At the close of the Bunter period, elevation took place, in the Midlands certainly, if not generally throughout the country, accompanied by extensive and long-continued denudation: during this interval of time the land appears to have been cut up by subaërial erosion, and its surface furrowed by channels.

On depression again setting in at the commencement of the Keuper period, these hollows appear to have been first filled up by coarse sediments that were drifted along by powerful westerly currents. This will suffice to explain the local development and rapid fluctuations in thickness of the Keuper Basement Beds.

In lithological character the Keuper Basement Beds show marked differences both from the underlying Bunter Sandstones and the overlying Waterstones; though there are beds in the series which strongly resemble one or other of those rocks. *Typically*, however, the texture of the Basement Beds is essentially Keuper-like: the grains of sand, whether coarse as any Bunter or fine as any Keuper sandstone, are mostly angular, clean, and of a flat and elongated or schistose type, while those of the Bunter are of a more globular or granitic type, and generally stained with a coating of ferric oxide; mica too is much more abundant than in most Bunter Sandstones. The quartzites of the Keuper Basement Beds count for less than nothing, as they have all the appearance of having been derived from the waste of the Bunter Pebble Beds.

I quite agree with Mr. Strahan that the Keuper Basement Beds, as defined by him, form a distinct subdivision of the Triassic series, and that whilst the Waterstones graduate up into the Red Marls, and their division therefrom is arbitrary, the Basement Beds are sharply separated from the rest of the Keuper.

In conclusion, I would recommend the retention of the term "Basement Beds" applied to these rocks as more expressive and less open to misinterpretation than that horribly confusing phrase "Lower Keuper Sandstone." E. Wilson.

Nottingham, 5 *Oct.* 1881.

MR. FISHER'S REPLY TO MR. DAY'S CRITICISM.

Sir,—If Mr. Day will consider what I meant by "obliquity of trend," in the trace of a furrow, made by a railway cutting, he will perceive that my assertion is correct, that "no apparent obliquity of trend can be given by a vertical section, *e.g.* by a vertical cliff." I believe that the difference between us arises from our understanding the obliquity to apply to different angles.[1]

To use Mr. Day's illustration of a shadow: let the shadow, made by horizontal rays, of a vertical square, whose sides are vertical and horizontal, fall upon a plane which is not parallel to the plane of the square. So long as the plane which receives the shadow is vertical (which answers to the vertical cliff), the shadow of a vertical edge of the square will be perpendicular to a horizontal line drawn on the plane. But if the plane be inclined to the horizon, the shadow of the vertical edge of the square will no longer be perpendicular to the horizontal line. It is the angle between the shadow of the edge

[1] See Mr. Fisher's article, January, 1881, p. 20.

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and a perpendicular to the horizontal line, which measures the "obliquity of trend," caused, as it will be observed, by the shadow-receiving plane being inclined to the horizon. If the plane be vertical, there will be no such obliquity.

O. Fisher.

RATE OF DENUDATION OF THE LAND BY RIVERS.

Sir,—In a paper published in April, 1853, in the Phil. Mag. I have calculated the mean denudation of the land by rivers and the sea to be equal to three feet in 10,000 years, taken over the whole surface of the land. I further corrected this in 1875, Appendix Geol. Mag. p. 433, *et seq.*, by taking into account the quantity of material not in suspension, viz. sand, etc., pushed out to sea by rivers. I find this equal to twice as much denudation as the material carried out to sea in suspension indicated by a new method.

I omitted this point in 1853, and Mr. James Croll, who followed my method of calculations, has always omitted it also.

This denudation would be nearly ten feet in 10,000 years, or one foot in 1000 years, with the present rainfall. But in the Pluvial period the rainfall would be 300 inches, or about ten times as great as the present. Belgrand afterwards suggested a twenty-fold rainfall.

By my formula of the increase of velocity of water at the same slope, according to increase of quantity, I found the velocity of streams would be enormously increased in the Pluvial period, particularly in the rainy seasons, as the quantity flowing in rivers would be enormous. If the quantity of rain increased eight times, the velocity of the stream would be double; but if the rainfall was very unequal, the mean velocity for the year might be much in excess, say three times the present velocity. In the Pluvial period, if the mean velocity may have been three times the present mean velocity of streams and rivers, Hopkins has shown the power of moving material increases in an enormous ratio with the velocity. If the moving force for removing strata is as the fifth power, and the velocity 3 times, then as 3^5 equals 729, the mean denudation in the Pluvial period would be 729 times the present. This would be equal to a mean removal of 9 inches in the year off the land, and a mean deposit of 3 inches in the sea, raising the sea-level to that extent.

The deltas of all great modern rivers are formed of thin stratified beds containing land plants, and always recent fresh-water shells that can only live in shallow fresh-water, or shells or animals living in estuaries. The surface of these modern deltas is always near the level of the sea at the shore-line, and must have always been so during their formation, as they are all shallow-water deposits. As the sea-level rose during the supposed period of 729 years, the deposits must all that time have exactly kept up with the elevation in order to keep marine deposits away. The depth of these delta deposits is from 500 to 1000 feet, as ascertained by borings.

In 3000 years, with a mean denudation of land of 9 inches a year,