

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Radium and Earth History.

It would appear that radium has landed geologists and biologists in a difficulty greater than that from which it was hoped it would deliver them. There is radium in the earth, and radium in disintegrating gives out heat. Therefore a once molten globe will cool down more slowly than if it contained no such independent source of heat. Lord Kelvin's calculations were made on the supposition that there was no source of heat except what the earth possessed as a molten globe. Hence we are at liberty to extend the time that has elapsed since the earth became the possible theatre of geological change to 500,000,000, 1,000,000,000, or even more, years ago. Radium has given us a blank cheque on the bank of time.

So far so good. But when the actual calculations were made as to how much the radium known to exist in the outer shell of the earth would effect its cooling, this was found to be too great. It would, in fact, raise the temperature of the earth the fraction of a degree annually.

Two suggestions in the way of explaining the difficulty have been made by Prof. Joly in his "Radio-activity and Geology." We do not think that either will bear the test of careful examination.

It is only the outer shell of the earth that can be examined for radium, and though there appears to be no diminution with depth, there may be less, or none, in the lower parts. If, then, we have to spread the heating effects of the radium of the outer shell over the whole earth, it will obviously be insufficient to raise its temperature. The only possible result of its disintegration will be a retardation of its cooling to an indefinite extent, which is what is wanted. This is the first suggestion.

The second, admitting that the proportion of radium in the interior may be the same as at the surface, avails itself of the fact that vast masses of the central earth may be thermally isolated for immense periods of time. The rise in temperature of such parts—due to their radium—need not, then, affect the rocky crust. In the course of prolonged ages, however, such internal reservoirs of heat might, so to speak, overflow. Great rushes of heat might reduce the outer shell to a molten state, and inaugurate a new geological era. To quote Prof. Joly:—

"With an interest almost amounting to anxiety, geologists will watch the development of researches which may result in timing the strata and the phases of evolutionary advance; and may even—going still further back—give us reason to see in the discrepancy between denudation and radio-active methods, glimpses of past æons, beyond that day of regeneration which at once ushered in our era of life, and, for all that went before, was 'a sleep and a forgetting.'"

But let us look at these interesting suggestions a little more closely. If the radium contents of the outer shell were spent in heating the whole earth—or any considerable portion of it beyond the shell containing it—then we might suppose it just sufficient to retard its cooling indefinitely. But as the temperature of the earth increases with depth, we cannot suppose that any of the radium-generated heat of the outer shell passes downwards. It must all be spent in heating its own mass. Therefore, according to calculation, this outer shell should be rising in temperature.

NO. 2246, VOL. 90]

There seems to be no escape from this conclusion. And this applies also—and even more forcibly—to the second explanation. For with an interior rising in temperature it is still more difficult to imagine any of the radium-generated heat of the outer shell passing downwards. The radium heat of the crust must all be spent on itself.

Even this does not express the full extent of the difficulty. The theory of the radio-active elements is that they have their periods in which they lose half their substance. The period of radium is 1760 years, and that of uranium 5,000,000,000 years. Now, since we know of no source whereby the supply of uranium in the earth is replenished, we must suppose that there was twice as much uranium 5000 million years ago as there is to-day. And whatever length of time we go back we must suppose there was more uranium, and hence a greater heating effect, than there is to-day. A molten globe could not begin to cool until the radium contents of its outer shell were less than that of the earth to-day.

The moon presents another difficulty. Our satellite is generally held to be a bit of the earth thrown off some fifty-six million years ago. It was then molten, and the drag of the tides produced in its molten mass by the earth gradually reduced its rate of rotation. Now it only turns once on its axis in the course of a revolution round the earth. The moon's radium has not prevented it reaching a stage of cooling far beyond that of the earth. And yet the moon may be supposed to have had the full proportion of radium known to exist in the outer shell of the earth. Yet it has cooled down from a molten state in fifty-six million years in spite of its radium! And it would appear that the earth has done the same, although it has not reached the same stage. For if the moon was molten when it began its separate existence, so must the earth—which gave it birth—have been.

And it would appear that there must be more radium in the sun than in the earth. For helium, the product of the disintegration of radium, was discovered spectroscopically in the sun years before it was known on earth. It must surely, therefore, exist there in much larger quantities. Hence the sun should be getting hotter at a greater rate than the earth.

The difficulties introduced by radium into earth history are greater than that which it was hoped it would remove.

G. W. BULMAN.

The Moon and Poisonous Fish.

MAY I ask for a little space in your columns to inquire if any of your readers can give any information as to the origin of a belief, very widespread in South Africa, that fish exposed to the influence of moonlight becomes poisonous? I have not yet attempted any experiments to test the truth of the statement, nor have I been able to obtain actual evidence of illness or death following the eating of such fish. The belief is very firmly rooted here among all classes of persons, but no one seems able to say how or when it originated, or on what grounds it is based. One very trustworthy witness told me that he had accidentally left some fresh fish out in the moonlight one night, and that it was quite bad in the morning; he admitted, however, that the closeness of the atmosphere might have occasioned the effect, and, of course, he did not divide the sample so as to keep part of it unexposed. I intend to test the statement experimentally when opportunity offers; meanwhile possibly some of your readers can say whether the belief in this ill-effect of moonlight is found in other localities.

E. G. BRYANT.

Grey Institute, Port Elizabeth, Cape Colony,

October 7.