

to say, that some of the very best workers have been, and are, the very men whose conclusions I venture to question or dispute. At all events, I have thought it a more profitable theme to dwell on the immense extent of our remaining ignorance, rather than on the little area over which our knowledge has been securely established—on the difficult, and, as it seems, the almost insoluble problems which lie before us, and are pressing close around us, especially those which are involved in the very last and the very latest changes which have taken place on the surface of our globe.—*The "Scotsman,"* Nov. 2nd, 1883.

CORRESPONDENCE.

MR. MELLARD READE'S REPLY TO MR. WALLACE ON THE
AGE OF THE EARTH.

SIR,—In replying to Mr. Wallace's letter in the October Number of the GEOLOGICAL MAGAZINE, I shall only refer to those points that I think really touch the question in dispute between us. Fortunately the issue is considerably narrowed by certain admissions which I will proceed to notice.¹ But before doing so I may perhaps be permitted to say that the letter is full of misconceptions and extraneous matter that have no bearing on and are no elements in the calculation.

Mr. Wallace states that his 3 million of square miles 177,200 feet thick represents the matter which *actually exists* on the globe in the form of stratified deposits, which he estimates took 28 millions of years in accumulating, using as his measure the present rate of denudation. Also that this deposit equals a stratified crust of from 9,000 to 10,000 feet thick, if spread over the whole of the existing land. So far, this is satisfactory and explicit. There is, however, this fundamental omission in his calculation and reasoning. He does not allow for the material having been worked up again and again to form this *actually existing* deposit. By the average number of times these particles of rock have been re-used, by so much—even if we assume the other elements to be correct—is Mr. Wallace's calculation in error. Every geologist knows that nearly all stratified rocks are more or less made up of the ruins of pre-existing stratified rocks, and the question to be answered is, how often have the particles been so re-used? If, as I estimate, the materials have on an average been re-used twelve times, then Mr. Wallace's result would have to be multiplied by 12, or instead of 28 millions as he estimates, the Earth would be 336 millions of years old.

My mode of arriving at a rough approximation of the number of times the materials of the sedimentary rocks have been re-used, though "incomprehensible" to Mr. Wallace, is really a very simple process, and until Mr. Wallace or some one else points out a better way, I suppose I may be permitted to use it. It is this. Stratified deposits if only derived from stratified deposits would make the age of the earth infinite. This would hardly suit Mr. Wallace. From

¹ In making these "corrections" it is evident that the origin of Mr. Wallace's difficulties is that he does not realize fully the conditions of the problem he set himself to solve.

what then have they in addition been derived? The only other form of rocks we know of are the igneous rocks, granites—when not metamorphic—syenites, basalts, etc.; but no one can affirm that even these are parts of the original non-sedimentary globe; they are no doubt largely re-melted sediments. But for my purpose I assume that they are, and I find that the area of igneous rocks exposed to denuding agencies is about $\frac{1}{2}$ the area of the whole land, and there is reason to suppose that this proportion has endured since the earliest rocks we know of were formed.¹ It follows that if all the land areas, igneous and sedimentary, were denuded at the same rate—as no doubt they have been in the aggregate—the process of accumulation of the existing thickness of sedimentary rocks has taken 12 times as long as if they had been derived directly from a bare original crust. Now it is only on the latter supposition, which we know to be contrary to fact, that Mr. Wallace's calculation could be true in principle or result.

But whether I was right or wrong in the figures given, it is a fact admitted by all geologists since the time of Hutton, that the sedimentary materials of the globe have been used up over and over again, and any calculation of the age of the Earth based upon the rate of accumulation of sediments and their aggregate bulk which ignores this, as Mr. Wallace's does, is either incomplete or fundamentally wrong.

T. MELLARD READE.

Oct. 5th, 1883.

REPLY TO MR. SKERTCHLY.

SIR,—Since the above reply to Mr. Wallace was written Mr. Skertchly has published a letter in the GEOLOGICAL MAGAZINE, on the same subject, in which he says, "First, I fail to see the slightest connexion between the area of exposed igneous rocks and the number of times sedimentary beds have been 'worked over' again. Surely at the beginning of geological time *all* the land was igneous, and practically that area has been diminishing ever since. This can therefore afford no clue to the question." To which I reply, *Geological Time* is the time of which we have *geological* knowledge, and Mr. Wallace's calculation as well as my own is limited to that time. The earliest recognized system of sedimentary rocks are Laurentian, and there is absolutely no data to prove that the igneous areas even in this period were greater in proportion to the sedimentary than they are now—if there is, I shall be glad to hear it. The hypothetical period between the Laurentian and the time when *all* the land was igneous is anterior to the date at which any calculation of the "Age of the Earth" based on sedimentation can commence, for there are no data on which to work. An inspired seer might perhaps tell us something of this period; but as I have no pretence to fill that rôle, it is useless for me to attempt it.

Mr. Skertchly also says, "Thirdly, Mr. Reade supposes the denudation of sedimentary rocks would reduce the mean thickness." As

¹ This question is discussed in my *Chemical Denudation in Relation to Geological Time*.