ON THE SEQUENCE OF THE PERMIAN ROCKS NEAR RIPON. BY
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THERE is considerable difficulty in determining with certainty the bottom beds of the Permian Rocks, near Ripon. Some beds, indeed, are seen to rest unconformably upon the Plumpton Rocks, as in Studley grounds beneath the 'Surprise,' near the Abbey, and at Knaresbro'. But these seem to me not to be actually the lowest beds of all, though, of course, they are the lowest in those places. Other beds occur as at Nordhouse, in Aldfield, and Well; which cannot be assigned to any position among the rocks which appear in these three places, or in the rocks above them, and must, therefore, have an horizon below. The Carboniferous Rocks had suffered immense denudation before the Permian period. If the Coal Measures ever existed in this neighbourhood (which I doubt), they had all been washed away, and much of the underlying millstone grit. If they did not exist, then the grit must have been exposed during the whole period of the Coal Measures to aerial denudation, and the consequence must have been the formation of considerable river-valleys, into which, as the land was sinking during the Permian period the sea flowed, and the earliest deposits would naturally be made in these ancient valleys. In lithological character also, as well as in the manner in which the fossils are preserved, the beds at Aldfield and Well, differ from the rest of the Permian series. At Well, the fossils seem chiefly to consist of *Producta horrida*; at Aldfield I have found more than twenty different kinds, most of which occurred in a very thin band of clay, which has now been exhausted by the extension of the limestone workings.

The bed which seems to lie above this consists of small slabs of yellowish limestone containing *Axius obscurus*, very similar to the Garforth limestone, near Leeds.* It occurs in the Studley ground beneath the "Surprise"; and at Hob Green, in Markington. It is difficult to determine the actual thickness of these two beds, but they certainly cannot together be less than 50 or 60 feet.

Above them is another bed, well exposed in Markington, of at

* At Garforth, the Limestone lies upon a bed of sand, which seems to have been derived from the Carboniferous rocks, and is probably a passage bed of Permian age.

least 50 feet in thickness, of a peculiar character. The surface of each layer is irregularly covered with small lumps or bosses, as if the Permian sea had been subjected to a set of various cross currents, which disturbed the natural process of horizontal stratification. It is a somewhat dark, yellowish, unfossiliferous limestone, full of the sparry cavities so characteristic of the Magnesian limestone. To this bed succeed others of solid limestone, which form the main deposits of the district, and are probably about 275 feet in thickness : they are quarried at Wormald Green, Markenfield, Quarry Moor, and in many other places. In some of its lower beds this limestone is a good building stone, of an agreeable creamy-white colour ; but more suitable for interior than exterior work. Fossils are occasionally found, as in two layers in an old quarry near Wormald Green. Old weathered stones also occasionally exhibit the presence of fossils, though they can seldom be separated from the matrix. In the upper beds in a quarry a short distance west of Markenfield Hall, there are many casts of fossils. Here the limestone is of a darker colour, and not so pure.

In the quarry belonging to Markenfield Hall, the limestone presents in its structure a close resemblance to the limestone at Ryhope, in the county of Durham, and in an old wall near the Hall I have found a portion of limestone of the same hard semi-crystallized form as that of Tunstall Hill, but have never discovered the bed from which it was taken. We may, therefore, assign the Markenfield beds to the same horizon as the Ryhope Limestone. Belonging to the main limestone there is a bed which is perfectly oolitic in an old quarry in Whitcliffe Lane. At Nidd Rock an oolitic limestone has disintegrated into a kind of gravel of small rounded grains, but larger than those in Whitcliffe Lane.

The whole of these rocks seem to have been deposited in a shallow sea ; for at Wormald Green the clay-partings are strongly ripple-marked, and many layers, when weather-worn, exhibit marks of false-bedding. Above the main limestone I am inclined to place the beds of Gypsum, which occur north of Ripon. They consist of layers of Gypsum and a red sandy clay which have been violently contorted, and they are about 40 feet in thickness. They are over-

laid by the horizontal beds of the Upper Magnesian Limestone. As far as I have been able to discover, the whole series has only been slightly dislocated. At Nordhouse, there are two parallel faults running N. and S., throwing down the strata about a yard. At Monkton Mains Quarry there is another small east and west fault, and a third at Quarry Moor. The strata are occasionally bent, as at Quarry Moor and Wormald Green. There is a fault, however, running east and west from Fountains Abbey, and passing a little to the south of the "Surprise," which seems to have thrown down the Magnesian Limestone considerably to the north. At Wormald Green, when the drift is removed, the surface of the limestone exhibits evident marks of denudation,—it is sometimes worn into "pot-holes," sometimes into rounded and smoothed bosses. But I have not seen anywhere traces of glacial striations, except in a few Magnesian limestone boulders picked out of the drift.

SOME INDICATIONS OF A RAISED BEACH AT REDCAR. BY
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AT Warrenby, a new village near Coatham, there is a bed of sandy clay, containing many shells of *Rissoa ulva*, with broken mussel and cockle shells, &c., and the vertebræ of fishes. Sections were obtained when the foundations were made for the houses, showing a horizontal structure. Here the surface of the land is about 14 feet above high water mark. It would appear that these shell beds were the estuary deposits of the Tees, and that the coast has been raised probably 20 or 25 feet since they were deposited. On the east side of Redcar the Boulder-clay is about 6 feet above the high water mark, and only rises at a very small angle to the east. The upper portion is black, sandy, and peaty, passing insensibly into the browner clay below. This again seems to indicate the former existence of a lower level. These indications of a raised beach are, however, not absolutely conclusive evidence, but I think it is worth while to draw the attention of Geologists to them.