

Recognition of Folds and Faults on Rock Surfaces beneath the Sea

INFORMATION about the folding and faulting of the rock layers beneath the sea can be obtained by geophysical techniques, used in conjunction with sampling; but it is not easy to give a precise position of the geological boundaries on the floor, and only large faults can be inferred. The required detail can be obtained, however, by means of a geologists' asdic, where there are rock floors which consist of alternations of hard and soft beds and the former, being resistant to erosion, stand proud as ridges. In the English Channel, the Purbeck, Portland, Kimmeridge, Corallian beds and the ancient rocks occurring as shoals to east and west of Eddystone give good results, while Tertiary, Chalk and New Red Sandstone beds are too homogeneous to be suitable.

The method makes use of echo-sounding equipment, but instead of pointing the beam vertically beneath a ship it extends laterally and is tilted down and stabilized at about five degrees below the horizontal, so that echoes can be obtained from any ridges within a wide belt of floor parallel to the ship's course. The value of the method has already been described¹ and the equipment has been used on R.R.S. *Discovery II* to make reconnaissance surveys of sea-floors around southern Britain, with recent publication of some studies of sedimentary structures^{2,3}. During these surveys rock outcrops of the type shown in Fig. 1 were found some miles south of the Dorset coast. The ship moved along a straight course (top of figure) covering two miles between the time marks, and examined a belt of sea-floor 800 yards wide, giving an exaggeration of scale of about four times for the range abeam. On this continuous plan view can be seen the dark bands of rock outcrops turning round in a gentle fold between the bottom right and left corners of the figure. In the upper part of the record a secondary beam which reached the sea floor beneath the ship gave a profile, in which an outcrop (black) terminates as a low cliff sloping away from the ship, at more than five degrees below the horizontal. The cliff marks the edge of a bed while the dip slope must be in the opposite direction and approximately at right angles to the line of outcrop of the bed. The continuity of any bed is interrupted by a parallel

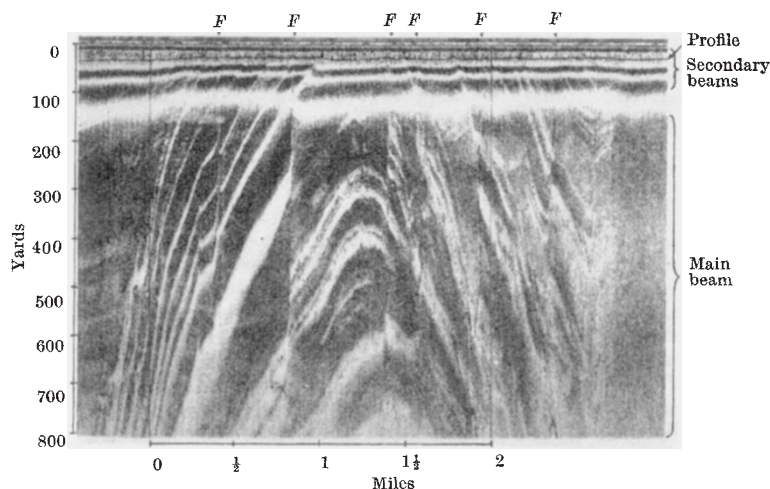


Fig. 1. A plan-view of rock outcrops (black) on the sea floor showing part of a gentle fold and small fractures, 'F-F'

series of small faults, marked on the edge of the record with 'F-F'. The pattern becomes increasingly blurred and vanishes as outcrops are progressively masked by loose sand at the right side of Fig. 1.

A complete acoustic and sampling survey of this ground, off south-eastern Dorset, has since been made and an account, which is in preparation, will be published elsewhere with Dr. D. T. Donovan as co-author.

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¹ Chesterman, W. D., Clynick, P. R., and Stride, A. H., *Acustica*, **8**, 236 (1958).

² Stride, A. H., *J. Mar. Biol. Assoc. U.K.*, **38**, 313 (1959).

³ Stride, A. H., *Dock and Harb. Authority*, **40**, 145 (1959).

Dissolution of Silicate Rocks

IN work on the determination of trace elements in silicate rocks¹, an attempt has been made to solve the inherent difficulties of achieving a rapid and efficient dissolution of large samples (up to 200 gm.) of silicate rocks and at the same time ensuring that the minimum quantities of reagents are used.

The classical treatment of rocks involves dissolving the sample in a sulphuric/hydrofluoric acid mixture or a perchloric/hydrofluoric acid medium, the sample being contained in a platinum dish. There are several disadvantages inherent in the use of platinum ware for these operations, in particular the extremely high price of platinum apparatus which is slowly destroyed by fuming with sulphuric acid. A further serious objection is the fact that no determinations of any of the platinoids can obviously be carried out in such a container.

Since I have been concerned mainly with the determination of very rare elements in silicate rocks, appreciably large samples have had to be used (on the average about 20 gm.). The dissolution of much smaller quantities of rock (say 1 gm.) presents few difficulties² but clearly a special technique had to be employed for these larger samples.

The dissolution technique presented here is the result of several years experience and depends on the use of 'Teflon' (polytetrafluorethylene) containers. This plastic possesses several very significant properties including an almost complete resistance to chemical attack by most reagents except molten alkali metals. It also possesses a marked freedom from warping or softening at temperatures up to 300° C. This material is expensive (a 150-ml. beaker costs about £6) but will certainly outlast platinum and is only a fraction of the cost of this metal.

It is hoped that a description of the method will be of assistance to other workers, particularly in the geochemical sphere, and will help them to reduce the tedium of the dissolution stage of chemical analyses on silicate rocks.