beds have thinned away before they reach Flintshire," and that I had reached the limestone proper, but as I descended the section passing various sandstones interstratified with the limestones, and finally found the mass of white and red sandstones at its base, resting upon what appears to be the main body of the Carboniferous limestone, my impression was altered, and the conclusion which, after much careful deliberation, I have arrived at is this; that in the southern half of their course, the whole of the beds between the Carboniferous Limestone and the Coal Measures do, on the North Wales Border, most nearly resemble the division of rocks elsewhere known as the Millstone Grit, but that in their northern portion, from the base of the white beds at the top of the Mold section, they have greater affinity with those described as the Yoredale series, with rather more of a calcareous element in their composition than the latter usually possess. I would therefore venture to suggest whether the time has not come when the *whole* of the beds lying between the Great Scar Limestone, and the Coal Measures, varying as they do in different localities, presenting many features in common, passing rapidly, as we have seen, in what I have called the North Wales district, from sandstone to limestone, and contrariwise, ought not to be united into one great group, with subdivisions according to locality and condition.

NOTICES OF MEMOIRS.

I.—The Great Boulder Drifts of North America.

AN Article on the "Relations and Characters of Western Boulder Drift," by E. Andrews, M.D., appeared in *Silliman's American Journal* for September last, of which the following is a brief abstract:—

The original Boulder-clay is beyond all question a stratified water-deposit. More than 2,000 miles of it have been exposed by waves along the shores of the great lakes, and along more than fifty railroads which have cut the hills in every direction. The meaning of the facts cannot be mistaken, and the western geologists most familiar with the sections *have been obliged to abandon the glacier theory*, and to admit the aqueous origin of the Boulder-clay under a sea floating vast quantities of ice. The original Boulder-clay is not only clearly stratified and cross-stratified, but marked by a peculiar style of undulation, and by the frequent occurrence of circular and oval valleys without any outlet. The most remarkable facts are those indicating the energy of the water during its deposition. As first observed by Professor Jewell, of Chicago, in a long tunnel, it contains two kinds of erratics, rocks and gravel-boulders, the latter sometimes three feet in diameter. The gravel must have been dropt from floating ice in frozen masses, and covered up before the masses had time to melt. The clay therefore must have been deposited with "unaccountable rapidity."

In Wisconsin, a remarkable valley, 400 miles long, runs mainly

from north-east to south-west, with a gentle slope on the north-west side and a very precipitous slope on the south-east. A broad Silurian ridge, which separates this valley from Michigan, is covered by a thick, coarse, stratified, water-worn gravel, which, at a distance of twenty miles south-east, shades off into the Boulder-clay of Illinois. The central part of this gravel deposit rises up into hills 800 feet above the level of Lake Michigan. The hills are often sharp and conical, and interspersed with deep circular valleys without outlets, called the Potash Kettles. The gravel runs south-west about 200 miles, and is over 20 miles in width. In the northern part it is coarse, with rounded stones up to more than a foot in diameter, and yet thrown up into steep, round, lofty hills; but southwards the material becomes finer, and the hills lower, until they shade off into the Illinois Prairies. On the north-west side of the valley no gravel exists. The drift must have come from the north in *a vast sweep of water deep enough to cover gravel hills* 800 *feet high, and with a velocity sufficient to throw coarse material up into steep hills.* The uninterrupted sweep of the water down the gradual slope of the valley allowed no great deposits; but the current striking the opposite precipice must have been partly obstructed so as to throw it into extraordinary and irregular commotion, here piling up lofty gravel hills, and there leaving deep hollows, as it swept across the broad ridge. The finer matter must have been carried south, so as to settle as clay, and this accounts for the masses of frozen gravel dropped by icebergs into the clay, and covered up before the masses melted. A similar gravel-range flanks the south-west border of the valley of the Georgian Bay, Lake Huron.

The gravel hills, and nearly all the drifts of this region, are covered with a thin stratum of orange-coloured loam, from a few inches to several feet thick,[1] which follows all the undulations, excepting valleys of erosion. It is free from boulders, and must have been deposited in a quiet sea after the boulders ceased to arrive.

Near the north source of the Western Drift the violence of the aqueous action is evident. There is little or no drift on the north slope of the Laurentian Hills. The whole country has been scratched and pounded by the drift action, but the loose material has nearly all been swept southwards. "Not even boulders could keep their footing" in the current. The only exceptions to the sweeping action are where abrupt declivities fronted the north so as to oppose the current. There the finer matter is gone, but the boulders are piled up in vast slopes, with their surfaces rammed together like a pavement. Everywhere else there is smooth rock, only covered with a little vegetable soil. Hundreds of miles of smooth rock run along the northern slope of the Laurentian Hills. Facts testify to the drift action for a thousand miles east and west along the Laurentian Crest, and for an unknown distance north, having been too violent to admit of deposition. South of the Crest the water was less violent, and deposition commenced.

[1] I have noticed a similar stratum of loam covering the drifts of Yorkshire and elsewhere.—D. M.

Dr. Andrews believes that the waters suddenly retired after the deposition of the orange loam, as, from the uplands of Wisconsin to the Ohio River, over a descent of more than 1,300 feet, no shingle-beach has been found. "It is possible," he continues, "that this sudden retirement, and the constant rush of waters, was the cause of the valleys of our streams being excavated to such an enormous breadth, compared with the feeble brooks that now meander through them."—D. M.

II.—New British Fossil Bird.—"On the Cranium of a Gigantic Bird (*Dasornis londinensis*, Owen), from the London clay of Sheppey, Kent." Under the above heading, Professor Owen has described and figured[1] the cranium of a large bird, which is interesting, not only on account of the rare occurrence of Ornithic remains in the British Lower Tertiary deposits, but also from combining certain characters of form and proportion with the large extinct birds of New Zealand, and also with the existing Struthionidæ. Like them, the Professor considers it to have been terrestrial in its habits. That it was of huge size is evidenced by the cranium, which is as large as that of the *Dinornis giganteus*, Owen, with which, and other species of Dinornithic and Struthionoid skulls it has been elaborately compared. Prof. Owen, in referring to the discovery of the large limb-bones (femur, tibia, and a portion of a fibula) of *Gastornis Parisiensis*, Heb., in the Plastic clay at Meudon, near Paris, thinks that it, like *Dinornis*, will "prove to be tridactyle and terrestrial," and that it is possible that this portion of skull may ultimately be found to belong to the same genus as the Parisian bird. The cranium of *Dasornis* is in the British Museum.—The same part of the Transactions contains two papers by Prof. Owen, in continuation of his many valuable contributions on the osteology of the extinct Birds of New Zealand —one on the sternum, the other on the cranium, of several species of *Dinornis*—both papers being illustrated with several plates.—W.D.

REPORTS AND PROCEEDINGS.

Geological Society of London.—January 26th, 1870.—Prof. Huxley, LL.D., F.R.S., President, in the Chair.—The following communication was read:—"On the Crag of Norfolk and associated Beds." By Joseph Prestwich, Esq., F.R.S., F.G.S. The author commenced by referring to his last paper, in which he divided the Red Crag into two divisions—a lower one, of variable oblique bedded strata, and an upper one, of sands passing up into the clay known as the Chillesford clay. In 1849 he had alluded to the possibility of this clay being synchronous with the Norwich Crag. He has since traced this upper or Chillesford division of the Red Crag northwards, with a view to determine its relation to the Norwich Crag. He has found it at various places inland, but the best exhibition of it occurs in the Easton Bavant Cliffs. He there found in it a group of shells

[1] Transactions of the Zoological Society of London, vol. vii., pt. 2, p. 145.