some possible moraines, of the second glacial period, or the times next preceding and following it? Surely there ought to be such if the land has not been submerged since.

I would take this opportunity of correcting an error of the press in my previous paper. In the diagrams, p. 83, for "Account of the Isle of Man," read "Antiquity of Man;" also, for Turby read Jurby, pp. 84 and 85.

In reply to Mr. Kinahan's letter in the April Number of the GEOLOGICAL MAGAZINE, I may be allowed to say that he seems to assume that I had seen the deposits to which he refers, and had been writing from personal observation. In this he is mistaken, as I have never been in Ireland. In alluding to the order of the Irish glacial series, I relied solely on the authority of Professor Hull's paper.[1]

Mr. Kinahan dissents: and says that an Upper Glacial Drift (Boulder-clay) has not been proved to exist in Ireland; but it is clear that he says so on the ground of a different definition of Glacial Drift, implied if not expressed, according to which it is never found stratified or rearranged:[2] whereas according to the views expressed in the paper above referred to, being "generally marine,"[3] it would naturally often occur under both conditions.

NOTICES OF MEMOIRS.

I.—ON THE ORIGIN OF THE CHESIL BANK, AND ON THE RELATION OF THE EXISTING BEACHES TO PAST GEOLOGICAL CHANGES, INDEPENDENT OF THE PRESENT COAST ACTION.[4]

By Professor JOSEPH PRESTWICH, M.A., F.R.S., V.P.G.S., Assoc. Inst. C.E.

THIS remarkable bank of pebbles, extending from Portland to Abbotsbury, a distance of nearly 11 miles, was described with great accuracy by Sir John Coode, M. Inst. C.E., in 1853 (*vide* "Minutes of Proceedings Inst. C.E.," vol. xii. page 520).[5] It was then 43 feet high and 600 feet wide at the south end, decreasing to 23 feet high and 510 feet wide at the north end. The pebbles diminished in size from Portland to Abbotsbury. Sir John Coode also stated that the shingle consisted chiefly of pebbles of chalk-flint, with a small proportion of others of red sandstone, porphyry and jasper, none of which could have been derived from local rocks. In order to determine their origin, he examined the coast from Portland to Start Point, and traced the flints to the chalk cliffs between Axmouth and Lyme, and the red sandstone, porphyry, and jasper pebbles to the New Red Sandstone of Budleigh Salterton, and other places in Devonshire; whence he concluded that the only source

[1] GEOL. MAG. July, 1871, pp. 294 sq.
[2] GEOL. MAG. April, 1874, p. 171, and April, 1875, p. 189.
[3] GEOL. MAG. July, 1871, p. 299.
[4] Being the substance of a paper read at the Tenth Ordinary Meeting of the Institution of Civil Engineers held on Tuesday evening, the 2nd of February, 1875.
[5] See also a valuable paper on the Chesil Bank by Messrs. H. W. Bristow, F.R.S., and W. Whitaker, B.A., F.G.S., in GEOL. MAG., 1869, Vol. VI. Pl. XIV. and XV. page 433.

from which the shingle of the Chesil Bank could have been derived was between Lyme Regis and Budleigh, and that it was propelled eastward along the coast to the Chesil Bank by the action of wind-waves, due to the prevalent and heaviest seas. The objection to this view urged at the time by the Astronomer Royal was, that the largest shingle occurred at the Portland end of the beach, or the most distant part from which it had travelled.

More recently an old "raised beach," standing from 21 feet to 47 feet above the present beach, had been discovered on the Bill of Portland, and Professor Prestwich showed that this beach contained all the materials found in the Chesil Bank, including also numerous chert pebbles from the Upper Greensand of the cliff between Bridport and Sidmouth. This raised beach was not due to any existing agency, but to causes in operation at a geological period so remote as the end of the Glacial period, and before the land had assumed its present position and shape. Remnants of this beach could be traced in or on the present cliffs, at intervals from Brighton to the coast of Cornwall, being more numerous in Devon and Cornwall, as the rocks were harder, than among the softer strata of Dorset and Hants, where, with few exceptions, the old line of cliff had been worn back and deeper bays formed. The travel of the shingle of this old beach was generally like that of the present beach from west to east.

The Author considered that the action of the "Race" off Portland, and of the tidal waves during storms, combined to drive the shingle of the old beach at the Bill, and of that portion of it which must be spread on the sea-bed westward of Portland, on to the south end of the Chesil Bank, whence the shingle was driven northward to Abbotsbury and Burton, by the action of the wind-waves, having their maximum force from the S.S.W., a direction which he showed to be the mean of the prevalent winds. Here, these wind-waves became parallel with the coast, and the westward movement ceased about Bridport, beyond which point the shingle travelled in the opposite direction, viz. from west to east, or from the coast of Devon to that of Dorset; the quartzite pebbles from the conglomerate beds of Budleigh Salterton, which travelled from that part of the coast eastward to and beyond Sidmouth, gradually diminishing in numbers as they approached Lyme, very few, if any, reaching Bridport. This conclusion was in accordance with the facts:—1. That the pebbles of the Devonshire and Dorset strata, which formed the shingle of the "raised beach," constituted also the bulk of the Chesil Bank. 2. That there were also, in that bank, pebbles of the rocks and flint of Portland itself. 3. That the largest pebbles occurred at the Portland end of the bank, the pebbles decreasing gradually in size to Abbotsbury. The large dimensions of the bank he attributed to the great accumulative and small lateral action of the waves.

Professor Prestwich next discussed the questions connected with the shingle of the south coast generally, and showed that the greater part of it was derived indirectly from beds of quaternary gravel and débris, from the wreck of the "raised beach," and partly from the strata of the chalk and other cliffs, and not altogether or directly

from the present cliffs. He noticed, also, the westward movement of the shingle from Lulworth towards Weymouth, owing to the interference of the Isle of Portland with the force of the S.S.W. wind-waves, and considered that none of the Devon and West Dorset shingle beach now passed the Bill of Portland, and that other such breaks might exist to the eastward whenever similar conditions were repeated. He explained the origin of the Fleet, like that of the Weymouth backwater, and of the Lodmore marshes, by the growth of the Chesil Bank on the one hand, and of the Ringstead and Weymouth Beach on the other, gradually damming in portions of the old coast-line. Those beaches themselves travelled on a line along which the opposing forces of the wind-waves and tidal currents and the inertia of the mass to be moved were balanced. These views were stated to be in conformity with the theoretical opinion expressed on abstract grounds by the Astronomer Royal, and with the experience of practical persons residing on the spot.

II.—Review of Professor Schimper's Fossil Mimoseæ.[1]

IN the prefatory matter to the present paper I have made no reference to any fossil remains of *Mimoseæ;* for at the time of drawing it up I had no ready means of ascertaining what evidence on the subject had been supplied by palæontologists, and I had not yet heard from Professor Schimper, who had kindly promised to communicate with me on the subject. Since, however, the early sheets of this paper were printed off, the third volume of his magnificent work on Vegetable Palæontology has reached us; and in it I find that a number of supposed fossil *Mimoseæ* from the Central-European Tertiary are described and figured, and referred severally to the genera *Prosopis, Inga, Entada, Mimosa,* and *Acacia.* The great majority of the species so determined are founded on impressions of leaves only; and these I pass entirely over; for although without collateral evidence it is impossible to deny that they may belong to the genera in question, it is equally impossible to affirm that they do so belong; for none of them show forms or venation exclusively characteristic of any of these genera. I thus see no reason to conclude on this evidence that any *Inga, Mimosa,* or Phyllodineous *Acacia* was in part of the Tertiary period an inhabitant of that part of Europe, when other evidence would tend to an opposite conclusion. With regard to *Prosopis,* the presumption that it might have been there is to my mind neither confirmed nor refuted by the fossil impressions described as *Prosopis* leaflets. On the other hand, those fruits of which so many excellent impressions are figured by Schimper, point to species of *Acacia, Entada,* and perhaps *Albizzia,* very similar to those now found in Africa—a case analogous to that of the *Podogonium,* of which specimens so very perfect have been preserved as to enable us satisfactorily to identify it as closely allied to some African Cæsalpineous genera not yet quite extinct.

Descending to particulars, the fruits figured by Schimper, pl. cvi.

[1] Extracted from a revision of the sub-order *Mimoseæ,* by George Bentham, Esq., F.R.S., 1875. Linn. Trans. vol. xxx. pt. 3, pp. 646, 647.

figs. 4, 5, 6, 7, 12, and 13, all referred to *Acacia*, are probably correctly determined, and represent species of the groups *Gummiferæ* and *Vulgares*, both of which are at the present day abundant in Africa. Fig. 4, indeed, if the leaves of figs. 1 and 2 really belong to it, must be very near to the *A. catechu* of the present day. The pods figs. 20 and 21, are determined as *Mimoseæ*; but if I had had such pods shown to me in a fresh state, I should have referred them without hesitation to *Acacia*. Fig. 20 is exceedingly like the pod of *A. constricta* from the United States, and very near to that of a few very narrow-fruited gummiferous *Acaciæ* of Africa, as well as to some of the Australian *Phillodineæ*. Fig. 21 is very like the pod of several *Acaciæ* of the group *Vulgares*, which, when rotting, often break up irregularly, as shown in the drawing. Both are very unlike any *Mimosa*-pods known to me. In this genus the lines separating the articula of the valve are always quite straight, and at right angles to the margin. Figs. 8 and 9, referred to *Acacia*, are more like the pods of some species of *Cassia*. Figs. 23 and 24 may represent *Albizzia*-pods. Fig. 22 may be an *Entada*, as determined, though not any recent species; but it is also nearly as much like some *Ormosia*-pods. Both these genera are still represented in Africa.

REVIEWS.

I.—Geological Map of London and the Neighbourhood.

THE publication by the Geological Survey of a Map with London as a centre, will be hailed with satisfaction by those interested in the geology of the metropolis, and of the country within easy distance around it. Formerly one had to procure four distinct sheets of the Geological Survey Map of England, in order to obtain the whole of London geologically coloured, and then one obtained actually more than was necessary for the illustration of London geology or convenient as a diagram for the wall of the library. The present Map embraces an area bordered on the North by Blackmore, Epping, Waltham Abbey, Potter's Bar, Watford, and Chesham Bois; and on the West by Amersham, Windsor, Chertsey, and Cobham; on the South by Epsom, Croydon, Farnborough, and Shoreham; and on the East by Gravesend, Grays Thurrock, Brentwood, and Frierning.

The Map is published both with and without drifts; but it need hardly be said that for most practical and scientific purposes the map showing drifts is alone desirable, for no geological map on a scale of one-inch to a mile can be considered complete if the superficial deposits be omitted. Their influence on the scenery of the district is trifling, for the main features were sketched out before the drift deposits were laid down: they rest indifferently upon the Tertiary strata and Chalk, and yet many of them, and particularly the Glacial Deposits, have suffered much denudation.

The formations represented include the Chalk, Thanet Beds, Woolwich and Reading Beds, Oldhaven Beds, London Clay, and Bagshot Beds. The Drift deposits, which are entitled equally to