

A

Yorkshire Philosophical Society.

ANNUAL REPORT

FOR

MDCCCLXXI.



ANNUAL REPORT
OF THE COUNCIL
OF THE
YORKSHIRE
PHILOSOPHICAL SOCIETY

FOR
MDCCCLXXI.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 6th, 1872.



YORK:
J. SOTHERAN, BOOKSELLER, CONEYSTREET.

—
1872.

TRUSTEE
OF
THE YORKSHIRE MUSEUM.

EDWARD WILLIAM VERNON HARCOURT.

PATRONESSES
OF THE
Yorkshire Philosophical Society.

HER MAJESTY THE QUEEN.
H. R. H. THE PRINCESS OF WALES.

PATRONS.
H. R. H. THE PRINCE OF WALES.
THE ARCHBISHOP OF YORK.

OFFICERS OF THE SOCIETY, 1872.

PRESIDENT:

HIS GRACE THE ARCHBISHOP OF YORK.

VICE-PRESIDENTS:

THE EARL OF ZETLAND, K. T.
THE LORD LONDESBOROUGH.
THE HON. & VERY REV. THE DEAN OF YORK.
W. H. RUDSTON READ, F. L. S.
JOHN PHILLIPS, F. R. S.
THE REV CANON HEY, M. A.
THOMAS ALLIS, F. L. S.
THE REV. JOHN KENRICK, M. A., F. S. A.
ROBERT DAVIES, F. S. A.
JOHN FORD.

TREASURER:

WILLIAM GRAY, F. R. A. S., F. G. S.

COUNCIL:

Elected 1870. W. MATTERSON, M. D.

EDWARD SWAINE.

J. BACKHOUSE.

GEORGE OLDFIELD.

Elected 1871. W. PROCTER, M. D., F. C. S.

S. W. NORTH, F. G. S.

J. L. FOSTER.

JOHN ROPER.

Elected 1872. THE RIGHT HON. THE LORD MAYOR
(W. WALKER).

MR. ALDERMAN STEWARD.

REV. G. VANCE SMITH.

ALFRED BALL.

HON. SECRETARY:

T. S. NOBLE, F. R. A. S., F. G. S.

CURATORS:

GEOLOGY AND MINERALOGY . . .	Wm. PROCTER, M. D., F. C. S.
COMPARATIVE ANATOMY . . .	THOMAS ALLIS, F. L. S.
BRITISH ORNITHOLOGY . . .	W. H. RUDSTON READ, F.L.S.
INSECTS AND CRUSTACEA . . .	REV. CANON HEY, M. A.
ETHNOGRAPHICAL COLLECTION	S. W. NORTH, F. G. S.
ANTIQUARIAN DEPARTMENT . . .	{ REV. JOHN KENRICK, M. A. Wm. PROCTER, M. D., F. C. S.
LIBRARY	REV. G. VANCE SMITH, B. A.
BOTANY	WILLIAM MATTERTON, M. D.
CONCHOLOGY	S. W. NORTH, F. G. S.
OBSERVATORY & METEOROLOGY, <i>under the care of a Committee consisting of</i>	{ W. GRAY, F. R. A. S.; F. G. S. JOHN FORD. REV. CANON HEY, M. A. T. S. NOBLE, F.R.A.S., F.G.S.

**Vote of Condolence to Mrs. Harcourt, on the
decease of the Rev. W. Vernon Harcourt,**

ADOPTED BY THE MONTHLY MEETING OF THE YORKSHIRE
PHILOSOPHICAL SOCIETY, 2ND MAY, 1871.

RESOLVED—

“That the Council has received with deep regret the intelligence of the death of the Rev. W. Vernon Harcourt, and desires to express its sympathy with Mrs. Harcourt and the family in the bereavement they have sustained. That the Council desires on this occasion to place on record its sense of the great obligation which the Yorkshire Philosophical Society owes to the late Mr. Harcourt, as having taken a leading part in the first formation of the Society, and having by his influence and personal exertions been the chief instrument of its establishment in its present locality, and as having for many years watched over its interests with unremitting care.”

Signed on behalf of the Meeting,

JOHN KENRICK,
CHAIRMAN.

REPORT OF THE COUNCIL
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY,
FEB. 6TH, 1872.

THE Council, in presenting to the Members of the Yorkshire Philosophical Society their 49th Annual Report, have much pleasure to announce that the past has been a prosperous year in respect of the objects and finances of the Society.

Thirty-seven new Members have been added to the Society during the year, being the greatest number ever elected in one year, whilst the Income arising from the Gate receipts shows an increased attendance of Visitors.

The total income for the year is £1,496 2s. 9d., being an amount considerably above the average. The total expenditure for the year is £1,326 5s. 1d., leaving a balance of £169 17s. 8d. to be applied to the reduction of the Society's debt.

Of this surplus upwards of £50 is due to the discontinuance of labour and material for the protection and propagation of tropical plants which have been disposed of for the reasons stated in the Report of last year; and a further sum of £50 is a legacy kindly bequeathed to the Society by an old subscriber, the late Mrs. J. Pearson, of Goodramgate.

The sum of £237 6s. 6d., charged under the head of "expenses and repairs," is considerably larger than in past years, but of this sum £68 4s. 0d. has been paid in respect of needful repairs done to St. Leonard's Hospital in 1868, whilst a further sum of £63 14s. 0d. is a payment on account of outgoings agreed by the Council to be expended on St. Mary's

Lodge, of which house and premises the Society, through the kind liberality of Professor Phillips, the late Lessee, are now the landlords.

The following are the circumstances under which this Lease has reverted to the Society.

In 1839, Professor Phillips, then the Keeper of the Society's Museum, obtained a Lease for life from the Society, of an old Building, together with a piece of land contiguous to the entrance to the Gardens of the Museum, in Marygate, at a ground rent of £15 a year. The Professor, by a large outlay, converted the Building into a residence House, now and for some time past known as St. Mary's Lodge, and which remained in his occupation until his removal to Oxford.

In the latter part of 1870, the following offer was kindly forwarded to the Council by Professor Phillips:—

“I propose to the Yorkshire Philosophical Society to sur-
“render my Lease of St. Mary's Lodge, from Michaelmas,
“1870, on condition that the Society pay to me annually £15,
“and further fund annually such sum as may accrue to the
“Society by this arrangement beyond the £15 now paid by
“me, and the £15 as above to be paid to me, for the purpose
“of founding a purchase fund for the purchase of specimens to
“be added to the Geological and Antiquarian Departments of
“the Museum.”

The Council have accepted this offer, and are now in communication with Professor Phillips, on the best means of carrying out his scheme.

The Lodge was let at Lady-Day last, to Mr. Smithson, at an annual rent of £55, and the Council propose to set aside a sum of £25 a year, in accordance with the Professor's wish.

It is not the least gratifying fact which the Council have to record that one so distinguished in the annals of science as Professor Phillips, though no longer resident amongst us, should still bear in remembrance a Society which formerly received from him so many benefits and so great honour during the time he was officially connected with it.

At the request of several influential citizens of York, the Council in the Autumn of last year granted permission to the

Society of York Florists to hold a Flower Show in the grounds of the Museum.

This act on the part of the Council which necessitated the usual suspension of the privileges of the Members during the afternoon of the day on which the Show was held, was gratefully acknowledged by the Committee of the York Florists, and was the means of affording great pleasure to a large number of persons, many of them members of this Society.

The holding of a Converzatione in the rooms of the Museum during some evening of the Winter Session has on more than one occasion received the consideration of the Council. The custom is one generally observed by Scientific Societies, and in the course of the past year the Council referred the matter to a sub-Committee. The Committee reported that the rooms of the Museum were not spacious enough to accommodate the large number of persons who, in all probability, would attend, and for the present the further consideration of the matter has been postponed.

Agreeably to a Resolution of the Monthly Meeting of the 4th October, 1870, the Council considered the desirableness of publishing a selection of the communications made to the Monthly Meetings. It appeared to them that the object of making these communications more extensively known would be obtained by publishing in a separate form, the Appendix to the Annual Report, continuing such Papers as should appear to be of sufficient interest for circulation among scientific societies and for sale to the public. This resolution has been carried out in regard to the Report for 1870.

The Curator of Antiquities reports:—The Antiquarian Department of the Museum has received few additions during the past year. The most remarkable of these is a Roman Altar found in excavating for the foundation of a house in Park-place, near Monk Bridge, and presented by William Thompson, Esq. It was dedicated by Marcus Rustius Massa to the Deæ Matres, and is of coarse gritstone. From William Webster, Esq., have been received some valuable electrotypes of the Seals of the Bishops of Durham, and others, and from Admiral Hotham, English Silver Coins of Edward VI., Charles I. and II., and William and Mary.

The Curator of Mineralogy reports:—In the Geological Department, during the past year, the minerals and the cases have been cleaned and the specimens partly re-arranged. New labels are now being prepared for them, under the direction of the Curator. A few minerals have been presented, of which the most important are a small collection, by Mrs. W. V. Harcourt, chiefly from Madeira, of an interesting character.

The Curator of Botany reports:—That the English and Foreign Herbaria are in a good state of preservation. The Curator has pleasure in stating that the English Herbarium (chiefly collected by the late Samuel Hailstone, Esq.) was inspected by Mr. Lawson, the professor of Botany at Oxford, whilst on a visit to York last spring, who considered it a valuable part of the property of the Museum, and well worthy of care and preservation.

The Curator of Insects and Crustacea reports:—Some progress has been made in the rearrangement of the Cabinet of Coleoptera, in accordance with the present state of Science, but in other respects there is nothing in the state of the Society's collections which calls for special remark on the present occasion.

The Curator of the Ornithological Department has only to report the addition of a Tern, and a singular variety of Field-fare, presented by The Rev. Canon Johnstone, and that the Collection is in a good state of preservation.

The Curator of Meteorology reports:—That the temperature of the year 1871 was one degree *below* a mean of 35 years, viz., $46\frac{7}{10}$ of Fahr. This deficiency occurred chiefly in the last four months of the year. February, March and August were respectively 3, 5, and 3 degrees *above* a mean. The first week in August, at Greenwich, was 6 degrees above a mean of 50 years. On the 12th of that month, the thermometer in the shade, registered at Greenwich 88 degrees, at Kew $86\frac{5}{10}$ °, at York 82°, being at Greenwich 10 degrees above a mean of 50 years. The temperature of November was 4 degrees *below* a mean. A heavy fall of snow occurred on the 10th: the mean temperature from that day to the 10th of December was $32\frac{6}{10}$ °, or 8 degrees below the mean of that period for 35 years.

METEOROLOGICAL REGISTER, YORK, 1871.

BAROMETER.				RAIN.		THERMOMETER.				
	Highest.	Lowest.	Mean.	Inches.	Days.	Average Mx.	Average Mm.	Mean Temp.	Highest.	Lowest.
Jan.	30·24	28·58	29·68	0·70	7	35·4	28·7	31·8	46	10
Feb.	30·24	29·32	29·84	2·50	14	46·3	39·4	42·0	56	27
Mar.	30·51	29·42	29·91	1·10	12	51·2	39·6	44·2	64	29
April	30·23	29·02	29·68	2·85	18	54·2	41·5	45·2	63	31
May	30·42	29·71	30·03	1·34	9	61·0	45·1	50·8	76	34
June	30·34	29·49	29·87	3·72	14	62·7	48·0	51·4	70	40
July	30·14	29·51	29·73	2·78	20	66·4	54·2	58·2	74	49
Aug.	30·48	29·20	29·60	1·05	.8	70·1	54·9	62·4	80	44
Sept.	30·40	29·14	29·88	6·30	12	59·5	53·3	53·3	74	39
Oct.	30·47	29·00	29·81	2·90	13	52·9	47·9	47·9	62	31
Nov.	30·33	29·34	29·93	1·05	11	40·5	36·7	36·7	50	14
Dec.	30·42	29·30	29·83	1·37	11	41·6	32·4	37·0	51	24
	30·51	28·58	29·81	27·66	149	53·4	43·4	46·7	80	10

PRESSURE.—The mean height of the mercurial column for the year was 29·81 inches. A sudden fall of ·5 on February 10th was accompanied by a terrific storm from S. E., which raged along the Eastern Coast. Fifty-eight vessels were stranded between Spurn Point and Bridlington Quay. At the latter place, the Life-boat was swamped, and six of her crew were drowned. On Friday, about 11 p. m., March 17th, a shock of earthquake was felt at York, in common with many other places in this and the adjoining county of Lancashire.

RAIN-FALL.—The rain-fall for the year, 27·66 inches, was $3\frac{9}{10}$ inches above a mean of 35 years. This excess is due to September, when the rain fall was $6\frac{3}{10}$ inches, or 4 inches above a mean, an amount unequalled in the registration of the Society. August, which on a mean of 35 years, registers 2·726 inches, (the greatest mean monthly rain-fall of the whole year), fell short of its usual amount by one inch and seven-tenths nearly.

The largest amount which fell in 24 hours was one inch and nine-tenths on September 28th.

RAIN-FALL, 1871.

	Bootham.	Cherry Hill.	Flaxton.	Malton.	Ackworth.	Sheffield.	Settle.
Jan.	0·70	0·645	0·55	1·00	0·66	1·21	..
Feb.	2·50	2·335	2·06	2·34	1·64	2·10	..
Mar.	1·10	1·330	0·90	0·75	0·56	1·26	..
April	2·85	2·830	1·99	2·80	2·75	3·12	3·14
May	1·34	1·405	1·95	1·79	1·50	1·42	1·64
June	3·72	3·870	4·19	2·98	5·13	4·63	3·19
July	2·78	2·875	2·97	3·82	2·71	3·08	7·36
Aug.	1·05	1·090	1·92	0·87	1·81	1·65	2·02
Sept.	6·30	6·090	4·28	5·91	5·80	6·40	4·29
Oct.	2·90	2·990	2·61	2·13	1·69	2·74	5·00
Nov.	1·05	1·270	2·25	1·77	0·96	1·52	2·14
Dec.	1·37	1·650	0·95	1·60	0·99	1·50	3·54
	27·66	28·380	26·62	27·76	26·20	30·63	..

WIND.—The prevailing winds of the year have been from the S., S. W., and W.

AURORA.—There were in March one, in April five, in May one, in August one, in September one, and in November three, displays of Aurora. Coincident with the display of April 19th, the disc of the Sun was literally covered with spots. A drawing (for which I am indebted to one of the scholars at the Friends' School, Bootham) showed more than ten groups, with more than sixty distinct spots.

Transits have been taken with sufficient frequency to keep correct time. The rate of the Sidereal time clock from Nov. 16th, 1871, to Jan. 3rd, 1872, was a loss per diem of .37 hundredths of a second.

From the 5th to the 14th of August inclusive, 344 meteors were observed; the maximum number (147) was observed on Thursday, the 10th. I am indebted for these observations on the meteors to Mr. J. E. Clark, one of the Masters at the Friends' School.

The following Lectures were delivered in the Theatre of the Museum during the past year:—

SUBJECT.	NAME OF LECTURER.
Recollections of Continental Travel in the last Generation . . .	Rev. CHAS. WICKSTEED, B.A.
On the Sun	R. A. PROCTOR, Esq., B.A.
Mechanics of the Animal Circulation	B. W. RICHARDSON, Esq., M. D., F. R. S.
The Ethnological and Political History of the disputed Provinces of Alsace and Lorraine . . .	R. G. LATHAM, Esq., M. A., M. D., F. R. S.
On Ditto	Ditto.
The Lives and Works of the principal Spanish Painters . .	Ven. Archdeacon CHURTON, M. A.
The Impurities of Water . . .	W. PROCTER, Esq., M. D., F. C. S.
On Electricity	T. H. WALLER, Esq., B. A.
On Skipton Castle	EDWD. HAILSTONE, Esq., F.S.A.

Twelve Members have been lost to the Society by death or resignation during the past year. This Society has especially to mourn the loss by death of the Rev. Wm. Vernon Harcourt, one of the Founders of the Society and its first President. This office Mr. Harcourt resigned in the year 1831, but from that date until the removal of his residence from York and its neighbourhood to the Family Seat at Nuneham, near Oxford, in the year 1863, he continued, as one of the Vice-Presidents, to take a most active part in extending and promoting its usefulness. It is impossible for those not conversant with the past history of this Society to appreciate the great labours of Mr. Harcourt on its behalf, and no name in its annals is entitled to higher honour or respect. Especially to Mr. Harcourt's exertions is the Society indebted for the land which forms the original site of the Museum and the surrounding gardens, now one of the chief ornaments of our city. It was on his application, supported by the influence of his Venerable Father, the Archbishop of York, that the Crown made the original grant of the land to Twelve Trustees (of whom Mr. Harcourt was the last survivor), for the purposes of

the Society. This was a matter of no ordinary difficulty, as an Act of Parliament had to be obtained before the grant could be legally made. Under the same high auspices the Subscription List to the Building Fund was commenced, which ultimately reached the amount of £8,600, and in 1830 the foundation stone of the present building was laid by Archbishop Harcourt.

In 1836, at the request of a large proportion of the Members of the Society, the bust of Mr. Harcourt, executed by the hands of Chantrey, was obtained and placed in the Hall of this Museum, to perpetuate the memory of the services of its first President and benefactor. For nearly 30 years after this date Mr. Harcourt continued to exercise over the affairs of the Society a constant vigilance, and the general success and reputation which this Society may have obtained is largely owing to his fostering care.

The following obituary notice is from the pen of his friend, Professor Phillips :—

The Rev. William Venables Vernon Harcourt, M. A., Oxon, was born in June, 1789, close to the ancient home of his family, at Sudbury, in the Rectory House then occupied by his father the Hon. and Rev. Edward Venables Vernon, who became Bishop of Carlisle and afterwards Archbishop of York, and took the name of Harcourt on succeeding to the property of the deceased earl. Mr. Harcourt, the fourth son in a family of sixteen children, had the advantage of his father's instruction, and did not proceed to a public school.

His first destination was for the navy, in which he served for five years; but then his literary tastes and predilection for the church prevailed, and he entered Christ Church, Oxon, with the advantage of the personal friendship of Cyril Jackson the Dean. At that time Conybeare and Peel were conspicuous members of his College, and the University was leading to eminence Buckland, Keble and Whately. Dr. Kidd had been for some years an admirable teacher of Chemistry, and to this attractive subject (to which his attention had first been drawn by Dr. Isaac Milner, who was Dean of Carlisle when his father was Bishop of that diocese) Mr. Harcourt clung with affectionate fidelity through all his subsequent life.

Soon after leaving the University (in 1811) Mr. Harcourt began his duties as clergyman at Bishopthorpe, close to his father's residence, and speedily manifested the good effects of his Oxford career by associating himself with the movement then beginning in Yorkshire in favour of institutions for the cultivation of science. He constructed a laboratory and became greatly occupied in chemical analysis, not a little aided and encouraged in this pursuit by his early friends Davy and Wollaston. The latter explained to him some of the methods of qualitative analysis on a small scale, in which he was unrivalled. The great ideas of the former he kept steadily in view. From Buckland and the brothers Conybeare he acquired a settled partiality for the then rapidly advancing science of Geology.

In 1821, the famous cavern of Kirkdale was opened in Yorkshire, and zealously explored by Buckland. Some of the treasures of this rich repository of pre-historic life forms were divided among several explorers in Yorkshire, and three of these, viz., Mr. Atkinson, Mr. Salmond, and Mr. Thorpe concurred in a resolution to reunite them in one collection as a basis for a Yorkshire Museum of Natural History and Antiquities. Of the institution which was established in consequence of this arrangement, the "Yorkshire Philosophical Society," Mr. Harcourt was chosen President, and by all the means at his disposal extended its influence, and animated and directed its energies.

The geology of Yorkshire had begun to attract attention ; and one of the earliest engagements for public lectures was contracted in 1824, with Mr. Smith, the author of the first geological map of the county, as well as of the first map of the strata of England and Wales. In 1826, Mr. Phillips was appointed to be the Keeper of the Yorkshire Museum, then contained in a small house ; but from this time it grew so rapidly as to require the erection of a spacious building, with library, lecture room and laboratory at a cost of £9,000. During many years Mr. Harcourt and his younger friend just named might be often met engaged in geological explorations. The laboratory, now removed to Wheldrake, was never unemployed ; the

monthly meetings of the Society heard always from the President some useful notices of the progress of science, and efforts, by no means unsuccessful, were made to spread through Yorkshire a spirit of local inquiry, which is still active in that large natural district.

It was fortunate for the British Association that its constituent meeting was, by advice of Sir David Brewster, arranged at York, by the ready zeal of a Society so active and under such good auspices. At this meeting (in 1831) the general plan of proceeding and the essential basis of the Association were drawn up by Mr. Harcourt and proposed on the part of the Society which he represented. Discussed and accepted by a body of 367 members, among whom Murchison was conspicuous, they have remained practically the same, though in many points improved by experience through forty years of work.

Over this increasing enterprise Mr. Harcourt, as General Secretary, watched with unceasing vigilance for several years, and found many occasions for the employment of his personal influence in furthering the advancement of science, both by consultation with its acknowledged leaders and by appeals to the members of the Government.

Elected President of the Association at Birmingham in 1839, he took occasion to discuss very fully the history of the discovery of the composition of water, supporting the claim of Cavendish by original documents, which were published in the annual volume. Not less remarkable in this address was the resolute vindication of the claim of science to entire freedom of inquiry into the constitution of nature, and a high-minded rebuke of the narrow views which refused to accept geological and astronomical truths on account of a supposed conflict of these with particular passages in the Bible—passages of matchless grandeur and beauty, but not destined to teach or control the teaching of the principles of natural science. Breathing as we do now the free air of advancing inquiry, there may be some danger of forgetting the obligations we owe to churchmen, such as Harcourt and Conybeare, who boldly employed their great influence to resist the heavy pressure of well-meaning but

ill-reasoning theologians, who sometimes appeared to forget that they were not endowed with "supernatural knowledge of the mysteries of nature."

One of the subjects to which Mr. Harcourt directed his attention with success was the effect of heat on inorganic compounds. With a view to extensive experiments on the effects of high heats in a manageable form, he began the construction of a furnace for burning hydrogen gas under great pressure; and by the aid of Sir William Fairbairn and the late Mr. Bryan Donkin, this furnace was provided with pressure-guages and became a safe and manageable instrument. It was employed for many years in the processes of fusion, required for the production of various kinds of glass for optical uses.

Following similar ideas he assisted as a Member of a Committee of the British Association in the examination of furnace-slags, on which the Report was presented by Dr. Percy. As early as in 1834, another train of researches on the same general subject was set on foot by Mr. Harcourt when he made arrangements for trying the effects of long-continued heat on rocks and minerals. For this purpose the furnaces of Low Moor, in Yorkshire, were employed by placing under them a large and varied series of rocks and minerals and artificial mixtures selected and weighed to represent various natural crystals interesting to geologists in connection with metalliferous veins and metamorphic rocks. The furnaces being usually kept in action for several years, it was expected that the long-continued and moderate heat would be sufficient to fuse some metals and probably cause new combination of oxides, silicates, or sulphides.

These operations gave indeed such results; and though contrary to expectation, the direct influence of high temperature was found to be too great, the conglutination of sand to quartzite, the formation of iron veins, the occurrence of cavities lined with a web-like silicate, and what was almost a chaos of changes and displacements showed the power of the agencies employed. It is much to be desired that those curious experiments should be repeated with precautions which are suggested by those on record.

Accustomed to the use of the gas-furnace, Mr. Harcourt turned it to experiments on transparent compounds of fusion, which might be made to have refractive indices beyond the ordinary ranges, combined with scales of dispersion more favorable to achromaticity. In this he was guided by the trials of Faraday to prepare glass for optical purposes. Many years since, the writer, who was often helpful in this way, ground one of the earliest of the Harcourt glasses into a lens, and found it indeed a highly refractive clear substance, but too much traversed by striæ to be of practical use.

When some years since Mr. Harcourt removed his residence to the family seat at Nuneham, near Oxford, he constructed furnaces of a different kind for the carrying on of these experiments, and followed them with the zeal, resolution and patience which had always characterized his firm and well-regulated mind. At an age when most men cease from continuous literary and scientific work, he, with failing sight but perfect memory, was indefatigable in training an assistant and superintending his work ; making many new combinations with substances untried before, and now selected for quality of fusion, resistance to atmospheric vicissitudes, range of refraction and specific action on different rays of the spectrum. Thus it was hoped finally to acquire glasses of definite and mutually compensative dispersions, so as to make perfectly achromatic combinations. After innumerable trials, and the production of glass of extremely various quality, Mr. Harcourt, continuing his inspection to the last, had the satisfaction of believing that, though he could not remain to witness it, a good result had been assured, and that Professor Stokes, to whom all the specimens were submitted for scrutiny, would be able to construct a lens of sufficient size to be fairly tried, and thus crown the long-continued labour with a permanent benefit to science.

It was hoped that a full account of these experiments might have been prepared by the author of them, for his strong mind felt little of the weight of eighty years, and overruled the bodily infirmities of age. But it was a character of the man never to cease experimental or literary research till he was satisfied ; resolute to contend with difficulties till all were over-

come, and too truly a lover of knowledge with faith in its progress to be hasty in publishing views on account of their novelty, which might be made available by proofs of their truth.

Professor Stokes has already presented to the British Association a notice of these researches, and to him we must now look for further records of a work to which he has cheerfully contributed a large amount of valuable aid.

The scientific pursuits of Mr. Harcourt were followed in the midst of great occupation as a clergyman, not only in charge of his parish, but open to perpetual demands for help in public institutions of an educational and charitable character. The Yorkshire School for the Blind, founded in honour of Wilberforce; the York County Hospital, the Castle Howard Reformatory, experienced the benefit of his guidance; indeed hardly any great movement in Yorkshire in favour of useful learning and comprehensive Christianity was carried on without his help, often given when his own health required cessation from labour. At many public meetings for these his place was to preside, a duty for which his thoughtful words and dignified presence and a certain natural union of gentleness and firmness, admirably qualified him.

Though never a person of robust health, Mr. Harcourt was not much troubled by positive illness till towards the close of his life, when he became confined to a home rich in books and monuments of art, surrounded by a cheerful family, to which the graceful hospitality which had become a habit of his life, brought many additions from the large range of his personal friendships, and the more limited circle of men devoted to literature and science resident in his own neighbouring University. He had been elected a Fellow of the Royal Society in 1824. His death occurred at Nuneham, in April, 1871.

Among the Honorary Members of the Society the names of Sir R. Murchison, Professor Hincks, and Dr. Miller, of Exeter, will cease to appear.

Sir R. I. Murchison, Baronet, the President of the Geological and of the Geographical Society, died on the 22nd of October last. His services to the Sciences which he cultivated are too well known to require any eulogium in this place.

Patrick Miller, Esq., M. D: and F. R. S., of Edinburgh, had been a Member of this Society since 1826, and died at the venerable age of 90, in the city of Exeter, last year.

Professor Hincks, F. L. S., who died in Canada, in the course of last year, aged 79, was formerly resident in York, and for many years Curator of Botany in this Museum. He subsequently became Professor of Natural History in Queen's College, Cork, but for some years past he had held the office of Professor of Natural History and Director of the Museum in University College, in Toronto, Canada. Mr. Hincks, who, at the time of his death, had but just resigned his professorship, owing to the infirmities of age, was an accomplished and enthusiastic Botanist, and had also devoted much attention to certain Departments of Zoology. He possessed a wide range of scientific knowledge, and through a long life had done much for the diffusion of scientific tastes and culture. Almost to the very close of life he was an enthusiastic student, actively engaged in pursuing his favourite researches, and alive to all that was passing in the scientific world. He published many papers on Natural History and other subjects, some of which were specially devoted to the Fauna and Flora of Canada, chiefly in the "Journal of the Canadian Institute." To the Museum connected with University College, (of which he was the director,) he devoted much time and labour and rendered it very valuable service. He was an active Member of the Canadian Institute, and one of the Editing Committee, which is charged with the publication of the "Journal." In 1869 he was elected President, and was re-elected the following year.

The following Members of Council retire during the present year:—Hon. Payan Dawnay, John Ford, Esq., W. C. Anderson, Esq., J. H. Gibson, Esq., M. D. The Council recommend for election for Vice-President, John Ford, Esq.; and for new Members of Council, The Lord Mayor, Alderman Steward, Rev. G. Vance Smith, Alfred Ball, Esq.

THE

TREASURER OF THE YORKSHIRE PHILOSOPHICAL SOCIETY
IN ACCOUNT FOR THE YEAR 1871.

Cr.	INCOME.	Expenditure.	Dr.
	£. s. d.	£. s. d.	£. s. d.
<i>Annual Subscriptions, &c.:</i>			
Members	686 2 0	Crown Rents	118 10 0
Lady Subscribers	69 3 0	Corporation Rents.....	51 3 4
Associates	14 0 0	Rates and Taxes	9 19 0
Arrears	12 0 0	Insurance.....	5 4 0
	781 5 0	Water Rent	6 10 0
			191 6 4
<i>Admission Fees of New Members:</i>			
Paid in Full	33 0 0	Keeper of the Museum 120 0 0	
Paid by Instalments ..	43 0 0	Henry Baines (Pension) 100 0 0	
	76 0 0	James Davison (Do.) 26 0 0	
Keys of the Gates	46 5 0	Head Gardener 70 4 0	
Temporary Subscribers	2 0 0	Servant 12 17 0	
<i>Rents:</i>		Lodge Keeper 39 0 0	
New Manor Shore Property	104 5 8	Attendant, Museum .. 23 8 0	
St. Mary's Lodge	27 10 0	Do. Hospitium.. 10 8 0	
Museum House	48 19 2	Collector 7 12 0	
Cottages in Marygate ..	24 0 2	Labourers..... 129 5 6	
Boat Yard.....	5 0 0		538 14 6
	209 15 0	<i>Interest to Insurance Company</i>	74 5 7
Gate Money	250 4 9	<i>Interest, &c. to Bankers</i>	3 19 0
Swimming Bath	40 0 0	<i>Museum, Estate, &c.:</i>	
Sale of Guide to Antiquities	8 15 0	General Expenses and Repairs	105 8 6
Use of Tent	30 0 0	Repairs of St. Leonard's Hospital in 1868	68 4 0
Proceeds at Whitsuntide	1 18 0	Repairs, &c. of St. Mary's Lodge	63 14 0
Pearson, Mrs., Executors of the late	50 0 0		237 6 6
		<i>Gardens, Conservatories, &c.:</i>	
		General Expenses and Repairs	66 6 1
		Plants and Seeds	5 0 0
		Coals and Coke	5 0 0
			76 6 1
		<i>Purchase & Preparation of Specimens</i>	2 5 6
		<i>Library, Books and Binding</i>	23 14 6
<i>Miscellaneous Expenses:</i>			
Printing of Report, List of Members, &c.	30 0 6	<i>Postage and petty Expenses</i>	3 14 0
Printing, Stationery, &c. 11 3 6			
Coals and Gas..... 50 13 3			
Painting of Museum, Museum House, &c. 17 15 0			
Expenses of Lectures.. 32 11 4			
Do. Hospitium 4 11 9			
Do. Bands.... 22 2 9			
Do. Tent 5 15 0			
			178 7 1
			£1326 5 1
Excess of Income for the year 1871	169 17 8		
			£1496 2 9
<i>Permanent Debt:</i>			
Yorkshire Insurance Company	1900 0 0	<i>Permanent Debt:</i>	
Due to Two Members £50 each	100 0 0	Yorkshire Insurance Company	1900 0 0
	2000 0 0	Due to Two Members, £50 each	100 0 0
Balance in Treasurer's hands, Jan. 1st, 1872	47 16 2		2000 0 0
		Balance due to Treasurer, Jan. 1st, 1871	122 1 6
Total Debt of Society, Jan. 1, 1872 £1952 3 10			2122 1 6
		Surplus of Income for the year 1871 169 17 8	
			£1952 3 10

W. GRAY,
Treasurer.Audited and found correct, 28th Feb., 1872.—W. PROCTER,
S. W. NORTH.

MEMBERS ELECTED IN 1871.

- Barnes, Mrs. Lavinia, *Gilling Castle.*
Bell, Wm. Henry, 29, *The Mount.*
Browne, George, *Micklegate.*
Buckle, Capt., *Micklegate House.*
Carrington, John T., *Holgate Road.*
Colman, George, 18, *Bootham Terrace.*
Coning, Thomas, *Goodramgate.*
Croft, Mrs., *White Cross Lodge.*
Day, James, Junr., *Holgate Bridge House.*
Fryer, John, *Trinity Lane.*
Fryer, John Firth, 20, *Bootham.*
Gray, William Lumley, *Gray's Court.*
Graves, Adolphus, *Monkgate.*
Grayston, James, Junr., *Bootham.*
Hedley, Robert, 31, *Coney Street.*
Hewetson, Richard, *Micklegate.*
Hill, Robert Farra, *King's Square.*
Hingston, J. T., *Clifton.*
Hudson, Henry Arthur, *St. Mary's.*
Keswick, John, *Micklegate.*
Martin, David, *Parliament Street.*
Marshall, J. I. F., *St. Saviourgate.*
Marshall, T. H., 2, *Driffield Terrace.*
Matthews, J. Philip, *St. Helen's Square.*
Milner, H. B. W., *Adel, Leeds.*
Mountain, Mrs., *Goodramgate.*
Needham, F., M. D., *Bootham.*
Ould, Rev. Fielding, *Lord Mayor's Walk.*
Overton, Henry, *Petergate.*
Rymer, Joseph Sykes, *Monk Bridge.*
Smithson, E. W., *St. Mary's Lodge.*
Swann, Robert, *Red House.*
Thompson, William, *Park Place.*
Volans, William G. B., 22, *Park Crescent.*
Wade, Rev. G. F., *St. Lawrence Rectory.*
Wilson, David, *King's Square.*
Young, Miss, *St. Olave's House, Marygate.*

LADY SUBSCRIBERS ADMITTED IN 1871.

Dale, Miss Maria, *The Crescent*.
Fidlin, Miss, 22, *Clarence Street*.
Gow, Miss, 4, *St. Mary's*.
Hornsey, Miss, 28, *Blake Street*.
Husband, Miss, *Burton House, Clifton*.
Riddell, The Hon. Mrs. W., 24, *St. Mary's*.
Skelton, Mrs., 81, *Micklegate*.
Smith, Mrs., 32, *Bootham*.
Terry, Mrs. Robert, *The Mount*.
Wallace, Lady, 1, *Duncombe Place*.

ASSOCIATES.

Johnson, Henry, *Goodramgate*.
Knowles, John Ward, *Stonegate*.
Moiser, Henry R., *Heworth Grange*.
Yeld, George, M. A., *Clifton*.

RESOLUTIONS

PASSED AT THE ANNUAL MEETING, FEB. 6TH, 1872.

1. That the Report of the Council now read be adopted and printed for circulation amongst the Members, Lady Subscribers, and Associates of the Society.
2. That the thanks of the Society be given to the Members of the Council retiring from office, also to the Treasurer, Secretary, and Curators, for their valuable services; that authority be given to the Council to hold Horticultural Meetings in the Museum Grounds, and to suspend the privileges of entry possessed by the Members during the holding of such Meetings; and to give admission to the Public to the Museum and Hospitium, on Whit-Monday and Tuesday, under the same regulations as last year.
3. That the thanks of the Meeting be given to the Chairman.

DONATIONS TO THE MUSEUM.

GEOLOGY AND MINERALOGY.

Strangways, C. Fox, Esq.	A small Collection of Minerals. A small Collection of Fossils. Specimen of Double Refracting Spar, from Germany.
Johnstone, Rev. Canon ..	A Common Fern, (<i>Sterna hirundo.</i>) A Light-coloured Fieldfare, (<i>Turdus pilaris.</i>)
Niblett, T. D. T., Esq., (<i>Haresfield Court, Gloucestershire</i>)	Molar of African Elephant, found near York.

ANTIQUITIES.

Bell, Mr. G., (<i>Gillygate</i>)..	Capital of a Column, found in digging a drain in Petergate.
Churchwardens (<i>St. Mary's, Castlegate</i>)	Fragment of a Cross found in the ex- cavations of St. Mary's, Castlegate.
Hotham, Admiral.....	English Silver Coins of Edward VI., Charles I. and II., and William and Mary.
Thompson, W., Esq., (<i>Park Place</i>)	Fragment of Roman Altar, dedicated to the Deæ Matres by Marcus Rustius Massa.
Webster, W., Esq., (<i>Park Place</i>)	Fifty-five Electrotypes of the Seals of the Bishops of Durham. Sixteen Electrotypes of Seals and Cameos.

ZOOLOGY.

Nelson, Mrs. Snake and Centipede (in Spirits of Wine), from West Indies.

MISCELLANEOUS.

Strangways, C. Fox, Esq.	Robinson's Anemometer.
Hearon, T. W., (<i>Durham</i>)	Exhibition Medal of 1851.
Nelson, Mrs.	Nutmegs (in Spirits of Wine).
Roper, J., Esq.	Various Plants.

BOOK PURCHASED.

Martini Lister Historiæ Conchyliorum, 4to., 1685.

LIBRARY.

Association, British, for the Advancement of Science	Report for 1870.
Association, Geologists' ...	Proceedings, vol. II. Report for 1870.
Author	The Tribute of Assyria to Biblical History, by W. R. A. Boyle.
Author	Literature, under the Shade of Great Britain, by W. R. A. Boyle.
Author	Report of the Deputy Master of the Mint, by C. W. Fremantle.
Author	Observations on Metalliferous De- posits and on Subterranean Tem- perature, 2 vols., by W. Jory Henwood, F. R. S., F.G.S., &c., &c.
Author	Catalogue of Anglo-Saxon and other Antiquities discovered at Faver- sham, in Kent, and bequeathed to the South Kensington Museum, by Wm. Gibbs, Esq., by C. Roach Smith, F. S. A.

- Author On the Lower Greensand Brachiopoda,
by J. F. Walker, M. A., F. G. S.
- Christiania, University of Le Névé de Justedal et ses Glaciers ;
par C. de Seue.
- Repräsentation der Imaginären der
Plangeometrie ; von Marius Sophus
Lie.
- Havets Temperatur mellem Island,
Skotland og Norge ; af H. Mohn.
- Bidrag til den antike Philosophis
Historie ; af Dr. Ge Vilh. Lyng.
- Om dem kyrenaiske Skole, navnlig
Annikeris og Theodros ; af Dr. Ge
Vilh. Lyng.
- Skolenæfenets Ordning i Massachu-
setts ; af Hartvig Nisfen.
- Club, Berwickshire Natu- } Proceedings for 1870.
ralists' }
- Club, Tyneside Naturalists' } Natural History Transactions of
Field } Northumberland and Durham,
vol. IV., part 1.
- Harvard College, (*Mass.*) On the Mammals and Winter Birds
of East Florida, by J. A. Allen.
- Hewson, Miss The Hebrew and Greek Scriptures,
by the late Rev. W. Hewson.
- Illustrations of Tracts on the Greek-
Egyptian Sun-Dial, with seven
steps, &c., by the late Rev. W.
Hewson.
- Plan of the Tumuli at Allen Tofts,
near Whitby.
- India, Governor General.. Palæontologia Indica, vol. III., pts.
1—8.
- Memoirs of the Geological Survey of
India, vol. VII., parts 1—3.
- Records of the Geological Survey of
India, vol. II., parts 2—4, vol. III.
and vol. IV., parts 1 and 2.
- Institution, Hull Royal ... Report for 1871.
- Institution, Royal, of Great Britain } Proceedings, vol. VI., parts 3 and 4.

- Institution, Royal, of Corn- }
wall } Report for 1870.
- Read, W. H. Rudston, Esq. Transactions of the Linnean Society,
vol. XXVI., part. 4, and XXVII.,
parts. 1—4.
- Journal of the Linnean Society.
- Zoology, Nos. 50—53.
- Botany, Nos. 56 and 65.
- Society, Chemical..... Journal for 1871.
- Society, Geological Quarterly Journal, Nos. 105—108.
- Society, Geological and
Polytechnic, of the West }
Riding } Report for 1870.
- Society, Liverpool Philoso- }
phical } Proceedings, Nos. 23 and 24.
- Society, Royal, of Edin- }
burgh } Transactions, vol. XXVI., part 1.
Proceedings, 1869—1870.
- Society, Royal Astronomical Astronomical and Meteorological Ob-
servations made at Greenwich in
1865.
- Society, Warwickshire Na- }
tural History } Report for 1870.
- Society, Zoological, of Lon- }
don } Transactions, vol VII., parts 3—6.
- Webster, W., Esq., (*York*) Archæologia Æliana, new series, pts.
4—21.
- Wood, Wm., Esq. Manuscript in Arabic.
-

SERIAL WORKS SUBSCRIBED FOR.

- Corpus Inscriptionum Latinarum (3 vols. with Atlas of Plates
published).
- Birds of Asia, by John Gould, F. R. S. (23 parts published).
- Fauna Antiqua Sivalensis, or Geology of the Sewalik Hills, in the
North of India, by Dr. Faulkner and Major Cautley. (Parts
1 to 9 of Illustration, and part 1 of Letterpress.)
- Natural History of the Tineina, by H. T. Stainton (12 vols.
published).

- Nautical Almanack.
Proceedings of the Zoological Society, with Illustrations.
Publications of the Palæontographical Society.
Publications of the Ray Society.
Sowerby's Thesaurus Conchyliorum, col. plates (29 parts published.)
The Zoological Record (Annual).
London, Edinburgh, and Dublin Philosophical Magazine.
Annals and Magazine of Natural History.
Archiv für Naturgeschichte. Berlin. von Troschel.
Geological Magazine.
Journal of the British Archæological Association.
Numismatic Chronicle.
Meteorological Magazine.
-

COMMUNICATIONS
TO THE
MONTHLY MEETINGS
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY.

1871.

APRIL 4TH.—A paper, by the Rev. J. KENRICK, was read explanatory of the cast of the Obelisk of Nemroud, presented by him to the Museum, and placed in the vestibule. He said the character found not only on the remains of Persepolis, but in various parts of Persia and Media, and still more profusely in Assyria and Babylonia, is formed from a very simple element, a stroke which, when elaborately made, resembles the head of an arrow, when less carefully, a nail or a wedge, *cuneus*. Hence it has been variously designated as arrow-headed, nail-headed, or cuneiform, the last name being now generally adopted. Two of those strokes are joined together by the broad end, forming a character resembling a pair of compasses partly opened; but with this exception the letters are formed not by the junction but by the juxtaposition or superposition of the strokes, so that many of them occupy a large space. This description applies only to the Persian form of the cuneiform character; the Assyrian and Babylonian are often very complex. It was by investigating the simpler, the Persian form, that the discovery of the alphabet was accomplished.

It is unnecessary to enumerate the abortive attempts made for this purpose by those who had only such imperfect copies before them as the early travellers in the east could furnish. But when Niebuhr, the father of the historian, had brought back accurate copies, European scholars turned their attention

to their decipherment and interpretation with some reasonable hope of success. Two northern professors, Tychsen, of Rostock, and Münter, of Copenhagen, led the way; they did not advance far, but they had struck the right path. They had ascertained that the inscriptions were alphabetical, that the words are divided by an oblique character, and the letters by a point, and that they are to be read from left to right, like the Indian and European alphabets, not from right to left like the Semitic. This was important, as an indication that it was not in Syriac, Phœnician, or Hebrew that the key to the meaning was to be sought. They had also pointed out the probability that a certain group of characters stood for *King*. It is found above, or beside, the large figures seen on the walls of Persepolis, everything about which, the colossal size, the umbrella held over their heads, the flyflap in the hand of the attendant, the sitting posture, while all around are standing or bowing, points them out as royal personages. Further, this group was followed sometimes by another, exactly corresponding with it, except by the addition of some characters at the end. It was natural to conclude that the second was a modified form of the first—a tense, if the first was a verb, a case, if it was a noun. That together they should represent *King of Kings* was rendered probable by the inscriptions of the monarchs of what is called the Second Persian Kingdom, the Sassanidæ, which are accompanied by a Greek translation, and in which the name of the sovereign with that of his father is followed by *King of Kings*.

At this point the inquiry was taken up by Grotefend, to whom we owe the analysis of the alphabet, and the first successful attempt to read the inscriptions into the words of a known language. His mode of proceeding was necessarily tentative, beginning with an assumption, the truth of which had to be proved, like any other hypothesis, by its solving the phænomena. Consulting the succession of the Persian Kings, he concluded that the father and son could not be Cyrus and Cambyses, because the names did not begin with the same letters. Darius and Xerxes seemed the most probable names, and it was in favour of this supposition, that in the group

assigned presumptively to Xerxes the second letter was the same as the sixth, and the fourth the same as the seventh. The final *s* in Xerxes being rejected, as probably a Greek termination, and the *x* as a double letter being resolved into *k* and *sch*, the whole was read *Kscherscha*. It is remarkable that Xerxes has been generally understood to be the Ahasuerus of the Book of Esther. The personal character, the wide dominion, the luxury, the pride, suit exactly, and when we reduce the name, as written in Hebrew, to its consonants, they come out KHSHRSH. Proper names undergo strange metamorphoses when they are heard in one language and taken down in another. Ki-li-su-tu is the Chinese way of writing *Christ*. The Greeks changed Chufu, the builder of the great Pyramid, into Cheops. If, then, Xerxes was the son, Darius was the father, three letters of his name, which in Hebrew is Dariush, being identical with those of his son's name.

The next step was to ascertain to what language the inscriptions belonged. Now the group of characters, which from its position was supposed to stand for *King*, begins with the same two letters as that which had been read *Kkscherscha*. It was necessary therefore to find, in the language of ancient Persia, a word for King beginning with these letters. In the Zend, the language in which the sacred book of Zoroaster was written, perhaps the oldest of the numerous dialects now called Aryan, it was found that *Kscheio* (the Persian *Shah*) was the word for King. The foundation thus laid was enlarged and built upon by subsequent enquirers, Lassen, Westergaard, and our distinguished countryman Sir Henry Rawlinson. The names of Cyrus, Darius, Xerxes, Artaxerxes, Darius II., Artaxerxes Mnemon, Artaxerxes Ochus have been read not only on monuments in Persia proper, but in other parts of the empire of the Achæmenidæ. They have not only confirmed the accounts of the Greek historians, but have given us an insight into the institutions and ideas of the people. One circumstance is particularly striking in comparing the Persian with the Assyrian and Babylonian inscriptions. The former are purely monotheistic, while the latter are steeped in polytheism. The following is the commencement of a dedicatory inscription by

Xerxes :—‘ The great god Auromazdes, he created this earth, he created that heaven, he created the lot of mortals. He made Xerxes sole king of many men, sole ruler of many.’* There are traces indeed of the acknowledgment of certain local genii, but the attributes of creation and providence are confined to Oromasdes. No trace appears in them of the worship of Mithras before the time of Artaxerxes Mnemon, though Xenophon in his Cyropaedia, (vii. 5, 18), composing a speech for a courtier of Cyrus, makes him swear by Mithras. But the conquest of Babylon corrupted the simplicity of their manners as well as of their faith, and in the time of Herodotus they worshipped Mylitta (Venus Urania) and Mithras.† This deserves notice in connection with Jewish history. It was from Cyrus that this people, carried captive by Assyrian and Babylonian monarchs, received the first permission to return to their fatherland. Whether he recognised the God of the Jews as the author of his victories over the nations or not, there can be no doubt, I think, that sympathy with the monotheism of the Jews was joined with a political motive in his permission to them to return. And from this time we hear of no relapse of the nation into idolatry ; on the contrary, they resisted to death the attempt of the Greek monarchs of Syria to establish it in their country.

The Persepolitan inscriptions, and those found in other parts of the empire are all triple. The character in all is cuneiform, but the language is different. The first is the old Persian, as already explained ; the second is called Median, against the presumption derived from what Strabo and others tell us, that the Persian and Median language was nearly the same, (p. 1046, ed. Oxf.) ; the third has been called Scythian, by which is meant that it belongs to some of those nations which modern ethnology calls Turanian, as distinct from Aryan. The cuneiform writing is singularly cumbrous, and it is difficult to conceive how it can have answered the manifold purposes for which writing must have been required, in an empire so wide,

* Lassen Die Keilinschriften, p. 147.

† Herod 1, 131. He appears to have considered the two deities as the same, but the monuments show this to be a mistake.

and among a people so energetic as the Persians. We can hardly suppose that they had not some running hand for ordinary purposes. Clemens Alexandrinus (*Strom.* i., p. 132) has recorded a tradition, that Atossa, the wife of Darius, and daughter of Cyrus, was the inventor of epistles,* which seems to point to a written character convenient for correspondence; but as no written document of the Persian times has come down to us nothing can be affirmed on this subject. But though a MS. in the old Persian character is not to be looked for, it is not impossible that in the countries subject to Persian dominion, but where the Greek language was spoken, a bilingual inscription should come to light, to correct and extend the results of philological enquiry. Darius, according to Herodotus (4, 87), erected two marble pillars on the coast opposite to Byzantium, in Greek and Assyrian letters, containing the names of all the nations which composed his army of 700,000 men. The one with the Assyrian characters existed at Byzantium in the time of Herodotus. Is it too much to hope that some lucky chance, like that which has given us the Rosetta and the Canopic stone, may bring to light a bilingual inscription, cuneiform and Greek?

It may be said that philology and palæography have gained by the discoveries which I have related, but what has been the gain to history? Her gain has been rather in the new and clearer light thrown on facts doubtful or imperfectly understood, than in the disclosure of facts previously unknown. There is, however, one remarkable exception. Some years ago, when I was endeavouring to frame a chronology of the life of Herodotus,† I was perplexed by the mention (1. 130) of a revolt of the Medes from Darius, which he succeeded in putting down. Now till very lately, no revolt of the Medes was known except that which took place b. c. 408, under a later Darius (Nothus). Yet it seemed strange that Herodotus, who so constantly speaks of the son of Hystaspes as simply Darius, should here, without any adjunct, apply the name to another. Besides, the revolt under Nothus occurred when Herodotus was in his

* Bentley on Phalaris, § xx.

† Egypt of Herodotus, p. xviii.

77th year, and as this is mentioned in his first book he was beginning a history, extending to nine books, at an age when in the course of nature he had not many years to live. The difficulty has been removed by the discovery and interpretation of a long inscription in the cuneiform character on the rocks of Behistun, in Media, the Mons Bagistanus of ancient geography.* It is of great length, in the usual three languages, and carved on the face of the rock at such a height that it was with the greatest difficulty it could be copied by Sir H. Rawlinson. Figures are carved on it which are supposed to represent the defeated conspirators, and the inscription, in which Darius Hystaspis is the speaker, declares that he had triumphed over the rebellion by which he had been assailed during the first four years of his reign. This then appears to be the rebellion of the Medes from Darius of which Herodotus speaks, and all difficulty is removed. Diodorus (6. 13) mentions the inscription, and speaks of it as being in Syrian (*i.e.* Assyrian, or cuneiform letters), and made by Semiramis, adding an interpretation, which bears no resemblance to the reality. This example may show how little reliance is to be placed on the interpretation by the later Greeks of cuneiform inscriptions; for example, that on the monument of Sardanapalus, at Tarsus. In the Peloponnesian war the Athenians could read the Persian dispatches. (Thucyd. iv. 50).

I have confined myself to the Persian form of the cuneiform character. Professor Max Müller has well summed up the history which I have detailed,† and borne unequivocal testimony to the soundness of the results obtained. It must in candour be acknowledged that he speaks more doubtfully of the interpretation of the inscriptions of Babylon and Nineveh. It was of the utmost importance for the further progress of discovery, that the reading of the Persian monuments had been fixed. They are accompanied by inscriptions in the other two characters; and as the three are evidently the same in purport, the ascertained meaning of the one served inquirers as a key to the other two. It was in this way that Hincks,

* Sir H. Rawlinson in Journal of Royal As. Society, vol. x., p. 1.

† Lectures on the Science of Language, second series, p. 4, 5.

Talbot, Oppert, and Rawlinson arrived at those results which will be described in a future paper. Some assistance was also derived from inscriptions in Assyrian and Phœnician characters on bronze weights and clay tablets.

MAY 2ND.—Rev. J. KENRICK contributed a continuation of his former paper “On the Cuneiform character, treating of the discovery and interpretation of the Obelisk of Nemroud.”

The destruction of Nineveh by the Medes and Babylonians, 606 b. c., was so complete that its site was unknown. Lucian, who lived about the middle of the second century, in one of his dialogues introduces Charon, who has begged a holiday from Pluto, that he may come above ground, and see what this upper world is like. Mercury undertakes to be his guide; they ascend Mount Parnassus and seat themselves, one on each of its two summits. Among other things Charon inquires about the sites of celebrated cities: “Where is that Troy from which for ten years together such crowds of ghosts came, that I had no time to dry my boat, much less to put her into dock? And where is the Ninus (Nineveh) of Sardanapalus?” “Ninus,” replies Mercury, “O Ferryman, has perished already, and no trace of it remains. You cannot say where it once stood.”* And such remained the case till very recent times. To have fixed the site of Nineveh, to have ascertained the topography of its buildings, to have exhumed and interpreted its monuments, is one of the most glorious achievements of science in the nineteenth century. In this work France led the way. The discoveries at Khorsabad, made by M. Botta, consul at Mosul, were soon followed by those of our countryman, Mr. Layard, at Nemroud. To him chiefly we are indebted for the antiquities which fill the Assyrian rooms at the British Museum. Of these one of the most remarkable is the obelisk of black marble, a cast of which stands in the vestibule of our own Museum. The decipherment and interpretation of its inscription was much more difficult than that of the Persepolitan inscription of which I spoke in my former

* *Lucian Necyomant. Charon, sive Contemplantes.*

paper. The character is more complex ; it is syllabic, not alphabetical ; some are not even alphabetical, but have originated in representations of visible objects, the resemblance to which it is very difficult to trace. It is probable that when the Persians became acquainted with the cuneiform character as practised by the Assyrians, they simplified it and made it wholly alphabetical. A passage in the so-called Epistles of Themistocles ascribes to the first Darius a change of the written character ;* and though these Epistles are probably, like those of Phalaris, the forgeries of a sophist, they may have preserved a true tradition of an historical fact. The language, too, appeared to be of a mixed character. There was a Semitic element in it, but there were many words which could not be resolved into Semitic roots, nor is it yet clear to what language they belong. Nevertheless much progress was made, the soundness of which was confirmed by a trial which took place in 1857. Mr. Fox Talbot in that year sent to the Royal Asiatic Society a sealed translation of a cylinder of Tiglath Pileser, and his fellow-labourers, Dr. Hincks, M. Oppert, and Sir H. Rawlinson did the same. The translations were opened and compared by Dean Milman and Mr. Grote, and published in parallel columns. In the numerous proper names and the arithmetical characters the decipherments were almost identical ; in the general sense there was a remarkable coincidence joined to considerable differences.

In what I have to say respecting the age and import of the inscription on the obelisk I depend wholly on the authority of the *experts*, and especially on a translation of it given in the Transactions of the Royal Society of Literature, Vol. IX., by G. Smith, Esq., Dr. Birch's Assistant in the Assyrian department of the British Museum, who has lately published "The phonetic values of Cuneiform characters." It commemorates the war of Shalmaneser II. against Hazael of Damascus and the payment of a tribute by Jehu, king of Israel. A powerful enemy to Assyria had risen up at Damascus. Benhadad (I.

* Themist. Epistolæ, ed. J. C. Bremer Ep. xxi. It speaks of "the golden bowls and censers, inscribed with old Assyrian letters, not those which Darius the father of Xerxes wrote for the Persians."

Kings, chap. xx.) had united thirty-two of the princes of Syria in a league, with which Shalmaneser was at war during Ben-hadad's reign, and also that of Hazael, who succeeded him (II. Kings, ch. viii.). His campaigns seem to have been little more than annual *raids*; the obelisk begins, "In my 18th year I crossed the Euphrates the eighteenth time," and in a subsequent part Shalmaneser says, "In my 21st year I crossed the Euphrates the twenty-first time." He claims to have captured 1,121 of Hazael's chariots. The number is large, but Jabin (Judges ch. iv.) is said to have mustered 900 chariots, and the Syrian league numbered 32 princes, probably including Palestine and Phœnicia. The obelisk describes the tribute imposed on Jehu as consisting of "silver, gold, and lead, vessels and cups of gold, rods of wood, royal furniture, and maces," and most of these articles can be traced upon the sculpture. The tribute-bearers have something of a Jewish physiognomy. The King is described as Jehu, son of Omri, it being apparently not known in Assyria that Jehu had usurped the throne of the descendants of Omri. From Palestine Shalmaneser appears to have passed on to the coast of Phœnicia, to have levied tribute from Tyre and Sidon, and to have carved an image of himself on the mountains near the coast. It is very probable, therefore, that the Assyrian King, of whose monument at Nahr-el-Kelb, near Beyrouth, we have a cast in the vestibule, is the same who erected the black obelisk.

The sculpture of the obelisk is free from all obscurity. The whole series represents the bringing of the tribute of an empire to a Sovereign, who is receiving homage in the first compartment of the front face. The same subject is continued round all the faces, as well as the inscription which contains 210 lines. The tribute is of the most varied kind; animals led in procession, bags probably containing gold dust, vases, elephants' teeth, and rods of wood, no doubt of costly or fragrant kinds. Mr. Layard has observed that the animals introduced belong to countries eastward of Assyria. The camel is the Bactrian with two humps; the bull, the elephant, and the monkey are all Indian. It would not be safe to infer from this that the empire of Shalmaneser extended to the Indus, but if some of

these were obtained by commerce it is a proof of its extent and activity. Jehu took possession of the kingdom of Israel in 884 b. c. and died in 866 b. c., between which years the war mentioned on the obelisk must have occurred. A later Shalmaneser, in 721 b. c., came up against Hoshea, king of Israel (2 Kings, ch. xvii. 3-6), took Samaria and carried away the inhabitants.

JUNE 6TH.—A paper, by the Rev. J. KENRICK, was read on the “Cuneiform character,” being a continuation of those previously communicated to the Society.

It is a natural inquiry, in closing our account of the decipherment of the cuneiform character, What has been the *gain* from these inscriptions to ancient history? The obelisk of Nemroud gave us an insight into the state of the Assyrian power and its relations to its neighbours in the 9th century b. c. and into the condition of Syria, Judæa, and Palestine. But other inscriptions carry us still higher. Besides those on stone and marble there is a large class of tablets of *clay*, in all the collections of Assyrian and Babylonian antiquities, often of a prismatic shape, which English antiquaries call cylinders, but to which the French have given the more appropriate name of *bâril*, for they very much resemble a small *keg*, diminishing in size from the middle towards each end. On these, when soft, characters were impressed with a wedge-shaped instrument, and they were then baked. Clay thus treated is a more durable record, not only than paper or parchment, but even than the hardest metals, being exempt from the influences which corrode bronze or iron, and even disintegrate granite. Their contents are most various, but among them are some historical documents of high antiquity. It was on one of these that the experiment of comparative translations was made, as I formerly mentioned, by Mr. Fox Talbot and his friends. It relates to the wars and conquests of Tiglath Pileser, whom the translators consider as the first of that name, and as having lived 1,100 years b. c. Very singular has its fate been. Four copies of it exist in the British Museum, which had been buried under the four corner stones of the great temple of Assur, at Kalaschergat,

on the Tigris. There they remained, unseen and unread, till, after a lapse of 3,000 years, they were dug up, deciphered, and interpreted, by natives of countries never heard of by any Assyrian monarch. This cylinder relates the events of five successive campaigns in which Tiglath Pileser carried his victorious arms among the nations bordering the upper regions of the Tigris and Euphrates. The lower regions, including Babylon, appear to have been still independent. Another of these clay cylinders contains the annals of Sargon (Sargina in the inscriptions), whose general, Tartan, is mentioned in Isaiah xx. 1, as besieging Azotus. His predecessor, Shalmaneser IV., had been engaged in expeditions against Judæa and Palestine, had taken Samaria, as related in 2 Kings xvii. 24, and attempted the reduction of Tyre. It is probable that Sargon had availed himself of the King's absence to usurp his throne, as he claims no descent from the ancient kings of Assyria. His monuments, on stone and clay, are so numerous that M. Oppert, in his *Annales des Sargonides*, has reconstructed from them the whole history of his wars and conquests. Isaiah warns the Jews not to put their trust in Egypt and Ethiopia, as capable of resisting the King of Assyria; and the annals of Sargon relate that he defeated the Egyptians in a great battle near Gaza. The monuments of Sennacherib, his son and successor, are especially interesting from his connection with the history of the Jews. Two cylinders, besides other records, give very full details of his campaigns against Palestine and Egypt. It was in the first of these, in the 19th year of his reign (686 b. c.), he tells us, that Hezekiah the Jew refused submission, and that he shut him up in his city, after reducing all the towns and fortresses in his kingdom. These he detached from Hezekiah's dominions, giving some of them to the King of Ashdod, some to the King of Gaza, and blockaded Jerusalem so closely that "he was like a bird in a cage," and whosoever went out of the gate was taken prisoner and carried off. The Jew Hezekiah, he continues, was seized with awe of my Majesty; he dismissed the garrison which he had collected for the defence of his city, and sent to me at Nineveh thirty talents of gold and four hundred talents of silver, with

precious stones, and also his daughters and wives, with male and female slaves. This agrees remarkably with the narrative in 2 Kings xviii. 13—14: “In the fourteenth year of King Hezekiah did Sennacherib, King of Assyria, come up against all the fenced cities of Judah and took them. And Hezekiah, King of Judah, sent to the King of Assyria to Lachish, saying I have offended ; return from me ; that which thou puttest on me will I bear. And the King of Assyria appointed unto Hezekiah three hundred talents of silver and thirty talents of gold.” To meet this demand, Hezekiah was compelled not only to strip his treasury of all its silver, but to cut off the gold from the doors and pillars of the Temple. It is remarkable that in the Second Book of Chronicles no mention is made of this submission of Hezekiah. It is equally remarkable, though easy of explanation in both cases, that no cylinder or other monument records the second expedition of Sennacherib against Jerusalem, which ended so disastrously for his army, as related in both Kings and Chronicles. Of the reality of his discomfiture, however, we have the evidence of Herodotus (ii. 141), who ascribes it, on the authority of the Egyptian priests, to a very different cause, the gnawing of the bow strings and shield straps of his soldiers by an invasion of mice, which left them a defenceless prey to their enemies.

No Assyrian monument makes any mention of the invasion of Judah by the army of Esarhaddon, the successor of Sennacherib, the captivity of Manasseh, and his subsequent restoration, as related in 2 Chron. xxxiii. 2, perhaps because the King himself took no part in it. The records of the two succeeding reigns before the overthrow of the Assyrian empire exhibit no points of contact with the Scripture history, but Babylon was evidently aiming at independence, and the Median power growing in the North. Their united forces brought the kingdom of Assyria to an end about the close of the 7th century B. C. The subject of the history of Babylon, as illustrated by cuneiform inscription, is too wide to be entered upon.

When the new materials for the history of the nations using the cuneiform character, which their records present, were

made available by their decipherment, it was a natural hope that by their means we might be able to reconcile the conflicting accounts of their early history which the Greeks and Romans have left us, but the task is more hopeless than ever. Some general facts, however, illustrating what Bunsen would have called "Assyria's Place in the World's History," may be stated with confidence. There can be no doubt that the cradle of the empire was in Lower Mesopotamia, in the region called by the Greeks and Romans Babylonia and Chaldæa. It is agreeable to analogy that the origin of civilized and powerful communities should be found in the rich alluvial soil near the mouth of great rivers. It was once thought that the population of Egypt had descended along the banks of the Nile from Ethiopia, but it is now known that the course of civilization has been the opposite. In the case of the Assyrian empire we may confidently state, that its origin is to be sought in the lower course of the Tigris and Euphrates. In the oldest ethnographical sketch which we possess, Genesis ch. x., the land of Shinar is made the beginning of the kingdom of Nimrod, Shinar being the Babylonian plain, and he appears only to have united and consolidated tribes previously independent and which long retained a distinct existence. *Kiprat Arba*, the four nations, is an expression by which the people of this region are often designated in the cuneiform inscriptions. In the narrative of Chedorlaomer's expedition (Gen. xiv.) the King of Shinar appears only as one of a confederacy. In the tombs which have been opened in Lower Mesopotamia, by Mr. Loftus and Mr. Ainsworth, implements of stone and bronze have been found but none of iron, though this metal was employed for ornaments. (Rawlinson, Five Monarchies, 1. 129). The cuneiform character, as seen on Babylonian and still more Chaldæan bricks, is much more complex than on the Assyrian monuments, and retains more decisive marks of a pictorial origin. In regard to sculpture there is hardly room for comparison, as no material but clay was at hand.

In calling the region nearest the sea Chaldæa, I have followed the usage of the later writers, both classical and Scriptural. But there is no reason to think that in earlier times it

bore this name. According to Professor Rawlinson it first occurs in Assyrian records of the 8th century B. C., and its origin is uncertain. In the Hebrew prophets the Casdim (which is rendered Chaldees) are first mentioned in Isaiah xxiii., 13, and then are spoken of as if recently incorporated with Assyria : " This people was not ; Assyria established it for those who dwell in the wilderness." This was written about the middle of the 8th century B. C. Now we have seen that the name Chaldæan is not found in the inscriptions of the region afterwards called Chaldæa, *i.e.* Lower Babylonia, and that it first makes its appearance in Assyrian inscriptions in the 8th century B. C. It seems to me that from these facts a strong presumption arises, that by some event, which history has not directly recorded, an incorporation of the Chaldees, a fierce nomadic nation, inhabiting the country between Assyria and the Euxine, with the Assyrians, had taken place. It is remarkable that the first attempt of Assyria at the permanent subjugation of Palestine took place in this century. Pul made Menahem tributary (771 B. C.), but Tiglath Pileser, a few years later, carried off the inhabitants of Galilee, and before the close of the century Shalmaneser had done the same thing with the kingdom of Israel. Mention of the Chaldees certainly occurs in books of Scripture which stand earlier in our present arrangement than Isaiah ; but it would be unsafe to assume that this is the order in which they were written. Gradually the name became equivalent to Assyrian and Babylonian, and ultimately lost its ethnic sense altogether, and denoted a caste of priests, or a college of cultivators of astronomy and astrology.

If Mr. Fox Talbot and his associates are correct in placing the cylinder of Tiglath Pileser I. in 1,100 B. C., it is evident that Assyria was already a powerful monarchy, and there is every probability that it was even then the growth of centuries. But beyond this contemporaneous documents fail, and Professor Rawlinson has not obtained general assent to the scheme by which he carries up the line of kings to the 19th century B. C. We must leave this point undecided ; at all events neither Assyria nor Babylon had, during these centuries, any place in the " World's History." What influence their

architecture, their sculpture, their military system may have had on western countries belongs to a much later age. We have no evidence that the Assyrians cultivated any branch of science, though they used their art of writing for all the purposes which an advanced stage of civilization demands. In Babylonia, on the contrary, astronomy was studied from a very early period. The accounts of observations extending 31,000 years from the time of Alexander the Great are, of course, exaggerations, but the fact that Ptolemy has preserved an account of lunar eclipses, as far back as 721 b. c., which, compared with calculations made backward by the modern lunar tables, agree with slight difference,—this fact, I say, is sufficient to prove that the Babylonian astronomers were very careful and accurate observers; an art which our secretary will tell us is the fruit of long practice only. Babylon furnished the materials from which the Greek intellect deduced scientific astronomy. If the art was degraded into an instrument of superstition and trickery, so that the Chaldeans became one of the pests of imperial Rome and had to be expelled from Italy (Suet. Vit. 14), the morbid curiosity of their employers should bear the blame.

With all their wide and desolating conquests, the Assyrian and Babylonian Empires left little mark on the history of the world. It might have been otherwise if they had succeeded in establishing themselves on the shores of the Mediterranean. Their occupation of Lower Egypt was transient; both of them unsuccessfully attempted the conquest of Tyre. But the history of the Jewish people was essentially modified by their vicinity to the great powers established on the banks of the Tigris and the Euphrates. One half of the nation was carried off into a distant region, where all traces of them perished; the other, purified by their affliction, returned to their native land, to be the subject of a history more wonderful, more deeply interesting, than anything in their past experience. From what has been said it will be evident that the discovery of the remains of Assyrian and Babylonian antiquities, combined with the decipherment of the cuneiform character, has given us a view into the history of centuries which were a

blank before. Much indeed remains to be done in interpreting these remains ; much, probably in revising what has been already done, but the true path has been struck. The four volumes of Mr. Rawlinson, the Camden Professor of History at Oxford, will afford ample information of what is known or believed, accompanied by excellent illustrations of manners, and the state of the arts of war and peace.

Nov. 7TH.—Dr. PROCTER read a paper on the subject of the Diamond Fields of South Africa. He observed that the recent discovery of diamond fields in South Africa has attracted an unusual amount of attention to that distant region of the world. This interest has on many accounts been excited in Britain ; there was the probable enrichment and the development of the resources of a British colony, as well as the consideration of the claim of the South African Republic to this territory of wealth.

The history of the discovery of Diamonds in Africa was of an accidental character, and in the first instance great doubts were entertained whether the stones were at all found in the territory, nay, it was even said that the whole story was false, and that the report was simply part of a scheme to promote the employ and expenditure of capital in searching for this precious gem in the colony.

The history of the earliest discovery is thus recorded by Dr. Atherstone :—In the early part of 1867 a Dutch farmer saw some children playing with a bright stone, and asked the mother of them to sell it. She laughed at the idea, and at once gave it to him. It was then handed to a trader to find out its nature, and was subsequently sent by Mr. Boyes, Clerk of the Peace for the Hope Town District, to Dr. Atherstone, who suspecting its true character, had it sent to the Paris Exhibition, and ultimately it was purchased by the Governor of the Colony, Sir P. Woodhouse, for £500 ; it weighed 21 carats. Other stones were found, one of which, known as the Star of South Africa, was purchased in its rough state for £11,200. This fact greatly raised the expectations in relation to the Diamond-producing characters of the country, and it

became evident that a new and vast source of wealth was about to be opened to South Africa.

Before describing the localities of the finds, it may be advisable to say a few words on the present sources of Diamond supply.

India, once the great diamond locality, is now nearly exhausted, and the Brazils, from whence at present the largest quantity is imported into the English market, is failing. When the gems were first found in the latter locality, European traders, who never dreamt of other than Indian diamonds, and who feared that if an infinite number were thrown on the market by this discovery of new mines, it would lead to a material depreciation of their stock, endeavoured to discourage their sale and spread a report that the so-called Brazilian diamonds were only the refuse of the Indian mines exported from Goa to the Brazils, and thence to Europe. A circumstance of a similar character to the recent one at the Cape.

The production of the Brazilian mines has been enormous, but it is every day decreasing. The first few years after their discovery, the yield was so enormous as, according to Mr. Emmanuel, to reduce the value of diamonds one-half. Now, however, the total produce does not exceed 240,000 carats annually of about the value of £1,000,000. In Borneo, the diamonds are found in the mountain chain besides the great river Bangor.

To return to the African region. The extensive tract of country lying to the N. E. of the Cape Colony, and adjoining the W. border of Natal constitutes at the present time the seat of two Dutch communities which claim to rank as independent states. They are respectively designated as the Orange River Republic and the Transvaal Republic; the latter is the more northerly and lies beyond the Vaal or N. Branch of the Orange River.

The great centre of the diamond district is right and left of the Pniel Mission Station, near the great bend of the Vaal River, 480 miles N. E. of Cape Town, upwards of 300 miles due N. of Algoa Bay, and 200 miles W. by N. of D'Urban (Natal). Diamonds have been met with along the valley of the lower

Vaal, but the finding places are not confined to the Orange River and its great branch. The valleys of at least two of its tributaries have yielded specimens 80 miles south of Pniel, and 70 miles from the Vaal. But none are so rich as the Pniel district—Hebron, an old mission station, 10 miles up the river on its N. bank, has been productive digging ground. The Klip Drift, or ford by which the waggon track from the S. crosses the Bechuana land, gives its name to the rich diggings five miles lower down the river than Pniel. Four or five miles further down are the Gong-gong diggings on the left bank, and new diggings, called Cawood's Hope, are just opposite.

This rich district traversed by the Vaal, and now occupied by an energetic digging and trading community composed of all nations of the world, belongs partly to the Pniel Mission Establishment, in the limits of the Orange River Free States, but the N. side of the valley is claimed both by the chiefs of the Korunna tribes, by the Orange Free States, and even by the Transvaal Republic, whose main territory is higher up to the E. on the N. side of the Vaal. In September, 1870, the number of British subjects was estimated at not more than 5,000 persons. In the early part of this year it had increased threefold, and advices from the Cape, dated 20th July, 1871, report that the population now at the Diamond fields are 34,000 persons, of whom 30,000 are Europeans. Newspapers are published, and in them appear accounts of the building of churches, market-places, theatres, villas, public offices, &c., with due attention to sanitary matters, and other evidence of a thriving, settled and civilized community.

Of the Klip Drift Diamond Field our knowledge is the most accurate. A plan of this field, by Mr. Cooper, a Government Surveyor, appeared in the *Mining Journal*, (4th March, 1871), and gives a good notion of the topography. From the same authority it is learnt that up to October, 1870, the value of diamonds found in only some part of this district was £215,000.

At or near Klip Drift, the river has an extremely winding course, among somewhat flat-topped hills, a mile or so in their greater diameter, and varying from 300 to 480 ft. in height, with gullies or creeks running down between them to the river.

The tops and slopes of these hills (locally called Kopjes) have been the chief sources of diamonds to the diggers. From the examination of specimens made by Mr. Rupert Jones, and sent by Mr. Cooper, the ground appears to consist of igneous rocks highly felspathic, and mostly amygdaloid, which are in places much decomposed, and their disintegrated fragments have been mixed with much waterworn material of both local and distant origin, a point of great importance, tending to show the transport of material by water or it may be ice. The matrix is seen upon and between the crevices of the rocks, the surface being strewn with fragments of rocky material, viz., a metamorphic sandstone, quartz, amygdaloid and greenstone. The rock on which the matrix is found is a greenstone with a brown decomposing trap containing felspar, mineralogical characters going to show their origin to have been volcanic. Mr. Cooper tells us that the rock covers the whole surface. On the Kopjes it juts out in numberless points or fragments, the whole being in detached pieces varying in weight from 5lb. to 500lb., and in indescribable shapes. It does not appear to be stratified, and the detached fragments of which the surface is composed seem to be rather the result of splitting or shaling off while cooling, many sides presenting curved surfaces or faces, and as they are not waterworn, this may probably be the effect of a disintegrating process. These detached rock fragments reach three, four or five feet in depth and are removed in working and cleared away to the clay, which is really a decomposed felspathic amygdaloid. It may be remarked that the term amygdaloid is applied to any rock containing nodules (usually almond shaped) of some minerals, as agate, chalcedony, calc-spar or zeolite scattered through a base of basalt, greenstone, or other trap. Its origin is obvious, as its formation can be traced through modern lavas. Small pores or cells are caused by bubbles of steam or gas confined in the melted matrix, these spaces become gradually filled up by matter separating from the mass, or carried in solution by water, permeating the rock, and are there deposited. To resume, this clay forms the limit of the present workings, and is avoided by the diggers. The diamonds have all been found between detached fragments of the rock (Greenstone) which occurs in irregular-

shaped fragments and portions consisting of waterworn pebbles, fragments of quartz, ferruginous sand, agate, &c. This matrix (gravelly alluvium) has been undoubtedly caused by the action of water and deposited on or between the fragments of the various trap rocks, and all the circumstances would tend to show that the country must have been submerged, and the matrix in which the diamonds lie must have been deposited in the run of the currents, lake, or body of water; or ice may have operated in depositing them in their present position; or again, it is a question to be settled whether they have originated in changes of the local strata; or, and still more probable, whether their existence has been brought about by the agency of the igneous rocks. The solution of this question has an importance higher than the settlement of a debatable matter of science. It is a consideration which may vastly aid the success of future diamond seekers. By knowing the original rock, its composition is learnt, and if the diamonds have been broadcast over the district as a result of denudation or aqueous action, certain minerals will indicate the probability of their presence or absence in that precise locality. If for example they have been derived from the igneous rocks, agate or carnelian, as indicative of degradation of the Karoo beds, will not be essential accompaniments, but there will rather have to be looked for an assortment of minerals known to abound in metamorphic rocks. Every person knows that the diamond is crystallized carbon, but its mode of formation is still a mystery. All that is known would go to show that its production is the result of the slow decomposition of some vegetable or bituminous material, an opinion which receives support from the fact that when the ash left by the incineration of the diamond is examined microscopically, it presents the remains of a vegetable structure. All attempts to obtain the gem by artificial means have failed, unless the recent statement made by Despretz is to be received. He says that he has obtained microscopic octohedra having the hardness of the diamond by the prolonged action of an inductive current on sugar charcoal, and also by the action of the electric current continued for six months on one of the chlorides of carbon.

It is an important consideration to enquire under what conditions are the diamonds found in the old and well-known and studied localities?

These localities are India, Borneo, Sumatra, Australia, the Urals, Algiers, California, and N. Carolina and Georgia. In all these places they occur in alluvial gravel derived from more or less distant mountains. The general inference is, however, that this gem occurs in regions which afford a granular quartz rock called *itacolumite*, which belongs to the talcose series, owing its lamination to a little talc or mica. This rock is found in the mines in Brazil, the Urals, Georgia, and N. Carolina. It has also been detected in a species of conglomerate composed of rounded silicious pebbles, quartz, chalcedony, &c., cemented by a kind of ferruginous clay. But they are usually found washed out from the soil. In Brazil only have they been found in their native beds, and in two different deposits, one called *gargulho*, consisting of broken quartz covered by a thin bed of sand or earth; and a second *cascalho*, of rolled quartz pebbles united by a ferruginous clay resting usually on talcose, micaceous or schistose clay. These with some accompanying limestone bands evidently represent in altered conditions old sandstones, clays, shell-beds, &c., such as constitute a formation of marine or fluvio-marine deposits. The diamonds which occur in these Brazilian schists are always regarded as being the results of some of the changes which have affected the strata, and they may represent the carbon of the old carbonaceous deposits separated from the other constituents either within the original mass of the strata or sublimed, and we have evidence of heat in the metamorphism, through fissures, from probable sources of carbon in Africa.

There is then a large number of facts, which go to show that, as in other countries, diamonds are most usually found in transported materials, and the great question which the seekers desire to solve is to trace their origin and learn whether it would not be more profitable to look for them in that matrix material.

A suggestion has been made by Dr. Rubidge and others, that large areas of this part of Africa have been covered with alluvium

derived by the operations of water and weather on the vast regions drained by the Orange and Vaal rivers, and now in part represented by the Draakenberg, which supplies the major part of the Orange system, giving to it agate gravel from their amygdaloid volcanic rocks. But to the North, the waters of the Vaal rise from mountains having a different rock construction.

It was moreover suggested by Dr. Rubidge, that the direct heat and pressure of volcanic dykes passing through coal beds might bring about a change of hydro-carbons producing pure crystallized carbon or diamond, as they have changed certain coal-seams in S. Africa and other places into coke and graphite.

Now it has been seen that the trap rocks of the Kopjes at Klip Drift are of volcanic origin, and have passed through fissured strata to the lower formations of the district. These low-lying formations are known to be a part of the great stratified formation which juts out S. of the Orange river basin in the Colesberg, Smithfield, and other districts, and which constitutes a large part of the interior of the colony. This formation is known as the Karoo formation from the Karoo desert, and consists of a series of shales and sandstones rich in places with reptilian remains, especially that remarkable two-toothed reptile the Dicynodon, also with fishes of the Palaeoniscan type, with seams of lignite and coal, remains of coniferous trees, ferns, and other plants, while throughout their extent the strata are crossed by dykes of trap rock, and often overlain or intercalated with igneous rock. Here, then, are found some of the elements demanded by the theory of Dr. Rubidge for the formation of diamonds by volcanic interference.

The difficulties which present themselves in solving the question of the original site of the diamonds are innumerable. If the theory of their formation be true, it will be seen that they may with reason be referred to several rocks, but whilst at the same time the disarrangement of rocks in this part of the world has been both extreme and extensive, the fact of the existence of the gem with material both waterworn and not waterworn materially complicates the matter. But all the circumstances considered, it may be concluded that the three probable sources of them are (1) Outcrops of old rocks lower in the

geological series than the Karoo beds, which lie on the floor of the valley, and are pierced and covered by greenstone and amygdaloid lavas, (2) The materials of some of the Karoo beds, and, (3) The metamorphic rocks of the Upper Vaal which occur with gneiss, mica slates, and quartz, bearing in this respect an analogy to some of the diamond-producing rocks of Brazil.

In relation to diamantiferous indications, the diggers have always regarded garnet and tourmaline as associates of the diamond, and this opinion is borne out by facts. In the Orange River Republic the mineral is found in isolated spots, called "Pans," which are basin-like hollows, being in wet seasons more or less filled with saline water, and in dry seasons presenting a saline efflorescent surface. In these localities the favoured accompaniment of the diamond is a fine clayey talcy detritus, full of garnet, tourmaline and corundum, and of a greenish, or, when iron is present, red colour. This material, Dr. Shaw considers, the correlative of itacolumite. As these indications exist throughout the whole of the diamond-producing region, Dr. Shaw goes on to say that he is disposed to think, that the talcose slate which produced the detritus, was the original matrix of the diamond, and this rock was one of the series of the metamorphic rocks—gneiss, mica-schist, &c. In the "Pans," fragments of these have been preserved. But the inference is that the original diamantiferous rock has extended throughout the whole of this part of S. Africa. This and the associated rocks were disturbed by the greenstone upheavals which probably occurred at various times. During, and subsequent to these disturbances, was the great lake-period of S. Africa, when the immense deposits of lacustrine formations were made. The ancient rocks yielded to denudation and wearing, in some cases went towards the formation of trap conglomerates, and generally have found their way to the nuclei of the present period, the Vaal river and those of its tributaries, the Reit and the Hart, and the pans and sheltered spots, where isolated diamond deposits exist.

But, if even the exact site of the matrix was accurately decided, it is questionable whether it would be more profitable to

work that precise locality, inasmuch as the diamonds wherever found have been by natural operations widely distributed, and, as it were, washed out of their birth-place, and, as Mr. Rupert Jones observes, it would in all probability be more remunerative, to obtain a clear notion of the stratigraphical structure of the whole country (a matter which has yet to be worked out) and of its geological history. Then would be learnt the place of origin, the mode of transport, the sites of deposit, and, it might be, the deposit of the stone, and hence might be discovered the laws which had regulated its deposition.

DEC. 5TH.—Mr. W. PUMPHREY presented, on behalf of Mr. Allis, a photograph of the skeletons of several *Dinornidæ*, and, on his part, read the subjoined paper on the subject of these very remarkable birds:—In presenting this photograph to the Society, I shall beg to remark that, when speaking of the bones of our dinornis, then on the table before us, in June, 1864, we stated that we had only had an opportunity of seeing one figure of the skeleton of the dinornis, which had only two pair of sternal ribs, whereas our bird had evidently three pair. On first looking at the photograph on the table, of the skeletons in the Canterbury Museum, we at once saw that they all possessed only two pair of sternal ribs, and we then inferred that Dr. Haast, like ourselves, had only seen Professor Owen's first published figure, and in writing to Dr. Haast we found that we were right in that opinion. We also saw that those skeletons were all deficient, in wanting the first pair of dorsal ribs, and the scapula coracoid. In these skeletons the last ribs are articulated into the sacral vertebræ, which are all exposed to sight. In our specimen, in which the bones were never separated, the sacrum entirely conceals the sacral vertebræ; and of the three last pair of ribs the first is articulated to the lower surface of the sacrum, and the two last pair are ankylosed to the bone, and form part of it. I therefore wrote to Dr. Haast, in a friendly letter, congratulating him on procuring so many bones, and on his skill in mounting them, at the same time pointing out to him where they were deficient, which we were able to do from the circumstance that our bones were so perfect, and, when found,

unmixed with the bones of any other skeleton, excepting those of its own young, thereby so much increasing its value as a typical specimen.

While no one can do otherwise than admire the acumen which enabled Professor Owen to determine the character of the bird from the bones he at first possessed, it can be no surprise that, from the imperfect state in which they were found, he made the mistake as to the number of sternal ribs, nor can we blame Dr. Haast for having followed so high an authority. In a letter received last week from Dr. Haast, he says, "I have lately made some extensive excavations in an old encampment of moa hunters, and obtained some very interesting results, also some excavations for moa skeletons were pretty successful. I obtained, among other portions of the skeleton, that of a gigantic eagle, showing that the moa had also its 'winged' enemies."

Received
13 MAR 1886



