

GEOLOGY

Maclure on North American Geology

"A Classic of Science"

The Father of American Geology Made Some Startlingly Good Guesses About Water and Ice as Geological Agents

SOME SPECULATIVE CONJECTURES ON THE PROBABLE CHANGES THAT MAY HAVE TAKEN PLACE IN THE GEOLOGY OF THE CONTINENT OF NORTH-AMERICA EAST OF THE STONEY MOUNTAINS; by William Maclure, Esq. President of the Academy of Natural Sciences, at Philadelphia, and of the American Geological Society. Published in the American Journal of Science and Arts (Silliman), Vol. VI. New-Haven, 1823. This is an exact reprint of the original publication.

IN THE PRESENT state of our geological knowledge, there are, perhaps only a few facts from which we are permitted to draw conclusions respecting the former state of the earth; amongst which is our entire ignorance with regard to the origin or formation of the primitive class of rocks, we having as yet had no opportunity of observing nature in the act of aggregating or forming such rocks: the other four classes of Volcanic (Volcanic?) Alluvial, Secondary, and Transition, we have either caught nature in the act of aggregating or forming such rocks, or rocks that from direct analogy are so similar in their construction, relative situation, &c. &c. as to warrant a deduction that they were most probably formed after this same manner.

Water appears to be the principal agent in changing the form of the earth's surface, and by the sea, lakes, and rivers, (the most extensive mode of operation;) when we see a river running between two precipices of rocks in a deep channel, whose stratification and arrangement are the same on both sides of the river, we are naturally led to suppose that the action of the run-

WILLIAM MACLURE (1763-1840) published in 1809 the first geological map of the United States, one of the earliest ever made of any country. His speculations reprinted here antedate much of the fundamental work on geology. In this connection see *Classics of Science: Agassiz, Ice Age*, SNL Sep. 26, 1931; *Lyell, Niagara Falls*, SNL July 13, 1929; *Lyell, Mastodons in North America*, SNL Sep. 7, 1929.

ning water wore down that channel, and that at some former period, the two sides of the river, now separated, were contiguous and unbroken: when we cast our eyes over immense tracts, such as the steppes in Russia, the prairies in the United States of America, or on plains that are nearly horizontal, we are tempted to conjecture that the earth took that form from the depositions from water, &c. &c. &c.

The continent of North-America, east of the Stoney Mountains consists of a ridge of primitive mountains, springing out of the great northern primitive formations, covered to the east and south-east by extensive beds of alluvial, apparently the depositions of the ocean, and on the west side overlaid by Transition and Secondary, filling the immense basin through which the Mississippi now runs with all its attendant streams.

The utmost stretch of imagination or conjecture can form no idea of any period of time, when that primitive chain of mountains called the Alleghany, did not exist; but direct analogy, and perhaps logical reasoning, authorises us to conjecture that there must have been a period, though beyond the date of our records, when neither the alluvial of the ocean, nor the Transition or Secondary depositions covered or overlaid either side of said range of mountains, and that the chain of mountains called the Alleghanies stood alone, and from the nature of the depositions which we now find covering each side, we may have a right to conjecture that it was surrounded by water; into which run all the rivers that drain said mountains, forming channels deep in proportion to the immense length of time they may have run, and consequently much more profound than the channels they afterwards wore in the level country at the foot of the mountains on the retreat of the waters; at this present time all the waters that fall into that immense basin west of the Alleghany

mountains are drained off principally by the Mississippi and St. Lawrence, and a small part now by the Hudson, although it is probable that formerly a greater proportion used to pass by that channel; these then are the only rivers that break through the whole chain of the Alleghany mountains, and run into the ocean.

If on a review of any existing series of phenomena, it is permitted to form conjectures on the past, and to look back on the probable changes, that may have preceded the present state, we presume that the situation of this continent will warrant such conjectures, and we should be naturally led to suppose, that at some former period, the continuity of the great chain of mountains was unbroken, by any of the three rivers that now drain the great basin; and that the waters confined by the high surrounding ridge would form an immense lake, the surplus of which would naturally fall over the ridge into the ocean, and would in the course of time cut those passages, which would drain said lake, and leave the great interior basin, with all its secondary or deposition formation, as we now find it: as the waters that would fall over the ridge into the sea, must have previously left sediments in the lake, there would be little or no matter fit for alluvial depositions; and more probably that great alluvial formation, from the bay of Mexico to Long Island, would not have been accumulated at

Our Aryan Ancestors

travelled on land in ox-carts and on water in dug-out canoes without sails. They wore linen and leather and did not go fishing. Who and what the

Aryans

were will be discussed by

Taylor

IN THE NEXT CLASSIC OF SCIENCE

this period, and the current now called the Gulf Stream, would have then most probably run along the foot of the chain of mountains.

The continent east of the Stoney Mountains, and south of the north edge of the great lake, would then consist of an immense lake, surrounded on the east and south side by a strip of high land from one hundred to two hundred miles broad; the rain falling upon which would partly fall into the lake and partly into the ocean, through small rivers, along the mouths of which navigators might have in vain searched for rivers proportionate to the apparent extent of the continent, as they now do on the coast of New South Wales, for rivers capable of draining so extensive a country.

The passage of the St. Lawrence through the high ridge between Quebec and Montreal, must either have been torn asunder by an extraordinary convulsion, been always in that state, or it must have been worn down by the gradual but continued action of running water, aided by the friction of all the substances it carries along with it; the undisturbed regularity of all the surrounding strata both on the banks of the St. Lawrence and Hudson, renders the first supposition improbable; on the second supposition that the river had always run freely through the passage in those mountains, it must follow that the river had always run in its bed from Lake Ontario to Montreal, and from the weight of water and rapidity of its current, for so long a time, must have

worn down a deep channel, and buried itself between high and perpendicular banks; but this does not correspond with the actual state of the river, which from the lake to the rising ground above Montreal runs in a bed very little below the level of the surrounding country, nor does either the present situation of the river or its banks, warrant the supposition that the action of the current had continued so long; by the same supposition the level of Lake Ontario must have always remained as far below the level of Lake Erie as at present, and the waters must have constantly fallen over the ridge at Niagara; but the small progress it has made in wearing away that ridge, compared with the effects of other rivers, (for instance, the Rhine below the lake of Constance with a tenth part of the water has worn a deeper bed ten times the distance through the high lands composed of harder materials) is against the probability of such a supposition; the small distance that the falls of Genesee river have worn its bed from the lake, with the shallow beds of the Oswego and all the other rivers that run into the lake, as well as the general nature of all the Genesee country, opposes the probability of the supposition or conjecture.

The above observations are equally applicable to the beds of the Hudson and Mohawk, before they fall over the ridge, from which it would appear that the most rational conjecture would be, to suppose the St. Lawrence wore down a passage through the high lands between Quebec and Montreal, as well as the Hudson, through the high lands above New York, and until they had affected such a cut, the whole basin on the west side of the mountains, was the bottom of an immense lake.

A similar mode of reasoning supports the conjecture that the basin of the Mississippi made part of the said lake, for the Tennessee river, while in the mountains under the name of the French Broad, has worn down its bed one hundred to two hundred feet in solid primitive and transition rocks, but when it comes into the basin, it is obstructed in its passage, at the Muscle Shoals, by a soft secondary sandstone; the sources of the Ohio, under the name of New River, &c. &c. &c. have likewise cut deep beds in the mountains before they reach the great basin, but after their union into one great stream, the Ohio is obstructed at its falls near its mouth by a secondary limestone;

from all which it would appear probable, that, had those rivers run as long through the secondary formation of the great basin, as their sources must have done to wear these beds so deep in the primitive mountains, the accumulated water of both the Ohio and Genesee would, long ere this, have worn away all the obstructing secondary rocks, and like all other great rivers that have run long in the same beds, would have been obstructed only by alluvion of their own formation. The Rappahannock, Potomac, James River, Roanoke, &c. &c. &c. that run into the Atlantic, have cut deep beds in their course through the mountains, through the level country their channels are shallow, and they all fall from twenty to thirty feet over the granite ridge into tide water, without having removed the fall half a mile from where they began, which could not have been the case had they run in the low country, as they had in the mountains.

That the branches or sources of these rivers should have run longer in the mountains than they have in the great basin or lower country; can be satisfactorily accounted for, only by supposing that they had long been wearing down these beds in the high lands before the great basin or lower country emerged from the waters, and that it has been only since the draining of those waters that their accumulated junction in the bed of the great basin under the level country began the formation of the channels they now occupy.

This conjecture may likewise account for some of the particularities in the state of the animals, originally found on this continent, such as the small number and wild condition of the wandering herds found on this part of the continent when compared with their neighbours inhabiting the elevated plains of Mexico; the great deficiency in Terrestrial Quadrupeds, compared with the vast abundance of Beavers, Otters, Muskrats, and other amphibious or aquatic animals; the great proportion of Gramnivorous and the small number of Carnivorous; the immense flocks of aquatic birds, and the very few terrestrial; might be mentioned as some of the problems solved by the foregoing supposition.

The accounting for the existence and extinction of the mammoth would not be difficult, by supposing with Mr. Peal that it was not amphibious, and though originally inhabiting the southern parts of the great lake, might in summer oc-

▼ The Science Service radio address next week will be on the subject,

R SPECIFICATIONS FOR LIFE WORK

A by

D Dr. C. R. Mann

I Director of the American Council on Education

O FRIDAY, OCT. 28

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asionally emigrate to the north, and leave their bones on the borders; being deprived of its element by the evacuation of the great lake, might perhaps be considered as sufficient good reason for their extinction.

The large masses of granite, some of them weighing tons, scattered over the secondary between Lake Erie and the Ohio, while there is not an atom of granite in place nearer than the north side of the lake, would seem to point at the only mode by which they could probably be transported; by supposing the lake extended thus far, and that the large pieces of floating ice from the north side might carry those blocks attached to them, and drop them as the ice melted in going south; few or none being found south of the Ohio, shows that the southern sun melted the ice before it got so far.

Science News Letter, October 22, 1932

PALEONTOLOGY

Species New to Badlands Among Fossils at Princeton

MORE THAN a ton of fossils, dating as far back as eight or nine million years, were unearthed in the Big Badlands district of South Dakota by the Scott Fund Expedition, recently returned to Princeton University, Prof. Glenn L. Jepsen, director of the expedition has announced. Many of the bones represent species hitherto unknown in the Badlands.

The Titanotherium beds of Oligocene age in South Dakota and Wyoming, one of the richest fossiliferous areas in the world, were worked by the expedition. The scientists found nine skeletons, among the more important of which were those of four saber-tooth tigers and a deer about the size of a dog. Other discoveries included fifty skulls.

In explanation of the variety and number of the discoveries of the expedition, Dr. Jepsen explained that one subdivision of the Oligocene fields, situated in the Big Badlands near the Black Hills in South Dakota, yields the remains of the Titanotherium, gigantic rhinoceros-like animal, and that most collecting parties operating there have searched only for the remains of this animal. Consequently, the remains of smaller animals have never previously been found, although paleontologists have known that they existed at the same time as the Titanotherium.

Science News Letter, October 22, 1932



7 GREAT SCIENTISTS

want to talk to you in your home

SCIENCE is absorbingly interesting. Scientists bring forth new points of view, new discoveries, new relationships of old discoveries, and thus they themselves are absorbingly interesting as human beings.

Men and women of intellectual curiosity would like to entertain many of these scientists, one by one, in their homes, but this is usually impracticable.

- 1 DR. ROBERT A. MILLIKAN, Nobel prize winner in physics, leader in scientific thought and head of the California Institute of Technology, speaks on "*The Rise of Physics*."
- 2 DR. JOHN C. MERRIAM, authority on the fossil animals and reptiles of western America, president of the Carnegie Institution of Washington, speaks on "*The Record of the Rocks*."
- 3 DR. EDWIN G. CONKLIN, Princeton University biologist, one of the world's greatest authorities on life processes, speaks on "*The Mystery of Life*."
- 4 DR. KARL T. COMPTON, eminent physicist, president of the Massachusetts Institute of Technology, speaks on "*Science and Engineering*."
- 5 DR. LEO H. BAEKELAND, industrial chemist and one of America's industrial pioneers, inventor of bakelite, velox, etc., speaks on "*Chemistry and Civilization*."
- 6 DR. WILLIAM H. WELCH, of Johns Hopkins University, "Dean of American Medicine" speaks on "*The Tubercle Bacillus*."
- 7 DR. WILLIAM M. MANN, director of the National Zoological Park of the Smithsonian Institution, leading authority on animal life, speaks on "*Our Animal Friends*."

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