as in this case, the results are entirely at variance with those of profound and elaborate researches in the same direction which have preceded. We propose, therefore, to examine briefly only a very few points in the reasoning from which these results have been deduced.

The author states in the commencement that equilibrium is disturbed by the three following causes :—

(*a*.) Alteration of the specific gravity of the water or air.

(*b*.) The rotation of the earth on its axis.

(*c*.) The attraction of the sun and moon.

He accordingly treats the subject under these three general heads. Under the first two he endeavours to show that none of the usual causes to which the currents of the ocean and the atmosphere have been usually referred can have much, if any, effect in producing them, and that they must, therefore, be due to some other cause. This seems to be designed to make way for the introduction into this subject of the new disturbing forces contained above under the last head (*c*). Much might be said with regard to what is stated under the first two heads in disparagement of the forces upon which these currents have been heretofore supposed to depend, but we shall confine ourselves here to a very few steps merely in the reasoning under the last head.

The author sets out under this head by assuming that the equilibrium theory of the tides is applicable to the real case of nature, and with this assumption he endeavours to show that the flood-tide rises higher above the plane of static equilibrium than the ebb-tide sinks below it. Now, it is well known by all who are familiar with tidal theories, that this theory is entirely worthless as a representative of the real tides of the ocean. Here, then, there seems to be a weak place in the very foundation of the whole reasoning, and any results based upon it should be received with much distrust, if even all the following steps in the argument were regarded as valid. In the second place, he attempts to show, by a method which is very unscientific and inconclusive, that the forces of the sun and moon tend to produce a current from the east towards the west in the flood-tide, but the reverse of this in the ebb-tide. This is then followed by another assumption in the following language :—"Since, as we have shown, the flood rises more above the normal level of the sea than the ebb sinks below it, we think we can assume, as an hypothesis, that the force of the flood-current will be greater than that of the ebb-current." From this he infers that the difference in these forces must produce a constant current in the ocean in the torrid zone from east to west, but, for reasons which do not seem clear, the reverse of this toward the poles ; and in this way, taking into account the deflections of the continents, he accounts for all the ocean currents without the aid of any of the usual causes assigned. In the case of the atmosphere he thinks that the same reasoning must hold, but admits that in this case the alteration of the specific gravity by heat toward the equator may produce some additional and modifying effects. Saying nothing with regard to the steps in the argument, these results are based upon a confessedly doubtful hypothesis, and therefore should not be received without further proof.

This is not a question to be settled by authority, but after the profound investigations of Laplace and Airy upon the tidal forces and the solution of the tidal problem, from which no constant currents around the earth were obtained, we would scarcely expect that such results would be legitimately obtained in a few pages of verbal reasoning without the aid of mathematics. It is true that more recently a very small effect of that kind has been obtained, tending to produce a westward current in all latitudes, from which, by means of friction, the earth's rotation on its axis is supposed to be slightly changed, but this effect is of an order almost infinitely small in comparison with those under consideration, and not at all contemplated in the author's reasoning, referred to above. WM. FERREL.

Washington, D.C., Nov. 7, 1874

Mud Banks on Malabar Coast

THE phenomenon of the "mud banks and of tracts of mud suspended in the sea" on certain parts of the Malabar coast, is not, as you suppose (vol. xi. p. 135), unexplained. The late Capt. Mitchell, curator of the Madras Museum, some years ago submitted a quantity of the mud to microscopic examination, and published the results in the *Madras Journal of Literature and Science* (I have not the work at hand, or I would give you volume and page). He found it to consist almost entirely of Diatomaceæ, of which he detected and distinguished sixty-two species. In the paper in the Madras Journal Capt. Mitchell gives a list of the genera and a numerical list of the specific forms.

The causes that have determined this local development of Diatomaceæ remain for investigation. They appear sometimes to shift their place. Thus, a Dutch navigator (Stavorinus, I believe) described two such banks as existing to the south of Cochin in 1777, but these no longer exist.

Richmond, Surrey HENRY F. BLANFORD

Ring Blackbird

EVERY morning a brown bird (apparently a female blackbird) feeds at my library window. She has a white spot on the breast, and a large white ring, in the exact position of that on a Barbary dove, not meeting under the chin. Is this an unusual variety? I see no mention of such a peculiarity in any of the books at hand, as Lewin, Bewick, Mudie, &c. C. M. INGLEBY

Valentines, Ilford, Jan. 4

*ON THE MORPHOLOGY OF CRYSTALS**

PROFESSOR MASKELYNE, in introducing his subject, said that in the assembly-room of the Chemical Society he should have to treat of Crystallography as the Science of Chemical Morphology. To the chemist the crystallisation of a substance is a familiar marvel ; so familiar, indeed, that he hardly sufficiently considers its importance in relation to his own science. For the physicist, on the other hand, the instinct with which the molecules of a substance obey the laws of a sublime geometry—sublime because simple and universal—is a theme the contemplation of which has guided him to some of the most subtle and almost metaphysical conceptions that he has formed regarding the constitution of matter, and has afforded him invaluable insight into the working of the laws that control the pulsations of heat and light and other manifestations of force. But, although the morphological relations of the crystal are the external expression of the more subtle physical properties which underlie them, he stated that the purpose of the lectures he was about to deliver would be confined to the consideration only of the former.

Placing a large and very perfect crystal of apophyllite from the Ghâts of India on the table, the lecturer pointed out that certain faces carrying peculiar striations were repeated four times ; that again others of a triangular form, planted on the angles of the latter, were repeated eight times, and that these had a lustre of their own ; while again a plane of octagonal form was repeated only once on the top and at the bottom of the crystal, and carried a peculiar roughened surface, which was seen to be made up of innumerable small square pyramids in parallel positions. He further showed that by turning the crystal round about an axis perpendicular to the last planes, the relative situations of the planes, as viewed from any point, came always to be the same at any revolution through a quarter of a circle. A group of faces repeated with similar properties was defined as a *form*, the crystal in question thus exhibiting three forms ; the repeated faces of each form retaining the same general aspect so long as they were not moved round through an angle greater or less than 90°. Then taking crystals of quartz which presented the same *forms*, he pointed out that faces that corresponded to one another on the different crystals, and even on the same crystal, have very different relative magnitudes ; and that, in fact, these magnitudes were controlled by no rigid geometrical law. On the other hand, the angles which measured the inclination of corresponding faces on each other were in every case identical ; hence angular inclination, that is to say, the direction in space, not relative position, that is to say, precise mutual distance, in the faces, has to be recognised as a principle

* Some notes of the Lectures delivered at the Chemical Society's rooms in Burlington House, on the Morphology of Crystals, by Prof. N. S. Maskelyne, F.R.S.