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

VOL. LXV.



LONDON:

Published by the Institute, 1, Central Buildings, Westminster, S.W.1.

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1933

762ND ORDINARY GENERAL MEETING,

HELD IN COMMITTEE ROOM B, THE CENTRAL HALL,
WESTMINSTER, S.W.1, ON MONDAY, JANUARY 9TH, 1933,
AT 4.30 P.M.

ALFRED W. OKE, ESQ., LL.M., F.G.S., F.Z.S., IN THE CHAIR.

The Minutes of the previous Meeting were read, confirmed, and signed, and the HON. SECRETARY announced the following elections:—As a Member: the Rev. Professor F. C. Haysmore. As Associates: Edwin Sibley, Esq.; Dr. Ellis S. Allen; Miss E. B. Coad; Dr. R. E. D. Clark as Life Associate; and H. G. Lambert, Esq., B.A., as Student Associate.

The CHAIRMAN then called on Mr. Douglas Dewar, F.Z.S., who had kindly offered to read Mr. D. J. Whitney's paper "On the Age of the Earth as deduced from the Salinity of the Ocean."

THE AGE OF THE EARTH AS DEDUCED FROM THE SALINITY OF THE OCEAN.

By DUDLEY JOSEPH WHITNEY, B.S., Exeter, California.

I.

THE problem of the age of the earth is not only a most important one, to every careful student of the natural sciences, but it is in many ways a much neglected problem. Statements are common that this or that fossil or formation is ten million or a hundred million years old, and the normal reader naturally believes that the scientists have good grounds for their statements about these things.

This is not true. There have been some careful studies made of this problem of the age of this globe upon which we live, but

the results obtained from different lines of study have been very conflicting, and common estimates of its age are based upon poorly founded speculation. The subject needs some careful analysis.

The first question which will arise in the study of this problem is : What is meant by the age of the earth ?

The age of a thing is normally calculated from the time it came into existence. On this basis the starting-point of the age of the earth would be figured from the time the earth became a definite body revolving around the sun. This would be the astronomical age of the earth.

The geologists, however, mean something entirely distinct from this when they speak of the age of the earth, though of course the geological and the astronomical ages of the earth are closely related. They count the age as starting from the time when the earth came into approximately its present size and temperature, and when geological processes began to be much as they are now. They count the age as extending from the time when land separated from water, and when sedimentary rock began to be formed in the way that it is now formed. The geological age of the earth is the age of the oldest sedimentary rock.

A brief explanation will make more clear the difference between the two ways of computing the age of the globe. Suppose that the material composing it was shot out from the sun a thousand million years ago, but that for five hundred million years the temperature was too high for the formation of true oceans or solid land. Then suppose that, by cooling, land formed and rivers washed rock powder into the ocean, where it formed sedimentary rock. The astronomical age of the earth would then be a thousand million years and the geological age of the earth five hundred million years. The age now commonly attributed to the earth is given without due study.

II.

Take what can well be considered a fundamental difficulty in calculating how old this earth is. If the age of an object is to be ascertained, the method by which it came into being ought certainly to be known ; also its condition at the beginning, otherwise the very foundations for calculating the age are absent. So also if the age of the earth is to be known its early condition and the

method by which it originated ought to be known. Not only are these things not assured, but the farther investigations are carried the more helpless astronomers and geologists become in deciding upon reasonable answers to these problems. The old Nebular Hypothesis, which was held to be sound science for more than a century, is now discarded, and the Planetesimal Hypothesis and the Tidal Theory and other speculations designed to replace the Nebular Hypothesis, are seen to be faulty the more carefully they are examined. If the geologists therefore are unable to decide how the earth could come into being by any naturalistic process, obviously they have no good starting-point for calculating its age.

The older geologists were convinced that they understood the earth's early history. They therefore, apparently, had a starting-point (in theory) that modern geologists do not have. They were sure that the earth started molten hot and was gradually cooling. All the older textbooks on geology describe the supposed movements of a solid crust of this earth resting upon a molten interior, and being shoved up, or sinking down as occasion required; but now physicists are certain that the earth is not cooling nor shrinking, at least to any material extent, and that through the radioactivity of certain minerals it may even be gaining in heat. In truth, they do not know whether it started hot and at approximately its present size, or whether it started cooler and attained its present size and heat by the accumulation of material from other parts of the solar system. Certain facts indicate one kind of a beginning and other facts indicate the other kind of beginning. The geologist is helpless in deciding upon the nature of the early earth.

Study for example the theories of the origin of the atmosphere, or the ocean, of the source of the chlorine in the ocean, of the causes of volcanoes, of the uplift of mountain masses, or of almost every other important feature of geological history, and confusion and uncertainty are met at every turn. Until questions like these are settled in somewhat reasonable manner, not one valid step can be taken by way of calculating the true age of the earth. As a matter of fact, if naturalism is helpless in accounting for the earth, and if facts are in conflict with every naturalistic hypothesis for the earth's origin, a legitimate and just theory is that a Creator called it into being. Before deciding definitely upon this kind of an origin, however, a more careful study of the problem is in order.

III.

Modern dogmas about the age of the earth were given their start when present theories of earth history were established. As early as 1787 James Hutton, a noted British geologist, pronounced as a basis for interpreting geological phenomena the proposition that geological processes of the past, through all time, were in their nature the same as those operating now. This principle was enunciated in even more detail by Sir Charles Lyell several decades later. Wind and water wear away the land, and sediment is deposited in lake, valley and ocean. Geologists insisted that all sedimentary rock everywhere, whether on mountain top or wave-beaten cliff, had that kind of origin.

When, therefore, great mountain masses almost the world over were seen to be composed largely of sedimentary rock, and when this rock was found to be very different in various places, different periods of time for its origin were determined upon, and by the necessity of the case the earth was then believed to be very old. How old it was, early geologists did not decide, or if they speculated upon the matter, they at least reached no definite conclusions.

Later on, systematic efforts were made to determine the matter. Lord Kelvin, calculating the probable life of the sun by the heat sent forth, figured that the earth could not be more than 20 to 40 millions of years old, for the sun could not be much older. Other methods of calculating the earth's age were also devised, and now we have valuable data from which we may draw some definite conclusions on the subject.

Provided Lyell's principle was correct, that earth processes in the past were the same as earth processes at present, an obvious way to measure the age of the earth is to determine the rate of erosion and of the deposit of sediment, and to compare that with the amount of sedimentary rock that was formed in the past. Find the amount of rock being formed now, and the amount that has been formed, and the number of years required to deposit this rock material will be known—allowing for a suitable margin of error. Fifteen years ago this measure was a standard measure of time. By it the earth was assumed to be from 60 to 100 millions of years old. Allowing for difficulties in determining the amount of rock formed in the past and the amount of erosion occurring now, the important question about this method of determining geological time is whether sedimentary rock of the

past was always formed as it is now. That matter will be taken up later.

Another measure of geological time was to determine the amount of material being carried in solution from the land to the ocean, and to compare this with the amount of such material in the ocean. This principle of measuring time is the same as the sediment measure: Material is removed from land to the ocean; determine the amount removed each year and the amount that has been moved, and the age of the earth can be determined—always provided that earth processes in the past were the same as earth processes now—and this was assumed by geologists to be a fact.

Among the materials in the ocean to be examined in applying this measure of time are sodium, potassium, magnesium, calcium and the sulphate radicle SO_4 . The foundation weakness of this measure of time is that the amount of these materials in the ocean at the beginning is not known and cannot be known. Some of the materials are also being removed from solution after reaching the ocean. Others are not, or the amounts removed are so small that corrections required on this account are of no material importance.

IV.

The material mostly used in this method of calculating the age of the earth is sodium. In fact, the other materials have been given little or no serious consideration.

The amount of sodium in the ocean is known to be approximately 14,130,000,000,000 metric tons. The amount carried into the ocean each average year is 158,357,000 tons. A little arithmetic will therefore show that, given an earth in the past like the earth now, only about 89,000,000 years would be required to make the ocean as salty as it is now, if the ocean contained no sodium to begin with—which is unthinkable. These figures and others to follow are obtained from the United States Geological Survey Bulletin, *The Data of Geochemistry*, which obviously is good authority. Provided rain has fallen upon land in the past, and rivers have run into the sea carrying materials from the land with it, sodium must have been increasing in the ocean. The 89,000,000 years therefore provides an extreme outside limit for the age of the ocean—and of the land—and this age must be reduced to allow for the amount of sodium in the ocean at the beginning.

Whether one assumes that the earth was very hot to begin with and gradually cooled down, or whether one assumes that the earth began small and that the water and the atmosphere were squeezed out from the earth, as planetesimals accumulated and caused heat and pressure, the primordial ocean and atmosphere would certainly be abundantly supplied with chlorine, carbon dioxide and the oxides of sulphur. All of these combine with water to form strong acids that would decompose the rocks and unite with the basic elements therein. The early ocean would therefore be rich in sodium, potassium, magnesium and calcium, also in sulphates. This is undeniable. Our time measures would therefore not be based upon the idea of an ocean free from these materials, but of one well supplied with them; and the time required to bring the ocean into its present condition might be very brief. For all that can be seen, analysing the matter from pure chemistry, the ocean would probably be almost as salty from the beginning as it is now, let it have what kind of naturalistic origin it might have had. Under those conditions the ocean would not be old. If it were old, it would be far more salty than it is now.

An interesting feature of the sodium content of the ocean is that it equals the sodium that would be contained in a coating of typical igneous (original) rock a third of a mile thick over the surface of the globe. There is therefore more sodium in the ocean than there is in the land standing above sea level, and than there would be if such land was pure volcanic rock from which no sodium had been leached. Such a condition indicates conclusively that when the elements settled down from their original heated condition (if they were at first in such condition) the chlorine, sulphur and carbon dioxide and other acidic substances in the ocean were combined with immense amounts of sodium, and of course with the other bases. The sodium measure of time therefore shows conclusively that the earth, as a body in something like its present condition, is definitely not old—no more than a small fraction of the 89,000,000 years.

V.

The other materials in the ocean as a rule give more striking results than the sodium. The potassium content of the ocean is 510,800,000,000,000 metric tons, and the annual addition from the land is 57,982,000 tons. As these figures stand, without

correction, this would give an ocean only 8,800,000 years old, though corrections for both the amount present at the beginning and for removal from solution should be made. Unlike sodium, potassium is removed somewhat from solution, partly by combination with other elements and partly through use by marine plants and animals. Upon the whole, however, it is very soluble, and most of that used by plants and animals goes back into solution. Allowing full correction for material removed, the great amounts that certainly would be in the ocean from the beginning indicate that the 8,800,000 years is far longer than would be needed to accumulate the potassium in the ocean. Even this, then, would be too high a figure to give as the age of the earth.

Magnesium is the next most prominent basic element in the ocean after sodium, and large amounts are removed annually from the land. The ocean contains 1,721,000,000,000 metric tons, and the annual increase from the land is 93,264,000 tons. Although magnesium is very soluble, considerable amounts are removed from solution by vegetation and by shell fish, though most of this is doubtless brought back into solution again. Large quantities must have existed from the beginning in the ocean, so the 18,500,000 years given by the magnesium measure, as the outside limit for the age of the ocean, must be far too high.

The sister element, calcium, though unsatisfactory as a measure in certain important respects, gives such astonishing time-results that it cannot be ignored. This is removed from land to ocean much more rapidly than any other material, 557,670,000 tons, or nearly four times as much as sodium, is carried annually into the ocean, but the amount in the ocean is only a small fraction as great as the sodium, or 552,800,000,000 tons. Using these figures as they stand, only 860,000 years would be required to give the ocean its present calcium content.

Large quantities of calcium are, of course, used by shell fish and other marine organisms, but much of this material will go back into solution on the decay of those organisms. The ocean is also far from being saturated with calcium salts, and particularly in the depths any calcium is likely to be rapidly redissolved. Considering the large supplies of calcium that must have been in the ocean from the beginning, let it have what origin it would, and the comparatively small amount now in solution, the age of the ocean by the calcium measure must be extremely limited.

VI.

The sulphur measure of time is also very significant. Like sodium, the sulphur which enters the ocean stays there. Some is removed, doubtless, by precipitation, mostly by change into sulphides through the agency of marine plants, but unquestionably nearly all of this is reoxidized into sulphates again. Sulphur fumes are abundant in volcanic action, and sulphur must have been produced in enormous amounts in the early earth, assuming that the earth had a naturalistic origin, and the ocean must have had large quantities of sulphates in solution from the beginning. They are also carried in enormous amounts into the ocean each year. The figures given in *The Data of Geochemistry* are: 3,553,000,000,000,000 tons of SO_4 in the ocean and 332,030,000 tons carried to the ocean each average year, which is more than double the amount of the sodium removed from the land. At this rate, the ocean if old should contain enormous amounts of sulphates, yet the full amount, counting as from a sulphur-free ocean, would be accumulated in only a little more than a million years. To ignore evidence like this, and to assert that the earth is very old, is most decidedly unscientific.

These figures, all of which indicate a young earth, seem to demand a re-examination of the sedimentary measure of time. That was based upon the idea that sediment in the past was deposited as it is now. Obviously if sediment were deposited more rapidly in the past than it is now the age by the sediment measure would have to be reduced accordingly, and we find upon analysis that it should be so reduced.

There are, for example, great deposits of fish fossils; and water and mud must have moved with extraordinary violence in order to catch, kill, and bury before decay great schools of fishes—often salt-water fishes. That kind of action is more like a Noachian Deluge than like present-day geological action. The organisms which gave rise to our petroleum deposits must all have been covered quickly and violently, or they would have decayed and petroleum would not have been formed. Coal also was formerly believed to have been formed by the burial of great masses of vegetation which grew in the places where the coal is found, but now the best geologists are coming to believe that the coal vegetation was washed into place and covered rapidly by sediment. This demands very rapid deposit of sediment, not slow processes such as occur now. The testimony of the sediment

measure of time is the same as that of the salt measure of time : the earth is still young.

VII.

The question now arises, What is to be done about these calculations ? Geologists began by assuming a kind of earth history which compelled belief in an earth hundreds of millions of years old. Lord Kelvin's investigations compelled them to believe in an earth much younger ; then the salt and sediment measures of time, even though unscientifically used, caused them to believe that the earth was only about 60,000,000 years old. Now, even these figures have been cast to the winds, and an age of a thousand million years and more is commonly and calmly asserted. The grounds for such assertions deserve some attention.

When radium was discovered, a new theory of the nature of matter was open. Then other elements were found to be radioactive. Uranium, throwing off energy, changes into different forms of radium, then into the inert metal, lead, and into the gas, helium. The metal thorium also changes into lead, and these leads differ from ordinary lead. By determining carefully the amount of uranium, or thorium, or radium, in an ore, and the amount of lead that has apparently formed by decomposition, the time required for the formation can be estimated. By this method of calculation various rocks in different parts of the earth are estimated to be a thousand million years old or older. As given to the public, this method of measuring the age of the earth seems plausible, but there are flaws in it which need not be discussed at length here. If this did not offer a means of deciding that the earth was very old, the method would certainly never be favoured. Findings have been inconsistent with one another, and the data used have been hand-picked. The Geological Survey Bulletin mentioned earlier, *The Data of Geochemistry*, cites examinations of certain Texas ores which would make these ores, all from the same general deposit, vary from 1,671,000,000 to 11,470,000,000 years old, which is a complete absurdity.

Long ages like these, or like a thousand million years, or an appreciable part of the same, are impossible if, as is assumed, water was wearing away continents and depositing the sediment in the ocean. The ocean under such conditions would be almost as salty as the Dead Sea, or the land would be leached of its soluble contents. Such conditions do not exist. Therefore the

earth is not old. It is most unscientific to take certain facts which can be used to help out a theory and to ignore other very plain facts which are in conflict with that theory, but this is what is being done by those scholars who inform the public that the earth is hundreds of millions of years old, and who unhesitatingly, and with supposed authority, assert ages of millions of years for certain formations or certain fossils. The thing is all wrong.

IX.

Some one may ask, What does it matter whether the earth is old or not? This can be answered, Yankee-like, by asking another question, What good is science, and why know anything about Nature? Some interesting conclusions are forced if the earth is really not old.

In the first place, if the earth is not old, standard theories of earth history will have to be utterly revolutionized, and the textbooks dealing with historical geology will have to be rewritten from start to finish. In the second place, if the earth is not old, worm never changed to fish and fish to man save by miracles greater than the most orthodox creationist ever demanded, and the biological sciences will have to be reorganized. In the third place, astronomers and physicists in assuming a very old earth and a very old sun may have to revise their views about the origin of the earth and of the formation of energy in the sun and in the warmer stars. If they assume that the sun has been supplying energy to the earth for hundreds of millions of years, when the earth is not hundreds of millions of years old, their theories will need revision.

In this connection a few facts can be pointed out. Energy from the sun seems to come in part from radioactivity and the destruction of matter, and frequently we hear about the immense length of time during which we may expect the sun to turn its mass into heat. Actually the amount of heat available from the breaking down of matter in the sun is very limited unless some ways of breaking up atoms exist, of which science knows nothing.

Radioactivity as we know it comes from the breaking down of very few elements, and these are mostly rare elements, and even then the loss of weight is small. Unless those elements are exceedingly abundant in the sun, the amount of material in the sun that can be altered into energy is therefore very small, comparatively speaking. In the radium series, for example, the

starting-point is uranium, which has the atomic weight of 238.2 and the final materials are lead, which has the weight of about 207, and several atoms of helium, which has the weight of 4. By this it can be seen that only a small part of the weight of uranium can be turned into energy, while the energy from the radioactivity of the more plentiful elements like iron, aluminium, silicon, calcium, and magnesium and the gases is either little or non-existent, for all that can be determined. Yet popular writers on science often speak as if almost the whole mass of the sun could be turned into energy. Actually the material in the sun that could be used for developing energy through the disintegration of the atom seems to be very small. The life of the sun, therefore, seems to be much more as Lord Kelvin calculated it, than as many modern physicists, carelessly assuming that the earth is very old, assert it to be.

Astronomers also assume that some passing star dragged material from the sun a thousand million years ago or more, thus forming the solar system. If the earth is not even a small fraction of this age, such a theory should be abandoned.

Summing up the whole case, we know nothing of the naturalistic origin of the earth, nor of the rest of the solar system; we know nothing of the early condition of the earth, and obviously we have no starting-point from which to calculate its age. Examining the data which geology provides, we find many conflicting features about the earth which contradict any theory of its naturalistic origin that can be suggested, and although we find nothing in nature to show its actual age, we find definite evidence to show that it cannot be old. And if it is not old, then scientific opinion in many lines will have to be revolutionized before it can rightly be called scientific.

Note.—Following is a brief autobiography.

Born in San Francisco 1883. Educated in the public schools of Berkeley, California. Graduated from the College of Agriculture of the University of California, December, 1907, with the degree of B.S. This was followed by one semester of post-graduate work. Taught one year in public schools of Hawaii, remaining in Hawaii for almost a year more, but returning to Berkeley on account of family duties. Engaged in newspaper work, then in farm paper work (editorial department). Was associate editor of the "Pacific Rural Press," for several years, resigning to become editor of "Orchard and Farm." Resigned and moved to Exeter district, where I have

been farming since, although I have continued writing for the agricultural press.

Several years ago, starting with the foundation of agricultural biology and agricultural observations in general, obtained at the university and in farm paper work, I began a systematic study of the relation of such transformation of species as evidently occurred to the doctrine of direct creation. From the beginning, though believing that Natural Selection was doubtless responsible for much change, I was convinced that it did not touch the great problems of the origin of life, or organs, and of the major forms of plant and animal life. My studies upon this led me into writing upon the subject, and later into public speaking.—D. J. W.

DISCUSSION.

Mr. SIDNEY COLLETT wrote: I am sure we all thank both the author and the reader of to-night's interesting paper, especially as the subject, as dealt with, quite rightly shows the unreliability of so-called "science." Hence, as knowledge increases, *i.e.*, as God's laws in nature are better understood by us, "science" so-called must of necessity change its views. The late Professor Ramsay said, in my hearing, that the scientific text-books which he studied as a young man, owing to the increase of knowledge, were all "scrapped!" and, for the same reason, it is safe to say that, ten years hence, much of the "science" of to-day will have to be abandoned and new theories adopted!

I have collected the names of leading scientists, who have given us their calculations as to the supposed age of the earth; all of them men of the first rank in the scientific world. Playfair said the earth had existed from all Eternity!

Professor Ramsay	made it	10,000 million years;
Eugène Dubois	„	1,000 million years;
Goodchild	„	700 million years;
Sir Charles Lyell	„	400 million years;
Charles Darwin	„	300 million years;
Sir Oliver Lodge	„	100 million years;
Sir George H. Darwin	„	60 million years;
Professor Sollas	„	55 million years;
Lord Kelvin	„	24 million years;
Dr. Croll	„	20 million years;
Professor Tait	„	10 million years.

So that, excluding Playfair's views, there is between the highest and lowest of these estimates the somewhat staggering difference of 9,990 million years. Should we not thank God that in the Bible there is an absence of such speculations? The Bible tells us in Ps. xxxiii, 6, "By the word of the Lord were the heavens made, and all the host of them by the breath of His mouth;" and in vv. 8 and 9: "Let all the inhabitants of the world stand in awe of Him, for He spake and it was done; He commanded and it stood fast."

The vote of thanks to the lecturer (and reader) was passed with acclamation.