LETTERS TO THE EDITORS

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Drift Experiments with Radioactive Pebbles

An experiment on the detection of movement of pebbles on the sea bed was carried out off Scolt Head Island in Norfolk during April and May 1956. Pebbles marked radioactively were used for this purpose. It is believed that it is the first time that such a method has been used in Britain to trace pebbles.

In each pebble, a hole ½ in. deep and ⅛ in. diameter was made. It was found that local flint from the beach was very difficult to drill, and a compromise had to be made by using pebbles of Permian Sandstone, with a few flints only, and also a number of pebbles made of cement. The pebbles averaged about 2 in. in major diameter and were all rounded. The specific gravity of the pebbles averaged 2·4, which is about 0·2 less than that of flint. In all, some twelve hundred were used.

The radioactive tracer used was barium-140, an isotope with a half-life of 12 days, which decays by beta-emission and low-energy gamma-radiation into lanthanum-140 (half-life 40 hr.). The lanthanum emits a series of gamma-rays of which the principal has an energy of 1·6 MeV., and it was these gamma-rays which were used for detection under water.

For loading the pebbles, pure barium-140 was used to avoid health hazard from the gamma-rays. The lanthanum-140 activity, which was negligible during loading, then built up to a maximum in about five days, after which it was almost in equilibrium with the barium-140 and decayed with an effective half-life of 12 days. About 15 microcuries of barium-140 was adsorbed to each of twelve hundred resin particles, and one of these was placed in each pebble and sealed with a resin-based adhesive.

In this experiment, three Geiger counter tubes with a sensitive length of 60 cm. were enclosed in a brass cylinder of 1 metre in length. The cylinder was mounted on a heavy metal sledge. The sledge was towed along the sea bed over an area of several hundred yards around the dumping position on each search. In the boat was a rate-meter, connected to the tubes in the cylinder by a multicore cable. The detector was capable of 'finding' a pebble at a distance of about twelve inches under water.

On April 5 the pebbles were all dumped at the same moment from a boat at a point some 500 yd. seaward from normal high-water mark off Scolt Head, in water varying in depth between 12 ft. and 25 ft., depending on the state of the tide. Throughout most of the time of the experiment the depth of water over the main dump of the pebbles was of the order of 16–20 ft. The shallowest depth of 12 ft. was only recorded at low-water springs and the greatest depth at high-water springs. The floor on which the pebbles were to be dumped was hard and consisted of shingle and sand. The place had been marked with a buoy which was placed 20 yd. farther seawards of the dump so that when detecting operations were carried out the buoy ropes should not foul the detecting apparatus. The position of the buoy was fixed by intersection from angles measured by theodolite and sextant from three fixed points on the island. The position of the stones was fixed by sextant angles from the boat to those points on the land. The weather at the time the pebbles were dumped was squally, and the following night there was a wind reaching force 5–6. It was impossible to make any further observations until April 8. On that day, clear records were found of some of the pebbles having moved southwards and a little west up to a distance of 200 ft. Further searches were made on April 9, 12, 20 and 23 and on May 5 and 15. The results obtained on all these dates were generally consistent and showed clearly that a number of pebbles had moved and continued to move very slowly in a direction slightly west of south, that is, inshore. The maximum movement was of the order of 260 ft. In addition, observations made on May 15 showed that some pebbles had also moved north and west, one definite record being found about 450 ft. north-west of the original dump. It may have been that this north-westerly movement had occurred previously, and was only found on May 15; but this seems unlikely since the area had been swept over on each search. It should be appreciated that the detecting apparatus sweeps a band only one metre wide, and therefore a considerable time is needed to sweep even a small area of sea bed, and it is impossible to guarantee that every square yard of a given area has been searched.

Nevertheless, the results show that in ordinary weather, with a few squalls but no true storms, pebbles can be moved along the sea floor. Waves during this period are not likely to have exceeded 3 ft. in height. The flood current in this part of Norfolk flows west, and the ebb to the east. The maximum speed of the flood at springs is about 2½ ft./sec. It seems unlikely that the current itself can move pebbles of this sort; but it might certainly work in with wave action and help to do so.

This experiment was designed to work out a technique for the use of radioactive tracers in determining underwater movement of coarser beach material. If the method can be perfected, it will give a very important aid to coastal physiographical study.

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Radiation-induced Changes in Reactivity of Bovine Fibrinogen

The acute effects of total body irradiation on mammalian hæmostasis are now well established[1]. Information concerning direct effects on individual clotting components is meagre, and in the case of fibrinogen is confined to observations following the application of doses of X-rays of such high magnitude as to have no practical significance in the field of mammalian radiation damage[2,3]. The present study of fibrinogen is therefore concerned with the direct influence of low doses of irradiation.

Purified bovine fibrinogen (lot No. 55199) was generously supplied by Dr. E. C. Loomis, of Parke, Davis and Co., and was shown to contain 90–93 per cent clottable protein. Solutions of this fibrinogen (3 mgm./ml.) in $0 \cdot 15\,M$ sodium chloride buffered