DEEP-FOCUS EARTHQUAKES AND ISOSTASY

IN a recent discussion[1] Professor W. T. Thom, Jr., wrote: "Pending proof that the deep-focus earthquakes *are* due to ordinary faulting, and are not due to instantaneous rupture produced by deep-seated 'explosions,' it would seem to be in order to consider that their bearing on the problems of tectonics and of isostasy remains indeterminate."

Since the writer had early referred[2] to the possible significance of deep-focus earthquakes for isostasy and has recently been quoted[3] to that effect, a brief statement may here be made.

The mere occurrence of earthquakes at great depths does not in itself prove, as Professor Thom rightly points out, faulting at those depths. It is indeed difficult to imagine faulting at a depth of 500 kilometers, though the question might be raised whether it is essentially more difficult than to imagine it at a depth of, say, 50 kilometers. Perhaps the main reason for greater difficulty in the first case is that we are accustomed to think of high temperatures and zero strength for the rocks at great depths. But is such low or zero strength a demonstrated fact?

The writer is far from assigning "ordinary faulting" as the cause of the deep-seated shocks and looks rather to the high-pressure experiments of Professor Bridgman as pointing to a solution. There is, however, one feature of the seismographic records of at least some of the deep-focus earthquakes that may again be referred to here. In a study of the earthquake of March 29, 1928, it was stated: "The apparent predominance of shear waves must be taken into account in any hypothesis that one might put forward in regard to the mode of origin of a shock at so great a depth as 410 kilometers. The records would seem to preclude anything in the way of a mere explosive activity."[2] The same prominence of the shear waves is found in a study now being made of the shock of June 29, 1934. This is the deepest earthquake reported thus far, having a focal depth of nearly 700 kilometers.

Again, if the source were an "explosion," one might expect the direction of motion of the first impulse to be generally the same. However, no such consistency appears. Thus, of 101 shocks in the interval from April, 1932, to April, 1934, qualified in the Bulletin of the Seismological Laboratory at Pasadena as "deep," 61 showed the first impulse as a compression and 40 as a dilatation.

The apparently limited geographical distribution of deep-focus earthquakes—though perhaps we still know too little on this point—would seem to indicate a lack of spherical homogeneity in the earth at rather great depths. It may be asked whether such homogeneity at depths of several hundred kilometers, while probably not essential, has not been at least implicit in the isostatic picture of the earth's interior.

While, then, it may be said that, for the time being, the bearing of deep-focus earthquakes on "the problems of tectonics and isostasy remains indeterminate," it may also be urged that deep earthquakes must find a place in any complete theory of the earth's interior, of its structure, constitution and development.

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THE NEW ERGOT ALKALOID

DURING the first half of the year 1935 communications appeared from four different laboratories, in three different countries, each describing the discovery and isolation of a new alkaloid from ergot, very different in its properties from those previously known. These communications dealt with researches which had been proceeding concurrently and independently, and in each case the authors gave a name to the alkaloid which they had obtained, so that four new names were put forward—Ergometrine,[1] Ergotocin,[2] Ergobasine[3] and Ergostetrine.[4] There was an obvious general resemblance between the substances thus variously named, but preliminary analytical indications and certain minor discrepancies in the earlier published physical constants and chemical properties left some doubt as to whether the four were really identical or only closely related alkaloids. Later and more detailed publications have removed most of these discrepancies. It appeared to us, however, that the question of identity ought to be settled finally by an exchange of specimens, a careful comparison of them in the laboratories concerned and, if possible, an agreed statement of the resulting conclusion. This exchange and comparison have now been carried out by the undersigned, of whom H. King has acted in the place of the late H. W. Dudley (who died on

1 SCIENCE, 83: 2141, 32, January 10, 1936.
2 *Bull. Seis. Soc. Amer.*, 22: 2, 81–137, June, 1932.
3 J. S. De Lury, *Jour. Geol.*, 43: 7, 763, October-November, 1935.

1 H. W. Dudley and C. Moir (Ergometrine), *Brit. Med. Jour.*, i: 520, 1935; SCIENCE, 81: 559, 1935. H. W. Dudley (Ergometrine), *Proc. Roy. Soc. London*, B. 810, 116; 478, 1935.
2 M. S. Kharasch and R. R. Legault (Ergotocin), SCIENCE, 1935, 81: 388 and 614; *Jour. Am. Chem. Soc.*, 57: 956 and 1140, 1935; M. E. Davis, F. L. Adair, G. Rogers, M. S. Kharasch and R. R. Legault, *Am. Jour. Obstet. and Gynec.*, 29: 155, 1935.
3 A. Stoll and E. Burckhardt (Ergobasine), *C.r. Ac. Sc.*, 200: 1680, 1935; *Bull. Sci. Pharmacol.*, 42: 257, 1935.
4 M. R. Thompson (Ergostetrine), *Jour. Am. Pharm. Assoc.*, 24: 24 and 185, 1935; SCIENCE, 81: 636, 1935.