it is, or used to be, transported for long distances. It is somewhat similar to the Redscar Grit of Wolfry Crags, but is quite unlike the general character of this bed.

It is noteworthy that I found near the base of the Redscar Grit in Gateup, bands of calcareous sandstone. Similar bands, as I am informed by Mr. J. G. Goodchild, generally occur under the rock which in Wensleydale was identified on purely stratigraphical grounds with the Redscar Grit.

This grit is the 'middle grit' of the late Professor Phillips mentioned on p. 65 of his "Geology of the Mountain Limestone District," and he is quite correct in saying that it corresponds in position with the top grit of Penhill.

NOTICES OF MEMOIRS, ETC.

ON THE EVOLUTION OF THE PROBOSCIDEA. By C. W. ANDREWS, D.Sc., F.G.S., F.Z.S., of the Geological Department, British Museum (Natural History).[1]

UNTIL the author's recent discoveries of primitive Proboscidea in the Middle and Upper Eocene formations of the Fayum, Egypt, the oldest known members of this mammalian order were *Dinotherium Cuvieri* and *Tetrabelodon angustidens*, from the base of the Miocene in France. The new Egyptian fossils not only reveal for the first time the early history of the order, but also provide more satisfactory material for the discussion of its evolution than has hitherto been available.

The most important changes in the Proboscidea occur in the skull, mandible, and dentition.

Owing to the increase in the size of the tusks and to the presence of the proboscis, the facial region of the skull becomes shortened, and at the same time the premaxillæ become wider. The presence of the proboscis also accounts for the position of the external nares. The demand for a greater surface of attachment for the muscles supporting a skull rendered heavy by the tusks and trunk, is met by the great development of the diploë in certain of the cranial bones, resulting in the enormous expansion of the forwardly sloping occipital surface. The maxillæ become greatly enlarged concomitantly with the increase in the size and degree of hypselodonty of the molars. At the same time the zygomatic arch becomes weaker and the jugal takes a smaller share in its composition.

The mandible is at first short and stout, with a massive symphysis. Afterwards it becomes more and more elongated as the stature of the animals increases; and this elongation is for the most part effected by the lengthening of the symphysial region, though the backward rotation of the ascending ramus tends to the same end. The prolongation of the mandible beyond the premaxillæ must have been covered by a proboscis-like structure composed of the upper lip and nose, probably more or less prehensile at its extremity.

[1] Abstract of a paper read before the Royal Society of London, March 26th, 1903; communicated by Professor E. Ray Lankester, F.R.S.

The lengthening of the mandible seems to have reached its maximum degree in the Middle Miocene, after which it again became shortened by the reduction of the symphysis, while the fleshy and now mobile proboscis was left behind as the sole organ of prehension.

In the upper dentition the chief changes are the loss of incisors Nos. 1 and 3, and the great increase in size of incisor No. 2, which eventually forms the great tusk characteristic of the later Proboscidea. The canines are soon lost. In the earliest forms, some at least of the cheek-teeth (milk-molars) are replaced by premolars in the usual manner, and these teeth remain in wear simultaneously with the true molars; but in later forms no vertical succession takes place, and as the milk-molars are worn they are shed, being replaced from behind by the forward movement of the molars. Of these also the anterior may be shed, until at length in old individuals of the later types the last molar is alone functional. The gradual increase in the complexity of the proboscidean molars is one of their most striking characteristics. All stages can be traced between the simple, brachyodont, bilophodont (quadritubercular) molars of *Mæritherium* (Middle Eocene) to the extraordinarily complex type of tooth found in *Elephas*. Thus in *Palæomastodon* (Upper Eocene) the molars are trilophodont, and the same is true of the first and second molars of *Tetrabelodon* (Miocene), in which, however, the last molar is complicated by the addition of further transverse crests. In the Stegodonts of the Siwalik Hills (Pliocene) a further increase in the number and height of the crests takes place, and the whole crown of the tooth is more or less covered with a thick coat of cement. Still later, the transverse crests become highly compressed laminæ united by cement, and these are as many as twenty-seven in number in the Pleistocene *Elephas primigenius* and the recent *E. indicus*.

The evolution of the lower molars corresponds with that of the upper molars. Of the lower incisors the middle and outer pairs (Nos. 1 and 3) are soon lost, but the second pair remains functional for a long geological period. When the symphysis becomes shortened, these incisors are sometimes retained as vestiges (e.g. in *Mastodon americanus*), but in the genus *Elephas* they have completely disappeared.

REVIEWS.

I.—Chart of Fossil Shells found in connection with the Seams of Coal and Ironstone of North Staffordshire. By Wheelton Hind, M.D., F.R.C.S., F.G.S., and John Stobbs, F.G.S. (Published by the North Staffordshire Institute of Mining and Mechanical Engineers, 1903. Price 5*s*.)

IT is an acknowledged fact that, compared with many other commercially less important geological formations, very little is known about the distribution of the fossils among the Coal-measures. In this respect the North Staffordshire Coalfield has been more carefully searched than others, though outside the