

On Geological Dynamics

By Sir. W. Thomson (Lord Kelvin)

Part I. Reply to Professor Huxley's Address to the Geological Society of London.

Part II. Origin and Total Amount of Plutonic Energy.

Part III. Note on the Meteoric Theory of the Sun's Heat.

Excerpt. *Transactions of the Geological Society of Glasgow*, 1869

(Quoted in *Geological Time* by Anon. [P. G. Tait] *The North British Review* 1869)

[Part I.]

I must, therefore, in the beginning, be permitted to say that the very root of the evil to which I object is that so many geologists are contented to regard the general principles of natural philosophy, and their application to terrestrial physics, as matters quite foreign to their ordinary pursuits I must also say, that though a clever counsel may, by force of mother-wit and common sense, aided by his very peculiar intellectual training, readily carry a jury with him to either side, when a scientific question is before the court, or may even succeed in perplexing the mind of a judge; I do not think that the high court of educated scientific opinion will ever be satisfied by pleadings conducted on such precedents. But jury and judge may be somewhat perplexed as to what it is on which they are asked to give verdict and sentence, when they learn that Professor Huxley himself makes the gravest of the accusations which he repels as made by me. In the course of his address he describes Kant's Cosmogony; and, pointing out anticipations in it of some of the 'great principles' taught in the *Theory of the Earth* somewhat later, by Hutton, he says, 'on the other hand, Kant is true to science. He knows no bounds to geological speculation, but those of intellect. He reasons back to a beginning of the present state of things; he admits the possibility of an end.' Professor Huxley does not use words without a meaning: and these mean that Hutton was not true to science, when he said, 'The revolt, therefore, of this physical inquiry is, that we find no vestige of a beginning, no prospect of an end.' The chief complaint on which I am now brought into court is, that I have extended the same accusation to modern followers of Hutton who have used this dictum as a fundamental maxim of their geology.

In opening his case, Professor Huxley asks, 'What is it to which Sir W. Thomson refers when he speaks of "geological speculation" and "British Popular Geology?"' then enters on a highly interesting and instructive discussion of various schools of geological philosophy, which constitutes the chief substance of his address, and recurs to the question, 'Which of these is it that Sir William Thomson calls upon us to reform?' But instead of answering this question he says, 'It is obviously Uniformitarianism' which Sir W. Thomson 'takes to be the representative of geological speculation in general.' I have given no ground for this statement. Not merely 'obviously,' but avowedly and explicitly, I attacked Uniformitarianism; but I did not attack geological speculation in general. On the contrary, I anxiously and

carefully guarded every expression of my complaint from applicability to other speculations than those involving more or less fundamentally the particular fallacies against which my objections were directed; and the very phrases I used to limit my accusations showed that I had not taken Uniformitarianism to be the representative of geological speculation in general. The geology which I learned thirty years ago in the University of Glasgow embodied the fundamental theory now described and approved by Professor Huxley as Evolutionism. This I have always considered to be the substantial and irrefragable part of geological speculation; and I have looked on the ultra-uniformitarianism of the last twenty years as a temporary aberration worthy of being energetically protested against.

In the course of his lecture Professor Huxley says: 'I do not suppose that at the present day any geologist would be found to maintain absolute uniformitarianism, to deny that the rapidity of the rotation of the earth *may* be diminishing, that the sun *may* be waxing thin, or that the earth itself *may* be cooling. Most of us, I suspect, are Gallios, "who care for none of these things," being of opinion that, true or fictitious, they have made no practical difference to the earth, during the period of which a record is preserved in stratified deposits.'

It is precisely because so many geologists 'have cared for none of these things,' which (though not matters of words merely) do certainly belong to the law of Nature, that they have brought so much of British popular geology into direct opposition to the principles of Natural Philosophy. Professor Huxley tells us that they have been of opinion that the secular cooling of the earth has made no practical difference to it during the period of which a record is preserved in stratified deposits. On what calculation is this opinion founded? One considerable part of the reform in geological speculation for which I ask is, that evidence adduced in favour of the opposite opinion should be thoroughly sifted, and not merely disposed of as matters of opinion, or of faith beyond the realm of reason.

It seems, however, in reference to the special subject of my paper, 'Geological Time,' that I chiefly urged the necessity of reform, and it is satisfactory now to see that in this respect considerable progress must have been made, when, on the 19th February 1869, Professor Huxley ventured before the Geological Society of London to suggest that limitation of the period during which living beings have inhabited this planet to one, two, or three hundred million years, may be admitted, without a complete revolution in geological speculation. When he says that on me rests the *onus probandi* of my assertion in January 1868, 'that a great reform seemed to have become necessary,' as had I had brought 'forward not a shadow of evidence' in support of that assertion, I cannot complain that he puts a heavy burden on me. No moderately well read or well instructed student of modern British popular geology wants evidence from me, in addition to that supplied by his reminiscences of books and lectures, that the admission of such a limit as even worthy of attention, is a creeping reform. Here, however, is some of it, if desired.

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Professor Huxley, immediately after his statement 'If we accept the limitation of time placed before us by Sir William Thomson, it is not obvious on the face of the matter that we shall have to alter or reform our ways in any appreciable degree;' says, 'we may therefore proceed with much calmness, and, indeed, *much indifference to the result*, to inquire whether that limitation is justified by the arguments employed in its support.' (The italics are mine.) This method of treating my 'case' is perfectly fair, according to the judicial precedents upon which Professor Huxley professedly founds his pleading. I make no comment or reply, but simply ask permission to put in the following evidence (the italics again are mine):—'He who can read Sir Charles Lyell's grand work on the Principles of Geology, which the future historian will recognise as having produced a revolution in natural science, yet does not admit how *incomprehensibly vast* have been the past periods of time, *may at once close this volume*.' (Darwin's *Origin of Species by means of Natural Selection*, Edition 1859, p. 282.)

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[“We [geologists] have exercised a wise discrimination in declining to meddle with our foundations at the bidding of the first passer-by who fancies that our house is not so well built as it might be” - *President's Address to the Geological Society of London*, February 1869. By Professor Thomas Henry Huxley.]

I cannot pass from Professor Huxley's last sentence without asking, Who are the occupants of 'our house,' and who is the 'passer-by'? Is geology not a branch of physical science? Are investigations, experimental and mathematical, of underground temperature, not to be regarded as an integral part of geology? Are suggestions from astronomy and thermo-dynamics, when adverse to a tendency in geological speculation recently become extensively popular in England through the brilliancy and eloquence of its chief promoters, to be treated by geologists as an invitation to meddle with their foundations, which a 'wise discrimination' declines? For myself, I am anxious to be regarded by geologists, not as a mere passer-by, but as one constantly interested in their grand subject, and anxious in any way, however slight, to assist them in their search for truth.