the Carboniferous Limestone Series of Scotland represents both the Yoredale Rocks and the Mountain Limestone of England, and that the Calcareous Sandstone is older than the Mountain Limestone. The newer reading, that the Scottish Limestone Series is the equivalent of the Yoredale Beds, and the Calcareous Sandstone of the Mountain Limestone, is a nearer approximation to the truth, but is still far from being correct, especially as it has been shown that the greater part of the Scottish Carboniferous Limestone Series, including the upper limestones and the whole of the Edge Coal Series, lies above the position of the Yoredale Beds of Phillips.

III.—THE SOLENT RIVER.

By the late Sir JOSEPH PRESTWICH, M.A., D.C.L., F.R.S.

(Communicated by Lady Prestwich.)

[The idea of a great river flowing through the Solent before the Isle of Wight was separated from Dorsetshire, was very clearly stated in 1862 by the Rev. W. Fox, who for many years was Curate of Brixton, in the Isle of Wight (*Geologist*, vol. v, p. 452). The subject was further dealt with two years later by Sir John Evans (*Quart. Journ. Geol. Soc.*, vol. xx, p. 189), and subsequently by Mr. T. Codrington (*ibid.*, vol. xxvi, pp. 541, 544). Sir John Evans has since entered more fully into the subject ("Ancient Stone Implements, etc., of Great Britain," and *Nature*, vol. xxvi, p. 532); and it was briefly discussed by Sir J. Prestwich in his paper on "The Raised Beaches and 'Head' or Rubble-drift of the South of England: their Relation to the Valley Drifts and to the Glacial Period; and on a late Post-Glacial Submergence" (*Quart. Journ. Geol. Soc.*, vol. xlviii, p. 274).

The following article was marked by Sir J. Prestwich as "part of Submergence paper as first written but reserved for a separate paper."—H. B. W.]

AT Portsea Island a change takes place in the character of the drift, the 5 to 6 feet of gravelly clay forming the "Head" on the Old Beach to the east, being replaced on the same level by a bed of gravel, which, according to Mr. T. Codrington, attains a thickness of 27 feet, and still contains some boulders similar to those of Hayling Island, together with blocks of sarsenstone. To the west of Gosport the ground rises and the low cliffs of Stubbington and Hill Head are capped by 10 to 15 feet of gravel of a somewhat different character. No foreign boulders are to be seen in it, though I have found pebbles of quartzite derived apparently from the Triassic strata of Devonshire, as also some small subangular fragments of granite and other old rocks, large blocks of Tertiary Sandstone, and a few worn fragments of a fresh-water limestone¹ containing small *Lymnaea*. There are no shells either fluviatile or marine, and no beach underlies the gravel which rests directly on the Tertiary strata. It is intercalated with seams of sand and loam

¹ Derived from the opposite coast of the Isle of Wight.

roughly bedded, and contains flint implements.¹ It is evident, therefore, that we have here some important changes in physical conditions, and that a considerable alteration in the characters of the drift-beds likewise commences. This has led to the belief that the gravel on the coast from this point to Bournemouth and Poole is the Alluvium of an old river, which, before the removal of the Chalk ridge that extended across the bay of Christchurch, blocked the rivers flowing southward, and diverted them into a main stream flowing eastward, passing along the line of the present Solent and debouching in the area now occupied by Spithead.

I cannot agree in this view, as it is wanting in proof, though as the subject is a complicated one, and would take too much time to discuss at length, I will merely touch upon some of the objections which occur to me. No one can doubt that the Chalk range of the Isle of Wight was once continuous to the Dorset Coast in the Isle of Purbeck, but it does not follow that it formed an impassable barrier by which the drainage of the Frome, the Trent, the Stour, Avon, and other rivers was stayed and made confluent, giving rise to the "Ancient river Solent."

There is no reason why these separate rivers should not have held on their southern course and passed through the barrier as the rivers on the Sussex coast do at the present day. To prove the contrary, it must be shown that the gravel-beds in question are of fluvial origin, and that they contain the débris of rocks through which the supposed river and its tributaries flowed, also that the levels are such as would accord with the gradients of a river of that character. An able exponent of the hypothesis admits that it is hard to distinguish between the presumed fluvial gravels and the older probably marine gravels.² First, as none of these gravels contain either fresh-water or marine shells, the difficulty is easily understood.³ By itself this would not be a strong objection, as we all know how frequently such organisms have been removed by the percolation of the surface-waters, but taken in conjunction with others, it cannot be neglected. Secondly, the débris forming the gravel consists almost entirely of materials derived from the high Chalk plateau to the north of the coast-line. Thirdly, there is no maintained fall of the gravel from west to east. The section given by Mr. Codrington⁴ along the coast for a distance of 10 miles between Poole and Barton shows the following surface-heights:—West—126, 125, 117, 115, 121, 110, 120, 114, 117, 98, 126, and 114 feet—East; and so on to 95 feet near Lymington. East of Lymington a lower plateau commences, the level of which continues at heights varying from 35 to 40 feet to Hill Head and Stubbington. So much for the surface-levels. Taking the levels at the base of the gravel, the

¹ Evans, *Quart. Journ. Geol. Soc.*, vol. xx, p. 188.

² Evans, "Ancient Stone Implements," 1872, p. 609. [See also ed. 2, 1897, pp. 688-696; also "Geology of Isle of Wight," ed. 2, p. 249. *Geol. Survey*; and C. Reid, "Geology of Bournemouth," 1898, pp. 10, 11, *Geol. Survey*.]

³ The only fossil I have found in these gravels is a small indeterminable fragment of bone in a pit near Poole Station.

⁴ *Quart. Journ. Geol. Soc.*, vol. xxvi, pl. xxxvii, fig. 2.

result is very similar. The top of the Eocene strata near Bournemouth is from 90 to 115 feet above the sea-level. It is about the same at High Cliff and Barton, and but little less near Lymington.

It is the same with the lower plateau, in which the surface of the Tertiary strata remains on a nearly uniform height above the sea-level for a distance of about 18 miles. Surely it is impossible to suppose that these levels can represent the gradients of a channel such as the supposed river must have had.

From Poole to Lymington, a distance of 20 miles, the gravel is nearly a dead level, and for the whole 35 miles to Stubbington there could only have been a fall of 60 to 70 feet. With these gradients, the transport of such a mass of débris as constitutes the gravel-beds would have been an impossibility; and equally unlikely would have been the sudden ending of the mass at Stubbington, and the escape of Hayling Island from the flood of this supposed river-gravel drift. Nor is the wear of the gravel as it must have been, had it been subjected to this long transport. In fact, there is no difference in the wear between the gravel in the neighbourhood of Bournemouth and that around Lymington—a condition equally inconsistent with the primary assumption.

It is, I think, more probable that the gravels on the Bournemouth and Barton coast represent a vast "head" derived from the high-level gravels further inland, for, like the latter, these coast gravels contain a considerable proportion of chert, ragstone, and ironstone fragments, derived originally from the Lower Greensand, and introduced thus indirectly into these lower-level gravels.

IV.—FURTHER INVESTIGATIONS REGARDING THE SUBMERGED TERRACES AND RIVER VALLEYS BORDERING THE BRITISH ISLES.¹

By Professor EDWARD HULL, LL.D., F.R.S., F.G.S.

I. *Introductory*.—The researches of previous investigators have had the result of showing that the platform on which are planted the British Isles and adjoining parts of the European continent was formerly connected by land with Iceland through the Shetland and Faerøe Islands, and this again with Greenland. This former connection is placed beyond doubt by the character of the fauna and flora. Dr. Wallace includes Iceland in his Palearctic region, which embraces the British Isles and Europe;² and, as Professor Newton has shown, all the land mammalia, with only three exceptions, are European. The exceptions are those of Arctic habitats—the polar bear, the Arctic fox, and a mouse (*Mus Islandicus*). Amongst the birds, the peculiar species are allied to those of Europe and the Faerøes. The botany and entomology of Iceland have been described in the Transactions of this Institute by the Rev. Dr. Walker, F.L.S.,³ and his observations bear witness to the former

¹ Read before the Victoria Institute, May 2nd, 1898. Published by permission of the Council of the Victoria Institute. The full paper, with map, will appear in the forthcoming volume of the Transactions for 1897-98.—E. H.

² "Geographical Distribution of Animals."

³ Trans. Vict. Inst., vol. xxiv, p. 205.