

CORRESPONDENCE.

FOREIGN PEBBLES OF BRITISH BEACHES.

SIR,—It is no doubt well known to Mr. Birds as well as many other observers, that the foreign pebbles, described by him¹ from the Brighton and St. Leonard Beaches, are not confined to the S.E. and S. coasts of England, they being indeed far more abundant in some places on the opposite coast of Britain.

Aberystwyth, in the centre of Cardigan Bay, is, like Brighton, celebrated for the "pebble" riches of its beach, which afford employment to a large number of lapidaries in their cutting and polishing. Now these "pebbles" are all of them foreign to the district, and many of them are not even British in origin. Flint agates and "onyx" are not uncommon, and jasper is abundant. Besides these there are large numbers of other interesting strangers, many of them igneous rocks, including granites and quartz-felsites in many varieties, both pink and grey; orthoclase-felsite, porphyrites, basalt, and serpentine, and volcanic agglomerate; also numerous sedimentary and metamorphic rocks.

So abundant are these foreign rocks that in some of the small Welsh bays they are decidedly more conspicuous than the local stones, and handfuls may be gathered in a square yard.

As to the origin of these pebbles I quite agree with Mr. Birds, that they are washed up from deposits now covered by the sea. I am not, however, able to see how these facts can determine for us the distribution of any vast ice-sheets such as Dr. Croll has described. To settle this question we must find whether the Boulder-clay was a true Till—a land-ice product, or only a marine Boulder-clay, stored with pebbles dropped from melting icebergs; and this cannot be settled by reference to the pebbles found on the beaches.

Now, in the case of the foreign stones of the Welsh shingles, none of them occur in the drifts of the neighbouring country, these drifts being entirely the products of local land-ice; but I have detected some of them in the drifts of the lowlands of Anglesea. These latter are, however, *marine* Boulder-clays—laminated deposits like the Norfolk Contorted Drift, and containing delicate marine shells in perfect preservation.

Therefore, I conclude that the foreign pebbles of the beaches are derived, not from any morainic formation produced by a vast ice-sheet, but from a Boulder-clay, formed as a marine deposit in the Irish Sea at a time when that sea was traversed by icebergs, brought hither by currents from the glaciers of Scotland, and Scandinavia.

The original homes of many of the rocks are unknown to me. There are many Scotch porphyrites, and a few rocks from the Lleyn peninsula. The flints and some basalts may have come from the North of Ireland.

W. KEEPING.

THE MUSEUM, YORK.

¹ See GEOL. MAG. January, 1881, p. 47.