

developments of limestone bands near Ilfracombe and in West Somerset. It is impossible to fix any definite boundary between them.

Fifthly. The upper beds of the Hangman group are very coarse and siliceous, silvery red-stained shales being sometimes intercalated; the lower beds are generally flaggy and of a grey colour.

Sixthly. The Lynton zone is represented by grits, generally breaking in even tabular layers, schists, schistose grits, and slates, of a uniform warm grey tint.

Seventhly. The Foreland grits are generally fine, flaggy, cream-coloured, dull-grey, brown, reddish or greenish grits, with beds of red grit, sometimes massive; they very seldom contain slates.

Throughout the series conglomerate is conspicuous by its absence. The Drayton and Slade group, if not another name for the olive slates which form the base of the Pilton beds, below the *Cucullæa* zone, has no existence; and if the *Cucullæa* and olive slates are to be regarded as a separate division, the term Marwood used by Prof. Hull is much the most suitable, owing to the presence of the Hangman lower down.

W. A. E. USSHER.

BEAR STREET, BARNSTAPLE, Dec. 1878.

#### THE NORTH DEVON SECTION.

SIR,—Professor Hull, having depended on the writings of others for his knowledge of the North Devon rocks, has obtained the result which usually follows this method of inquiry. His proposed classification looks, no doubt, very well in print, but there are two or three points to which any one knowing the locality must take exception.

At page 531 it is suggested that “it will probably be found on a careful re-survey of North Devon, that the Pickwell Down Sandstones are somewhat unconformable to the underlying beds.” Now, as a matter of fact, so far from this being the case, there is a gradual passage from the slates to the sandstones; first slates alone, then slates with layers of sandstone; next, sandstones with layers of slate, and finally the Pickwell Down Sandstone itself. With regard to a re-survey of this district, it must be remembered that the present map was constructed, not by the Geological Survey, but by De la Beche, working as an amateur; and the only boundary-line shown on it is that separating the Devonian and the Carboniferous. In 1865 I laid down for the first time, on the one-inch scale, the various subdivisions of the North Devon series from personal observations made during the preceding three years. The nomenclature I then published I had occasion to alter shortly afterwards by the substitution of *Cucullæa* zone for Marwood zone,<sup>1</sup> and the adoption of “Pickwell Down Sandstone” for the upper portion of the Morthoe group. Mr. W. A. E. Ussher, F.G.S., of the Geological Survey, who has now been engaged for some months in mapping the river valleys, informs me that, after going carefully over the ground, he has not only adopted these subdivisions, but also the general horizons as shown on my map.

As far as the Drayton and Slade beds are concerned, they have been placed by Professor Hull in a most convenient position in his

<sup>1</sup> For reasons see Quart. Journ. Geol. Soc., vol. xxiii. p. 374.

classification, as passage-beds between the Baggy or Marwood bed and the Pickwell Down Sandstone; though to do this they must be transported bodily at least one mile to the south. I may also notice the misapplication of the term Baggy and Marwood *slates*—this bed consisting principally of sandstone; the thin intercalated beds of olive slates and shale being the exception.

In the Morthoe group I am not aware of any “purplish” slates. Their real colour is a silvery grey. The purplish slates included by Professor Phillips in the then undivided Morthoe group lie *above* the Pickwell Down Sandstone, and form the passage between it and the *Cucullæa* zone.

The suggestion as to the Foreland Sandstone being Upper Silurian must be taken for what it is worth; as with a few most indefinite traces, which may be attributed to organic remains, it is impossible to fall back upon palæontological evidence.

Another objection to Professor Hull’s explanation of the North Devon section is, that he seems to ignore altogether the existence of Upper Devonian fossils. The Ilfracombe group with its limestones undoubtedly belongs to Middle Devonian age, and if both the Pilton beds and the *Cucullæa* zone are transferred to the Lower Carboniferous, he leaves no fossiliferous bed whatsoever of Upper Devonian age; but has evidently trusted that “Drayton and Slade” might serve to fill up the gap, or that an unconformity might exist at the base of Pickwell Down to account for it.

PILTON, BARNSTAPLE, Dec. 16, 1878.

TOWNSHEND M. HALL.

#### MIOCENE FLORA IN ARCTIC REGIONS.

SIR,—Voluminous and elaborate writings have issued from the press, in almost every possible form, to account for the existence of a Miocene flora in Arctic regions, without, I need scarcely say, any satisfactory result. I venture in a few lines to suggest an element of change, or rather a new application of one, which seems to have escaped notice. It consists in the transfer of water by the Gulf Stream from Equatorial to Polar Regions. This is incessantly in progress, and it would be difficult to ascertain the immensity of the volume of water which is thus transferred, simply through the agency of the sun. It would be equally difficult to ascertain the enormous quantity of ice which is amassed annually by the congelation of this water. It is the fact of its being so warmed which leads to its being conveyed nearer to the North Pole than it could be under other known causes, but the point must be reached when its fluidity, in great part at least, must cease.

Now, it appears to me, that, owing to this cause, there must be such an accumulation of ice as would tend, if the pressure were equally circumpolar, to depress the Equator; and, if it were lateral, as under circumstances it must be, to produce an obliquity of poles, in proportion to the bulk of the ice and its nearness to the Pole. With reference to this obliquity, I might merely add Q. E. D., and submit the problem to the public in the naked simplicity of truth, reserving to myself the privilege of defence or explanation as occasion may