CORRESPONDENCE.

THE "LOWER KEUPER SANDSTONE" OR "BASEMENT BEDS."

SIR,—While cordially agreeing with much that Mr. Strahan has to say on the above subject, I would enter a strong protest against the general line of argument which runs through his paper to the effect that, in the Midland counties, the Basement Beds of the Keuper are more closely connected stratigraphically as well as lithologically with the underlying Bunter sandstone than with the overlying members of the Keuper, and that the most important break in the Triassic series comes at the base, not of the Basement Beds of the Keuper, but of the Waterstones. In the counties of Nottingham, Derby, and Stafford, the Keuper Basement Beds consist of a series of white and red sandstones and conglomerates with irregular interstratifications of red marl; they are very variable in character and thickness, never more than 50 or 60 feet, and often entirely absent. On the east side of Nottingham the Keuper Basement Beds (when present) rest on the Pebble Beds of the Bunter; but four miles west of the town, in Stapleford Hill (where by the way they are locally well developed), and in Catstone Hill, they repose directly on the Lower Mottled Sandstone of the Bunter. Here then we get decisive evidence of an unconformable overlap of the Bunter Pebble Beds by the Keuper Basement Beds, and the removal of at least 200 feet of strata during the interval of time which separated those two groups of rocks.

Mr. Strahan cites the appearances of erosion of the Basement Beds beneath the Waterstones in support of his theory of a great break at that horizon, but denies that erosion of the rocks beneath the Basement Beds is of any value as evidence of a break between the Basement Beds and the Bunter. About three years ago I had the opportunity of examining the junction of the Keuper Basement Beds and Waterstones, at Colwick Wood near Nottingham, for a distance of over a hundred yards. In this section the (irregular) bedding planes of the Basement Beds ran roughly parallel with those of the Waterstones. At the top, though the junction line was quite even, the Basement Beds certainly had the appearance of having suffered denudation before the deposition of the Waterstones. In view however of the abundant evidences of contemporaneous erosion in the Basement Beds, no importance can be attached to these appearances as indicative of any considerable lapse of time between the two series. The Waterstones and the Basement Beds were apparently conformable. This conformability is equally evident in the district of Alton, Staffordshire.

It is true that, in parts of Notts and Derbyshire, the upper members of the Keuper overlap the Keuper Basement Beds and rest on the Bunter and older rocks, but we have good reason for believing that this is simply a *conformable* overlap, for the Waterstones are themselves also partially or wholly cut out by the rising surface of the older underlying rocks.

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.