island tide-stations be exploited? The answers to these and other questions will require sophisticated observational programmes. Scientists of the Soviet Union (unfortunately none could be present at the meeting) have an imaginative series of "polygon" experiments in operation, involving the deployment of an antenna-like array of current meters in a 100-mile square of ocean. American and British scientists are planning a PREMODE experiment in which participating groups plan to carry out independent projects in the same area at the same time so that the results will be complementary. The "polygon" and PREMODE experiments signify a new approach to the study of ocean currents and their dynamics. Perhaps there will be fundamental changes in our thinking over the next ten years.

ARCHAEOLOGY

Export Pottery Revealed

from our Geomagnetism Correspondent

THE unmarked wreck of a nineteenth century cargo vessel containing British pottery has been discovered in Delaware Bay between Lewes, Delaware, and Cape May, New Jersey, only thirty-nine feet below the surface. It was found by two ships of the US National Oceanic and Atmospheric Administration (NOAA), the *Rude* and the *Heck*, during a routine wire-dragging of the bay in search of submerged navigational hazards. The ship's anchor, of woodstock type weighing about 3,500 pounds and measuring about six feet across the flukes and eight feet along the shank, indicates that the wreck was that of a sea-going vessel, probably British.

Some of the pottery found in the wreck. (Photograph by courtesy of NOAA.)

Scuba divers found the wreck laid open on the bottom. Most of the cargo was embedded in coral and silt; but thousands of pieces of British-made pottery, neatly packed, were exposed in a pile about ten feet high and thirty feet across. According to Jefferson

Miller, curator of ceramic history at the Smithsonian Institution's National Museum of History and Technology, the white, undecorated pottery found in the wreck was manufactured from 1850 onwards, but no later than 1876. He identified it as the products of Powell and Bishop, a Hanley, Staffordshire, pottery firm which operated between 1876 and 1878; J. W. Pankhurst and Co., also of Hanley, 1850-82; and W. and E. Corn of Longport, Staffordshire, about 1864-94.

Most of the chinaware was English "ironstone", a heavy durable earthenware intended for everyday use. One exception was a hand-enamelled cup with simple multi-coloured flowers manufactured between 1850 and 1900. The cargo also included pitchers and washbowls.

SUPERFLUIDITY

Flow in Solids

by our Solid State Physics Correspondent

THE speculation by A. J. Leggett (*Phys. Rev. Lett.*, **25**, 1543; 1970) that it may be possible to observe in certain solids a mild form of superfluidity is not as far fetched as it might seem. There is no suggestion, of course, that a solid can exhibit the astonishing flow properties which allow liquid helium-4 to pass through holes so minute that even many gases are barred from entry. The identity of a solid hinges, after all, on its rigidity and atomic order. But what Leggett is proposing is that certain insulating solids may be in a sufficiently similar quantum state to that in superfluid helium to show a diminution in the moment of inertia of the solid which can be detected in an experiment.

The onset of superfluidity in liquid helium is associated with the Bose condensation of the fluid at about 2.2 K. A recent suggestion that a finite fraction of the atoms in a Bose solid may reside in the zero momentum state alerted Leggett to the possibility that a milder strain of the same superfluid condition may also manifest itself in these solids, and he has calculated the lower limit of what he calls the superfluid fraction in such a solid. If all the atoms are localized at given atomic sites, superfluidity cannot occur, but if atoms can swap places in the lattice, the solid should exhibit some drop in its rotational inertia from the classical value. This swapping is quite in keeping with the concept of a solid, providing the atomic sites themselves are essentially fixed.

Leggett suggests that the most favourable material in which to observe the effect should be solid helium, although practical difficulties may mean that other substances are more suitable. He suggests two experiments in which the superfluid property could manifest itself. If the solid is formed into the shape of a ring, the moment of inertia of the ring should be below that expected in a classical calculation. This could be tested in some dynamic experiment. The sample would have to be retained at a very low temperature throughout. A second test would be to rotate the solid and bring it into impact with some other body. If the solid had the superfluid property there should be some residual angular momentum. Leggett points out that it is not surprising that nobody has stumbled on the effect by accident because the conditions required to observe it are quite exacting.