orium amount cannot certainly be greater than that equivalent in α activity to 2 mg. of uranium. At present the preparation has reached about one-fourth of its equilibrium value as regards actinium-X.

In ten years, of the 13·2 mg. of radium in the preparation, 0·053 mg. would have disintegrated. On the assumption that uranium is the primary parent of actinium, Rutherford has calculated that 8 per cent. of the atoms disintegrating must choose the actinium route ("Radioactive Substances," p. 523). So that, if it were formed from radium, the amount of actinium present in the preparation would be 0·0042 mg. But the active deposit from this quantity has an α activity not greater than 2 mg. of uranium. Hence the period of average life of actinium must be at least fifteen million years, the quantity in minerals must be at least 170 grams per ton of uranium, and the α activity of pure actinium in equilibrium could not be greater than 1650 times that of uranium. But a specimen of actinium, prepared and presented to me by Dr. Giesel, must have, judging from a cursory examination, a far greater activity than this, and Mme. Curie ("Radioactivité," I., p. 189) speaks of some actinium preparations as of the order of 100,000 times as active as uranium. All the researches go to show that its actual quantity in minerals is very small, and, if there were anything like 500 times as much actinium as radium in minerals, one would have expected it long ago to have been isolated and its spectrum and chemical reactions characterised. So that the experiments appear to disprove the possibility that actinium can be formed directly from radium. Similar arguments to those above may be used to show that it cannot be a primary radio-element, and its origin remains still a mystery. In the current number of the *Physikalische Zeitschrift* (p. 752) Hahn and Meitner modify my original suggestion and suppose that the branching of the uranium series takes place at uranium-X, two simultaneous β-ray changes occurring, which produce two eka-tantalums, one the known short-lived β-ray-giving product, and the other a still unknown long-lived α-ray-giving parent of actinium, also in group VA. There seems nothing improbable about this. It is almost the only other alternative remaining to be tested, and it should not be difficult to settle by experiment.

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Radium and the Evolution of the Earth's Crust.

HAVING been away from home, I did not see Mr. Holmes's letter on radium and the evolution of the earth's crust, contained in NATURE of June 19, until some weeks after its publication, and thought that the interest in the subject would have so far passed as to make it not worth while referring to, what I believe to be, a considerable misapprehension of the structure of the earth as revealed by earthquakes. Later correspondence has shown that interest in the subject has not waned, and as a correct appreciation of what has been established regarding the constitution of the interior of the earth seems likely to remove some of the difficulties which have arisen out of the study of radio-activity, it may be useful to review the results obtained from the study of the transmission of earthquake waves to long distances.

To begin with, it must be distinctly understood that this line of research can tell us nothing, directly, regarding the chemical composition of the earth, nor can we distinguish between stony and metallic material; all that can be established is the rate at which two distinct forms of wave motion are transmitted, and if, at any particular depth, we find a marked change in these rates of transmission, we may say that it is caused by a change, either in chemical composition or physical state, of the material through which the waves have travelled. With this premised; the first great change takes place at, probably, about ten miles or so from the surface, and seems to correspond with the passage from the heterogeneous and fractured rocks of the outermost skin to more homogeneous material. Below this, and to a depth of about 100 miles, it is difficult to say whether any further change takes place; there are indications of change at about fifty and about one hundred miles, but it is not such as has a great effect on the rate of transmission of the simpler forms of elastic waves, and, as the differences in the time intervals concerned are not of a greater order of magnitude than the inevitable uncertainties of observation, it is difficult to be certain of the reality of the supposed alteration.

Below a depth of about 100 miles there is no evidence of any change until a depth of about 2400 miles is reached; throughout this layer there is a progressive increase of elasticity, but it is gradual and seems to be directly connected with the increase of pressure, with the result that the material, whatever it may be, develops a high degree not only of resistance to compression but also of rigidity as against stresses of short duration. At the depth mentioned, or at somewhere between 0·6 and 0·5 of the radius, measured from the surface, a very marked and remarkable change in the nature of the material, of which the earth is composed, takes place. The change is rapid, and is characterised by a small decrease in resistance to compression, accompanied by a great reduction, if not the complete disappearance, of rigidity. It is impossible to determine how this change is brought about, but it is very much what would be produced either by passage from the stony shell to the metallic core, of one hypothesis, or from the fluid or solid-fluid to the gaseous state, of another.

Whatever may be the final interpretation of the distant records of great earthquakes, the important point to be noticed is that the two great changes which they indicate in the constitution of the interior of the earth are, first, at a depth of only a few, probably not more than ten, miles, and, secondly, at about 2000 to 2400 miles from the surface. Between these depths there are suggestions of variations in composition down to a depth of 100 miles or thereabouts, but they seem to be of only minor importance, and apart from this no change in physical character, or, presumably, in chemical composition, can be detected.

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8 North Street, Horsham, Sussex, August 15.

Poroscopy: the Scrutiny of Sweat-pores for Identification.

AT the recent meeting of the British Medical Association some attention was directed to a method of criminal identification which has been used at Lyons and elsewhere. A fully illustrated account of it occurs in *Les Archives d'Anthropologie criminelle* for July, from which, after careful perusal, I cannot find that there is anything in the method that does not come under the scope and practical working of dactylography. Dr. Locard has shown good reason why we should give more attention than has been usual to small patches of finger-prints, and to seek among the pores for what the ridges are too meagre to supply. Dr. James Scott, at Brighton, rightly describes "poroscopy" as founded on a study of the "impressions or orifices of the sweat ducts of the finger pulp, instead of the ridges." But pores, the openings of sweat ducts, as printed impressions, cannot be studied quite