

development of the male sexual elements in *Crepidula* is certainly independent of season, and so also apparently is that of the female sexual elements, since *Crepidula* breeds almost continuously from about March to December.

The males of *Crepidula* can certainly recognise females by some particular sense as yet unknown, as will be seen from the following facts. In examining a large number of chains of *Crepidula* (see Orton, 1909, *loc. cit.*), small to medium *Crepidula* were often found isolated and settled on the left-hand side of the females. Now this is the wrong side to permit of copulation, but in spite of the fact that copulation could not be effected these individuals were found to have an unusually fat and extensible penis capable of stretching probably twice as far as usual. In the experimental observations described above it was found that isolated *Crepidula*—certainly not older than those settled in the wrong place—had their penis absorbed. The conclusion is obviously reached that the males on the females knew that the latter were there and tried their best to reach them, whilst the totally isolated ones have resigned themselves unreservedly to a complete sex-change. It is only since proof has been obtained of rapid sex-change following complete isolation that a satisfactory explanation could be given for the phenomena of the misplaced males, but the explanation given above has for a long time been suspected of being the correct one.

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Wegener's Displacement Theory.

I QUITE agree with Mr. Lake's remarks (July 15, p. 77) as to the unsuitability of the tracing-paper method of investigating the merits of Wegener's hypothesis. All who wish to pursue the subject will do well to adopt his suggestions as to the practical method.

For some time I have been engaged on the subject, and, though I must plead guilty to the use of the tracing-paper method in the first instance—and there is this to be said in its defence, that we are attacking the master with his own weapon—results certainly warrant Mr. Lake's mild censure that for the truth of Wegener's theory to be accepted we must also believe in a great degree of plasticity for the earth's crust.

If the American coast be superimposed on that of Africa, the parts that coincide (according to Wegener, with a divergence of never more than 100 kilometres) are confined to that represented on the African coast by the distance from Kamerun to a point slightly north of the mouth of the Orange River. There is a divergence along the coast of Cape Colony, and an angle of approximately 15° between the superimposed coast of South America (N.E. coast of Brazil, etc.) and the African coast along the Gold Coast, Ivory Coast, Liberia, etc. These divergences may be easily accounted for by comparatively recent denudation, or fracture.

Assuming the truth of fracture—after Wegener—along the line Kamerun to Orange River, the Zwart Bergen of Cape Colony certainly do fall into place exactly with the Permian cordillera of the Pampas. But this added coincidence merely leads us into greater difficulty. For to make the superimposed American coast coincide with the African coast in this manner, we have to swing the American continent through an angle of 45° from its present position.

This leaves us with Newfoundland in the position approximately 45° W., 32° N.—in the Atlantic Ocean.

The Hercynian Appalachians—another of Wegener's "test" ranges—appear in a position in the Atlantic north of Cayenne, stretching in a general N.N.E. direction (along the line 52° W., 8° N.— 47° W., 20° N.). They are in the right direction for joining up with the British Hercynian range, but are separated therefrom by a distance of ocean above 2000 miles.

To lessen this distance, and bring it within a reasonable distance of the British Hercynian range for joining-up purposes, we cannot allow any bending of the American continent. Any alteration in the relative positions of North and South America throws the direction of the Appalachians out absolutely and entirely. The only way the joining-up can be done for both the Zwart Bergen-Buenos Ayres range and the Hercynian range on both sides of the Atlantic is either (1) a great movement of the Eurasian continent south-west, or (2) a movement of the African continent south to a distance of about 500 miles from its present position, and at the same time a rotation about an axis somewhere in the neighbourhood of Suez (for example) of not less than 50° .

In other words, since the fracture, either the Eurasian continent has been rotated in a general S.E. direction (clockwise) or the African and Indian masses in a N.E. direction (counter-clockwise), or both these motions have taken place, from a centre somewhere in the Suez-Madeira Islands line.

Are the Himalayas, the Carpathians, the Alpine system, the Atlas Mountains, the result of the clashing together of the African-Indian, European-Asiatic continents by these movements? As Prof. Sollas has reminded me, the first word on Wegener's theory lies with the astronomers and physicists. To them I leave the task of finding a force which has acted in two parallel directions west on the North and South American continents, making their advance west without rotation relative to each other and overcoming the resistance at the expense of the Andes Cordillera and its continuation in North America, and has at the same time driven the Eurasian and Asiatic continents south-east and the African-Indian continent north-east (relative to the Americas) with such determination that the great folding of the Himalayas-Alps line resulted—and waited until Tertiary times to do most of it.

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The Elliptic Logarithmic Spiral.

I AM much obliged to Mr. Wright for his correction (*NATURE*, July 8, p. 40). I had made a search in English and Continental books on curves and concluded that this spiral had been overlooked as a curve. But it appears to have been recognised in connexion with the spherical pendulum. Prof. Lamb in his "Dynamics," p. 288, as I now find, refers to the curve as "a kind of elliptic spiral," and Dr. Besant describes it as "an ellipse gradually shrinking in size."

I take, however, a little umbrage in having given the curve a name, especially as it seems to be of importance in damped elastic systems with one degree of freedom, and in fact it may be called a characteristic. Thus in the elastic system without friction, the force displacement diagram is a straight line; with fluid friction varying as the velocity, we have the elliptic logarithmic spiral; and with solid friction, a series of parallelograms. The dissipation per cycle, its rate during the cycle, as well as what may be termed the timbre of the motion, are in this view brought out very clearly.

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