

the highly disturbed Permian epoch, the succession of a warmer period, and then the return to cold in the Glacial epoch, when we know that mountains were elevated to an extraordinary height and extent, appear to me to tell a very consistent story of this part of the history of our earth.

No sooner was the north of Europe, and the land which masked this country, depressed and submerged, than icebergs and field-ice were borne down, and covered parts of this country, of which we see such interesting evidences in the Eastern Counties.

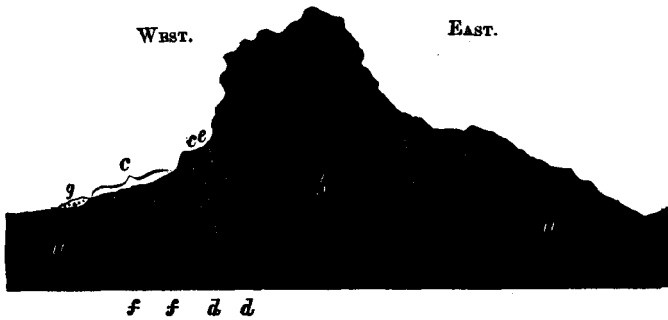
In conclusion, I will add a few remarks on the distribution of Proboscideans, which bear upon the subject. It has been a question whether the *Elephas primigenius* has ever been obtained from the forest bed. Certainly its constant companion, the *Rhinoceros tichorhinus*, has not. The result of my own observation is that an elephant resembling the *Elephas primigenius*, in point of number of the laminae of the teeth, is found not only in the forest bed, but in the Norwichee crag. This has been regarded by Dr. Falconer as a type of *Elephas primigenius*, the true *Elephas primigenius* having been a Post-glacial importation, together with the *Rhinoceros tichorhinus* and the reindeer. They could pass into France and this country, and live there long after some of their race had been entombed in the ice of Siberia. That they migrated from the north of Europe, driven by the cold, which their hairy and woolly coats could not enable them to bear, is, I think, correct. That the *Mastodon Arvernensis*, *Elephas meridionalis*, *E. antiquus*, *E. priacus*, and others, migrated from the south-west with the *Rhinoceros Etruscus*, and that their remains were also carried into the estuarine deposit of the Forest bed by a river flowing in the direction of the Rhine from the south-west, are statements which are based upon long observation and experience.

NOTICES OF MEMOIRS.

I.—ON BITUMINOUS STRATA OF GNEISS AND MICA SCHIST IN THE PROVINCE OF WERMLAND (in the West of Sweden). By L. J. IGELSTRÖM.

IN the north-western district of Wermland, M. Igelström has discovered a hill consisting, in its central part, of hyperite, the rest chiefly of common reddish granitoid gneiss. Beneath the central hyperite and above the fundamental gneiss, there is a mass, twenty Swedish fathoms in thickness, consisting of bituminous strata of gneiss and mica schist. The bituminous matter is distributed everywhere throughout the whole mass of these strata, so as to be present even in the smallest fragment and thence giving them a black colour closely resembling gunpowder. When M. Igelström heated some fragments in a retort of iron, there were formed combustible hydro-carbons as gases, to the amount of nine per cent., and a combustible oil, as well as a non-combustible, colourless oil were collected in the receiver of the heating-apparatus. This interesting

discovery of bituminous matter in rocks that, perhaps, are to be considered as Laurentian, strengthens the views put forth by so many able authors as to the "non-azoic" nature of these rocks, and it is especially worthy attention that, so far as we are aware, bituminous matter is nowhere else found in such old rocks and in such abundance as to thoroughly penetrate them and to become an integral part of them. What we did hitherto know was the presence of graphite in the Laurentian rocks.¹



Section of "Nullaberg" in Wermland.

EXPLANATION OF SECTION.

a. Common reddish granitoid gneiss. *b.* Hyperite. *c.* A thick layer of bituminous gneiss and bituminous mica schist together. *d.* Thin strata of bituminous mica schist, from one to one and a half Swedish yard in thickness. *ce.* Fine grained gneiss or mica schist. *f.* Black, thin, bituminous strata with silvery scales of mica. *g.* Drift, gravel, etc.

G. L.

II.—THE OTOLITES OF FISH. By E. T. HIGGINS, M.R.C.S. Journal of the Linnean Society. Vol. IX. No. 35, January 30, 1867.

THE object of this paper is to show that the otolites of fish have a certain distinctive value in determining the genera and species to which they belong, and that the close study of them in the recent forms will enable the ichthyologist to confirm or disprove the specific relationship of recent individuals, and to determine the affinity of the fossil species.

The author gives a description of the auditory apparatus in fish, comparing it with that of other members of the animal kingdom. The otolites of osseous fish may be said to be three in number on each side, as the exceptions to the rule are very rare; of these three, however, but one—the central or largest—is of scientific interest, the other two in the majority of fish being so small as to be with difficulty found, and, when found, to be of very little use for the purpose of identification. The author states that although he has examined many thousands of fossil otolites he has not yet met with a single specimen that could be referred to either of these smaller bones.

Mr. Higgins does not agree that the shape of the groove on the under surface of the central otolite is absolutely necessary for the

¹ See Geol. Mag., Vol. I, page 202. Dr. J. Bigsby, On the Laurentian Formation.

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identification of a species, as has been asserted; he admits that there is a very great difference in its shape amongst genera, but in closely allied species it is so similar as to be almost identical, and not to be depended upon. In his opinion, identity of outline is the only certain character; in by far the largest number of fossil otolites the convex under surface is more or less bouldered, and consequently the shape of the groove altered, so that, were this essential for identification, but few species could be recognised. The concavity of the upper surface being better preserved, the task is rendered comparatively easy, and but little skill is necessary in dividing them into species. The author remarks that in all fishes differing from one another to that degree as to entitle them to rank as distinct species, he has found the otolites in each case to be distinct and well marked. This, he adds, is perhaps more than can be said of either teeth or scales, and it is a generalization of the highest interest in connexion with palæontological researches, as otolites are often met with in Tertiary deposits, when no other vestige of the fish to which they belonged has been preserved.

REVIEWS.

I.—ON THE PHYSICAL GEOGRAPHY AND GEOLOGY OF THE COUNTY OF LEICESTER. By D. T. ANSTED, M.A., F.R.S., &c. (Nichols and Sons).

THOUGH a large part of the county of Leicester presents nothing very striking either in its geology or physical features, the north-western portion offers a fine field to all interested in geological studies. It is valuable as showing within a very small area a remarkable variety of rocks, while both in the pure and the applied branches of the science, there are some knotty problems yet unsolved.

The district has naturally had a fair amount of attention already paid to it. In the "Annals of Philosophy" for Jan. 1824, is a paper by Messrs. W. Phillips and S. L. Kent, on the mineralogy of the crystalline rocks of Charnwood Forest, and the rocks of Enderby and Croft are noticed by the Rev. T. Yates (vol. ii. 2nd series, Trans. Geol. Soc., p. 263). In 1836, Mr. Mammatt published his "Collection of Geological Facts intended to elucidate the formation of the Ashby Coal-field." This, as the title points out, was intended mainly as a record of observed facts; but the clear way in which these are stated, and the few generalizations attempted to be drawn from them, shew the author to have been no common man, and, considering the state of the science at the time of publication, are deserving of the highest praise. In 1842, Mr. Jukes published in Potter's History of Charnwood Forest, an account of the geology of that district and its immediate neighbourhood. This little tract has always seemed to us a model of clear geological description, and is unmistakeably the result of painstaking labour in the field, and not a mere compilation from books. The author of the work now before us has thought fit to make some disparaging remarks on its description