

present depth [and width] by pre-Glacial streams." Nothing is easier than to draw such a diagram; the difficulty comes in proving that the Preglacial valley truly had the width and depth there assigned to it. If it had any such width, its branch valley must have had an accordant junction with it, but as a matter of fact the branch hangs over the main valley. An additional difficulty would be found in justifying the assumption that the profile given for the Snowdon crest and for a cwm beneath it correctly represents the result of normal erosion in Preglacial time; yet such an assumption is made, for no "solid black" is added to indicate that the mountain profile has been perceptibly modified by glacial erosion.

It is then concluded that "according to this interpretation the topography of Snowdon at the beginning of the glaciation was essentially the same as it is now", and therefore that glacial erosion has been of small measure. Like the reticular system of fracture valleys this conclusion can have little value until a never-glaciated mountain district of altitude similar to that of North Wales is found, in which the effect of a sub-recent uplift in reviving normal erosion has been to produce huge cwms under sharp-edged mountain crests, and half-mile-wide side valleys hanging over still wider main valleys, with vigorous streams plunging down narrow clefts between the two. Mountains and valleys of such forms do not exist outside of deglaciated regions, and a great body of excellent evidence indicates that their peculiar forms are the product of glacial erosion.

W. M. DAVIS.

HARVARD UNIVERSITY,  
CAMBRIDGE, MASS.

### **Recent Sinking of Ocean Level.**

SIR,—Professor Daly's speculation in the June number of this Magazine regarding the possibility of a recent worldwide sinking of sea-level calls for exposition of the facts as regards the British Isles. The writer feels somewhat at fault in the matter as he has made a statement of results without evidence and expected it to be accepted. Under the circumstances Professor Daly can hardly be blamed for setting one statement against another, and considering that perhaps the facts may be as required by his theory. It should be pointed out, however, that there is not really, as Professor Daly has implied, any conflict between the writer's account of the so-called 25 ft. beach and those of Sir A. Geikie<sup>1</sup> and Hull. As regards Kinahan's discussion of the raised beaches of Ireland, it can confidently be said that what is not absolute error in it is so indefinite as to have little meaning. To him anything served as evidence of a shoreline, from a glacial corrie or a drift-bank to a limestone escarpment. The lowest of his horizontal shorelines is by his own statement only 4 feet above mean tide level, so that it is not clear

<sup>1</sup> Anniversary Address to the Geological Society, 1904.

how it could be distinct from the modern shore. His statements, moreover, do not agree with those of Geikie and Hull.

Now to put the facts as briefly as possible. There are three sets of raised beaches traceable over considerable areas in the British Isles, (1) the pre-Glacial, (2) the Late Glacial, (3) the Neolithic (so-called 25 ft.). The submerged forests rest on the sediments of (2), and are overlain by those of (3). The Late Glacial and Neolithic beaches are thus quite distinct. The Neolithic beach is the best developed. It does not occur in the South of England and Ireland, where the only known raised shorelines are pre-Glacial. As regards the demonstration of the warping of the Neolithic beach, the writer has in his possession a notebook containing some hundreds of measurements made by H. B. Maufe and himself in various parts of the country, and covering in a rough way most of the coasts where the beach is found. The measurements were made either with reference to a comparable point on the modern shore or to high-water mark, or to both, where both were determinable. Many extended stretches of coast outside the area of the beach have also been examined without finding any trace of it. These observations have never been published because of their incompleteness. They are, however, amply sufficient to demonstrate the deformation of the beach and its approximation to or disappearance under sea-level along the periphery of its area of distribution. The exact position of the zero isobase is very difficult to determine, hence the writer's admission in a letter to Professor Daly that it might lie further south than shown in the diagram referred to. The average gradient is only one or two inches to the mile.

As regards dates, which Professor Daly expressly asks for, and climatic conditions, which must interest him, we have fortunately some very definite facts, which are in agreement with observations on the continent of Europe. The beach was formed in Early Neolithic or Campignian times, and elevated to nearly its present surface in late Neolithic times. Campignian implements are found embedded in it 12 feet below the surface, and polished stone axe-heads lie on its surface not many feet above present high water-mark. Its fauna indicates a climate some degrees warmer than that of the present day.

With Professor Daly's contention that eustatic movements of ocean level have taken place in recent geological times, the writer is in perfect agreement, but that the latest movement has been a negative one is not supported by the evidence in this country or on the continent. Outside the zero isobase of the Neolithic beach, in Ireland, England, and Denmark, Neolithic remains are found beneath sea-level, indicating a distinct positive movement. The widely distributed submerged forests dating from early Neolithic or immediately pre-Neolithic times onwards provide very good evidence of a general submergence. The very puzzling Micmac errace, in its horizontality so unlike the post-Glacial beaches of

Europe, has naturally led Professor Daly to a different conclusion. Why it alone should be undeformed, lying as it does among the highly warped shorelines of North America, is a mystery which the tracing of it into other areas may ultimately solve. Its parallelism to the modern shore is the more puzzling, as Gilbert seems to have proved that the warping of the Great Lakes Region is, like that of Scandinavia, still progressing. As regards the very widely distributed raised shorelines and reefs of tropical seas, the writer has long thought that they are more probably the equivalent of the pre-Glacial shoreline of Europe than of any of the later raised beaches. Maufe was inclined to hold the same view when he was working on the raised reef at Mombasa. If this is the case, the conclusion must be that the ocean, after the Glacial oscillations, has returned to a level a little lower than that of pre-Glacial times.

W. B. WRIGHT.

DUBLIN.

June 15, 1920.

[We regret that this letter was received too late for insertion in the July number.—ED. GEOL. MAG.]

#### THE BOURNEMOUTH CLIFFS.

SIR,—I have no desire to prolong this discussion, but as I have been asked where photographs of the cliffs, as they appeared about thirty years ago, may be seen, I should like to refer those who are interested to one illustrating an article on "Scientific Aspects of Bournemouth", which appeared in *Research* of December 2, 1889.

Yours faithfully,

C. CARUS-WILSON.

### OBITUARY.

GEORGE SWEET, F.G.S.

BORN 1844.

DIED 1920.

MR. GEORGE SWEET, who recently died at the age of 76, was born at Salisbury, England, but spent most of his life as a manufacturer of pottery near Melbourne, Australia. He was a keen geologist, and was second in command of the second Funafuti expedition under Professor Edgeworth David. He also made extensive collections of fossils from the Carboniferous and Cretaceous strata of Queensland, and investigated the Permo-Carboniferous glacial beds of Bacchus Marsh. In 1905 he was President of the Royal Society of Victoria.