

LETTERS TO THE EDITOR

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[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Tidal Evolution and Geology

It appears to me that the difference of opinion between Mr. George Darwin and his interpreter, Dr. Ball, is very small. Dr. Ball is careful to confine his large tides to the Eozoic rocks, and has not asserted their efficacy in Carboniferous times.

The Laurentian rocks form nearly 19 per cent. of the total known thickness of strata of all ages, and occur at the bottom of all; but we must ascend through nearly 66 per cent. of the total thickness before we reach the lowest bed of the Carboniferous period; and it is plain that Mr. Darwin's large tides may have existed (as Dr. Ball suggests) in the Eozoic period, and have become much smaller before the Carboniferous period began.

The real importance, in my opinion, of a large tide considered as a geological agent, depends upon its rise and fall, and not upon its ebb and flow. The waves of the sea, agitated by the wind, make the ocean surface a vast planing-machine, acting upon the coast-lines; and a great range of tide applies this planing-engine either twice or four times a day to every part of the coast laid bare by the rise and fall of tide. The effects must have been very serious when the day was six or eight hours long.

The claim for priority made on behalf of Kant, by the metaphysicians, must be set aside, as Kant's statement was not based on sound dynamical principles.

SAMUEL HAUGHTON

Trinity College, Dublin, January 17

I WAS much interested in reading Prof. Ball's lecture in NATURE, vol. xxv. p. 79, but failed to understand the following passage on p. 81:—"The reaction of the earth tends to increase that distance, and to force the moon to revolve in an orbit which is continually getting larger and larger." In what sense does the reaction of the earth tend to "drive away" the moon? Will the Royal Astronomer of Ireland, or some other friend of science, be so kind as to add a few words of explanation?

J. R. B.

The Remarkable White Spot on Jupiter

EARLY in the present month this singular object became obscured, so that on January 1 I could scarcely distinguish it at all, and on the 3rd, 5th, and 6th it was noted as extremely faint. The origin of the spot's disappearance was obvious. A dark mass on the north border of the great south belt (and therefore in the same latitude as the white spot) appeared on December 14; it followed the white spot 1h. 4m., according to observations by Mr. A. S. Williams at Brighton. The dark spot moved with more rapidity than the latter, and soon overtook it, so that as the former swept over it, its disappearance was complete. On January 6 the white spot was seen struggling through the south-east limits of the dark patch. On January 7 it had further freed itself, and I saw it much plainer, though it still continued somewhat faint. On January 9 it was bright, and evidently on the point of regaining its normal brilliancy. The dark patch referred to is obviously of the same character as the train of black spots visible on one of the northern belts last winter; they move with even greater velocity than the white spot, and are somewhat evanescent as regards duration. They appear to be excrescences from the surface of Jupiter, and as they near the outer envelopes, are dispersed into longitudinal bands; in fact, it is these dark spots which sustain the decided tone of the belts, for the latter show a disposition to become fainter, until reinforced by the commingling of these dark eruptions.

As to the brilliant white spot, it is an object of notable permanency; and though it failed to come generally under notice until October, 1880, it had probably been a conspicuous marking on Jupiter during the few preceding years. Certainly in 1879 it was very bright, and several times observed by Dr. F. Terby at Louvain, and Mr. J. Gledhill of Mr. Crossley's obser-

vatory, Halifax. I computed back the dates of its conjunctions with the red spot, and found the following nights in 1879-80 when it might have been well observed:—

1879, September 1	1879, November 29
„ October 16	1880, January 13

The date of November 29 is amply confirmed both by Dr. Terby and Mr. Gledhill as follows:—

1879, November 27, 5h. 40m., a brilliant white spot ("Tache brillante et blanche") slightly east of the *f.* end of the red spot. —Terby.

1879, November 29, 6h. 30m., a bright gap into north border of the great south belt. It is situated about a quarter the distance from the middle to the *p.* end of red spot. —Gledhill.

In two days the white spot traverses an extent of longitude equivalent to half the length of the red spot, so that the above observations are quite consistent, and there can be no doubt that they relate to the curious object at present visible. Mr. Gledhill's drawing of November 29 shows the spot to be some twelve hours past conjunction with the red, so that the phenomenon probably occurred on the morning of November 29, which is not far from the computed time. The ensuing conjunction on January 13, 1880, is confirmed by Dr. Terby. On January 11, 6h. 16s., he saw a brilliant white spot occupying the same longitude as the *f.* end of the red, which is exactly the computed place, and there can be little doubt that these white spots are identical with each other and with the white spot of to-day.

Mr. Gledhill's drawings supply other interesting facts. Thus at 6h. 45m. both on November 13 and December 8, 1879, there was a brilliant white spot or gap (in the north side of the great southern belt) about $\frac{1}{4}$ h. past the central meridian. These observations again conform to the positions of the present spot, which in the interval between the two dates mentioned had performed sixty-one rotations. It is curious that at periods of twenty-five days (equal November 13 - December 8 as above) the transits of the white spot recur at very nearly similar times. Mr. Gledhill's observed conjunction of November 29, 1879, compared with my own similar observations on December 24 last year proves that the white spot had completed seventeen revolutions of Jupiter in the 756 days!

If possible it is important to trace still further back the apparitions of the white spot. The special brilliancy of this object and its unique position indenting the north side of the southern belt, could hardly escape notice unless indeed the spot was temporarily obscured, as it sometimes is, when the dark patches sweep over it. This brilliant spot should have been nearly in the same longitude as the red spot on the following dates in the last half of 1878:—

July 29	October 26
September 11	December 10

Can observers furnish any additional links in the previous history of this wonderful object? W. F. DENNING
Ashley down Bristol, January 10

Fossil Insects of the Dakota Group

THERE are till now, as far as I know, no fossil insects out of the Dakota group published. Among a large number of fossils belonging to this group, and collected by Mr. Chas. H. Sternberg, some of the leaves show insect galls and mines, the latter mostly of a decided Tineid and Tortricid character. Perhaps a list of those plants may be of interest. The determination of the plants is by Mr. L. Lesquereux¹:—*Aspidiophyllum trilobatum*, 6 specimens; *Sassafras cretaceum*, 1; *Araliopsis grosse-dentata*, 4; *A. cretaceum*, 2; *A. mirabile*, 4; *A. acutiloba*, 1; *A. Haskenanum*, 1; *Ficus primordialis*, 1. Mr. Sternberg informs me that this is only a partial list of his fossil plants, which were all collected in Central Kansas. Among the plants figured in the Cretaceous flora by Mr. L. Lesquereux (Hayden's "Survey," vol. vi.), I find on the following plants insect-mines or galls:—*Menispermites obtusiloba*, *Greviopsis Heydenii*, *Protophyllum Sternbergii*, *Platanus recurvata* and *Heerii*, *Liquidambar integrifolium*. All from Kansas or Nebraska. Mr. F. B. Meek ("Cretaceous Invertebrata" in Hayden's Rep., vol. ix. p. xlv.) says: "The evidence respecting the exact part of the European Cretaceous series to which the Dakota group belongs

¹ I am informed by Mr. Lesquereux that a large number of *Magnolia* leaves from the Tertiary of Alaska show serpentine trails not larger than a thread running all over the leaves, apparently under the epidermis.