

On impressions of rain-drops in ancient and modern strata / Sir Charles Lyell.

Contributors

Lyell, Charles, Sir, 1797-1875.
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Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

tends below it. In those impressions which have been made when the wind was blowing, and when the rain fell obliquely, the cavities are not only of an oval shape, but all deeper at one end than at the other. Foot-prints of birds, and the winding tubular tracks of annelids are seen on the same surface with the rain-prints. On splitting open slabs formed by numerous thin layers deposited by successive tides, impressions of previous showers are seen, and casts of the same, standing out in relief on the under surface of incumbent layers.

The Lecturer next considered the nature of certain small protuberances, which might, on a cursory view, be mistaken for casts, which project from the upper surface of certain layers of mud, and are caused, some of them by dried bubbles of mud, and others by small particles of solid matter, covered with a film of mud. He also distinguished between the cavities produced by air-bubbles rising up through the mud, which give rise to cavities differing in shape from those formed by rain, as he has proved by several experiments.

In illustration of the foot-tracks of quadrupeds, such as the muskrat, the mink, the dog and others, so common on the recent red sand of Kentville, on the borders of the Bay of Fundy in Nova Scotia, Sir C. Lyell exhibited a copy of a brick, one foot square from Babylon, now in the British Museum, on which the track of a small animal of the *Ichneumon* tribe, apparently the Asiatic Mongoose, is distinctly seen. This brick has been sun-dried (not baked in a kiln,) and must have been traversed by the creature, when the clay mixed with straw was still very soft. In the middle of the brick is an inscription in the Babylonian cuneiform character, which according to Colonel Rawlinson's interpretation signifies that Nabokodrossor, King of Babylon, built certain cities, &c. This king is the same as the Nebuchadnezzar of scripture, so that the brick is twenty-four centuries old.

When the tidal waters densely charged with fine sediment creep gently over a slightly inclined sand or mud-bank, they do not disturb the surface, especially when it has been baked hard in the sun, as happens in summer in Nova Scotia; and the new layer of matter which is thrown down, fills up all superficial indentations, which serving as moulds are protected from further disturbance by the casts thus taken from them.

Mr. Cunningham threw out as a conjecture, that the fine-grained quartzose substance of Storeton Hill, might have resulted from blown sand. That such was really its origin, Sir C. Lyell, who has himself examined the quarries on the Mersey, entertains little doubt; for on the sea-shore near Savannah in Georgia, he saw the foot-tracks of raccoons and opossums which had been made in sandy mud at low water, in the course of being gradually filled up with blown sand, clouds of which were swept along by the wind from adjoining cliffs. This layer of sand when the tide rose again would in its turn be overspread by a new deposit of mud.

After describing both the impressions and casts of rain occurring in the recent red mud of the Bay of Fundy, the Lecturer pointed

out their close analogy with markings inscribed on triassic slabs of sandstones in New Jersey, on which also ripple-marks, shrinkage cracks, and foot-prints of birds have been observed. The character of these ancient impressions may sometimes be seen to vary where the rain has fallen obliquely on rippled surfaces, the cavities being deeper on the windward and shallower on the leeward sides of the ridges formed by the ripple. Casts of rain-prints are seen on the lower surface of several sandstone strata. The direction of the rain is usually distinguishable, the longest diameters of the cavities being all parallel, and their deepest ends all on the same side. The markings attributed by Mr. Redfield to hail, are deep, irregular in form, and extremely angular in outline; and the walls are steeper, especially at the deepest extremity of the excavation where they often overhang.

The carboniferous rain-prints of Sydney, Cape Breton, observed by Mr. Richard Brown, are some of the most delicately sculptured on the laminae of shale. In some specimens they are quite separate from each other, most of them oval and with distinct rims. Mr. Brown remarks that they only extended over a certain narrow zone, disappearing when the stratum containing them was traced further in each direction; so that they appear to have constituted a narrow belt, as might be expected if they were formed on a sea beach. For when rain falls on recent mud bordering the Bay of Fundy, impressions are only made on one portion of the exposed surface, the upper part of the bank (left dry for ten days or more after the highest spring tides,) being too hard to receive any imprints, and the lower part near the water's edge being too soft. In some shales from Cape Breton, perfect casts are seen projecting from an under surface where the drops are few in number, while in another stratum distinct casts of a heavy shower are preserved in a fine-grained sandstone which presents a warty and blistered appearance. The casts also of small cracks, which must have traversed the subjacent clay, stand out in relief. Together with these memorials of rain are seen numerous winding cylindrical cavities, open at the top and precisely resembling these now formed by annelids on the recent mud of the Bay of Fundy. These strata occur in the same series of beds, in which so many examples of buried forests occur, with the trunks of trees standing erect, and having their roots attached to them. There are also numerous rippled sandstones at different levels in the same formation.

On re-examining the slab which he brought in 1846 from the coal-strata of Greensburg, Pennsylvania, on which Dr. King first found impressions of a carboniferous reptile, Sir C. Lyell finds not only shrinkage-cracks but a multitude of small tubercles covering the surface resembling the casts of rain-prints, and which he can scarcely doubt are referable to pluvial action.

In conclusion, the Lecturer enlarged on the important inferences deducible from the discovery of rain-prints in rocks of such remote

antiquity. They confirm the ideas entertained of the humid climate of the carboniferous period, the forests of which we know were continuous over areas several hundreds of miles in diameter. The average dimensions of the drops indicate showers of ordinary force; and show that the atmosphere corresponded in density as well as in the varying temperature of its different currents with that which now invests the globe. The triassic hail, moreover, implies that some regions of the atmosphere were at this epoch intensely cold; and coupled with the foot-prints, worm tracks, ripple-marks, and the casts of cracks formed by the drying of mud, these impressions of rain clearly point to the existence of sea-beaches where tides rose and fell, and therefore lead us to presume the joint influence of the moon and sun. Hence we are led on to infer that at this ancient era, the earth with its attendant planet was revolving, as now, round the sun, as the centre of our system, which probably belonged then as now to one of those countless clusters of stars with which space is filled.

C. L.

In the Library, were exhibited : —

Marine Worm from Tale-bank Quarry, Wensleydale, Yorkshire
[presented by F. H. Gabriel, Esq., M. R. I.]

Transparent Iceland Spar; an ancient Alabaster Canopic Vase, and
a Vase in marble from Old London Bridge [by Mr. Tennant].

Model of Nelson Column, Yarmouth; Calabashes, Weapons,
Cloth and Needle from New Guinea, &c. [from the United Service Institution].

Grotesque Figure (naturally formed) in Marble [by Mr. Eades].

Turn-tables showing various Modes of diminishing Friction [from the
Royal Polytechnic Institution].

Model of an Anti-Friction Wheel-Carriage, &c. [by Mr. Coles].

A delicate Balance for Chemical Analyses [constructed by J. W. M.
Marriott, Esq., M. R. I.]

Shakspearean Shield (a design for a bas relief by Luke Limner, Esq.)
and Specimens of Bookbinding [from Messrs Leightons].

Specimens of Imitation Ivory [by Mr. B. Chiverton].

GENERAL MONTHLY MEETING.

Monday, April 7.

WILLIAM POLE, Esq., M.A., F.R.S., Treasurer,
in the Chair.

Francis Bayley, Esq.	The Lord Moreton.
John J. Bigsby, M.D. F.G.S. &c.	Henry Twining, Esq.
Allen Davis, Esq.	James S. Willes, Esq.
Rev. Joseph Hambleton, B.D.	

were *admitted* Members of the Royal Institution.

Hugh M. Cairns, Esq.	Edward Thornton, Esq.
Alexander Matheson, Esq. M.P.	

were duly *elected* Members of the Royal Institution.

The Secretary announced that the Actonian Prize of One Hundred Guineas had been adjudicated to Thos. Wharton Jones, Esq. F.R.S. for an "Essay on the Senses in General, and on the Sense of Vision in particular, as illustrative of the Wisdom and Beneficence of the Almighty."

A Donation of £10. from John Pepys, Esq. M.R.I. was reported, and the warmest thanks of the Members voted to Mr. Pepys for this additional act of liberality to the Royal Institution.

The following PRESENTS were announced, and the thanks of the Members ordered to be returned for the same ; —

FROM

Jacob Bell, Esq. M. P. M.R.I. (the Editor).— *Pharmaceutical Journal*, March and April, 1851. 8vo.

The Editor — *The Athenæum* for February and March, 1851. 4to.

The Statistical Society of London — *Journal*, Vol. XIV. Part I. 8vo. 1851.

Messrs. Reeve and Benham (the Publishers) — *The Literary Gazette* for Jan. and Feb. 1851.

Professor Faraday (the Author) — *Researches in Electricity*, Series 24 — 27. 4to. 1851.

Monatsberichte der Königl. Preuss. Akademie für Jan. 1851. 8vo.

Signatures of some Eminent Fellows of the Royal Society, lithographed from the Charter-book (for Private Circulation by C. R. Weld). 4to. 1851.

The Institution of Civil Engineers — *Proceedings* for March, 1851. 8vo.

The Royal Institute of British Architects — *Proceedings* for March, 1851. 4to.

The Royal Society of Literature — Transactions, Second Series, Vol. II. and III. 8vo. 1847—50.

Proceedings, Vol. I. Nos. 1 — 20. 8vo.

W. Spence, Esq. — Portrait of Rev. W. Kirby, F.R.S. &c. with Sketch of his Life and Works.

W. B. Carpenter, M.D. F.R.S. (the Author) — On the Mutual Relations of the Vital and Physical Forces. 4to. 1851.

The Author — The Apology of an Israelite for not becoming a Christian. 12mo. 1851.

Charles Babbage, Esq. (the Author) — Thoughts on the Principles of Taxation with Reference to a Property Tax, &c. 8vo. 1851.

John Prosser, Esq. Life-Sub. R. I. — Atlas Géographique et Physique de Nouvelle Espagne, fondé sur les Observations Astronomiques, etc. par M. Alex. de Humboldt. fol. Paris, 1812.

Hone's Satirical Tracts: — The Political House that Jack built, &c. 8vo. 1819-20.

A Letter from the King to the People. 8vo. 1820.

The Queen's Rights and the People's Wrongs. 8vo. 1820.

Tracts, in one vol.: viz. — Age of Reason, by T. Paine; Reply by Gilbert Wakefield; — Priestley's Letter to the Philosophers and Politicians of France, &c. &c.

Tracts circulated by the National Anti-Corn-Law League. 8vo. 1842.

Joseph G. Cogswell, Esq. — Alphabetical Index to the Astor Library. 8vo. New York, 1851.

The Author — Letters on Church Matters; by D. C. L., Vol. I. 8vo. 1851.

The Trustees of the British Museum — Vetus Testamentum Græcum e Codice MSS. Alexandrino, &c. curâ et labore H. H. BABER, A. M. 3 tomi. fol. 1816 — 21.

Descriptions of the Ancient Terracottas. 4to. 1810.

Descriptions of the Ancient Marbles, Pt. 1—10. 4to. 1812 — 1845.

Nummi Veteres in Museo, R. P. Knight ab ipso descripti. 4to. 1830.

Catalogue of the Anglo-Gallic Coins. 4to. 1826.

Catalogue of the Hargrave Manuscripts. 4to. 1818.

Catalogue of the Burney Manuscripts. fol. 1840.

Index to the Arundel and Burney MSS. fol. 1840.

Catalogue of the Oriental MSS. Part 1 — 3. fol. 1838 — 41.

Catalogue of the Manuscript Music. 8vo. 1842.

Catalogue of the MSS. Maps, Charts, and Plans, 2 vol. 8vo. 1844.

Greek Papyri, Part 1. 4to. 1839.

Select Papyri in the Hieratic Character, Part 1 — 3. fol. 1841—44.

List of Mammalia. 12mo.

Catalogue of Mammalia, Part 1 and 2.

List of Mammalia and Birds of Nepal, presented by B. H. Hodgson, Esq. 12mo. 1846.

List of Additions to the MSS. 1841 — 1845. 8vo. 1850.

List of Birds, Part 1 — 3. 12mo. 1844 — 8.

Catalogue of Reptiles; Part 1, Tortoises, &c. Part 2, Lizards. Part 3, Snakes. 12mo. 1844—9.

Catalogue of Amphibia, Part 2. 12mo. 1850.

List of Osteological Specimens. 12mo. 1847.

List of Lepidopterous Insects, Parts 1 and 2, and Appendix. 12mo. 1844 — 8.

List of Hymenopterous Insects, Part 1 and 2. 12mo. 1846 — 48.

List of Dipterous Insects, Part 1 — 4. 12mo. 1848 — 49.

Nomenclature of Coleopterous Insects, Part 1 — 4. 12mo. 1847 — 9.

List of Crustacea. 12mo. 1847.

List of Myriapoda. 12mo. 1844.

Catalogue of the Mollusca, Part 1 and 2. 12mo. 1849 — 50.

Catalogue of Bivalve Mollusca, Part 1. 12mo. 1850.

The Trustees of the British Museum, continued:—

Nomenclature of Molluscous Animals and Shells. 12mo. 1850.

List of Homopterous Insects, Part 1. 12mo. 1850.

List of the British Animals, Part 1, Radiata. Part 2, Sponges. Part 3, Birds. Part 4, Crustacea. Part 5, Lepidoptera. 12mo. 1848—50.

List of Donations, 1828—30. 4to.

Inscriptions in the Cuneiform Character from Assyrian Monuments discovered by A. H. Layard, D.C.L. fol. 1851.

The Asiatic Society of Bengal—Journal, Nos. 215, 216. 8vo. 1850.

The Chemical Society—Journal, No. 13. 8vo. 1851.

The Geographical Society of Bombay—Transactions, Vol. I. to VI. and Vol. VIII. Part 1. 8vo. 1836—1848.

The Royal Society—Proceedings, No. 59 and No. 77, parts 1, 2. 8vo. 1851. Transactions for 1850, Part 2. 4to. 1851.

List of Members for 1850. 4to.

Adam Murray, jun. Esq. M. R. I.—Specimens of British Minerals.

F. H. Gabriel, Esq. M. R. I.—Fossil Marine Worm from Tale-bank Quarry, Wensleydale, Yorkshire.

Wm. Bollaert, Esq.—Specimens of Minerals collected in the Texas (vide Trans. Geog. Soc. 1843—49.)

WEEKLY EVENING MEETING,

Friday, April 11,

H. R. H. PRINCE ALBERT, Vice Patron, in the Chair. 1850

PROFESSOR FARADAY

On Atmospheric Magnetism.

ON a former evening (*January 24, page 1*) it was shown that Oxygen gas was magnetic, being attracted towards the poles of a magnet; and that like other magnetic bodies, it lost and gained in power as its temperature was raised and lowered, and that the change occurred within the range of natural temperatures. These properties it carries into the atmosphere; and the object, this evening, was to show how far they might be applied to explain certain of the observed variations of the terrestrial magnetic force.

If a source of magnetic power be considered (as a magnet) it presents us with a system having polarity; and if the parts which are called the poles be taken as representing the most concentrated condition of the polarity, then the contrary polarities, manifest externally in relation to the magnet, are perfectly definite, being exactly equal to each other. If the magnet be irregular in the disposition of its force, still the same definite character of the sum of the contrary polarities holds good.

External to the magnet those concentrations which are named poles may be considered as connected by what are called magnetic