few simple clearances of ground and sowing of hardy plants and planting of a few trees are possible or desired. Or it may be an extensive, luxuriant, and varied domain, for the perfecting of which half a lifetime of man is insufficient, and the highest skill required. But preparation of the ground piece by piece, levelling, draining, enriching of the soil, division of the space into others appropriate for different purposes, are all in their measure present in the making of a garden. The conditions of nature—sunlight, warmth, moisture, natural composition of soil, level, exposure, and shelter—are all required to contribute to the ideal result, and can all be utilised or checked according to the purpose in view. When all the preparation and planning of the *environments* or the garden itself have been carried out, there still remains the equally difficult task of adapting the seeds and plants to the conditions already foreseen and produced, and the period in the life of the garden must be taken into account, and appropriate plants grown; the seasons of the year and the climate of the place will determine much that is done, or that will be possible in future years, to bring the garden to its ideal.

If this slight analogy be followed, it is seen to be a very fair picture of the double process of anticipation, preparation, and making of this globe for the plants and animals that are to be, and of the plants and animals that shall in their suited time and place occupy the environments so slowly but wisely provided. To unfold the great plan as a grand whole is impressive,

but to see how piece by piece the purpose in creation is worked out in the divinely-wrought preparation of environments for organisms and organisms for environments is more conclusive still, if not more interesting. The astronomer, chemist, physicist, and geologist can give us expert information as to the secondary causes by which this globe has passed from the molten and liquid mass that it may have been 100 million years ago to what it is to-day. The manner of production of the atmosphere of our globe, the oxygen probably derived from the living processes of lowly plants (such as *confervæ*) in the warm primeval seas, may be expounded, but in all such cosmic matters which are great enough to give him enough occupation, the scientific observer may be reminded of the old saying, "Ne sutor ultra crepidam."

The whole duty of the scientific man is to contribute his quota of expert evidence in the subjects of his choice, and to bring them to that great assize with which Philosophy is concerned, and where her voice is ever the last to be heard.

On former occasions I have dealt more fully with the known geological history of the globe and the changing environments in successive epochs.* It is not needful to do more here than to refer to the warmth, equability, and homogeneous character of the primary, the increasing definition of land and sea still with excessive moisture, warmth, and equable conditions of the secondary, closing with a period of greater cold and more severe conditions of life, the slow development of more complex climates, continental areas increasing by elevation, diminution of the previous excessive warmth and moisture, more volcanic action with its profound effects upon the face of the earth, the gradual cooling of Pliocene times characteristic of the Tertiary Period, until the present geological epoch was ushered in by the glacial period of the Quaternary Age, this again subsiding and allowing the present state of the globe, with all its adaptations to man and the existing fauna and flora, to take its place.

It is enough to state that the four successive groups of environments, which we call geological ages, are wonderfully matched by the plants and animals which in due time were produced to fill them. We cannot conceive the tender infancy of the living world to have arisen and have prospered even under the guiding hand of the Creator during the glacial period, or that the age of mammals could have been placed on the stage of this world during the sub-carboniferous times, or the age of reptiles to have found its suited home and cradle in the Laurentian period.

* *Trans. Vict. Inst.*, vols. xxxii, xxxiii, xxxiv.

This we can all allow. But the agnostic evolutionist would claim that this immense bulk of evidence is as much on his side as on that of the teleologist, though the former does nothing more than record the facts, whereas the latter sees the facts equally, and *in them* a wealth of meaning. He asks, "Is it enough to adduce 'natural laws' to account for the production of environments, and on the other hand of organisms, and simply to leave the stupendous correlation of facts lying over against one another as if they had nothing to do with one another, except that somehow they seem to fit one another rather remarkably?" Science is well within her province when she takes these past facts as data and unfolds with her marvellous precision the story, until a vivid picture is presented to the science-informed mind of what must have occurred during many millions of years. Each fact great and small, and each group of facts becomes fitted into the natural order of things, and yet the last word has not been said, for it remains for Philosophy informed by Science to co-ordinate the great congeries of facts and introduce some guiding principle into the whole—that principle can be nothing more nor less than the conception of purpose. The interrogator of nature must push his inquiries beyond the How, When, and Where, to the Why of all this "great progression of Nature."

5. The fifth line of evidence is largely referred to by Temple under the supremacy of the moral law, chiefly to show its position towards Religion, not as a branch of evidence for purpose.* It is under the aspect of evidence for purpose in the world that I would briefly refer to it.

The evidence in favour of purpose in our whole scheme of things would still come far short of completion if it could not be shown that the marvellous series of adaptations provided throughout nature were produced for the benefit and improvement of *persons* rather than *things*. This distinction, applied by Professor Campbell Fraser to man as opposed to non-conscious organisms and inorganic phenomena, is of great importance in this connection. Indeed, it touches the very basis of Theism. However beautiful in their order and adaptations to needs, may be the most nearly perfect plants and animals, they at any rate know naught of the voice within, the infinite nature of duty, and the beauty of holiness. No endeavours, however successful, to trace the moral law to a lower origin alters the fact that an ethical sense *exists now* in all men, and it distinguishes the

* *Ante*, p. 101.

genus homo from the other groups of the Anthropeida more notably than any specific physical character. On the theistic, no less than the scientific, theory of things, "Nature's great progression" from the inorganic to the organic, the formless to the formed, the simple to the complex, the protozoa to man, exhibits manifold degrees of feeling and thought. The senses, intellect, and will show themselves with increasing definiteness throughout the great ascending scale of being up to man, and not to man as one of the genera of the anthropeida, which, in the glacial period, might perhaps have sufficed for his classification; but to modern man, though not to modern man alone, but modern Western civilised and scientific man. What chasms there are, not only in physical characters, but in mental ascent, from protozoa to metazoa, from invertebrates to vertebrates, and from the earliest of these to man! It would be hardly more strange than sad that ever an "excelsior" should mark the ascent of animal mind, that it should be crowned in the noble attributes of man, that the topmost branches and finest fruit of the tree of knowledge which has grown up and round and in him should culminate in this refined and well-informed character of conscience, this chiefest taxonomic distinction of the *genus homo*, and that the last great fruit of a long evolution should be a fatal illusion—a will-o'-the-wisp which has led him far from the safe and solid ground of nature and her phenomena into the regions of religion, morality, and ethical goodness. This strange "illusion" has at any rate been the efficient factor in the course of human evolution which has availed to prevent the earth from becoming a shambles, and its highest ideals no more than those of hunger and animal love. Is it, can it be, the part of Science to destroy with pitiless logic and triumphant discoveries in her own sphere the supremacy of the moral law in the hearts and minds of educated men; to show that, however useful in the childhood of man has been the assumed relation of the moral law to the Unseen and Infinite Being, it must now be discarded as a creed outworn, and that now under the newer regulative system which Mr. Herbert Spencer declared to be the pressing need of the age, the laws of comfort shall be the laws of conduct? One can but remark here that if the links of man with the Infinite Being, postulated by the theistic position, be the childish illusion which the agnostic declares it to be, it is the only phenomenon recorded in the book of nature and the history of mankind, of a vast benefaction to man and his subject creation being produced by fancy and promoted by fraud. Taking the ground of

nature alone we may say it fails. Nature knows no "single instances."

Surely the conception of this order of things as a training-school for the higher faculties of the highest of living things meets the facts of the case with a completeness which cannot be ignored in open court. The reign of moral order, however yet imperfect, is extending its conquest on all the frontiers of barbarism and lower human life, and this is the one witness which was needed to complete the chain of evidence for purpose. Here, too, we see the double side to the evidence as in the adaptations and organisms before considered. The moral *persons* on the one hand, and on the other the surroundings of growing complexity, the advancing solidarity of the human race, which furnish to the former a scene in which their moral faculties may be exercised, supply this double line of testimony.

The five classes of evidence for purpose in this globe on which the lot of man is cast may be objected to as being confined to the conditions and inhabitants of one small planet. From the nature of the case *evidence* is not available for any others of the host of heaven, but our evidence is valid as far as it reaches, and no contrary evidence outside or inside this sphere is forthcoming. Nevertheless such scientific proofs as are available for other worlds than ours points clearly to a general order under partially ascertainable natural laws.

DEGREES OF PURPOSE.

We have seen the sense in which the term Purpose is here employed, but it remains to ask not only for its verbal definition but its limits in the scheme of things around us, in other words, "Where does Purpose begin and where does it end?" The answer to this question has been enormously widened since the researches of modern biology have shown the presence of a nervous system in an increasing series of animals far down the metazoa and the borders of the protozoa, for wherever the most rudimentary and elemental nervous apparatus is found there must Mind be considered to be present in embryo. The gradations which are shown to exist in the ascending scale of animal life up to man are so immensely numerous and yet so minute, that no valid evidence is forthcoming which can prevent our looking upon mind as a phenomenon, on its physical side, continuous and growing in complexity from the sense-organs of a polyp to the brain of a man. Even where a nervous apparatus of the simplest kind is not to be discovered at present, as in

a bacterium, the modern tendency is to attribute even to such lowly creatures a measure of purpose or will in its humble life.

Even in plants it has been shown by Francis Darwin * that a mechanism for the transmission of stimuli is to be discovered. This mechanism cannot truly be called a nervous apparatus, and yet it furnishes means by which the purposes of a higher apparatus are subserved. If we start from the rudimentary actions of a bacterium which may be watched under a microscope, and trace the growing complexity of the life-processes and actions of a hydra, sponge, medusa, sea anemone, worm, starfish, crab, mollusc, fish, frog, reptile, bird, or mammal, we cannot refuse the conclusion that the enlarged conception of will and intelligence is applicable to each and all, though between the actions of a bacterium and those of a mammal a seemingly infinite gulf is fixed on the older theory of the production of animal and vegetable forms of life. It may be urged that this graduation of nervous and mental phenomena from the lowest to the highest forms of life destroys the distinctive properties of the human as distinguished from the lower animal mind. But it is far otherwise when we take the view that the highest not less than the lowest is but the expression of divine and infinite mind, and that though between man and the highest ape there is that "vast gulf" which Huxley so freely acknowledged to exist,† the physical medium through which God manifests Himself in living beings is of the same essence in the lower as in the higher creatures. We cannot now look with minds dominated by materialistic views upon consciousness in man as a "secretion of the brain" in the same sense as the gastric juice is a secretion of the stomach, nor as a mere mode of motion. No view of thought meets fairly the requirements of modern knowledge which does not look upon the matter of our earthly bodies as that which *limits* consciousness and confines its intensity within certain limits rather than that which *produces* consciousness.

Purpose may be truly said to begin where the rudiments of mind first appear, and to end with God the First Great Cause, or more correctly to begin at the centre with God and to end at those lowliest of creatures which require a microscope for their detection. It will be useful here to follow out in some

* *Nature*, 1901, November 14, p. 40.

† *Man's Place in Nature*, p. 153: "At the same time, no one is more strongly convinced than I am of the vastness of the gulf between civilized man and the brutes, or is more certain that, whether *from* them or not, he is assuredly *not of* them."

detail one particular line of the works of man in which the limits of purpose are very wide. Among the important agencies of human intercourse and development roads of various kinds are prominent. Roads are obviously the products of purpose, and if we trace briefly some of them in an ascending scale, we trace at the same time a very definite gradation of purpose on the part of man. Pre-historic man can have had little more than a few beaten tracks, hardly differing from the tracks of goats on the side of a mountain, by which he would wander from one locality to another. In such a roadway it is hardly possible to trace purpose, for it would be formed in a subordinate way by his finding this path the line of least resistance to his movements from place to place. With growing intelligence and power of associating with his fellows, he would come to see the results of his half-conscious purpose exhibited in a path which it would be to his interest to keep open. A pathway of this kind must have been for an immense stretch of time the precursor of Watling Street, that great trunk-road which from pre-Saxon times cut a diagonal course from the south-east to the north-west of Britain, or the Icknield Way, another of the earliest lines of British communication, crossing at right angles the former great road. From primitive pathways like these, gradually converted into highways, it was a great advance when the Romans ran their great military roads through the country, ignoring natural obstacles with masterful wisdom, and leaving behind them these monuments of their power and greatness. Beyond these developments of roads the growing needs of man and his increasing skill slowly produced still higher forms. Thus in the coaching days of 100 years ago a high degree of perfection for the purpose in view was attained. Then, again, further improvement in the surfaces of roads was reached by the teachings of Macadam, and yet such roads as these could not meet the further development of traffic which came with railways as they covered the country in the first half of the nineteenth century. Thus railway lines grew and progressed towards their present perfection, until we reach their present development which carries them up mountains and through mountains, underground, over rivers, and over the heads of dwellers in great cities.

These marvellous changes and advances beyond the primitive pathways of our rude prognathous hair-clad ancestors embody a world of growing purpose, and we may, in this simple illustration, read even among this one class of work, on the

part of one animal, albeit the highest of all, an extensive series of ideas carried out and of purposes portrayed. An illustration of this kind reminds us of the numerous *degrees of purpose* manifested by man in his teeming works. But in addition to such degrees of purpose as these we find that there are very great diversities of intelligence in the carrying out of the same purpose and plan.

A few instances of this may be given. The masons and carpenters employed in the construction of a great Gothic cathedral are but dimly conscious, if conscious at all, of the architectural plan and the religious conceptions embodied in the slowly-reared structure to which the skill, knowledge, and taste of some old architect of the thirteenth century has given birth, and yet they are concerned in the carrying out of his noble scheme which shall delight future ages of men, not alone by its great purpose and plan, but also by its delicate workmanship.

Again, a highly-trained chemist will dispense with skill and accuracy the prescription of a physician, and yet be far from any true conception of the purpose immediate or remote, kept in view by the latter. It is far short of the physician's knowledge of the individual patient and his physical state for the chemist to be well acquainted with the ordinary uses of the individual drugs prescribed.

A navy employed in making a new railway will be practically acquainted with the laborious details of his manual work, and see much of the crust of the earth in which he works; but how different is his limited knowledge of the purpose of the whole from that of the chief engineer, the financiers, and the geological adviser, from whose expert knowledge a great pioneer railway shall arise to open up new centres of human life!

A shipwright employed in the construction of a battleship will tell one much that is of importance and interest as to the mechanical details of his work, and in such a man honest, careful work is most necessary to the perfection of the whole; but the gulf between his technical knowledge of his own department and the profound calculations, scientific and pecuniary, of the chief constructor is immense, and yet each is concerned in the great purpose of the whole.

Again, how far removed is the daily work and knowledge of a British private soldier from that of the commander who for weeks has been maturing a strategic plan which shall at one stroke turn the flank of a formidable army and settle the issue of a campaign! Each fulfils his portion of the purpose, and yet

how different the knowledge of the private soldier from that of his chief leader!

In July, 1870, one evening Bismarck, with Moltke and Roon, were dining together in Berlin in gloom and anxiety, when the famous and fateful telegram from Ems was received. The subtle statesman saw that the moment for which he had prepared his nation had come. He amended and expurgated the sentences of the telegram so that they should explode the train he had been preparing, with the result of precipitating that war which was to change the map of Europe and weld the States of Germany into an Empire. How far removed from the deep calculations of the statesman was the understanding of the telegraph operators who transmitted to the Embassies of Germany the words of this telegram!

Such illustrations might be greatly multiplied, but enough has been said to show the line of argument.

We see, then, in regard to the conception of purpose among the inhabitants of this planet, that two facts stand out—

1. Purpose is displayed in all ranges of living beings, from a bacterium at one end of the scale to a man at the other end, the gradations in the upward development being almost imperceptible.
2. Degrees of purpose in the various human agents concerned in any of the great works of man are numerous, and the extremes great.

The bearing of these two aspects of purpose upon the question of a Divine Intelligence which forms and guides the universe is very clear, and it constitutes one of the main converging lines of proof of the truth of Theism. If the highest intelligence of the highest of earth's creatures be led to trace, as knowledge grows from more to more, a measure of purpose in the creatures beneath him, till the lowest of all is reached; if he sees in them not only the purpose of their production, but the purpose ceaselessly displayed in their life-processes; if he be forced by the necessities of thought to refer all this wealth of life and purpose to a Great First Cause, it becomes impossible to deny to that Cause a purpose and plan such as the highest human mind can in part comprehend. As modern man studies the book of nature, the course of human history, and the workings of human mind, he comes to the irresistible conclusion that he is reading, in hieroglyphic characters it may be, but with growing certainty, some pages of the great plan and purpose which a benevolent and infinitely wise Being is unfolding.

It has been seen that a growing knowledge of living nature has served to enlarge enormously the sphere of purpose. The old controversy on the subject of free will or determinism can never again engage the minds of men with the fervour and passion seen in the past. No longer now need this controversy divide even religious men into hostile camps. It has no *locus standi* in a practical age like that which is upon us. No civilised community would venture to act for 24 hours as if determinism were true in ethics even though the prevailing fashion among ethical teachers still seems to be to deny that man is free. If governments could be induced to govern their people on the theoretical lines of the non-religious experts on ethics, a very little time would have passed before the survivors in the progressive nations of the world would be longing for that "friendly comet," referred to once by Huxley, which should resolve them and their earthly abode into their original elements. But the degrees of purpose which have been reviewed, as passing through the whole scale of living beings, and the irresistible evidence which is forthcoming, that man at least is free to make himself bad or to make himself good, raise a very important point to which, in his *Gifford Lectures*, Professor Campbell Fraser frequently refers.

MEN ARE PERSONS NOT THINGS.

He shows that the only intelligible conception of the world in which we live requires us to look upon men as *persons* and not *things*. All scientific progress, all secular business, all moral progress requires that this view of men as moral beings be acknowledged. It appears to lie at the root of all human life, and to be frankly admitted by all except by the learned and comparatively small coterie of scientific experts on ethics who have captured the minds of their fellow scientists. If this be formally granted, the whole of terrestrial existence gains enormously in interest and importance, and the dark mystery of evil becomes less and less oppressive to the human philosopher. It is appalling to contemplate in thought what the condition of mankind and his subject creatures would be if it were not almost universally acknowledged in civilised countries. History, fortunately, gives us one object-lesson of the results which would follow if mankind were to hold the view that men are things and not persons, and therefore irresponsible agents. The lesson is writ large in the page of modern history. One of the greatest geniuses ever seen was that man who has been called "the Scavenger of God," of whom it was said that "nothing where

he had passed was as it had been before." It is not for us to appraise the amount of evil or of good which emerged after his marvellous career was ended. A military genius unequalled since the times of Alexander the Great and Julius Cæsar, a statesman of the greatest prescience, of immense political insight, a conqueror with world-embracing visions, a man of dazzling abilities of many kinds but without a vestige of moral principle or unselfish aim, Napoleon stands as the exemplification of the doctrine that men are *things* and not *persons*. We know it from his own published correspondence that he looked upon himself not as a person to whom the ordinary laws of conduct applied, but as a "force," a "movement," a "phenomenon" in Nature's drama. He knew no law but that of might; considered no will but his own, was without conscience, without pity, and without remorse. He could come with glowing sentiments as a deliverer to the cities of Italy and mulct them of millions of gold, stealing art treasures from their churches in the guise of a friend. He could be a Mohammedan or a Roman Catholic while at heart an atheist, as it served the immediate purpose. It is not going too far to say that one good result at least has followed from his career, and that is to show what a giant intellect divorced from any moral principle can do when the man himself has brought himself to think that he is a *thing* and not a *person*.

With this view of purpose in the whole embedded in our minds we can the better understand the meaning of life, though "we know in part" must ever be the conclusion of the human mind. Thus do we find it possible to regard our earthly life as a probation and education, this earth as God's school or, perhaps, one of His schools, and are prepared no more to question His methods of teaching us than a young child those of his schoolmaster.

THEISM AN INDUCTION.

Since Temple wrote, the claims of Religion need no fresh enforcing, even if those of Science have grown greater and more cogent. But there is a point which should be raised as between Religion and Science to which he does not refer. It is this, that the evidence and reasoning by which the Theistic position is supported is a nearly completed induction, and this, as it has been observed, is the most that Science herself can say of any of her great generalisations or laws. It may be objected that in the sphere of religion we cannot conduct the exact experi-

ments of the chemist and physicist, or the much less exact experiments of the biologist. If it were true that Religion can conduct no experiments, any claim on the part of Religion to rest on an induction would necessarily fail. But in the process of theistic proof there are all the stages of an inductive inquiry, *Observation, Hypothesis, Deduction, Verification*, including *Experiment* in a delicate and subtle region of phenomena, the human soul and human conduct. Christianity has indeed been called "the greatest experimental Science of all." Theism claims to rule the conscience of man and so his actions, and has stood the test of many ages, and has more profoundly modified the course of human history than any other force except those of hunger and animal love. It has been one long course of *undesigned experiments* to show what spiritual energy can do in modifying and even transforming the life of man. The higher the form of the theistic faith the more marked are the effects on human life, until we come to that form of Theism which all modern enlightenment allows to be its highest form, viz., Christianity, and this has gone immeasurably beyond all other forms in its great transforming power. What more significant experiments can Science make in her line than Christianity is continually making in a higher province still?

I would submit that the validity of Religion and its postulates rest upon a basis as strong and sound as those of Science, but that both must wait for *proof* till some immensely greater range and depth of knowledge is reached by man. The "venture of Theistic faith" is no greater than the venture of Science. Science no more than Religion can afford to think it possible that the great order of nature in which we live and move and have our being is the outcome of blind chance on the one hand or of a malevolent power on the other. It is the stultification of all the triumphs of modern Science to suppose it possible that the apparent order around may at any moment become disorder, and the seekers after truth and light be suddenly put to confusion.

DISCUSSION.

The CHAIRMAN.—I am sure I may thank Dr. Kidd, in all your names, for the paper he has so carefully prepared and read to us.

You observe that Dr. Kidd has taken a book for his text and I

think it is a very good plan. I was privileged to hear the Bampton lectures referred to and took careful notes of them. I also heard, when an Oxford undergraduate, a sermon on the human race, afterwards published as the first of "Essays and Reviews," which was not so much on science as on the claims of conscience in man. Certainly there was no one who could combine so much dogged courage and great clearness on such a subject as Dr. Temple. He did his work as a Bampton lecturer splendidly. I think the lecture that impressed me most was the third lecture on Will. He reduced Will almost to a minimum, showing that a great deal of what we should imagine to be "free will" was the result of environment and habit, automatic action and sub-conscious action and so on; in fact we wondered, some of us, if he would leave anything; but he did, he left a minute residuum of human will, and on that residuum he built an argument for Divine will; for, after all, though God undoubtedly exercises will, yet will is that, in God, which goes under the name of force in nature, "will force," and if we recognise that we are creatures of God, then we recognise that there is something in the human will which is analogous to the Divine will, for we are made partakers of His Divine nature. What is true of will, is true also, I suppose, of purpose.

I will, if I may, refer to the passage of the paper under the title of "Characters common to Religion and Science." I am not quite certain whether I agree with the sentence as it stands. Perhaps I misunderstand it. "As each develops, a shrinking of the province of mystery takes place," p. 95. "Shrinkage" may happen in one direction; but I think when you lose the sense of mystery in one direction you get it back again in another. I do not think that any discoveries of modern Science have really reduced mystery. I think it is rather the other way. I daresay most of us have read Professor Oliver Lodge's speech at Birmingham the other day on the mystery of radium. He tell us how many millions of atoms and trillions of electrons, if placed in a row, would occupy one inch. I do not know where the mystery lies more, whether in the fact he asserts, or in the possibility of his having a brain to affirm it as a discovery. But when you get the idea of millions of things, in a row, occupying an inch, one feels at once that we are close to an exceeding mystery; and when we are told that the atoms that make up creation are nothing more than positive and negative electrons, I do not think

we come very near the solution of the mystery of creation. Others may feel differently, or perhaps I have not quite taken in what Dr. Kidd meant.

I remember Professor Jowitt preaching a sermon in Westminster Abbey in which he said, "It is the function of science to do away with the sense of wonder." I do not believe it. I believe the sense of wonder becomes stronger as we see the vastness of creation and the minutiae of creation governed by the numerous forces that permeate the whole of creation. But I think the main body of Dr. Kidd's address has been on Purpose, more on Purpose than on Archbishop Temple, and we read Purpose into nature because we have Purpose in our own nature. We are always reading ourselves into Purpose. I believe behind your face is the human soul, taking in what I say. You do not tell me you are human beings; but I infer it. I read humanity into you; and so there is something that entitles us to read Deity into God, and amongst the things we thus read into God is Purpose.

Dr. Kidd has thought out what, to me, is a very important point, that it is not a single cause producing a single effect; but a combination of many causes producing one effect; many causes, sometimes far-reaching and leading on to something far ahead. This is what tells us of Divine purpose in creation.

Some of us may have read Dr. Chalmers' Bridgewater Treatise where he deals with collocation in nature, and shows that the purposes of God can be seen not only in things He does, but in the preparation of material in such places as would call them into action when required for their different purposes.

Perhaps as we meditate on Purpose we ask more and more, what is, then, the final purpose of a human being? which it all leads up to. Is it physical, or is it spiritual?

Again and again I think Dr. Kidd, in his paper, speaks of the training of the physical as the scaffolding and the mind as a building. There is a great difference between the two. The early Christians discussed whether the oyster made the shell or whether it was the shell that made the oyster. Some still say, now, that the shell makes the oyster. But I think the early Christian writers knew better than that; they saw there was something which developed certain forces and so brought the oyster into being, the shell acting as the environment. So it is that in a human being

there is something from birth, or preceding birth onwards; and if one might venture to look into the New Testament to see if there are any passages which show what the purpose of God in the creation man is, I would venture to point to two, one in the second chapter of Hebrews, which says, "For it became Him, for whom are all things, and by whom are all things, in bringing many sons unto glory, to make the Captain of their Salvation perfect through sufferings," and the other, in the eighth of Romans, that we should "be conformed to the image of His Son." If that is not a great purpose, I do not know what purpose is.

Rev. F. A. WALKER, D.D.—There are a few points that I should like to allude to in this very able and instructive paper for the purpose of information as much as anything else.

We have had a great deal of science brought before us in the course of this paper.

Dr. Kidd says, "Thus the whole ascending series of animal forms shows so simple an arrangement as that of the sponges, and so complicated a group of mechanisms as the fourfold stomach of a ruminant." I refer, of course, to Dr. Kidd's great knowledge of anatomy and scientific knowledge in respect of the sponges; but I would mention that as long ago as 1860 I was, in company with Dr. James Scott, the first to discover that the sponge was in no sense a plant, but an animal with organs of respiration, digestion, etc. There were several very local and rare sponges here, and he informed me that the sponge not only possessed organs of digestion, but a system of interlacing hairs that served to expel the water it had taken in, and also to intercept the minute animals that it received at the same time and which served it for food; so that its physical arrangement would not appear to be altogether of the simplest.

As it was said of old, in reference to the funeral pageant of a Roman Emperor, that the omission of certain statues from among those carried in the procession only rendered the said statues more illustrious, "*Brutorum et Cassiorum imagines*" (the Hampdens and Cromwells of that day); so that what Dr. Kidd leaves out is, on that account, all the more intentionally significant when he states, "we may allude to first the bones, muscles, skin, feathers, scales, hairs, spines, claws, teeth, horns." Nearly every physical organ is here enumerated, those which serve

the creature for a defence against the cold, those that constitute weapons of offence, and also the means of its nutrition. Teeth, in particular, are to be found in every organic being from man to the mollusc, and the garden snail is said to be possessed of 1,400 teeth. But the sting is altogether omitted, and this was, no doubt, intentional on the part of Dr. Kidd, who recognized its rarity; with the sole exception of that of the scorpion only occurring in one tribe of all living creatures, and only in one of the ten or more chief orders of insects.

Then on page 91 the author says, "Such names as those of Thales, Empedocles, Heraclitus, Democritus, and Aristotle, and the Roman Lucretius, are landmarks in the history of science." Aristotle, who flourished between 400 and 300 B.C., is mentioned last, and no Greek philosopher of later date is spoken of, and this is, perhaps, designedly so on the part of Dr. Kidd as recognizing in him the most versatile and voluminous of writers, and the greatest human intellect that the world has ever seen. It is not too much to say that, next only to Holy Scripture, the *Ethics of Aristotle* has had greater influence on the mind of man than any other one book whatsoever, forming the subject for commentators, repeatedly studied and thoroughly believed in by monks of the middle ages, and furnishing the basis of reasoning by such eminent theologians among ourselves as Hooker in his *Ecclesiastical Polity* and Butler in his *Analogy*.

The SECRETARY (Professor EDWARD HULL, LL.D.)—Perhaps I may be allowed, at this point, just to express my own very deep obligation to the author of this paper, which of course is only an echo of the feeling of us all here present.

I think I am the guilty person who had the audacity to suggest to my learned friend to handle the "Bampton Lectures" of the late distinguished Primate. It was just after the death of the Archbishop that the thought naturally occurred to me, and I am very pleased indeed that our Chairman concurs in the view, that occasionally, for the purpose of our discussions, some work of a deceased author of distinction and learning may be introduced as a subject for the purpose of keeping his works, to a certain extent, before the public mind; and, perhaps, of giving ourselves some knowledge of what he has written, of which we may not have had possession previously.

When I made the suggestion to Dr. Kidd to give us an Essay on these Lectures, I must state that it was with the greatest kindness that he at once assented, notwithstanding, as I was perfectly aware, that his time was exceedingly precious, and that I was throwing a great burden on his shoulders.

However, he did not allow these considerations to stand in the way of what I felt sure he wished to do for the benefit of the Institute, and for our own exceeding delectation.

I think, therefore, it is only right that I should express my feeling of gratitude to him for so doing.

REV. F. STORRS TURNER.—Are there two paths, or streams, of human thought and activity, which flow in separate channels? Archbishop Temple said, "The scientific man often asserts that he cannot find God in science, and the religious man often asserts that he cannot find science in God." It is not religion and science which are at variance; but some of the men who study these truths. Their frequent disagreement is a fact, but it belongs to mental pathology; it exhibits the defects and distortions of human nature, not its normal and healthy development. Religion is sometimes regarded as a special product of the moral sense; while science is taken to be a purely intellectual product. But the latest and best psychology has discarded the notions of separate mental faculties. Intellect, feeling and will are inseparable and mutually interpenetrate. The intelligence is active in religion as well as in science. The will is equally manifest in the pursuit of knowledge and in the pursuit of moral goodness. Feeling supplies the data of both pursuits. The alleged conflict between science and religion really is nothing but misunderstanding on one side or the other, or more probably on both sides. If we consider the history of man, whether of the race or the individual, it seems that religion and science were born together and grew together. Later on, discord arose. It may be that the narrow-mindedness of religious teachers was the first occasion of this. Often enough have they been taunted with the persecution of Galileo and Bruno. But I think that, as impartial judges, we must condemn the scientific teachers as the chief offenders during the past half-century. Happily there has been a change for the better in recent years; but looking back upon fifty years, who of us does not see clearly that within this period what is called the *Zeitgeist* has been grievously led astray by a monstrous,

misbegotten spectre which has stolen the name of *Science*—though in reality it is a hybrid mixture of unjustified hypotheses and bad metaphysics. This unholy alliance has produced the irrational conception of a soulless, godless universe; a cold, dead mechanism, in which inexorable fate is somehow combined with blind chance. Shall we treat this pseudo-science leniently? To me it seems that Dr. Temple's treatment of this science falsely so-called, is not trenchant enough.

While his arguments are in the main good and sound, they seem to me open to criticism in more than one fundamental matter. While pointing out that the uniformity of nature is only hypothesis, he does not demand a precise account of what is meant by the phrase. Nature, as we see and know it, is *multiform*—not uniform. The uniformity is hypothesis: the multiplicity is an immediate and present fact. Surely just because it is hypothesis, science is bound to furnish an intelligible meaning for the phrase. And when the man of science runs the changes on other terms and phrases—such as order, the stability of nature, continuity, or the favourite phrase, the universality of causation—he should be followed, step by step, by a persistent demand for his *meaning*. It will be found in the end, that he can give no meaning which will agree with all the facts. Either he will fall back upon the intolerable assumption of an irrational mechanism or he will lose himself in utter confusion of thought. Science is not yet omniscience.

But Dr. Temple was content to accept this postulate of science without any definition; only contending for two exceptions, God's free will and His power to work miracles, and man's free will. The wisdom of this way of thinking is questionable. The *Hibbert Journal* for October, 1903, contains an article by Professor Jones which expressly combats this theory, not with any reference to the Archbishop, but in antagonism to Professor William James. Professor Jones says, "I am persuaded that this method of defending morality and religion is a wrong method, and calculated not only to perpetuate the contradiction between the theoretical and practical aspects of our life, but to injure religion in a fatal way. The true defence seems to me to be in a direction which is almost directly opposite. *Instead of their mutual exclusion, I should prefer a theory of their mutual inclusion.*" This pronounced disagreement between philosophers must make us pause before we decide.

Professor Jones's argument is too long and too profound to be reproduced here. But I venture to state that before reading his article I was dissatisfied with the Archbishop's doctrine. To me it seems that Dr. Temple conceived of the Deity as outside of the world, so that the two stand apart, as it were, God having once for all, long ago, created the world, and thereafter left it to go on by itself, governed indeed by divinely ordained laws, but not needing divine control and support from moment to moment. The world being thus conceived as in nearly the whole of its extent and course governed by the "uniformity of nature," the Deity is supposed to have made two exceptions to this general rule. These exceptions are human free-will, and divine intervention working miracles to attest revelation. This conception of the relations between God and the world is one which has long been held, and still widely prevails; but recent philosophy is strongly inclined towards another conception, a conception which, pushed to an extreme, has led to pantheism, viz., *the immanence* of God in the universe. To some minds it has seemed that the cosmos *is* God. God is all and all is God. But we are not obliged to go to the pantheistic extreme. We may refuse to *identify* the world with God; and at the same time may refuse to believe that God is altogether outside the world in some far-off region. We may believe that God is here and now, in an eternity which includes all time, in a proximity which fills all space.

"Nearer is He than breathing,
Closer than hands and feet."

And this belief in the immanence of God in all times and places, in all things and events, in all lives of all beings, seems to be the way in which Jesus thought of His Father; the God who sends the sunshine and the rain, without Whom not a sparrow falleth, Who clothes the lilies with their beauty, and of Whom He said, when He Himself was accused of sabbath-breaking, "My Father worketh even until now."

The CHAIRMAN then called on Dr. Kidd to reply.

Dr. KIDD, in response, said he was quite unable to deal with all the points that had been raised, and it was rather late if it were possible; but he would refer to one matter that Canon Girdlestone spoke of, viz., that the province of mystery does not shrink. I think, he continued, that is hardly correct. Mystery after mystery

has been made clear by science, more and more up till now. That does not exclude the fact that great mysteries remain, but when we compare our knowledge of to-day with that of fifty years ago, it is enough to say that mystery does shrink, even though greater mysteries may arise.

As to the question of sponges that Dr. Walker referred to, I think he is quite correct in what he says as to their organs of respiration and digestion.

I put the name of Aristotle last among the Greeks in order to point him out as the greatest of all—the greatest father of knowledge of those days. Many others might have been referred to, but I did not want to make the list too long.

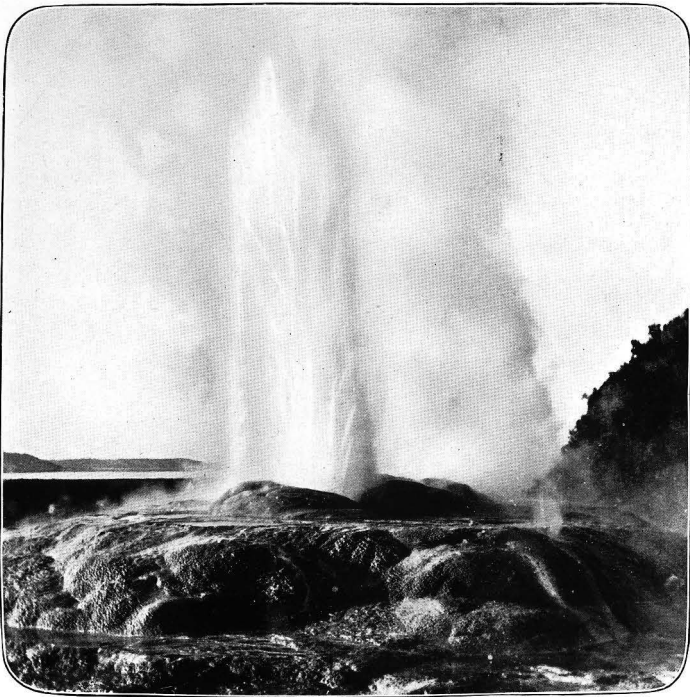
The criticism we have just had of Archbishop Temple's lectures is very valuable; but I do not think, as to the last point, that the immanence of God is at all excluded by the way in which Dr Temple has dealt with the matter. As far as I can understand, it does not exclude the view of the immanence of God, but it is a mere recognition of the claims of science.

As to the two paths of mental progress, what has been said goes rather to confuse what is meant here, which merely represents the paths of religion and science in early times, which ought at that time to have been separated. Those two paths diverged for many centuries, just as in these modern days they are coming together again.

I thank you for the reception you have given my paper. I am sorry that I have dealt with the subject so imperfectly, but it is a very large one.

The Meeting then terminated.

To face page 129.



THE WAIKITI GEYSER, NEW ZEALAND.

(From a photograph by Mr. Iles, Rotorua, N.Z.)

ORDINARY MEETING.*

CAPTAIN HEATH, R.N., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following paper was read by the author :—

ON THE HOT LAKES DISTRICT, NEW ZEALAND.

By Miss HILDA BOORD. (*With photographic illustrations by kind permission of Mr. Josiah Martin, of Auckland, N.Z., of Messrs. Valentine and Sons, of Dundee, and of Mr. Iles, of Rotorua, N.Z.*)

HAVING been asked by Professor Hull to give an account of what I saw during my stay in that part of New Zealand which is most justly termed the Wonderland, I can but endeavour to comply with his request. I must confess at once, however, to being no scientist myself, and therefore I fear that my observations can have no more value than those of any other ordinary traveller; circumstances, moreover, prevented me from visiting some of the principal places of interest.

My best plan, I think, will be to take up my narrative from the time my sister and I left Pipiriki on the Wanganui River; a river so exquisitely beautiful in itself that it would be fatal to my present purpose to dwell upon its banks and describe its many charms.

It was in the New Zealand autumn, nearly three years ago, that we started one morning on our seven days' coaching trip across country to Rotorua from Pipiriki, a very small settlement formed, for the most part, of Maoris. They are very

* Monday, February 8th, 1904.

unsophisticated still in this out-of-the-way neighbourhood, and we had opportunities of observing the native customs of the *hongi*, or salutation by nose-rubbing, and the *tangi*, or wailing, a very dismal performance.

Our road, such as it was, lay for half the day through beautiful bush, composed chiefly of the birch trees, as they are commonly called, though they are I think more nearly allied to the beech. They have a very minute leaf for such large trees, and there are at least three varieties, known to the settlers as black, red, and white birch. We were too far south for the Kauri Pine, which only grows in latitudes north of the city of Auckland. What strikes one most in coaching through the country are the great tracts of bush which have been burnt down. It is a melancholy sight to see the gaunt skeletons of bare, scorched, dead trees still standing, as it were, to form their own tombstones, reminding us of what they must once have been. There may be many good reasons for burning the bush in so ruthless a manner, and one is that it is the cheapest way of clearing the country from the settlers' point of view; and another, that it causes the undergrowth to spring up, thus providing fresh food for the sheep and cattle; though amongst it is often to be found the *tut*, or *tutu*, which is poisonous to sheep. The practice is said to be altering the climate of the country, though how this may be, of course, I do not know.

At last we emerged upon the beautiful Marumutu Plains. It was quite different scenery up here, and much colder. Passing through the small missionary station of Karioi, we came as far as Waiouru, where we put up for the night, continuing our journey next day. We no sooner got up on to these weird-looking plains, than we caught sight of the strange group of mountains that seem to rise suddenly out of their midst, I mean Mounts Ruapehu, Tongariro, and Ngaruhoe. The name *ruapehu* means "hole of dust and ashes." This mountain (9,009 feet—the highest in the North Island) is eternally snow-clad, and has a crater on the summit, with a lake, the water of which sometimes reaches boiling point. Notwithstanding this, however, the sides of the crater are mantled in ice and snow. A little further north is black Tongariro, with the cone-shaped, and also black, Ngaruhoe rising out of it, and emitting a small volume of black smoke every few minutes. Earlier in the day we should have caught a glimpse of Mount Egmont, or *Taranaki* (the native name meaning "naked spear"), about seventy miles

away to the west, but the air was not clear enough for us to see it at the time.

We were skirting these mountains for a day and a half. The roads were very heavy indeed just then owing to the late rains; and in dry weather they are as unpleasantly dusty, or powdery, for they are composed, as is all the soil of this district, of nothing but pumice. Whilst waiting next day on the shores of Lake Taupo, we filled our pockets with pieces of pumice-stone, which are as plentiful as pebbles on the sea-beach. The pumice is of a softer kind, however, than that which we are accustomed to use for inky fingers, and powders much more readily.

We were now some 3,000 feet above sea level, having risen from about 180 feet at Pipiriki. The Rangipo Plains, across which we now steered our way, are very deceptive, and take longer to cross than probably appears at first sight, as one continually comes upon deep ravines formed by rivers and streams, and which are not noticeable until quite nearly approached, on account of the ground above and up to the very edges of the gorges, being perfectly flat.

Far away in the bush on our right dwell the Kiwi, which is a brown-feathered fowl here, whereas the West Coast kiwi of the South Island, is a grey bird. They are said to be fast dying out. Wild horses also rove about in herds. I believe their name is legion, though we only saw a few. They originally escaped during, or were let loose after, the last Maori war. We passed and crossed several rivers of very uncanny propensities. In one place there are two rivers flowing side by side, and rising from springs within only a few feet of each other; one is a very strong alum river, and the other is strongly impregnated with sulphur, and they flow sometimes over, and sometimes underground.

On reaching Tokaanu, on the southern shore of Lake Taupo, we experienced the very curious sensation of driving along for the first time with boiling and bubbling pools of water and puddles of mud on either side of the road. I think we felt as if we had suddenly been transplanted to another planet, where Nature had gone awry, or, at least, where other laws, unknown to us, prevailed.

Next morning we crossed Lake Taupo, the largest lake in the North Island, and about 25 by 18 miles across; it is 500 feet deep, and quite as beautiful in its own way as are the Cold Lakes of the South Island. It is 1,211 feet above sea-level. The low range of volcanic mountains in the distance is very

fine; whilst Ruapehu, rearing his hoary head, and Ngaruhoe, steaming and black, rise from rocky Tongariro. We gradually left these behind us, to form a splendid background from the northern side of the lake.

We were now getting into the heart of the Hot Lake district. Without waiting to describe the very novel and unique inn at which we stayed at Taupo, I must just mention that through the grounds—which are themselves contained in a round basin of rock some 40 feet deep and of about 4 or 5 acres space—flows a steaming-hot alum and sulphur stream, with a bath-house fitted up at one end. There are other pools and baths, less hot, in different nooks and corners where visitors bathe in novel, if rude luxury, for the dressing-sheds were then of the most primitive description.

My sister went that day to see the "Crow's Nest," a geyser which throws up its water at an angle of 45 degrees and from 20 to 80 feet high. I did not accompany her, as I was reserving my energies for the more famous Wairakei Valley, which we were to visit next day.

Before going further, it may be as well to mention that the principal places I visited during my stay in the Hot Lake District were Wairakei, and Rotorua (under which heading I may include Whakarewarewa and Ohinemuto). At Wai-o-tapu, I regret to say, we did not stay long; still more do I regret not having visited Tikitere; and most of all must I always mourn having omitted to pay homage to that king of geysers, Waimangu. I shall, nevertheless, have a few words to say about him later on.

But in those places and districts which I did visit, we saw as good specimens of the various moods in which volcanic forces in a moribund condition show themselves as, I suppose, are to be seen in all the world. The different forms these moods take may, for my present purpose, be placed under six headings, namely:—

- (1) Hot springs.
- (2) Low-pressure steam jets.
- (3) Mud volcanoes.
- (4) Fumaroles.
- (5) Explosion craters.
- (6) Geysers.

At Wairakei (where we will now take our stand) we found all these in profusion, and comprised in a valley about half a mile long, barely a quarter of a mile across, and between steaming sinter cliffs rising from 60 to 100 feet high. It is all most

beautifully wooded and wild, and luxuriant in fern and moss. The valley lies north-west by west, and south-east by east, and has the hot stream Te Wairakei running through it and finally emptying itself into the Waikato river. Of course this stream is fed by numerous hot springs all along its course, as well as by the outpourings of at least seventeen geysers in the valley.

Under our first heading of "hot springs" I must mention the numerous pools of various sorts that we here saw, whose colour, consistency, etc., are due, of course, to the chemical, or mineral, properties of the soil and subsoils through which the springs issue. There are blue pools, opal, or variously tinted pools, white pools of the consistency of cream, and which are formed of the finest fuller's earth to be found in the world. This last is a white clay held in suspension, and looking like pools of hot milk. Then there are vermilion-coloured streams and yellow-ochre streams, each flowing over beds of the clays from which painters procure two of their most effective colourings; but of course, vermilion paint is otherwise obtained as well.

Then I must mention the terraces of brittle sinter over which flow numerous small streams, always hot, and each imparting its own colour to the deposit—glistening white, dark red, of brown, pale yellow and cream-colour. We saw better examples of sinter terraces, however, at Whakarewarewa, near Rotorua. It is said that in time they may equal the pink and white terraces which, together with part of Lake Rotomahana, disappeared in the great Tarawera eruption in 1886. But surely the subterranean forces which were at work to form these famous terraces are scarcely in a condition likely to reproduce them? For, appalling as the catastrophe undeniably was, there was no mention of lava having been ejected, and therefore, I suppose, it cannot be classed as a *true* volcanic eruption. On the other hand, however, the conditions now existing may, as far as I know, be perfect for the reproduction of terraces which may vie with the departed ones, if only those conditions continue to exist long enough. That Nature has not yet exhausted her powers in those regions we are well aware, owing to the very recent appearance of the mighty geyser we are to consider presently.

Of the Low-Pressure Steam Jets I can here take but little notice, as we simply lived amongst them for three months. It is these which cause the steaming creeks and cliffs, and the hundreds of boiling or nearly boiling pools which make walking in the manuka scrub an exercise to be performed with "caution and good heed." I may remark in passing that a

Maori child fell into one of these pools, during our stay at Rotorua, and was so badly scalded that it did not recover. There is a story told, too—and I have no reason to doubt its truth—of an unfortunate man (he gave a church to the Maoris at Tokaanu, which he built with his own hands, by the way), who was walking home one night when he missed his path, and was found, boiled, in one of the hot pools next morning. It is in these boiling pools that the Maoris wash their clothes, and it is in this steaming earth that they make their *hangi* or earth-ovens. If you but push your stick into the bank by which you happen to be walking, or perchance sitting, as we were in the Wairakei Valley, the ferns hanging all about us moist with condensed steam, this all-pervading steam escapes from the hole you have made.

Mud-volcanoes are to be seen here and also at Whakarewarewa and Ohinemuto. Mr. Josiah Martin, F.G.S. (to whom I am indebted for some of these photographs), thus describes their formation in a paper printed in Messrs. Thomas Cook and Sons' Handbook to New Zealand, and from which I have refreshed my memory:—

“The continued escape of steam through soft rocks assists their decomposition into clay of various colours; and around the centre of action will be formed pits, cauldrons, craters, or cones, according to the consistency of the material ejected.”

I well remember at Ohinemuto we saw a most extraordinary mud volcano throwing black mud into all sorts of fantastic shapes, such as marks of interrogation or interjection, or, again, into the form of a skull! We tried the effect of throwing in great lumps of earth, but though it stopped its play for a few moments, it was soon absorbed and the play was more eccentric than before. The “Brain Pot” is a famous mud volcano, which we saw at Whakarewarewa, in which the Maoris used (not so very long ago) to boil their enemies' heads.

Except for one fumarole, or blow-hole, which we saw in the Wairakei Valley (where we are still supposed to be stationed, though I wander away occasionally), I do not remember seeing any other which I can so classify. And this one had a small tubular opening down which the guide rammed the branch of a tree, which was boiled to nothing in less time than it takes me to describe the proceeding. Sometimes, however, the branch would be promptly ejected with a shriek, or whistle, on the part of the fumarole. This one is, if I remember rightly, known as the “Whistler.” The “Devil's Trumpet” at Karapiti is the finest fumarole in the country, and is said by

Sir James Hector to be the safety-valve of New Zealand; but White Island also claims that distinction.

Explosion craters are most extraordinary. We saw, or more correctly speaking, heard, one at Wai-o-tapu as we were walking warily by the alum cliffs and over the brilliant yellow-crust ground and amongst the many wonders there to be seen, when we were suddenly startled by an explosion just under the earth at our very feet. And we saw another at Whakarewarewa, called the "Torpedo." It is so named from its position under a stream, where it keeps throwing up large mud bubbles with a loud explosion each time.

And now we come to our most important subject, namely, Geysers. But how shall I describe them? To say that they are wonderful, beautiful, and even awful, beyond description, seems to me to be using words which can convey but little meaning to those who have never been fortunate enough to see them for themselves. I suppose—indeed, I am sure—that familiarity, even with the Hot Lake District, may to a certain extent breed contempt. For, on our first arrival at Rotorua, where geysers were playing all around us, and where the air was heavy and laden with strong sulphur fumes, I well remember wondering, with an uncanny feeling, whether during the night a new geyser might not burst up under the very house in which we dwelt! But before we left we slept peacefully through minor shocks of earthquake as we should here in England through an insignificant thunder-storm. But, whilst the sense of fear may abate, the sense of awe and wonder at these marvellous displays of the effects of subterranean heat can only be stimulated and ever increased by the privilege of a closer acquaintance with Dame Nature in her wrathful moods.

Mr. Josiah Martin, to whom I have already referred, mentions three distinct types of geyser action, as represented in this district, namely, the intermittent, the periodical, and the explosive.

The intermittent geysers, are, of course, those in which the accumulations of steam are liberated with a sudden outburst of activity, very short in duration, and at uncertain intervals. The "Crow's Nest" geyser at Taupo, already mentioned, is a specimen of this type. I must have seen many others of this class, but I cannot remember them with sufficient distinctness to give them their names.

But of periodical geysers we saw several in the Wairakei Valley alone. We were hastened from one spot to another by the guide, who knows exactly at what moment any particular

geyser will be playing, also whether an intermittent geyser is likely to be playing between times. We saw, for instance:—

The Petrifying Geyser,	plays high every 2 hrs. 25 mins.
The Twins	” ” ” 4½ ”
The Eagle's Nest	” ” ” 30 ”
Great Wairakei	” ” ” 8 ”
Dragon's Mouth	” ” ” 5 ”

Feather plays often, but goes high every 2 hours.

Pack-Horse, Heron's Nest, and Black Geysers, etc., are irregular.

The “Pack-Horse” geyser is so named because it sprang up at a spot where a pack-horse plunged about, at last putting his hoof through the treacherous ground, much to his hurt, if not to his destruction.

Mr. Martin classifies “Pohutu” at Whakarewarewa as a periodical geyser: “the finest geyser in the country,” he says; but he had not, of course, then heard of “Waimangu.” But, after a three-months' sojourn within two miles of “Pohutu” I find it necessary to differ from him; at least, I do not understand Mr. Martin in designating “Pohutu” a periodical geyser. For during all that time it never played at regular intervals, and by everyone in the neighbourhood it was considered very erratic indeed. I must own, however, that Mr. Martin says, “Its discharge, *when not interfered with*, occurs at regular periods, and will continue as a beautiful display for two or even three hours.” I may add that Pohutu throws its water to a height of 100 feet when at its highest. Now the means of interference with the play of a geyser may be natural, or it may be artificial. It is well known in the Hot Lake District of New Zealand that the action of one geyser in the neighbourhood will often determine the action of another; or, on the other hand, it may alter or prevent its play altogether. For instance, if one geyser, situated on a certain volcanic crack of the earth's surface, be particularly lively, it may exhaust some of the motive-power which would otherwise be expended on another geyser situated further along that crack, unless, as sometimes happens, *all* the geysers in that neighbourhood are particularly lively at the same time, which activity is specially noticeable after heavy rainfalls. My crude, and no doubt unscientific, mode of expression may very possibly make the facts I saw and noted appear to clash with Professor Bunsen's Tube theory, which, it seems, would point to the absolutely independent action of each separate geyser. I may, however, be quite wrong in my surmise; at any

rate, I will leave it to more competent heads than mine to fit square facts into round theories.

The artificial method of interfering with a geyser's play is to "soap" it. I am not aware that this habit of soaping geysers is generally known in England. The "Great Wairoa Geyser" at Whakarewarewa is situated perhaps 10 or 20 yards from "Pohutu," and for some reason or other has ceased to play naturally. Some say it is only since the railway was made: but as the railway is some distance off, I can see no reason for holding it accountable. The apparently worn-out geyser is, therefore, soaped occasionally. That is to say, several bars of soap are thrown into its mouth, forming a crust as they melt which keeps in the heat for some minutes (say eight or ten) after which the accumulated heat gathers sufficient strength to burst through the soap, and the geyser ejects its contents about 80 feet high. "Pohutu," however, from its natural formation does not lend itself to being soaped. But it is quite possible that soaping the "Great Wairoa" may materially interfere with the behaviour of "Pohutu." I may say that the soaping of the geyser is only allowed to be performed by the Government Officials, under whose supervision they are placed.

Explosive geysers are very well represented in the Wairakei Valley. The "Great Wairakei Geyser," which may be taken as a type, has a deep, funnel-shaped basin. After a short period of rest, the water rises rapidly with a deep, gurgling roar, then the contents surge up in steaming waves. This is followed by a powerful upheaval, in the form of a dome, of the whole contents of the basin. From this mass, when relieved from tension, there suddenly flashes in various directions explosive outbursts of steam and spray. After this violent display of energy, the water sinks once more into the basin, or perhaps is withdrawn into the tube, to repeat the same phenomena after an interval of six or eight minutes.

This description is quoted from the same authority, Mr. Martin: my own acquaintance with the wonderful Wairakei Valley having been made in one morning, I may perhaps be excused for coming away somewhat dazed and bewildered, and with but a confused idea of all I had seen.

I have, however, a very clear recollection of the "Champagne Cauldron." We descended to it by steps in a rock, and still further below us was a circular basin, about 70 feet across, and in perpetual ebullition. The guide took me to a ledge of rock overhanging the basin, where we seated ourselves and waited events. Presently, we felt a rhythmical tapping and throbbing

of the ground beneath us, and, simultaneously, the water began to rise higher—6 or 8 feet—a seething mass of sparkling hissing foam, with small fountains playing all round its swollen surface. Needless to say, we were at once enveloped in dense clouds of steam. To say that a person falling into this Cauldron would be scalded to death, is to put the matter very mildly; the victim would be absolutely boiled to shreds in a very few moments.

It would be most dangerous, and well-nigh impossible, to visit this valley without a guide. The geysers are not only difficult of access, and often hidden (when at rest) in the manuka and fern, but also in some places it is necessary to climb over the brittle sinter formation surrounding one geyser in order to reach another. And in doing this, we had to step across gaps and yawning chasms where the heat of the issuing steam was so intense as to make us greatly accelerate our pace. To be caught by a geyser would be more dangerous and less comfortable than to be caught by the in-coming tide.

We have seen that there is one called the "Petrifying Geyser." But, as far as I remember, petrification is a property common to all geysers (correctly so named) in New Zealand. This particular one, however, was no doubt more highly impregnated with soda, thus enabling it to deposit a greater amount of silica, which forms the beautiful rock known as siliceous sinter. The surroundings over which this geyser plays are composed of petrified manuka, fern, moss, and beech (or birch) tree. The "Eagle's Nest" geyser also has the gift of turning all it touches, not into gold, but into a most delicate coral-like substance. In its action it brings down the branches of any trees within reach, and they have quite the appearance of a huge nest which, under the spell of the petrifying, all-pervading silica, takes a fairy-like fawn-coloured tint and a frosted appearance, which are extremely pretty.

But I might speak of a hundred-and-one other wonders that we saw, not only here, but at Wai-o-tapu, at Rotorua, and at Whakarwarewa, but time forbids; and I must hasten on to that mighty new geyser which made its first appearance in January, 1901, just after our arrival in New Zealand. Or, at any rate, it was discovered and first brought to notice then by a Dr. Haines; and I think we may safely say that it is by far the finest geyser in the world. This geyser is called "Waimangu" (meaning "black water"), and is situated about seventeen miles from Rotorua, or half-way between that place and Wai-o-tapu, but not by the ordinary route. The "Waimangu," which belongs to the explosive type of geyser, has chosen to

spring up in the desolate regions which were once the home of the far-famed Pink and White Terraces, both of which, together with half of the Tarawera Mountain, disappeared in the great eruption of 1886, which also much reduced the size of Lake Rotomahana. The surrounding country is weird beyond description, scored as it is by ancient flows of lava. The whole of the neighbouring district is said to have benefited (from an agricultural point of view) by the last eruption, owing to the rains which followed it, and which converted the layer of ashes and fine dust which had been distributed over the land into a muddy soil which much improved it for productive purposes.

During our stay at Rotorua—which lasted three months—the “Waimangu” was playing every two or three days for several hours at a time. I was unable to visit it myself and, unfortunately, on the occasion of my sister's expedition thither, “Waimangu” proved sulky and would not play at all. I shall therefore do best, I think, to read an account from one of the Auckland papers, given by an eye-witness and one well acquainted with geyser-action in its every variety, namely, by the Wairakei guide whom I have already mentioned.

The paper is dated June 29th, 1901.

“A party of four, consisting of Mr. Parker, Mr. R. Graham, Mr. Scholtz and myself, pitched camp and ascended Mt. Kakamea on the afternoon of the 24th of April last, to obtain a view of the country generally and to mark off the principal volcanic lines in the neighbourhood on the map, preparatory to visiting the Great Waimangu Geyser the following day. We arrived near the geyser about 9 a.m. next day. We found it quiet, but evidently approaching steaming point by the amount of vapour given off. Having obtained a fair idea of the height of the cliff on the south-east side (about 200 feet) and wishing to reach a position over the fissure line passing under the geyser from the direction of White Island and Tarawera, in order to time the pulsation during her play, we crossed over the boiling river marked on the map, and found the temperature 140 degrees Fahr. The stream of water would just about fill a flume 16 inches wide and 7 inches deep, clearly showing that a large amount of steam was undergoing condensation. We then ascended the hill behind the Inferno Crater, which contained a small lake of water, the depth of which we did not obtain, but we estimated its area at about 90 yards long and 40 or 50 yards wide (almost as large as that of the geyser). On the top of the hill we found another small

dry crater not named on the map, and sitting down on the summit, we lit our pipes and obtained a good view of Lakes Rotomahana and Tarawera, of Mt. Tarawera, and of the steaming rocks in our immediate neighbourhood, all on the line of the fissure which was blown out in 1886.

“Having enjoyed half-an-hour’s rest, we felt the hill shake heavily beneath us, and away we went as fast as we could down to the foot of the hill near by the geyser, sitting down in such a position that we could watch the Inferno Crater Lake on our right hand, the boiling creek on our left, and the geyser in front. Mr. Graham had scarcely erected his camera when the hill was again severely shaken, and the subaqueous geyser (Torpedo) in the Inferno Crater began to crack like volleys of musketry. The water in the geyser basin began to spring, keeping perfect time with the Inferno Lake which was doing likewise. Twenty-eight seconds after the Torpedo exploded, and the geyser gave the first shot, and play commenced. It threw a vast body of water and black sand about 10 feet. Nine minutes after another shot 20 feet; 9 minutes later 30 feet, always increasing in height, until in perhaps three-quarters of an hour she appeared to obtain her greatest height, 200 feet or a little over, and kept this up every 9 minutes for at least half an hour, when it subsided to what I can best describe as a 20-foot boil. When the geyser obtained its maximum height it was discharging a great torrent of water at a temperature of 180 degrees Fahr., having risen 40 degrees since we crossed it before play. The temperature of the Inferno Lake was 110 degrees Fahr., and the pool was springing at least 10 inches. As the water line shows, it has been springing 4 feet or 5 feet, it is evident that it must have been throwing its load far beyond 1,000 feet high sometimes. So correctly did the play follow the amount of spring in the Inferno Lake, that any of us watching that, could safely say what the geyser shot would be 28 seconds later. I must say that it is by far the grandest geyser I have ever heard of, much less seen; a sight no man or woman will ever forget. I was delighted to find that it answers correctly to the pulsations of the earth recorded pretty well all over the world; at any rate, by seismograph in Japan, White Island, and Yellowstone Park, and felt repeatedly almost every day by myself on the pulsating cliff in the Wairakei Valley at intervals of four, five, and nine minutes. This is owing to the fact that the geyser is situated near the point of intersection of three fissures of the first, second, and third magnitude, and which are part of the

great thermal circulating system which extends over the whole earth, which radiates from its two thermal poles which lie near the equator, and are antipodes to each other.

“Owing to my excitement and delight at finding that the geyser answered in every respect to precisely the same general laws and habits of play as many others under my care, except upon a far grander scale, I came away without correctly measuring the amount of spring in the Inferno Lake. The height the geyser had been throwing its shot can be correctly estimated, and also an approximate estimate of the amount of force could be calculated, if the depth and area of the Inferno Lake could be obtained. However, its shot has far exceeded those witnessed by Mr. and Mrs. Haines, which I read in that excellent account by Mrs. Haines, published in your paper a few weeks ago, viz., 600 to 800 feet. We left the geyser about twelve o'clock, having been favoured with excellent weather, favourable wind and display. We could get and remain close enough to examine the machinery in its immediate neighbourhood, which all works like a band of music, with the Inferno Lake acting as conductor. It will impress the visitor with the might and power of Nature's forces.”

Since that account was written, I have heard that the Waimangu geyser has taken to throwing up, not only gold quartz, but the raw material itself. But whether the report is authentic I cannot tell.

I have quite lately received accounts of the extraordinary eruption which occurred last August, when four persons lost their lives. But the accounts vary as to the height to which the geyser played: one saying 800 feet, others even greater. From the cross shoots observed during this eruption it is inferred that some of Waimangu's subterranean tubes must descend at considerable angles down into the earth.

Shortly before this great eruption the Government guide (whose brother was one of the victims) succeeded, with another man, in crossing the geyser's basin—of course during quiescence. The measurements of the basin were found to be 134 yards long by 80 broad, and the greatest depth sounded was 48 feet.

“Some idea of the force of the eruption of the geyser may be gathered from the circumstance that a photograph taken while it was playing shows a stone thrown up to an altitude of 1,800 feet, and the stone on falling was found to measure 8 feet by 12 feet.” This seems doubtful.

In order to bear out the assertion that this new geyser is actually “by far the greatest in the world” it may be as well

to compare its highest shots of from 800 feet to 1,500 feet, with those of other known geysers. Here is the description given by Mr. Campbell of the play of the "Great Geyser," Iceland.

"It was a grand display, and well worth all the waiting. Instead of ending suddenly or gradually, the steam salute shot faster and faster; thuds followed each other rapidly, and the whole ground shook; then the sound of dashing water and the music of waves was added to the turmoil. A great dome rose in the middle of the pool, and frequent waves dashed over the edge of the basin, while streams overflowed and drenched the whole mound. Great masses of rolling steam burst out of the water-domes, and rose in the still air, swelling like white cumulus clouds against a hard blue sky. At last the whole pool, 50 odd feet wide, rose up, a single dome of boiling water, and burst; and then the column in the tube, 70 feet deep and 20 feet wide, was shot out of the bell-mouthed blunderbuss with a great burst of steam. The charge scattered; it rose about 80 feet, and most of it fell back and sank in with a rush; and so the glittering fountain rose thrice, like some mighty growth."

Professor Barrett, in whose article on geysers, in *Science for All*, I found the above quotation, goes on to say, the height to which the column of water is thrown has been variously estimated. The earliest records—a century ago—say 360 feet; but in modern times 100 feet seems to be the general opinion, and this has been confirmed by careful measurements made by competent observers.

In the Yellowstone National Park the three largest geysers, the "Grand," "Old Faithful," and the "Giantess" throw their waters respectively to the maximum height of 200 feet, 130 feet, and 250 feet. The "Beehive" may also be mentioned; it sends a spout 200 feet high.

When it is realized that in every case the steam of course rises many times higher than the water-shoot, of which we have been mainly thinking, a better idea may be gained of the magnificent spectacle presented by a geyser, even though it fall short of the stupendous heights reached by some of the monsters we have been considering.

A short description of White Island, mentioned above in the guide's account, may not be amiss here. It is from a New Zealand paper of three years ago:—

"White Island, the active volcano situated in the Bay of Plenty, some thirty miles off the coast, is one of the most remarkable islands in the world. It is in direct line with the

rest of the thermal region in New Zealand, and undoubtedly acts as a safety valve for the North Island. It is not often visited; but an excursion is annually run from Opotiki, from which it takes about three hours' steaming. Anchorage can only be got in one place, Crater Bay, in about fifty fathoms of water. At certain times, when the air is calm, enormous clouds of steam remain suspended over the island, and can be seen for miles. Arrived on the island, it is found that only the outside shell remains, the interior being occupied by a lake half a mile long and a quarter of a mile in breadth. The water of the lake is a beautiful green, and is composed of dilute hydrochloric acid, which is ruinous to cotton materials. Directly the water touches it the material loses all its colour and then falls to pieces. Parts of the lake are boiling, while other parts are cold. At times the water of the lake pours into the active crater and is rapidly ejected in clouds of steam. The lake is only six years old, and each year it increases in size, and the time seems not far distant when the island will be covered with water. The whole surface of the island is composed of sulphur of every possible tint, and some years ago a party of men were left on the island for the purpose of collecting sulphur for export. After a short stay they were so frightened by the awful surroundings and violent volcanic action that they could not be persuaded to remain any longer. It is said that a species of rat, red in colour, lives on the island and thrives on a small kind of crab. The fumes of the sulphur are in places overpowering, and walking is very dangerous, the safest way being to test every step with a stick before proceeding, as in many places the surface is merely a thin crust."

Before concluding, I should be very glad if anyone here could give, or suggest, a reason why the "Waimangu Geyser" sprang up so suddenly? And why it began by assuming such huge proportions? Assuming, on the "tube" theory, that it has a tube, it does not, I suppose, necessarily follow that the depth of the tube must be in proportion to the height of the geyser's play? I gather, rather, that it is the reverse; for the tube of the "Great Geyser" in Iceland, which is 76 feet deep (and has, I imagine, been growing from below, upwards) has taken, it is estimated, over 1,000 years to form, and we know that its play is on the decrease.

If then "Waimangu" already has a tube, why has it only so lately made its appearance? If it has as yet no tube, where does it hold the great bulk of water hurled into the air, together with huge rocks of a rhyolitic character every two or three days?

Am I right in surmising that the subterraneous heat must either here be specially near the surface, or, if at the base of a tube, the motive-heat must be extraordinarily great for it ever to reach the boiling-point of that (assumed) great depth, and to be capable of lifting so huge a bulk of water? The regularity of the geyser's shot, occurring, as it does, every nine minutes and rising ten feet higher each time, certainly seems to point to the existence of a tube of some depth. Is it possible that "Waimangu" is in reality an ancient geyser which, for some reason best known to Vulcan and his workmen, has been re-endowed with life?

DISCUSSION.

The CHAIRMAN.—Ladies and gentlemen, I think that the new departure that the Secretary has spoken of in allowing a lady to read a paper here, you will, by the result of this afternoon, quite realize is a departure in the right direction, for we have had a most interesting paper, charmingly read.

It is a great many years since I was in New Zealand, but I have always had the most intense interest in the place from the peculiarity of the country altogether, and the remarkable volcanic conditions that exist all over it.

Many years ago I was in Tory Channel, which has an unenviable notoriety, as it was really the scene of the massacre of the crew of the *Tory* before the last New Zealand war. We were on a boating expedition, and we spent the night at the cottage of a settler there. We were talking about the country and earthquakes, and they said that on an average they had an earthquake once a month during the year. Just outside the city of Auckland there stands Mount Eden—an extinct volcano, the crater of which was almost as perfect as the day the volcano left off working. From the top of this cone there were to be seen, as far as I remember, thirteen not extinct volcanoes, probably, but volcanic cones. The whole country is full of interest from this very lively volcanic action that is going on.

No doubt there are many here who are interested in New Zealand, and I hope they will give us the benefit of their remarks.

Professor Logan Lobley, who is here, can, I think, give us some interesting remarks on the geological aspect of the country.

(The photographic slides were then exhibited on the screen.)

Professor LOGAN LOBLEY, F.G.S.—I am much obliged to you for the honour you have done me in asking me to take part in the discussion at so early a period of the evening.

I must congratulate the Institute on setting the example to other Societies by inviting a lady to read a paper on a scientific subject. I would also congratulate the author on giving us a most interesting and valuable paper respecting a district of such great physical interest.

The volcanic district of New Zealand, both of North Island and South Island, is very remarkable in one respect. I have in my mind compared the Rotorua district and the similarity with the Phlegrean fields of Italy and that district with a portion of the surface of the moon; but there is a distinct difference between the aspect of the surface of the Rotorua district and that of the Phlegrean fields. They are both volcanic; but in the Italian district, as all those know who have been to Italy, there is a preponderance of crater features, while in the Rotorua district that preponderance of craters is less conspicuous. That, I think, is entirely due to the fact of the great preponderance of acidic rocks in the New Zealand area, which gives such large deposits of pumaceous ejectamenta and of siliceous sinter from the boiling springs, and this interferes very much with the crater-like character of the area.

There is another point that has never been noticed, as far as I am aware, and it is of great interest, namely, the long continuance of volcanic action on the New Zealand area, the volcanic action of the Neapolitan volcanic and those of Sicily and the Lipari islands. All those volcanic hills and craters have had their origin within the Pliocene period; whereas the volcanic action has continued in New Zealand from before Tertiary times; for the newest volcanic rocks of the South Island are overlaid by Tertiary rocks; so that we have evidence of a very long continuance of volcanic action in the New Zealand region which continues into the present time. This volcanic action, in one part of this paper, is said to be scarcely a true volcanic action because there was no lava in the eruption of 1886. But it does not follow at all that the

action is not truly volcanic because there is no lava. Many of the greatest eruptions that have taken place in the world have been entirely devoid of lava flows. The great eruption of A.D. 79, which destroyed Pompeii and Herculaneum, was entirely without lava, and the recent West Indian eruptions were entirely destitute of lava flows.* These are explosive eruptions in which the whole of the lava has been converted into fragmentary ejectamenta. So that the absence of lava is no indication of want of true volcanic action.

The fact of these eruptions in New Zealand being chiefly explosive and without lava-flows is due, I think, to the fact that the rocks are chiefly acidic (or siliceous) and to there being a great access of water to the rising lava, and so converting the whole into ejectamenta of a dry solid character which otherwise, without a sufficient amount of water, would have partly flowed away in liquid lava.

There are a great many points that are suggestive of remark, but I will not occupy your time further.

The CHAIRMAN.—I think we have a gentleman here who has been to the Lipari Islands, Mr. Narlian.

Mr. NARLIAN.—What I have seen of the photographs reminds me very much that all the formations I have seen are very much like what we have had at Nilcano. Again, as the Professor has observed, in all acidic formations there is an absence of lava-flow. The last great eruption we had was absolutely devoid of all lava-flow. The vapour and fumes were highly charged with electricity, and the column ejected might have been 15,000 feet as well as we could measure. Of course it was not all charged with water, but the shaft and small bits perhaps of rock went up, in many cases, 15,000 feet. Estimating the height of the mountain from the level of the sea, and taking the proportion of the column ejected from the crater, I could not take it under that measure. Some of the great boulders ejected were a good deal more than the size of this room, and were ejected to a distance of 1 or 1½ miles, and a great many of them have been spread over the island.

I believe in other cases, also, a terrace-like formation is found.

* "Volcanic action and the West Indian eruptions of 1892," *Trans. Vict. Inst.*, vol. xxxv, p. 214 (1903), also the same subject by Prof. J. W. Spencer, *ibid.*, p. 198.

The SECRETARY.—Have some of those terraces been raised out of the sea ?

Mr. NARLIAN.—No ; from the sea the formation of the mountain is very abrupt—something like, perhaps, 45 degrees.

The SECRETARY.—I think I ought to join, with Professor Logan Lobley and yourself, sir, in expressing our obligation to Miss Boord for this exceedingly interesting and graphic paper which she has read before us. She has given us an account of the phenomena she witnessed in this wonderful island, in a clear, lucid and agreeable manner, and I could see from the manner in which the audience were following her in the paper that they were all very much interested in her observations. We, in this happy island of ours, are not so favoured as some other countries in regard to recent volcanic phenomena, though we have grand representatives of extinct volcanic action. We have no eruptions from craters, no geysers and very seldom any earthquakes that we are conscious of ; so that we are dependent on travellers to Iceland, Yellowstone Park, the Lipari Islands, the West Indies and other regions of the globe for accounts of these grand operations of nature ; the results of heat and moisture acting with tremendous force through the agency of steam, producing wonderful effects at the time and leaving their marks for many a day afterwards. We are, therefore, indebted to those who bring us information and produce before us pictures and photographs of the phenomena they have seen like those exhibited here to-day, and which, after all, though beautifully representative, yet fall very far short indeed of the phenomena themselves as seen in nature. For these reasons I think we are very much indebted to Miss Boord for her paper.

The CHAIRMAN having put the vote of thanks to the Meeting, which was carried unanimously, Miss BOORD, through the Chairman, thanked the Meeting for the manner in which her paper had been received, and the proceedings terminated.

ORDINARY GENERAL MEETING.*

COLONEL GEORGE MACKINLAY, LATE R.A., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following elections were announced :—

MEMBERS :—Rev. J. Marchant ; Ebenezer J. Sewell, Esq.

ASSOCIATES :—F. D. Hopkins, Esq. ; James Heaton, Esq.

The following paper was then read by the author :—

OBSERVATIONS ON IRRIGATION WORKS IN INDIA.

By C. W. ODLING, Esq., M.Inst.C.E., C.S.I.

IT is possible that some of those, whom I have the honour of addressing this evening, have lived in India for a longer or shorter period. In that case a portion of my remarks may be superfluous, but I think it will be wise for me to assume that the acquaintance of my audience with India is limited to what they may have read in books or newspapers or heard from friends. To begin with, I may say that the overwhelming importance of irrigation in India is due to the liability of that country to famines. The famine of 1897 and 1898 attracted much attention in England, and large sums were raised by private generosity for the relief of our fellow-subjects in India. This famine, which commenced in the winter of 1897, has only lately come to an end, relief works in the Central Provinces having ceased in 1903. In that famine, food was always procurable at a somewhat high price, but the people who had lost their crops were unable to purchase it, as they had not the wherewithal to do so. At the time, I was residing in what are now called the United Provinces of Agra and Oudh, and I do not think that, in those Provinces, any deaths occurred owing to relief not being procurable. Severe privation was widespread and unavoidable, and unfortunately many persons did not seek

* Monday, 22nd February, 1904.

relief in time. The lesson taught by the Orissa famine of 1866 had resulted in the State fully accepting, in principle, the obligation to provide, in times of famine, the means of supporting life. In other words, to maintain relief works, where wages sufficient for subsistence could be earned, and to give gratuitous relief where necessary. This obligation has, I believe I can rightly say, been acted up to. Owing, however, to the experience gained in this famine and to the labours of a Commission, of which that distinguished official, Sir Antony Macdonnell, now Under Secretary of State for Ireland, was President, I have no doubt that in future famines the management will be more efficient, as regards relief, and more economical in the expenditure to be incurred. My own recollections extend as far back as to the Orissa famine of 1866, in which I am sorry to say that three-quarters of a million of people perished, the greater number of starvation pure and simple. That famine formed my introduction to India, and a very doleful introduction it was. The crops had failed and means of communication, by which sufficient food could be speedily brought into the country, did not exist. Even the road from Calcutta to Cuttack, the capital of Orissa, was unmetalled, and this road is intersected by numerous large rivers which were unbridged. Things are different now. Cuttack is connected with Calcutta, about 250 miles distant, by a railway which extends to Madras. There are two navigable canals, passing from Cuttack to the seaboard, and there is inland water communication, mainly by canals, but partly by rivers and tidal creeks, between Calcutta and Cuttack. In speaking of the canals between Cuttack and the coast, I may advert to the rise of the port of Chandbally, which, when I first saw it, in the year 1867, was a small fishing village with a few mud huts. After the Orissa famine of 1866, a Scotch captain, who had an interest in a small steamer, the *Celt*, which at one time plied on the Clyde, explored the Orissa coast to see if he could find a harbour sufficient to admit a vessel of light draught entering it. Eventually he found that he could navigate the River Dhamrah for 20 miles from the sea to Chandbally, whence Cuttack, 60 miles distant, could be reached by road and other nearer places by rivers or creeks. The result of this exploration was, that in five years, there were three separate lines of steamers running between Calcutta and Chandbally. Up to the time of the opening of the railway, in-so-far as I remember 1900, the usual method of reaching Cuttack, from Calcutta, was by sea to Chandbally and thence to Cuttack by canal.

I have digressed somewhat from my subject in order to bring to notice a typical instance of expansion of trade and the enterprise of the British mercantile marine. I trust that Captain Macneill derived some benefit from his energy, but I fear that the reward for the most part went to the great shipping companies, who reaped where he had sown.

Turning to the more immediate subject of my lecture, I find that in the year 1901-02, which is the last for which I have been able to procure returns, 20 millions of acres were irrigated by works constructed by the Indian Government. The area of England is given in *Whitaker's Almanack* at 32,600,000 acres, so that the area so irrigated in India is equivalent to nearly two-thirds of the area of England. The cultivated area of India is 226 million acres, less than one-tenth of which was irrigated by State irrigation works. The crops irrigated were mainly food crops, other crops such as flax, linseed not used for food do not cover more than about 10 per cent. of the area irrigated, and allowing this margin, the food produced was sufficient to feed 16 millions of people for a year. For some of the smaller works no capital accounts are prepared, but the works, for which such accounts have been kept, had, up to the 31st March, 1902, cost $29\frac{1}{2}$ millions of pounds, and the net revenue, after paying working expenses, was £1,800,000, or upwards of 6 per cent. on the capital outlay. These are, so far as I can give them, the broad outlines of the extent and results of irrigation works already carried out by the Government of India. It is not to be supposed that there are not what I may call private irrigation works, such as field embankments, which impound drainage water, and channels leading from tanks, rivers, and streams. In years of good rainfall these works are said to irrigate some 14 millions of acres; when the rainfall is deficient that area is less by possibly 50 per cent. Wells are also largely used for the irrigation of crops, other than rice, 12 millions of acres being so watered in a normal year. One way or other something like one-fifth of the cultivated area of India is artificially irrigated in ordinary years, and crops over that area of land secured independently of the rainfall.

The crops grown in India may be divided into autumn crops—known as *Kharif*—such as rice, millets, and pulses—and spring crops known as *Rabi*, such as wheat, barley, and linseed. The former are harvested in November and December, and the latter in March and April. Sugar cane and some other crops require a whole year to mature. The chief crops which are irrigated are rice, wheat, barley, and sugar cane.

Incidentally, I may refer to the rainfall which for India as a whole—excluding Burma and the Himalayas—is taken, in a late official publication, as 42 inches for the year, on an average, and to be liable to fluctuation, also on an average, to the extent of about 7 inches only. The variation in separate tracts is very great, and unfortunately, the lower the rainfall the greater its liability to serious deficiency. As an example of the variation in different parts of India, I may refer to Cheera Poonja in the Khushi Hills, where the normal annual fall exceeds 450 inches, and Bikaneer, where it is under 5 inches. There is a large part of India where the rainfall exceeds 70 inches, and where the chance of failure of crops, owing to deficiency of rainfall, is small. Allowing for this tract in which the rainfall is always sufficient, and for the area in which the crops are secured by irrigation, there is the Irrigation Commission, to whose report I am greatly indebted for some of the information contained in this paper, comprising a tract of nearly a million square miles, no part of which is at present secure from drought followed by serious deficiencies in the crops and consequent famine. It is to protect this part of India that irrigation works are required. My own experience has been, that the Government of India have never been unwilling to find the money required to construct irrigation works, from which a return of 4 per cent. on the expenditure might reasonably be expected. In many cases, the return on the capital expended has been greatly in excess of this rate—in fact, as I have already mentioned, the works constructed with the expectation that they would pay at least 4 per cent. per annum, now taken together, return upwards of 6 per cent., but several of the projects have, as remunerative works, failed altogether. The irrigation works in Bengal and Bombay (exclusive of Sind), on which $4\frac{1}{2}$ millions sterling have been expended, return something less than 1 per cent. on their capital cost. The Kurnoul Canal in Madras, which cost $1\frac{1}{2}$ millions sterling, pays about $\frac{1}{2}$ per cent. on that sum.

The profitableness or otherwise of irrigation works depends, naturally, largely on the average rainfall; in the Punjab, where the fall is low, averaging 10 to 23 inches annually, the return is $10\frac{1}{2}$ per cent. on the capital expended, and the works last constructed—known as the Chenab Canal project—give a return of $18\frac{1}{2}$ per cent. On the other hand the Madras works, which serve a country where the average annual rainfall varies from 30 to 40 inches, gave a return of $9\frac{1}{2}$ per cent., the works last constructed, amongst which is the Kurnoul project, to

which I have previously referred, not however having proved to be remunerative.

The fact is that, except in very dry localities, it is not easy to say how far canal water will be taken advantage of. When the Sone canals, with which I was for many years connected, were constructed, the opinion of the Engineers and the Civil Officers was that spring crops, such as barley and wheat, would, if anything, be more irrigated than rice, for which it was supposed the rainfall, which averages about 42 inches in the year, would in many places be sufficient. The Lieut.-Governor, Sir George Campbell, insisted that the canals should be designed with regard to the supply of water, available in the river in the cold weather, when spring crops are irrigated. On the other hand, Colonel (now General) Rundall, R.E., the chief adviser to the Government of India, advocated the canals being constructed chiefly with a view to rice irrigation, with which he had long experience in Madras. The Lieut.-Governor's views, as might be expected, prevailed, and the canals were restricted in size, and otherwise designed, in accordance with the Lieut.-Governor's opinion, as to the work which they would be called on to perform. The actual result has been, that the rice irrigation is limited only by the amount of water available. So far as water can be guaranteed for rice, the cultivators eagerly avail themselves of it, and double the area of this crops could be irrigated, if water could be supplied. In regard to spring crops, wheat, barley, and the like, there is in most years little demand for water, not one-tenth of the area for which water can be supplied is usually irrigated. It is not by any means a matter of obstinacy or prejudice, as where water is beneficial it is taken and, in some cases, lifted by mechanical means 6 feet or more, at a cost of treble or quadruple the amount of the water rate. Once in seven or eight years, when the winter rains fail entirely, the whole of the water which the canals can supply for spring crops is used, but, generally speaking, it is the rice irrigation only that counts. These canals, I may remark, pay at present 2 per cent. on the capital outlay, but there is little doubt that had they been designed with reference mainly to rice irrigation, the return would be double. As it is they will, before many years have passed, probably pay from 3 to $3\frac{1}{2}$ per cent. on the outlay incurred, and in years of famine the value of the crops saved cannot be disregarded, in fact, from one point of view, it is the greatest benefit they confer on the country.

It is stated in a Government resolution, that for the year

1901-2, the value of the crops in India as a whole, raised by the aid of irrigation from the works, for which capital accounts are kept, is estimated at nearly 42 crores of rupees (28 millions of pounds), or about 95 per cent. of the capital outlay expended on them.* There is, in fact, a return from canals, quite independent of the actual money receipts, in the food raised by their help, at a time when it is most required. That eminent statesman, Lord Curzon, who as Viceroy now so worthily controls the Government of India, has fully recognized this fact, and irrigation works are being pushed on as fast as plans can be prepared, without too much regard to their character as remunerative works.

The State irrigation canals usually directly depend for their supply of water on rivers. There are a few small canals, fed from reservoirs and tanks, but the irrigation canals in India are in the main supplied directly by rivers, some of which are snow fed and give a sufficient supply of water all the year round, whilst others can be depended on for a full supply only during the rainy season, that is from July to October. The rivers of India have many peculiarities, perhaps the most striking being, that it is difficult, during flood time, to know where they will be the day after to-morrow. The Ganges has been known to change its course, by as much as 2 or 3 miles, in the course of one rainy season. The Indian rivers are a study in themselves. An Engineer, who built one of the largest railway bridges in India, at the ceremony when the bridge was opened, remarked that he had watched that particular river as a cat might watch a mouse, for three years, and was then as far from knowing what change might occur in its course, during a single rainy season, as he was when he first saw it. The non-snow fed rivers, which are those with which I am best acquainted, are frequently dry, almost always fordable in the dry weather, whilst in the rains, they may be anything from 1 to 3 miles wide, with a raging current, between 8 and 20 feet deep, passing down them. A journey in the rains from Calcutta to Cuttack used, before the days of railways or the rise of the port of Chandbally, to be attended with many possible troubles, not the least of which was the chance of being detained, with no shelter but a palanquin, on the banks of a river for 48 hours. One particular river, with which I am acquainted, the Byturnee, which in the summer may be crossed on stepping stones, has

* *Government of India Resolution*, No. 1213 C. W.—I. of 10th September, 1903.

within my own knowledge in 1868, overflowed its banks, so that a European, who was staying, with his wife and child, in a travellers' rest house some eight miles away, had to take shelter on the roof, where I am sorry to say the child died.

The rivers, in the deltas of Bengal, frequently become narrower as they approach the sea, with the result that in the flood season they overflow their banks for long distances, and for 30 to 50 miles, they form seas of water with villages, dotted here and there, on hillocks, appearing above the water. At that time of year the difficulty, when travelling in a boat, is to be sure you are in the river and not sailing over what ought to be dry land, with the chances, should the flood subside, of finding your boat stranded two or three miles away from the river bank. Such rivers are frequently embanked, but the general result of such embankments is only to intensify the flood lower down the river, the flooded country on each side, when open, performing the office of a reservoir and impounding the water, until the flood commences to subside, when it gradually passes away. Here in England the banks of rivers are usually the lowest parts of the country and are apt to be flooded in wet years, like the last; in deltas, the reverse is the case, the banks of the rivers are frequently the highest parts of the country, as the silt has accumulated there more than elsewhere. In flood time the water in the rivers is heavily charged with silt, and when it overtops the banks, its flow being diminished in speed, the greater part of the silt, which is only held in suspension, when the velocity of the water is considerable, is forthwith deposited. Some portion of the finer particles of the silt of course remain, and are gradually deposited on the fields, which, in the course of long years, are raised also. Deltas are, in fact, the product of river silt. Even outside the deltas proper the Indian rivers have, what in England would be looked on as eccentricities, the River Sone, for instance, being $2\frac{1}{2}$ miles wide at Dêhri, the site of the weir, from which the Sone Canals take off, whilst 60 miles lower down, where the East India Railway crosses it, that river is 6,000 feet wide only. The deficiency in width is partly made up by greater depth.

The rivers of India, from an irrigation point of view, may be divided into two classes, those whose source lies in the snow-capped mountains of the Himalayas and those which rise in the hills situated in the interior of India. The said hills, it may be mentioned, are anything between 4,000 and 8,000 feet in height, whilst many of the peaks of the Himalayas are more than 20,000 feet in height. In the case of rivers whose source is

in the Himalayas whilst the volume of water varies, it is always considerable, the lowest discharge being in April, before the snows commence to melt: in the case of rivers whose source is the hills in the interior of India the discharge is greatly restricted from November to March, and during April, May and June, many rivers are almost dry, a large river, the Mahanuddy, for instance, which is nearly two miles wide in an ordinary flood, becoming fordable from April to June, and being then only a few hundred feet in width.

In Bengal proper, rivers are very numerous and the meeting place of the community, especially the women, who carry water from them for domestic use and take advantage of the opportunity to chatter with their neighbours. They are also much resorted to, by both sexes, for bathing purposes, a pastime which cannot always be indulged in in safety, many of the rivers abounding in alligators, who are given to devouring children and do not disdain adults when children are not to be had. I have shot several alligators and found inside them bangles and other feminine ornaments, indicating that they had quite their share of female flesh. One river in Orissa is known as the Kimeria-Kimer, being the Ooriya term for alligator. In that river bathing places are frequently fenced round with bamboos, a practice which I notice has been copied at Folkestone, iron bars taking the place of bamboos, but I have not heard of alligators appearing at that place.

I now turn to the great irrigation systems of India on which, as I have previously mentioned, nearly 30 millions sterling have been expended. The water is in nearly every case obtained from some great river, and the usual course is to build a wall—technically known as a weir—across the river, so as to raise the water and keep it permanently raised, some 10 or 12 feet above the river bed. The designing and building of these weirs affords full scope for the engineering abilities of the staff of engineers employed by the Government of India in the Irrigation Branch of the Public Works Department. Essentially, a weir comprises the wall mentioned, which is usually built on wells, the foundation being generally sand, and slopes of heavy stone, in front and behind. Work is carried on when the rivers are at their lowest, say from November to May, so that the season of heavy floods is escaped. I am not going to inflict on you any technical engineering details, but I may perhaps say that there are occasionally incidents connected with the construction of these large works, which cause anxious moments to the resident staff. I was at one time

Resident Engineer in charge of the construction of the weir across the Brahminee, a river 4,000 feet wide. This is not a snow-fed river, and usually from December to June it is nearly dry. In this year, however, a heavy flood occurred in January, and as I had two railway lines laid across the river bed and in use, its effects were disastrous. The lines were submerged and the movable plant, including portions of railway waggons, swept down the river, and gradually picked up miles away. A flood in that month of the year was an unheard-of occurrence. Fortunately for me the Inspector-General of Irrigation was present, and I think that my predominant feeling was rather more one of satisfaction, that he was there to witness the incident, than distress at the occurrence, which was in itself sufficiently annoying, as all work stopped in June, and a great deal of leeway had to be made up. Cholera was another peril to which we were not infrequently subject. The work-people took the matter in their own hands, and after a few cases dispersed. I have myself known, on one canal under construction, the work-people to diminish in two days from upwards of 20,000 to one-tenth of that number. I may perhaps say that, on such occasions, there is a good deal of amateur doctoring, and that a pint of rum will, so far as my experience goes, cure any case of cholera in an adult, provided, and the proviso is important, that the person experimented on has never touched alcohol before. Such persons, I may add, are in some parts of India by no means rare.

The water in the river having been raised to a sufficient extent canals are dug, which extend many miles in length, and compared with those common in England, are of great size. The canal with which I was most concerned was 80 yards wide at water line, and there are many much larger. The discharge, 3,000 cubic feet per second, was sufficient to cover 18,000 acres of ground with water 4 inches in depth in 24 hours, and as rice, the crop with which we were mostly concerned, can live without water for 12 to 14 days, the crops on 220,000 acres could be saved independently of the rainfall. A canal on the other side of the river was capable of irrigating something more than half this area, so that crops on some 350,000 acres were safe. Our chief difficulty, when the canal first commenced to run, was with silt, which was deposited in large quantities in the first mile of the canal, reducing its depth by one-half, in times of flood, when much silt was deposited. After a time, the engineers in charge, managed to so arrange the supply, that the water which entered contained less silt, and that such silt

as it did contain was carried on to the fields, where it was useful as a fertilizing agent. The chief part in this reform, which saved much expense in dredging, was taken by a gentleman whom I see present this evening. Weeds were another of our difficulties. The moment the water was clear and the supply low, so that its velocity in the canal was small, they commenced to spring up, and I can, having seen this example, well understand how weeds have actually blocked and in fact extirpated rivers in Central Asia and Egypt. The peculiarity of the weeds, at least those with which I am personally acquainted, is that so far as screw steamers are concerned they only materially impede the progress of the boat when it is travelling with the current. I remember on one occasion taking a distinguished party some 50 miles, in a small steamer up a canal; the journey was performed with no trouble, and indeed we had not much difficulty during the first 40 miles of the journey back, but it took us quite four hours to do the last 10 miles, and as I was in charge of the canal I was not a little mortified. I mention the circumstance as a good example of learning by experience. The weeds I may say have been much diminished by the measures taken to prevent silt deposit and what is perhaps of nearly equal importance, paddle steamers are now used. Weeds have very little effect on the progress of paddle steamers, and after such a lesson I took all possible precautions for the future. The canals with which I have been personally connected, have locks, and are used for navigation as well as for irrigation. There is considerable doubt as to whether this is a wise arrangement, as with a navigation canal it is desirable to keep the velocity of the current as low as possible, whilst in respect to canals, for irrigation only, a high velocity is desirable, so that the canal may not be larger than is necessary, and, further, the higher the velocity the more silt the water will carry on to the fields.

The main canals leading off from the rivers having been constructed, branch canals taking off from them are excavated, and other channels, known as distributaries, are again dug leading off from the branch canals, until the water is delivered well into every village, which may be taken as an area of say 2,000 to 3,000 acres. From these distributaries channels are led into the fields; these minor channels have usually been made by the villagers, but the tendency is now for water to be led to each holding by channels made when the distributaries are constructed. Here I may perhaps mention that upwards

of 40,000 miles of canals and distributaries have been constructed at the expense of the Government of India.

When a canal has been built, so far from the difficulties being over, my experience has been that they are about to commence. After all a canal and its appliances can be carried out with the ordinary difficulties attendant on the construction of a large engineering work. Rivers, large or small, are crossed by weirs or aqueducts, the slope of the canal is kept at that necessary to give the desired velocity to the water, masonry falls or waste weirs being built should the slope of the country exceed that given to the canal, and finally, escapes are provided into which water not required can be discharged. One thing I may perhaps mention, which is, that if there is a weak spot in the works the water will find it out, and that the work, both as regards material and workmanship, must be first class. In common with railways, canals have been of great use to the country in introducing masonry, iron and woodwork, of a class which had never been previously seen in many districts. When the canals were completed the workmen remained and used for other works the skill they had acquired whilst employed on canal construction.

I will give one concrete example of indirect material advancement consequent on the building of a canal. In 1872 I was employed as Resident Engineer on the construction of what is known as the High Level Canal between Cuttack and Bhadrak. A weir across the Pattia river was one of the works, and large quantities of stone were required—this stone we obtained from an estate known as Sokinda. Now in Sokinda, which is in British territory, but at that time in reality ruled by a landholder, a direct descendant of the ancient chiefs, such a thing as a cart was unknown. Pack bullocks were employed for the transport of grain and such commodities as had to be moved. The contractors I employed commenced by importing 2,000 carts, and in June, when the working season expired, these carts were not considered worth either moving or storing, and they were sold, to what I may call the aborigines, for what they would fetch. In subsequent years a similar course was followed, and there has been no lack of carts in Sokinda since.

The canal banks, I may add, are in some cases high, the width is considerable, and the quantity of earth to be moved any distance from 20 to 100 yards and any height up to 20 feet, large. All this earth is carried on women's heads in baskets, wheel-barrow being unknown, indeed there is a tradition that wheel-barrow were once sent out from England for a railway,

but the coolies, who promptly removed the wheels, found them heavy and inconvenient to carry on their heads, so the experiment has not been repeated.

Returning to the stage following the completion of the canal, the next thing is to dispose of the water, and an elaborate organisation is necessary. To begin with, the system of farmers occupying some 50 to 1,000 acres, the buildings requisite for which have been supplied by the landholder, is unknown in India. The land is occupied in small plots of from 2 to say 10 acres by cultivators (*ryots* is the usual name for them) who have built and own all the buildings on the land. The land in Bengal and Upper India is the property of a landlord, whilst in Bombay and South India it usually belongs to the State. Under any circumstances the cultivator pays rent to the landholder, and usually cannot be evicted so long as the rent is paid. In many cases the rent cannot be raised except at stated intervals, and then only if the yearly value of the land has been increased by some agency other than the labour of the cultivator. I have spoken of landlords, but it is necessary to say that in India, broadly speaking, the State is the sole landlord, the so-called private landlords (*zemindars*) having the right only to a share of the rent. This share has in some cases been permanently settled, and in other cases for a term of years, usually thirty. Where the settlement is for a term of years, the State usually receives half the rent paid by the cultivators to the *zemindar*, but where the settlement is permanent the share, which was originally 90 per cent., has grown,* till in 1893 it was found that for four districts in Behar, the government out of a rental of about 240 lacs of rupees received 34 lacs, and the *zemindar* retained the remainder. The assessment under which Government received $\frac{9}{10}$ of the rents paid by the cultivators, erred probably on the side of excess, though the *zemindars* had their homestead land and all waste or common land revenue free. It cannot be said that the share Government now receives errs on the side of excess, indeed the complaint made by those provinces in which the permanent settlement does not exist is that Bengal does not pay its fair share of the general expenses of the Indian Empire. I have no personal acquaintance with these parts of the country, Bombay and Madras, where the Government deals directly with the cultivator, but the settlements are in such cases always, I believe, for a term of years, and I gather that, though the rents imposed are not

* Supplement to the *Calcutta Gazette* for October 25th, 1893.

excessive, the rigidity with which they are exacted, be the seasons good or bad, might with advantage be modified.

Tenants holding directly from the State have an advantage inasmuch as they are required to pay a fixed rent only, without the addition of presents known as *salami* or *awabs*. Cultivators dealing with a landlord are expected to present gifts, on the occasion of a birth or marriage in the landlord's family, or their own, or whenever a decent pretext can be found for exacting an extra payment. The reasons given for levying these gifts sometimes border on the grotesque. I was at one time living with a magistrate in charge of a subdivision of a district, who in the course of an inquiry found that illegal cesses, under thirteen different heads, had been imposed on the cultivators. On one occasion the landlord had, long years previously, entertained a magistrate, and had since levied yearly a tax to compensate him for the expense which he had incurred. The poles which supported the telegraph wires passed through his land, and, under the name of *tar kercha*, telegraph tax, he imposed a cess of 1s. 6d. a pole on those of his tenants who occupied fields in which the telegraph poles were fixed. He paid nothing himself towards the cost or working of the telegraph line, and, indeed, was entitled to compensation, if he cared to claim it, for the trifling area of land occupied by the poles. The possibility of levying an extra cess was too good to be lost. A donation to a school was followed by an annual cess about equal in amount to the donation. It is fair to say that these gifts were in some cases regarded by both parties as the equivalent of an increased rent, which might possibly have been legally demanded, but which would certainly have been resisted and involved both sides in heavy legal expenses. In moderation the cultivators do not object to occasional gifts which have become customary.

As I have said, many, probably most, of the cultivators are protected from eviction so long as they pay their rents, and many even against any arbitrary increase in rent. On the other hand there are tenants at will, but whatever the tenure, the cultivator owns his own house, and it is with him, and not the landlord, that the Irrigation Officer deals. The crops differ in different parts of India, but so far as irrigation is concerned the difference, broadly speaking, is between those parts where the only irrigation that counts is rice, and Upper India where the spring crops are equally, if not more important. My own experience has been in those parts of the country where the main irrigation is of rice. Under any circumstances the water

has to be supplied to the field channels in sufficient quantities, and in due season, the area irrigated has to be measured and assessed, bills for the sums due have to be made out and delivered to the person who is liable, and finally the money has to be collected. When things have settled into what may be called a state of routine, incessant care, watchfulness, and industry are sufficient to keep the system going with a moderate number of complaints, many of which will be found to rest on some real grievance. Such a system takes time and actual experience to evolve. The persons who will have to pay are not always helpful. In the case of one village, I found that the persons who had been returned as liable to pay water rates, were for the most part dead, and the few persons who were still living, were inhabitants of neighbouring villages who were not on good terms with its present inhabitants. In the end a system fairly satisfactory alike to cultivators and to Government is arrived at.

The work to be done in managing canals is heavy, and unfortunately, in Bengal at least, it involves daily travelling and exposure during the most unhealthy time of the year, July to September, when not only is the heat oppressive but the atmosphere is saturated with vapour. There is another side to the story, and I do not think I know anything more enjoyable than an Irrigation Officer's tours in January and February. The air is then bright and crisp, I have heard it likened to champagne, the temperature in the daytime pleasant, and at night just sufficiently cool to render a fire, a bonfire, in front of a tent if under canvas, desirable, though perhaps not necessary. The crops then on the ground, mainly wheat and barley, remind one of the old country, and the cultivators are always desirous of having an interview with the canal engineer, who, on his part, is glad to become personally acquainted with as many as possible of the people, for whose benefit his active life is spent, and with whom it is a pleasure to deal in their own villages. There they are usually truthful, and to no one more so than to the officers, on whose zeal so much of their welfare depends. In law courts it is a different story. The same men who, in their own villages would be ashamed to deviate from the truth, consider themselves in no way disgraced by committing perjury in court in the interest of themselves or their friends.

The influence of canals is unfortunately not for good in all directions. Rice is a far more certain crop than wheat or barley; it is not liable to blight, red dust, or numerous other

diseases to which cereals are subject. It also requires less labour, and is therefore the popular crop. In the case of the Sone canals, over 100,000 acres of rice has displaced wheat, barley, and other spring crops, though it may be doubted if it is, from a health point of view, good for the country to have this area of land covered with 4 to 5 inches of water for three months of the year at least.

To show the effects of canals in the Punjaub, which is a country of scant rainfall, I may refer to the Chenab Canal, which has cost about one and three-quarter million pounds sterling, and commands an area of 4,700 square miles—more than the area of Yorkshire—three-fifths of which was irrigated in the year ending 31st March, 1902, yielding a revenue of 18·8 per cent. on the capital outlay. More important than the financial result is the fact that a barren plain, inhabited by a few thousand nomads, has been rendered available for cultivation, and even now supports a population of nearly a million of inhabitants. Works of this character do much to justify English dominion in India, and to show the advantage of Western civilisation. I need scarcely say that all irrigation projects will not be so remunerative, in fact some of them may fail to do more than pay working expenses. But the indirect benefits are so great that there is abundant justification for their construction in those parts of the country where scarcity is frequent, and such works are feasible.

India, I may say, is pre-eminently an agricultural country, and interests in the land are widespread, so that any measures which will render it more fruitful, reaches all classes of the community. There is the same, and possibly greater reluctance, to adopt new methods of cultivation which are not altogether absent in a country so far advanced as England. So far as irrigation is concerned, there has been nothing new to learn in using water periodically to mature the crops. In places where the rainfall is sometimes sufficient, there has, however, been at first, considerable reluctance to pay for a commodity which has hitherto been regarded as a free gift from above. But it is, sooner or later, recognised that the certainty of good crops and the convenience of obtaining water when required are worth a price, and eventually water rates are paid, if not cheerfully, without any particular difficulty.

The charge for the water supplied is low. For rice, which must constantly be kept in a depth of from 4 to 6 inches of water, the rates vary from two shillings an acre in Orissa to

8s. 4d. in the Punjaub. It is not likely that water could be supplied for this crop from wells, by any mechanical means, at a price which the cultivator could afford to pay; for spring crops, which require less frequent waterings and smaller quantities of water, wells are at present largely used, and it is possible that windmills or some other power may in time supplant animal power which is now used. In Madras there is no special rate for water, the charge for which is amalgamated with the land revenue.

I have before mentioned that one of the duties of the great majority of women in India is to draw and convey to their dwellings the water required for domestic use. Where the spring level is high, that is where water is within 20 to 25 feet of the surface, most cultivators have a well of their own, and the burden on their womankind is not great, but there are parts of the country where it is necessary to sink wells to a depth of 100 feet or more to obtain water. In these places wells are costly to construct and are few in number. The High Level Canal, in Orissa, passes through a locality of this description, and previous to its construction the women, who lived in the villages near it, had to go from 1 to 3 miles for water, which they carried on their heads in large earthen vessels. The exercise, no doubt, gave them a very erect carriage, but it was exceedingly burdensome. The canal was accordingly looked on as a perfect godsend, and the satisfaction of the women at its advent was doubtless great, though owing to their retiring disposition the canal engineers did not hear their views on the matter. The village priest was, however, much struck with the blessing that had been bestowed on them, and whenever he saw me he uplifted his hands and solemnly blessed me for the boon which he thought I had been the means of obtaining for his flock. It is something to have the value of one's work recognized, and I always felt grateful to the old man for his benediction.

I hope that I have not wearied you with the somewhat technical language the subject on which I have been speaking has compelled me to adopt. Irrigation officers are all enthusiasts, and it is something to have adopted a career in which there can be no doubt that the work carried out has been for the good of the country in which one's lot has been cast. There is the further and more general question, whether with all the great things which England has done for India, of which irrigation is only one, it is, as has been asked by an eminent publicist, possible to render the country prosperous in the sense that frugal comfort will be the reward of industry.

There are certain parts of India, Eastern Bengal for example, where this standard is always reached, as the rainfall is invariably sufficient to mature the crops. But there are parts of India where a perceptible proportion of the population is always on the verge of starvation, and where actual distress follows a deficiency of rainfall. Irrigation will do much to remedy this inequality. It is not a panacea for all evils, and there are parts of the country where any irrigation schemes are quite impracticable. The necessities of life are few and simple in such a climate, and in those parts where the means of earning the little required to procure them can be made secure, I know no country where the mass of the people live in greater comfort. Railways have done much to render famines, like those of old, impossible; great industries like those connected with tea, mines, jute, indigo, and other articles have done something to provide employment for the population, who have, in parts of the country, multiplied beyond the power of the soil to support all. There are large tracts of the country still awaiting cultivation, and it is to be hoped that with the freer means of communication, the people will be less reluctant to change their domicile. This is to some extent already happening, as large numbers of labourers have migrated to the tea districts and mines, whilst a beginning has been made in colonizing the waste lands of Burmah. It would not be right in this paper to omit to refer to the marvellous effect irrigation canals have had on the wild frontier tribes, whose constant fighting seems to be partly due to want of sufficient occupation. The Swat Canals, near Peshawar, may be taken as an example. They were constructed with armed guards protecting the work-people, and ever since their construction have been the scene of murderous conflicts. They have, however, turned a tribe of marauders into a prosperous agricultural community. The same result has followed the construction of canals in Beluchistan and elsewhere on the frontier.

My paper has dwelt exclusively with the material wants of the country, the other and not less important spiritual wants, which are more commonly the themes under consideration at this Institute, I leave to other hands, merely mentioning them here, to show that they have not been forgotten.

DISCUSSION.

The CHAIRMAN.—I am asked to mention that besides members present we are favoured with the presence of visitors, who, I hope, will take part in the discussion and add to its interest as having been engaged in the construction of important works on canals in India. I will therefore call on Mr. Buckley to help us in starting the discussion.

Mr. R. B. BUCKLEY.—Sir, I have just noticed that Mr. Odling, towards the close of his paper, mentions that irrigation officers are always enthusiasts. I am an irrigation officer. Now my experience is that sometimes you get an enthusiast to talk to you on his hobby in a manner which is not always advantageous. However, strengthened by your kind support, I venture to make some criticisms on this paper.

I have known Mr. Odling for some thirty years, and have worked under him and with him, and therefore know how well he does his work.

I think the paper seems to throw a little too much importance on the work done by the British Government and by engineers in India in irrigation. Irrigation is rather treated here as though the works that conferred benefit on India had been originated and constructed by the British Government—indeed I think the very words are used. That it is not altogether true. Mr. Odling mentions one case where the works paid as much as 18 per cent., which is quite correct; but some four or five of them were not initiated by the British Government, but by the natives long before our time; and if we have done many useful works for India, as is the case, we have learnt a good deal from our native subjects before we begun to improve on their methods.

Irrigation is not new, as the paper leads one to believe, but it is very old; in fact, what little I know of the garden of Eden I am much inclined to think that probably the cutting of small channels was known at that time. I suppose the first natural overflow of the Ganges and the Indus would help to show the advantage of artificial channels. The Egyptians appear to have cut channels from the Nile to irrigate their land, and the Babylonians constructed a great many in the valley of the Euphrates some 300 years B.C. Certainly in India

they speak of two or three crops a year instead of one. Again, about 200 A.D. the Rajah Chandra Gupta constructed some of those works that originated in India. Then again, Tamarlane, who conquered India, had encouraged irrigation works. The first year a man was to have his land free; the second year he could pay what he liked, and the third year he had to pay taxes. But since those days, of course, there has been a great advance in irrigation—one hears of it all over the world.

On the second page of the paper the author refers to famine. It has been stated by the first Famine Commission that one acre of food grains irrigated will feed from two and a half to three persons a year, and I thought that perhaps a few results would be interesting to this meeting. Taking the five principal provinces of India, the area which is represented by irrigation works is about $16\frac{1}{2}$ million acres. Taking that standard of two and a half to three persons an acre being fed per year, these irrigation works will feed about 42 millions of people for one year. The actual population of these provinces is about 200,000,000. So that, approximately, one-fifth of the population has its food supplied by works administered by the Government works of India.

Now the action of irrigation works in reference to famine is, I think, often misunderstood. It is a common thing to hear people who are not acquainted with the details to say, "Why don't they construct more irrigation works here and there and so prevent famine?"

It is one of the most remarkable things I know that people always think if you want to save a country from famine you have only to catch irrigation engineers and irrigate the country; but they forget the fact that you cannot irrigate the land without water. There are many parts of India where water is not available and you cannot, therefore, irrigate the whole country. That proportion of the people who can be protected from famine is, no doubt, considerable; but the actual proportion which is afforded is really somewhat larger, because there are other means which afford an increase of food supply. But it is certainly a fact that although irrigation works will, in a particular district, when constructed, entirely prevent famine in that district, they will not prevent famine very far beyond its own area. I mean they will protect a zone beyond it, but not much more than that. I am afraid as to the deaths at Orissa in 1866, it is a

fact that they died of starvation, because they could not carry the food to the people. There was any amount of food around them, but it could not be carried there. The same thing applies to-day, and in this country we are in precisely the same condition. We could not live on our own food supply, we have to import it, and if from any cause the means of communication were interrupted, we should starve as the people of Orissa starved.

Mr. Odling has referred to the areas irrigated. I wish to show you, briefly, how great an advance has been made. The old works, to which I referred a little while ago, irrigated, in 1855 or 1856, about four million acres only. Shortly after that, Lord Mayo introduced a system by which immense prominence was given to irrigation works. In the next four years that figure of four million acres had risen to ten millions, and then, in a few years, to twenty million acres. Lord Curzon in the Report of the Commission lately sitting proposes to expend another £30,000,000 ($29\frac{1}{2}$ millions is the figure given by Mr. Odling as the cost up to March, 1902) in increasing the irrigation works of India. I am glad to see that those works are not to be gauged entirely by their financial results, but they are to be constructed if they are likely to produce results beneficial to the people.

There is another point upon which I think the paper does not give you sufficient clearness of ideas as to the size and volume of these works that are referred to. It is always very difficult to speak on technical subjects in a way that those not acquainted with them can follow. Mr. Odling speaks of the discharge of a canal being 3,000 cubic feet per second. Not many here, perhaps, know what that means. I propose to compare it with this little river here, the Thames. Now the Thames, at Windsor, or about there, has an ordinary discharge of about 1,000 cubic feet a second.

Mr. Odling, in mentioning these canals, speaks of them as carrying 3,000 cubic feet. I am glad to say I succeeded at one time, when water was badly wanted, in securing 4,000 feet. However, that is three times the size of the Thames. The Ganges carries about seven times the amount of the Thames at Windsor. The Chenab canal that Mr. Odling mentions carries no less than 10,800 cubic feet a second.

The Thames, at flood, has been gauged to discharge from 11,000 to 12,000 feet a second; so it will carry, when doing its worst, about

the same as the Chenab canal. But there is one canal, not in India, which outstrips all these, viz., a canal in Egypt, which in times of its maximum discharge carries as much, I believe, as 30,000 cubic feet a second—more than double what the Thames carries in its maximum flood.

I think that gives some idea of the magnitude of the works constructed in India.

The Chenab canal, that Mr. Odling refers to, was constructed in the Punjab. Before that canal was made the country was an entire waste. I do not think there was any village in it at all. If there was it consisted of two or three huts here and there. A certain number of nomads, as Mr. Odling says, wandered about the country, feeding their cattle where they could get a little grass or food for them; but, practically, the place was a desert. Mr. Odling has told us that there are now 1,000,000 people there. In the paper read by Mr. Preston the other day he said that the canal irrigated 1,900,000 acres, and it was estimated that it would irrigate 2,900,000. Now most of us know something of Egypt. The culturable area of Egypt is about 5,000,000 acres, and that of the Chenab canal, which is one canal constructed in India by the British Government, will irrigate just about one-half the entire culturable area of Egypt. There are at present 1,000,000 people living where there were perhaps a few hundred who lived there before, and that canal will, in the course of a few years, when developed, be able, probably, to support a population of at least 5,000,000 or 6,000,000. The entire population of Egypt is 6,000,000. That one Chenab canal is supporting, not in the same luxury perhaps and not producing such luxurious crops as Egypt, but it is supporting a population of over 4,000,000 in comfort.

Mr. Odling referred to the duties of irrigation officers, and he mentioned that his pleasantest time was in the cold weather. I must take some exception to that, because the pleasantest time I ever knew was during the last famine in Bengal. It was my duty to travel and find work for the famine-stricken people, and I saw the threshing floors, but there were no crops and no work. My duty led me down to the canal that Mr. Odling has quoted, and I there found the whole country in crops and the people well fed and contented. This was at the time of year that Mr. Odling speaks of as being so unpleasant. The crops were luxuriant and the area well irrigated;

but you had only to travel, in some cases 100 yards or 300 yards, outside the area where water had not reached, and the crops were almost invisible. That was a time when the whole country was wealthy and happy ; but I went in the time of famine when the canal was not only bringing happiness and prosperity to the people who won the food ; they were not only well fed themselves, but they got double and treble the price for their produce and sold with enormous benefit to themselves. The happiest time I ever spent was in going over that country and observing the prosperity of the people. I never enjoyed anything more than seeing the result of these labours in the happiness they brought to the inhabitants of India.

Sir CHARLES STEVENS.—Mr. Chairman, I was hoping that I should be crowded out by Mr. Buckley and other experts who are here, because Mr. Buckley's speech was very much more interesting and important than anything I can say.

I was glad to receive Mr. Odling's invitation to come here to-day, because I knew that I should have much to learn from my old colleague, as I may call him ; and, again, I thought I should have this opportunity of congratulating the Institute on having a paper from one of our chief Indian authorities on this very important subject.

Mr. Buckley has anticipated me in more than one remark that I was thinking of making. I was glad to find that Mr. Odling laid stress on big figures, because an English audience, as a rule, has very little idea of the work that has to be done in India. When Mr. Odling spoke of a tract of nearly a million square miles unprotected, I think that people who have lived all their lives on the British Isles, the total area of which is about 122,000 square miles—will have some slight idea of the country of which engineers have yet to deal. I do not know whether this estimated area includes the very large area which is either occasionally or constantly protected by private people. There are some large works which have been constructed after the model of the Government works ; but I am referring more particularly to the minor works of which one sees hundreds or thousands, perhaps, in the country which are constructed in places where nothing on a large scale could possibly be carried out.

On going through the country we see little rivers and streams

embanked where water is preserved not only for the usual domestic purposes, but to keep alive the crops and preserve them from drought, and the advantageous influence of those must be very large. When one compares the areas that have already been irrigated by these works with the millions of acres that are said yet to be left, I think one should bear in mind that irrigation works are valuable not merely for the actual quantity of crops which they are instrumental in growing, but also that those additional crops afford a margin or reserve for future times of scarcity.

I quite agree with what Mr. Buckley said—in fact, it is a commonplace now I think—that so far as we know there was never yet a time when there was not food enough in India to actually feed the people; but the difficulty has been that of communication or transport. That was the difficulty, as we have heard in Orissa, and the difficulty in the great Behar famine in 1873. In the year 1897–98, the time Mr. Buckley was speaking of just now, we passed through a time of as great scarcity as that of 1873; but everything went comparatively smoothly. Unfortunately, as Mr. Buckley said, the threshing floors were empty and the people thin; but still, somehow or other, the food got there, the difference being that railways now permeate that country, which in 1873 was not the case. So that what the Government had to do was to find the money. The traders found the means of transport, and the Government was spared the great labour and anxiety of providing the food. That same office was, to some extent, but to a much less extent, of course, performed by the canals and railways.

The SECRETARY.—I have to read a note of apology from Sir Colin Scott Moncrief, who was expected to be here this evening and whom we should have welcomed to speak on Mr. Odling's paper: "I am very sorry to have to tell you that I cannot come to Mr. Odling's lecture to-morrow. I had fully counted on doing so; but an intimate friend has suddenly died and I must attend her funeral to-morrow at Hitchin at 3 o'clock."

On the part of the Council and myself I may express our obligations to Mr. Odling for undertaking to prepare this paper for the Institute. [Applause.] I knew when I asked him to do so that he was just the man to do it well, and I think you will all agree with me that he has fulfilled our highest expectations.

He has told us, and so have Mr. Buckley and Sir Charles Stevens,

a great many details about irrigation works, much of which is new, I have no doubt, to most of us ; but perhaps I might be allowed, sir, to refer for a moment to the physical conditions which have rendered irrigation in India, as well as in other countries, possible or feasible.

Now, you cannot have irrigation without abundance of water from rain. Where does the rainfall of India come from ? No doubt some of those present are perfectly familiar with these matters, with the great physical arrangements which Providence has made for the supply of water to tropical regions without which they would be waste deserts ; and India is a splendid example of the operation of this physical machinery which has been set in motion from the earliest times ; in fact, since the present distribution of land and sea came into existence. The water that falls on the surface of India comes, I need hardly say, from the ocean ; but the question arises, why does it come at particular seasons constituting monsoons ? That may not be so generally known. In these parts we have a rainfall at all times of the year and we are not surprised at it ;—though we have been at the amount we have had lately ! But why in the case of India, and in the case of the Abyssinian mountains, does the rain fall at certain seasons of the year ? It comes about in this way. It is a splendid result of the combined action of the power and influence of the sun's heat and the relative distribution of land and sea. During the spring, when the winter is over, the sun is gradually rising towards a vertical position, and it pours down its rays with irresistible power on the vast area of land exposed to them between the two great arms of the Indian Ocean.

It is remarkable that the sun's rays pass through the air without imparting to the air additional heat—at least to any appreciable degree—but their effect is to warm the surface of the land, and in this way the air overspreading its surface. The effect of this is to cause the heated air to rise and so to draw in the winds from the Indian Ocean heavily charged with moisture and moving over the lands to the north-east, and forming great masses of cloud which gather over the Ghauts and along the flanks of the Himalayas. The air becomes oppressive, but relief is found in grand displays of electrical phenomena. The rain falls in torrents accompanied by thunder and lightning, imparting verdure to the parched lands and filling the rivers and pools with much needed supplies of water.

This is the character of the "south-west monsoon," but there are sometimes localities where the rainfall is deficient or absent, and here it is that irrigation is so beneficial. The north-east monsoon which occurs during winter is of less importance, and is owing to the higher temperature of the air over the ocean, which results in a reverse direction for the air over the land.

I may add that the Nile receives its periodic supplies from the Abyssinian highlands, mainly through the Atbara, in consequence of the relative positions of land and sea west of the Indian Ocean being similar to those on the east, and the same effects of the sun's heat arise on both.

Colonel HENDLEY said that Mr. Odling and Sir Charles Stevens had both referred to the unhealthy condition of the rice tracts which were irrigated from the canals, but he would like to ask Mr. Odling whether it was not true that the canals themselves in certain districts had not, at least in the past, been responsible for increased unhealthiness owing to their having produced waterlogging of the soil, and if this was the case, whether steps had not now been taken with success to overcome this evil.

I should also have liked, had there been time, to have asked whether the construction of canals in the more arid regions of India had not materially improved the climate especially by leading to increased rainfall. At page 161 reference is made to the pleasure derived by the canal engineer from his friendly intercourse with the people at his tent door. It is such intercourse that encourages loyalty to the Government, but unfortunately frequent transfers, which are the rule in these days, threaten to destroy it. It would be interesting to know whether the irrigation officers are less often moved than those of other departments. Very few names now become household words amongst the peasantry as was the case in the past, when the man who was left long enough in a district to do something for the people was never forgotten. For example, Colonel Dickson, the father of modern irrigation in Ajmere Merwara in Rajputana, who died about the time of the Mutiny, is still spoken of with regard, and a light is, or was, until recently, kept burning at his tomb—in Bewar.

Mr. Odling has dwelt much upon the magnificent triumphs of engineering which many of the great irrigation works are. As an outsider I have greatly admired them. Who can but wonder, for

example, at the canal near Rurki, which runs *under, over, and through* a river, or at the grand waterways in Orissa and the Sone works. It is not a small thing moreover that the sides of the canals are generally covered with fine trees which, besides being most valuable, add greatly to the beauty of the country.

Mr. ODLING.—The canal districts were at one time very unhealthy, but where they have been drained the health of the districts has greatly improved. In some cases the soil is five inches under the water for a great part of the year. I am, however, bound to say that in those districts where there are natural rice lands they are just as unhealthy as those lands that have been artificially fitted for rice irrigation.

I have one other remark to make, and that is that Mr. Buckley has very properly pointed out that the canal system did not originate with the British Government. In fact it took its start in the time of Alexander ; but there were large works in the south of India that have been greatly improved by the British Government.

Sir Charles Stevens mentioned the importance of communication. I rather dwelt on it in the paper. The system of railways has been a good deal developed of late years and will continue to be so.

Mr. Buckley also well stated that while the canals will do something for the people, nothing but their own providence will ensure complete protection from famine.

I take the opportunity of thanking the meeting for the great kindness with which they have received my remarks.

NOTE.

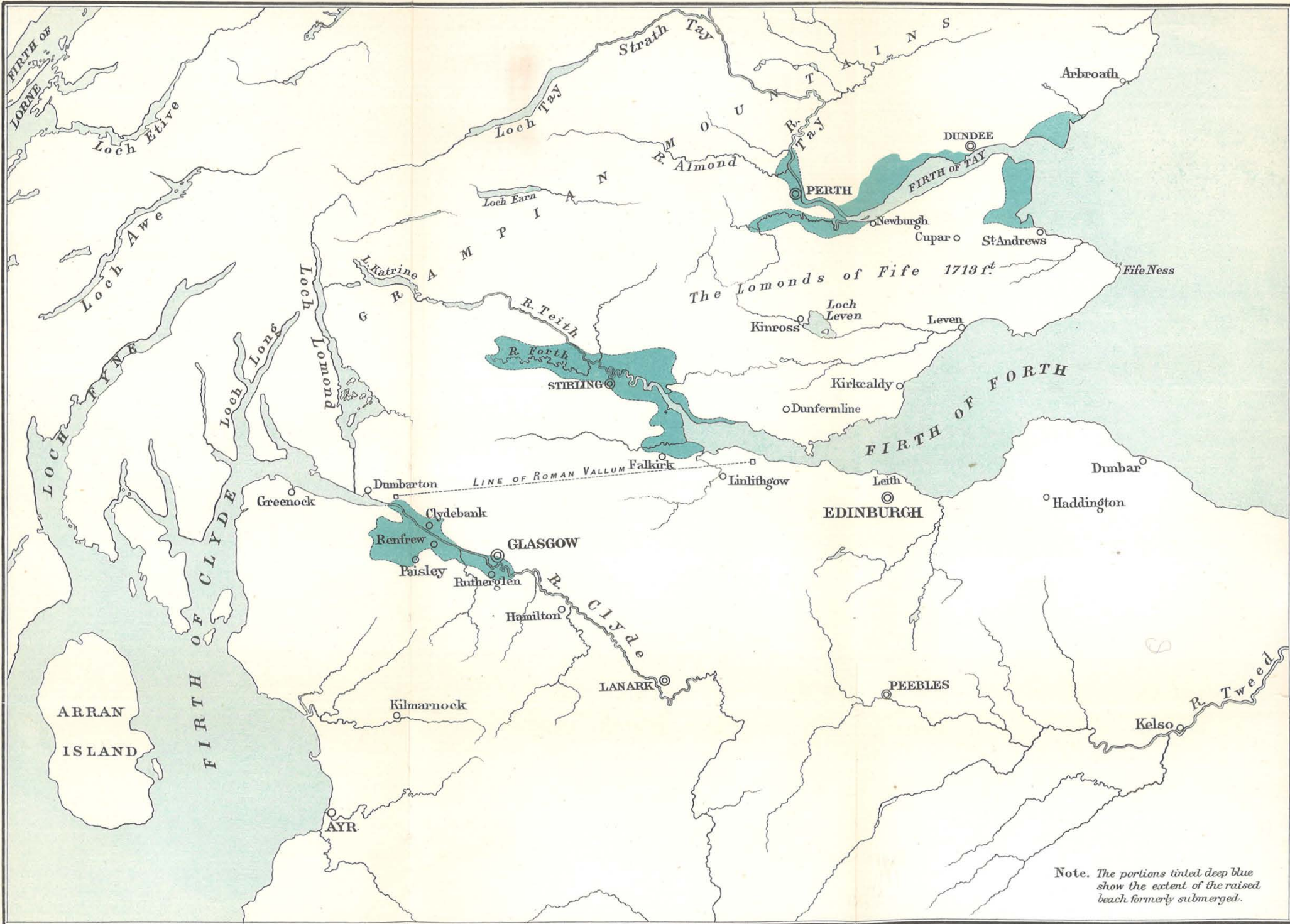
The following returns from the Department of Revenue and Agriculture, give the latest results of irrigation in India.—E. H.

From the Department of Revenue and Agriculture at Calcutta the complete Agricultural Statistics of India for 1897-98 to 1901-02 have been received in two volumes—one for British India, and the other for the Native States. The volumes give details relating to provincial and district areas, crops, live stock, implements, the incidence of land revenue assessment, varieties of tenure, and other subjects. The following table is a compilation of the figures relating to crop areas in British India in 1900-01 and 1901-02:—

AGRICULTURAL AREAS IN BRITISH INDIA.

	1900-1.	1902-3.
	Acres.	Acres.
Total	546,114,173	550,315,716
Forests	66,305,506	66,363,530
Not available for cultivation	135,864,477	135,359,092
Cultivable waste	104,727,080	107,525,236
Fallow	42,212,336	42,144,323
Sown with crops	197,115,565	199,710,722
Irrigated	30,056,002	32,619,781
Rice	69,026,273	70,067,328
Wheat... ..	20,103,024	18,606,958
Other grain crops	92,915,849	88,325,309
Sugar	2,651,379	2,596,592
Coffee	133,529	120,343
Tea	502,173	495,539
Other food crops	6,518,771	6,183,494
Oilseeds	12,913,372	11,967,839
Cotton... ..	9,609,820	10,301,059
Jute	2,102,236	2,278,330
Other fibres	511,253	564,045
Indigo... ..	977,349	792,179
Opium... ..	621,891	607,418
Tobacco	973,441	952,245
Fodder crops	3,022,585	2,944,148

The area of the Native States in 1901-02 is returned at 53,973,702 acres, of which 4,009,956 acres are entered as under forests, 10,743,854 as cultivable waste, 12,457,436 as not available for cultivation, 14,159,772 as sown with crops, and 5,252,525 as fallow. Of the cultivated area, 1,947,400 acres were irrigated in 1901-2, as compared with 1,740,462 acres in the preceding year. There were 801,283 acres under rice, 611,242 under wheat, 10,962,997 under other grain crops, 57,408 under sugar, 125,157 under coffee, 536,104 under other food crops, 892,243 under oilseeds, 420,991 under cotton, 39,082 under other fibres, 8,062 under indigo, 67,797 under opium, 25,522 under tobacco, and 138,861 fodder crops.



MAP TO SHOW EXTENT OF SUBMERGENCE OF THE CENTRAL PART OF SCOTLAND.
(TO ILLUSTRATE PROFESSOR HULL'S PAPER.)

ORDINARY MEETING.*

REV. JOHN TUCKWELL, M.R.A.S., IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The following candidates were put forward by the Council :—

MEMBER :—George Benson Clough, Esq., Barrister-at-Law.

ASSOCIATE :—Harry Bonny, Esq.

The following paper was read by the Author :—

ON THE AGE OF THE LAST UPRISE OF THE BRITISH ISLES. (With Map.) By Professor EDWARD HULL, M.A., LL.D., F.R.S. (Secretary).

CONTENTS.

PART I. PRE-HUMAN OSCILLATIONS OF LAND IN POST-TERTIARY TIMES.

1. Introduction :—Numerous oscillations of land in British Isles in the Post-Tertiary Period, divisible into Pre-Human, Pre-Historic and Historic, as follows :—

- | | | |
|---|---|--|
| Pre-historic
or Pre-human
period. | } | 1. Great elevation of land during the first glacial epoch, or Great Ice Age. |
| | | 2. "The Great Submergence" or inter-glacial epoch. |
| Human Period. | | 3. Re-elevation of the second glacial epoch. |
| | | 4. Final emergence, as determined by the raised beaches. |

PART II. RAISED BEACHES OF THE HUMAN PERIOD IN BRITAIN.

2. Description of the raised beaches along the coast of Scotland and of North-East Ireland, their levels and enclosed works of human art, etc.
3. Special interest of the works of art made of iron.
4. Gildas' description of the Picts during the Roman occupation and its historic interest.

* Monday, March 7th, 1904.

5. Indications of the partial submergence of Scotland during the Roman occupation. Evidence derived from the Roman Wall (*Vallum*). Views of Sir Archibald Geikie. Statement of Gildas.

PART III. DATE OF EMERGENCE OF THE LAND.

6. Inferential date; that the final elevation took place well within the Christian Era.

PART IV. CONCLUSION.

Introduction.—Whatever may have been the length of time between the Pliocene Tertiary and the historic periods,—generally included in the term “Post-Tertiary”—it cannot be denied that it included several remarkable oscillations of the land of Western Europe—indeed we might say, of the Atlantic sea-board on both sides. Oscillations which have left their impress upon the physical features of the lands, and in this way have powerfully influenced the social character of the present inhabitants. We begin with the first of these terrestrial movements of Post-Pliocene times—namely, that of the first glacial elevation—to which Professor James Geikie has given the generally accepted name of “The Great Ice Age.” We here recognise a movement of elevation of land reaching a height of several thousand feet above the present surface of the ocean, during which the Continental platform now covered by the waters of the sea was upraised, its surface abraded, and traversed by channels (or cañons) of the existing rivers, to their outlets on the floor of the abyssal ocean at depths of 6,000 to 7,000 feet below the present surface. Having already described in the pages of the *Journal of the Institute* the position and character of these “drowned river channels,” I need not further allude to them here, except to reassert my conviction that in the great elevation of the continental lands of Europe and Africa of which these submerged river-valleys are evidence, we have a sufficient cause for that vast extension of extreme arctic conditions shown by the glacial phenomena of a past time in Scandinavia, the Alps, Pyrenees and Atlas mountains, extending far beyond the limits of existing glaciers, as also in the British Isles from which the glaciers have altogether passed away.*

Succeeding to the epoch of the great Ice Age came that of the “Interglacial stage,” in which the British Isles were depressed beneath the ocean to varying depths, of which the maximum was 1,200 feet in Central England, North Wales, and central

* *Trans. Vict. Inst.*, vols. xxx, xxxi, and xxxii.

Ireland. This level being indicated by raised beaches with sea shells of existing species in Denbighshire, Carnarvonshire (Moel Tryfaen), and the Wicklow Mountains.* From this maximum level of depression the amount diminished both to the north and south. In Lancashire these gravels rise along the banks of the Irwell to about 600 feet, in Scotland to about the same. On the other hand, in Gloucestershire, the level of submergence was determined by myself many years ago to be 600 feet in the Cotteswold Hills, being that to which rolled quartzite pebbles are to be found scattered over the tableland formed of Jurassic limestone, these pebbles having been derived from the New Red conglomerate of the Midland Counties and drifted to their places by marine currents. This determination was fully confirmed by the late Professor Phillips in his *Geology of Oxford*.† Extending our observations still further south, we find the gravels of this period forming plateaus resting on the Bagshot Sands at Englefield Green and Windsor Forest southwards, and finally, in the Isle of Wight, forming the terraces of St. George's Down and Headon Hill, at a level of 400 feet above the sea. Such, in brief, are some of the localities at which the interglacial gravels may be observed. They are everywhere later than the newest Tertiary strata, and the deposits are consequently referable to the Great Ice Age.

The rudely stratified clays with glaciated pebbles and erratic blocks to be observed along the valleys of the Irwell and Ribble and other parts of Lancashire resting on the interglacial sand and gravel indicate a recurrence of sub-glacial conditions, when the waters of the sea were clouded with glacial mud, and floats of ice carrying blocks from the glaciers entered the sea. This epoch need not detain us, as it was probably of short duration; and the deposits resulting from it do not appear to have extended into the centre and southern parts of England. We, therefore, pass on to the consideration of the subject which more immediately concerns us, and to

* The fact of these beaches occurring at *nearly the same* level along a west to east tract of about 100 miles is clear evidence of their marine origin, although attempts have been made to prove they owe their formation to "the great ice-sheet" which filled the Irish Sea. An ice-sheet never could have produced beds of stratified sand and gravel with shells, some of which are but little injured; an ice-carriage would have ground them to powder.

† Page 457. The gravels were first described by Dr. Kidd and Dean Buckland. Phillips gives the extent of submergence as 1,500 feet—somewhat excessive.

which the preceding observations seemed a necessary introduction. All the deposits above described belong to the prehistoric, probably the prehuman period.

I have thought it necessary for the sake of perspective to pass in review these deposits of Post-Tertiary age and the oscillations of land, before entering upon the description of those which more immediately concern us, in order that the reader may gather how considerable have been these oscillations during the period immediately preceding that of the human race in our islands; and having done so we are now in a position to consider the deposits and terrestrial movements of a time during which man himself has been a witness of the scene.

PART II.

Raised beaches.—The general uprise of the land at the close of the Post-Pliocene or glacial period appears to have been accompanied by pauses giving rise to the formation of marginal terraces at several successive levels. These terraces are of frequent occurrence along the Norwegian fjords, rising to a maximum level of 700 feet in the latitude of Mølle.

To what extent these higher terraces of Scandinavia represent (if at all) the "Interglacial gravel" of the British area it is impossible to say; but we are safe in considering that the lower terraces of the former are representative of those in Scotland, England, and Ireland. And as regards these latter, there are at least two in Scotland, the higher having a general level of about 70 feet, the lower, of 25 to 30 feet above the present surface of the sea. At both these levels there were prolonged pauses in the process of elevation; but owing to the longer period at which the upper terrace has been exposed to atmospheric erosion, and also to the fact that during the elevatory process the terrace itself was subject to attack from the sea waves, it is not so clearly defined and continuous as is the case with the 25-foot terrace which lies at much lower level. This terrace is therefore of more recent origin, nor (as far as my information extends) does the upper terrace present us with those works of human art which are so abundant in the strata of the lower level. If this view be correct then it would appear that, between the formation of the upper terrace and of the lower, there was a considerable lapse of time.

The 25-foot beach of Scotland.—This is the most conspicuous and latest of all the terraces of Central Scotland, and is sometimes called "the 30-foot beach," as its margin occasionally

approaches to, or touches, that level above the high-water line. It has been described in more or less detail by several writers; by Robert Chambers in his *Ancient Sea-Margins*; by Smith of Jordan Hill; by Sir Archibald Geikie in the *Journal of the Geological Society*,* and more recently in his *Scenery and Geology of Scotland*.† I have myself had numerous opportunities of examining this terrace along the western coast and isles as well as in the interior of the country.

The 25-foot beach forms a fringe along the western coast of Scotland, and is especially conspicuous along the coast of Cantyre and the Firth of Clyde where it affords the most convenient sites for roads, houses and churches. On the one side we have the rocky sea-coast; on the other the cliff of rock or steeply shelving bank, which formed the old coast-line before the uprising of the land (Fig. 1). On Cantyre the inner cliff is

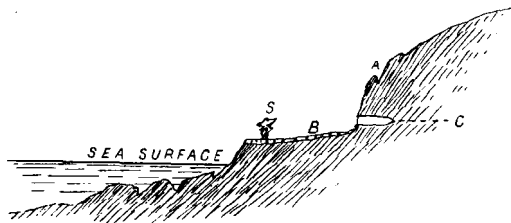


FIG. 1.—GENERAL SECTION OF COAST OF CANTYRE.

- A.—Old coast cliff.
- B.—Raised Beach.
- C.—Cave.
- S.—Sea-stack.

sometimes perforated by tunnel-shaped caves, the floors of which are strewn with rounded pebbles of hard stone which the waves made use of for breaking into the schistose rock. The resemblance to a sea-beach goes still further in the existence of old sea-stacks rising from the surface of the terrace, monuments of wave-action during the uprise of the coast.

The terrace is likewise well-developed on the eastern coast of Scotland and along the margin of the Firths of Forth and Tay. But physically its most important features are those of the interior parts of this country; for here it gives rise to the broad plains or "carse," which border the valleys of the Clyde, Forth and Tay, with their branches. To this category belong

* *Quart. Journ. Geol. Soc.*, 1862.

† Published 1865.

the Carse of Gowry, Falkirk and Stirling, and they have been largely taken advantage of for the sites of towns and cities, such as those of Leith, Burntisland, Dundee, Arbroath, Greenock and the lower part of Glasgow. These towns are built either partly, or altogether, on the upraised terraces which have their representatives along the coast. At Glasgow, which is partly built on the same platform, the silt and sand of which it is composed have yielded no fewer than eighteen canoes, some of them under the very streets and houses, together with stone hatchets, boat-hooks, anchors, pottery and other works of art. The boat-hooks and anchors are of iron, and indicate an age on the verge of what may be called that of "Roman Civilization" for Great Britain. Most of the Clyde canoes were formed out of single oak stems, but two of them were built of planks. Of these the more elaborate was discovered on the property of Bankton in 1853. The description of this clinker-built boat, with keel, cutwater and planks fastened by means of oaken pins, is given in much detail by Sir R. Geikie,* as indicating the use of iron implements; to which may be added a plug of cork indicating some communication with more southern and civilized people. It is clear that this boat is of later age than either "the stone," or "the bronze" periods. The occurrence of skeletons of whales, one at Airthrey near Stirling in silt fully a mile from the present river, and at a height of about 25 feet above high-water of spring tides; another at Dunmore in stiff clay at a height of about 24 feet; and a third at Blair-Drummond, which lies seven miles higher up the valley than Airthrey, show that pretty deep sea-water spread into the centre of Scotland at this period.

But more impressive still, as showing the presence of men capable of working in iron, is the occurrence of an iron anchor, dug up near the spot where the Dunmore whale was found. It appears to have been about 20 feet above high-water mark, and consisted of a beam and ring in tolerably perfect condition; the flanges, however, were much decayed. Other anchors have been found below Larbert Bridge, and near Camelon in Stirlingshire, as also an iron boat-hook on the farm of Inchmichael imbedded under 8 feet of stratified gravel at a distance of a mile from the margin of the Firth of Tay. The surface of the ground was about 3 feet higher than that of the surrounding carse or about 28 feet above high-water mark. This boat-hook, which has

* *Supra cit.*, p. 222 *et seq.*

been described by the late Mr. Robert Chambers, is preserved in the Museum of Scottish Antiquaries in Edinburgh. Enough has probably now been stated to show that, at a period when iron was in general use in North Britain amongst the lowland inhabitants, the sea had occupied the land up to a level of about 30 feet above the present surface of the ocean, sufficiently deep to allow the ingress of whales; in other words, when the land was submerged to that extent: and when the arms of the sea stretching into the interior of the country, both from the eastern and western coasts were navigated by men far removed in the arts from the savages who only used stone weapons and implements. Consequently the whole region has been elevated into land since that period, and these firths have been converted into the river-valleys of the Clyde, the Firth and the Tay, while the marginal tracts form the wide plains or "carse" on either side of these rivers. We have now to consider the question at what period did the rise of the land take place owing to which this remarkable change in the physical geography of the country was brought about. But before entering upon this subject we must glance at the coast of Ireland in order to determine whether, and if so to what extent, that country was affected by the terrestrial movement here contemplated.*

Effect of the submergence on the land.—I have been able to define, with a great approach to accuracy, the submerged areas on the 1-inch ordnance map of Scotland by means of the contour lines along the valleys of the Clyde, Forth and Tay, inasmuch as the 50-feet contour closely coincides with the margin of the 30-feet terrace. This is owing to the fact that the 50-feet contour represents the height above the mean level of the sea at Liverpool—not above that of high-water—which is the datum for the terrace itself. When tracing this contour on the map, one could not but observe that it coincided with an abrupt rise in ground above the nearly level plain formed by the raised beach. As regards the change effected in the topography of the country itself, the prolongation of the present estuary of the Forth into the heart of the country above Kippen and Thornhill in the valley of the Forth, had the result of almost dividing Scotland into two parts. The distance of land from the

* The occurrence of several places in the valley of the Tay and beginning with the word "Inch" (Celtic for Island) is very suggestive of former conditions; thus we find Inchturre, Inchmartine, Megginch Castle, Inchyra and Inchcoonans. These are all remote from the present sea-margin.

western end of the estuary to the shore of L. Lomond at Balmaha, being only eleven miles. During the submergence L. Lomond must have been a salt-water firth or sea loch. (See Map, p. 175.)

Raised beach of the Irish Coast.—The northern coast of Antrim is at so short a distance from that of Cantyre that it is natural to suppose that whatever changes of level affected the latter must also have been, to a greater or less extent, extended to the former, and such is unquestionably the case. The “25-feet raised beach” of the west coast of Scotland is represented also on the coast of Antrim by “the 15-feet beach” which may be traced at intervals all round the coast of Donegal, Londonderry, Antrim, Down, and southwards to that of Wicklow, wherever protected from the direct action of the waves. Its highest limit is about 15 feet above high-water mark at Portrush, Larne, and Belfast Lough; but, with the exception of a diminution of level as compared with the raised beach of Scotland, it presents all the features which I have described as characterising the Scottish terrace. At Larne Harbour, for example, the terrace rises from 15 to 20 feet high, composed of stratified sand and gravel, with numerous blanched marine shells of existing species. At Kilroot on the north shore of Belfast Lough, the beach contains numerous arrowheads or spearheads of worked flint rudely sculptured. These are the only works of human art which have been found in this Irish beach.* The level of the beach itself gradually falls as we trace it southwards by the coast of Louth and Dublin bay till at co. Wicklow it almost descends to the level of high-water of spring tides.† All along the inland border of the terrace in the north of Ireland we find similar features to those of Cantyre, namely, the old coast cliff, sometimes perforated by caves in which bones of deer, sheep, goats, otters, badgers and birds were found by the late Dr. Bryce and Dr. McDonnell some years ago. Remarkable sea-stacks occur at Ballycastle and Island Magee rising above the terrace and now out of reach of the waves. From the above account it will be seen that the

* The gold “Celtic” ornaments, etc., recently discovered lying on the surface of the raised beach, and covered over by the soil, have been determined by the Court of Chancery not to have been directly connected with the raised beach itself, but to have been hidden for safety under the soil after the elevation of the land. This does not uphold the view of Mr. Arthur Evans as to the deposition of the ornaments as described by him in *Archæologia*, vol. lv (1897).

† I have described this beach in some detail in my *Physical Geology of Ireland*, 2nd edit., p. 138.

terraces on each side of the Irish Sea are representative of each other; and the inference is that whatever terrestrial changes in recent times affected the Scottish area, also affected that of Ireland to a greater or less degree. With regard to the northern parts of England south of the Scottish border they doubtless partook of similar changes; but I do not propose to extend our survey farther than is necessary for our immediate object.

PART III.

Date of Emergence.—We have now to endeavour to determine approximately the period at which the rise of the land took place, and the evidence on this head is partly circumstantial, partly inferential. There has existed a feeling for a long time past that this uprising was at such a distant period that there was no use in attempting to investigate the subject at all. But we have seen that it is certainly within the human period and not only so, but within a period comparatively recent, and in which works of art were not uncommon. If we accept as generally true that the "Stone Age" was succeeded by that of the Bronze, and the "Bronze Age" by that of Iron, we have clear evidence that this last had prevailed for a considerable time when portions of Scotland and Ireland were below the waters of the sea; and this brings us down to the epoch of modern art. We have therefore to inquire within what limits of time we may infer the introduction of iron into North Britain—and we may add into the North of Europe—for use in the arts. That iron came into use in Northern Europe and Britain some centuries before the Christian era seems pretty clear; though the exact time cannot be determined. When the armies of Rome brought the civilization of the south into contact with that of the north they found the value of iron already well known to their enemies;* and the description given by Tacitus of the Caledonian weapons shows that bronze swords were no longer in use in Scotland.† That iron was in use in the arts of Norway as far back as the third century of our era is shown by the discovery of a boat by M. Engelhardt

* Sir J. Lubbock (now Lord Avebury) *Prehistoric Times*, p. 7.

† The question occurs, were bronze swords ever in general use amongst the Caledonian warriors; it does not follow that everywhere bronze succeeded stone in the manufacture of weapons in North Britain. In fact in the case of Scotland, it is probable that iron succeeded to stone directly, without the intermediate stage of bronze.

in the moss at Nydam in 1862, in which iron was used for the bolts, and in close proximity to numerous Roman coins ranging in date from A.D. 67 to 217; while at Thorsbjerg other articles of iron were found with Roman coins ranging from A.D. 60 to 197.

Now it is highly probable that Scotland and Norway were in intercommunication during the Roman occupation of the former country, and we might even hazard the view that the clinker-built boats together with the boat-hooks, anchors and other objects of iron were of Roman manufacture. Between the clinker-built boat of Bankton, above described, and the canoe hollowed out of the trunk of a tree, there is so great a distinction in the stage of art that we might well be justified in recognizing the former as the work of Roman art and the latter as that of the savage; and the Norwegian discoveries lend to this view additional force from the presence of the coins of definite date lying in proximity to objects and works of art made of iron. In a word we find ourselves in presence of works of art of a civilized race and those of the savage, one the Roman, the other the Caledonian highlander.

The "Roman Wall," or Vallum.—But however strong the evidence afforded by the remains above described that the "25-foot terrace" was under the sea at no very distant date; in fact, during the period of Roman occupation, that afforded by the position of the "Roman wall" is still more confirmatory if the account I am about to give of this rampart be correct. For this account we are indebted to Sir Archibald Geikie, who has in much detail collected the evidence which I shall now briefly capitulate, referring the reader to this author's original memoir for fuller information.*

The mainland of Great Britain twice contracts into narrow width, of which the Romans in their early occupation took advantage by constructing two lines of ramparts from sea to sea for security against the hostile tribes to the northward respectively. The first is known as "Hadrian's wall," from the Tyne to the Solway Firth, wholly in England, constructed about A.D. 120; the second from the Forth to the Clyde, about A.D. 142, and known as "the wall of Antoninus." (See Map.)

* *Quart. Journ. Geol. Soc.*, vol. xviii, p. 229. Sir A. Geikie's conclusions have been called in question, but it is scarcely credible that so able an observer could have been mistaken in his facts of observation, and with the conclusions deduced from them I can see no reason to disagree; in fact, it seems to the writer that he has made out his case.

This wall was constructed to repel the attacks of the Caledonian tribes from the north, and was abandoned about 45 years afterwards, which would bring us down to about A.D. 187, or the close of the second century of our era.

Dealing with the eastern end of the northern wall, Sir A. Geikie states that west of Borrowstounness (or Bo'ness), the ground rises from the old coast line as a steep bank the summit of which is 50 to 100 feet above the sea. Between the bottom of this abrupt declivity and the present margin of the Firth of Forth there is a narrow strip of flat ground on which Bo'ness is built, and which nowhere rises more than 20 feet above high-water. It is in fact a prolongation of the Carse of Falkirk and of the raised beach of central Scotland, which was submerged when the waves beat against the steep bank which here formed the old coast margin. But the important point for us is, that the Roman wall appears to have terminated at the top of the steep declivity. The flat terrace below, over which, if it had been land as at the present time, the rampart would have naturally been carried to the sea margin, presents no traces of this "wall or foss." In the words of Sir A. Geikie, "if the land were here depressed 25 feet, no part of the wall would be submerged."* Again, the western extremity of the wall stood on a little eminence called Chapel Hill on the north bank of the Clyde near West Kilpatrick, and the conditions are somewhat similar to those of the east end of the wall. Between the rising ground and the margin of the river is the nearly flat terrace about 20 feet above high-water mark, and the base of the hill is 5 to 6 feet higher; over this terrace the wall does not appear to have been carried, and it is now traversed by a railway and canal. In making the latter a number of Roman antiquities were found: the terrace is a portion of the raised sea beach. The inference seems clear that the *vallum* terminated at the promontory of Chapel Hill, because at the foot of the descent the sea itself formed a sufficient protection against the Caledonian highlanders as far at least as an advance by land was concerned, and the same remark applies to the eastern extremity at Bo'ness. The strategic reasons for terminating the walls are self-evident on the hypothesis that they were carried from sea to sea. To leave wide spaces at either end incomplete while the rampart was carried over the intervening land would have been an act of folly for which we cannot credit such skilful engineers as were the Roman settlers. Hence in the words of

* *Ibid.*, p. 230.

Sir Archibald Geikie, "the Antonine wall, therefore, yields no evidence in favour of the view that the land has remained stationary since the time of the Romans," a favourite article of faith with some persons.

Ancient Harbours.—It may be mentioned in corroboration that there are the remains of old Roman harbours along the east coast of Scotland at Inverest and Cranund which show that the land has been raised since Roman times; and of another at Camelon in the valley of the Carron, at which an anchor was dug up. Lastly, there is the tradition of a Roman harbour in Falkirk Carse, below Larbert Bridge, where pieces of broken anchor have been discovered;—from all of which the late learned Dr. Nimmo, writing in 1777, inferred that the Firth stood considerably higher in former ages than at present.

Historical evidence.—I have only one more point of evidence to add to the above in support of the view that the land of North Britain has been considerably elevated since the Roman occupation, and that is of an historical kind. The historian Gildas, who lived in the early part of the seventh century, describes the "Picts" or Ancient Caledonians as a "*transmarine*" people, who, emerging from their forests, attacked the Roman garrisons from the north-east, crossing the intervening water in their coracles.* The interpretation which I would venture to place on this interesting passage is as follows:—

At the time of the Roman occupation of Scotland an arm of the sea occupied the valley of the Forth, a prolongation in fact of the present Firth, separating the land in occupation of the Romans on the south, from the Grampian Mountains on the north, the slopes of which were covered by forests affording shelter to the highlanders who, emerging from time to time, and crossing the intervening estuary in their coracles, attacked the Roman entrenchments, doubtless making it very unpleasant for the soldiers, who in sheer disgust abandoned the inhospitable country, leaving Britain to its fate about the year A.D. 187. The term "*transmarine*" used by Gildas is specially worthy of note, and would scarcely be applicable to the Caledonians had they been separated at this time from their foes only by the waters of the river Forth, as at the present day; but with the sea stretching inland nearly twelve miles beyond Stirling, as shown by the map, the expression becomes quite intelligible.

* Quoted by Professor Rhys in *Celtic Britain*, 2nd edit., p. 167.

PART IV.—CONCLUSION.

It now only remains for us to gather up in a few words the evidence we have been considering bearing on the question, when the last emergence of the northern portion of the British Isles took place. We have seen that there is abundant evidence of a higher civilization in a country the natives of which were in a condition not much removed from that of the savage; certainly uncivilized. In the one case, we find axes, anchors, and boat-hooks of iron, clinker-built boats; in the other, canoes hollowed out of the trunks of trees, and we may suppose men using for weapons, bows and arrows, and spears armed with heads of stone or horn. This, however, is hypothetical. That the objects of iron, etc., representing the higher civilization were brought in by the Romans, there can scarcely be a doubt. We know as a fact that these invaders entered the country and constructed a rampart across the land of Scotland about the year A.D. 142, and we may be sure they did not rest content with boats constructed after the manner of the Caledonian canoes. Finally, we have the statement of the old historian Gildas, regarding the mode by which the Caledonian highlanders attacked the Roman settlements, paddling their canoes across the arm of the sea which separated their habitation from those of their enemies; and lastly, the evidence afforded by the form of the Roman Vallum at either end, terminating at a height overlooking the terraces which were once the sea-bed. All this evidence is cumulative, and confirmatory of the view that at the period of the Roman occupation of Scotland in the latter part of the second century of our era, the sea occupied considerable tracts of the present land, not only along the coasts, but running far up into the interior along the valleys of the Tay, the Forth, and the Clyde.

Having established this point, the only question remaining for us to discuss is, at what period did the land emerge to its present level above the surface of the adjoining sea? The answer to this question can only be conjectural. It is probable that the movement was slow at the commencement, and towards the end; and if we suppose that the upward movement begun at the commencement of the third century, it may not have concluded till two or three centuries more had elapsed. The only evidence that might have been deduced on this subject would be that of the very oldest ecclesiastical buildings, and the position of their sites, in reference to that of the terrace

and the sea margin ; but as these only reach back to the tenth century in this part of the British Isles, though to a much earlier period in England and Wales,* there is too wide an interval to allow of exact determination. At that time the rise of the land had probably reached the stage at which it seems to have remained till the present day.

Explanation of Map.—The extent of the land submerged beyond the margin of the present river banks, namely, those of the Tay, the Forth and the Clyde, is shown by the darker shade of blue ; the lighter shade being that of existing sea and firths. The upper margins of the formerly submerged terrace have been traced from the 50-foot contour line on the Ordnance Survey Maps, corresponding very nearly to the 30-foot level above high-water of spring tides.

DISCUSSION.

The CHAIRMAN.—There is a good deal in this paper that is very suggestive, though, perhaps, few of us feel ourselves competent to discuss a matter that is so particularly and specially the province of geologists. Yet I think everything that touches on the history and condition of man is a matter of genuine interest to members of such a society as this.

On hearing such a paper as this, it occurs to one that geologists, like many other scientists, appear to be reducing the very long period which was supposed, years ago, to have existed since man first appeared on this globe. The fact that these geological changes, elevations, and depressions, have been going on in such recent times may serve, perhaps, to correct needless exaggeration in the other direction. Then I think the fact that these various implements are found in those raised beaches is also a matter of interest to us. If I understand correctly, the researches of modern geologists show that there have been, really, two Human Periods.

* In fact, it is considered on very good evidence that St. Mary's church in Dover Castle, and St. Martin's at Canterbury were built by Roman soldiers about the middle of the second century. See *Dover, the Ancient Cinque Port*, by an Ancient Freeman (1904, Marshall and Son).

I do not know whether it is possible to establish that with regard to the Stone, the Bronze, and the Iron Ages. In some countries the different Ages, no doubt, are shown by the remains that are found; but I do not think we need suppose that those different periods were contemporaneous throughout the whole world. Dealing with our own times, certain tribes in America are now using flint implements, so that we have flint implements contemporaneous with the highest civilization yet obtained by man.

Another thing that interests me in this paper is the reference that Professor Hull makes to the early period preceding these more modern oscillations and elevations. There seems to have been a break, if I understand it, in the history of man shown in this way. In certain of the caves in different parts of the country, as for instance even in the Brixham Giant's Cavern, you have deposits in which what are known as "palæolithic" implements are found. Then over that you have a layer of stalagmite, and over that layer of stalagmite you have a more recent deposit in which what are known as "neolithic" implements are found, made of bones and so forth; practically indicating that there are two eras in the history of this and other caves, and that the men who wrought the palæolithic implements had not attained to, or at any rate practised, the art of smoothing and polishing them as the men of a later period had done. Now it may interest us to inquire whether anything is known in the history of the human race that would at all agree with these breaks in its history. Well, we have, I think, something that may possibly correlate with this change. Take, for instance, the change of temperature in the northern parts of Europe. I believe the mammoth is not necessarily an Arctic animal, but it is of the elephant species, and probably therefore preferred a temperate or even a tropical climate to the Arctic conditions; and, as we are aware, for many years thousands of tons of mammoth ivory were brought year by year into this country, indicating, apparently, as Professor Hull has told us, that these many remarkable elevations of the land were accompanied by (if not producing) a very low temperature. Then there appears to have been a return of something like temperate conditions at all events, as these creatures have been found in these regions. Then there was a gradual elevation of the land when they were suddenly frozen, and they have been found almost intact in our own time. Such changes as these,

occurring within the human period, not unnaturally cause us to think of what was brought before us some years ago at this Institute by Professor Prestwich, who found in some of these cases indications of a deluge that had swept over the whole of the earth, washing away every living creature, and accumulating large quantities of the bones of various animals on the northern shores of the Mediterranean Sea. Then you have other changes following, showing how the history of man has gone on through the later geological periods right up to the present time.

I just throw out these suggestions as matters that may, perhaps, deserve a little consideration and may help to make this paper more interesting and instructive to us.

The subject is now open for discussion.

Mr. MARTIN ROUSE.—I think that Professor Hull in his admirable paper has thoroughly proved his case. It is a paper teeming with historic interests whether to the geologist or to the antiquarian.

I should like to ask regarding that part which the Chairman dwelt upon, whether the lofty beaches that have been found up to 1,200 feet in North Wales and the Wicklow Mountains are thinner, or more scanty, than the beaches with which the paper mainly deals at the height of 30 feet; because that would help us, would it not, to determine those questions which are matters of eyesight, of which the last speaker spoke—whether the former submergence and re-emergence was a very sudden one, whereas the latter was, as we know, a very gradual one. If the submergence which led to these lofty beaches was a very rapid one, or the uprise that followed it was rapid, then, of course, these beaches would be very thin and scanty, and would correspond in that regard with the thin beaches found at 25 or 30 feet level.

Then I should like Professor Hull kindly to explain a little more fully how the 50 feet contour line corresponds very nearly with the 30 feet beaches, because on the face of it I do not quite understand how 50 feet above the mean sea level at Liverpool would be the same as 30 feet above high water mark. If it is 50 feet above the mean level, of course the mean level at that rate would be 20 feet above the lowest level, or 20 feet below the highest level, *i.e.*, there would be a difference of 40 feet between high and low water mark, which I should have thought too great.

The AUTHOR explained.—The rise and fall of the spring tides at Liverpool is 26 feet, of which the mean level is 13 feet. This is the “ordnance datum”; add to this 30 feet for the upper level of the terrace and the result is 43 feet, not much below the 50 feet contour and sufficiently near for the purpose in view.

Mr. MARTIN ROUSE.—Then is not there a slight mistake in the paper? Referring to Norway, you say in the paper at pages 183 and 184, “When the armies of Rome brought the civilisation of the south into contact with that of the north they found the value of iron already known to their enemies,” and it goes on to speak of Roman coins being found along with a boat well made, as proving the Roman occupation of Norway, or as pointing to the Roman occupation. Is not that a slight slip, inasmuch as the Romans never did occupy Norway?

The SECRETARY.—Are you sure of that?

Mr. MARTIN ROUSE.—Perfectly, sir.

The SECRETARY.—How do you account for the coins being found?

Mr. MARTIN ROUSE.—I think they came by trade. The Romans, I assume, occupied a good piece of Germany and they were driven back.

The SECRETARY.—They never went across the Baltic, you mean?

Mr. MARTIN ROUSE.—No. There is no proof that they went across the Baltic.

The SECRETARY.—Very well, I thank you.

Professor LOGAN LOBLEY.—As you have been good enough, Mr. Chairman, to ask me to speak on this paper, I have great pleasure in rising to say a few words, as I am greatly interested in it as a geologist and greatly interested in it as a lover of archæology and a lover of the history of my country.

Very seldom do we hear a geological paper read which has reference to such modern times as that given by Professor Hull today. This brings us quite into an historical period, the second, or third century of our era, and that is quite unusual in geological papers.

It seems to me from the evidence brought forward in this paper, that the case, as Mr. Martin Rouse has said, has been very well proved, especially by the fact of the Roman wall not having extended quite to the present margin; that seems very strong evidence

indeed that this uprise has occurred in very recent periods. But the other uprisings, mentioned in the former part of the paper, belongs to quite a different era. The great uprise represented by shelves at a height of 1,200 feet to 1,300 feet above the level of the sea was at a long preceding period, and has no connection whatever with the uprise more especially spoken of in this paper. But we must not think, late though this period has been, that this was the last oscillation of the land in these islands. Professor Hull does not speak of it as the last oscillation or movement of the land but as the last uprise of the land. Now there has been a fall of the land since that period, evidently ; because we have submerged or sunken forests round our coasts and on the coast of Cheshire, at low water, you may see the stumps of trees. This shows the depression that has taken place since that uprise, and that these elevations and depressions have taken place in all geological epochs of the world's history down, one may say, to the present time ; and we have evidence that they are going on even at the present day, for the movement of the land in the Scandinavian Peninsula, in the last century, has been measured to amount to about 3 feet in 100 years, and that is going on as we know.

Then we have distinct evidence that in the last century the whole of the western coast of South America rose very considerably and at one time it rose 9 feet in 24 hours, which is a permanent uprise ; but there has been a very considerable uprise along the whole of the west coast of South America in recent times. These are facts in geology which show us very clearly that the present state of things has been due to the various movements of the terrestrial sphere through a vast number of ages.

This paper has brought before us a controversy very recently raised, viz., as to whether the elevation of the relative levels between land and sea is due to the movements of the land, or of the sea. It has been accepted as a commonplace in geological teaching that the level of the sea is a permanent level.

The SECRETARY.—Since Lyell's time.

Professor LOBLEY.—Yes ; that the water, being mobile, any change of level in one place will be distributed over the whole of the sea of the globe ; and seeing that the seas occupy three times the amount of the surface of the globe that the land does, the small alteration of level would be quickly distributed and lost ; so we may

take it for granted that the sea level is a permanent and fixed level and that any alteration of level must be due to the movement of the land. But now some continental geologists have been raising the question whether this is to be accepted as definite, or not, and have even thought that it may be from a shrinkage of the crust of the globe, a diminution of radial extent of the globe, the distance of the centre of the globe to its mean surface, which might so take down the level of the surface of the sea. It seems to me that the paper of Professor Hull has a very direct bearing on that question and entirely disproves it, and I may say corroborates the theory of Lyell; for if this alteration of level, of say 25 feet and so on, takes place in a very short time, that cannot possibly be due to any diminution of the general level of the sea, for no shrinkage of the globe could give such a diminution of the general level of the sea in so short a time. The shrinkage of the globe, if it goes on (and Lord Kelvin advocates that, and I have the temerity to oppose it and I say there is no evidence of that or of the cooling of the globe) is entirely based on a *a priori* reasoning. At Oxford, some years ago, I brought forward very strong evidence to show that there has been no cooling of the globe and no alteration in the general temperature of the globe since the Cambrian period. So I consider this paper of Professor Hull's is an exceedingly interesting and important one, and I hope it will draw attention to this controversy and tend to establish the position I have, as a geologist, always held, that the mean level of the sea is constant, and that it is the land that rises and falls, and not the sea.

Professor ORCHARD.—Our thanks are due to the learned author of this able paper for the interesting subject he has brought forward.

Some of us may have been a little surprised, and even startled, by the idea that since the time of the Roman occupation there has been an uprising in these British Islands. It is really but another illustration of the fact that there is nothing stable underneath the sun.

Reference has been made to the antiquity of man and to the universal deluge. With regard to the antiquity of man, the scientific world generally, I believe, now credits the view that there is no evidence of the existence of man on the earth earlier than after the close of the glacial period. That has been put, I think, pretty

well beyond the question, as from seven thousand to ten thousand years ago. The paper which we have had the pleasure of listening to, would not, I apprehend, be regarded by its author as entirely conclusive. The evidence cannot be called demonstrative. At the same time there is a great deal of probability about it. He has brought forward witnesses of very good character and unimpeachable honesty. The Roman wall strengthens his argument, and what the author says on page 180 of the paper shows there is a great deal to be said for this interesting theory. What he says in the last paragraph of page 180 with regard to the iron anchors and iron boat hook seems to be of very great interest indeed.

I should like to ask Professor Hull whether he can draw any date of demarcation between what is called the Stone Age and what we know as the Iron Age?

I would also like to ask him his opinion as to the cause of these supposed uprisings in the British Islands.

The CHAIRMAN.—I would like to say one word concerning what Professor Lobley said about the cooling of the earth. If I have correctly understood Lord Kelvin in his remarks on the thermal conductivity of the earth, it seems to me that the earth is giving off its heat, but it does not necessarily follow that the earth is becoming actually lower in temperature.

I think there can hardly be any doubt that the earth must be giving off its heat through volcanos, and all sorts of ways. The sun itself is giving off heat constantly, and yet we are told that the sun is not becoming cooler, because it is contracting constantly, the contraction causing the temperature to be maintained while the heat is being given off, as we know, in enormous quantities. That may possibly be a reconciliation between what Professor Lobley said and Lord Kelvin's writings as I have understood them.

I am sure we are all very grateful to Professor Hull for bringing such an interesting subject as this to our notice.

The SECRETARY.—I have listened with great pleasure to our chairman's remarks, which indicate that he has grasped subjects connected with geology and with physical history as well as those of a higher and different kind.

But to pass on to Professor Lobley's questions, I would ask him whether he is perfectly sure that those cases of submergence on the shores of Cheshire and, as I have seen them, on the shores of

Waterford in Ireland, were not contemporaneous with the rise of the land in Scotland and the north of Ireland ?

Mr. Rouse asked if the high beaches, indicating a submergence of some 1,200 feet, were scanty. I presume he means that since then they have only been of rare occurrence here and there.

Mr. MARTIN ROUSE.—No, sir, I meant thinner. My line of thought was that if there were a submergence and a rapid fresh rise, then there would be little time for deposit. The deposit would be much thinner in the centre.

The SECRETARY.—No, the beach in Mœl Trefaen, North Wales, is of considerable thickness. I have not examined it myself, but I believe some of those beaches have been illustrated in the *Journal of the Geological Society*, and I think the thickness of some is 15 feet or 20 feet of gravel with marine shells of still existing species.

I accept Mr. Rouse's statement that the Romans never did occupy Norway, and I am much obliged to him for the correction. A young lady with whom I am acquainted made the same statement to me, and I asked her how she knew it ; she said it was very well known that they did not. However, I do not think that invalidates what I have said as regards intercommunication with Scotland.

Professor Lobley referred to the sunken forest in Cheshire, with which he is acquainted. I know of one in the West of Ireland, in county Mayo, and another in county Waterford (Tramore Bay), a most remarkable instance, in which the process of subsidence may have been going on *pari passu* with that of elevation. I do not think the one is antecedent or subsequent to the other. I recollect making that very statement to Professor Phillips at a meeting of the British Association, and I remember his illustrating the process by a movement of his arm—one part of his arm going up and the other going down.

I doubt very much if there has been any movement of the least importance to the British Islands since the movements to which my paper refers.

Professor ORCHARD.—I asked Professor Hull if he could give a definite line of demarcation between the Stone Age and the Iron Age, and whether he could attribute it to any particular cause.

The SECRETARY.—Yes, I had forgotten that. Do you mean a date in years ?

Professor ORCHARD.—Within a hundred years.

The SECRETARY.—B.C. or A.D. ? That is quite impossible, and it does not follow. It is not like the case of the introduction of different kinds of architecture in our ecclesiastical buildings in England or Europe which is most remarkable and seems to have taken place over very wide areas. We know when we pass from the Early English to the Decorative, and from the Decorative to the Perpendicular styles. We know within a few years when those buildings were erected ; but we cannot use an argument of that kind with regard to the Stone Age and the Iron Age.

Professor ORCHARD.—I thought not. Thank you.

The SECRETARY.—They were not contemporaneous all over the earth and in the British Islands. As to the cause, the whole crust of the globe, if we could see it, is no doubt in motion, but it may be very slow in some parts and comparatively rapid in others.

I thank you for the kind manner in which you have received my paper.

The Meeting then terminated.

ORDINARY GENERAL MEETING.*

THE REV. CANON GIRDLESTONE, M.A., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following candidate was put forward by the Council and was elected :—

LIFE-ASSOCIATE—Rev. Arthur I. Birkett, M.A., C.M.S. Missionary, India.

The following paper was then read by the Author, entitled :—

No. I.

THE SAMARITAN PENTATEUCH. By Rev. Canon GARRATT, M.A.

THE Samaritan Pentateuch is preserved at Nablous by the small remaining body of Samaritans in various MSS., some of unknown antiquity, greatly older to say the least than any MSS., either of the Old Testament or of the New Testament, and written not in that square Hebrew character with which we are familiar, but in the older Hebrew character, which is nearly that used by the Samaritans now, and closely resembles though not altogether identical with, that on the Moabite stone and in an ancient inscription found at Jerusalem in connection with the conduit which Hezekiah made. I do not say that it is exactly like either of these. All our present copies were copies made by Samaritans in the fifteenth century. The sight of the original MSS. is a privilege hardly ever granted in the present day, and the opportunity of examining them never. They have been to a certain degree tampered with by their guardians or perhaps I should rather say copyists; for some readings which were in them in Jerome's days are not in the copies which we possess.

These MSS. were well known in the fifth century to Jerome, who valued them highly. They were known to be very ancient MSS. when he saw them. Kennicott at the close of the eighteenth century proved in the *Dissertatio Generalis* at the end of his great Bible, that the Samaritan Pentateuch was the

* Monday, March 21st, 1904.

Pentateuch possessed by the Ten Tribes, that in fact it was the Israelitish recension as contrasted with the Jewish. Of course if that is the case, if the Pentateuch as a whole existed in the time of Jeroboam, the consequences are very far-reaching. Three hundred years before, according to the higher critics, Deuteronomy was written, the whole of the Pentateuch was in the hands of the northern as well as the southern kingdom.

But how did it get into the hands of the Samaritans? In 2 Kings xvii, we read of a mission by the King of Assyria of a priest to teach the people whom he had brought from other conquered countries to take the place of the Ten Tribes whom he had carried away captive. The priest he sent was not a Jewish priest but an Israelitish priest: "Then one of the priests whom they had carried away from Samaria came and dwelt in Bethel, and taught them how they should serve the Lord." Of course when he came he must have brought them the law of the Lord. Some of the prophets who prophesied especially to the Ten Tribes—Hosea, Amos, Micah are constantly blaming the northern nation for breaking the "law." Their acquaintance with the Pentateuch is always taken for granted. Their prophets could take it for granted that they knew all about the circumstances of Jacob's birth, his prayer at Bethel, which are mentioned as familiar facts in Hosea xii, 4, 5; the destruction of Sodom and Gomorrah, the forty years in the wilderness, the coming up out of Egypt, and the existence of the ceremonial law (Amos v, 21-25; Hosea iv, 6); the history of Balaam (Micah vi, 4, 5). These Israelitish prophets accuse their nation of doing what the higher critics treat as an impossibility—having the law and not keeping it, as Hosea says (viii, 12); "I have written to him the great things of my law, but they were counted a strange thing." Therefore the Israelites had the Pentateuch. This was the law which the Israelitish priest brought to the Samaritans. After the lapse of more than 2,500 years we find them still in possession of the five books of Moses, and of these only. They have no Hexateuch. They have indeed a book of Joshua, but it is not the Book of Joshua which we know, and it is not, like these five books, written in Hebrew, but in the Samaritan language. They have also a translation of the Pentateuch into the Samaritan language, and sometimes these manuscripts are spoken of as the Samaritan version. They are nothing of the kind. They are Hebrew books written in the old Hebrew characters. If you look at them in what we call Hebrew letters you will find them the same books in the same language as your ordinary Hebrew

Bibles. They are of course without points, as there were no points till long after they were written.

There are differences of reading. In a thousand readings the Samaritan agrees with the Septuagint as against the ordinary Masoretic Hebrew, and in a thousand more with the Hebrew as against the Septuagint, and is therefore evidently independent of both. There are very important differences by which we are able to remove some apparent difficulties. But the vast majority of these variations are very minute differences from the ordinary Hebrew, being most of them differences of spelling Hebrew words, very much like the difference between "favour" as we print the word in English, and "favor" as they print it in the United States—very intelligible variations between two branches of the same Israelitish family, the Ten Tribes and the Two having both the same mother tongue.

How is it that the fact of these two independent recensions has been lost sight of, and that the greater number of well informed and learned men are totally ignorant of, or strangely silent about, the whole matter?

At the beginning of last century, after some two hundred years' discussion, mainly as to the value of the Samaritan readings, it was supposed to have been completely settled by Kennicott. But when the higher criticism was introduced, the leaders of it saw that unless they could get rid of these Samaritan MSS., they could not go on with it. So Gesenius, one of the main originators of it, on taking his doctor's degree, wrote a dissertation *On the origin, character and authority of the Samaritan Pentateuch*. From that day to this there has been hardly any discussion on the subject. You will find it sometimes referred to, as in Smith's Dictionary, 1861, where it is said that in 1815 Gesenius "abolished the remnant of the authority of the Samaritan Pentateuch." What the writer intended to convey to his readers I do not know. In the same article the same writer says: "Since up to this moment no critical edition of the Samaritan Pentateuch, or even an examination of the Codices since Kennicott, who can only be said to have begun the work, has been thought of. The treatment of the whole subject remains a most precarious task, and beset with unexampled difficulties at every step. It is, however, this same rudimentary state of investigation—after two centuries and a half of fierce discussions—which has left the other and much more important question of the *Age and Origin* of the Samaritan Pentateuch as unsettled to-day as it was when it first came under the notice of European scholars."

What do the higher critics say about a question which so much concerns them? I can find no reference to it in Wellhausen's *Die composition des Hexateuch*, nor in his *Prolegomena*. In his criticism in both these books, on 2 Kings xvii, a chapter in which it could not be forgotten, it is not even mentioned. Nor do I find any allusion to the subject in Driver's *Introduction*. Chancellor Lias says in *Principles of Biblical Criticism*: "This independent edition of the books of Moses is most characteristically ignored by the new Criticism." It is evidently not a welcome subject with modern critics. Bishop Herbert Ryle (now Bishop of Winchester) in his *Canon of the Old Testament*, is an honourable example of breaking through what I can only call a conspiracy of silence among the critics. He published a second edition of his book in 1895, and added to chapter iv an appendix on the Samaritan Pentateuch, and speaks of the importance of the subject as apparent to every thoughtful student, which makes the silence of the best known men of the modern critical school the more remarkable. "Important, however," he says, "as the subject is, it will be felt to belong more properly to the province either of an enquiry into the history of the Hebrew text, or of an investigation into the history of the Hebrew characters. But in recent years the evidence of the Samaritan Pentateuch has been loudly proclaimed to be the rock upon which the modern criticism of the Pentateuch must inevitably make shipwreck. Under these circumstances an apology is hardly needed for briefly touching upon the subject."

I will not enter on his attempt to represent the Pentateuch as having been brought by a renegade Jew to the Samaritans in the time of Nehemiah, in whose days he places the institution of Samaritan worship on Mount Gerizim. He supposes that events which Josephus places in the time of Alexander the Great really took place in the time of Nehemiah, who makes no mention of them, and that "at the time when the Samaritan worship was instituted, or when it received its final shape from the accession of Jewish malcontents, the Canon of the Jews at Jerusalem consisted of the Torah only."* This is from the first edition. To such straits is the most reasonable and candid higher critic driven to avoid shipwreck on the rock of the Samaritan manuscripts.

Bear in mind that admittedly there have been no new facts since Kennicott's days, and that Gesenius himself gives no

* *Canon of the O.T.* (2nd Edition, p. 93).

reason why the Samaritan text should not have come down from Jeroboam's days, except that he does not believe there was any Pentateuch in those days. "We think," he says, "it must be taken for granted that the Pentateuch could certainly have passed from the Jews to the Samaritans, on the supposition that the Jews themselves had it in the form in which we now use it." Let us see what Kennicott, the last real investigator of the subject, says. These are the words in which he concludes his argument: "In the history of the Hebrew text . . . it was shown that the Pentateuch was placed by Moses by the side of the ark, and copies afterwards taken for the use of the priests all over Canaan. Nevertheless, in the reign of Manasseh, when idolatry pervaded the country of Judæa for fifty-five years, while some copies perished, the rest were carefully concealed. So that at Jerusalem the law was almost unknown, when Moses' own autograph (Heb. 'by the hand of Moses,' 2 Chron. xxxiv, 14) was found and publicly produced in the reign of Josiah. But copies of the law were preserved among the Ten Tribes. These were carried into captivity, but a Samaritan priest returned to teach the inhabitants the manner of the God of the land, which could not be done without the written law. From which time, about B.C. 714, the Pentateuch was preserved by these Samaritans for a thousand years, till the time of Origen, Eusebius, Jerome, etc., who often quoted it. After the lapse of one thousand two hundred years, manuscripts were found with a few poor Samaritan families surviving to-day" (that is, when Kennicott wrote), "in Palestine and Egypt . . . Lastly, the character in which the Samaritan Codices transmitted to our times are written seems to be more the original character than that in which our Codices are written . . . there are not so many errors in the Samaritan as in the Hebrew, because they have not been so often copied. How adorable is the wisdom of God, that Christians should have received the Pentateuch from these two nations, so hostile to one another for two thousand years that their hostility should have passed into a proverb."*

It is not only the Samaritans and the Jews who were at variance. The same thing was true of the Ten Tribes and the Two. No time can be named from Jeroboam's days when the Law has not been in the keeping of hostile nationalities, who certainly would not have accepted it from one another. Thus we trace the whole Pentateuch in two independent texts to a

* Kennicott, *Dissertations*, p. 60.

period nearly 300 years previous to that at which, according to modern critics, any part of it was written.

The question may naturally occur to some how we can collate the Samaritan MSS. without being able to read the character in which they are written and having access to the eighteen copies in Europe. The answer is that in Kennicott's great Bible all the variants are given in Hebrew characters on a page opposite to the text; and there is also a Samaritan Pentateuch in Hebrew characters, a handsome book, printed 1790 at the Clarendon Press.

We must now look at a few of the variations in the Samaritan recension. The number is very large indeed, but an immense number are simply variations of no more consequence than the difference in printing the word "favour" in England and in the United States. But there are many of very great interest, of which I can only give a few specimens. Time forbids my doing more.

1. In Genesis ii, 1, there is both in the Septuagint and in the Samaritan a word not in the Hebrew. The Greek word is $\xi\tau\iota$, the Samaritan Hebrew עַרְר. "Out of the ground *yet again* God formed every beast of the field, etc." The word implies a previous creation of animals, and couples the first and second chapters as inseparable and as consecutive.

2. The words Jehovah and Elohim are so frequently reversed in the Masoretic and Samaritan texts as to make any Elohistic and Jehovistic theory impossible.

3. In Genesis iv, 8, for "And Cain talked with Abel his brother," the Samaritan reads: "And Cain said unto Abel his brother, Let us go into the field," in which the Septuagint agrees with the Samaritan. The words cannot mean "talked with Abel his brother" as in the Authorised Version, nor can they mean as in the text of the Revised Version, "told Abel his brother." They can only mean what the Revisers have put in the margin: "Cain said to Abel his brother, Let us go into the field." But this is in the Samaritan and the Septuagint, not in our Hebrew copies.

The Samaritan text sometimes explains quotations, showing what the Hebrew was in the time of our Lord and His Apostles.

4. In Genesis ii, 24, it is said in our Hebrew and English Bibles, "They shall be one flesh." But in Mark x, 7, our Lord Himself quotes it thus, "They *two* shall be one flesh." This is the Samaritan as well as the Greek reading. With this, Kennicott says, Philo and all the ancient versions agree. Of course this alteration must have been made while the Masorites had possession of the manuscripts. All the Hebrew MS. we have

now either passed through their hands or were copies of them. For as Kennicott tells us, they would not allow any Jew to keep in his possession any copies not in accordance with their revisions. The consequence is that we have no manuscripts of any great age except the Samaritan MSS.

5. In Genesis iii, 2, instead of "The woman said unto the serpent," we find in the Samaritan manuscript, "The woman said unto the liar." Was there not a reference to this when our Lord said (John viii, 44) of the devil, "He is a liar and the father of it"? If so this was the reading in the Hebrew copies in our Lord's time.

6. In St. Paul's quotation (Hebrews xii, 18) from Deuteronomy v, 22, there are four words, "fire," "darkness," "blackness," "tempest." In our present Hebrew there are only three, "fire," "cloud" "thick darkness." In the Septuagint there are only three, fire being omitted. But in the Samaritan there are four as there are in the Epistle, though not exactly the same four.

7. In Genesis xxvi, 18, the Samaritan text reads Elon the Hivite for "Elon the Hittite"; and in xxxvi, 3, 4, 10, 13, 17, Mahalath for Bashemath. The daughter of Ishmael in Genesis xxviii, 9, whom Esau married, is called Mahalath, but in Genesis xxxvi, is called Bashemath in the Masoretic text, Mahalath in the Samaritan text. According to the Masoretic text in these three passages there is a contradiction. Here according to Wellhausen is "the most palpable contradiction in the whole of Genesis." He even goes so far as to say: "I do not shrink from expressing the alternative; either the whole critical literature of the historical books of the Bible is groundless and futile, or Gen. xxvi, 3, 4 *seq.*; xxviii, 8 *seq.*, originate from different sources," Gen. xxxvi, 1-5, 9-19 (*Die Composition des Hexateuch*, ss. 51, 52).

In the Samaritan text the contradiction disappears. There are two Elons, one a Hivite, and the other a Hittite, and a daughter of each Esau married. Esau had five wives—Judith the daughter of Beeri the Hittite, Bashemath the daughter of Elon the Hivite; both of whom were a grief to Isaac and Rebekah, and neither of whom is recorded to have had any children; Adah the daughter of Elon the Hittite; Aholibamah, the daughter of Anah; and Mahalath, the daughter of Ishmael. These last three were the mothers of all Esau's children, Bashemath in the Samaritan being always in chapter xxxvi, in the genealogy replaced by Mahalath the daughter of Ishmael. With these variants the supposed contradiction absolutely vanishes.

8. There is a noticeable variant in Exodus xxi, 20, as to the punishment of a man who should smite his man-servant or his maid-servant with a rod if his servant die under his hand. In the Masoretic Hebrew text the law runs thus: "And if a man smite his servant, or his maid, with a rod, and he die under his hand, he shall be surely punished. Notwithstanding, if he continue a day or two he shall not be punished; for he is his money."

With this the Septuagint agrees. "Punished" may here mean anything and it might mean death, but would no doubt be interpreted according to the discretion of the courts. He should be punished if death ensued at once, but if death did not ensue immediately there is no command for his punishment.

The command as it stands in the Hebrew and the Septuagint is a very considerable moral difficulty.

But the Israelitish Code as it appears in the Samaritan text is different: "If a man smite his servant or his maid with a rod and he die under his hand, he shall die. Notwithstanding, if he continue a day or two, he shall not die, for he is his money." And therefore it is not likely that he intended to kill him; it was homicide, not murder. "He shall not die," but any punishment short of death may in this case be inflicted.

There is a pathetic history recorded by Bishop Colenso about the effect produced by this text on his mind in consequence of the observations of a Zulu with whose help he was translating it into the Zulu language (*On the Pentateuch*, vol. i, 9). Had he been translating it from the Samaritan Codex he could not have been moved, as he unhappily was moved, by the Zulu's objection.

9. There is a curious historical variation in Gen. xlvii, 21. The reading in our Hebrew Bibles is "as for the people, he removed them from one end of the borders of Egypt even to the other end thereof." But in what follows we learn that Joseph's purpose was to obtain a fifth part of the produce of the land for Pharaoh, and it would seem an extraordinary method of obtaining this to remove the cultivators of it from the land into the cities. But the Samaritan Text agrees with the Septuagint and Vulgate in changing the words into "he made bondmen of them," which, of course, was the Hebrew when the Septuagint was translated. The Samaritan has retained the true text.

10. There is a much more important difference. On this I am afraid it would take too long for me to enter. I can only state the fact. There is a difference, or, rather, several minute

differences between the Decalogue in Exodus and the repetition of it in Deuteronomy. It is difficult to understand any difference between statements as to words spoken by God Himself and written with the finger of God on tables of stone. Of this difficulty the higher critics have taken every advantage. Now I am prepared to show that by collating the Samaritan with the ordinary Hebrew and the Septuagint, that is to say, comparing three sets of MSS.—the MSS. of the Synagogues, from which our English translations are made, the Hebrew MSS. existing in the time of Ptolemy, from which the Septuagint was taken, and the Samaritan manuscripts, we arrive at a common text in which no difference remains between Exodus and Deuteronomy, but the Ten Commandments in both one and the same without the difference of a letter.

Differences in the Ten Commandments in Exodus and Deuteronomy.

Dr. Driver and the Bishop of Winchester both dwell on these differences. Driver puts them in parallel columns to show how different they are. I do not deny the difficulty of supposing words actually spoken by God in the hearing of the people being repeated by Moses in different forms. But I venture to say that a more careful study removes the difficulty altogether.

In the first place, the most apparent difficulty is removed by Bishop Ryle himself. He observes that the reasons assigned in Exodus and Deuteronomy for the observance of the fourth commandment are not part of the commandment but “explanations of the commandment.” The same thing is true of the phrase: “As the Lord thy God commanded thee,” in the commencement of the fourth and fifth commandments in Deuteronomy, evidently not a part of them, but a reminder by Moses when repeating them on different occasions.

Bearing this in mind, let us collate the Jewish, Israelite, and Septuagint records of the ten commandments in Exodus and Deuteronomy. The Greek is evidently translated from different MSS. from either of the two others.

The first difference in the commandments themselves between Exodus and Deuteronomy in our A.V. and our ordinary Hebrew copies is that in Exodus we have “Remember,” in Deuteronomy “Keep”; but in the Samaritan it is the same in both—“Keep.”

In both Exodus xx, 10, and Deuteronomy v, 14, the necessary words “in it” are inserted in our A.V. in italics, because not

found in the Jewish text. But "in it" is found in the Samaritan.

In the fifth commandment, the words "that it may go well with thee" are in Deuteronomy not in Exodus, in both the Jewish text and the Samaritan. But in the Septuagint they are in both alike, and no doubt were so in those Hebrew MSS. from which the Septuagint was translated.

In Exodus xx, 14, we read, "Thou shalt not commit adultery," and in verse 15, "Thou shalt not steal," and in verses 16 and 17, the same form is used. Whereas in Deuteronomy v, it is slightly varied by the insertion of the Copula, which changes "Thou shalt not" into "Neither shalt thou." But in the Samaritan it is in Deuteronomy as in Exodus, "Thou shalt not."

In Exodus xx, 18, we read, "Thou shalt not covet thy neighbour's house, thou shalt not covet thy neighbour's wife." But in Deuteronomy v, 21, it is "Neither shalt thou desire thy neighbour's wife, neither shalt thou covet thy neighbour's house, his field." The Samaritan is identical in Exodus and Deuteronomy, "Thou shalt not covet thy neighbour's house, and thou shalt not covet thy neighbour's wife, his field," which removes the discrepancy. But the Septuagint appears here to be more correct than either. Like the Samaritan it is the same both in Exodus and in Deuteronomy, "Thou shalt not covet thy neighbour's wife, thou shalt not covet thy neighbour's house, nor his field," the order being in both the more probable.

It is not difficult to see how the mistake arose. The word for "field" would be undistinguishable from a word for "wife" in the Samaritan MSS., and in all Hebrew MSS. before the Masoretic corrections, the two words being only distinguished in Masoretic Hebrew by the difference between Shin and Sin.

Collating all three, and placing in parentheses the explanations in the fourth and fifth commandments, which are not part of them, there is absolutely no difference of a word or a letter between the ten commandments as recorded in Exodus and Deuteronomy.

"Sanctify" and "keep holy" are merely different renderings of the same Hebrew word. So are "mayest live long" and "days may be prolonged."

In the Samaritan Codex there is no difference in Deuteronomy between "desire" and "covet." It is the same word as in Exodus.

We have really three Codices for collation—the Jewish or

Masoretic, the Israelitish or Samaritan, and that from which the Septuagint must have been translated, and by comparing these we can draw out the exact form of the Decalogue and show it to have been the same both in Exodus and in Deuteronomy.

The apparent differences only begin with the fourth commandment, and here is the resulting text in both Exodus and Deuteronomy:—

“Keep the sabbath day to sanctify it. Six days shalt thou labour and do all thy work. But the seventh day is the Sabbath of the Lord thy God; in it thou shalt not do any work, thou nor thy son, nor thy daughter, thy man-servant nor thy maid-servant, thine ox nor thine ass, nor any of thy cattle, nor thy stranger that is within thy gates.”

“Honour thy father and thy mother, that it may go well with thee, and that thy days may be long upon the land which the Lord thy God giveth thee.”

“Thou shalt not kill.”

“Thou shalt not commit adultery.”

“Thou shalt not steal.”

“Thou shalt not bear false witness against thy neighbour.”

“Thou shalt not covet thy neighbour's wife. Thou shalt not covet thy neighbour's house, nor his field, nor his ox, nor his ass, nor anything that is thy neighbour's.”

Thus collated there is no distinction between the Decalogue in Exodus and in Deuteronomy—not the distinction of a letter.

Conclusion.

What I consider myself to have proved is this: that about 350 years before (according to the “higher critics”) any part of the Pentateuch was written, the whole Pentateuch in two Recensions existed in the two nations of Israel and Judah, and are both in our hands to-day; and that, therefore, the whole theory connected with them vanishes like the unsubstantial fabric of a dream.

DISCUSSION.

The CHAIRMAN.—It is not often that we have the privilege, in this room, of listening to an octogenarian, and it is very encouraging when we find that members of the Victoria Institute are not only able to live till eighty years of age, but that they are also able to produce such a paper as we have heard this afternoon, and we may

hope that when Mr. Garratt becomes a nonagenarian we may have the privilege of hearing him again and seeing how the subject is getting on. He has opened a rich mine which has remained more or less closed. The subject has been touched on, as we hear, by Bishop Ryle and Mr. Spencer. But it is a puzzle. All questions of the various readings of the Hebrew Bible are puzzles; but investigations are being made of the MSS. in the Bodleian Library. I saw two of them in 1860, one supposed to have been written by Aaron's grandson, I think; but it does seem a phenomenon that up to this time there should be no possibility of collating it. I am always afraid of somebody else bringing up this and substituting something for it. It is everyone's interest to keep it safe; for that and a few other such MSS. are most valuable. There may be something which we have not yet found, and it may be that God, in His providence, is keeping it against the time it will be needed.

Rev. F. E. SPENCER.—I think we are very much indebted to Canon Garratt for introducing this subject, especially if it should lead to an unprejudiced investigation of it. I have looked into several of the written introductions and the current treatment of the subject, and it seems to me to be quite superficial, and to come, mostly, by way of casual allusion to it, perhaps with a reference, thrown in, to a Latin essay of Gesenius: this essay, I believe, cannot be got at the British Museum.

The AUTHOR.—Yes, I have got it there.

The CHAIRMAN.—I think it is in Zion College also.

Rev. F. E. SPENCER.—Acquaintance with it does not encourage confidence in its finality. But not sufficient allowance has been made, I think, by the author of the paper for the extreme complexity and real difficulties of the subject, indicated, for instance, by the Essay of Emanuel Deutsch, in Smith's 1st Edition, which is quoted. The best notices known to me on the subject, outside Deutsch, are those of König, 1893, and Hengstenberg (*Dissertations on the genuineness of the Pentateuch*, 1847), of which last Möller says, "It is quite incomprehensible how individual objections of criticism can be brought forward, again and again, as if no answers had ever been made to them." The subject of the Samaritan Pentateuch seems to me to be involved in prejudice, misunderstanding and inherent perplexity. I should like to sum up, briefly, what I have to say on these points. First, I cannot help thinking, with due deference

to the author of the paper, that as a final and satisfactory *Argumentum ad hominem* the "short and easy method" of the "higher critics," so called, of the Samaritan Pentateuch, fails. There is no such perspicuous evidence as would rebut the possibility that, if the Pentateuch *did* arise, as Wellhausen and Kueuen say it arose, the Samaritans *might* not have adopted it in the Hebrew form which it eventually reached. Hengstenberg himself shows that the Samaritans were heathens, with little, if any Israelitish blood; that they are, and were, constitutionally, liars; and that there is evidence of the percolation of both Hebrew and freethinking, if not Alexandrian ideas amongst them. The Samaritan character in which the Pentateuch is written is not, in itself, a decisive proof of age, for it was probably used by those whom the Talmud calls idiotic, long after the Babylonian script came into fashion with the correct Hebrews.

Yet, secondly, for all that, the subject is of great interest, and I cannot help feeling that there is something at the bottom of it. After all that has been said by prejudiced and unprejudiced witnesses there remains the impression that at bottom both in the Samaritan Pentateuch and the LXX version, an independent text and an old text underlie them, though to reach it seems a matter of much difficulty. The subject is complicated in the Samaritan Pentateuch by two considerations: (1) In 2,000 places the Samaritan agrees, it is said, with the LXX. That has been investigated by some gentleman and he puts it down as 2,000.

The AUTHOR.—It agrees with the Septuagint in 1,000 and 1,000 in the Hebrew.

Rev. F. E. SPENCER (continuing).—Pardon me, I think this gentleman says it is 2,000; but against this are set a considerable number of divergences—"Quite as often disagree," says Deutsch. Of these divergences and agreements no satisfactory explanation has been made. (2) The Samaritan text has clearly been modernised and made smoother. It has a considerable number of euphemisms, toning down, as they thought, the coarseness of the original. It has a certain amount of alterations in a doctrinal interest, softening supposed anthropomorphisms and introducing the ministry of angels, as well as the well-known alteration of Ebal in Deut. xxvii, to "Gerizim and God has chosen, for God will choose." But that there is an underlying independent ancient text seems probable by

the fact of the differing numbers of the Patriarchs' Ages, the LXX, Samaritan and Hebrew, perhaps by the differing lesson portions, and perhaps by the readings indicated by the reader of the paper. (3) I have never been able to attach importance to the difference in Deuteronomy, where Moses is explaining the law, from its form in Exodus. Moses is engaged in enforcing the spirit of the Ten Commandments, and the slight changes are all significant of their intention. But there is an intention parallel in the variants of our Lord's republication of the spirit of the law, showing that the spirit and not the bare letter prevails over mere literal sameness.

Rev. JOHN TUCKWELL.—May I be allowed to ask the last speaker if he will kindly favour me again with the reference he made to the period when the Hebrews are supposed to have adopted the Babylonian script? I wrote down, as I understood him to say, "long after the Babylonian script came into fashion with the Hebrews." Whose words were those and upon whose authority was that statement made?

Rev. F. E. SPENCER.—You will find it in Deutsch's article where he quotes from the Talmud.

Rev. JOHN TUCKWELL.—My reason for asking the question is that there is not even the slightest foundation for the belief that the Hebrews at any time ever adopted the Babylonian script. The Babylonian script is cuneiform, as we know; and from the time the Hebrews came into possession of the Promised Land there is not a single trace that the Hebrews ever made use of the cuneiform. We find abundant evidence of the use of the cuneiform in other parts of the East, and we find indications of the use of the cuneiform prior to the supposed period when the Israelites entered the land; but that I believe is a most gratuitous statement and one without foundation.

Mr. MARTIN ROUSE.—I should like to say, having carefully perused the article in the *Imperial Bible Dictionary* on that point, I am convinced that the Samaritan letters, as we find them in the text, are the earliest forms; and that, after that, follow the monumental letters found on coins and inscriptions, and the present square Hebrew letters are derived from the latter.

Rev. JOHN TUCKWELL.—May I add to what I said just now, that there is not the slightest indication that the Babylonians ever wrote alphabetically; so it seems impossible that any letters in use

amongst the Hebrews could be derived from the Babylonians. The Babylonian letters certainly form 500 or 600 combinations of wedges, each standing for a syllable or entire word. The Babylonians, for a thousand years, were utter strangers, apparently, to anything like alphabetical writing. I state that to show upon what false grounds that higher criticism, as it is called, rests.

Mr. H. SEFTON JONES.—With reference to the passage from a Targum quoted by the previous speaker, the allusion to the "Babylonian writing" still used by the "unlearned," this must obviously refer not to the cuneiform scripts but to the Phœnician (early Aramaic) characters commonly in use in Mesopotamia from before the exile onwards. The tablets in the British Museum with the text inscribed in cuneiform, and bearing docketts or titles on the end or edge in these Phœnician characters, were familiar instances of the contemporaneous use of both scripts.

With regard to the point raised by the interesting paper just read regarding the variations in the text of the Decalogue, a very remarkable variant had recently been published, obtained from a Hebrew papyrus fragment found in Egypt. Mr. Stanley A. Cook, in a short paper on this fragment (*Soc. Biblical Archaeology*, November, 1902), pointed out that the order of the Commandments agrees with that quoted by Our Saviour, as recorded in Luke xviii, 20, and not as given in our Old Testament. This interesting point tended to show that too much stress should not be laid upon identical wording.

Professor LANGHORNE ORCHARD.—I think not this Society, only, but all Bible students are indebted to the learned authors of the papers which have been brought before us. It is deplorable that the obscurantism of the "higher critics" has so long been successful in ignoring or neglecting the Samaritan Pentateuch. The rejection of evidence which conflicts with a favoured hypothesis is neither scientific nor philosophical. There can be no question, after what we have heard this afternoon, as to the great importance and value of these Samaritan MSS. Any attempt, such as was made by Gesenius, to destroy their authority, whilst leaving unsettled their age and origin, is doomed to failure. With regard to age and origin the Samaritan Pentateuch appears to have been a copy from the Hebrew original of the Mosaic era. As pointed out by Kennicott, copies were, no doubt, taken for the use of the priests

all over Canaan ; others would come into the hands of Jeroboam's priests and be the Israelitish recension of our (Jewish) Pentateuch.

Here, as in all other cases, progress of research and knowledge is found to issue in vindication of the Bible. Does it not teach us that God may permit difficulties to exist in order that we may trust Him with regard to them and so glorify Him ? We may see no rift in the clouds, but if we wait, they will part and the light will stream through.

Rev. G. F. WHIDBORNE.—We are, I am sure, very grateful to Canon Garratt for having given us this paper, and I only hope he will give us another before he is ninety ! I know he is well stored with subjects.

I would say that it seems to me, quite apart from discussion on the Babylonian script, that we have got a most difficult question for the "higher critics" to settle in the mere fact of what Canon Garratt has brought before us that the Samaritans, soon after the time of the destruction of Samaria, had the Pentateuch, and I cannot understand how the "higher critics" are going to reconcile that with their views.

There is one point of Canon Garratt's paper upon which I should like to make a remark. He says, "In Genesis ii, 19, there is, both in the Septuagint and in the Samaritan, a word not in the Hebrew. The Greek word is *ἐπι*," and then he gives the Samaritan, "out of the ground *yet again* God formed." This word, *ἐπι*, conveys the words necessarily, I think, in a reiterative sense, and if it is so in the Samaritan that "out of the ground God still formed every beast," it implies, as the author says, a previous creation.

Rev. CANON GARRATT.—I think Mr. Spencer referred to a point in Deuteronomy treated of by Gesenius, that the Samaritan text appeared to be a softening of the original as if, according to Gesenius, it was made even more grammatical, and that, all together, many difficulties were removed. He mentioned that as an objection. But I think it should be borne in mind that, supposing the view I have taken is right, at the time of the separation of the two kingdoms it was in the northern kingdom that this recension, that seems to be a softening and an improvement in some respects, took place.

I cannot quote a text to show it, but the whole aspect of the history seems to show that the northern kingdom was more cultivated, and that if the scholars got the recension into their hands

they would be extremely likely to remove any difficulty they could, and the great probability is that while it was in the hands of the Israelitish scholars, they removed whatever they thought not to be quite grammatical.

The CHAIRMAN.—That is interesting. I am sure I may thank Canon Garratt in all your names for his address this evening.

I will now ask Canon Hammond if he will be so kind as to read his interesting narrative concerning the Samaritan Passover of the year 1861.

The Chair having been vacated by Canon Girdlestone and taken by Rev. John Tuckwell, the following paper, entitled "The Samaritan Passover of the year 1861," by Rev. Canon Hammond, LL.B., was then read by the Author:—

No. II.

THE SAMARITAN PASSOVER OF THE YEAR 1861.

By Rev. Canon HAMMOND, LL.B.

WHEN I was in Jerusalem in the Spring of 1861—forty-three years ago—I came into close contact with two German scholars, who were busy on the text of that Samaritan Pentateuch of which you have just heard. I think, but I am not sure, that it was then that I realized for the first time that there were Samaritans still in the world, as well as Jews—lineal descendants of those same Samaritans of whom we read in the Gospels. Anyhow, I soon became deeply interested, both in them and in their institutions, and when, a few weeks afterwards, I reached their ancient and only home, Nablus, and found that their Passover—a rite which very few Europeans had then seen—was to be celebrated in a week's time, I had no difficulty in persuading my travelling companions to fill up that week with an expedition to Cæsarea and Carmel, and to return with me to Nablus to "Keep the feast," which is held on the summit of Mount Gerizim, where once their schismatical temple stood. After some hard riding, we pitched our tents in the Vale of Shechem, at about 3 o'clock in the afternoon of the appointed day, and as the Passover is killed "at the going down of the sun," we lost no time in ascending the

holy mount. When there, I jotted down some particulars of what I saw and heard, and these particulars I have now the honour to lay before you.

There are eighteen tents in all. They stand on a level plateau a few hundred feet below the summit. The oven where the Passover lambs are to be presently roasted, and from which the flames are even now leaping forth, is a circular pit, dug in the ground, but also banked up to a height of about three feet above the surface of the soil. I notice *six* lambs peacefully grazing near at hand; they are straying at will among the people. These are the lambs for the sacrifice, and they are now eating their "last supper," whilst, as in our Lord's case, the arrangements are being made for their death. I had understood that the Samaritans always sacrificed *seven* lambs as, in fact, they frequently do, and I had concluded that they do so, because *seven*, as the Bible abundantly shows, is the sacred or covenant number. I ask Shellabi how it is there are only six. He tells me that this year the Samaritans are *too poor* to offer more. There were only six, however, the next year, when our present King, then Prince of Wales, was a spectator of the ceremony under the escort of Dean Stanley. As I am watching them, a bonny Samaritan boy approaches a lamb, catches it, clasps it round the neck and kisses it. It did not remind me, but it might have done, of the kiss of Judas.

And now, the little band of *men*—for the women are merely spectators, and take no part in the rite, though they will presently partake of the supper, Dean Stanley tells us that in 1862 they were shut up in their tents—the *men* stand in a group with their faces toward the *Kiblah*, or "Holy Place" of their religion, at the opposite end of the summit. It is time to begin the long ceremonial, for it is about half an hour before sunset, and the Mosaic law was this, "Thou shalt sacrifice the Passover at evening, *at the going down of the sun.*" At first they kneel or crouch, and then they stand and chant with prodigious energy—Stanley called it "vehemence"—and in the monotonous tones of the East—those tones from which our Gregorian music is derived. They are all in holiday attire; some of them—Dr. Stanley counted fifteen in 1862—in long white robes. I notice among them a few aged men, with venerable white beards. Each holds in his hand a MS. Prayer Book, in Hebrew and Arabic. The priest (or really Levite), however, standing on a rough stone, in front of the congregation, recites his prayers *by heart*—this fact escaped me, or did not impress me,

but Dean Stanley observed it. I notice that the rubrics in these MS. books are in red letters, just like ours. I take up my position by the side of the old priest Amram—he was not officiating, or rather he was taking no *prominent* part in the service—that part fell to his nephew Jacob, who was to succeed him at his death. The singing is responsive or antiphonal, like that of our choirs. It is all done, the entire function, so it seems to me, in a very business-like and perfunctory way. I could not detect much evidence of devotion, the old priest was the only one who seemed to be praying.

The service at this point was largely—so Stanley learnt ; I did not—a commemoration of the glories of Abraham and Israel, and it lasts till the sun is near the horizon. Now, a lamb is brought into the circle. The wood is laid in order. The children of the community squat, Eastern fashion, near two large iron cauldrons filled with boiling water. I observe six men, young men, in white raiment. They are the men, I subsequently find, appointed to slay the victims. The five other lambs are now brought near, and all are ranged in a line alongside the cauldrons, between us and the Samaritans, who never stop for a moment in the recitation of their Liturgy. The victims are placed in a circle, each lamb's head towards another's tail, round the furnace, at the bidding of the Amram. The old priest and the young priest now consult for a moment ; it must be about the precise hour of sunset, for they look at their watches. Sunset must be near, for some of the men now gird up their long garments ; Eastern dress compels this girding of the loins, where hard work has to be done. The six youths in white, the ministrants who have to kill the lambs, take up their position by the side of their victims.

At this point the voices of the people are hushed, and the sonorous monotone of the young Levite Jacob alone is heard. The rest fold their hands as in prayer. Occasionally, Jacob prolongs a note—that is the signal for a response on the part of the people—we have something very like it at home, showing that there is nothing new under the sun. A moment later and Jacob is reciting the twelfth chapter of the book of Exodus—the account of the first Passover. By the time he has reached the sixth verse—"the whole assembly of the children of Israel shall kill it in the evening"—the last glint of the sun disappears below the horizon. We are not left, however, to the dim light of the gloaming, for the Paschal moon is shining brilliantly overhead. We all gaze, in almost breathless expectation, for it is clear that the supreme moment is at hand. Nor have we

long to wait, for at the word שָׁחֲטוּ, "they shall kill," the executioners suit the action to the word; each man brandishes his knife and seizes his lamb; the next moment, he has drawn that knife across its throat. Not a cry is heard; not one plaintive bleat! A few convulsive struggles, as the blood streams from the wound, and then all is over. "He is brought as a lamb to the slaughter and as a sheep before her shearers is dumb, so He openeth not His mouth." When their quiverings have subsided the bodies are passed on from hand to hand and are laid round the furnace. At a signal, the crowd rushes forward to strip off the fleece—I cannot remember whether they were skinned, as in the Jewish ritual, or whether, as Stanley says, the wool alone was removed with the help of boiling water—the command of the Law is explicit, "Not sodden *at all* with water, but roast with fire." Before this was done, however, indeed, almost as soon as the throat was cut, some of the men dipped their fingers in the blood and streaked the foreheads of the young children. I ask Shellabi what this means, and he tells me that it is only the *firstborn* that are thus marked; a reminiscence, perhaps, of that first Passover, when the *doorposts* were sprinkled with blood and the *firstborn* of the Egyptians were slain. And then—and a touching sight it was—the Samaritans solemnly and tenderly embraced each other. As far as I could see, every man present embraced every other man, kissing first the one shoulder and then the other, but the younger men kissed the *hands* of the elders. It was a moving spectacle—this pitiful remnant of a once powerful race, by this kiss of charity proclaiming its oneness, its cohesion, its devotion to the faith, on the occasion of their solemn feast, and we thought of the "holy kiss" of the early church.

But so far, the lambs are only slain; now, the preparations for the Supper must begin. Whilst the lambs are being skinned by some members of the community, others, book in hand, recite the appointed portions of their Liturgy, for every act of the sacred drama has its own prayer or psalm. I observe that at this point the women, who hitherto had stood somewhat apart, now draw near to watch their husbands and brothers. A little later and they all move to a long trench, where the unleavened bread is to be eaten. A youth goes round with a sort of tray, made of straw or wicker-work, on which were morsels of unleavened bread, each morsel inclosing a leaf or two of bitter lettuce; he doles out a morsel to each. There is some clamouring on the part of the children for more. I ask Shellabi—somewhat thoughtfully—whether we may not

partake. He says "No: the Samaritans would never allow it." Then he reminds me of the words of the Law—"There shall no stranger eat thereof." All the same, he presently secures a morsel for me, which he bids me hide out of sight. I did hide it, and I have it to this day.

But whilst this has been going on, the lambs have been prepared for the furnace. Each is suspended—and you may imagine what a shock it gave me to see it—each is suspended *on a cross of wood*. I daresay this is only done for convenience—that the men may handle the carcase and put it into and out of the fire the more easily, but it is strange to see on Mount Gerizim this shadow of Mount Calvary. I thought at the time that I had made a discovery, but I learnt later on that Justin Martyr, who was a native of Nablus and no doubt had seen its Passover seventeen centuries ago, referred to this feature; he says that the Jews did the same, but he probably *inferred* that from the practice of the Samaritans. Whilst the lamb is thus suspended, it is of course disembowelled and the entrails are buried. All this took some time, but it was all done to the accompaniment of chanting, interspersed, I must say, with a good deal of chattering. A foreleg was then cut off. I ask Amram what this means, and he replies that it is the "portion of Levi," the "wave-shoulder" which was the priests' share. Now the six crosses, supporting the six carcasses, are held in a circle round the mouth of the pit or oven. Two or three men lay hold of each cross. The furnace has just been fed with fuel—fuel of crackling thorns—and great tongues of flame leap out of the opening, to the great delight of the children. The intoning is resumed, and at a certain word—perhaps the words "Burnt with fire"—the six bodies are at the same moment plunged into the oven. It is not an easy thing to do, for the greatest care has to be taken lest any lamb in its descent should touch the side of the furnace. A wooden framework is now hurriedly placed over the mouth of the oven; on this grass is heaped, and earth again upon the grass, the whole being plastered down and cemented together with water, so as to seal up the oven. Then, there is a long break in the proceedings, for the process of roasting will take some hours, and we have already been two hours over the rite, and that after a most tiring day, so we retire to rest in Shellabi's tent, after a meal of tea and eggs and dates and cheese.

At half past ten or eleven Shellabi wakes us; I had been roused before, but only for a moment, to find some scorpion or other reptile crawling over me. He tells me that the lambs

are now ready ; in '62 the feast did not begin till past midnight. They judged, we were told, by the smell when the lambs are sufficiently roasted. So once more the whole Samaritan nation assembles round the furnace, and once more the strident chanting is commenced. Everything that is done is set to prayer or recitation. You can see that they are waiting for a word, and when that word comes the pickaxe descends, the covering of earth is rapidly cleared away, a great cloud of smoke and steam curls upward to the sky, and when it clears, the crosses, with the lambs attached, are drawn out one after the other. The bodies are much blackened and charred, but still the outline is clearly visible. "His visage was so marred, more than any man, and His form more than the sons of men." Each of the carcasses is placed on a large wickerwork tray and is carried to the trench before spoken of. Now begins the true Paschal feast. Sitting on their haunches like men in haste, their loins girt, their shoes on their feet—hitherto they had gone barefoot—and their staff in their hand, they ate the Lord's Passover. Some, I observe, as if to show their haste, tear a portion of flesh from the body on the tray and then walk about whilst they eat it. They are divided into groups, one group round each lamb. There was no mistake about the *haste*. In twenty minutes, Stanley says *ten* minutes, everything but bones and a few remnants had disappeared. These bones and remnants were then collected into the trays or mats, a fire was kindled and every scrap and morsel was consumed. So the Mosaic law requires, "And ye shall let nothing of it remain until the morning, and that which remaineth of it until the morning, ye shall burn with fire." In '62 they searched the ground with lighted candles to see whether any fragment had escaped them, but I do not think that this was done in '61 ; the ritual varies apparently somewhat from year to year. And with this burning of the bones, the Samaritan Passover, "the only relic of Jewish sacrifice remaining in the world," and a rite which, with some breaks, has lasted for at least 2,000 years, came to a close. It was now near midnight, so we bade a hasty adieu to our host and descended the steep mountain side, the moon—"the moon that shone in Paradise"—bathing every blade and leaf in liquid silver. We descended to our tents in the beautiful valley, feeling that this had indeed been "a night to be much remembered," and this a

"Day in golden letters to be set
Among the high tides of the calendar."

DISCUSSION.

The CHAIRMAN.—I am sure, ladies and gentlemen, this paper is not likely to provoke any discussion.

Canon Girdlestone has been obliged to leave, and he has asked me to discharge the duties of Chairman at the close of the meeting; but before leaving he gave me the name of Mrs. Finn from Jerusalem, and I shall be very glad to hear something from her.

Mrs. FINN, M.R.A.S.—It has given me much pleasure to hear Canon Hammond's interesting account of the celebration of the Samaritan Passover which he witnessed in the year 1861, and the more so as it was my dear husband, the late Mr. James Finn, who when Consul at Jerusalem obtained permission for the Samaritans to resume their Passover service and sacrifice on Mount Gerizim after many years during which the local authorities had prevented their observance. The British Government had directed Mr. Finn to befriend the interesting little Samaritan community, who were exposed to many petty annoyances from their rough Moslem neighbours in Nablous (Shechem). The latter were, however, not unwilling to be on pleasant terms with the British Consul, who was thus able to obtain, in a quiet way, redress for many vexatious little acts of aggression. The Samaritan High Priest on behalf of his people petitioned that they might be allowed to hold their Passover service and sacrifice on Mount Gerizim as of old. Mr. Finn communicated this to Her Majesty's Ambassador at Constantinople, Sir Stratford Canning, who was ever ready to use British influence on behalf of the oppressed, and to secure civil and religious liberty for all classes and creeds in the Ottoman Empire. And in those days, British influence was great, and it was never exerted in vain. The then Sultan, Abdul Medjid, highly valued the friendship of the British nation and of the British Ambassador, and he at once issued orders that henceforth the Samaritans be no more molested in their religious observances. The Samaritans were, and are still most grateful for the kindness shown to them, and they have made many British travellers (among them H.M. the King, when Prince of Wales in 1862) welcome at their Passover service since the celebration was restored. While listening to the learned and important paper on the Samaritan Pentateuch which has just been read by the Rev.

Canon Garratt, an idea occurred to me which may possibly prove useful. Canon Garratt speaks of the value of the Samaritan Pentateuch as being the oldest known copy of the Law of Moses, and points out the value of the collation of that MS. with the Hebrew received text—so far as that collation has been carried out in copies accessible to Kennicott and others. The Samaritans guard their great copy of the Pentateuch, which they say was written by the grandson of Aaron, so jealously, that comparison between it and the Hebrew text has been all but impossible. But while I was living at Jerusalem there was also living there, from 1858 to 1862, Dr. Levysohn, a professor of the University of St. Petersburg and an old friend and tutor of Cyril the first Russian Bishop at Jerusalem. Dr. Levysohn, a Christian by birth and a profound Hebrew scholar, devoted himself to the study of the Samaritan Pentateuch and literature. He became possessed of a magnificent roll of the Pentateuch and of many small MSS. and fragments of MSS. He was on the most friendly terms with the Samaritans and obtained permission to compare the MS. in his possession with the great MS. This he did, as he himself told us, literally "*on his knees*," so great was his reverence for that most venerable Record of the Law of Moses. Dr. Levysohn also made with his own hands lithograph facsimiles of the MSS. in his possession. I have specimens of these which he most kindly gave to us, and which I will gladly show to anyone who may like to see them. It is greatly to be regretted that Dr. Levysohn's valuable MSS. and all his notes fell into the hands of an ignorant couple, who brought some of them at least to England, with a view to sale. I do not know what ultimately became of them—Dr. Levysohn died soon after in Russia.

As to the difference between the Samaritan character and the square character of our Hebrew Bibles—it is noteworthy that the so-called Samaritan is practically identical with that used on the Maccabean coins, in the Siloam, and other inscriptions. But Hebrew Sacred rolls (all that now exist) are written in the square character. This latter had been called the Babylonian character, not however because it has any affinity with Babylonian cuneiform (which is not alphabetic at all but ideographic, having a sign for each word); I would suggest that the square character may have been called "Babylonian" because it first came to be *generally known*

after the return from Babylon—and that it became known through the action of Ezra the priest and scribe, who, with the scribes under him, first made copies of the Law for general use in synagogue worship in the square character; which, if in use before, was chiefly in use only at the Temple and by the priests. It may be that the square was the sacred character and the so-called Samaritan or “coin” character was the secular character used for ordinary purposes. And it may be that the celebrated Samaritan Pentateuch was a copy—purposely made in the *secular* character, for use of the Samaritan *heathen* (as they were), and obtained for them from the then existing Temple at Jerusalem—by the priest whom the King of Assyria sent to “Teach them the manner of the God of the land.” Should this have been the case, we may have in the great Samaritan Pentateuch a more or less accurate copy of the original Law of Moses preserved in the Temple of Solomon until its destruction by Nebuchadnezzar. The actual antiquity of the Hebrew square character is a point not yet decided. Some, with Dr. Neubauer, hold that it was gradually evolved after the Captivity. But it is important and interesting to notice that in the days of Our Lord, the Rolls of the Law used in synagogue worship were written in the square character. For when Our Lord said (Matthew v) that “not one jot or one tittle should pass from the Law till all be fulfilled,” He clearly had in His mind the Yod (י jot or iota), the smallest letter of the Hebrew square alphabet, whereas the Samaritan Yod is every bit as large as any other letter of their alphabet. And in the *Tittle* Our Lord refers to the hair lines put at the top of some of the Hebrew square letters (called in Hebrew *Tagin* = “crowns”), which are so written only in MS. rolls intended for use in Divine worship at the synagogue.

The SECRETARY (Professor EDWARD HULL).—I have a letter from Dr. Chaplin (written from St. Leonards-on-Sea), which I will read—“Dear Professor Hull: thank you much for sending me copies of the interesting papers by Canon Garratt and Canon Hammond. With regard to the cross piece for the spit which is passed through the body of the lamb, of course it is only to prevent the latter slipping down and touching the bottom of the oven.” This is the point Dr. Chaplin wished to explain.

I am sure we are much obliged to Canon Garratt and Canon Hammond for their exceeding kindness, and I have, personally, to

thank them for responding to my invitation to prepare these papers for the Institute.

A MEMBER.—I should like to say with regard to what Mrs. Finn has just said about the origin of the Hebrew square characters, that I have, for some time, studied them as a member of the Society of Biblical Archæology. While the Samaritan is almost identical with the old Phœnician letters, it seems to me that the square character is not at all like it and could never have been derived from it.

I have a strong impression that what Mrs. Finn has just suggested may be true, that while the square character was used for sacred purposes, the Phœnician, or Samaritan character, was used for secular purposes, such as inscriptions on coins and monuments.

Mr. MARTIN ROUSE.—I do not think we should close the proceedings without saying that we are immensely indebted to both readers of the papers. Canon Hammond has pointed to the beautifully solemn and typical aspect of that great Passover sacrifice instituted by the Lord Himself 1,500 years before Christ came into the world as the one sacrifice made for sin for ever.

To the useful emendations that the writer has mentioned as capable of being made from the Samaritan version is one in Exodus xxxiii, 7, where in the Masoretic Hebrew text we find: "And Moses took the tent and pitched it without the camp . . . and called it the 'Tent of Meeting,'" whereas the Samaritan text has: "Moses took his own tent," etc. This is evidently the correct reading, inasmuch as the Tabernacle or tent of meeting proper did not begin to be made until Moses had once more ascended to the mountain-top and had spent another forty days with God (*cf.* chap. xxxiv, 2, 4, 28). The number of the Samaritans, all told, says Canon Hammond, was in 1861 about 145. At his visit in 1873 to witness the same ceremony, Dr. Samuel Manning (author of *Those Holy Fields*) found the number further reduced to 120. Is it not a striking phenomenon in the growth of peoples that the Israelites, who by successive conquerors, down to 1,800 years ago, were driven from their land in poverty and hardship should, since then, have multiplied to many millions, while the Samaritans, who have remained as peasant owners in their province of Canaan ever since, have dwindled down to little more than a hundred persons? What purpose could the Almighty One have had in bringing so strange a contrast about except this, that the Samaritans, who were

originally intruders upon His people's inheritance, should, in Canaan itself, keep their ancient copy of His laws and maintain their observance of His Passover as a witness to the nations of their vast antiquity just up to the time which He had appointed for the restoration of His people to their own land? And from every hand these are beginning their march to the country of Abraham, Joshua, and David, while the knell of departure is sounding in the ears of Samaritan and Turk.

The CHAIRMAN.—I do not think we should separate without an acknowledgment of the very kind offer that has been made by Mrs. Finn. I feel sure I am speaking on behalf of the Council of the Institute when I say we would do our best to secure that some competent person or persons should inspect these very valuable MSS., or any copies that may be obtained. For my own part I cannot help feeling that very great importance is to be attached to them, whether we have the originals of the dates supposed, or copies. The likelihood, at all events, is that tolerably faithful copies of the earliest are in the hands of the Samaritans, and that lends great interest to them. I am sure we would do our best to make use of the offer of Mrs. Finn.

Our thanks have already been expressed to both the authors of the papers.

Mrs. FINN.—Supposing the secular character is the so-called Samaritan script, and the sacred character the Hebrew square, it is just possible that when the Samaritans asked for a copy of the Law of God, that the Jewish priests allowed them to have a copy, not in the sacred script but in the secular script, and in that way they obtained possession of the true copy preserved in the Temple at the time.

The CHAIRMAN.—That is a very probable suggestion, I think.
The Meeting then closed.

ORDINARY GENERAL MEETING.*

DAVID HOWARD, ESQ., D.L., IN THE CHAIR.

The following paper was then read by the author :—

THE CONCEPTION OF THE GREAT REALITY.

By SYDNEY T. KLEIN, F.L.S., F.R.A.S.

AT the outset we must recognise that when we with our finite senses try to form a conception of the Infinite it necessarily takes the form of a negative, the negative applying to those things of which we have cognizance; we carry our thought to the utmost limit possible with our present knowledge, and when we have come to a standstill we conceive the Infinite to be not that but *something further on*. As our knowledge increases by small steps, that *something further on* seems ever to be flying from our grasp by mighty strides, until we are forced to bow our heads and recognise that we are in the presence of, though still not in sight of, the Great Reality. A divine impulse is ever urging us forward to greater conceptions, but shattering our hopes and giving us a feeling of despair if we arrogate to ourselves a greater power of conception than we have knowledge to sustain. We have to approach the study with indeed that feeling of elation which the knowledge of our divine origin wakes within us, giving us a feeling of certainty that our souls are capable in the hereafter to attain to the highest summit of knowledge, but with that humility in the present which makes us acknowledge that he who knows most,

* Monday, April 11th, 1904.

knows most how little he knows. In this frame of mind let us now examine our surroundings.

We are living in a world of continuous and multitudinous changes, in fact, without change we could have no cognizance of our surroundings, we should have no consciousness of living; we have become so accustomed to certain sensations that we are apt to take them as facts and scoff at the suggestion that they are non-realities. I propose, however, to show that what we perceive are not realities; and true conception of our surroundings depends upon the knowledge which we can bring to bear to interpret the meaning of these sensations. It is only in response to our conscientious endeavours to form new concepts that knowledge is being daily revealed to us; the more we progress in knowledge the more we see that perception alone without knowledge leads to false concepts, and these in their turn if held dogmatically create fatal obstacles and difficulties to our progress towards the appreciation of both the natural and the supernatural. Let me give you a few examples of this in the natural.

In early times the sun and the stars were seen to revolve round the earth once every day, and, without knowledge of astronomy, this was taken for granted as an absolute fact; later on, however, it was noted that the stars never changed their relative positions; this necessitated a new concept, namely, that they were fixed on the inner surface of a huge globe. This false concept brought other difficulties into play, the question arose as to what was beyond the globe, and also the difficulty that the stars as well as the sun were found to be at such an enormous distance from the earth that their rates of motion were quite inconceivable; even in the case of the sun the motion represented over twenty-five million miles per hour and the apparent motion of the stars was thousands of times faster than light travels. These difficulties were not swept away until by the advance of knowledge, the falsity of conception based only upon appearance was made manifest and it was seen that it was the earth which moved and not the stars; even then, owing to its supposed antagonism to what was stated in the Bible, the new conception was opposed with great bitterness, it being long looked upon and denounced as a sacrilegious invention.

Our present conception that the earth turns round on its axis once every day and rolls in its orbit round the sun once in every year may be called a reality to our finite senses; but I shall show later on that, except for the finiteness of our senses

and the imperfection of our knowledge, the concept is not a true one—with perfect perception and perfect knowledge there can be no such thing as motion, which is the product of time and space.

Let us now go from our senses of sight to that of touch. If you hold a cannon-ball in your hand, perception by the sense of touch tells you that it is solid and hard, but it is not so in reality except as a concept limited by our finite senses. A fair analogy would be to liken it to a swarm of bees, for we know that it is composed of an immense number of independent atoms which are incessantly darting about and circling round each other at an enormous speed, but never touching. If our touch-perception were sensitive enough we should feel those motions and should not have the sensation of a solid; we have a similar case of limitation in our other senses. We can hear beats up to 15 in a second, but beyond that number they give us the sensation of a continuous sound, as you may see by this instrument (syren). In our sight-perception we also have the same limitation, we can see pulsations of intermittent flashes at the rate of 6 in a second, but beyond that number they give us the sensation of a continuous light; the effect is seen very clearly in making the top of a match red-hot; when stationary or moved slowly, it is a point of light, but move it quicker and it becomes a *line* of continuous light. If our sight-perception were sensitive enough we could see the darting about of these atoms, and the cannon-ball would take on the appearance of a swarm of bees. We are so accustomed to take everything for granted that it may perhaps startle some of you when I ask you to consider whether we can even assert that we have ever seen matter. Let us turn towards a common object in this room. We catch in our eyes the multitudinous impulses which are reflected from its surfaces under circumstances similar to those in which a cricketer "fields" a ball; he puts his hands in the way of the moving ball and catches it, and knowing the distance of the batsman he recognises, by the hard impact of the ball, that the batsman has strong muscles, but he can gain thereby no idea as to his character. And so it is with objective intuition; we direct our eyes towards an object and catch thereby rays of light reflected from that object, at different angles, and by combining all these directions we recognise form and come to the conclusion that we are looking at, say a chair; the eye also tells us that rays are coming in greater quantity from some parts of it and we know that those parts are polished; the eye again catches rays giving higher or lower frequencies of

vibration and we call that colour ; our eyes also tell us that it intercepts certain rays reflected from other objects in the room, and we know that it is not transparent to light ; and those are our perceptions of a wooden chair. We know, however, with great precision the relative weights and the forces exerted in the combinations of the atoms composing matter ; we know that they vibrate ever quicker and quicker as their temperature rises, and, as the quicker they vibrate the less cohesion they have, so matter passes from the solid into the liquid and thence into the gaseous state as the temperature is raised. Our greatest Physicists are ever working on this subject, and the theory which explains the most and seems to fulfil the conditions under which these atoms act, points to each of these being a vortex in the ether, that subtle medium which, having the properties of a solid of almost infinite elasticity, we know to be universally present, as it is by means of that wonderful elasticity that we are able to receive the light from stars sunk far away in the depths of space. I cannot show you a vortex in the ether, but I can start one of these through the still air of this room, and at a distance of 50 feet you will be able to appreciate it as a considerable force. One of the most interesting and suggestive thoughts follows from the conception of an atom as a vortex in the ether. It can be shown that in a perfect fluid where there is no vortex motion no mechanical action can possibly start it, but where vortex motion once exists no mechanical action can possibly stop it. Under these conditions matter is proved to be a manufactured article, not made by natural physical forces but by some great supernatural power outside the visible universe, and once having been made it can only be destroyed by the action of that same creative force. I shall touch upon this subject later on, when I suggest a new conception of the meaning of Creation ; meanwhile, I will only ask you to consider how, owing to our senses being limited by the considerations of time and space, we are surrounded by inconceivables ; and yet it is those very inadequate conceptions which force us to acquire knowledge, the greatest incentive we have to pursue our investigation, as we have seen, is the fact that perception without sufficient knowledge leads us into difficulties. Let me give you two instances of these inconceivables :—Infinite space is inconceivable by us, but it is also quite as inconceivable to think of space being limited, and yet one of these two must be true. Again, matter is either composed of atoms of a certain size which cannot be divided, or is infinitely

divisible: both of these are inconceivable, the latter for the same reason as that of the extent of space, and the former because it is inconceivable that an atom could not be divided into two parts by a stronger force than at present holds it together. It might be suggested as an explanation that if an atom could be divided it might cease to be matter, its parts would have no existence, and this is corroborated in a wonderful way by the fact that one of these vortices disappears immediately and completely if cut in two.

Another example of perception leading to a false concept is our sense of pain; we apply a red-hot coal to the tip of one of our fingers and our perception would have us believe that we feel intense pain at the point of contact, but we know this to be a false concept, as it can be shown that the pain is only felt at the brain; there are in communication with different parts of our body small microscopical nerve threads, any of which may be severed with a penknife close to the base of the skull, with the result that no pain can then be felt although the finger-tip is seen to be burning away.

Another example is our sense of hearing. A musical sound is made up of a certain number of pushes in a second, but each push is silent; it is only, as we have seen, a musical sound to our sense when the pushes recur at intervals of not more than the sixteenth part of a second. The prongs of a tuning-fork vibrating five hundred times per second seem to be travelling very quickly, but are really only moving at the rate of five inches per second when the amplitude is the one-hundredth part of an inch.

Light is also composed of rills in the ether, but the rill itself is not light; it is only light when these rills strike with a certain enormous frequency on a special organ adapted for it, we might say, counting those frequencies, and if these frequencies fall below a certain number, or above twice that number, per second, there is no counting, there is no sense of sight. In fact, our physical senses are only adapted for appreciating frequencies within certain limits.

Let us now turn for a moment to our conception of the supernatural. Our earliest impressions are necessarily anthropomorphic; as children we are taught that God sees what we do, therefore He must have eyes; He listens to our prayers, therefore He has ears; He is able to walk in the Garden of Eden, therefore He has legs; He calls to Adam and speaks to His prophets, therefore He has a mouth; He sits on a Throne, therefore He has a body; and He raises His right hand when

He makes a solemn declaration, therefore He has arms; He is continually mentioned as being in certain definite places, He can therefore be localised. As our knowledge increases we find that these are conventional descriptions, but the former Conception clings tenaciously, and it is very common to hear statements showing that the Deity is looked upon as a magnified man with senses, greatly improved, but still limited; it is difficult for such persons to grasp the fact that God cannot be said to be *anywhere* but that *everywhere* God is. The principal difficulty is to realise that human conception is limited by considerations of Time and Space rendering motion a necessary basis for thought, but to the Spiritual, which transcends Time and Space, the only reality is the *here* in Space and the *now* in Time, and, to such motion can have no objective reality.

As in the case of the natural, the more we gain knowledge of our surroundings the nearer and nearer we get to the appreciation of *truth*, so may we see in the case of the supernatural that a knowledge of God is the *summum bonum* of our aspirations; that alone being able to give us a true conception of the Great Reality, the very essence of that personality which is necessary for each one of us if we are to experience everlasting life. Let us then take these two mysteries of Time and Space, the *for-ever* and the *never-ending*, and see whether we can get a clearer insight into the subject before us by tracing them to the utmost limit of human conception. I will first take the subject of Space, and I think the best method I can adopt will be to take you, in imagination, for a journey as far as is possible by means of the best instruments now in use. We will start from the sun, and, moving outwards, we will rapidly mark the number and character of the worlds involved in the solar system. Let us first understand what are the dimensions of our central luminary. The distance of the moon from the earth is 240,000 miles, but the dimensions of the sun are so great, that were the centre of the sun placed where the centre of the earth is, the surface of the sun would not only extend as far as the moon, but as far again on the other side, and that would give the radius only of the enormous circumference of the sun. Let us now start outward from this vast mass. The first world we meet is the little planet Mercury, only 3,000 miles in diameter, revolving round the sun at a distance of 36,000,000 miles. We next come upon Venus, at a distance of 67,000,000 miles. She is only 400 miles smaller in diameter than our earth, and with the dense atmosphere with which she is surrounded, animal and vegetable life similar to that on our earth may be possible. Continuing

our course, we arrive at our earth, situated 95,000,000 miles away from the sun. Still speeding on, a further 50,000,000 miles brings us to Mars, with a diameter of nearly 5,000 miles, and accompanied by two miniature moons. The conditions on this little globe are probably more like those of the earth than on any other planet, and its day is almost the same length, namely, 24 hours 39 minutes. The sight of this planet in a good instrument is most interesting. Oceans and continents are plainly visible, and the telescope shows large tracts of snow, though not necessarily water snow, surrounding its polar regions, which increase considerably during the winter, and decrease during the summer seasons on that planet.

The distances we now have to travel become so great that I shall not attempt to give them; you can, however, form an idea of the tremendous spaces we are traversing when you consider that each successive planet is nearly double as far from the sun as the preceding one.

In the place where we should expect to have found the next world we find a group of small planets ranging in size from about 200 miles in diameter down to only a few hundred yards. They pass through nearly the same point once in each of their periods of revolution, and it has been suggested that they are fragments of a great globe rent asunder by some mighty catastrophe; about 400 have been discovered and named.

We now continue our voyage over the next huge space and arrive at Jupiter, the largest and most magnificent of the planets. This world is more than 1,000 times larger than our earth, its circumference being actually greater than the distance from the earth to the moon. It has five moons, and its year is about twelve times as long as ours. Pursuing our journey, we next come to Saturn. It is nearly as large as Jupiter, and has a huge ring of planetary matter revolving round it in addition to eight moons. Further and further we go and the planets behind us are disappearing, and even the sun is dwindling down to a mere speck; still we hurry on, and at last alight on another planet, Uranus, about 60 times larger than our earth. We see moons in attendance, but they have scarcely any light to reflect. The sun is only a star now; but we must hasten on deeper and deeper into space. We shall again, as formerly, have to go as far beyond the last planet as that planet is from the sun. The mind cannot grasp these huge distances. Still we travel on to the last planet, Neptune, revolving on its lonely orbit sunk so deep into space that though it rushes round the sun at the rate of 22,000 miles per

hour, it takes 164 of our years to complete one revolution. Now let us look back from this remote point. What do we see? One planet only, Uranus, is visible to the unaided eye; the giant planets Jupiter and Saturn have disappeared, and the sun itself is only a star; no heat, no light, all is darkness in this solitary world. Thus far have we gone, and standing there at the enormous distance of 3,000,000,000 miles from our starting point, we can begin to comprehend the vast limits of the solar system; we can begin to understand the ways of this mighty family of planets and satellites. But let us not set up too small a standard whereby to measure the infinity of space. We shall find, as we go on, that this stupendous system is but an infinitesimal part of the whole universe.

Let us now look forward along the path we are to take. We are standing on the outermost part of our solar system, and there is no other planet towards which we can wing our flight, but all around are multitudes of stars, some shining with a brightness almost equal to what our sun appears to give forth at that great distance, others hardly visible, but the smallest telescope increases their number enormously, and presents to our mind the appalling phantom of immensity in all its terror standing there to withstand our next great step. How are we to continue on our journey when our very senses seem paralysed by this obstruction, and even imagination is powerless from utter loneliness? One guide only is there to help us, the messenger which flits from star to star, universe to universe; light it is which will help us to appreciate even these bottomless depths. Now, light travels 186,000 miles per second, or 11,000,000 miles every minute of time. It therefore takes only about four hours to traverse the huge distance between our sun and Neptune, where we are now supposed to be standing. But to leap across the interval which separates us from the nearest fixed star, will require a period not to be reckoned by hours or by days or by months, long years must roll away before light, travelling with its enormous velocity, can complete its journey. Let us use this to continue on our voyage. On a clear night the human eye can perceive thousands of stars in all directions, scattered without any apparent order or design; but in one locality, forming a huge ring round the heavens, there is a misty zone called the Milky Way. Let us turn a telescope with a low aperture on this, and what a sight presents itself. Instead of mist, myriads of stars are seen surrounded by nebulous haze. We put a higher aperture on, and thus pierce further and further into space; the haze is resolved into

myriads more stars, and more haze comes up from the deep beyond, showing that the visual ray was not yet strong enough to fathom the mighty distance; but let the full aperture be applied and mark the result. Mist and haze have disappeared; the telescope has pierced right through the stupendous distances, and only the vast abyss of space, boundless and unfathomable, is seen beyond. Let us pause here for a moment to think what we have done. Light, travelling with its enormous velocity, requires as a minimum average ten years to traverse the distance between our solar system and stars of the first magnitude; but the dimensions of the Milky Way are built up on such a huge scale that to traverse the whole stratum would require us to pass about 500 stars, separated from each other by this same tremendous interval; 10,000 years may therefore be computed as the time which light, travelling with its enormous velocity, would take to sweep across the whole cluster, it being borne in mind that the solar system is supposed to be located not far from the centre of this great star cluster, that the cluster comprises all stars visible arrayed in a flat zone, the edges of which, where the stratum is deepest, being the locality of the Milky Way.

Let us once more continue our journey. We have traversed a distance which even on the wings of light we could only accomplish in 10,000 years, and now stand on the outskirts of a great star cluster, in the same way, and, I hope, with the same aspirations, as when we paused a short time ago on the confines of our Solar System. Behind us are myriads of shining orbs, in such countless numbers that human thought cannot even suggest a limit, and yet each of these is a mighty globe like our sun, the centre of a planetary system, dispensing light and heat under conditions similar to what we are accustomed to here. Let us, however, turn our face away from these clusterings of mighty suns, and look steadfastly forward into the unbroken darkness, and once more brace our nerves to face that terrible phantom—immensity. We require now the most powerful instruments that science can put into our hands, and by their aid we will again essay to make another stride towards the appreciation of our subject. In what to the unaided was unbroken darkness, the telescope now enables us to discern a number of luminous points of haze, and towards one of these we continue our journey. The myriads of suns in our great star clusters are soon being left far behind; they shrink together, resolve themselves into haze, until the once glorious universe of countless millions of suns has dwindled down to a mere point of haze almost invisible

to the naked eye; but look forward: the luminous cloud to which we are urging our flight has expanded, until what at one time was a mere patch of light has now swelled into a mighty star cluster; myriads of suns burst into sight—we have reached the confines of another Milky Way as glorious and mighty as the one we have left, whose limits would require 10,000 years to traverse; and yet in whatever direction the telescope is placed, star clusters are to be seen strewn over the whole surface of the heavens. Let us take now the utmost limit of the telescopic power in every direction. Where are we after all but in the centre of a sphere whose circumference is 100,000 times as far from us as the nearest fixed star, and beyond whose circuit infinity, boundless infinity, still stretches unfathomed as ever; we have made a step indeed, but perhaps only towards acquaintance with a new order of infinitesimals; once the distances of our solar system seemed almost infinite quantities; compare them with the intervals between the fixed stars, and they become no quantities at all. And now when the spaces between the stars are contrasted with the gulfs of dark spaces separating firmaments, they absolutely vanish below us. Can the whole firmamental creation in its turn be only a corner of some mightier scheme? But let us not go on to bewilderment; we have passed from planet to planet, star to star, universe to universe, and still infinite space extends for ever beyond our grasp. We have gone as far towards the infinite as our sight, aided by the most powerful telescope, can hope to go. Is there no way then by which we can continue our journey further towards the appreciation of this infinity? A few years ago we should probably have denied it was possible for man to go further; but quite lately a new method of observation has been developed. This I shall take for my next stepping-stone.

Let us first consider this question: Why is it that the further an object is withdrawn from the eye the fainter and smaller that object becomes, until at last it disappears altogether from the sight? There are two quite distinct reasons for this. First, the rays from any shining point diverge from such point in all directions; hence the nearer the object the greater the number of rays which will enter the pupil of the eye; and, conversely, when the object is removed to a great distance, so small a quantity of light finds its way into the eye that it fails to excite the retina sufficiently to cause the impression of sight, and the object is invisible. Now, if you take a lens, or what is popularly called a burning-glass, and place it in the beams of the sun, you will see that it gathers all the

rays falling on its surface into a bright point of light behind it; now place such a lens between your eye and a star, taking a star so far away that the eye unaided can only just see it as a glimmer of light, what happens? Why, instead of the eye receiving only a faint and almost imperceptible quantity of light, it appears now to take in the whole mass of rays which pass through the larger lens; for the lens has caused them to converge into a pencil of light sufficiently minute to enter the eye; thus the eye receives as much light as though the pupil had been enlarged to the dimensions of the lens. Thus armed, to what remoteness may we not now reach? The star might now be withdrawn so deep into space that the whole light concentrated by the lens is not more intense than the faint ray was from the star in its first position; and this mighty acquisition has been attained by the simple interposition of a piece of glass, and of course the larger the lens the further we can pierce into space. We now come back to the second part of our question:—"Why does an object become apparently smaller and smaller as it is withdrawn from the eye, until it at last disappears from sight?" The reason is, that the eye is a very imperfect instrument for viewing objects at a great distance; the eye can only see an object when it is near enough to subtend a certain angle, or in popular language, to show itself a certain size, in fact, the eye cannot single out and appreciate parallel rays. Could it do this, objects would not grow smaller as they are removed. This pencil might be removed to the moon, 240,000 miles away, and would still appear to the eye the same size as it does here close to you, but the result would be inconvenient. You would never be able to see at one and the same time anything larger than the pupil of your eye. The beauties of the landscape would be gone, and our dearest friends would pass us unheeded and unseen; everyday life would resolve itself into a task similar to that of attempting to read our newspaper every morning by means of a powerful microscope; we should commence by getting on to a big black blotch, and, after wandering about for half an hour, we might then begin to find out that we were looking at the little letter e, but anything like reading would be quite out of the question. We may, therefore, be thankful that our eyes have the imperfection of not appreciating parallel rays. But we will now consider how this imperfection may be remedied by science. There are two ways of doing this, viz., firstly, by increasing the amount of light received, by means of telescopes of great aperture; and

secondly, by employing an artificial retina a thousand times more sensitive than the human. Now the human retina receives the impression of what it looks at in a fraction of a second, provided, of course, that the eye is properly focussed, and no further impression will be made by keeping the eye fixed on that object. But in celestial photography, when the telescope is turned into a camera, the sensitive plate having received the impression in the first second may be exposed not only for many seconds or minutes or hours, but for an aggregate of even days by re-exposure, every second of which time details on that plate new objects sunk so far in the vast depths of space as to be immeasurably beyond the power of the human eye, even through telescopes hundreds of times more powerful than the largest instruments that science has enabled us to construct, and yet here is laid before us a faithful chart, by means of which we may once more continue our journey through space. A short exposure will show us firmaments and nebulae just outside the range of our greatest telescopes, and every additional second extends our vision by such vast increases of distance that the brain reels at the thought; and yet, as we have seen, exposures of these sensitive plates may be made not only for seconds, but for thousands and even hundreds of thousands of seconds! And still there is no end, no end where the weary mind can rest and contemplate; the mind of man can only cry out that there is no limit. In spite of all its strivings and groping by aid of speculative philosophy, the finite cannot attain to infinity, nor get any nearer to where the mighty sea of time breaks in noiseless waves on the dim shores of eternity.

Let us now examine in a similar manner the second great mystery, the Infinity of Time.

With this object in view we will first consider the human sense of sight and hearing, and take sound, or the vibrations which affect the drum of the human ear. Sound travels in air at about 1,130 feet per second, and if the vibrating body giving out the sound oscillates sixteen times in one second, it follows that, spread over this 1,130 feet, there will be sixteen waves, giving a length of about 70 feet to each wave. This is the lowest sound that the human ear can appreciate as a musical note. When the number of vibrations in a second sinks below sixteen, the ear no longer appreciates them as a musical sound, but hears them as separate vibrations or beats. The best instrument for illustrating this is the "Syren." This comprises a disc with sixteen holes pierced at regular intervals round the

edge, a jet of high pressure air is forced through each of the holes successively as they revolve. When the disc does not quite complete one revolution in a second, only fifteen puffs come to the ear in a second of time, and they are heard as puffs; but when the rate reaches one revolution in a second, the sound, as if by magic, changes into the lowest musical sound. The octave above this is obtained by doubling the number of puffs, namely, by revolving the disc twice in one second, and the next octave by revolving four times in a second, and so on, until at about the thirteenth octave the sound has become so high that the majority of listeners cannot hear it, and fancy it must have stopped, whereas a few will still be saying, "How shrill it is." At last, at about the fourteenth octave, it passes beyond human audition, and although we can show that the air is still vibrating, all is silent, the ear being incapable of hearing so many beats in a second. It is, however, possible to make these higher vibrations perceptible to our senses. We can actually measure the length of these silent waves, and as we know the rate at which they travel, we can at once compute the number which occur in a second of time and thus ascertain their pitch. We now have to travel only about forty octaves before we arrive at those subtle frequencies which the eye appreciates as light. Beginning with red, the effect transmitted to the brain passes to orange, yellow, green, blue, indigo and violet; only about one octave that the eye can appreciate, and all is darkness; but we can still go on a little further by the help of Science. Beyond the violet we have the actinic or chemical rays, which are used in photography, and which enable us to trace the frequencies for a further two octaves. Beyond this we cannot pierce with our present knowledge; but there may be, and probably are, latent in our nature, senses which, properly developed, will be able to appreciate still more subtle vibrations, and organs which perhaps even now are being prepared for the reception of these subtle influences. Science steadily points to electricity and magnetism being a form of motion, and it may be that in these invisible rays we may some day discover the nature of those mysterious forces. We want, as it were, a special "microscope" to examine these vibrations, which I shall refer to later on, and a similar method to that already mentioned in Space under Celestial Photography, to traverse and examine hundreds or thousands of octaves by each second of exposure; for although the path extends to infinity, we have already arrived at the utmost limits of our finite senses, and find that after all we can only appreciate, as it were, a few inches along the huge line of

infinite extent, stretching from the Creator, the infinite down to the created or finite; and bear in mind that we have only travelled in one direction; the path we have taken extends in the opposite direction also to infinity. We started with sixteen vibrations in a second, as the lowest number we human beings can appreciate as a musical sound; let us now descend by octaves. The octave below is eight vibrations in a second; the next four; then two; and then one vibration in a second. But we do not stop there. The octave below this is one vibration in two seconds, then in four seconds, eight seconds, sixteen seconds, and so on, until it is possible to conceive that even one frequency in a million years might be appreciated as a musical sound, or even as one of the colours of the spectrum, by a being whose senses were greatly extended in both directions, but still finite.

Once more we must call a halt. Our finite minds become bewildered in attempting to even glance at these infinities of time.

We measure space by miles, yards, feet, and inches; we measure time by years, hours, minutes, seconds; and by these finite means we try to fathom these two marvellous infinities. With our greatest efforts of thought we find, however, that we can get relatively no distance whatever from the *HERE* of Space and the *NOW* of Time. It is true that the *present*, as a mathematical point, appears to be hurrying and bearing us with it along the line stretching from the past to future eternity, but in reality we get no further from the one nor nearer to the other. Let us change our view, and examine this subject under a different aspect.

First of all, look round this room and note the different objects to be seen. Even in so small a room you do not see the objects as they really are at this instant, but as they were at a certain fixed length of time ago. Those objects which are further away are further behind in point of time than those that are nearer to you—in fact, however near you are to an object, you can never see it as it is but only as it was. We are dealing with very minute differences here, they being based on the rate at which light travels; but they are differences which are known with a wonderful degree of accuracy.

Now let us follow our subject. The moon is 240,000 miles distant. We do not, therefore, ever see her as she is, but as she was $1\frac{1}{4}$ seconds ago. In the same way we see the sun as he was eight minutes ago, and we see Jupiter as he was nearly an

hour ago. Let us go further to one of the nearest fixed stars. We see the star as it was more than ten years ago; that star may therefore have exploded or disappeared ten long years ago, and yet we still see it shining, and shall continue to see it until the long line of light has run itself out; all around us, in fact, are the appearances of blazing suns as they were thousands of years ago, and by the aid of the telescope and of our sensitive plate, we catch the light which started from clusters and firmaments probably millions of years ago. Now let us take the converse of this. To anybody on the moon the earth would be seen as it was $1\frac{1}{4}$ seconds ago, and from the sun as it was eight minutes ago; and if we were at this particular moment in Jupiter, and looking back, we should see what was happening on this earth an hour ago, namely, when you were arriving at this house. Now let us go in imagination to one of the nearest fixed stars, and looking back we should see what was happening 10 years ago; and, going still further to a far-off cluster, the light would only just now be arriving there which started from the earth at the time when man first appeared, and all the events which have taken place from that remote time to the present would, as time rolled on, reach there in exactly the same succession as they have happened on this earth.

Let us now come, in imagination, towards the earth, from some far-off cluster of stars. If we traverse the distance in one year, the whole of the events from the creation of this world would appear before us, only thousands of times quicker. Make the journey in a month, a day, an hour, a second, or a moment of time, and all past events, from the grandest to the most trivial, will be acted in an infinitesimal portion of time.

Do not these thoughts make clear some of those metaphysical enigmas which confront us whenever we see great injustice being perpetrated and crimes remaining undiscovered. Let us but turn to any point of space and we shall find at each point, according to its remoteness, the actual deeds being enacted, whether for good or whether for evil, in fact it may be said that throughout infinite space every event in past eternity is now and will be for ever and ever indelibly recorded. A crime committed hundreds or thousands of years ago may never have been found out; but for ever and ever there is and will be to eternity depicted in space the actual living scene from beginning to end. The criminal and his victim have alike died and turned to dust; the place and surroundings have been swept away from the present *here*; but for ever and ever

the whole tragedy will be acting *there* in the presence of the Great Reality; when we have fully grasped this, we recognise that omniscience is synonymous with omnipresence, and we appear to have here an insight into that Great Book wherein are registered every thought, word and deed which in the direction of the Reality has helped to nourish, or, in the direction of the shadow, has tended to starve the *personality* of each one of us, for we know that every word we utter or that has been uttered from the beginning of the world and every motion of our brain connected with thought, is indelibly imprinted upon every atom of matter. If our sense of perception were greatly increased we need not go to Palestine to see on the rocks *there* the impressions of the image of Christ and His disciples or the words they uttered as they passed by, but any stone by the wayside *here* would show His every action and resound with every word He uttered. In fact, every particle of matter on this earth is a witness to that which has happened, every point in space and every moment in time contains the history of the past in the smallest minutiae. The *here* embracing all space and the *now* embracing all time are the only realities to the Omniscient.

Let us once more change the scene and we may grasp even more clearly that Time is not a *reality*, but is only a mode or condition under which our material senses act. A tune may be played either a thousand times slower or a thousand times quicker, but it still remains the same tune, it contains the same sequence of notes and proportion in time, the only characteristics by which we recognize a tune. And so in the same way with our sense of sight, an event may be drawn out to a thousand times its length or acted a thousand times quicker, it is still the same scene. An insect vibrates its wings 10,000 times in a second and must be cognizant of each beat, whereas we have seen that we, with our senses of sight and hearing, can only appreciate at the most respectively seven and twenty vibrations in a second as separate beats. That insect must therefore be able to follow the life of a plant or a flash of lightning under the conditions of a microscope magnifying several thousand times compared with our vision. The whole life of some of these insects extends over a few hours only, but is to them as full of detail as our life of 70 years, but to them there is no day or night, the sun is always stationary in the heavens, they can have no cognizance of seasons. If, on the other hand, we take the converse of this, we may conceive conditions under which the power of appreciation might be reduced to only one

vibration in twenty-four hours; there could then be no knowledge of the sun except as a broad band of light always extending across the heavens, one could not follow its movements so as to see its shape. Let us look at this from another aspect: we are looking at the insect whose wings are beating 10,000 per second and if we travel away from it at the rate of light, the present will always be with us; the wing, although still vibrating at that enormous rate, will appear to be stationary and will continue in that state for a million years provided we continued our flight with the rays of light. If we travelled a little slower than light, say one minute less in a thousand years, the same scene would be presented to us, but that which was acted upon this earth during one minute of time would now take a thousand years to accomplish; the swiftest railway train would appear standing still, it would take $5\frac{1}{2}$ days and nights to cover each inch of ground. It is thus possible to understand how the growth of a flower, the flight of a bird, or the lightning flash might be drawn out and examined under conditions of time which would lead to the discovery and tracing of even the principle of life itself. The same conditions may be attained by greatly increasing our power of perception, and I have been able to construct what may be called a time microscope to show this effect. Instead of an insect's wing I use a large tuning-fork kept in rapid vibration by an electro magnet, the whole being projected on a screen and, as our perception is increased, the projection of the tuning fork on the screen will be seen to slow down and at last come to rest, although it can still be seen and heard vibrating at its full capacity. But let us go one step further and increase our flight beyond the rate at which light travels, scenes would now progress in the opposite direction to that which we are accustomed to; men would get out of bed and dress themselves at night and go to bed in the morning, old men would grow young again, tall trees would grow backwards and enter the earth, embedding themselves in the seed, and the seed would rise upwards to the branch that nourished it; the dead would be taken from their graves, brought back to their homes. The future would change places with the past, the effect would give birth to the cause as presented to our finite senses; but to the Great Reality there is no change, the here and the now comprising all beginnings, ends, causes and effects.

Once more we must call a halt: we again see that time and space are only relative modes by which our senses appreciate our surroundings; if everything connected with us were from this moment to move twice as quickly and be half the size, we should

be absolutely ignorant of the change, and if this were carried to extremes and everything happened infinitely quicker and all our surroundings became infinitely smaller, we could have no cognizance of the change, our sun and the stars with their respective distances might be reduced in size until they were no larger than the molecules of iron in the blade of a pocket-knife, or infinitely smaller, an eternity compressed into a moment, but our earth would continue on its orbit round the sun, our daily life would go on as usual, and we should have no knowledge of change. We must recognize, therefore, that time and space are not realities but are limits only, set to our corporeal senses, in fact, they are but transient conditions under which matter exists. The Spiritual, the Present, the Here, are the only realities, all else is but shadow which will cease to exist when the Light of Truth reigns supreme.

With these conclusions before us I will suggest a new conception of the Creation. All creation around us is the materialisation of the Thought of the Deity, He does not require time to think as we do, the whole of the Universe is therefore one instantaneous thought of the Great Reality; the forming of this world and its destruction, the appearance of man, the birth and death of each one of us, is absolutely at the same instant, it is only our finite minds which necessitate drawing this thought out into a long line, and from our want of knowledge and our inability to grasp the whole, conceiving that one event happened before or after another. In our finite way we examine and strive to understand this wondrous Thought, and at last, a Darwin, after a lifetime spent in accumulating facts on this little isolated spot of the Universe, discovers what he thinks to be a law of sequences and calls it the evolution theory, but this and other theories are probably only one of countless other modes by which the *intent* of that Thought is working towards completion, the apparent direction of certain lines on that great tracing board of the Creator whereon is depicted the whole plan of His work.

Let me give you a similar example of creation by a word which even our finite minds can grasp. When I utter the word *cat*, it starts a practically instantaneous thought in your minds, the power of that thought being dependent upon the knowledge you have gained. If you analyse it you will find that, though instantaneous, it comprises all the sensations you have ever felt on that subject throughout your whole life. It commenced, perhaps, when you were only a year old, and sitting on your mother's knee, your hand was made to stroke a kitten, and you

felt it was soft and it gave you pleasure; later on when you were older you had it in your arms, and you felt the first intimation of that wonderful *στοργή* which manifests itself in most children in their love for dolls, it was delightful to cuddle, and that it purred; later on you found that it played with a reel of cotton and that it could scratch, make horrid noises, and many other things which make up the life of a cat and connect it with its surroundings. All these thousand and one facts are now drawn out, by analysis in Time and Space, in a long line, and are placed one in front of the other, but the thought started by the word cat was a fair example of an instantaneous creation. One other example of an instantaneous thought:— Let us suppose a large room fitted with, say, a hundred thousand volumes comprising all the knowledge gained by every specialist in every science concerning the plan of Creation. In our finite minds, under the limits of Time and Space, the word representing that library would start, when uttered, an instantaneous thought analogous to that of our last example, according to the knowledge that each individual had already acquired of the contents of those books, but this knowledge had only been gained by taking down each volume separately and reading one book at a time, beginning at the beginning and taking each page in succession, and a lifetime would not suffice to enable us to read them all, whereas if our knowledge were complete, if we were omniscient, the word representing the contents of that room would start an instantaneous thought comprising not only every book, but every chapter, page, word, letter and punctuation contained in that library or in one which comprised all knowledge from the beginning to the end of Time.

May we not carry the analogy even further and see that as our conception of a cat was made up of numberless small acquisitions of knowledge, some of which had to be discarded or eliminated as errors from our minds as our knowledge grew, and as each true fact became confirmed and impressed upon our brain, it made itself a *permanent* record, so in this wonderful thought of the Great Reality, whose mind may be said to be omnipresent, each individual soul is a working unit in the plan of creation; each unit as it gains a knowledge of the will or intent of the Deity forms for itself a personality helping forward the work towards its fulfilment; without that knowledge there can be no personality, no unit in the great completed thought, no life hereafter; may we not even carry the analogy one step further and see that, as in the case of our conception

of a cat when fully formed, certain *permanent* records on our brain are made use of for forming new concepts on other subjects, so it may be that we shall be employed to eternity in working out other plans of the Great Reality, when His new thoughts touch upon those particular traits which find a sympathetic response in our personalities; we shall in fact carry with us vestiges of numberless completed creations, each one of which will beautify and intensify our personalities. Does not this conception open up a wonderful vista of our noble inheritance in the great scheme of creation, and how we, when carrying out His will, are truly offsprings from the Great Reality?

In conclusion, let us once more realise that to the Great Reality neither time nor space exists as an objective, the beginning and end coalesce; a million years is coincident with a moment of time, and we can then perceive the fallacy of the stock argument that "The belief in omniscience necessitates a belief in fatalism." The future is present to the spiritual; though to our senses a million years is almost unimaginable, and every moment of that time events are subject to the free-will action of man, yet to the spiritual there are no such limits; the creation of the world and its future dismemberment, the birth of each one of us and our death, must be at the same moment. We can therefore understand how the Great Reality is cognizant at this very moment of what will be taking place millions of years hence without in any way interfering with the free-will of those who live and act during that period; in fact to the spiritual the present includes the whole of past eternity and overlaps future eternity. The spiritual which had no beginning and will have no end, is always in the *present* and comprises *everywhere*, the here and the now being the only realities. When we have once grasped this we begin, perhaps for the first time, to penetrate the meaning of those mysterious words of Christ:—

"Verily, verily, I say unto you before Abraham was I am" (*ἐγὼ εἰμὶ*).

DISCUSSION.

The CHAIRMAN.—We have to thank the lecturer for this exceedingly interesting and very valuable appeal to our thoughts and to our imagination to realize one of those profound conceptions. I do not know that they are not altogether unrealizable; but the nearer we get to them the better it will be for our metaphysical

condition. We are conditioned in Time and Space, we are conditioned in finality, and by reason of the imperfection of our nature we may guess that we must be so conditioned in order to work out our life. We work subject to those conditions, and if we try to know everything that is not our business, to know and try to understand the Infinite, we run our heads against something, and the sooner a child learns that it hurts its head to run it against a door the better. It seems to me that the line of thought presented here is valuable. The power of conception by the senses of course varies in different animals. I believe a dog's conception of sound is keener than ours, and that he can hear a considerably higher octave than we can. Again, a cow can hear considerably below. For myself I have grave doubts whether grasshoppers, for instance, make any noise except occasionally; I have heard members of my family say, "What a fearful noise they were making!" As far as my knowledge goes they do not make a noise, and possibly there are other things where one is equally unable to grasp the whole. It is humiliating, but I think it is very wholesome, to have this sense of limitation of our thoughts, and if we carry it out the world-old puzzle of Predestination and of Free Will is only caused by this idea of ours that we understand things absolutely, and that, therefore, that sequence of thought that is present to our minds is the thing itself. Words fail when we contemplate the absolute existence of Time and Space, and the more we think of it the more we doubt.

Rev. F. A. WALKER, D.D.—The author says, "An insect vibrates its wings 10,000 times in a second." It would be useful to know what insect he refers to, or whether it usually vibrates its wings so many times a second. I think the vibration of the wings of an insect is caused in great measure by the circumstances under which the insect finds itself, and that if the insect is in a condition of hunger or fright it will vibrate its wings much more rapidly than ordinarily. A blue-bottle fly, when caught by a spider, will vibrate its wings very rapidly, and clutch the spider in its efforts to escape, and so rapidly will it vibrate its wings that you can scarcely see them. The wings become more visible again as its physical condition becomes weaker, and it succumbs to the spider, but it would be interesting to know if the ordinary vibrations are so rapid as stated here. Again, Mr. Klein mentions an instance of an insect's

wings vibrating and states the effect of using a large tuning-fork. It is a well known fact that if you produce a very slight vibration with a tuning-fork in close proximity to a spider's web, a vibration so feeble that the human ear will scarcely take it in, the spider, nevertheless, hears it, the sense of sound being greater in the lower animals; in fact, the sense of hearing in the spider I imagine is much more acute than its power of sight.

The AUTHOR.—I have often brought spiders out of their webs by sounding a tuning-fork near them. I believe you taught me how to do it in our earlier days.

Rev. F. A. WALKER.—Spiders that have no webs are much slower in catching their prey than those that work by sound. Spiders that weave a web work by sound, and they hear the vibrations of the wings of an insect, but spiders that do not weave a web work by sight, and in pursuing their prey they frighten the insect.

[The Chair was then vacated by Mr. HOWARD and taken by Captain HEATH.]

Mr. MARTIN ROUSE.—I should like to ask the lecturer to kindly re-state the arguments derived from rapidity of hearing and his observations by which he arrives at the conclusion that past, present and future are all one to God.

The AUTHOR.—I drew up five or six conclusions upon this paper which, perhaps, may give you what you want if I may read them.

Conclusions to be drawn from Paper on "The Conception of the Great Reality."

No. 1. As we gain a knowledge of the Reality, and our personality becomes a real power, we approach the point where we may even feel that we are thinking, or having divulged to us, the very thoughts of God.

No. 2. "Infinity" is non-existent, it is a self-deception, a figment created by the finiteness of our senses, the necessarily pseudo-conception formed by our senses which (cramped by the dominion of time and space) are incapable of grasping the *whole* reality.

No. 3. "Duration" in Time and "Extension" in space, the twin mysteries which ever elude our grasp when we try to analyze them (because they are simply modes under which our senses act), are yet

absolutely necessary to us for perception. Without the former we could have no cognizance of warmth, pitch in sound, or colour in light, and without the latter the time beats being without amplitude, would have no power to affect our senses. When combined they give us the impression of motion, without which we should have no consciousness of living.

For convenience we arbitrarily divide Time into two parts, namely, past and future eternities, and space into the infinitely small and the infinitely great: In the case of Space, we treat its two divisions on equal terms, but in the case of its twin sister Time we have unaccountably got to look upon the future as non-existent until we arrive at, and are able to perceive with our senses, what is happening there. This curious state of things is probably only accidental to the present stage of development of the human mind, and may at any time be rectified; it would anyhow seem to be as reasonable to maintain in the case of Space that when travelling towards a foreign town, that town does not really exist until we arrive there. Time and Space may in a certain sense be looked upon as two great permanent existences, but in reality the former is all contained in the *now*, and the latter in the *here*. It is only our finite mode of perception under present conditions which prevents us seeing each as a whole, as stated in Conclusion No. 2.

No. 4. When we increase the rate of perception until it is equal to what may be called the Flow of Time, we enter into the *now*, the permanent existing present, where motion ceases to exist; the same condition is attained by *either* increasing the rate of transmission in Space until it is equal to the rate of transmission of those frequencies which are the very base of all perception, *or* by increasing the extension in Space of the perceptive sense until it becomes omnipresent. In both cases the *now* and *here* are reached.

No. 5. If our senses were extended so as to be capable of perceiving the *whole* truth, we should realise that the only reality is the spiritual, the here and the now.

The difficulty of forming a true conception of the Reality is increased by our not generally recognising the following:—

First.—That the invisible is the real, the visible is only its shadow.

Secondly.—God cannot be said to be anywhere, but that everywhere God is.

Thirdly.—That our senses only perceive the surface of things.

Nature may be likened to the glass of a window upon which may be seen patterns, smudges, dead flies, etc. ; it requires a knowledge of the reality to enable us to look through the glass at the reality which is beyond.

Fourthly.—That it is not we who are looking out upon Nature, but that it is the Great Reality which is looking into us and persistently trying to tell us the sublimest truths.

Mr. MARTIN ROUSE.—I wanted to say that I did not understand how there can be no sequence to God. If One cannot see faster than light and yet only as slowly as light, He cannot see at two different rates at the same moment, and therefore He must have one definite rate of seeing, and if He sees at one definite rate, then He sees each event in succession, and therefore there must be a past as well as a present and future to Him.

Rev. JOHN TUCKWELL.—I thought I should like to say a few words ; but at this late hour they will be few. I cannot help thinking that admirable though this paper is in its intention, and though it is valuable and suggestive, there are a great many sentences in it that need to be corrected. I think the writer of the paper has, at all events, got into some confusion in the use of the word *reality*. In some cases he prints it with a small *r*, and in other cases with a large *R*. I suppose the capital letter indicates some slightly different conception in his own mind to that indicated by the small *r*, but surely God is not the only reality !

I confess the paper is confusing, and I hope the lecturer will revise it so that it may be a little more accurate in some of its details.

I would refer to one of his illustrations. He has told us that as you get away from the world you see things that transpired yesterday ; and then, further away, things that transpired a year ago and a century ago, and so on. But I think he has forgotten to prove to us that ether exists everywhere. How do we know to what extent throughout Space ether exists ? All this is based on the assumption that ether exists universally throughout Space, and this conclusion as to the presence of everything at one moment is all dependent on waves, or rills, whatever may be the correct expression, in this mysterious substance, ether. But you have there the idea of succession. Every wave of the ether, every beat of the insect's wing, is preceded by one beat and is followed by another beat. Here you have, in the very language of the paper, a denial

of many of its propositions. You have succession. We are told that an insect's wing beats 10,000 times a second, which means that you have a first beat, a second beat, a third beat and so on, up to the 10,000 beats. What is that but succession? are we to suppose that all those beats take place instantly at the same moment? If they do not there is succession, and if succession there is Time, and if there is Time the whole of the reasoning, on this basis, falls to the ground completely. But I think the lecturer has also got into confusion between our conception of things and the conceptions of the Divine Being. I can easily understand, at least it is thinkable and believable, of course, that to the infinite mind everything is present, that there is nothing past and nothing future in the infinite thought. All is present to Him which is not to my finite mind; but I am not God, and God is capable of creating a universe that is not Himself, and in this universe He is capable of creating beings whose senses do not deceive them. Bishop Butler says, "God did not give us our senses to deceive us," and though I am not certain what light or matter may be, there is something that occurs to me to give me the idea of light as I look at a window. There is a horse yonder, which was not there a little while ago, and I believe there is something there, and that this is an objective universe, and that there is something outside my own consciousness; and therefore, whatever may be the fact concerning the mysteries of the divine being, though He made me, not like Himself in every respect, or equal to Himself, I have some notion that His works are objective realities.

I have thrown out these undigested thoughts to show that we are on safe ground when we hold to our old belief that there is an Infinite Being, that we are creatures surrounded by objective realities, that the future is future and the past is past, that there is something that corresponds with these expressions, something that corresponds with the idea of past, present and future, and that the common sense view of the world and realities is the true one.

Mr. BOSCAWEN.—I think the mere fact that we are finite creatures impels us to know the Infinite. It is an ideal we cannot reach, but to which we always look and like to look. It is an unknown quantity. The mere word *finite* implies Infinite, something beyond us, and whether we call it God, or whatever we call it, we must admit that there are things beyond us which we cannot realize.

I agree with Mr. Tuckwell in one respect, that it is a very curious paper. There are many things in it which we can agree with, and many things we cannot agree with. But whatever view you put on it you must remember this, that the human intellect is limited, and that there are things around us to-day with which we are familiar which years ago would have amazed us.

The CHAIRMAN.—Allow me to convey a very hearty vote of thanks to the author for his paper, and for the immense amount of valuable matter which it contains.

The SECRETARY (Professor EDWARD HULL).—I beg to second that. I feel very grateful to the author of the paper for the great pains he has taken, but I must say it is a paper that will require considerable consideration on the part of the Council.

The vote of thanks having been duly carried, the Meeting closed.

Remarks by Professor LANGHORNE ORCHARD.

Though this paper contains much that is interesting, suggestive, and ingenious, the reasoning does not appear to be free from fallacy. The argument developed in the paper is surely based on misapprehension. The velocity with which light travels, and that with which an observer's eye travels, could in no case affect the successiveness in arrival of pictures of scenes enacted at different distances of time or space. Although an omnipresent Being might perceive all past visible scenes in pictures simultaneously present, this is no proof that past events are not really past. Present knowledge of a past event is not knowledge of a past event as a present event. The panorama does not constitute the history it represents. An event is one thing, knowledge of it is another.

Another curious fallacy occurs in connection with the Author's theory of Creation, where an "instantaneous thought" is called an "instantaneous creation," as though a "thought" was the same as a creation. The origin of a concept is, however, not a creation of the object. It is noticeable, also, that the Author admits a *succession* of such origins. May I suggest that the word "Externalization" should be substituted for "materialisation"? The fact that Past and Future are as real as Present is indicated by all three being elements in the sacred name Jehovah. It is also witnessed to by our intuitions, which cannot have been given in order to deceive us.

THE AUTHOR'S REPLY.

The AUTHOR.—In replying to the discussion, I cannot help expressing a regret that those who have spoken have not attempted to criticise the general plan of argument of the paper, especially as among the Members of this Institute we have so many deep thinkers who are capable of adding much to the interest of the subject. Indeed, with the exception of the Chairman, not one of those who took part in the discussion appears to have grasped the design for which it was written. The title of the paper was originally "*Our* Conception of the Great Reality," but our Secretary, or the printer, altered this to "*The* Conception," and this may account for one of the speakers, who seems to think the paper was meant to show how the Great Reality Himself forms conceptions; he, however, goes further and makes the startling suggestion that God perceives by means of light, and argues from this that God *must* see events in sequence! Surely we cannot imagine an Omniscient and Omnipresent Being receiving knowledge by the perception of senses; neither can He be said to form conceptions, He does not have even to think, for He *knows* everything. Such comments come under the category of those, referred to in my paper, who still look upon God as though He were a magnified man with senses enormously increased, but still finite.

The Rev. Mr. Tuckwell complains of my not putting a capital "R" when I refer to the reality, and argues, from that, that I have got into confusion. I would remind him that the paper in his hands was an uncorrected proof struck off without my seeing it, and, although in two places I find a small "r" when referring to the Great Reality, which will of course be put right when the proof comes into my hands for correction, in every other case the word reality is meant to be written with a small "r" as referring to the spiritual, the here, and the now. The whole argument of the paper is not, as Mr. Tuckwell seems to think, that God is the only Reality; but that the spiritual, the here, and the now, are the only absolute realities as opposed to the generally accepted idea that matter, space and time are still realities even when examined apart from our finite senses. He also expresses the hope that I will revise

the paper and be more accurate in some of my details. I should have wished that he had pointed out where such revision was necessary. He does indeed mention two as illustrations, but I fail to see that he has shown any need for revision; he says that I have omitted to prove that ether exists everywhere; I have made no such statement, neither does my argument take this for granted. In illustration of the human perception sense I was contented to point out the fact that ether extended not only sufficiently far to carry the sight of events a year or a century back, but for millions of years back. But this was only an illustration, it was not meant to argue that God required the presence of ether to gain a knowledge of past events. He also argues that because I state the fact that to our finite senses an insect beats its wings 10,000 times a second, and each beat is in front or behind another, therefore there must be sequence in reality, the whole argument of my paper controverts this. He quotes Bishop Butler as saying, "God did not give us our senses to deceive us," and argues that this proves that matter, time, and space are absolute realities. I do not think that Bishop Butler would feel complimented at being thus quoted, because we know as a fact that our senses do woefully deceive us; it is a matter of everyday experience that "Perception without knowledge leads us into false concepts," and this, as pointed out in the earlier part of my paper, is our greatest incentive to gain knowledge.

Professor Orchard fails to grasp the fact that whether you are watching an event in the same room or from a distance which light would take a thousand years to traverse, you are still looking at that event from the same intuitional advantage, you do not see in either case the event as it *is*, but only as it *was*. But again, I would like to point out that the method of my argument was to lead the finite mind to appreciate that to an Omnipresent Being every past event was present, it is only the finite sense of sight that is affected by the rate that light travels. I think the illustration I gave of a word starting in the human brain an instantaneous thought, was a fair analogy and useful for forming a conception of Creation as an instantaneous thought of God, where the mind of God may be said to be omnipresent. I also prefer the word *Materialisation* as being more in consonance with our surroundings, and it does not raise the question of how there can be anything external to an omnipresent being.

Dr. Walker can study the rate of beats in any insect's wing by noting the pitch of the sound given out by that wing ; this will give the exact number of beats per second ; the highest rate which has been recorded, as far as I know, is about 12,000 per second, the pitch in this case being $5\frac{1}{2}$ octaves above the ordinary pitch of a man's voice, or $4\frac{1}{2}$ above a woman's. I made a curious discovery last summer whilst trying experiments for perfecting my *Time-Microscope*. I found, as explained in my paper, that as the rate of perception was increased until it approached the rate at which time may be said to flow, motion gradually slows down, until at a certain point it ceases to give evidence of movement. I took the common house fly, and ascertained that its wings beat about 900 times per second, and by experiment I was able to prove that it had clear sight perception of frequencies up to, at all events, 600 per second, by the following means :—I found that if I approached the fly at the rate of 3 inches per second it always flew away, but at 2 inches per second it had no perception of movement, and I could, four times out of five, put my finger upon its back and hold it fast. It was curious to see it turn its head to look at my approaching finger, but it evidently could not see that it was moving. I tried this experiment on other kinds of flies, and in the case of a large dragon-fly, settled in the middle of a road, which I had several times tried to get near by walking slowly, I found that I could only approach it at the rate of about half an inch per second, thus giving a rate of perception to that insect of only about 200 per second, and I was able to pin it down to the ground with my finger after taking several minutes to approach it. This, and other experiments I have made, provided a curious proof of the conclusion I had arrived at by other means, that time and space, and therefore motion, cease to exist as objective realities when the rate of perception is sufficiently increased.

In conclusion I would like to say that I fully appreciated from the commencement that the subject of my discourse is far too vast to be adequately covered in the short space allotted to papers read before this Society. I have only been able to touch, and that briefly, on one of the many aspects of the Great Reality, but if I have succeeded in interesting the members and have given reason for thought for other minds to work upon, my object in addressing you to-night has been fully attained.

ORDINARY GENERAL MEETING.*

MARTIN L. ROUSE, ESQ., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following paper was read by the author :—

*ON THE SYNCHRONOUS CHRONOLOGY OF THE
KINGS OF ISRAEL AND JUDAH.* By FREDERICK GARD
FLEAY, Esq., M.A., author of *Egyptian Chronology*, etc.

IN late years a tendency has developed to disparage the historical accuracy of the book of Kings. This has been caused by the difficulty in harmonizing the chronological details of the Hebrew text with the most recent discoveries made in deciphering the Assyrian records. According to the method adopted by the most eminent Assyriologists the result is : first, that the reigns of Uzziah and Jeroboam II. have each to be diminished by twenty years, which, as they were contemporary, is a quite admissible hypothesis ; such an error of a round number has its parallels in other places in the sacred text, and its admission would in no way affect any other detail in the chronology.

But secondly, the scheme devised by the united efforts of the most eminent authorities in matters of oriental philology, and adopted by the most popular expositors of Assyriology among the English public, requires also the following changes : for Jotham, 2 years instead of 15 ; Ahaz, 7 for 15 ; Omri, 8 for 12 ;

* Monday, April 25th, 1904.

Joram, 8 for 12; Menahem, 4 for 10; Pekah, 3 for 20; Hoshea, 7 or 11 for 9; beside various other minute alterations. If such arbitrary changes be really required, the author of the book of Kings and the authors of the books of the Chronicles of the Kings of Judah and Israel, to which he refers as his principal authorities, must have been utterly untrustworthy in all matters of chronology; and, if that be the case, there is no trustworthy chronology in the whole of the Old Testament. Before assenting to this startling proposition, it may be well to examine the details of years mentioned in the Book of Kings. Possibly Arithmetic, Logic and Common Sense may help us as well as Assyriology and Philology.

The only attempt in the conservative direction at all noteworthy which I have met with is that of Oppert. He assumes too large a hiatus in the list of Assyrian eponyms, invents a second Menahem, separates Pul from Tiglath Pileser, and is on the whole rather more wild and extravagant than his opponents. Nevertheless I feel that the hypotheses of the Assyriologists are *primâ facie* so improbable that it is quite worth while to reopen the question, which I now proceed to do.

I take as starting point for my reckoning the taking of Samaria by Shalmaneser, or rather by Sargon, in 722 B.C., a date which is fixed within a month or two by universal acceptance of all authorities; and from this, by the calculations to be given hereunder, I arrive at 962 B.C. for the accession of Rehoboam and the separation of Judah and Israel. The first problem before us is to account for the difference between 240 years thus assigned to the existence of the divided monarchies and 260 years or 241 years, which are the numbers arising from the addition of the items in the text for Judah and Israel respectively, without contradicting the dates required by the Assyrian monuments.

There are many apparent discrepancies of one or two years between the lists of the Kings of Judah and Israel on which I shall say a word further on. At present I confine myself to the larger and more important differences.

The first of these is the statement 2 Kings xv, 1, that Azariah's accession took place in the 27th year of Jeroboam II. This is impossible; but the impossibility has always been recognised, and the new Assyriological scheme has nothing to add to the old orthodox solution, viz., for 27 read 14 (the 27th year from the *end* of Jeroboam's reign).

The second difficulty is the difference in the total reckonings of Judah and Israel. This amounts to 19 years, and used to be

accounted for by assuming 19 years interregnum in the Israel list. These interregnums throw the reign of Jehu too far back, and are as irreconcilable with the Assyrian monuments for that king as they are with the Egyptian for the reign of Rehoboam. All this is obviated by making the superfluous 19 or 20 years the length of the time that Uzziah lived in leprous seclusion during the reigns of Jotham and Ahaz, 2 Kings xv, 5. This gives his reign 32 years alone, and 20 contemporary; brings his death to 739 or 740 B.C., the exact year that modern critics desiderate for the call of Isaiah, Is. vi, 1; and allows him several years contemporaneous with Menahem, agreeably to the Assyrian monumental evidence to that effect.

Before considering the third difficulty, the contemporaneity of Menahem and Tiglath Pileser, I must prepare the way by enumerating the data that have been recovered from the history of Assyria, and before doing this I must lay before you a statement of the triple problem to be solved.

Firstly, the dates of the Kings of Israel and Judah must be reconciled; this, as I have already shown, is accomplished by the assumption of a co-regnancy between Uzziah and his successors Jotham and Ahaz for twenty years, a co-regnancy which is demanded as regards Jotham by the sacred text: "The king Azariah dwelt in a several house, and Jotham the king's son judged the people of the land."

Secondly, the Egyptian reckoning for Shashank (Shishak) must agree with the Hebrew for Solomon and Jeroboam. It will be found further on that this is effectually done on the now proposed scheme: but no other system hitherto proposed can be forced into agreement with the Manethonic numbers: some authors shift the date of Shishak a score of years up, others a similar interval down; but all make their alterations ineffectually and without authority.

Thirdly, the Assyrian records, official and therefore authoritative, cannot possibly be in contradiction with the true reckoning (as I contend) preserved in the Hebrew texts. To Oppert belongs the credit of suggesting the existence of a break in the list of Assyrian eponyms between Assur nirari and Tiglath Pileser. If any historic truth lies at the foundation of the Sardanapalus legend as given by Ctesias, if the Medes did for some twenty-five years exercise supremacy over Assyria, if Arbaces and Belesis are not mere figments of a dream, whatever may be true in their history must be introduced somewhere in the eponym list. But Oppert's interval

forty-six years, calculated to suit his date, 1017, for Solomon, is too long, and his separation of Pul and Tiglath Pileser is disproved by the Assyrian monuments.

I defer further discussion of this important crux to a later stage of the argument when all the data necessary thereto shall have been set forth; but here I may remark that it is only in comparatively recent years that Assyriologists, who previously held to Oppert's views, have discovered (without any new evidence having arisen) that the eponym list *must be* continuous; and about the same time also discovered that so many ancient authorities, Herodotus, the Old Testament writers, Manetho, etc., were utterly untrustworthy.

Now we come to the fourth and last difficulty, the contemporaneity of Menahem and Pul.

[744-3] Pekah and Rezin King of Syria invade Judah, 2 Kings xv, 37; xvi, 5, "The Lord began to send them" near the end of the reign of Jotham, and in the first years of Ahaz (743) they besieged him in Jerusalem. He applied to Tiglath Pileser to aid him, and became tributary to him. In 743 Tiglath was in Arpad, which town he besieged for three years and took in 741.

738: Tiglath P., Menahem and Rezin pay tribute to Tiglath. This is the crucial date. According to the ordinary chronology Pekah (not Menahem) was on the throne. Oppert accounts for this discrepancy by inventing a second Menahem with arbitrary dethronements and restorations of Jeroboam and Pekah. The Assyriologists for the most part alter the years for the reigns of Jotham, Ahaz, Menahem, and Pekah as may suit their hypotheses.

734. Ahaz pays tribute to Tiglath (Schrader i. 255, transl.) Tiglath in Philistia.

733-2. Tiglath besieges and takes Damascus, where Ahaz meets him. 2 Kings xvi, 10.

732. Rezin of Syria is slain in the 14th year of Tiglath.

731. Paqaha is slain and Hoshea appointed in his place by Tiglath.

At this point I insert the undated annals, iii Rawl. 10, No. 2, which Schrader puts 734 B.C. In this crucial fragment we find Tiglath at Shi-mir-ra and Ar-ga-a, towns west of Lebanon, Ga-al (Gilead), [A]bel [Beth Manchah], Beth Omri (Samaria) and Gaza; then follows: "The whole of its (Samaria's) inhabitants I . . . deported to Assyria; Pa-qa-ha their king I slew, Hosea I appointed over them." This comes in quite naturally

between 2 Kings xvi, 10, when Ahaz went to Damascus to meet Tiglath after that town had been taken, B.C. 732, and 2 Kings xvii, 1, when Hoshea's reign began, B.C. 731 : it does not suit B.C. 734, when Ahaz paid tribute indeed, but Samaria had certainly not been deported: yet, because in 734 the list of governors mentions Tiglath's campaign to Philistia, and in 732 does not mention that to Samaria specifically, but includes it in that to Damascus (which is far more consistent than including it in that to Philistia), the Assyriologists put it at the earlier date, thus introducing a purely unnecessary discordance with the simple Scriptural narrative, and greatly confusing the historic sequence in Assyria.

Such in outline are the meagre but really sufficient data for this dozen years, derivable from the Assyrian annals of Tiglath Pileser and the Book of Kings. The difficult point to determine is the identity of Paqaha. At first sight it is natural to identify him with Pekah. But the retention of Pekah as the predecessor of Hoshea entails all the arbitrary mutilations of four reigns which I have previously noticed. The name Pekahiah seems to lend itself to the transliteration Paqaha just as well as Pekah; for, although —iah is represented by —au in Hazakiau for Hezekiah and Assiyaau for Azariah, this latter name also appears as Asriau. If we take then Paqaha to be Pekahiah and transfer Pekah to a position between Zechariah and Shallum, perfect agreement with the Assyrian annals will be obtained, and any alteration of regnal years in the Hebrew text will be unnecessary.

Let us then examine the text and ascertain whether any violent or impracticable changes are involved in this hypothesis.

The order of the restored text will be—

Zechariah	...	...	...	v. 4-9, 11-12.
Pekah	...	...	...	v. 27-29, 31.
Shallum	...	...	...	v. 10, 13-16.
Menahem	...	...	...	v. 17-22.
Pekahiah	...	...	...	v. 23-26.

The change in the order is confined to the replacement of 5 verses: 10, 27, 28, 19, 31: and no syllable of the text itself would be interfered with; but there is one verse (30) which is not enumerated above for which I can find no defence in any way. That Hoshea did not obtain the throne by an independent conspiracy, but was appointed by Tiglath, who had smitten Pekah, we know from the Assyrian annals; and the 20th year of Jotham is an impossible date; for Jotham

reigned only 16 years. If Hoshea's predecessor was Pekah, son of Remaliah, we cannot evade the difficulties which I have already pointed out; but they disappear if this verse be rejected, as it must be, on the ground that its writer was ignorant of the facts now disclosed in the annals of Assyria and of the chronology of the neighbouring kingdom of Judah. Moreover, he contradicts 2 Kings xvii, 1, which assigns the accession of Hoshea to the 12th year of Ahaz, which cannot by any means be identified with the impossible 20th of Jotham. An exactly similar instance of insertion of an unauthentic verse occurs in 2 Kings i, 17, where Joram of Israel is said to accede in the 2nd year of Jehoram of Judah, in direct contradiction to 8, 16, where the true statement is given, viz., that the accession of Jehoram of Judah took place in the 5th year of Joram of Israel.

How the error in the case of Pekah may have arisen is easy to explain. It is clear that "the chronicles of the Kings of Israel" were arranged under the headings of the "acts" of the several kings in independent documents. Let us separate them thus:—

Acts of Zechariah	...	v. 8-9, ^Δ 11-12.
„ Pekah	...	v. 25, 27-29, ^Δ 31.
„ Shallum	...	v. 10, 13, ^Δ 15.
„ Menahem	...	v. 14 16-22.
„ Pekahiah	...	v. 23-24, ^Δ 26.
„ Hoshea	...	v. 30, ch. xvii, 1-41.

When the Book of Kings was compiled, the four verses 25, 10, 14, 30, which I will call "head links" were inserted in the four places marked by carets (^Δ) respectively, so as to bind the narrative into a consecutive whole. Zechariah and Pekahiah are fixed in position as sons of their predecessors Jeroboam and Menahem, and in the head link, v. 14, "Menahem, son of Gadi, . . . smote Shallum, son of Jabesh," is definite and conclusive. The succession of all the kings except Pekah is therefore fixed. But the head link v. 30 has been shown not to be authentic, and those in v. 25 and v. 10 are not definite. We have only, "Pekah son of Remaliah smote *him*," and "Shallum son of Jabesh smote *him*," in place of expressly stated names defining the kings smitten; this leaves it open to insert Pekah either after Zechariah or after Pekahiah, and unfortunately he was inserted in the wrong place, and the surreptitious verse 30 was afterwards put in to justify the wrong insertion.

All the Assyrian data are thus shown to be compatible with the Hebrew narrative.

Turning from the synchronisms with the Assyrian annals to those of Egypt, the first Pharaoh we meet with is Shishak; to whom Jeroboam fled in the time of Solomon, 1 Kings xi, 40, and who came up against Jerusalem, B.C. 958, in 5 Rehoboam, 1 Kings xiv, 25. This king was certainly Shashank Hezkeper-ra, the first King of Dynasty XXII. His date, according to Manetho, reckoning from 340 B.C. as the close of native sovereignty in Egypt, was 978 to 957, and this agrees with the old Egyptian chronicle as shown in my *Egyptian Chronology*. Assyriologists and Egyptologists alike have striven hard to reduce this king's accession by 20 or even 50 years; but they have only done so to their own satisfaction by arbitrary alterations without a shadow of proof.

Zerah the Ethiopian, who came against Asa, 2 Chron. xiv, 9, some time in the last 30 years of his reign, 930-901 B.C., comes within the data limits of the same Egyptian Dynasty XXII, but has not been certainly identified as yet, and is therefore not capable of synchronic comparison.

So or Seva, 2 Kings xvii, 4, to whom Hoshea sent between 731 and 722 B.C., when Shalmaneser "found conspiracy" in him, was unquestionably Sabaca (Shabak) Dynasty XXVI; his date according to Manetho was 714-706; but, on comparison with the monuments, the old Egyptian chronicle and Herodotus, it appears that he was claimant to the throne of Egypt in succession to Kashta in the Ethiopian line as early as the time of Zet and before Bokenranf, and therefore before 722. See on this point my *Egyptian Chronology*, p. 81. In just the same way we find Tirhakah, 2 Kings xix, 9, King of Ethiopia, coming out to fight against Sennacherib in 702-1, although the date usually given for Taharaka is 693 to 685. Here again Manetho and the Chronicle require a date of 703 for this reign; and so does Herodotus, who calls him Sethon. The only way to elucidate all these contemporary Egyptian dynasties will be to tabulate them as follows:—

B.C.	Manetho.	Chronicle.	Herodotus.
810	40.y. Petubastes	19.y. { Miamun Nut. Piankhi.	
791	...	44 Three Saites.	
770	8 Osorcho		
762	10 Psammus		
752	31 Zet		50.c.y. { Amyr- tæus. Sabaco.
747	...	44 { Kashta [22] Shabak [8]	
725	...		
721	6 Bocchoris		
717	...	Shabak & Shabatak [4].	
715	8 Sabacon (read 2)		
713	...	Shabatak [8].	
713	14 Sebichus („ 10)		
705	...	Shabatak & Taharka [2]	37 Sethon.
703	{ 18 Ammeres (Eus.) 18 Tarkus	37 Taharaka.	
685	7 Stefinates		
678	6 Nechapsos		
672	6 Nechoa (8 ap.)		
666	54 Psammeticus	54 Psamtik	54 Dodekarchy & Psam.
612	[1]6 Nechoa II	16 Necho	16 Neka
596	6 Psammathis	6 Psamtok	6 Psamaris.
590	19 Vafris	19 Uahabra	25 Apries [read 19].
571	44 Amosis	44 Aahmes	44 Amosis.
527	0,6 Psammecheritis	0,6	0,6 Psammeni- tus.
527			
		177 stated total.	

These dates are certain within a year or two, the names for the Chronicle are inferred by me from the history as given by monumental inscriptions. The years of the dynasties only are given by the Chronicle as below to which I append Manetho's for comparison.

	Chronicle.	Manetho.
xxiii	19.y. 2 Diopolites	89.y. 4 Tanites.
xxiv	44 3 Saites	6 1 Saite.
xxv	44 3 Ethiopians	40 3 Ethiop [30].
xxvi	177 7 Memphites	150,6 9 Saites [159].
	284	285,6

Manetho by the omission of 10 years for Nechoa II dislocated all his dates from Dyn. XXIV to XXVI. He recovers his ten years partly by counting the 6 years for Bocchoris twice over; once for Bokenranf himself and again in the 8 years of Sabacon with whom he was contemporary: the other 4 years he gets by counting the co-regnancy of Shabak and Shabatak twice over, once for each king: this point is so important that I venture to repeat a portion of the table with enlargements showing how Manetho (as in Africanus) and the Chronicle (from whom Eusebius must have obtained his version) derived their numerical data.

B.C.	Afric.		Euseb.	
725		4	12	Zet : Shabak.
721		4		Bokenranf : Shabak.
717	8	2	12	Bokenranf : Shabak and Shabatak.
715		2		Shabak and Shabatak.
713	14	8		Shabatak.
705		2	20	Shabatak and Taharqa.
703	18	18		Taharqa.

Tabulation does not make easy reading, but it affords the most convincing test for those who will take the trouble to examine it. I therefore risk the charge of dullness by giving yet another table of the accessions of the contemporary kings for Judah, Israel, Egypt and Assyria mentioned in the Old Testament:—

B.C.	Judah.	Israel.	Egypt.	Assyria.
978	...	...	Shishak.	
961	Rehoboam ...	Jeroboam ...	dies 957.	
945	Abijah.			
944	Asa ...	...	Zerah : cotem.	
902	...	Ahab.		
885	...	...	...	Shalmaneser.
867	...	Jehu.		
763	...	Pekah.		
745	...	...	...	Tiglath-pileser.
743	Ahaz.			

B.C.	Judah.	Israel.	Egypt.	Assyria.
743	...	Menahem.		
733	...	Pekahiah.		
731	...	Hoshea.		
727	Hezekiah ...	...	...	Shalmaneser.
722	...	Captivity ...	Shabak ...	*Sargon.
705	...	...	Tirhakah ...	Sennacherib.
698	Manasseh.			
681	...	...	...	Esarhaddon.
643	Amos.			
641	Josiah.			
613	...	...	Necho.	
610	Jehoahaz.			

* Merodach Baladan reigned in Babylonia 722-709, then Sargon 709-704.

For completeness I have carried this table lower than my immediate object requires, but not lower than will be required in future papers, if the series be continued. The Scriptural references are contained in the books of Kings, Chronicles and Isaiah. I give a list of them.

	Kings.	Isaiah.	Chronicles.
Shishak ...	i. 11, 40 ; 14, 25	...	ii. 12, 2-9.
Zerah ...	...	...	ii. 14, 9.
Tiglath Pileser ...	ii. 15, 29 ; 16, 7	...	i. 5, 6 ; 5, 25 ; ii. 28, 20.
(Pul) ...	ii. 15, 19.		
Shalmaneser ...	ii. 17, 3 ; 18, 9.		
So (Shabak) ...	ii. 17, 4.		
Sargon ...	...	20, 1.	
Merodach Baladan ...	ii. 20, 12	39, 1.	ii. 32, 31.
Sennacherib ...	ii. 18, 13 ; 19, 16-36.	36, 1 ; 37, 17- 37	ii. 32, 1-23.
Tirhakah ...	ii. 19, 9 ...	37, 9 ...	
Esarhaddon ...	ii. 19, 37	37, 38 ...	? ii. 33, 11.
Necho ...	ii. 23, 33	...	ii. 35, 20.

At this stage of the discussion I may state as a main result of my own investigations that at the very root of the rash and hasty, but elaborate and ingenious hypotheses, that are sapping the belief of modern criticism in all ancient authorities whether sacred or profane, from Herodotus and Manetho to the Biblical Historians and Prophets, there lies one radical evil habit, which is gradually but surely undermining the slow but scientific method of historic investigation, namely, the assumption of the truth of some one datum, which however probable is not proved, and on it building a superstructure, which ultimately collapses, because its foundation is not on a rock. Haste for ephemeral popularity and fear of being anticipated are replacing the Keplerian patience and Newtonian exhaustiveness of our forefathers. For instance, Schrader denies the existence of any gap in the Assyrian eponym list; Sayce, Driver, Cheyne (I mention only such authors as are generally read in England), adopt the consequent disparagement of the Old Testament history, which I have in this paper endeavoured to refute; Oppert invents a new king and advocates the baseless notion of dethronements and restorations of Israelite kings; Budge introduces a second siege of Jerusalem shortly before the death of Sennacherib, all baseless fabrics built on some fanciful assumption.

I might mention many more such instances, but will content myself with one. It seems so plausible that the great Rameses II should be the oppressor of the Hebrews, and his successor the Pharaoh of the Exodus, that hardly a dissentient voice is audible on this matter. One consequence is that the whole Hebrew history from Moses to Solomon has to be condensed into two centuries, or thrown over altogether. I need hardly say that to me such a hypothesis is totally incredible; and that I, as I have shown in my *Egyptian Chronology*, prefer the older authorities, the book of Judges, and Manetho to Josephus and his modern followers.

I now give a general table for all the kings of Judah and Israel.

SYNCHRONOUS TABLE.

Judah.		Reign.	B.C.	B.C.	Reign.	Israel.
Temple	...	37	999		...	
Rehoboam	...	17	962	962	22	Jeroboam.
Abijah	...	3	945	...	...	18
Asa	...	41	942	...	...	2.c.
2	...	...	...	940	2	Nadab.
3	...	...	...	938	24.c.	Baasha.
26	...	...	...	915	2.c.	Elah.
27	...	...	...	914	12.c.	Omri.
38	...	...	...	903	22	Ahab.
Jehoshaphat	...	25	901	...	...	4
+17	...	...	...	881	2	Ahaziah.
+18	...	...	...	879	12	Joram.
Jehoram	...	8	876	...	...	5
Ahaziah	...	1	868	...	...	12 or 11
Athaliah	...	7	867	867	2[9]	Jehu.
Jehoash	...	40	860	...	...	7
23	...	...	...	838	17	Jehoahaz.
+37	...	...	...	821	16	Joash.
Amaziah	...	29	820	...	...	2
15	...	...	...	805	41	Jeroboam.
Azariah	...	[32]	791	...	...	+27
+38	...	...	...	764	0,6	Zechariah.
+52	...	...	...	763	20	Pekah.
Jotham	...	16	759	...	...	2
Ahaz	...	16	743	...	...	+17
+39 Az.	...	...	...	743	0,1	Shallum.
+39 Az.	...	...	...	743	10	Menahem.
+50 Az.	...	...	...	733	2	Pekahiah.
12 Ahaz, +20 J.†	...	...	...	731	9	Hosea.
Hezekiah	...	5	727	...	240	Sum.
Sum	...	240	...	722	...	Captivity.
Hezekiah	...	24	...	...	...
Manasseh	...	55	698	...	...
Amon	...	2	643	...	...
Josiah	...	31	641	...	...
Jehoahaz	...	0,3	610	...	...
Jehoiakin	...	11	610	...	...
Jehoiachin	...	0,3	599	...	...
Zedekiah	...	11	598	...	...
Captivity	...	...	587	...	...

The regnal numbers are taken without alteration from the Hebrew text, twenty years being allowed for the co-regnancy of Uzziah with Jotham and Ahaz, and one year for the insurrection of Jehu before his recognized accession. Quite possibly

this year may be omitted, and the years of Athaliah reduced to six. No injury will thereby accrue in any way to my main argument.

In transferring a chronological reckoning from regnal years to dates B.C. an apparent difference of one or two years may arise for three reasons: firstly, the regnal months not being given, it is not possible to tell whether the years stated are in excess or defect of the true amount of years *and* months: we do not even know how many months were considered necessary to justify their being set down as a year; secondly, we do not know the epoch from which the kings' reigns were reckoned: it may have been from the day of accession, it may have been from the New Year's day of the accession year; thirdly, the new years in the Jewish lunar reckoning and in the modern chronologers B.C. begin at different annual epochs. In the absence of more definite data it is impossible to harmonise more closely than to a difference of two years on either side. Much ingenuity has been wasted in attempting to evade this impossibility. I have thought it sufficient to delete those cross references of the compilers which are palpably mistaken in their reckoning. Those in the reign of Uzziah are of course due to my proposed shift of Pekah's position; the others are inherent in the text and cannot be got rid of without conjectural alterations on any hypothesis whatever. These calculations are therefore too inaccurate to be of much help, and the only use I have made of them is to reckon the reigns of Baasha, Elah and Omri as ending in current years not after complete ones; a course which has been taken by all my most important predecessors in this investigation.

If my scheme is correct, one or two passages in the prophetic writings have a new light thrown on them. "The year that king Uzziah died," Isaiah vi, 1, is 740 or 739 B.C. "The two years before the earthquake," Amos i, 1, becomes identified with the narrative in Josephus (*Antiq.* ch. ii) and fixes the date of Amos to 761 B.C., in exact accordance with the results of modern criticism: and the "three shepherds cut off in one month," Zechariah xi, 8, that is to say, before the expiry of the second month, will be Jotham, Pekah and Shallum. This requires the invasion of Pekah to be extremely short, only of a few weeks, and in no other way can I understand how the invasion of Pekah and Rezin, which "began" in the time of Jotham (2 Kings xv, 27) and was so successful in the commencement of the reign of Ahaz (2 Chron. xxviii), could have been brought to a close so sudden and resultless than by the

conspiracy of Shallum and the consequent change of policy. It seems likely indeed that this invasion of Judah was the motive of the conspiracy; for Jehizkiah, son of Shallum (2 Chron. xxviii, 12) was one of the heads of the children of Ephraim who "stood up against them who came from the war." Surely this is much more likely to have happened immediately on the success of his father's conspiracy than after the interval of three reigns of two distinct stocks (as required in the received arrangement) between the reign of Shallum and the intervention of his powerful son and his three friends.

So much stress has been laid by Duncker and others on the bearing of the statement of Menander as to the reigns of the Phœnician kings, that I must not, though I attach little weight to it as a ground for argument, pass it by unnoticed. This is as good a place for touching on it as any other. *Josephus against Apion*, Book I, quotes Menander to this effect. From the 12th year of Hiram, when the temple of Solomon was built, to the 7th of Pygmalion, when Dido founded Carthage, are 143 years 8 months (say 144 years). I do not give the years for the intervening kings which are defective somewhere by a score of years. If we take the building of Carthage to date 846 B.C., in accordance with Appian (Duncker, *Hist. of Antiquity*, ii, 113), this gives for the Temple date $846 + 144 = 990$ B.C., which is Duncker's date; but if, as I think, Josephus means the completion and dedication of the Temple (not the laying the foundation as Duncker supposes), we must add seven or eight years. This brings us to 998; my own date is 998-9. This would be quite satisfactory, but as Justin's date for the foundation of Carthage is 826, and there are other conflicting testimonies on this point, an equally good case can be made out for the reckoning of the Assyriologers. It is futile to ground any argument on a datum so uncertain; all that I can do, and this I am bound to do and have done, is to show that no inference can be made from Josephus' quotation irreconcilable with the scheme proposed.

Now we have sufficient data before us to be able to discuss that most difficult question; are the eponym lists of Assyria continuous throughout, or is there a break in them either before Tiglath Pileser (as Oppert supposes) or elsewhere? Let us briefly enumerate the facts as given in the book of Kings and the Assyrian records. Rezin or Hazion of Damascus was adversary to Israel all the days of Solomon; his son Jabrison was contemporary with Jeroboam, and his son Benhadad with Baasha. Then comes a King of unknown name, no doubt a son

of Benhadad I, contemporary with Omri, succeeded by his son Benhadad II, contemporary with Ahab. The King of Damascus from the 6th to the 14th year of Shalmaneser is called Dad-idri (Hadadezer) and is almost certainly identified with Benhadad II. Between him and Israel for the three years 18-20 Ahab these was "peace" and alliance; at the extreme end of the 3 years Ahab fought by the side of Dad-idri at the battle of Qar-qar; they were defeated by Shalmaneser in his 6th year. The alliance between Dad-idri and Ahab was thus broken, and that same year Ahab was slain at Ramoth Gilead in fight with his former ally. In the biblical narration, so far as it is taken from the story of Elijah and Elisha, Benhadad II is not mentioned by name; but there is no question as to which "King of Syria" is intended. In 11 Shalmaneser Dad-idri and other Kings of the Khatti and sea coast were routed by the Assyrian King; this must have taken place near about (perhaps immediately after) the "war of the King of Syria against Israel," and the "siege of Samaria by Benhadad" probably as retaliation by Assyria for injury to his Israelitish vassal. In 14 Shalmaneser Dad-idri and 12 Kings were again defeated, and we hear no more of him in Assyrian annals or of Benhadad II. in the Bible.

In 18 Shalmaneser Hazael of Damascus was defeated and tribute received from the Tyrians, Sidonians, and "Jehu son of Omri," evidently at his accession. I think that Jehu was not then "compelled to submit" (as Schrader puts it) but simply continued the vassalage of Joram. Hazael must have succeeded Dad-idri between 14 and 16 Shalmaneser, and in the Bible we find him and no other mentioned as contemporary with Jehu. We next meet with Hazael fighting against Jehoash of Judah, and receiving from him "treasures of the house of the Lord" and gold from the King's house. This was probably in the time of Samsi Rimmon. Jehoahaz was also contemporary with Hazael, who died and was succeeded by Benhadad III, somewhere in the reign of Joash. Corresponding to this we find in an Assyrian inscription of 10 Rimmon nirari that he received tribute of the land Omri (*i.e.*, of Joash) the Tyrians, etc., and shut up in Damascus its King Masi. This king I take to be the immediate successor of Hazael and identical with Benhadad III. Hazael died in the reign of Jehoahaz and was succeeded by Benhadad his son, who was king in the reign of Joash when he recovered from him the cities which he had taken in the time of Jehoahaz. There is no reason for a third king between Hazael and Benhadad: and Masi of 10 Rimmon nirari in the time of Jehoahaz, must be anterior to the Benhadad of the time of

Joash. There is no reason why Benhadad III should not have his distinctive name Mazi, as well as Bendadad II that of Dad-idri.

Finally Jeroboam II restored Damascus and Hamath to Israel, and this brings us to the accession of Assur-dan-ilu, after which we get no help from Assyrian records until the annals of Tiglath Pileser.

In the following table I have given all the scriptural references on which the preceding sketch is based, with the parallel successions of the Kings of Damascus and Assyria and B.C. dates according to my reckoning. But the reign of Assur-dan-ilu ends here at 788, and is succeeded by the next eponym, that of Purilsaggali in 763, the year of the eclipse. There is a break of 25 years, and immediately after the table I will offer my explanation.

i, ii Kings.	Israel.	Damascus.	B.C.	Assyria.	Events, &c.
i. 11, 23	1 Solomon ...	Rezin ...	1002	...	Rezin = Hezion.
15, 18	1 Jeroboam ...	Tabrimon ...	962	...	
15, 20	1 Baasha ...	Benhadad I. ...	938	...	
20, 34	1 Omri ...	Father of B. II. ...	914	...	
20, 34	1 Ahab ...	Benhadad II. ...	903	...	Elijah.
22, 1	18 Ahab ...	...	884-2	...	3 years' peace.
		Dad-idri ...	880-1	6 Shalmaneser ...	Qarqar.
22, 31	21 Ahab ...	"King" ...	880-1	...	Ramoth Gilead.
ii. 3, 1	1 Joram ...	...	878-9	...	Elisha.
5, 1		"King" ...	...	...	Naaman.
6, 8	4 Joram ...	"King" Dad. ...	875-6	11 Shalmaneser ...	War : Isr. Dam., Ass. Dam.
6, 24		B. Dad. ...	874-5	...	Siege Sam. : Sh. routs Dad.
8, 7	7 Joram ...	B. Dad. ...	872-3	14 Shalmaneser ...	Sh. routs Dad. : Elisha.
8, 15, 28	12 J. = 1 Jehu	Hazael ...	867-8	18 Shalmaneser ...	Jehu tribute to Sh.
10, 32		Hazael ...	864-5	21 Shalmaneser ...	Tyré, etc., tribute to Sh.
12, 17		Hazael ...	...	Samsi Rimmon ...	Joash of Judah.
13, 3	Jehoahaz ...	Hazael : B. ...	...	...
	11 Jehoahaz ...	Mazi ...	827	10 Rimmon-nirari ...	Land Omri tributary.
13, 25	Joash ...	Benhadad ...	821	...	
14, 28	Jeroboam ...	...	798	1 Assur-dan-ilu ...	Damascus recovered.
			788	...	Zidiil eponym.
			763	Purilsaggali ...	Eclipse of Sun.

Various methods have been tried to explain the discrepancy between the Assyrian and Hebrew reckonings:—

1. The most popular at present is that of the Assyriologers Kamphausen, Schrader, etc., adopted by Sayce, Driver, Cheyne and many other high authorities. They maintain the unbroken continuity of the eponym Canon and sacrifice the Hebrew numbers altogether, but have utterly failed to avoid the contradiction thus introduced between the dates of Shishak and Rehoboam. They do not, however, for the most part, go so far as Robertson Smith, who maintains that the Hebrew numbers were based on cycles of 240 or 480 years, the smaller intervals being filled in by mere guess; a hypothesis utterly unworthy of so sagacious a writer.
2. Another group mostly of writers of lower repute in Assyrian matters, though better acquainted with Egyptian, take refuge in denying the identity of "Ahabbu of Sirhala (Sir'lai)" with Ahab of Samaria, and of "Jehu son of Omri" with Jehu son of Nimshi. These require no refutation.
3. Oppert and others have suggested breaks in the eponym lists at impossible places. Oppert, for instance, would insert 47 years before Tiglath Pileser, but there can be no doubt of the identity of the eclipse in the month Sivan of the eponym Purilsaggali with that of June, 763.
4. The view now proposed that there was a break of 25 or 26 years just before this eponym.

Let us examine the accounts of the Median kings given by Herodotus and Ctesias.

B.C.	Ctesias.		Events.	
	Years.	Kings.		
791	28	1. Arbaces.	Assur-dan-ilu succeeds.	
763	50	2. Mandaucas.	Sardanapalus dies 788 B.C.	
		Sosarmus, 30 y.	Eclipse of Sun. Sivan (June).	
713	50	3. Artycas.	Years.	Herodotus.
654	22	4. Arbianes.	5[9]	3. Deioces.
632	40	Artæus.	22	4. Fraortes.
		Artynes, 22 y.	40	5. Cyaxares.
		Astybaras 40 y.		(28 y. Scythians.)
592		6. Aspadas.	35	6. Astyages.
			128 + 28 stated sum.	
557			29	7. Cyrus.
551				Astyages surrenders.
528			7, 5	8. Cambyses.
521				9. Darius.

Herodotus gives only 4 kings before Cyrus and for the first king Deioces 53 years; but his sum, 128 years, excluding the 28 under Scythian rule in the time of Cyaxares, or 156 including them, requires an addition of 6 years to the reign of Deioces. His number for Cyrus is reckoned from an earlier epoch than the final surrender of Astyages, which as well as the epoch of Darius have fixed historical dates 551 and 521. His list only takes us back to 713. But Darius himself states that he had eight predecessors. There are two wanting. Ctesias supplies five, of whom two are evidently replicas of their predecessors; Artynes of Arbianes and Astybaras of Artæus; they reproduce the numbers precisely and are omitted by Herodotus. Taking Sosarmus as the third to be omitted, we get as the date of Artæus' accession 791. If then there be, as I believe, a historical foundation for the story of Sardanapalus, Arbaces conquered him in 788, the 3rd or 4th year of his reign, and ruled over Assyria until 764, the year before the eclipse. That during this foreign reign the institution of eponyms should have been suspended is surely not incredible, and in the "list of governors" there is a line* corresponding with the

* An unexplained line in *Henslowe's Diary* of exactly similar nature gave me the first clue to the change of theatrical companies A.D. 1594, and was the foundation stone of my *History of the English Stage*.

lines which elsewhere in the lists indicate accessions of new kings. If this line does not indicate the regnal portion of Arbaces, what does it indicate? I have found no answer to this question in any book accessible to me.*

I offer no suggestion as to who was king from 763 to 754; perhaps there was none; certainly no Median.

The interval from Qarqar to Jehu's tribute is apparently 12 years in the Assyrian reckoning, 14 in the Hebrew; but if the battle took place early in 6 Shalmaneser and the tribute was paid late in 18 Shalmaneser the real interval may have been nearly 13 years, and these may have fallen in B.C. reckoning apparently 14 years apart. There is no real contradiction in the dates.

There is not much to be learned from the genealogies for this period; we have in the list of the kings of Judah a continuous series of father to son from Solomon to Jeremiah 16 kings in 408 years, with an average of $25\frac{1}{2}$ years for a generation; and 14 high priests for the same time 29 years for a generation, or if we admit Hoshea (Odeas) on the authority of Josephus and the Seder Olam 15 priests 27 years for a generation. All this agrees with the general results obtained from the histories of other countries, but at the same time shows how careful we should be not to *found* our calculations on genealogical lists, but to use them only as tests for conclusions derived from other sources. For the list in 1 Chron. vi, 3-13, omits the six priests between Amariah and Shallum, five of whom are known from other scriptural texts; inserts Ahitub and Zadok instead of them who are certainly misplaced; and transposes Azariah III from his true position after Urijah to one after Hilkiah. All this has been definitely proved by Lord A. Harvey (*Genealogies*, p. 300 *seq.*).

The only other genealogy for this period is that of Elishama, 1 Chron. ii, 25-41, and as this contains eleven generations from Zabad, one of David's warriors, 1 Chron. xi, 41, to Elishama, the grandfather of Ishmael, who smote Gedaliah, 2 Kings xxv, 25; that is to say, thirteen in all for 416 years from 1002 B.C. to 586, we get exactly 32 years for a generation, just what we should expect for a private family not subject to the accidents to which a reigning house is necessarily exposed. On the other hand, if we adopt the scheme of the Assyriologists, we are

* I have in this section used a Latinised transliteration of Greek names for convenience, having taken my table from Browne's *Ordo Sacclorum*, though not without collation with the original authorities.

compelled to make Ahaz father of Hezekiah at the age of twelve, or to reject the regnal years given in the book of Kings. On the whole then the genealogies give, if not extensive, yet valuable confirmation of the truth of the scheme now proposed.

I append a table of the ages of the Kings of Judah, (1) at the birth of their first-born; (2) at their accession to the throne; (3) at their decease, together with the contemporary high priests, which will be useful for reference.

Father.	King.	Dead.	King's Name.	High Priest.
[18	19	59]	Solomon ...	Zadok, 1 K. iv, 2; Ahimaaz, 1 C. vi; Azariah, 1 C. vi, 10.
[23	41	58	Rehoboam ...	Johanam, 1 C. vi.
[22	35	38]	Abijah.	
[21	16	56]	Asa ...	Azariah, 2 C. xv, 1.
28	35	60	Jehoshaphat ...	Amariah, 2 C. xix, 11.
18	32	40	Jehoram ...	Jehoiada, 2 C. xxii, 2.
16	22	23	Ahaziah ...	Jehoiada, 2 C. xxii, 11.
22	7	47	Jehoash ...	Zechariah, 2 C. xxiv, 20.
38	25	54	Amaziah.	
43	16	68	Uzziah ...	Azariah, 2 C. xxvi, 17.
21	25	41	Jotham.	
22	20	36	Ahaz ...	Urijah, 2 K. xvi, 10.
32	[15]	44	Hezekiah ...	Azariah, 2 C. xxxi, 10
45	12	67	Manasseh ...	? Hoshea [Josephus: Sed erolam].
16	22	24	Amon ...	Shallum, 1 C. vi.
14, 6	8	39	Josiah ...	Hilkiah, 2 K. xxii, 4.
28	25	36	Jehoiakim ...	Seraiah, 2 K. xxv, 18.
—	8	8, 3	Jeconiah ...	
—	21	32	Zedekiah ...	Jehozadak, 1 C. vi.

The numbers in square brackets are approximate fillings when no dates are given in the sacred text. The other numbers are taken from the Book of Chronicles, occasionally corrected from the Book of Kings for the second and third columns; the first column is calculated from the other two.

Finally, to sum up the whole matter now before us, there are four typical schemes of chronology for the period of separation between the kingdoms of Judah and Israel:—

First, the Ussherian, which introduces arbitrary inter-regnums, etc., and is in absolute contradiction to the official Assyrian data recovered from the monuments;

Second, Oppert's, which introduces a supposititious second Menahem, and assumes too large a gap in the list of Assyrian eponyms;

Third, the scheme of the modern Assyriologers, which openly asserts the untrustworthiness of the Books of Kings and Chronicles in all matters chronological, and arbitrarily alters the lengths of ten reigns by differences of three to fourteen years; thus cutting away all ground for belief in the historical fidelity of the author of this portion of the Scriptures; and

Fourth, the scheme now proposed which, by inserting 25 years for Arbaces in the eponym lists, and by the transposition of four verses containing the reign of Pekah, but making no other change whatever except in passages which all parties alike admit to require emendation—by these two simple alterations attains both absolute agreement with the Assyrian records and internal self-consistency, and at the same time vindicates the substantial veracity and fidelity of the original Hebrew annalists.

DISCUSSION.

The CHAIRMAN.—Professor Hull has a letter from Canon Girdlestone bearing on the question.

The SECRETARY read the following:—"I am sorry I cannot be present to hear Mr. Fleay's paper. He has done good service by his work on Egyptian chronology, and this new essay will help us in the right direction. Probably he does not know the Oxford 'Helps to the study of the Bible,' for the chronological part of which I am mainly responsible. It will be found to agree to a considerable extent with his conclusions, but was published about fifteen years ago."

The CHAIRMAN.—We have here some distinguished Assyriologists, and no doubt others who can speak on the subject.

We are greatly indebted to Mr. Fleay for his paper, which must have cost him much time and thought.

Mr. THEO. PINCHES, LL.D.—Although I am an Assyriologist, I may say that I cannot claim to be a chronologist. That is a matter arising partly from my natural incapacity to make long and abstruse calculations, and partly from the fact that there is really so much of a doubtful nature connected with the subject that I have held aloof, as far as possible, from all chronological questions.

The discrepancy of forty years between the Assyrian and Hebrew chronology has been to my mind sufficient reason for keeping myself from any attempts to form a theory of my own. I content myself, in fact, with simply accepting, provisionally, the chronological *data* as given by my contemporaries who have made a speciality of the subject, and that, I think, is best. I am speaking, of course, from my own point of view. My desire has been not to have to make a confession that I have been mistaken. That may have been cowardly on my part, but still I think it was the best course. Assyriology, as you know, is a progressive study. We are constantly learning and constantly having to change the opinions we may have formed, and on that account we may expect, at any time, to find materials necessary for filling up gaps or doing what may be necessary to put things straight from a chronological point of view. I need only mention here that the Germans and the English are working on the site of the ancient city of Asshur, the capital of Assyria, and according to the accounts that have come to hand they have found an enormous amount of material and names, from about 1900 years B.C. to the time of Abraham. They have found the names of kings well known.

Owing to pressure of time I have been unable to read this paper through before coming to the meeting, but on hearing it read now for the first this evening, I feel it my duty to add my testimony to its general excellence. I would here wish to remark that Dr. Budge's introduction of a second siege of Jerusalem, shortly before the death of Sennacherib, is a theory that has found acceptance with a great many Assyriologists, and in fact it seems to suit the case very well, *i.e.*, as far as I was able to judge, when dealing with that portion of Assyrian history in my book on the Old Testament and the records.*

* *The Old Testament in the Light of Historical Records*, 2nd Edit., 1904.

I am quite in agreement with the lecturer concerning the identity of Ahab, and while mentioning that point I may say that instead of reading *Dad-idri* I read Adad-idri. The way in which his name becomes identical with that given in the Old Testament, viz., Benhadad, is because in the Hebrew they omitted the last portion, and the Assyrians omitted the first.

Concerning the matter of the possibility of introducing twenty-five years for Arbaces into the eponym list, that I must leave for the present; but as I have said, if I can find any comments to make tending to illustrate the subject I shall do so, and hope they will be published in the *Transactions* at the end of the discussion.

Professor ORCHARD.—I am sure we shall all agree with what has been said as to the industry and, I might also add, the ingenuity, of the author of this paper.

I note that he assumes a co-regency between Uzziah and his successors Jotham and Ahaz of twenty years. That, so far as I can judge, is a perfectly reasonable assumption. I cannot, however, concur in all the statements of the learned author. In order to work out the theory he is obliged to throw over at least two persons. The passage he refers on page 257 (2nd Book of Kings) he appears to think is indefensible. "I can find no defence," he says, "in any way that Hoshea did not obtain the throne by an independent conspiracy but was appointed by Tiglath, who had smitten Pekah, we know from the Assyrian annals." The probability is that he conspired as agent of Tiglath. Then he says "the 20th year of Jotham" is an impossible date, because he reigned only sixteen years. But the statement is not only that he reigned sixteen years, but that he reigned sixteen years in Jerusalem, and he may easily have reigned for some time afterwards somewhere else. Then the author continues to deal with the supposed difficulty. "Moreover he [the sacred writer] contradicts 2nd Kings xvii, 1, which assigns the accession of Hoshea to the 12th year of Ahaz, which cannot by any means be identified with the impossible 20th of Jotham." The 20th of Jotham is not impossible, nor does there seem to be the difficulty the learned author supposes with regard to that verse. He says, "an exactly similar instance of insertion of an unauthentic verse occurs in 2 Kings i, 17," because of the supposed discrepancy in chapter 8, verse 16, but that may be so read as to cause no discrepancy whatever.

It appears to me that the author, with the best intentions, doubtless, has been somewhat misled by an inordinate estimation of the Assyrian chronology. That it is of great importance cannot be denied. It must, however, be remarked that the Assyrian Records are not quite so inviolable as the author appears to imagine. Again he asserts, "the Assyrian Records, official and therefore authoritative, cannot possibly be in contradiction with the true reckoning (as I contend) preserved in the Hebrew texts." He there makes the Assyrian Records to be the ultimate standard of appeal.

The AUTHOR.—No.

Professor ORCHARD.—It appears to me to be so; but perhaps I was a little hasty in making that assumption. Professor Sayce has pointed out that there are several mistakes in the Assyrian Records with regard to the length of reigns; and Oppert, too, regards those records as being though valuable, unreliable and in his opinion, when there is a difference between the Assyrian Records and the Scripture narrative, that the Scripture narrative should be held to prevail over the Assyrian Records, and I think we should be of the same opinion.

I notice on page 263 of the paper a remark that I thoroughly endorse, where the learned author reminds us that "there lies one radical evil habit, which is gradually but surely undermining the slow but scientific method of historical investigation, viz., the assumption of the truth of some one datum, which, however probable, is not proved, and on it building a superstructure, which ultimately collapses, because its foundation is not on a rock." I venture to say that the assumption in this paper of the untrue datum is the inviolability of these Assyrian Records. We may hope that as this subject is very interesting, we may derive some assistance from those investigations which Dr. Pinches has reminded us are being now carried on by German investigators.

The CHAIRMAN.—I think this paper is very valuable indeed. The author seems to have proved absolutely that there is a gap in the eponym calendar of the Assyrians of twenty-five years.

I would also say that he has incidentally touched on an important point regarding the Exodus. I have always been unable to see that taking Rameses II. as Athaiah, we could ever fit the chronology of Egypt with the chronology of the Hebrews.

As regards Jeroboam II, I think it is not necessary to take the twenty-seven years in the manner usually taken, for I find that by taking it in the ordinary manner, if Uzziah came to the throne as a little child and was under a regent for a time, as may very well have happened, on the sudden death, by assassination, of his father, the twelve years required would be made up, and that would bring us to the twenty-seventh year of Jeroboam, instead of the fourteenth as was supposed, about an interval of twelve or thirteen years.

I would also say that I have consulted an eminent physician as to the impossibility, or possibility, of Ahaz having a son at the age of twelve years; or, if you will carefully examine it, at the age of nearly thirteen years, and Dr. Walter Kidd said it is quite possible for such a thing to happen in the East.

It is a mistake to suppose, as is generally done, that the Bible gives us no other means of confirming the chronology of the twin kingdoms of Judah and Israel than its fixing of the accessions in one line in certain regnal years of the other line and *vice versa*. We have one well-known sum total given as a check upon the addition of the individual reigns; and we have another which is little known but more definite. I will take the second in the first place, because it is more definite, that is to say, its initial as well as its final point, is stated.

In the fourth chapter of Ezekiel we read that the prophet is to foretell the siege of Jerusalem which brought the kingdom of Judah to an end in a manner that was common in prophecy by dramatic illustration, namely, first by portraying the city upon a tile and imitating the operations of a siege, and then by lying down many days in succession and eating a small weighed ration of food and water all the time. In directing him to do this God told him that he was to be one day for every year of a certain period "three hundred and ninety days" on his left side to "bear the iniquity of the house of Israel," and "forty days" on his right side to "bear the iniquity of the house of Judah" (vv. 4-6).

Now if we reckon back fourteen years from the beginning of the siege, we come to the revival in the twelfth year of King Josiah, when he destroyed the idols throughout the land, from which time it is to be presumed that little by little iniquity and idolatry gained ground again.

Thus from—

Josiah's 12th to his 31st and the 3 months' reign of Jehoahaz inclusive 20 years.
Jehoiakim's 1st to his 11th and the 3 months' reign of Jehoiachim inclusive 11 „
Zedekiah's 1st to the end of his 9th, when the siege began 9 „
<hr style="width: 10%; margin: 0 auto;"/> 40 „

That Zedekiah's first year was distinct from Jehoiakim's eleventh is proved from Ezekiel xxxiii, 21, where the siege elsewhere said to have ended in the eleventh year of Zedekiah, is said to have ended far in the corresponding part of the twelfth year of Jehoiachim's captivity.

And that Jehoiakim's first year was distinct from Josiah's 31st is proved by another figure given in Ezekiel i, and where the narrative is introduced by the words "In the thirtieth year," and this is further defined to be the fifth year of Jehoiachim's captivity; for by reckoning back in the same way we come to Josiah's passover held in the eighteenth year of his reign, attended by many of the remnant of Israel as well as by the Jews, and described as the most striking one that had been held "since the days of Samuel the prophet"; thus:—

From Josiah's 18th to his 31st and Jehoahaz's 3 months' reign inclusive 14 years.
Jehoiakim's 1st to his 11th inclusive 11 „
Jecooniah's 1st to his 5th 5 „
<hr style="width: 10%; margin: 0 auto;"/> 29 in the 30 „

Having thus proved the accuracy of Ezekiel's sum total in these two cases, let us assume that he is correct in his sum total of 390 years. This then will bring us to the beginning of the declension under Jeroboam; for throughout the history of the northern kingdom his "sin with which he made Israel to sin" was never given up.

Now we have every reason to judge that Jeroboam established his corrupt worship of God in the first year of his reign. Not only is no interval or lengthy event recorded between the secession and

this establishment, but he himself is represented as saying "If this people go up" not "continue to go up" to do sacrifice in Jerusalem, "then shall their heart turn again unto their lord Rehoboam." Therefore we have the whole period from the beginning of the divided monarchy down to the commencement of the great siege given by the Bible as 390 years.

Now this figure I find with very little adjustment in either line to agree with the detailed chronology of the reigns in the kingdoms of Judah and Israel. And further it agrees with the other well known sum total of years given in 2 Chronicles xxxvi, 21. As stated there, the whole period during which the land lay desolate was to be seventy years, that the land might enjoy her sabbaths, or sabbatical years. Therefore the whole sabbatic period up to the end of this desolation (or the completion of Ezra's temple)* was 480 years, or up to the beginning of this desolation it was 420 years.

Now from the beginning of the siege	
(end of Zedekiah's 9th year) to the	
end (middle of his 11th) was	... 2 years.
Add	... 390 "

Therefore from the beginning of the	
Divided Kingdom to the end of the	
Jewish Kingdom was	... 392 "
Take this from	... 420 "
And you have	... 28 "

into the reign of Solomon, that is since he reigned 40 years, back to the twelfth year of his reign, which was the year after the temple was completed. But by the chronology given in the paper there is no room for the 420 years, they are made to begin ere the temple's foundations were laid. Yet surely during the most God-fearing seven years of Israel's history while the temple was being built the sabbatic year could not have failed of observance.

Lastly, I find by reckoning back to the entrance of the Israelites into Canaan, that the twelfth year of Solomon was itself a sabbatic year. Thus:—

* Compare Zech. viii, 5, with Ezra vi, 16.

	Years.	Months.	Days.
From the Exodus to the laying of the Temple's foundation in the fourth year and second month of Solomon was	479	2	23
Thence to its Dedication... ..	7	6	7
<hr/>			
In his eleventh year	486	8	0
Subtract for the Wanderings	40		
<hr/>			
	7)446		
	<hr/>		
	63·5		

The previous year was thus a fifth and this one was a sixth after a sabbatic year. Therefore the next year or the twelfth year of Solomon was itself a sabbatic year.

Thus admirably does the Scripture history agree with itself in its statement of comprehensive epochs, and since as yet we cannot prove that the Assyrian history does so, let us wait for further discoveries in that field. Meanwhile we have a clear agreement in the order of events between the secular history and the sacred, and many names and transactions that are recorded in both.

The AUTHOR.—I am going to read a very short postscript to my paper presently, and that draws me into a great difficulty in regard to answering anything that has been said in the way of discussion.

What Dr. Pinches said with regard to the name Dadidri I was familiar with before. I had read Dr. Pinches' statement of that written in his book recently published.*

With regard to what the Chairman said, I have fully entered into the consideration of this number of 390 years, but I wanted, if I could, to confine this paper within narrow limits, for I was sure if I went beyond those limits we should have more matter than we could deal with at one meeting, and for that reason I even cut out of the paper itself a discussion of the question of the reign of Hezekiah.

* Referred to above, p. 275.

POSTSCRIPT.—On reading this paper since it has been set up in type, it strikes me that it is too positive in its tone and may convey an impression that I mean it to be accepted as a final solution. This, however, is not the case. It is purely tentative, and since it was written I have met with additional reasons for regarding it in this light. In February I received an inquiry from Mr. C. Crain, of Boston, Mass., U.S.A., as to the progress of my investigation in Hebrew Chronology, and in reply to my answer he sent me a *précis* of his own scheme of this period, which struck me so strongly by its ingenuity and careful research, that I asked him to draw up a short statement of his views in order that I might lay it before you in the discussion on this paper as an alternative to my own; this in a letter dated 31st March he promised to send, but it has not yet reached me. His paper was published in *The Shepherd's Voice* during the year 1895, but until the correspondence now mentioned I had never heard of that publication or of Mr. Crain.

His scheme appears to be *founded* on the cross references in the books of Kings between the reigns of the kings of Israel and Judah, he admits coregnancies of various kings, and there may be some new difficulties as to age of fatherhood for two of the kings of Judah, but he retains *every Scriptural date* except the 27 years in 2 Kings xv, 1; and all the Assyrian dates *without any gap in the eponym lists*. If the date of Shishak can be lowered to 940, or thereabouts (and this I find on careful revision of my Egyptian scheme is perfectly feasible) and the coregnancies admitted (on which question I am at present engaged), I shall withdraw my own scheme in favour of Mr. Crain's. Nevertheless I shall not in any case regret having proposed it; for, if Mr. Crain proves to be right, the vindication of the Scriptural dates will be absolutely complete, and I need hardly say that no one will be more pleased than myself if my paper should prove to be merely a vantage ground from which the "Shepherd's Voice" shall be more clearly heard proclaiming the perfect consistency and historical accuracy of the Book of Kings. I append a tabular view of Mr. Crain's remarkable scheme condensed by me from the elaborate table which I received from him in March.

F. G. FLEAY.

HEBREW CHRONOLOGY SYNCHRONIZED WITH ASSYRIAN.

Judah.		B.C.	Israel.		
1 Rehoboam	...	930	1 Jeroboam	...	...
5 (Shishak)	...	926	...	...	...
17 ...	...	914	...	...	...
1 Abijah ...	...	913	18 ...	...	...
3 ...	1 Asa ...	911	20 ...	...	...
...	2 ...	910	...	1 Nadab	...
...	3 ...	909	22 ...	2 ...	1 Baasha
...	15 (Zorah)...	897	...	...	...
...	26 ...	886	1 Elah ...	...	24 ...
...	27 ...	885	2 ...	Zimri	1 Omri.
...	...	881	Tibni dies	...	...
...	...	874	1 Ahab ...	...	12 ...
1 Jehoshaphat	41 ...	871	4 ...	...	...
17 ...	1 Jehoram (a)	855	...	1 Ahaziah	...
18 ...	...	854	21 (Qarqar)	2 (6 Shal.)	1 Joram.
22 ...	1 Jehoram (b)	850	...	...	5 ...
25 ...	...	847	...	...	...
Ahaziah...	8 ...	843	...	...	12 ...
...	1 Athaliah	842	1 Jehu ...	tribute	18 Shalmaneser.
1 Jehoash...	7 ...	836	7 ...	...	...
...	...	815	28 ...	...	...
23 ...	...	814	1 Jehoahaz	...	...
...	...	803	12 ...	tribute	9 R. nirari.
37 ...	...	800	15 ...	1 Joash	...
38 ...	1 Amaziah	799	16 ...	2 ...	...
...	...	798	17 ...	...	...
40 ...	...	797	...	...	...
...	...	788	1 Jeroboam (a)	13 ...	...
1 Uzziah (a)	15 ...	785	1 Jeroboam (b)	16 ...	...
14 ... (b)	28 (flees) ...	772	17 ...	...	...
...	29 ...	771	...	...	...
...	...	750	...	...	1 Pekah (a).
...	1 Jotham...	749	...	...	2 ...
38 ...	...	748	41 ...	Zachariah	...
39 ...	...	747	Shallum	1 Menahem	...
...	9 J. = 1 Ahaz (a)	741	...	...	...
...	...	738	7 Tiglath P.	10 (tribute)	...
50 ...	...	736	1 Pekahah	...	...
...	...	735	2 ...	...	...

Judah.		B.C.	Israel.		
52	... 16 J. = 8 A. (a) = 1 A.(b)	734	...	...	17 = 1 (b).
...	...	731	...	...	20 ...
...	20 J. = 12 A. (a)	730	1 Hoshea	...	...
...	...	728	3 ...	...	...
1 Hezekiah	...	727	...	...	...
...	16 A. (a)	726	...	...	...
6	...	722	9 ...	Samaria	taken.

The following communication has been received from the Rev. R. C. OULTON, B.D., Rector of Glynn, co. Antrim:—

I have read with great interest and pleasure Mr. Fleay's valuable paper on the above subject. His method of reconciling the discrepancies between certain statements in Kings and the researches of Assyriologists, as well as other passages in the sacred historical writings, seems to me ingenious, and, to a considerable extent, well grounded. May I be permitted to offer some criticism on his treatment of 2 Kings xv, 30? This thirtieth verse he gives up as untenable for the following reasons:—1st. "Hoshea did not obtain the throne by an independent conspiracy, but was appointed by Tiglath, who had smitten Pekah," according to Assyrian annals. 2nd. "The twentieth year of Jotham is an impossible date; for Jotham reigned only 16 years." In expressing my opinion that the rejection of the verse in question is too drastic a method, I would tentatively suggest another way of meeting the difficulty.

In the first place, it does not appear to me that the verse necessarily implies that Hoshea got possession of the throne "by an independent conspiracy." After the murder of Pekah, there may have been an interregnum for some years (as the country was probably in a disturbed state) until he was recognised as reigning king by Tiglath Pileser.

Secondly, the date given namely, the twentieth year of Jotham, may fairly be taken to apply to the time not when Hoshea came to the throne, but rather to the time of the conspiracy.

Thirdly, the contradiction between twenty and sixteen years as the period of the reign of Jotham may be accounted for in the

following way :—There may have been some uncertainty as to the exact duration of this monarch's reign owing to the want of agreement as to the precise time, in the original Jewish Chronicles, from which the writers of the Book of Kings copied. There are evidently marks of a different hand in verses 32, 33, and by no means have we a right to assume that the same writer penned all the historic events recorded in the fifteenth chapter.

One general remark I would make, and it is this—that we ought not to take it for granted that where there is a discrepancy between the Assyrian monuments and the Jewish records, that the former are *invariably* accurate.

ORDINARY GENERAL MEETING.*

CAPTAIN G. P. HEATH, R.N., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following paper was read by the author :—

*NOTES ON THE THICKNESS OF THE LUCERNE
GLACIER OF THE POST-PLIOCENE PERIOD.* By
Professor EDWARD HULL, M.A., LL.D., F.R.S. (Secretary).

THE valley of the Lake of Lucerne, or as it is better known, the Vierwaldstätter See (Lake of the Four-forest cantons) is unsurpassed in Switzerland for the beauty and grandeur of its scenery. Its lofty banks, clothed with forest, give place to mural cliffs of limestone too steep for trees to grow on, but diversified by terraces of richest green verdure; while the waters of the lake itself present a sparkling surface of bluish-green tint reflecting the azure of the cloudless sky. Following the direction of the upper lake into the valley of the Reuss, you behold the landscape bounded by lofty mountain peaks and ridges, rising higher and higher till culminating in the far distance amongst the snowy summits of the Bernese Oberland. Here the pure white cone of Finsteraarhorn pierces the sky to a height of 14,026 feet above the level of the sea; farther on extend the more massive group of St. Gotthard heights. It is hard to conceive that such a scene of verdure and beauty as that which we survey immediately around us from the terraces of the Burgenstock or the Seelisberg Hotels was once enveloped in snow and ice; that an immense glacier occupied the lake lying so placidly at a depth of about 1,500 feet beneath our feet, and not only filled the channel to the level of its surface, but reached

* Monday, May 9th, 1904.

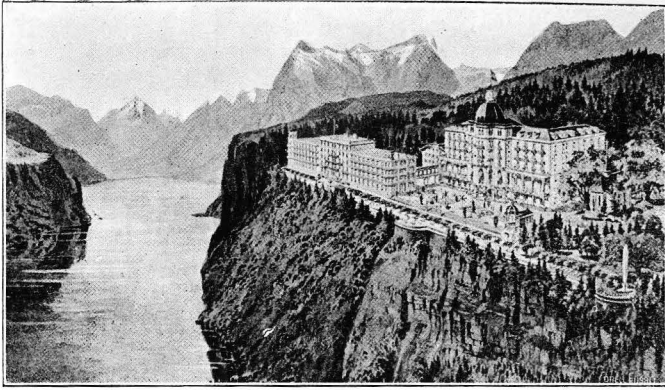


FIG. 1.—LAKE OF LUCERNE.

Section through moraine at Bellevue above Treib.

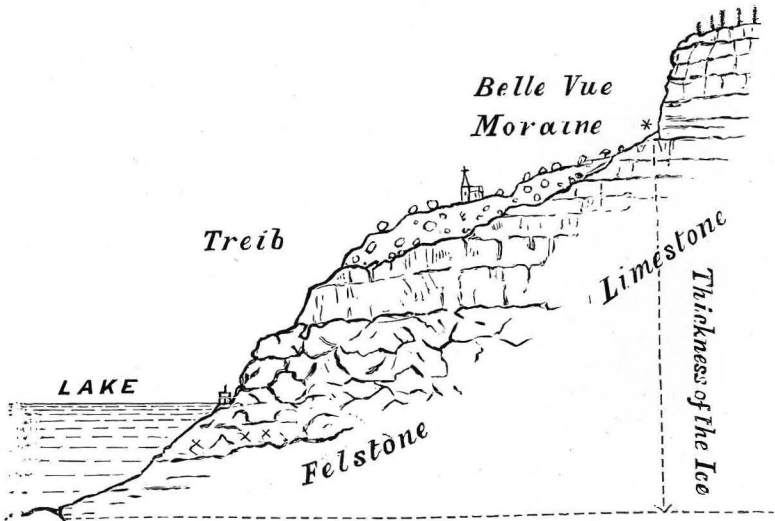


FIG. 2.—GEOLOGICAL SECTION ACROSS LAKE LUCERNE.

* Indicates the upper limit of the glacier ice.

to the height at which we stand, and that all the lofty heights and terraces above and around were enveloped in a perennial mantle of snow. In a word, to reproduce to the mind the present scene as it was during the Glacial epoch, we must ascend the higher valleys of the Bernese Oberland seen in the distance, and stand on the cliffs overlooking the Mer de Glace under the slopes of Mount Blanc, at a height of 10,000 feet above the level of the sea. Such is the transformation scene indicated by the phenomena visible at intervals as we wander along the dense forests or open glades around, at a level of only about 2,780 to 2,800 feet above the sea.

There is, of course, nothing new in what has been stated above. The late Sir Andrew Ramsay in his memorable essay entitled "The Glacial Origin of Lakes," recognised that the valley of the Lake of Lucerne was once the channel of a "great glacier," and shows that the lake itself lies in a "rock basin," being deeper in the central part than at the outlet; and he overthrows the view—at that time held by some Swiss geologists—but, I presume, now generally discarded, that the lake occupies the space left by "a gaping fissure."* The fact that the present glaciers of the Alps once descended so low as to fill the valleys of the great lakes, rising high on their banks, has been recognised since the days of De Saussure, Charpentier,† and others. Their former extension is testified to by the occurrence of boulders of gneiss, granite and protogene derived from the central core of the Alps, lying scattered over the sides of the valleys formed of the more recent formations of Cretaceous and Tertiary strata, for the most part composed of fossiliferous limestone and shale; while the surfaces of the rocks themselves are often polished and worn by glacial grooves and striations at long distances from the nearest limits of the existing glaciers. This being so, it occurred to me, while endeavouring to realise on the spot, during the late summer, the physical change that has taken place, to endeavour to measure with some approach to accuracy the actual depth to which the glacier of the Lucerne valley attained during its period of maximum evolution.

Fortunately the data for the solution of this problem are not wanting, and I hope to make it clear how they are to be applied.

Upper limit of Glacier action how determined.—The height

* *Quart. Journ. Geol. Soc.*, vol. xviii, p. 196. Ramsay makes the depth of the lake 853 feet, which would be probably near the centre opposite Vitznau.

† *Essai sur les Glaciers.*

to which a vanished glacier once extended is determined by the phenomena presented by the sides of the valley which it once occupied. These phenomena are chiefly of two kinds:— either the surfaces of the rocks of which the valley is formed are glaciated, or moraine matter with erratic boulders is found resting on them. Should the sides of the valley be sufficiently lofty as to have surmounted the glacier, the rocks rising above the glaciated limit will be fresh and sharp, presenting no evidence of ice-erosion; nor will they be covered by morainic matter or erratic blocks. The subjoined section will illustrate these statements, and it is one taken at the spot where I propose to measure the thickness of the former ice in the valley of the Lake of Lucerne. (Fig. 2.)

The section on the wall, and that also given in the paper, will illustrate this more clearly. The Seelisberg Hotel stands on a promontory jutting out into the valley of the Lake of Lucerne at the point marked Treib.* The section Fig. 2 is taken about half a mile from where the Belvue Hotel stands; and where the church is built upon a large moraine formed of gravel and boulders, some of which boulders are of enormous size; and at its upper limit, which is presumed to be also the limit of the former ice, the limestone rock rises in a lofty cliff, which was uncovered by the ice; in fact, there was no glacier higher than that limit, as far as my knowledge extends. Those brownish patches illustrate the moraine which rests upon the limestone; and below this you descend by a winding road down to that point at Treib which is just where the lake makes its sharp bend. The lower part of the section is a mass of bedded felstone, as far as I was able to make out, and contemporaneous with the formation.

Above the point of Treib where the "Lake of the Four-forest cantons" makes a sudden bend to the east, there occurs the moraine above referred to, on which stands the Belvue Hotel, amidst forest trees and gardens. In the background is a rampart of lofty vertical cliffs of bluish limestone. The surface of the moraine, although much modified by art from its original rugged and broken outline, is formed of rubble, clay and gravel, and is largely covered by forest trees. But from time to time we meet huge blocks and boulders of granite, gneiss and schists strewn in groups or separate; some of these weighing probably from 40 to 50 tons. None of these huge blocks belong to the district: they have their source in the far off

* The hotel directly overlooks that branch known as the Bay of Uri.

mountains of the Bernese Oberland and adjoining heights. Similar erratic blocks are to be observed near the Seelisberg (Sonnenberg) Hotel, resting directly on the surface of the native limestone and amongst the forest trees overlooking the lake. The height to which these erratic blocks extend above the surface of the lake is about 1,400 feet, which may be taken as the limit to which the edge of the former glacier extended.

That these transported blocks had their origin in the Bernese Oberland, the St. Gotthard and the Finsteraarhorn, at a distance of 20 or 30 miles from the head of the lake, there can be no doubt. The valley of the Reuss, which is continuous with that in which the upper lake lies, points towards these distant snow-clad masses; and we know from the observations of geologists that they are formed of granite and varieties of gneiss and schists, similar to those of which the boulders themselves are formed.* From Dr. Baltzer's section, the Finsteraarhorn is shown to be a mass of solid granite called "black granite," while the St. Gotthard mass consists of gneiss and varieties of schist. Such is the composition of the boulders lying on the slopes of the Seelisberg at a distance, as I have stated, of some 20 to 30 miles from their source. Similar blocks occur on the adjoining ridge of Bergenstock; and by an opening in the moraine matter on the south side of the ridge above Stanz I was able to observe the direction of the glacial striæ, indicating clearly that the ice had passed right over the ridge into (what is now) the lake of Lucerne on the other side.

It may be observed that the promontory above Trieb at Seelisberg very naturally became the site of a moraine during the period when the valley was the channel of a great glacier. Here (as above observed) the glacier coming down from the interior mountains along the Valley of the Reuss into the upper arm of the present lake called the Urner See, would be forced to change its course to a direction at right angles, owing to the barrier presented by the ridge of the "two mysterious Mythen" as they are called by Lord Avebury† by which the ice was diverted westward. The ridge of Seelisberg formed the inside of the elbow, and the movement of the ice would be here retarded, with the result that the moraine matter with its blocks of granite would be deposited at this spot.

* See Von Dechen's *Geologische Karte von Deutschland*; also *Livret-guide Géologique de Le Jura et les Alpes* (1894), Sheet 9, by Dr. A. Baltzer.

† *The Scenery of Switzerland*, by Sir John Lubbock (Lord Avebury), p. 283.

Thus the thickness of the great ice river which filled the valley of the Urner See was about 2,157 feet, being the height of the limit of the erratic blocks above the surface of the lake (namely, 1,500 feet) added to the depth of the lake itself (about 657 feet) at the bend of the valley at Brunnen.

Lord Avebury states that the glacier of the Reuss extended to Aarau and down the valley of the Aar to Coblenz. On the east it filled the lakes of Egeri and Zug, extending along the Albis to the Uetliberg and to Schlieren on the Limmat, following the valley down to Coblenz.* Measured from the St. Gotthard, this would be a distance of seventy-five English miles in a straight line; but measured along its numerous windings it would be probably at least eighty. This length, however, is far exceeded by the old glacier of the Rhone and the Rhine, which almost enclosed the glaciers of the Aar, the Reuss and the Limmat, and had their origin in the same great central mass of the Bernese Oberland.

DISCUSSION.

The CHAIRMAN.—We are much obliged to Professor Hull for the paper he has read, and although it is short, I have no doubt there are gentlemen here who can supplement it by some remarks on its contents. (The Chairman then called on Professor Logan Lobley.)

Professor LOGAN LOBLEY.—Mr. Hudleston, who is a much greater authority on glacial phenomena than I am, is here, and I should like you to have his remarks first.

Mr. W. H. HUDLESTON, F.R.S.—I cannot say that I am much of an authority on glacial phenomena. It is certainly not my special subject.

I have listened with great pleasure to Professor Hull's paper, which if short is, at any rate, very effective, and gives one a most excellent idea of the interesting phenomena that surround Lake Lucerne. I was so interested when I received this short paper that I ventured to jot down one or two notes which, with your permission, I will read in preference to making a regular speech. I made the

* *The Scenery of Switzerland*, by Sir John Lubbock (Lord Avebury), p. 130.

notes in reference to certain passages which appear in the paper, and they are as follows:—

1. The “*Valley*” of the Lake of Lucerne, which valley? This lake results from a combination of old preglacial valleys, both longitudinal and transverse, the Bay of Uri forming part of the transverse system.

2. “*Beauty and grandeur of its scenery.*”—One realizes at once that the great limestone masses of the Alps cut up into far finer figures than do the gneisses of the Italian side, as evinced, for instance, in the Lago Maggiore; hence the wonderful scenery of this lake which culminates in the bay of Uri. The head of the Lake of Geneva presents similar features, due in a measure to similar geological causes. But nothing in the Alps, nothing perhaps in the world, can vie with the Bay of Uri. It derives historical interest also as the birthplace of Switzerland. The Lower Cretaceous limestones are the chief formations, drawn out along two great folds involving portions of the Lower and Middle Tertiaries.

3. “*It is hard to conceive.*”—With geologists there is no difficulty; everybody nowadays realizes that there was such a thing as a Pleistocene Glacial period, and that a mountain chain like the Alps must have experienced its severity to the utmost. The whole of Switzerland is full of proofs, and the sight of the transported boulders of granite from the central massifs is one of the charms of a Swiss trip. Doubtless there was a *Mer de Glace* moving down the Valley of the Reuss and its continuation, the Bay of Uri, and there must have been a fine turn round the corner above Treib, where the Belle Vue moraine is situated.

4. The “*Glacial Origin of Lakes.*”—On this point there may be some room for divergent opinion. Of course the idea of a gaping fissure due to tectonic causes, in the case of the very complex Lake of Lucerne, is quite out of the question. As I said before, the Bay of Uri forms part of one of the most striking transverse valleys of erosion in the whole Alps. It was at one time a gorge of one of those rivers which are almost as old as the mountains themselves, and which kept deepening their channels *pari passu* with the axial elevation of the chain. Hence the Bay of Uri has been in the course of its history a cañon, a *Mer de Glace*, and now a submerged river valley, forming part of the most complex lake system in the Alps.

5. *Measurement of the thickness of the glacier at its maximum.*—The Belle Vue moraine, as I understand, is situated at the corner above Treib, and must represent, one would say, the remains of the left hand lateral moraine of the old glacier as it made this sharp turn to the westward. This may possibly represent an excessive upper datum line, since the extra pressure of the ice at this point might tend to lift the left lateral moraine somewhat above the mean level of the glacier; otherwise there can be no doubt as to the thickness of the ice at this point being fully 2,000 feet.

6. *The general limit of the erratic blocks.*—This being about 1,400 feet above the lake, if we add the depth of the lake, the sum fairly well represents the thickness of the glacier. As to the nature of the boulders, one would naturally expect to find the granitoid gneiss of St. Gothard which is in a direct line, but any granite coming from the Finsteraarhorn itself must have made a long détour by way of the Furka pass and the Urseren thal across the Aar valley in the first instance.

7. *The barrier of "the two mysterious Mythen."*—It is an open question whether the glacier did or did not follow a route previously indicated in pre-glacial times. There can be very little doubt that the original valley of the Reuss passed northwards by way of Brunnen, Schwyz and the Ægeri sea. The mysterious Mythen form a mountain mass which prevented both river and glacier from extending to the eastward, but it is doubtful if this mountain mass had any other effect on the old Reuss drainage. The origin of the middle part of the Lake of Lucerne is obviously very difficult to explain, hence the precise cause of the deflection of the Reuss drainage to the westward instead of to the northward is not quite clear. But I suggest that the transverse valley of the Reuss found its way into a valley which was partly longitudinal (geotectonic) and partly transverse, and which now constitutes the middle section of the Lake of Lucerne.

As regards the two "mysterious Mythen" themselves, they are represented by Schmidt as a mass of Jurassic rock resting on the usual Eocene of the district. Since there are no Jurassic rocks in the immediate neighbourhood, their appearance in this attitude seems to have astonished even the Swiss geologists themselves, accustomed as they are to the most unexpected inversions.

8. *Retardation of the ice on the angle formed by the Seelisberg.*—This subject has been already considered under No. 5.

9. *Extension of the Reuss glacier.*—We are told that this glacier extended as far as Coblenz on the Rhine, and we may well believe that it was there simply merged in the mass of the Rhine glacier, which appears to have been bounded on the north by the granite hills of the Black Forest. It is only by tracing its moraines that the individuality of a glacier could be shown in the midst of the huge sea of ice, which must have, more or less, filled the central valley of Switzerland during the period of maximum glaciation.

I think those are the principal points that I wish to make, and it has given me great pleasure to have been able to make them.

Mr. MARTIN ROUSE.—Did you say that the Jurassic rested on the Eocene ?

Mr. HUDLESTON.—Yes, that is so in the case of the Mythen.

The SECRETARY.—And there is isolation ?

Mr. HUDLESTON.—Yes.

The CHAIRMAN.—What is the meaning of the term "Mythen" ?

Mr. HUDLESTON.—I cannot say.

The CHAIRMAN.—There is something mythical about it, perhaps.

Professor LOGAN LOBLEY, F.G.S.—I have listened with much interest to Professor Hull's paper which, though short, as Mr. Hudleston says, is very effective. I have also listened with very great interest to the notes containing the valuable and interesting remarks by Mr. Hudleston, who knows the district exceedingly well. He has dealt with the local features so adequately that I think it would be unnecessary for me to say anything further about them. The great features which we see displayed by that map have been explained as it is only possible they can be explained. The series of longitudinal valleys and transverse valleys are very marked in the Swiss area. If you looked down on that model of Switzerland, which existed some little time ago in the Museum of Practical Geology, but which I regret to say is not there now, you could see those longitudinal valleys and transverse valleys with very great distinctness.

One point Mr. Hudleston referred to which is very well illustrated in this country, not far from where we are, and that is the cutting open of the river gorges *pari passu* with the raising of

the land. That is shown by the gorges on the south side of the great Weald Valley, where you have rivers flowing from the Weald northwards to the Thames and southward into the English Channel. These rivers have been flowing in that direction from the time they originally flowed, when their source was higher than the Chalk. They have continually flowed down and eroded the Chalk until at the present time the river valleys are deep gorges, transversely crossing the chalk, and have been eroded, as I have said, at the same time that the land was being raised and at the same time as the surface was being lowered by denudation.

But a larger consideration is suggested by Professor Hull's paper, and that is the cause of this great mass of ice being in this valley at the Post-pliocene period. It seems to me that we cannot dissociate this from those great features of the glacial period we know of in the European area. We have had glacial conditions in this country extending southwards to the Thames, and we have glacial conditions in various parts of Europe extending over a very much larger area. Those conditions were evidenced in a paper brought before the Institute by Professor Hull some time ago on the glacial conditions on an extensive scale occurring in the south of Europe.* It seems to me that all these glacial phenomena must be due to some one great cause. What is that one great cause? The origin of glacial phenomena has been attributed to astronomical changes; but it seems to me they may be more probably accounted for by geographical changes, such as by elevations of large areas. If there were a general elevation of the northern portion of Europe, continued for a sufficient length of time and of sufficient dimensions, we might get a repetition of the glacial conditions of which we have such abundant records as having occurred in the past. If the whole of Switzerland were higher, by 2,000 feet, or even 1,000 feet than at present we should have glacial phenomena, which we have in different parts of Switzerland, extending over a much greater area than the glacial phenomena described by Professor Hull to-day. It seems to me to be unnecessary to bring in these astronomical causes to account for the glacial epoch. We can recognise the enormous thickness of the ice in the Valley of Lucerne at a distance of nearly

* "Another Possible Cause of the Glacial Epoch," *Trans. Vict. Inst.*, vol. xxxi.

twenty miles from where we have at the present time actual glacial conditions, and the *Mer de Glace* and other portions of Switzerland which have enormous thicknesses of ice; so that comparatively little elevation would give an enormous extension of ice into the adjoining lower regions such as those of the Lucerne Valley.

The SECRETARY,—in reply to a question by Mr. Rouse—said that the Finsteraarhorn is known to be composed of what is called “black granite.” I suppose it is blue granite, with black mica.

Mr. HUDLESTON.—I cannot say.

The SECRETARY.—But I cannot say that I examined the boulders very carefully, nor am I sufficiently acquainted with the granite of the Finsteraarhorn; but I think in some portions it is very likely there is some of this granite amongst the boulders. As I understand from Mr. Hudleston’s map, there is a continuous valley and Finsteraarhorn would be somewhere *here* [*pointing*].

I think, giving glaciers due credit for the wonderful things they perform in the way of transporting blocks, I do not think there is anything insuperable in the idea that the granite comes from these heights, as there is a continuous channel.

Mr. HUDLESTON.—Oh yes.

The SECRETARY.—I am exceedingly gratified that Mr. Hudleston has been able to be here this evening. He is one of our Vice-Presidents and a most valued member. It is not often that we have the pleasure of seeing him, which is partly due to the fact that he is unable to be in London during most of the period of our session in winter. I am very glad that he has been so good as to put his observations on paper, because they will supplement my own short paper very considerably, and they touch on points that I have not noticed.

With regard to the glacial origin of lakes to which Mr. Hudleston referred, I simply referred to it as a chronological question; and as Mr. Hudleston did not express his individual dissent to the theory of my late friend and chief, Sir Andrew Ramsay, I do not think it necessary to defend Sir Andrew Ramsay’s theory. I think myself, from the phenomena of the lakes in Switzerland and the fact that they are really excavated or eroded out of the solid formations, though sometimes helped to rise above the level by means of moraines thrown across their outlet, there is very strong evidence that glaciers had a great deal to do with the deepening of the central

parts of the lakes, and that view finds great support, I might almost say confirmation, by the soundings along the fiords of Norway. Nearly all the great Norwegian fiords are deeper in the central parts than at their outlets by a very considerable amount of depth, sometimes 1,000 or 2,000 feet, and if these fiords, like the valleys in the Alps we have been discussing, were originally river valleys, and they were also unquestionably filled by glacial ice, it is very hard to resist the evidence they give that they owe part of their depth (the deeper parts) to the erosion of former glaciers which we know to have existed.

The rocks rising above the surface of the Lake of Lucerne have undergone the most extraordinary modifications in their structure by means of the forces to which they have been subjected, as shown by the wonderful flexuring and contortions one sees on looking across this part of Lucerne Lake. The whole of the southern side of the lake, which rises to about 2,000 feet above the surface, here presents the most wonderful flexures, foldings and inversions of the strata of limestone.

Mr. HUDLESTON.—Oh yes, foldings like gneiss itself.

The SECRETARY.—Yes, I have often wished I could take a picture of them, had I been an artist, to place before the Institute, but I admit they are valleys of erosion, and that combination of the longitudinal with the cross valleys has no doubt determined the main features.

I do not know that I can quite agree with Mr. Hudleston, though no doubt he has good reason for supposing, that the glacier originally went out in *this* direction [*pointing*].

Mr. HUDLESTON.—Even straighter than that. Well, I cannot say that any glacier went *that* way, but a pre-glacial river went that way [*referring to the diagram*].

The SECRETARY.—That is a very interesting point.

Then with regard to Professor Logan Loble's view of the cause of the glacial period, I think he is quite aware that I am altogether with him in that view, that the elevation of the whole of Central Europe (western and northern) has been the great preliminary cause of the cold of the glacial epoch; but we need not discuss that now.

I am much obliged for the way you have received my paper.

PREHISTORIC REMAINS, WITH DRAWINGS, NEAR TENDA, ITALY.

The following letter, containing information of much interest, has been received from our valued Associate, Cavaliere W. P. Jervis, F.G.S., dated Turin, 30th June, 1903, is here inserted, and was to have been read at the meeting of the Institute on Monday, May 9th, 1904, but time did not permit of this, which the Editor regrets.

DEAR SIR,

“Let me allude to the well known discovery of human skeletons of prehistoric date found in a cave in Eocene (nummulitic) limestone on the coast between Menton and Ventimiglia.

“They have found about 800 drawings cut on the polished glaciated chlorite schist near Tenda, in four adjacent little valleys, close to the summit of the Maritime Alps. They are marvellously well preserved, and rubbings of a great many of them have been taken. I conversed on the subject with Sir Thomas Hanbury, and went to Genoa, where I had a lengthy conversation on the same matter at his house, which was very instructive and interesting.

“Although several competent men have occupied themselves on this question, these drawings present too ample a field for the hateful word *hypothesis*, which is the upas tree of science, for, being so unique as yet, it is still impossible to conjecture as to the race of our fellow-men to whom we may attribute them.

“The greater proportion of the figures represent rural, peaceful, agricultural life—men ploughing with yokes of two or more oxen, and accompanied by a boy, who leads the oxen. The ploughs are such as are still used in primitive parts of Italy, as are the yokes on their necks. There seems to be a genealogical connection. Then the other animals represented are *domestic forms*. Curiously enough most of the work is represented from *above*, but the men are seen at *full length*.

“The late Prof. Issel said that these figures are rather meant as *symbols of thought* than as drawings. I suggested to him that if the rubbings (taken by an intelligent, but unscientific person), instead of being classified according to forms, had been represented in the position in which they are engraved on the rock, we might be led to discover

the object intended to be conveyed, perhaps indeed find definite words, but not letters of any alphabet. Should such be substantiated, we might be led to a more distinct notion of these ancient people. The rubbings are reproduced with the utmost skill and accuracy, nothing is wanting but the proper arrangement, and there is yet time to do that also. Mr. Bicknell has been most conscientious in his task.

“If uncertainty exists as to the people by whom these engravings were so carefully made, we learn that the authors at least were quite unacquainted with any art representations, and had never seen the roughest artistic work. They are the result of uncultured genius.

“But as to their age we can form some definite clue. There are likewise representations of arms, such as tomahawks, strikingly akin to Pacific Island forms, arrowheads of various short designs, showing the precise manner of fixing as the prehistoric people so generally adopted. Then there are short, straight daggers, evidently of bronze, being far too long and slender for us to imagine them to have been made of stone, like the arrowheads were. This seems to me to prove sufficiently that a tribe or race of men is indicated as having preceded the bloody and cruel Roman conquests, at least of these poor mountaineers. The representations of bronze, perhaps even ironwork, find a date even subsequent to what is generally called the Neolithic age. For though stone implements were employed by many of these Alpine mountaineers, *from want of knowledge of metallurgy, which is really the reason why simple people were obliged to have recourse to them*, these metal arms might have been obtained at the coast from merchants trading from some southern country.

“There are figures of wheels, and many undesirable objects, but all is carefully executed. Issel presumes that it is the work of successive generations of men. The most remarkable objects to my mind are men shown in excellent positions, throwing tomahawks to a considerable distance; for not only is this instrument shown while the man's arms are still uplifted, but a faint straight line connects the man's arm with the weapon, while at short equal distances this line is divided by a firm circular mark. This I interpret to signify the trajectory, as likewise the number of units of distance to which the man was able to throw the weapon itself. There is here ample

scope for specialists, and for comparison with analogous work in other countries, for this is unique as regards Italy. Is it not the beginning of a grand prehistoric chapter of research ?

“ Hoping that this will find you in perfect health, and thinking of new studies on the ocean bed.

“ I am, dear sir,

“ Yours sincerely,

“ W. JERVIS.”

The Meeting then closed.

ORDINARY MEETING.*

CAPTAIN E. W. CREAK, C.B., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following candidate was elected :—

MEMBER :—E. F. Frost, Esq., West Wrattling.

The following paper was read by the author :—

*ON THE ORIGIN OF THE MARINE (HALOLIMNIC)
FAUNA OF LAKE TANGANYIKA.* By W. H.
HUDLESTON, Esq., M.A., F.R.S. (Vice-President).

[*With Two Plates.*]

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PART I.—GENERAL CONSIDERATIONS : ZOOLOGY AND PALÆONTOLOGY.

Introductory.

History of the subject and statement of Mr. Moore's views.

The argument limited to the halolimnic gasteropods—Appendix on the Conchology.

Distribution of Jurassic faunas in intermediate areas—African Jurassics.

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On the possible transference from marine to freshwater conditions.

Jurassic fossils of the Mediterranean basin.

PART II.—OUTLINES OF AFRICAN GEOLOGY.

The three principal geographical divisions.

The Plateau-range of East Africa (the Great Central Range of Mr. Moore).

Geology of British East Africa.

Geological structure of the Congo basin.

The periphery of the Congo basin.

Suggested correlation of the beds composing the interior of the basin.

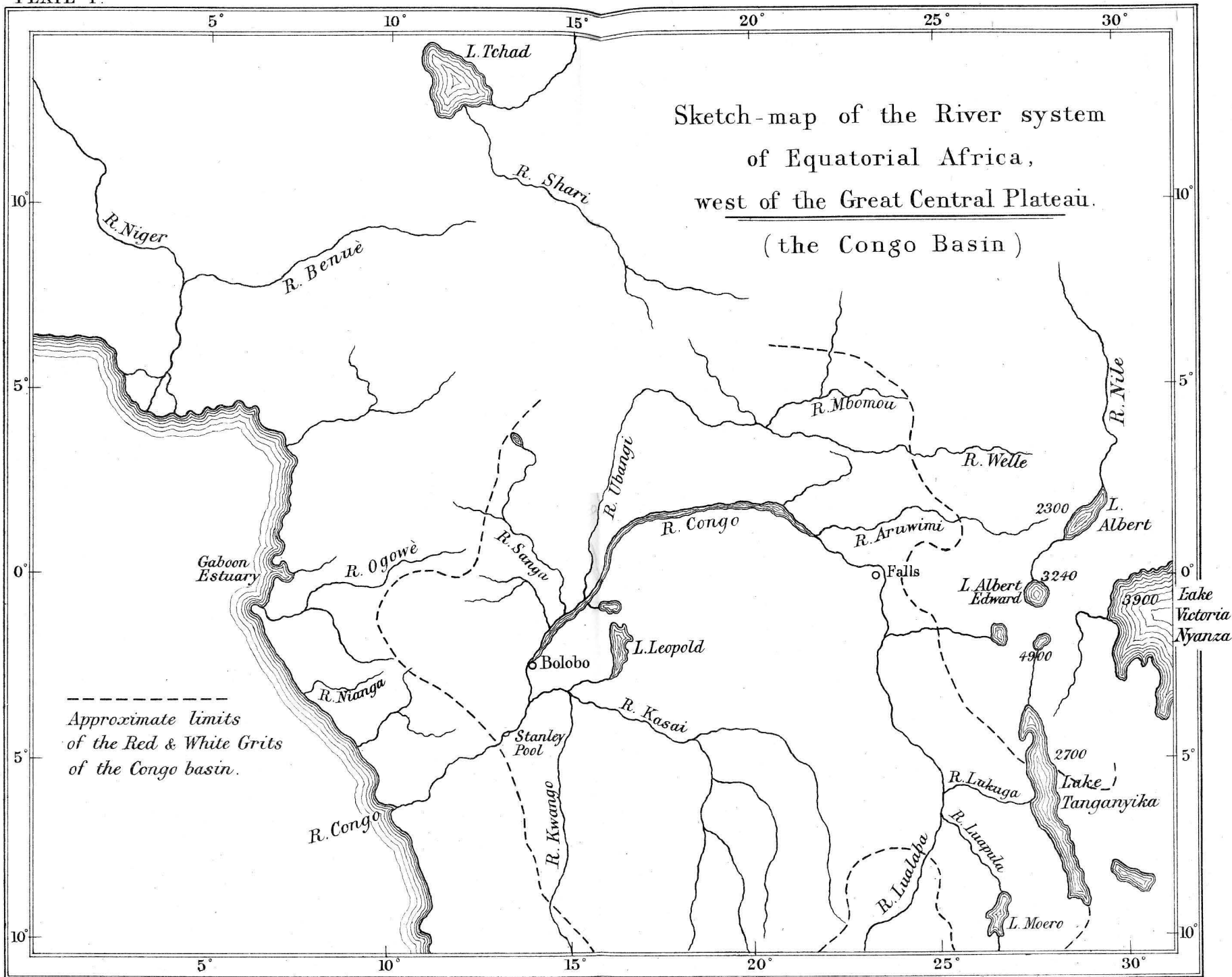
Structure of a Graben.

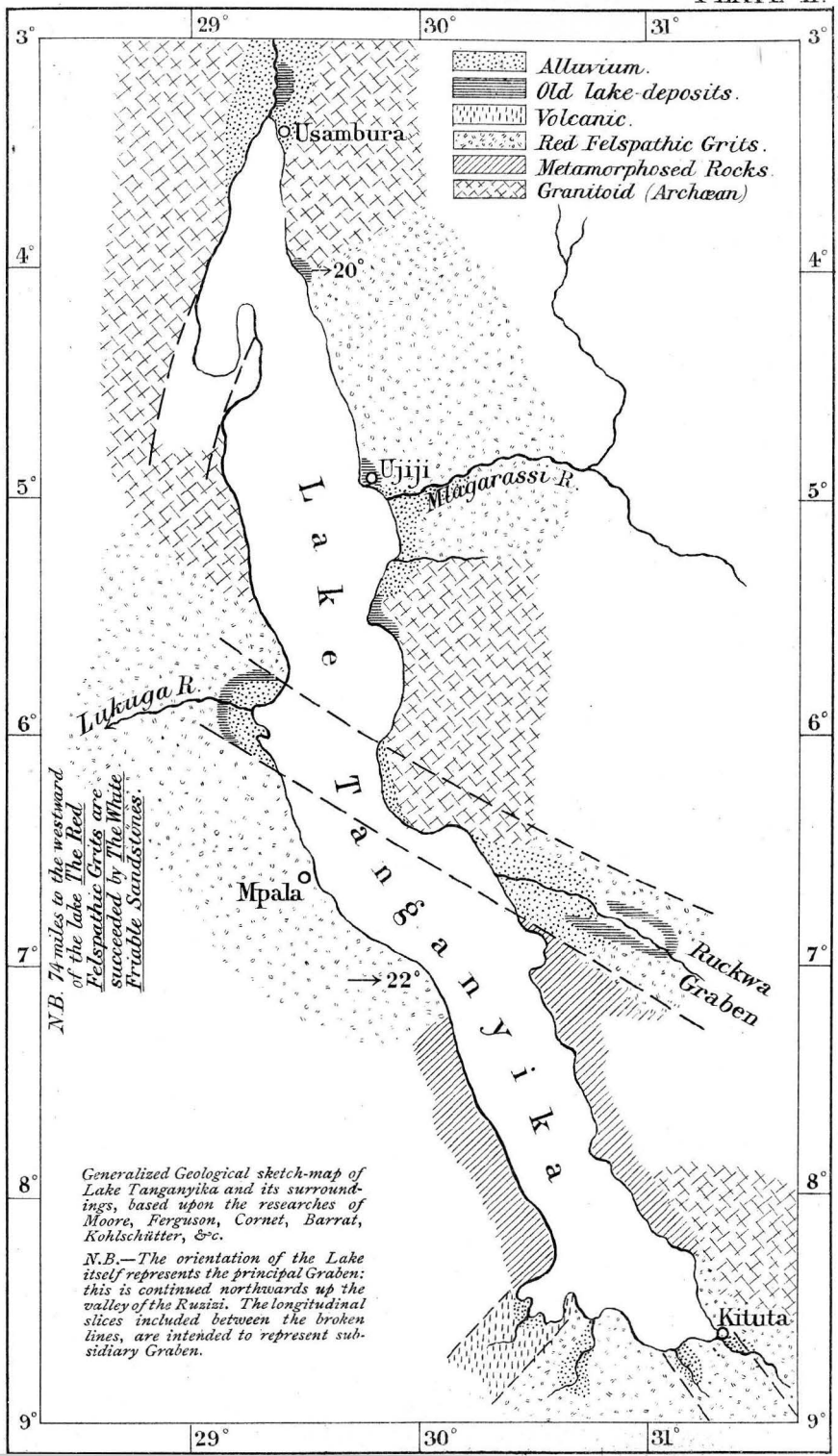
Geology of Lake Tanganyika.

PART III.—CONCLUSIONS.

1. The zoological aspect.
2. The palæontological evidence.
3. The argument from geology.

* Wednesday, May 25th, 1904.





- Alluvium.
- Old lake-deposits.
- Volcanic.
- Red Felspathic Grits.
- Metamorphosed Rocks.
- Granitoid (Archæan)

N.B. 74 miles to the westward of the lake The Red Felspathic Grits are succeeded by The White Friable Sandstones.

Generalized Geological sketch-map of Lake Tanganyika and its surroundings, based upon the researches of Moore, Ferguson, Cornet, Barrat, Kohlschütter, &c.

N.B.—The orientation of the Lake itself represents the principal Graben: this is continued northwards up the valley of the Rusizi. The longitudinal slices included between the broken lines, are intended to represent subsidiary Graben.

NOTE.—It should be observed that the title of this paper is rather unfortunate, since it starts by begging the question of a marine origin. I consented to write a paper for the *Victoria Institute* on the "Tanganyika Problem," and this I have endeavoured to do, so far as available information will allow me, but I admit at the outset that many years of observation must elapse ere the Tanganyika Problem is fully solved.

PART I.

GENERAL CONSIDERATIONS, ZOOLOGY AND PALÆONTOLOGY.

Introductory.—Fifty years ago Central Africa itself presented a problem, which as far as geographical exploration extends, was ripening for solution at the hands of the bold explorers of the latter half of the nineteenth century. By degrees the wonders of the Dark Continent were revealed to the geographer and the naturalist, and even the geology of those regions has received some share of attention, rather by way of comparison with the already known features of more accessible districts, such as the Cape, than for any detailed and systematic description of the rocks which constitute their surface. Although missionaries of German origin contributed materially to our early knowledge of East Central Africa, still the larger share of exploration has fallen to the lot of our own fellow-countrymen.*

When the geographical features became better known, it was ascertained that this once mysterious region contained numerous lakes of immense size, some of them situated in deep chasms of the earth's crust. And, more unexpected still, it was found that there were volcanoes both extinct and active, constituting lofty mountains; and furthermore that on some of these mountains glaciation had been developed on a considerable scale, and that glaciers even now exist on the higher peaks, actually under the equator.

What wonder, then, that Equatorial Africa, and particularly the eastern portion of it, should present problems, both in geology and zoology, which are difficult of solution? As for ourselves, we must admit at the outset that we are entirely dependent on the descriptive portion of those numerous and excellent works which tell us of this country; and if we venture in any case to hesitate at accepting all the inferences

* One of the greatest of whom, Sir H. M. Stanley, has just passed away; to the general regret of all from the King downwards. Sir Henry Stanley was a Hon. Corresponding Member of the Institute.—E. H. (Ed.)

which their authors have drawn, it must be with bated breath and with the full consciousness ever present in our minds that they have been there and that we have not. In the light of so much that has recently been revealed, it is only natural that many controversies should arise, and some of these perhaps may be ultimately settled by more extended investigations leading to further knowledge of the subject. As a case in point, I may mention the remarkable circumstance which has greatly exercised the minds of certain zoologists, viz.:—that there are some species of fishes in the waters of the Upper Nile which also occur in the hydrographic basin of the Jordan in Palestine, and yet are not found in the waters of the Lower Nile in Egypt. When zoologists are desirous of accounting for anything which seems abnormal or difficult of explanation, they are quite prepared to make the earth's surface undergo considerable modifications in order to suit their special line of argument, and indeed they can generally find a sufficient number of geologists to back them in such a course. This subject may crop up again when we proceed to consider the geological structure of eastern Equatorial Africa, and, therefore, it will be sufficient at the present moment merely to refer to the hypothesis, which connects the drainage of the Jordan system, through the Gulf of Akabah and the valley of the Red Sea, then supposed to be a fresh-water river, with a portion of the "Rift Valley" system, and ultimately with the drainage of the Upper Nile. Far be it from me to say that such an explanation is incorrect, but it certainly ignores all existing hydrographic arrangements most completely.*

The case I have just quoted is perhaps more difficult of solution than the problem which we are now called upon more especially to consider, viz.:—the origin of the halolimnic fauna of Lake Tanganyika, or in other words what Mr. Moore very aptly calls the "Tanganyika Problem." In attempting to grapple with this very curious and interesting question, besides the zoological evidence, it will be necessary to consider the geological structure of Equatorial Africa as far as the scanty details of our present knowledge permit; and if we venture in this connection to attempt to trace any portion of its physical history in times past, such reconstruction should harmonize as much as possible with known facts and existing features.

* On this subject the reader is referred to a paper "On the physical conditions of the Mediterranean Basin, which have given rise to a community of some species of fresh-water species in the Nile and in the Jordan Basins." *Trans. Vict. Inst.*, vol. xxxi, p. 3 (with map).—E. H. (Ed.)

History of the subject and statement of Mr. Moore's views.—The history of the recognition of the halolimnic fauna is important as tending to show what were men's views from time to time as each step in the progress of discovery was made. It will be remembered that Lake Tanganyika was discovered by Burton in 1857, and that his companion, Speke, picked up a few dead shells from the shores and brought them to England. The well-known conchologist, Dr. Sam. P. Woodward (*Proc. Zool. Soc.*, 1859, p. 348, Pl. XLVII) was struck with the peculiar forms of some of the gasteropods, which he considered had a certain marine look about them. Subsequently when further shells were procured, Mr. Edgar Smith (*Proc. Zool. Soc.*, 1881, p. 276), in a paper on a collection of shells from Lakes Tanganyika and Nyassa, expressed an opinion that they might turn out to be the relics of a former sea. The subsequent discovery of medusæ in Lake Tanganyika seemed to confirm these views as far as that lake was concerned. Hence before Mr. Moore appeared upon the scene, most of those who had paid attention to the subject had expressed themselves as favouring the view of the marine origin of this peculiar fauna.

Mr. Moore, as a result of his first journey in 1896, found "that in Nyassa and Shirwa there were no jelly-fishes, nor anything except purely fresh-water forms; while in Tanganyika there were not only jelly-fishes, but a whole series of molluscs, crabs, prawns, sponges, and smaller things, none of which appeared in any of the lakes he then knew, and all of which were distinctly marine in type.* Further than this, however, he found that none of these strange marine looking animals were to be compared directly with any living marine forms, yet, in their structure, some of them certainly seemed to antecede a number of marine types in the evolutionary series, and, in consequence, they appeared to hail from the marine fauna of a departed age. The most definite result of the first Tanganyika expedition, therefore, appeared to be that the sea had at some former time been connected with the lake, but when or how remained a mystery."

The above are Mr. Moore's own words in explanation of his views after the termination of his first expedition. It should be borne in mind that at this period, viz., in 1898, when his inferences were laid before the Royal Society (*Proc. Roy. Soc.*, vol. 62), there was an idea then partially and perhaps generally prevailing, that owing to the peculiar structure of the Rift-

* J. E. S. Moore, *The Tanganyika Problem* (1903), p. 3.

Valley system and its obvious physical connection with the great Red Sea depression, that the "halolimnic" fauna might have entered Lake Tanganyika from that quarter, and would consequently be found in some of the Rift-Valley lakes to the northwards, and especially in Lake Kivu, with which at the present day Tanganyika is hydrographically connected through the River Rusizi. It was therefore indeed a surprise when Mr. Moore had to announce as the result of his second expedition, commenced in the spring of 1899, that no trace of the "halolimnic" fauna had been discovered in any of the lakes, such as Kivu, the Albert Edward, or the Albert Nyanza, which lie to the northward of Tanganyika in the western arm of the Rift-Valley system. Nay, more, it would seem that no such thing as the halolimnic fauna was to be found in the great upland basin of the Victoria Nyanza, nor in the chain of lakes associated with Lake Rudolf (Basso Narok), which lie towards the northern termination of the eastern arm of the Rift-Valley system.*

To quote Mr. Moore's own conclusions on this point: "It has been shown that throughout Equatorial Africa, as in other great continents, there is a normal fresh-water fauna which has nothing peculiar about it . . . Subsequently, the fauna of L.

* There appears to be no longer any doubt as to the presence in Lake Victoria Nyanza of medusæ indistinguishable from those of Lake Tanganyika, and the fact cannot be without its effect upon the acceptance of the view put forward by Mr. J. E. S. Moore, that the fauna of Lake Tanganyika differs from that of the other East African lakes in alone possessing evidences of a marine origin. On December 1, 1903, Prof. Ray Lankester exhibited at the Zoological Society some medusæ from Victoria Nyanza obtained by Mr. Hopley on August 31, 1903, and sent to London by Sir Charles Eliot. A doubt being raised by some supporters of Mr. Moore's theory as to these medusæ having really come from Lake Victoria and not from Lake Tanganyika, Sir Charles Eliot, in a letter dated Mombasa, December 20, 1903, wrote to Prof. Lankester saying that the medusæ were collected by Mr. Hopley himself, in the Kavirondo Gulf, by the side of which the railway terminus is situated, and that the water was full of them. Mr. Hopley, at the request of Sir Charles Eliot, had endeavoured to study the life-history of the medusæ, but he failed to keep them alive for more than a few days. The specimens sent to London were said by Dr. R. T. Günther to be indistinguishable from the *Limnocnida tanganyicæ* of Lake Tanganyika. It is interesting in this connection to note that the Victoria medusæ were discovered quite independently in the same locality (Kavirondo, in the Kisuma district), and apparently at about the same time of year. According to *Globus* (January 28, p. 84), M. Ch. Alluaud, on the day of his arrival at Lake Victoria, discovered a marine medusa similar to that of Lake Tanganyika, and communicated an account of his discovery to the Paris Geographical Society on September 19, 1903.—*Nature*.

Tanganyika has been examined in detail, and it has been shown that this lake, like all other great lakes of Central Africa, contains the ordinary fresh-water fauna of the continent; but that in Tanganyika, and in Tanganyika alone, there are a number of organisms possessing definitely marine and somewhat archaic characters. Along with these, the halolimnic members of the Tanganyika fauna, there are others, such as the prawns, sponges and protozoa which, although not like the previous types, unique in being found in Tanganyika for the first time as fresh-water forms, are notwithstanding probably portions of the same group, for they are peculiar to Tanganyika, and are not characteristic of the general fresh-water fauna of the African continent." He further suggests that the African ganoids and certain other members of the African fish fauna may be portions of the "halolimnic" fauna. Lastly, he points to the significance of the similarity which subsists between the shells of the halolimnic gasteropods and "the remains of those found in the deposits of the old Jurassic seas."

Thus far Mr. Moore. When we ourselves attempt to face the Tanganyika Problem, it is obvious that it will have to be considered both from a zoological and a geological point of view, and the question is which shall we consider first, the zoology or the geology? We are dealing with an exceptional fauna, occurring under peculiar conditions and in what was, until quite recently, a most out-of-the-way place. Perhaps the first question we should ask ourselves is this: Do we consider that there is sufficient evidence of the *marine* origin of the halolimnic fauna? This fauna is placed by Mr. Moore himself under two different categories. (1) The halolimnic gasteropods, which are thought to be homæomorphic with certain shells from beds of the Inferior Oolite formation in Western Europe, and are thus inferentially regarded as descendants of those forms. (2) A fauna, not so thoroughly exceptional as the halolimnic gasteropods, made up of prawns, sponges, protozoa, etc., which are archaic in type and may be portions of the same group of marine derivatives. The presence of *Medusa* also is held greatly to strengthen this view. As regards the portion of the argument relating to the fishes, it has been stated by a competent authority that the fishes described by Mr. Boulenger in Mr. Moore's beautiful book are all essentially present day types, and do not in any way represent survivors from the seas of the Mesozoic period.*

* *Geological Magazine*, September, 1903, p. 418.

The argument limited to the halolimnic gasteropods.—Although, therefore, the subsidiary fauna of exceptional character may help to strengthen the argument in favour of the marine origin of the entire halolimnic group, yet the most important link in this chain of evidence is to be sought in the *halolimnic gasteropods*, which are considered so greatly to resemble Inferior Oolite forms, and which on the strength of this resemblance are held to be derived from a well known gasteropod fauna of Jurassic age. The malacological evidence, as regards the Tanganyika species, has been well worked out by Mr. Moore, and the conclusions as to the peculiar mixed and to a certain extent archaic structure of their anatomy must undoubtedly have great weight. But at this point the argument fails us, for when we are disposed to institute a comparison between living and fossil species we must in the main fall back on conchology alone. One point of importance must be noted here, viz., that, since the connection between the halolimnic fauna of Tanganyika and the old Jurassic marine fauna is confined to univalves, one might almost have expected that some lamellibranchs, and particularly *Trigonia*, if only in a modified form, might have accompanied their molluscan relatives. For it can hardly be contended that *Trigonia* would suffer more from translation to fresh-water conditions than the numerous species of gasteropods which are correlated with Jurassic forms. Moreover, if conchology is to be our guide in this matter, it is to be regretted that the author of the "Tanganyika Problem" should have endeavoured to minimize the value of a branch of science on which his conclusions with reference to the Jurassic origin of these Tanganyika shells must in the main be based.*

The above considerations apart, it must be admitted that there are some genera of Tanganyika gasteropods which have a striking external resemblance of form and ornamentation to certain well-known genera which more especially characterize the Inferior Oolite of the Anglo-Norman basin; and if such resemblance is not fortuitous, there seems a fair reason for regarding them as the possible descendants of such genera or their allies. Consequently, some portions of Mr. Moore's latest work are devoted to a detailed comparison between the Tanganyika shells and their presumed Jurassic analogues. The text is accompanied by excellent illustrations, the shell and the fossil being drawn side by side. As a detailed criticism of these comparisons might be somewhat tedious to the members

* *Geographical Journal* for 1903, p. 682 *et seq.*

of this Society, it will be sufficient to relegate this portion of my paper to an appendix, and briefly to state the impressions which a careful examination of both sets of shells, the fossil and the modern, have left upon my mind.*

As a result of this detailed examination I find on conchological grounds, that the evidence of an ancestral connection between certain fossils of the Inferior Oolite of the Anglo-Norman basin and the following halolimnic genera, viz., *Typhobia*, *Bathanalia*, *Limnotrochus*, *Chytra*, *Paramelania*, *Bythoeceras*, *Tanganyicia*, *Spekia*, and *Nassopsis*, is not nearly so strong as I had anticipated from the inferences already drawn and from what I had read in several publications. There are two Jurassic genera, chiefly developed in the Lower Oolites, viz., *Amberleya* and *Purpurina*, which have their conchological analogues in Lake Tanganyika, and in some cases the resemblance is very striking. But this is scarcely sufficient to justify the assumption that the oceanic character of these Tanganyika molluscs will more or less necessitate that the Tanganyika region of to-day must have approximated in character to an arm of the deep and open sea in ancient times,† and the inference is in Jurassic times. Indeed some people, I believe, have gone so far as to describe Tanganyika as an arm of the Jurassic sea. On biological grounds alone this is not at all probable; because under any circumstances this would have been a different zoological province from that occupied by the Anglo-Norman basin in Jurassic times.

It is further pointed out in the appendix, that, besides the resemblance between Jurassic and Tanganyikan gasteropods noted by Mr. Moore, there are other cases of what I have regarded as mere mock resemblances; but in order to appreciate such cases it will be necessary to study the appendix closely, which the majority of the members probably will not be inclined to do.

On the whole, taking the evidence of the *Medusa*, and the other semi-marine forms, as well as that of the halolimnic gasteropods themselves, a fairly good *prima facie* case for the originally marine origin of these exceptional organisms has been made out; nor do these curious gasteropods appear to be in any degree of close relationship with their ordinary fresh-water companions, although most of them undoubtedly bear traces of a long probationary experience of life in fresh-water. This may

* Appendix to Part I.

† *Proceedings Royal Society*, 1898, p. 455.

be seen in the texture of the shells, the colouring, the condition of the epidermis, etc., which may be noted in some of, but not in all, the genera.

The strongest argument of all in favour of an exceptional origin is the fact that, so far as is known at present, the halolimnic gasteropods are confined entirely to Lake Tanganyika, and this circumstance will incline us to look to the Congo basin, as being the place where the mystery may some day be solved.*

Before attempting to grapple with this part of the subject, which will involve the study of the geological structure of large portions of Equatorial Africa, there are two independent considerations on which I might say a word.

Distribution of Jurassic faunas in intermediate areas.—The first of these considerations relates to the distribution of *known* Jurassic faunas in areas intermediate between the Anglo-Norman basin and Lake Tanganyika, so far as such an investigation can be made, and thus endeavour to ascertain if this will throw any light upon the possible Jurassic origin of the halolimnic gasteropods themselves. From the quarries of Dorset to the depths of Tanganyika is a far cry, and there should be some half-way houses, some stepping stones, as it were, to bridge over the vast distance that lies between them. Mere zoological conjecture, as I have already pointed out, is not sufficient. We must have some palæontological evidence in corroboration of the intimate relationship claimed to exist between the two gasteropod faunas, *i.e.*, between the real fossils and those molluscs which are only archaic in their internal development. In the first place, then, I may say that in this country the peculiar gasteropod fauna which characterises the Inferior Oolite of the Anglo-Norman basin can hardly be traced above the Lower Oolites, though a stray form may linger in the Callovian or even the Corallian of Yorkshire. In middle France a repetition of this peculiar fauna is seen in the Callovian of Montreuil-Bellay. When we trace the Jurassic faunas into the south-west of France, although there is much in common with parts of the Inferior Oolite of our own country, yet the analogy, as far as gasteropods are concerned, is mainly confined to such genera as *Nerinea*.

* The fact that a species of jelly-fish identical with the one in Tanganyika has recently been discovered in the Victoria Nyanza, but slightly affects the argument as regards the halolimnic gasteropods. We can scarcely doubt that the more mobile organisms have had opportunities of establishing themselves from the great centres of distribution in a way which is denied to the more sedentary molluscs.

Out of about thirty genera of gasteropods quoted in Dr. Glangeaud's list from the Lower Oolites of the south-west of France the genus *Purpurina* does not appear at all, whilst the genus *Amberleya* is restricted to a single unnamed species. On the other hand the genus *Purpuroidea* is recognised.* Going further south again, we look to Choffat for information as to the Jurassic faunas of the Iberian peninsula. Hitherto, I have been unable to come across any systematic list of the gasteropod fauna of the Jurassic beds, though I note in the *Faune Cretacique du Portugal*,† a species of *Purpuroidea* described by that author. There are, however, throughout Choffat's numerous publications many lists of Jurassic fossils, yet I can find nothing which might lead one to suppose that the peculiar Anglo-Norman facies of Inferior Oolite gasteropods can be traced in the peninsula.

There is one very rich gasteropod fauna of Lias-Oolite age in Sicily which inspired the famous monograph of Gemmellaro: "Sui fossili del calcare cristallino della Montagna del Casale e di Bellampo, nella provincia di Palermo." The gasteropod facies of these beds possesses some forms which appear specifically identical with those of the Anglo-Norman Inferior Oolite. However, there is no *Purpurina* and only one species of *Amberleya*.

On a higher Jurassic horizon in the same island, we recognise an *Amberleya*-like form in *Eucyclus alpinus*. On the whole, however, there is nothing in this assemblage which would help us to connect this gasteropod fauna specially with the halolimnic gasteropods of Tanganyika.

The above enumerations may be regarded in the light of a search after the stepping stones between the Anglo-Norman basin and Lake Tanganyika; and if there has ever existed, either in Jurassic, Cretaceous, or Tertiary times, any such connection, direct or second hand, between the region in which Lake Tanganyika is situated and the sea, as is claimed by Mr. Moore, such connection has most probably been from the northwards and ultimately by way of the Congo basin. At any rate the physical configuration of Africa seems to point in this direction; and since this is the case, any discovery of Jurassic faunas, such as those of Madagascar, though very interesting in themselves, and in reality much nearer Tanganyika, is of less

* *Bulletin des services de la Carte Geologique de France* (No. 50), vol. viii. (1896-7) p. 118.

† Vol. i (1886), p. 6, Plate I, fig. 1.

importance in considering the origin of the halolimnic fauna as being outside any possible connection with the Congo basin.

African Jurassics (Madagascar and Abyssinia).—Briefly referring to a valuable paper by Messrs. Baron and Newton on fossils from Madagascar,* we may note that the Jurassic fossils of that region are fairly numerous, the following horizons having been determined by means of the ammonites: viz., Oxfordian, Callovian, Bathonian, Bajocian and Lias. Amongst the Gasteropoda were two species of *Cerithium* from the Oxfordian. The remainder of the gasteropods were mostly from the equivalents of the Great Oolite (Bathonian), and included *Nerita Buvignieri*, M. and L. together with species of *Nerinea* and *Natica* described by Morris and Lycett; also *Solarium* and *Trochus*, and likewise a new species of Opisthobranch of large size referred by Mr. Newton to *Trochactæonina*. Along with this limited assemblage of gasteropods occur a very considerable number of lamellibranchs. A peep at Jurassic times almost under the equator is interesting in this connection, but there is nothing in the Madagascar fauna which particularly reminds us of the halolimnic gasteropods of Tanganyika.

The very important development of Jurassic limestones in Abyssinia described by Dr. Blanford, is extremely interesting from the fact that undoubted marine beds of Jurassic age have been raised, in a district situated about 10° N. of the equator, to plateau elevations of 8,000 feet. Nevertheless, owing to their apparent poverty in gasteropods, these beds throw no light upon the question with which we are at present concerned.†

Character of Fresh-water Faunas.—The second independent consideration of which I propose to treat relates to the character of fresh-water faunas, and more especially of the mollusca, and this, though a large subject, must be treated briefly. Without going back into the very remote past, we possess a considerable number of fresh-water forms, interlarded as it were with those of marine origin, in the Coal-measures. This subject has received much attention from Dr. Wheelton Hind, and it is interesting to note that most of these forms are lamellibranchs, hence they are, to a certain extent, outside the subject more especially under consideration. Gasteropoda in the really fresh-water beds of the Coal-measures are rare.

The earliest appearance of *Paludina (Vivipara)* in this

* *Quarterly Journal, Geological Society*, vol. 51, pp. 57-92.

† Blanford, *Geology and Zoology of Abyssinia*, 1870.

country occurs towards the top of the Inferior Oolite, where it is extremely local; and as a proof of the conservative character of some fresh-water organisms, always supposing them to have lived in fresh-water, this form is almost identical with the *Paludina vivipara* of the present day. I mention this genus as being very characteristic of fresh-water; and on the higher horizon of the Purbeck beds the genus is represented by two other species in great abundance, together with many other fresh-water genera. Nevertheless in the Purbecks, as in the Coal-measures, there are estuarine intercalations when a different set of fossils are found, and in the case of *Paludina langtonensis* from the Lower Oolites of Oxfordshire marine gasteropods occur in the same bed. The above statements supply a few facts as to the appearance in time of certain fresh-water organisms; but the question of their origin seems scarcely to have got beyond the range of conjecture. However, it is in the Coal-measures and in some members of the Jurassic system that the question of the origin of fresh-water molluscs can best be studied at present. The remarkable uniformity in general character of these organisms over very wide spaces is itself a problem as yet by no means solved.

Before proceeding to study the geology of Equatorial Africa as in any way affording a possible clue to the origin of the halolimnic fauna and especially the gasteropods, which present such a contrast to the average fresh-water molluscs of Tanganyika or of any other African lake, we might consider a possible explanation, which has already been put forward, viz., that some of the halolimnic genera, such as *Paramelania*, for instance, might be related to such a stock as *Pyrgulifera*,* a fossil from fresh-water beds of the Upper Chalk in southern Europe. As far as external appearances go, the halolimnic *Paramelania* resembles the Cretaceous fresh-water *Pyrgulifera* quite as much as it does the Jurassic *Purpurina*, and since *Pyrgulifera* was nearer in time and moreover a fresh-water shell, it might with more probability be regarded as an ancestral form. Too much stress should not be placed on the resemblance of a single genus, but it is a fact of some importance that a fresh-water genus of the Cretaceous period is conchologically as like the old *Purpurina* as any of the Tanganyika shells.

On the possible transference from marine to fresh-water con-

* Figured on p. 343 of the *Tanganyika Problem* and referred to on p. 335.

ditions.—If we accept, merely for the sake of the argument, the marine origin of the Tanganyika halolimnic gasteropods, and still further if we suppose that they are derived from certain indicated Jurassic forms, it becomes a question when and where the transference from marine to fresh-water conditions was effected; in other words, when and where did their ancestors cease to be marine molluscs and become fresh-water ones. I have already said that it is to the immense Congo basin that we must look for any indications on the subject; but before making any attempt in this direction it may be as well to point out the difficulty in supposing that this transference was effected anywhere in the Tanganyika region itself. If such a transference ever took place, we should seek for it rather in some region where Jurassic beds are known to occur, or at least in their neighbourhood, unless we leave everything to mere conjecture. Again, the question when, that is to say, at what geological period, did the transference take place is equally important. The original Jurassic stock of our hypothesis must have existed as Cretaceous molluscs during the Cretaceous period and as Tertiary molluscs during the Tertiary period. It may be argued that these considerations are in favour of an early separation from a marine area, since fresh-water conditions are held to be conservative of form, and consequently the more remote in time the transference took place the less likelihood of change in the morphology of the shells.

Undoubtedly, in the long run, these questions of when and where, which I have put before the members of the Institute, must be determined by geological and above all by palæontological considerations. The nearest known Jurassic fauna of any importance which has hitherto been described is that of north-west Madagascar, distant in an air-line from the south end of Lake Tanganyika about 1,400 miles, and almost on the same parallel of south latitude. The improbability that the halolimnic stock was derived from this source has already been indicated, owing to the physical structure of East Equatorial Africa, which we shall presently proceed to study. It is on the whole a fortunate circumstance for the hypothesis of a Jurassic origin for the Tanganyika stock that this is the case, for in these Jurassic deposits, which would have the advantage of being under the same conditions with respect to latitude and presumably in the same zoological province as the area of Tanganyika in Jurassic times, *there is not a single genus of gasteropods which has any especial resemblance to the halolimnic gasteropods of Tanganyika.* See *ante*, p. 310.

Jurassic fossils of the Mediterranean basin.—Hence, if we still cling to the notion of a Jurassic origin, we must go further afield and direct our attention to other Jurassic deposits and especially to those of the Mediterranean basin, as being more likely to give us some inkling of a possible derivation in this direction. I have already referred to the very rich deposits of the Lias-Oolite in Sicily, but we may come to Africa itself, where, in the extreme north, marine Jurassic and Cretaceous beds have been fairly well exploited, both in Algeria and Tunisia. Now, as a proof of the apparent poverty of the Jurassic beds in Gasteropoda, I would observe that Coquand* was only able to enumerate one species, although the Cretaceous and Tertiary beds of this region account for over fifty species of Gasteropoda. It may be noted that *Voluta*, *Strombus*, *Fusus* and *Buccinum*, are quoted from beds of Cretaceous age in Algeria, but this Gasteropod fauna in its entirety has nothing in common with the Tanganyika halolimnics beyond a doubtful shell referred to *Trochus*. In Tunisia† the most ancient formations are those of Jurassic age, forming some of the mountain cores such as Zaghouan. In that country the Ammonite fauna is characteristic of certain stages of the Jurassic system, but no gasteropods are mentioned. Still following the Mediterranean coast, when we come to Egypt the Jurassics fail us entirely, and beds of Cretaceous age rest directly on the Archæan.‡

It is not necessary to pursue this line of investigation further, beyond observing that if there are any stepping stones between the Anglo-Norman basin and Central Africa *quâ* Gasteropods, they remain to be discovered. I will now direct attention to another aspect of the Tanganyika problem, viz., the Geology of Equatorial Africa, more especially in connection with the physical history of the Congo basin.

* *Géologie et Paléontologie de la région sud de la Province de Constantine, Marseilles*, 1862.

† *Expl. de Carte Geol. Provisoire*, par Aubert, circa 1890.

‡ By this name I propose, without prejudice, to indicate the Crystalline complex which is the foundation-stone of the African continent.

PART II.

OUTLINES OF AFRICAN GEOLOGY WITH ESPECIAL REFERENCE
TO THE CENTRAL REGIONS IN WHICH LAKE TANGANYIKA
IS SITUATED.

It need hardly be observed that Africa is an extensive though well-defined continent, and from its size it might be expected to exhibit considerable variety of rock formation. Yet this is by no means the case, since the proportion of crystalline rocks and barren sandstones is so great that its life history has been, for the most part, but obscurely written. If the medals of creation were ever struck here in any considerable quantity they have since been in a great measure destroyed. The absence of fossil evidence is especially noteworthy in the equatorial regions, which form the special ground of our inquiry.

Roughly speaking, for geological purposes the whole of Africa might be divided into three divisions of very unequal size.

(1) *The Northern Division*.—This may be considered as part of the Mediterranean basin, and indeed, almost as European for geological and orogenic purposes, always regarding the Atlas range and its dependencies as being under the same tectonic system as the Alps. Although the precise boundaries of this division can scarcely be defined, it is a limited area and by no means deficient in marine fossiliferous rocks. In Part I, under the heading of Algeria and Tunisia, some of the palæontological features of this division have already been indicated. Marine beds of Mesozoic and Tertiary age constitute the bulk of these rocks. Morocco may be included in this category.

(2) *The Region of the Great Deserts* constitutes the principal part of the second division. Prof. Cornet* tells us that this is characterized by the horizontality of the palæozoic beds, as though the area had not been one of disturbance for a long period. He also says that there is a great hiatus in the formations of this region, extending in time from the Carboniferous to the Cretaceous.

* "Formations postprimaires du bassin du Congo," *Ann. Soc. Géol. Belge*, vol. 21 (1893-4).

Egypt might be included in this district, where, as in the case of the Nubian sandstone, beds of Cretaceous age rest on the Archæan. Altogether the Cretaceous and Tertiary beds of this region are analogous to those of Syria and of countries still further to the eastward. The southern extension of the great Cretaceous overlap in this area is not exactly known; but De Lapparent* has recently announced the discovery of Eocene fossils on the frontier of Sokoto due west of Lake Tchad. He also announces the discovery of an upper Cretaceous echinoid, believed to be from Belina, which is 300 miles north of the same lake.

The full significance of these discoveries can only be realised by the aid of a map; but among the results thus obtained we find that marine deposits of Mesozoic and Tertiary age, as proved by their fossils, are now known to exist within 14° north of the Equator. Indeed there is no reason why a considerable portion of the basin of Lake Tchad should not be underlain by Cretaceous-Eocene formations, which in all probability extend from the Atlantic coast of Senegal to the crystalline rocks of the Ethiopian Highlands. The effect of this would be that a much larger portion of Northern Africa than hitherto supposed must be included in our second division, though the limits between this and the third, or peninsular division, cannot yet be defined. There is, however, one marked difference between our second and third divisions, which cannot be too soon realised, viz., that in the second division fossiliferous marine beds of Mesozoic and Tertiary age penetrate into the heart of the continent, whereas in the third division such beds occupy but a narrow fringe between the sea and the peninsular massif. Thus, the physical history of the two regions is entirely different.

(3) *Peninsular Africa*.—Constitutes the third division, and this may be divided as follows:—

Section a.—*The Cape Beds*, which have now been studied for a long time, and which it is necessary in some measure to refer to, if we would endeavour to understand the geology of Equatorial Africa. There is a useful summary of these beds in a recent issue of the *Geological Magazine*,† which I condense as follows:—

* *Bull. Soc. Géol. France* (4) III, No. 3, p. 299 (1903).

† December, 1903, p. 569. See also Seward, *op. cit.*, November, 1903, who deduces the age from plant evidence.

	<i>Beds.</i>		<i>Age.</i>
	Superficial Deposits	....	Recent, etc.
Coastal	{ Pondoland Series	....	Cretaceous.
	{ Uitenhage Series	....	Wealden.
	{ Stormberg Series	....	Rhætic.
Karoo	{ Beaufort Series	....	Triassic.
	{ Ecca Series	}	Permo-Carboniferous.
	{ Dwyka Series		
	Cape System	....	? Old Palæozoic.
	Pre-Cape Rocks	....	Archæan.

The beds above referred to the Cretaceous and Wealden are simply strips along the coast, and it may be said generally of the principal system, viz., the Karoo, that its fauna and flora are entirely fresh-water or terrestrial. The older beds on which the great Karoo system unconformably rests contain no marine fossils. It is probable that the beds marked as Rhætic were formerly regarded as Triassic.

Section b.—We now come to consider the geological structure of *Equatorial Africa* adjoining the Cape Beds, which lie to the south. With certain exceptions presently to be described, the beds of this region coincide geographically with the Congo basin. Cornet says of this region that it is constituted by depressed massifs, formed of Archæan and Palæozoic beds much folded; these are covered by beds almost horizontal extending over immense distances, consisting of conglomerates, sandstones and clay schists, all utterly unfossiliferous. This is the unpromising region which we have to study with some degree of detail, but before doing so it will be necessary to glance at the history and structure of the peculiar mountain chain, which though it hangs to the eastern side of the continent, is called by Mr. Moore the great Central Range.

The mountain-chain or plateau-range of East Africa.—In the above geological disquisition we must not lose sight of our main object, which is to account, if we can, for the presence of the peculiar halolimnic fauna of Lake Tanganyika. Now this lake, which has a length from north to south of 400 miles, lies at the junction of the Great Central Range with the enormous Congo basin. We shall consider the structure of the Congo basin in some detail presently, but a few words as to the peculiar mountain system with which the lake is connected ought to be useful. If we want to account for anything, we must understand the position on all sides.

This mountain chain is largely volcanic in its composition, and it will be sufficient for our purpose if we take our start from the great volcanic mountain mass of Abyssinia, whose geological

features, to a certain extent, resemble those of the peculiar mountain plateau-region which is characteristic of Equatorial East Africa. Isolated volcanoes, now extinct, such as Elgon, Kenya and Kilima-Njaro rise to heights, in the two latter cases, of over 18,000 feet, but the most characteristic feature is the double chain of depressions which contain the numerous longitudinal lakes of Equatorial Africa. This system, which may be said to commence with Lake Rudolf, just south of Abyssinia, bifurcates, the eastern and smaller arm containing such lakes as Baringo (3,200 feet), and Navaisha (6,200 feet), whilst the western, or more important arm, includes the uppermost Nile-valley and such lakes as the Albert Nyanza (2,300 feet), the Albert Edward (3,240 feet), and Kivu (4,900 feet). This latter lake, as Mr. Moore has shown, formerly belonged to the Nile-valley system, but owing to volcanic extravasations the drainage has been reversed and its waters now find their way into Lake Tanganyika (2,700 feet). The two arms of this double series of longitudinal depressions are regarded as to a certain extent coalescing in the great lake of Nyassa (1,500 feet), where the system of these peculiar longitudinal depressions may be said to terminate. The mountain system of East Africa, in another form, is renewed in the Drakensberg, where the surveyors have lately found numerous indications of volcanic action. A sketch-map of the East African Lake-Chain (after Suess), modified from Gregory's *The Great Rift Valley*, is appended. (Fig. 1.)

Between the two arms of the system of longitudinal depressions ("Graben" of Suess) is situated the wide basin of the Victoria Nyanza (3,900 feet), which has an area in miles of 270×225 —a veritable inland sea. This constitutes a sort of broad and shallow depression in complete contrast to the Graben with their vertical walls and succession of trough faults.

Our brief sketch of the Great Central East African Range would not be complete without allusion to two very remarkable features in connection therewith, which characterize the uppermost Nile-valley system in the neighbourhood of the Lake Albert Edward. The first of these is the still active volcanic range of Mount M'fumbiro, which crosses the great western arm of the Graben system at a right angle, and rises to a height of 14,000 feet in Karisimbi (extinct), whilst the rim of the crater of the still active Kirungo-cha-Gongo Mr. Moore found to be 11,350 feet. As he observes, this mass acts like a dam to the original drainage of the Graben. The chief points to note

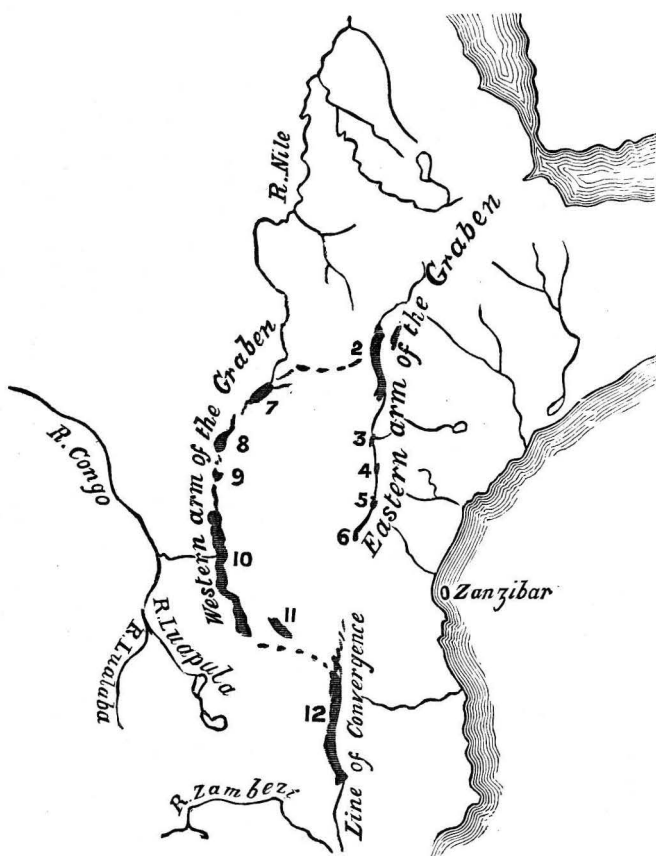


FIG. 1.—PLAN OF THE GRABEN SYSTEM AND ITS RELATION TO THE CONGO BASIN.

- | <i>Eastern Arm.</i> | <i>Western Arm.</i> |
|---------------------|---------------------|
| 1. Lake Stefanie. | 7. Lake Albert. |
| 2. " Rudolf. | 8. " Albert Edward. |
| 3. " Baringo. | 9. " Kivu. |
| 4. " Navaisha. | 10. " Tanganyika. |
| 5. " Natron. | 11. " Rukwa. |
| 6. " Manyora. | |
| | 12. Lake Nyassa. |

in this case are: (1) The existence of volcanic action within the containing walls of the great western Graben. (2) The fact that volcanic action is not extinct in this region, though it

is probably fast dying out. There are yet some traces of volcanic activity in the eastern arm of the Graben, where the mountain Longonot (9,350 feet) still shows a fresh looking crater and emits steam. The facts in regard to the existence of modern volcanic action in the Graben system is of importance in connection with any attempt to estimate the age of this mountain plateau-system, in which the Graben themselves are situated.

The second feature in connection with the equatorial portion of the Great Central chain is the existence of the short, but lofty Ruwenzori Range, whose southern extremity lies actually on the equator. Whilst the axis of the volcanic chain of Mount M'fumbiro lies at right angles to the northerly trend of the great western Graben, that of the crystalline system of Ruwenzori is approximately parallel to it. "These ranges, which rival the Alps in magnitude and in the sublimity of their scenery, lie along the eastern edge of the depression, and appear, in fact, to stand out into it beyond what was originally its eastern face."* We recognise the importance of the above observation, as it tends to show that this portion of the Graben is older than the Ruwenzori Range itself. The adjacent Victoria Nyanza plateau is mainly composed of schists and gneiss, and this class of rock usually terminates abruptly at the eastern edge of the Graben where the depression ensues. But opposite Ruwenzori, instead of being broken off at the edge of the depression, the gneiss and schists are bent and piled upon the steep flanks of the mountains themselves, which in their more central portions are found to consist of massive old amphibolites. These latter are, most probably, the base of the Archæan, as developed throughout the greater part of Equatorial Africa, and these amphibolites seem to have been thrust up through the overlying gneissic and schistose layer.†

Geology of British East Africa.—Having paid some attention to the physical structure of the Central Range with its associated Lake Chains, it would not be amiss just to glance at the geology of the equatorial region of East Africa and its relations to the remarkable system of Graben already partly described. In this respect we cannot do better than follow Gregory in his description of the region between the Indian Ocean and the Victoria Nyanza, which includes the eastern arm of the Graben system. The subjoined section, which lies

* Moore, *The Tanganyika Problem*, p. 94. He gives the altitude of the highest peaks at about 16,500 feet.

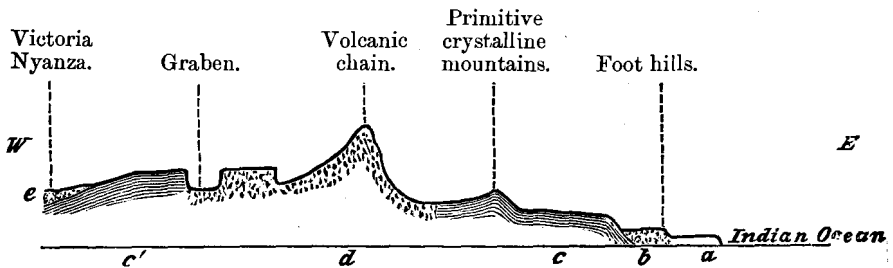
† *Amphibolites* are igneous rocks in which hornblende is a chief constituent; diorite is a common variety.—E. H. (Ed.)

almost on the Equator, will serve not only as a description of the immediate region, but may in many respects be regarded as typical of Peninsular Africa, both east, south and west.

In particular the section shows :

- (1) That fossiliferous deposits are a mere coastal fringe, or at least get no further inland than the Foot Hills. and,
- (2) The enormous development of old crystalline and more recent volcanic rocks.

FIG. 2.—SECTION ACROSS BRITISH EAST AFRICA (AFTER GREGORY: "RIFT VALLEY," p. 222.)



GEOLOGICAL SIGNS.

- (a) Coastal deposits : raised coral-reefs and old sea beaches with much wind-borne sand.
- (b) The foot plateau. The seaward portion consists of shales, etc., of middle Jurassic age as proved by their ammonites ; the middle portion of bright coloured sandstones, probably of Triassic age, but without marine fossils ; the western portion of shales of probably Permo-Carboniferous age, with land plants and fresh-water mollusca (*Palæamodonta*).
- (c) The portion of the Archæan rocks to the eastward of the volcanic region.
- (d) Volcanic region, consisting of plateaux, mountains (Kenya, Kilima Njaro, etc.), and Graben.
- (e) Archæan rocks west of the volcanic region. N.B.—The Archæan system is said to cover something like two-thirds of British East Africa, and there can be little doubt that it underlies the greater part of the rest.
- (e) Lower Palæozoic rocks without fossils on the horizon of the Karagwe series—here and there on the shores of the Victoria Nyanza.

An old crystalline axis is well shown in the above generalized section, and, as we perceive, these crystalline rocks are stated to cover two-thirds of this part of the country. Indeed it has always been an idea of mine that the immense extent of old

crystallines in Peninsular Africa helps us to understand the sandy and unfossiliferous nature of the bulk of its sedimentary rocks. What we now see are merely the eroded stumps of crystalline masses which once towered in the air, but which have been riven for ages by equatorial storms and rains, and their material distributed by torrents, rivers, and backwaters, so as to help to level up the surface. In this particular case the crystalline system has been invaded by an enormous extent of volcanic extravasations, and if we wish to discover the age of the Great East African Central Chain, as it now exists, we must endeavour to ascertain the period during which these phenomena have been in operation. The origin of Lake Tanganyika itself depends upon these considerations. That this period is post-Jurassic, there can be little doubt, for the strip of Jurassic rock near Mombasa is traversed by dykes, which seem to be connected with the general mass of extravasated matter on the central plateau. It is probable, however, that a much later date may be assigned. In this connection I would refer to Dr. Gregory,* who places the first plateau-eruptions in the Cretaceous, probably towards the close of that period, as is the case with the great basaltic outpourings of Western India. From this time up to the Pleistocene there have been, according to this author, a succession of eruptions and coast-movements, and he places the first series of Rift-Valley faults (Graben) in the Upper Eocene and the second series in the Pliocene. These statements are made, principally with reference to the eastern arm of the Graben system, but it would probably apply also to the western arm in which Lake Tanganyika is situated. It is pretty clear, however, that volcanic eruptions have taken place, as we now know, down to the present time, and that earth movements have continued, for some of the fault scarps, Dr. Gregory observes, are so bare and sharp that they must be of very recent date.

Enough has now been said with regard to the anomalous history and condition of the Great East African Central Chain and its double string of lakes of depression. Tanganyika is the largest and most peculiar of all these, and its origin is intimately connected with the above considerations. We may believe that its initiation may have taken place in early Tertiary times, but that both its drainage area and also the great Rift in which it occurs have undergone some modification owing to the instability of the earth's crust in that region.

* *The Great Rift Valley*, p. 235.

Geological structure of the Congo basin.—The above considerations present to us only one phase of Tanganyika's history. If we desire even to try to account for its peculiar fauna we must now turn to another factor in the case, viz., the geological structure of the Congo basin, with which it seems, almost by accident, as it were, to be connected. This is a very large subject, and the region under consideration is quite the converse of the one previously described; for we are about to deal with an immense circular area having only an elevation of from 1,000 to 2,000 feet above sea level, and which, for the most part, seems to have been free from tectonic disturbance. It might be thought there would be immense variety of formations in this region, but if the Belgian and French geologists, whom I shall presently quote, are correct, we have the old story over again:—a rim of crystalline and, possibly, palæozoic rocks, with absolutely unfossiliferous sedimentaries, largely consisting of sandstones, dumped down in the centre.

The best evidence we obtain of the general structure of the Congo basin is derived from the writings of Professor Cornet, of Mons, supplemented for the French Congo by those of Mons. Barrat, a mining engineer, and inspector of public works.* The first mentioned author is a geologist of great experience, and his earliest work in this region (Katanga) relates to the geology of the Uppermost Congo in the basin of the Lualaba, which is almost in touch with Tanganyika itself. Before venturing, however, to deal with this ground, I will bring to your notice Professor Cornet's experiences on the Lower Congo. The railway from Boma to Stanley Pool has materially helped the engineer to obtain a fairly accurate idea of this piece of country. It is true that this railway is only 350 kilomètres (216·35 miles) in length, and that the distance from the outlet of the Lukuga on Lake Tanganyika, measured in a straight line along the sixth parallel of south latitude, is nearly 1,300 miles, yet the section traversed by the railway and prolonged to about the neighbourhood of Bolobo, appears to be the key to

* *Cornet*. "Terrains anciens du Katanga (expédition de 1891–93)," Liège (1897).

Cornet. "Observations sur la géologie du Congo occidental." *Bull. Soc. Géol. Belg.*, vol. x (1896).

Cornet. "Études sur la géologie du Congo occidental." *Op. cit.*, vol. xi (1897).

Cornet. "Les formations post-primaires du bassin du Congo," *Ann. Soc. Géol. Belg.*, vol. 21 (1893–4).

Barrat. "La géologie du Congo Français." *Ann. des Mines*, Livraison d'avril (1895).

the structure of nearly the whole basin of the Congo. I may be pardoned, therefore, if I dwell upon this section on the Lower Congo in some detail.

The western Congo may, from a geological point of view, be divided into four zones from west to east as follows (see Fig. 3, page 324.)

- I. The Maritime Zone.
- II. The Crystalline Zone.
- III. The Calcareo-schistose Zone.
- IV. Zone of the Sandstones.

I. The Maritime Zone.—This consists of old estuarine deposits, and more particularly of fragments of Tertiary beds, Cretaceous beds, and of continental pre-Cretaceous sandstones. It is interesting to note that the only fossiliferous beds whose age may be known from their contents, constitute a narrow and insignificant fringe on the borders of the Atlantic, just as we have seen to be the case on the east coast of equatorial Africa (see Fig. 2, p. 320). All the other zones are without any definite traces of organisms.

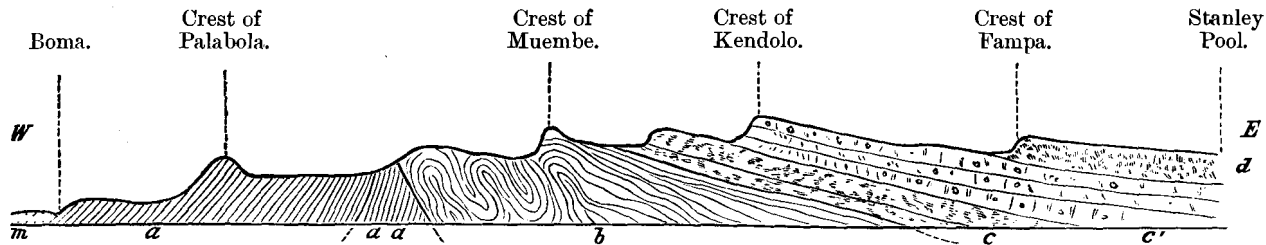
II. The Archæan and metamorphic beds.—The Archæan is well represented on the Lower Congo from the granitoid gneisses of Boma, in the west, to the chlorite and sericite schists of the higher portions. The dip is generally towards the west at variable angles, which are sometimes low. Both north and south of the Congo this zone can be traced for some distance. The so-called metamorphic beds are less crystalline, and in some cases calcareous.

III. The calcareous-schist system.—There is a massive conglomerate at the base, and this is succeeded by schistose argillaceous limestones. The middle member consists largely of marbles, whilst the highest beds are calcareous schists with silicious concretions. The beds of this system exist in a series of synclinal basins indicative of a thrust towards the west, and with a diminution of folding as one advances eastwards, until the beds pass under the felspathic grits of the fourth zone with a slight dip to the eastwards. The age of these beds is uncertain, but it is thought that part of them may represent in time the Devonian of other countries.

Zones II and III represent the rim of the basin in which the nearly horizontal sandstones of the fourth zone were deposited.

Zone IV. Zone of the Sandstones, or beds of the Congo basin proper. These are the beds to which Professor Cornet more

FIG. 3.—DIAGRAMMATIC SECTION ON THE LOWER CONGO BETWEEN THE ATLANTIC COAST (W.) AND STANLEY POOL, ABOUT 1,000 FEET ABOVE THE SEA (E.) (AFTER CORNET).



<i>m.</i>	Coastal deposits	...	...	...	...	Zone I.
<i>a.</i>	Archæan	....	....	....	....	} Zone II.
<i>aa.</i>	Metamorphic	....	....	....	....
<i>b.</i>	Calcareous schist system	....	....	....	....	Zone III.
<i>c. & c'</i>	Red Felspathic Grit system	....	....	....	....	} Zone IV.
<i>d.</i>	White Friable Sandstone system	....	....	....	....

N.B.—The beds of Zone IV are in complete discordance on the underlying rocks, and constitute the “formations post-primaires” of Prof. Cornet.

particularly alludes in his paper on the "Formations post-primaires." The lowest, or *Red Felspathic Grits*, is divided into two sections by a slight unconformity. It reposes in complete discordance upon the flanks of Zone III. There is a great variety of detrital matter in this formation, including conglomerates, fine grained sandstones and argillaceous schists, but one of its characteristics consists of thick beds of grit largely charged with big grains of altered felspar causing a reddish or brownish tinge. These beds correspond to the "couches de Kundalungu" of the highest Congo (Lualaba), and form part of the margin of Lake Tanganyika, as we shall see presently. On the Lower Congo the Red Felspathic Grit series extended to the westward of its present outcrop, as shown by outliers, possibly as far as the crystalline zone.

The upper portion of Zone IV, *d* of the section, which is strongly in evidence near Stanley Pool, extends up the river as far as Bolobo. It consists of white or yellowish silicious sandstones, very pure, soft and friable under the fingers, forming beds several hundred mètres in thickness and having a wavy and current-bedded stratification. Enormous sarsens attest the former presence of these beds in areas where the softer material has been removed by denudation. The beds of this system, in this region, are nearly flat, or with a slight dip to the eastward. They correspond to the "couches de Lubilache" of the Lualaba district, and may be known as the *White Friable Sandstones*.

It will not be necessary to carry the geological *résumé* of the Lower Congo any further, beyond pointing out one or two matters which may have a bearing in future discussion relative to the fauna of the Middle Congo, and, in consequence, of Lake Tanganyika. In the first place it must be borne in mind that from Stanley Pool to Boma the present river Congo has cut for itself a passage through what may be regarded as the western coastal range, in a series of falls and rapids which precludes any present connection with marine conditions. We cannot doubt that during the initiatory stages of this escape from the interior, the waters of the Congo basin selected the most depressed portion of the coastal range, which thus presents an appearance, in section, of less importance than would be the case either to the north or the south of the river's course; also denudation has been active in lowering the rim of the original basin. It may be mentioned in this connection that the coastal range in the north of the French Congo (province) attains elevations of 1,500 mètres in the "Monts de Cristal,"

which are of granite. Secondly, it must be remembered, that, as far as what we may term the solid geology is concerned, the White Friable Sandstone series is the highest in the sequence of the beds which form the vast interior. These are often concealed by horizontal beds of clayey and sandy alluvium (silt), dating from a period when the mean level of the river was higher; also by spreads of what the French geologists call "Laterite." Even these alluvial beds seem devoid of organic remains, except that in one case shells of *Aetheria* are mentioned.*

Having thus briefly considered in some detail the material of which the Congo basin, in a geological sense, is constituted, we are now in a position to glance at the structure and physical history of that immense area, including some attempt to fix the chronology and parallelism of the two great sandstone systems, which probably cover more ground than any other sedimentary beds throughout Africa. Cornet, in speaking of the physiography of the Congo basin, describes it as an immense "vat," whose peripheral margins are always higher than the central region.

The periphery of the Congo basin (Plate I).—The western portion we have already studied in the traverse from Boma to Stanley Pool. Although the topography varies throughout this immense circle, the geological sequence is pretty much what we have seen. Thus, on the southern margin, the watershed between the Congo and the Zambesi, towards the sources of the Lualaba, runs from elevations of 4,000 feet to 5,000 feet. On the south-east the headwaters of the Congo-Luapula proceed from a region of gneiss, mica schists and argillaceous schists with granitic massifs, which extend between lakes Nyassa and Tanganyika. The "ancient rocks" of Katanga, so well described by Cornet, of course form a part of the general periphery in these regions. It would be well to mention here that, although such ancient rocks are, in the flatter parts of the basin, covered

* There is an article by Stainier (*Trans. Inst. Mining Engineers*, vol. 15 (1898) p. 491), in which the author, besides summarising the results of Cornet and others on the solid geology of the Congo basin, gives a very useful abstract of the *superficial formations* of this immense area. These include (1) Products of the alteration *in situ* of subsoil rocks; (2) Products of decomposition on slopes under the influence of rainfall; (3) Alluvial deposits in watercourses; and (4) Ancient alluvial deposits. It can readily be understood that the solid geology of the Congo basin is largely masked by some one or other of the above conditions, to say nothing of vast districts under water and swamps.

by one or other of the sandstone systems (formations post-primaires), yet the latter have been cut clean through by streams in many places, so that the framework and bones of the skeleton are occasionally displayed throughout the vast region under description.

The eastern margin of the periphery calls for especial notice, as Professor Cornet considers Tanganyika to be within the limits of the original basin, since the Red Felspathic Grits extend to the east as well as to the west of the lake. Its eastern affluents descend from a granitic or metamorphic district stretching towards the east and also bordering the lake for a considerable distance. When we come to deal more especially with the geology of the shores of Lake Tanganyika it will be seen that these Red Felspathic Grits, almost horizontal in many places, are occasionally tilted in this region, showing that Tanganyika is within the influence of the disturbances in connection with the Great Central or East African Range, whereas the Congo basin, as a whole, is outside these influences. The south end of the lake is bordered with red and variegated grits belonging to the Red Felspathic series, which are horizontal and have been transformed by metamorphism into a kind of quartzite with intercalation of eruptive rocks. At the outflow of the Lukuga are seen grits and red schists (of the Red Felspathic group) which continue for a distance of 120 kilometres westward from Tanganyika. At this point (Wabenza) they are covered by the white friable schists (White Friable Sandstone) of the centre of the basin. This formation also prevails at Nyangwe, but the Red Felspathic Grits reappear at Stanley Falls.

The limits on the north-east of the periphery are constituted by the western lip of the western arm of the Graben, which contains the lakes belonging to the Upper Nile. The region of the sources of the Aruwimi consists of crystalline rocks. On the north gneiss occurs at several points between the basin of the Uellé and the White Nile.

On the north-west there is a sandstone plateau of an altitude of 2,000 to 2,800 feet, which occupies the meeting ground of the Shari, Congo and Nile basins, and falls to the north in a plain some 400 feet lower, watered by the Auk, an eastern branch of the Shari, the principal feeder of Lake Tchad.*

* Chevalier, quoted in the *Journal of the Royal Geographical Society*, vol. 22, p. 569 (November, 1903).

This completes the periphery of the Congo basin as at present constituted.

Suggested correlation of the beds composing the interior of the basin.—Having completed the circuit of the Congo basin, we must next endeavour to ascertain something of the geological history of this vast tract and its constituent elements. The first question we ask ourselves must be, what is the approximate age of these two great interior sandstone formations? Without fossils, terrestrial, fresh-water or marine, to guide us, this can only be done by way of inference and analogy.* Cornet calls them post-primary, that is to say, they rest in almost horizontal layers, for the most part, either on crystalline rocks or on old palæozoic rocks inclined at high angles. This is very much the case with the Karoo beds at the Cape, which are in position analogous to the two sandstone series of the Congo. The Karoo beds fortunately contain a fairly abundant fauna and flora, which is wholly terrestrial and fresh-water. The geological position of the Karoo beds is pretty well known, and I must refer to a previous statement on this subject (see page 316). We are not altogether without links in the chain of evidence.

A paper appeared lately in the *Quarterly Journal of the Geological Society* by Mr. Molyneux,† on “The Sedimentary Deposits of Southern Rhodesia,” where a provisional classification of the several formations, down to the Zambesi, was suggested. Beneath a series of sandstones and grits, capped by volcanic rocks, occur some 800 feet of beds containing workable and impure coal and also some recognizable fossils (Matobola beds). The interest of these consists in the fact that scales of the fish *Acrolepis* were recognized, the genus also occurring in the Lower Karoo, and likewise in the so-called “Drummond’s beds” on Lake Nyassa. A very few lamelli-branches were obtained from the Sengwe coal-field and were described by Dr. Hind. These are small, oval, gibbose bivalves belonging to the genus *Palaeomatela*, similar to species from the Permian of the Volga. A few plant remains were collected, and amongst others fronds of the fern-like plant *Glossopteris Browniana*, Brongn., and of some of its varieties. There can be very little doubt, therefore, that the Matobola-beds of Southern Rhodesia may be referred to the terrestrial and fresh-water Lower Gondwana system of Permo-Carboniferous age. The

* This was Prof. Cornet’s view at the time he wrote.

† Vol. 59 (May, 1903) p. 266.

"Drummond's beds" towards the northern end of Lake Nyassa present similar traces of this fauna in association with a series of conglomerates, red grits and shales, and as they are not far from the south-east rim of the Congo basin, their evidence is all the more valuable.*

There is good reason, on the whole, for supposing that the Red Felspathic Grits of the Congo basin are the equivalents in time, and to a certain extent in composition, of part of the Karoo system of the Cape. If this view be accepted, we might roughly correlate the White Friable Sandstone series with the Upper Karoo, which may possibly extend upwards as high as the Rhaetic period. It should be distinctly borne in mind that no marine organisms occur in any of these beds referred to the Karoo. Mons. Barrat, in his map of the Congo basin, boldly correlates the whole of the post-primary sandstone systems of that basin with the Karoo, and in a general sense he is probably not far wrong. Cornet himself considers that the "Bassin primitif du Congo," at the period of the horizontal deposits, was separated by a chain of mountains from a region lying towards the south, south-east and east, where the beds of the real Karoo were being deposited.†

It is difficult to conceive the precise physical conditions under which these lifeless masses were accumulated during a period which may be regarded as very early mesozoic (including the Permo-Carboniferous). That the mountainous periphery already described was being ground down by atmospheric causes and its products distributed by some sort of water action throughout the central depressed area seems certain, and it is also highly probable that during the greater part of the time there was no drainage outlet, so that this part of Equatorial Africa became the dumping ground of a mass of mechanical sediments, which had no means of escape by the usual method of rivers flowing towards the ocean. But a time came, perhaps towards the middle of the mesozoic epoch, when deposit ceased to be the order of the day and these interminable sandstones themselves became subject to the laws of

* The Drummond's beds of Nyassa are described as a small system of grits, schists and limestones with fish (*Acrolepis*), molluscs (*Mutela oblonga*) and plant remains. Other localities are quoted where the Red Felspathic Grits contain remains of vegetation, according to the traveller, Thompson.

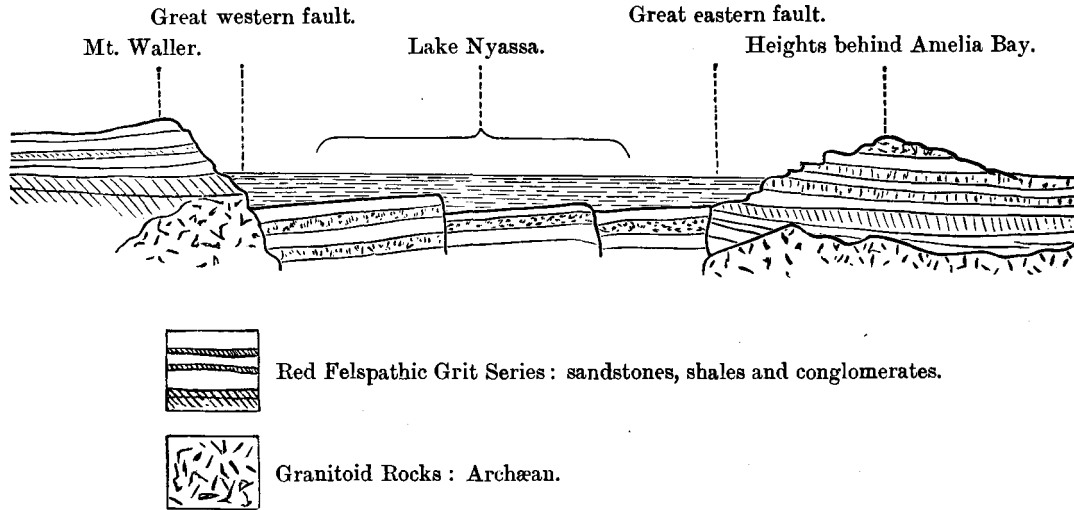
† It is admitted that the Karoo beds of the Cape constitute a somewhat indefinite system, yet within certain limits their horizon may be accepted as fairly well understood.

denudation. A new era had arrived, and some faint shadow of modern conditions was inaugurated. Unfortunately, there is no evidence, as far as I can make out at present, of what took place between the close of the White Friable Sandstone period and that of sub-recent and recent deposits. This interval doubtless was, during part of the time, a period of great inland waters, where the basins of the Congo, Shari and White Nile inosculated and where the fauna now existing in Equatorial Africa was to a considerable extent evolved, and the rivers themselves partly marked out. But enough perhaps has been said on this subject, and I must now conclude this geological disquisition with a brief description of the more immediate surroundings of Lake Tanganyika itself, inasmuch as a proper understanding of the peculiar physical features of this lake may help us to consider, if not to explain, the origin of its still more remarkable molluscan fauna.

Structure of a Graben.—Before proceeding to consider the geological features of Lake Tanganyika, I would draw the attention of members to the structure of a Graben as depicted by Mr. Moore in the case of Lake Nyassa. This traverse, which is taken through Mount Waller towards the north end of the lake, shows the relation of the Red Felspathic Grits to the underlying granitoid rocks (Archæan); and it also exhibits the system of trough-faulting, which may be taken as one form of the structural arrangement of a Graben.

Geology of Lake Tanganyika.—As regards Tanganyika itself the lake occupies the principal depression in the western arm of the Graben-system of Equatorial Africa, running due north and south for 400 miles, and the present elevation of the surface of the water is stated to be 2,700 feet. There are several affluents, the principal one being the Ruzizi at the head of the lake, whilst there is only one effluent, viz., the Lukuga, which escapes through a chasm in the western walls (? *vide* Gregory, *The Great Rift Valley*, p. 3), and ultimately joins the Congo drainage system, to which at present it belongs. The discharge of the Lukuga seems to be a precarious one, and it is clear that there have been times when the water did not escape, in which case one would expect an increase in its salinity. Great depths are reached in this lake, and Mr. Moore considers that it is not all of one age, the central portion between Karema and Ujiji being regarded as the oldest. This circumstance is also true of Lake Nyassa, where in some places the bottom is so bare of recent deposit as to suggest that such portions may have been added to that lake

FIG. 4.—STRUCTURE OF A GRABEN.



at a comparatively recent period. Oscillation of the floor and containing walls of both these great Graben lakes is noticeable in places.

In attempting to construct a geological map of Tanganyika I must be guided by Mr. Moore to a certain extent, not forgetting, however, to consult the works of Cornet, Bornhardt, Kohlschütter and other distinguished scientists. If there is obscurity in the geology of Equatorial Africa, still there is a certain degree of simplicity as far as the composition of the several formations with which we have to deal. Around Tanganyika, though not to the same extent as around Nyassa, the basement granitoid rocks (Archæan) are strongly in evidence. Upon these at the south and south-east end of the lake, in complete unconformability, reposes the great sandstone and shale formation, which, we have seen, Cornet in his numerous writings on the Congo basin calls the *Red Felspathic Grits*, or "couches de Kundelungu" of the Lualaba district, and which constitute the lower division of his "formations post-primaires." Beds of this character also extend to the east as well as the west of the lake, and this part of the area now occupied by Tanganyika must have been within the limits of the original basin of deposition (see *ante*, p. 327). These Red Felspathic Grits, so horizontal for the most part throughout the basin of the Congo, are tilted in portions of the western wall and notably at Mount M'rubi, where they are said to have an inclination to the eastward. As previously observed, this shows that Lake Tanganyika is within the influence of the movements connected with the East African Plateau Range, whereas the bulk of the Congo basin is without the sphere of those influences. At the south end of the lake the Red Felspathic Grits are shown for the most part as horizontal, although, according to Mr. Moore's mapping, much cut up by subsidiary Graben, which carry on the principal Graben of Tanganyika in a southerly direction. In one of these subsidiary Graben, towards the south-west, is situated both the true and the salt lake Mwero of the higher Congo, and that perhaps is about as far west as the Graben-system can be traced. In the neighbourhood of Cameron Bay there are considerable indications of volcanic eruptive matter, and, according to Cornet, much of the Red Felspathic Grits have been transformed into quartzites with intercalation of this eruptive material. These most probably are the "metamorphic" beds of Mr. Moore, which seem to occupy both sides of the southern third of the lake.

Towards the northern termination of the series which has

been subject to this kind of metamorphism, the great Rukwa Graben strikes the Tanganyika fissure at an acute angle, and it is extremely probable that this longitudinal depression, as pointed out by Mr. Moore, extends across the lake and reappears as the great gap in the western wall through which the drainage of Tanganyika has been effected. Possibly subsequent erosion may have had something to do with the deepening of the primary fissure, which thus becomes a "rift-valley" in the true sense of the term. After passing over modern lake deposits, the Red Felspathic Grits are encountered on the Lukuga as previously stated (p. 327), and extend for a distance of 120 kilometres from Tanganyika, and beyond this point are covered by the *White Friable Sandstones* which constitute the upper member of Cornet's "formations postprimaires."

It seems doubtful whether any fossils occur in connection with the Red Felspathic Grits of Lake Tanganyika. There can be no doubt whatever that the Red Felspathic Grit series of Cornet is the same as the sandstone series of Mt. Waller and Amelia Bay on Lake Nyassa, which is identified by Bornhardt with the Karoo formation, and with which are associated the so-called "Drummond's beds" with their *Glossopteris* flora and fresh-water fauna (see pp. 328 and 329). At more than one spot in the vicinity of the northern end of Lake Nyassa indisputable evidence of coal, fossil plants, shells and fish scales of fresh-water origin have been found. It seems unfortunate that the corresponding beds (*i.e.*, the Red Felspathic Grits) of Tanganyika and the Congo basin seem to be barren in this respect. At least such appears to have been Cornet's opinion, and he accounts, as we have seen, for the barrenness of these beds on the supposition that they were laid down in a basin on the west side of the primary mountain range of what is now East Central Africa.*

* Reymond (*Bull. Soc. Géol. France*, 1885) speaks of certain "schistes fossilifères," collected by Giraud in 1881, at some distance from Mpala on Lake Tanganyika, which were said to contain a *Cyrena* and fish remains (*Lepidosteus*). This alleged discovery on Tanganyika may be the same as that mentioned by Drummond (*Tropical Africa*), where he observed that three days north of Nyassa Giraud found in the schists certain fossils which Bertrand referred to *Lepidosteus* and *Cyrena*. Moreover, Moore considers that "Drummond's beds" occur at two or three localities on or near Tanganyika, but as he mixes these up with modern lake deposits, it is not very easy to get at his meaning, the more so, since no organic remains are mentioned, other than those of the lake itself. On the whole, I conclude with Cornet, that no good evidence of fossils belonging to the Red Felspathic Grit series has hitherto been found in the Congo basin, of which L. Tanganyika at present forms a part.

The next formation in order of time is the volcanic series to which allusion has already been made towards the south-west corner of the lake, and with this may be associated the metamorphosed sandstones, etc., which appear, in fact, to be portions of the Red Felspathic Grits and not "primary metamorphics," such as those described by Cornet in Katanga. These volcanics most probably belong to the graben-system, and must be approximately of the same date as similar volcanics towards the north end of the great Nyassa-graben and elsewhere.

The latest formations in point of time are deposits derived from the lake itself, and these are of especial interest as containing the remains of the existing halolimnic molluscs. It is probable that they may be met with at many places along the shore. Mr. Moore refers especially to the line of coast between Ujiji and Usambora, where layers of modern lake-deposit, somewhat shattered, are found dipping 20° to the east, conformably to the sheets of Old Sandstone on which they repose. According to the same author the flat floor of the Ruzizi valley (at the head of the lake) is composed chiefly of modern sandstones and alluvium. Higher up the valley, to about 200 feet above the present surface of the lake, his party kept passing over older and older ground, and the plains thus traversed were found to be intersected by water-courses in some cases to a depth of 90 feet, so that the older stratified materials were exposed. These strata were found to consist of brown and yellow sandstones, having a slight dip to the south, and contained many shell fragments and also some fossilised shells which could be identified as *Neothauma*, *Nassopsis* and *Paramelania*. The age of the deposit is probably Pleistocene, and not only has the water level of the lake fallen, but he thinks that the valley-flat north of Tanganyika has undergone elevation also since those days. It should not be forgotten that Mr. Moore (*Tanganyika Problem*, p. 90) states that the water of the lake is somewhat salt. He observes that it seems to be fresher now than when Livingstone and Stanley examined it. Moreover, as both these explorers aver, there are traditions among the Arabs that, within the recollection of living men, it was a lake which never flowed out at all.

PART III.—CONCLUSIONS.

1. The zoological aspect.
2. The palæontological evidence.
3. The argument from geology.

To a certain extent the probable conclusions have already been indicated in Parts I and II of this communication, but a brief summary at the final stage may be of use. On the whole we have three main factors to guide us in the investigation, and these we will take in the order above indicated.

The zoological aspect of the question.—This is mainly studied by means of conchological comparison, and it will be seen on referring to Part I, and more particularly to the Appendix, that, in my opinion, the resemblance between the Tanganyika shells and those of our British Inferior Oolite is not sufficiently close to warrant any theory as to the derivation of the former from the latter. But, on the other hand, there is the malacological evidence derived from the study of the anatomy of the existing mollusc, which reveals a peculiar archaic character, and also a singular blending of attributes usually held to be distinct. Such peculiarities, whilst pointing to the exceptional character of this assemblage of gasteropods, fail altogether to establish any connection with the Inferior Oolite of the Anglo-Norman basin. Yet the very existence of a group of halolimnic gasteropods limited to Tanganyika, is in itself a proof that there is something remarkable about these molluscs, and such a view is further confirmed by anatomical investigation. Hence these gasteropods may, in some way, have had a remote marine origin, although that need not have been Jurassic.

It has always seemed to me that the most hopeful line of research is to be sought in the waters of the Congo basin, and particularly in Lakes Bangweolo and Mwero. If the halolimnic gasteropods had their origin in the vast inland seas of this immense system, as they existed formerly, there should be some trace of them in the lakes of the Upper Congo. This, Mr. Moore informs us, is unfortunately not the case, although in Lake Mwero a genus closely approaching the *Neothauma* of Lake Tanganyika has been found. I am rather inclined to consider that the zoological evidence points to a local and restricted origin for these Tanganyika shells, and if we accept the theory of their special marine derivation, whether Jurassic or more recent, it must always be with a certain degree of doubt.

The palæontological evidence.—Since the hypothesis of a

Jurassic origin for the Tanganyika shells has been mooted, the Palæontological evidence brought forward in Part I may now be briefly recapitulated. I must confess that the possibility of tracing a connection between the Inferior Oolite fauna of the Anglo-Norman basin and the fauna of Lake Tanganyika had a considerable fascination for me, and I rather hoped that as we approached the Mediterranean basin there might have been some evidence in favour of these views. On the contrary, except in Sicily, no really important gasteropod fauna has been discovered in the intermediate areas, and even in the case of the Sicilian fossils, the prevailing assemblage of gasteropods lends but little countenance to any theory of a Jurassic origin for our halolimnic shells.

These considerations were originally based upon a hope that there might be some evidence of a Jurassic derivation by way of the Congo basin, but the more I studied this part of the question the less faith I had in my original expectations. Supposing, as is by no means improbable, that there may have been a communication with Tertiary and even with Mesozoic seas on the northern side of the Congo basin at some period of its history, the misfortune is that we obtain no palæontological evidence in the direction required. If we take North Africa, the Iberian Peninsula, or even the south-west of France, wherever Jurassic deposits are known, they have never yielded a fauna approaching that of the Anglo-Norman basin, and therefore do not help us in the least towards covering the immense distance in space which exists between that classical region and the centre of Equatorial Africa. As regards Jurassic deposits within the limits of the African tropics, such as those of Abyssinia and Madagascar, we have already seen that their fauna, so far as known, has no analogy with the Tanganyika gasteropods. This, however, is a fact of minor importance, since the Madagascar deposits especially occupy a region which there is good reason for believing on geological grounds has never had any connection with the Congo basin, in which Lake Tanganyika is situated.

The argument from geology.—Since neither the zoological nor the palæontological evidence favours the notion of an Inferior Oolite origin for the halolimnic gasteropods, we must endeavour to ascertain how far the geological history of this part of Equatorial Africa tends to throw any light upon the subject.

In Part II, I have endeavoured to sketch a brief outline of this history, dwelling more especially on the geological structure of the Congo basin, and of that portion of the East

African Plateau-chain which flanks it on the east. The importance of Lake Tanganyika in a physiographic sense is based largely upon the fact that it lies at the junction of these two very different regions, the latter a disturbed, and the former a quiescent one. As constituting a part of the western arm of the Graben-system, I am inclined to the belief that it is by no means an ancient feature of the earth's crust. Much depends upon the date assigned to the East African volcanic plateau, which was probably initiated towards the close of the Cretaceous period. The Graben-system is of necessity more recent, and if this system has any connection, as regards time, with the Jordan-valley fissure, it must be post-Eocene in date. I think that we may provisionally accept this date for the initiation of the Graben-system, though I should be disposed on other grounds to make it more recent still, bearing in mind that its activities are not yet extinct.

Lake Tanganyika, as Mr. Moore points out, was formed at different times, but since its existence could not precede that of the Graben-system, the oldest date that we can assign to any portion of it is Middle Tertiary. It is not contended, however, that there were no large lacustrine sheets of a different character at the time of its formation in the neighbourhood, and notably in the area now occupied by the eastern portion of the Congo basin. The geological history of this vast territory is unfortunately a blank since the deposition of the "White Friable Sandstones." All we can say is that nothing which could indicate the presence of a Jurassic Sea or even of a Cretaceous Sea has been discovered therein. There can be little doubt that the "Red Felspathic Grits" of Cornet, which underlie the "White Friable Sandstones," may be comprehended under the very wide term of Karoo, which gives us an approximate date. The overlying "White Friable Sandstones" will, therefore, be Mesozoic in age, and probably like the Karoo beds non-marine in origin.

We now come to the consideration of a very interesting question, viz., the connection between Lake Tanganyika, which is a fissure lake, with the wide and quiescent area of the Congo basin. For several years, as you are aware, geographers were in doubt as to whether Lake Tanganyika had an outlet, and when the outflow of the Lukuga was at last established it was thought that the outflow was intermittent. The conditions vary even now, I believe, according to the supply of water in the lake. But what I especially wish to point out is the peculiarity of the Lukuga outlet in a fissure lake surrounded

for the most part by lofty enclosing walls. Was this outflow caused by a cross-fissure (Graben) such as might be produced by the prolongation of the great Rukwa-Graben in the way indicated by Mr. Moore? At any rate these drainage facilities may not always have existed, and in that case Tanganyika during part of its history would be a closed water, and consequently more or less saline. Whether such conditions as these had anything to do either with the origin or conservation of the halolimnic gasteropods I do not venture to say. My endeavour has been to find any geological evidence in favour of the view that they were derived either primarily or secondarily from a Jurassic stock of Inferior Oolite age. It must be confessed that thus far my efforts have been without success. At the same time mere negative evidence must not be accepted as final.

In conclusion, then, since neither the zoological, the palæontological nor the geological evidence affords much support to Mr. Moore's theory, we must regard the Tanganyika problem in its main features as unsolved. In the present state of our knowledge we are not bound to submit an alternative hypothesis. Yet, if we still cling to the notion of a specially marine origin for the halolimnic gasteropods, the most promising quarter for a solution of the riddle is to be sought along the northern margin of the Congo basin, where it adjoins that of the Shari. This opens up the notion of a possible communication through the depression in which Lake Tchad is situated with the undoubted marine deposits of the second geological division of Africa. That the so-called "post-primary" deposits of Equatorial Africa, like their equivalents at the Cape, are, with the exception of coastal strips, mainly of terrestrial and fresh-water origin, I entertain no doubt. The only exception to this rule appears to be a Jurassic formation in Abyssinia known as the Antalo limestone.

It should be distinctly understood that I have not taken up this investigation in a controversial spirit; nor indeed, in the first instance, with a view to controverting the theory of a Jurassic origin for the Tanganyika gasteropods. If, during the course of the inquiry, I have been unable to find evidence in favour of that hypothesis, it has at least been a source of gratification to follow Mr. Moore's lead in his character of explorer and naturalist. In this way both myself and those members of the Victoria Institute who have taken the trouble to follow me, must feel indebted to him for having awakened a more than passing interest in one of the many problems of Equatorial Africa.

APPENDIX TO PART I.

NOTES ON THE COMPARISONS BETWEEN THE HALOLIMNIC GASTEROPODS AND CERTAIN FOSSILS FROM THE INFERIOR OOLITE—TOGETHER WITH AN ABSTRACT OF MR. MOORE'S STATEMENTS REGARDING THE MOLLUSCA OF TANGANYIKA GENERALLY.

* Forty-six species of mollusca are enumerated (*The Tanganyika Problem*, p. 138), consisting entirely of Gasteropods and Lamellibranchs, the former preponderating. Of the latter are a number of distinct specific forms supposed to be related to *Unio*. Many of the Gasteropods belong to normal genera, such as *Limnæa* (four species), *Isidora* (two), *Phyopsis* (one), *Planorbis* (three), *Ampullaria* (two), *Vivipara* (one), *Cleopatra* (one), *Melania* (three). There is also the very fine *Vivipara*-like genus, *Neothauma*, Smith, which cannot in any sense be regarded as halolimnic. Mr. Moore further observes that the normal fresh-water molluscs found in Tanganyika are specifically distinct from the representatives of the same genera occurring in the neighbouring lakes. Excluding *Neothauma*, there are fourteen Gasteropodean types (p. 218) judged by their conchological characters, generically distinct, as follows, viz. :—

<i>Typhobia</i> .	<i>Spekia</i> .
<i>Bathanalia</i> .	<i>Nassopsis</i> .
<i>Limnotrochus</i> .	<i>Syrnolopsis</i> .
<i>Chytra</i> .	<i>Stanleya</i> .
<i>Paramelania</i> .	<i>Reymondia</i> .
<i>Bythoceras</i> .	<i>Horea</i> .
<i>Tanganyicia</i> .	<i>Ponsonbya</i> .

Out of these the following are regarded as specially representing the halolimnic molluscs, and are classified in six groups, viz. :—

Typhobia and *Bathanalia*, *Tanganyicia*, *Limnotrochus* and *Chytra*, *Spekia*, *Paramelania* and *Bythoceras*, *Nassopsis*.

It is more especially the above forms which are regarded as homæomorphic with certain fossils, chiefly of the Inferior Oolite, and this resemblance has impressed Mr. Moore so strongly, that he is disposed to consider these groups as the partially modified descendants of the old Jurassic molluscs.

As most of these comparisons were made with fossils in my own collection, I have endeavoured, in those cases where it has been possible to procure the particular Tanganyika shells, to check the resulting determinations, of course on conchological lines solely.

1. *Melania admirabilis*, Smith, with *Cerithium subscalariforme*, D'Orbigny.

N.B.—These shells are not referred to in the above list. On pp. 219 and 353 of the *Tanganyika Problem* are back and front views of the

* It is probable that this is not an absolutely full list.

Melania admirabilis of Lake Tanganyika—at least, I suppose that both of these cuts are intended for the Tanganyika shell, and not for the Jurassic fossil. The likeness is by implication only, for on referring to page 273 for the affinities of *Melania admirabilis* I find no recognizable account of that species. It is true that on page 269, the author makes a general attack upon the genus *Melania*; but this is rather with a view of criticising the suggested relationship of *Typhobia* to *Melanopsis*.

The shape and ornamentation of *Melania admirabilis* (judging from the figures) and *Cerithium subscalariforme* are singularly identical. There is some difference in the apertures, for in *C. subscalariforme* there is a well-formed anterior spout slightly reflexed. Not having any specimen of *M. admirabilis* in my possession, I cannot pursue the comparison any further.

2. *Typhobia horei*, Smith, with the genus *Purpuroidea*, Morris and Lycett.

Mr. Moore in this case does not institute any close comparison, but rather suggests (p. 350) that *Typhobia* is matched by the Oolitic fossil genus, *Purpuroidea*, "from which it is difficult, if not impossible, on conchological grounds, to distinguish it." I select *Purpuroidea Morrisii*, Buvignier, a characteristic Great Oolite fossil, to exemplify the genus.

Here the ornamentation and general strombiform character of the shell in each case is strikingly apparent. On comparing the apertures we find that, instead of the short notch of *Purpuroidea*, the inner lip of *Typhobia* is produced anteally into a narrow and reflexed spout. In other respects both the outer and inner lip in *Typhobia* and *Purpuroidea* greatly resemble each other and equally differ from *Strombus*. Whilst recognising a considerable degree of homœomorphy between the two shells from Tanganyika and Minchinhampton respectively, a comparison of the shell substance seems to suggest important differences. So far as we are able to judge from the usual calcite replacement of the fossil shell, one would say that *Purpuroidea* had a thick and heavy shell. On the other hand *Typhobia* has a very thin and fragile shell, and, despite its identification as a halolimnic shell, has all the appearances of a fresh-water genus—so much so, indeed, that its affinities with *Melania* have been suspected by some, though this would seem to be negated by internal characters. As regards the history and distribution of *Purpuroidea*, the genus makes a doubtful appearance in the Inferior Oolite of the east of England; it is fairly abundant in limited districts of the Great Oolite and is last seen, so far as England is concerned, in the Corallian of Yorkshire. It would seem also to be fairly abundant in the Corallian beds described by Buvignier. It does not occur on a higher horizon in this part of Europe.

3. *Bathania howesi*, Smith, with *Amberleya orbignyana*, Hudl.

Bathania is figured on pp. 227 and 348. Of this peculiar genus Moore says (p. 228) that it is an inhabitant of deep water throughout

the southern third of the lake, and he considers that, in conchological characters, it is identical with several marine Jurassic fossils, described under *Amberleya*. He further remarks that except for its widely different shell, *Bathanalia* is structurally identical with *Typhobia*. Referring to the diagnosis of *Amberleya*, quoted in p. 346, Moore says that this would absolutely answer for *Bathanalia*. According to his view the thin shell, the absence of all trace of epidermis, and the character of the whorls, as well as the sculpture and character of the mouth, are all essentially the same in *Bathanalia* as they are in *Amberleya*.

Judging from figures only, this is the most striking of all the resemblances. I gather, however, that there are some differences in the aperture.

On p. 348, Moore has figured the back only of my specimen of *Amberleya orbignyana*. The right hand upper figure on this page is intended for an *Amberleya*, which I do not quite recognise. The two lower figures represent *Bathanalia*, back and front. It is unfortunate that no good front aspect of *Amberleya* is presented to the reader, for if the aperture in *Bathanalia* is correctly drawn, it does not possess the straight pillar lip, coming forwards almost to a point, which is so characteristic of *Amberleya*. In all other respects the resemblance is most striking, even to the angular outline of the outer lip, which in *Bathanalia* is prolonged into a short process. It should be observed, however, that there is somewhat of an umbilical opening in *Bathanalia*, whereas the shell of *Amberleya* is entirely closed.

Amberleya (including *Eucyclus*, which latter, if not a synonym, has a close relationship) is eminently characteristic of the Lias. It comes up from the Lower Lias, and culminates in the Inferior Oolite, especially in beds having a Cephalopod facies, as in the Anglo-Norman basin. Occurs also in the Great Oolite, and seems to have left this country with bed of Corallian age.*

4. *Limnotrochus thompsoni*, Smith, with *Littorina sulcata*, Hebert and Deslongchamps.

See pp. 233 and 349. It is also compared with *L. dorsetensis*, Hudl. In the possession of a black epidermis and in its general aspect *Limnotrochus thompsoni* has a certain fresh-water character. The aperture, however, is more like that of *Littorina* than of *Trochus*. The trochiform outline of the shell and the ornamentation, especially the

* Since writing the above, I have had an opportunity of inspecting a specimen of *Bathanalia* through the courtesy of Mr. Da Costa. I am more than ever impressed with the extraordinary resemblance of the spire to that of *Amberleya pagoda*, but the character of the mouth is so very different, that I conclude the resemblance of the spire to be fortuitous.

strongly bicarinate body whorl, have a singular resemblance to *L. sulcata*, H. and D. The aperture, however, presents considerable differences, and in this respect *Limnotrochus thompsoni* more nearly approaches some of the many varieties of "*Littorina*" *dorsetensis*, the chief difference being that in the latter the umbilicus is closed and the aperture is not free as in the former case. Nevertheless, the general resemblance is sufficiently striking.

5. *Chytra* (*Limnotrochus*) *kirkii*, Smith, with *Onustus ornatissimus* D'Orbigny.

See pp. 229 and 350. Originally the empty shell had been described and figured by Mr. Smith (*Proc. Zool. Soc.*, 1881), who classed it under *Limnotrochus*. Mr. Moore has founded for this species the genus, *Chytra*, and further observes that the shell of *Chytra kirkii* is remarkably solid, resembling both that of *Solarium* and *Zenophora* (*Onustus*).

The resemblance of *Chytra* to the Jurassic species referred to *Onustus* is very slight indeed, beyond the general pyramidal shape of the shell. One of the leading characteristics of the Jurassic *Onustus* is the imbricate overlapping of one whorl over the next one, and this feature is equally seen in the *Onustus pyramidatus*, Phillips, as in *Onustus ornatissimus* D'Orbigny. There is no trace of this kind of overlapping in *Chytra*, which, to my notion, has more the character of *Solarium*. The basal characters in *Chytra* are also different to those in the Jurassic species of *Onustus*.

Hence I fail to trace any marked resemblance between *Chytra* and *Onustus*. Nevertheless *Chytra* is perhaps the most thoroughly marine in aspect of all the halolimnic series, the shell being thick and more or less free from epidermis. Indeed, most conchologists, if they did not know its habitat, would hardly suspect that it was anything more than a somewhat aberrant *Solarium*.

6. *Paramelania damoni*, Smith, with *Purpurina bellona*, D'Orbigny.

See pp. 245 and 345, for figures. There are three species of *Paramelania* mentioned by Moore (index, p. 366) viz., *P. crassigranulata*, Smith, *P. crassilabris*, von Martens, and *P. damoni*. Other species also have been described by Bourguignat, some of which possibly belong to *Nassopsis*. The species of *Paramelania* selected by Moore for comparison with the Jurassic *Purpurina* is *Paramelania damoni*, of which unfortunately I do not possess a specimen, and must therefore rely solely on Moore's figures, pp. 245 and 345. The comparative figures are to be found on p. 345. The particular *Purpurina* there drawn is *P. aspera*, Hudl. from the *Concavus*-beds of Bradford-Abbas. This is a very rugose form of *Purpurina*, and its resemblance to *Paramelania damoni* (judging from the figure) is very striking; only that in *P. aspera* and indeed in *Purpurina* generally, the anterior notch or channel is more in evidence, and also more reflexed than in the majority of specimens of

Paramelania. In this respect the regulation *Purpurina bellona* (which occurs on a higher horizon than *P. aspera*) more resembles the average *Paramelania*s of Tanganyika. It should be remarked also that most species of *Paramelania* have a considerable amount of brown scaly or epidermal matter, and are generally thick and nassoid or purpuroid in the texture of the shell. Reference is made to the conchological similarity of *Pyrgulifera*, a genus of fresh-water shells (p. 343) of the Upper Chalk, to *Paramelania*, and this casual identification opens up several interesting questions.

7. *Nassopsis nassa*, Smith,* with *Purpurina inflata* (? auctor).

See pp. 250 and 347. During life this mollusc, we are told, inhabits the surface rocks of Tanganyika, and its shells are always richly encrusted with the green algæ which clothe the rocks for a considerable depth. It is sluggish and appears to browse within a very limited area, like the *Patellas* of the Ocean beach.

As regards the Jurassic fossil figured for comparison (upper figures, p. 347) under the name of *Purpurina inflata*, I should point out that this specimen is not *Purpurina inflata*, Tawney, but a peculiar unnamed form which was figured in Plate I of the "Jurassic Gasteropoda." The true *P. inflata* has a very different figure and ornamentation, but possesses a rounded and almost unchanneled aperture, having in fact the least indented mouth of all the *Purpurina*.

The real value of these comparisons is an unknown quantity, but the conchological resemblance of both *Paramelania* and *Nassopsis* to certain named and unnamed forms of *Purpurina* is clearly pointed out by Mr. Moore, and admitted, as I understand, by Mr. Edgar Smith. Such resemblances are interesting, but if *Paramelania* and *Nassopsis* are really different genera, as their internal structure would imply, one learns two things from this fact: (1) that the outward form of the shell is not always indicative of the character of the animal within, and (2) that two different genera of existing molluscs are compared with the one Jurassic genus, *Purpurina*.

It may be mentioned here that the genus *Purpurina* was somewhat loosely constituted by D'Orbigny, and was more carefully reconstituted by Piette and Deslongchamps, who regarded it as having relations on the one side with *Turbo* and on the other with *Cerithium* and *Purpura*, Fischer places *Purpurina* among the Littorinidæ, but its real family relationship is by no means clear. In the Jurassics of this country *Purpurina* first makes its appearance in the Marlstone (Middle Lias), culminates in the Inferior Oolite, is rare in the Great Oolite, and dies out

* I possess a specimen supplied by Sowerby and Fulton, marked "*Paramelania coronata*," Bourguignat; which greatly resembles the figures of *Nassopsis nassa*.

in the Callovian of Yorkshire. It is also represented in the Callovian of Montreuil Bellay, where a gasteropod fauna, greatly resembling that of the Inferior Oolite of the Anglo-Norman basin, is found to occur.

8. *Bythoceras*, Moore.

See pp. 238 and 242. There are two species figured, but, so far as I know, no special comparison with Jurassic forms is invited.

9. *Tanganyicia*, Cross.

See p. 246, *T. rufoflosa*. In this case also, no special comparison with Jurassic forms is instituted, but its general resemblance to *Natica* is pointed out. The fine spiral coloured lines are characteristic of this very pretty little shell, which though naticoid in its outline is certainly different as regards shell-substance to the regulation *Natica*. It is said to be a littoral form and occurs in abundance.

10. *Spekia zonata*, Cross or Smith, with the Jurassic genus, *Neridomus* M. and L.

See pp. 256 and 351. On p. 257, Moore remarks on its *naticoid* appearance, and considers it so "completely similar to that of numerous fossil naticoid forms that, had it appeared fossilized instead of having been found living in a great fresh-water lake, there is not the slightest doubt that it would have been placed in one of the numerous fossil genera which are supposed to group themselves about the living *Naticas*." Yet on p. 349 (the figures are on p. 351) he says: "Again we find that the shells of the Tanganyika genus, *Spekia*, are practically indistinguishable from the fossil remains of the marine Jurassic genus, *Neridomus*."

In this latter conclusion he is partly correct, for there is no doubt that the affinities of *Spekia* are with the *Nerites* rather than with the *Naticas*. *Spekia* is *neritoid*, not *naticoid*, but I fail to trace any especial resemblance to *Neridomus*. If the reader turns to the illustrations on p. 351, he will perceive that the two representations of *Spekia* are back views, whereas the two intended to represent *Neridomus* are front views, nor does the author assist the comparison in the text. But if we take a typical Jurassic *Neridomus* such as *N. Hemispherica* from the Great Oolite of Minchinhampton, which may be regarded as the type on which *Neridomus* was founded, we at once find that the columellar region is convex and the shell imperforate, whereas in *Spekia zonata* the columellar region is extremely concave, and in some specimens a peculiar umbilical slit is noticeable. Hence, beyond the fact that both *Spekia* and *Neridomus* belong to the *Neritidæ* there is very little resemblance so far as the anterior aspect is concerned. It may be remarked, in conclusion, that *Spekia zonata* is related to *Neritina* rather than to *Nerita*. There is nothing naticoid about it, and moreover its thick epidermis and general aspect are highly suggestive of fresh-water conditions, although its shape may be somewhat unusual.

Of the remaining genera of Gasteropods enumerated, none are especially correlated with Jurassic forms, although they are regarded as belonging to the halolimnic group. *Syrnolopsis* is a genus of small elongate shells represented by two species, and there is stated to be an almost exact conchological identity (p. 219) between these shells and the marine genus *Syrnola*. It is not necessary here to comment on all the remaining halolimnic genera, consisting mostly of small forms, but I would point out certain conclusions with reference to some of them, e.g., *Reymondia*, Smith. There are several species, mostly small, but *R. horei*, Smith, is the most conspicuous form, and may be taken as the type. I mention the circumstance because of the very considerable conchological resemblance between this very smooth shell and some of the Jurassic species such as "*Phasianella*" *elegans*, M. and L., and other sub-elongate forms. This identification seems to have escaped Mr. Moore. I do not attach any importance to it, since neither *Reymondia horei* nor "*Phasianella*" *elegans* have any special features of ornamentation like *Amberleya* and *Purpurina*. There is also another case of mock resemblance, where *Horea ponsonbyi*, Smith, presumably a Prosobranch, bears a strong likeness to some of the striated *Actaeoninae* of Jurassic age; whilst the remarkably straight columellar lip of *Horea* reminds one of *Orthostoma*, which is, I believe, a synonym of D'Orbigny's genus, *Actaeonina*.

Not the least interesting of the Tanganyika molluscs is the handsome viviparoid shell, *Neothauma*, whose varieties are figured on p. 261. This of course is a thoroughly fresh-water genus, and has no connection with the halolimnic fauna beyond sharing the hospitality of the same lake. One of the most remarkable characteristics of *Neothauma* is the extraordinary difference, judging from the figures, between shells from the south of the lake, and those from the middle and the north. If the internal structure is the same in all three, we have again an instance of the difficulty of recognizing an animal by means of its shell even in living creatures. Here again is a singular instance of mock resemblance to a Jurassic species, since the strap-like or bicarinate variety of *Neothauma* would also do for the figure of *Cloughtonia cincta*, Phillips, a well known fossil of the Inferior Oolite of Yorkshire and the East Midlands.

Postscript. This appendix was written before I had the advantage of hearing Mr. Edgar Smith's presidential address to the Malacological Society, delivered in February last. It was highly satisfactory to find that the chief conchological authority in this country had arrived at pretty much the same conclusions as myself, with regard to the presumed connection between the halolimnic gasteropods of Tanganyika and certain shells of the Inferior Oolite.

DISCUSSION.

The CHAIRMAN.—As we have the pleasure of Mr. J. E. S. Moore being present, we will ask him to open the discussion.

Mr. J. E. S. MOORE, F.L.S.—I should like to say a few words with respect to the nature of the Tanganyika problem, as it presents itself more to the zoologist than the geologist. We have just heard a very able exposition from Mr. Hudleston on the bearing of the one position on the other; but I should like to point out, from my own point of view, that that is not really the main aspect of the Tanganyika problem. The main aspect is that you have a large number of animals besides gasteropods, such as jelly-fish, prawns, sponges, protozoa, etc., which are not present in other lakes, and which are of a marine character, and it would appear there is very little doubt that these animals have no relation whatever to any fresh-water areas; and, consequently, whether they have originated from a Jurassic source, or some other, is simply a minor matter for discussion. But the fact which remains is that they are of marine origin, and I do not see that it can be disputed. Whether they have originated from Jurassic fauna is a matter of hypothesis, and, as Mr. Hudleston points out, there is a striking similarity between the shells of gasteropods and certain genera of the Inferior Oolite of the Anglo-Norman basin. Unfortunately geologists, as Mr. Hudleston has said, have not been able to find any evidence that makes their origin more certain; but if you do not associate them with the Jurassic sea, I should much like to know where they did come from.

There are one or two other points upon which, possibly, it may be necessary to say a few words. Mr. Hudleston pointed out that the peculiar jelly-fish that inhabits Tanganyika has recently turned up in the Victoria lakes, and one would suppose that implied that the whole of the Halolimnic fauna was present in Lake Victoria. There are cogent reasons for doubting this. But as a matter of fact not many years ago one of the few fresh-water jelly-fishes turned up in the Royal Horticultural Society's Gardens in London, and has not been seen since; it had been probably transported among water plants. Well within recent years communication has been opened up between Tanganyika and Victoria Nyanza, and the natives have a habit of carrying a large quantity of water. It is only about forty miles from the basin of the Tanganyika to the water-shed of one of

the great rivers which flows away to the Victoria Nyanza, so that it is a matter of comparative ease for one of those organisms to be transferred from one basin to the other. Therefore judging from the fact that the fauna of Lake Tanganyika differs from that of other East African lakes in alone possessing evidences of a marine origin, I should be inclined to regard the jelly-fish as being an emigrant from Tanganyika.

In all other respects I think I am in essential agreement with Mr. Hudleston's paper, and am intensely interested in the way in which he has correlated the geological facts relating to the Tanganyika problem. It seems, on the whole, that there is probably less evidence of direct connection between the Tanganyika gasteropods and Jurassic gasteropods than we formerly supposed; that being so it seems that the whole Tanganyika problem is much where it was when I came back from my first expedition, only it has grown bigger and is more difficult to understand.

I am extremely interested in what Mr. Hudleston has said, and congratulate him heartily on his paper.

Dr. BLANFORD, F.R.S.—One matter I would point out is that I was not the original discoverer of the Jurassic beds of Abyssinia. They were discovered by the French explorers Ferret and Galinier.

There is one other point I would refer to and that is the extraordinary resemblance that seems to be more apparent every day between the geological conditions of South Africa, including Central Africa, and the Indian Peninsula. There are similar rocks—thick sandstones destitute of fossils, or only containing plants and some fossils of fresh-water origin, and I suggest that these great Indian and African formations, chiefly sandstone and apparently of fresh-water origin, are great river deposits like those of the Ganges plain.

Dr. HENRY WOODWARD, F.R.S.—I am no authority on the subject of the paper, for my acquaintance with the subject is purely as a reader of Mr. Moore's book and I have not visited Africa.

With regard to the mollusca I was led, as Mr. Moore was, and many others, to be struck by the extraordinary resemblance between the Jurassic shells, which are now placed on the table behind Mr. Moore's specimens for your consideration, and the specimens which Mr. Moore brought from Lake Tanganyika. My

brother, Dr. S. P. Woodward, was the first to call attention to the shells brought home by Captain Speke, and he also called attention to the fact of the marine forms which have been observed in the Caspian, and his conclusion, generally, was that many of these old sheets of water which were now fresh, or either partially fresh, or wholly fresh water, had at one time been connected with the sea; and certain animals, like the Caspian cockle and shells that Captain Speke brought home from Lake Tanganyika, I think show the same remarkable marine affinities and might have been survivors from animals that had been left behind when the sheet of inland water was isolated from the rest of the main ocean.

I think Mr. Hudleston has taken a very wise view in his remarks. He says, "I don't care whether they are Jurassic or not." The main contention he held too was that they were originally descendants of marine forms. Their ancestors might have been merely Tertiary. They might have been, as Mr. Hudleston suggests, possibly derived from Cretaceous beds of North Africa; but still the instances of marine molluscan fauna remain, and the fact of those little Medusæ being met with is of great interest.

What probably led Mr. Hudleston to see the difficulty of accepting the view of the marine origin of these forms was that these rift valleys, to use Dr. Gregory's term, are so much more recent. They are not of that great antiquity that the lakes of Europe, Asia and Arabia, and that part of the world, which indicate marine origin, claim. Lake Baikal and those other lakes and the old Caspian, are evidently old seas that have been cut off from the ocean at very remote times. There are lakes in Sweden which were cut off from the sea and contain seals at the present day, showing that they were at one time part of the Baltic, but are now inland and separated entirely from the sea.

Mr. Hudleston's is a very interesting paper and shows an immense amount of research to bring together this collection of facts in a convenient form for study. I also congratulate Mr. Moore on having obtained another supporter in Mr. Hudleston.

Rev. G. F. WHIDBORNE, F.G.S.—I can only say that I have listened with extreme interest to the paper, which has taught me a great deal, and as the time has fled I think I will say no more.

The SECRETARY (Professor EDWARD HULL, LL.D.).—I would like to be allowed to move a very cordial vote of thanks on

the part of the Council and ourselves, to the author of this paper. It is most incumbent on me to do so, for I think I am in some way responsible for it.

When Mr. Moore's admirable work appeared, and long before, indeed, this subject of the possible origin of marine forms in one of our great African Lakes, in the very heart of that great continent, struck me as one of the most interesting physical problems that had been put before us in the present generation; and when Mr. Moore's work came out we took an early opportunity of becoming possessed of it; and I considered with myself, who can we get amongst the members of the Institute having the knowledge and ability to deal with a problem of such vast breadth and intricacy? Naturally Mr. Hudleston, who is a Vice-President of the Institute, came before my mind as being capable in the above sense, and I wrote to him on the subject. I felt that I was putting an almost herculean task upon him, but I felt sure if his strength and time permitted he would not refuse; and he has not, happily for us. He has given us a paper of immense interest and one that will take a marked position in the *Transactions* of this Institute.

It is very gratifying that Mr. Moore, the author of this work, has been able to be present and to take part in the discussion.

I had some observations to make, but I will not do so at this late hour, and will simply move a hearty vote of thanks to Mr. Hudleston for giving us his paper this evening. [Applause.]

The CHAIRMAN.—I should like to second that. I came here only to learn, and I have learnt a great deal since I came here; in fact I read the paper before. I am naturally interested, because having been brought up at sea the greater part of my life, I am interested in marine fauna. I therefore beg to second the resolution of thanks for the paper, which I think will encourage many to study the subject.

The AUTHOR.—I ought to thank you for your kindly reception of my paper, which I can assure you has been a great pleasure to me to write, and I ought to thank our Secretary for giving me the hint that I might find something to do in that connection. It has also been a satisfaction to us to hear Mr. Moore take part in this discussion. I see he has now left; but he practically admits that probably these gasteropods (and I only deal with those) are not of Jurassic origin. I will not go the length of saying they are not,

but there is no proof that they are. That, I think, is all I will undertake to say. Of course there is just a possibility that they are not marine at all. When you bear in mind the peculiar position of Lake Tanganyika, there is a possibility that these things may have been generated by other means.

COMMUNICATION BY REV. DR. IRVING, F.G.S.

“May 25th, 1904.

“DEAR PROFESSOR HULL,

“It is with much regret that I find myself unable at the last minute to come to the meeting at the Victoria Institute to-day, at which you have so kindly asked me to take part in the discussion. Had I been able to be present I should have pointed out two or three things which seem to me to bear upon the *problem as to the presence of marine forms of life in the great Lake of Tanganyika*, if not anticipated by the author.

“(i) The first line of inquiry would seem to be as to their affinities with the present *fauna* of the Indian Ocean on the one hand, and with that of the Atlantic on the other. The orography of the African Continent and its present drainage system would suggest the probability of the latter affinity being closer than the former.

“(ii) The lake-waters are presumably ‘fresh.’ But inquiry is needed as to what that term means in this case; (a) whether it is to connote little more than the absence of the superabundancy of *sodium chloride*, to which the ocean-water owes its salinity in the popular sense of the word; or (b) whether comparative analyses of the lake-water and sea-water do not reveal a general equivalency (or an approximate one) between the *salinity* (in the chemical sense of the word) of the lake and ocean-waters. No doubt Mr. Hudleston (who writes F.C.S. after his name) has thought of this and included it in his inquiry (*cf.* the salinity of the Dead Sea).

“(iii) Have we yet to hand sufficient stratigraphical data of those vast regions, which lie between the Lake Tanganyika and the eastern or western littoral of the continent, to give us any clue to the recency or remoteness of a possible connexion between the lake and the ocean?

“(iv) There is no improbability in the view that the present marine fauna of the lake consists of modified descendants of a

portion of a former ocean-fauna, when we recollect what is well known of the relations and the affinities of the faunas of the *Permian* and *Muschelkalk* inland seas or lakes.

“The case of the distribution of the modern *sturgeon* is very suggestive.

“Yours very truly,
“A. IRVING, D.Sc.’

P.S.—The suggestions and enquiries of Dr. Irving, which are very relevant to the problem, are to a greater or less degree dealt with by the author of the paper, but are none the less valuable as coming from an independent source.—ED.