Plate 1 (A).

Underway sampler in cocked position before it strikes bottom. Note that the towing point on the hinged arm is aft of the center of gravity, that the hinged door is open, and that the sampling cup protrudes. (Scale in inches).

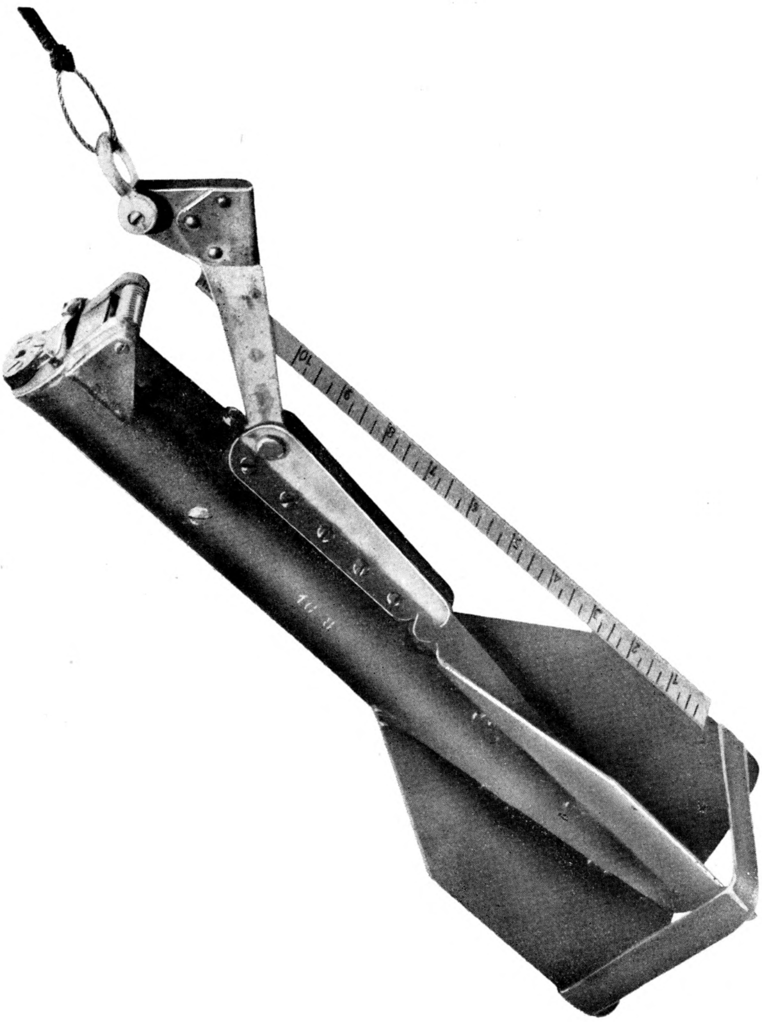

Plate 1 (B).

Underway sampler in sprung position, as in retrieving. Note that the released hinged towing arm permits towing from a forward position and that the sampling cup has been pushed inside and is covered by the closed door. (Scale in inches).

Photographs by U.S. Navy Electronics Laboratory.

THE UNDERWAY BOTTOM SAMPLER

(known as the " Scoopfish ")

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FOREWORD

This bottom sampler was designed for use from aboard ships underway. Previous to its invention it was necessary to stop the vessel each time that it was thought desirable to take a bottom sample and naturally, when vessels other than special research ships were taking samples and had a heavy programme to fit in otherwise, few if any samples could be taken in former conditions. Now, by means of the " Scoopfish ", samples may be obtained to about 100-fathom depths without being obliged to stop; it will follow, of course, that a much greater number of samples may be had for examination.

Dr. K. O. Emery and Mr. A. R. Champion have published a paper describing this new instrument and indicating its possibilities. By kind permission of the authors and of the *Journal of Sedimentary Petrology*, this Review gives the following few extracts :—

SUMMARY

This new instrument for collecting bottom samples was designed for operation from aboard ships moving at speeds up to about ten knots. Its use permits accurate correlation of bottom materials with bottom topography because both the sampler and a recording apparatus (for instance an echo-sounder) can be operated simultaneously.

Most instruments for collecting samples from the sea floor are designed to be lowered as near vertically through the water as possible and depend upon the impact of striking bottom or the release of a cable strain to activate a closing mechanism to keep the sample from washing out as the instrument is hoisted back to the surface. Clamshell snappers, orange-peel buckets, rotating drum scoops, coring devices, and most dredges thus require the sampling ship to heave-to or at least to move only slowly through the water. Because quite a lot of time is required to stop the ship and then to start it moving again, only a limited number of bottom samples can be obtained during a working day.

Early in the recent war an instrument called the bathythermograph was developed at Woods Hole Oceanographic Institution for obtaining a continuous curve of water temperature plotted against depth. It was lowered from ships moving through the water at speeds up to about fifteen knots. This was made possible by the use of a winch capable of paying out light cable behind the ship at a rate faster than the forward speed of the ship. The instrument has a heavy nose to facilitate rapid sinking through the water and tail fins to provide control as it is hauled up back through the water to the ship. After the bathythermograph had touched bottom several times in water less than about 70 fathoms deep, a small tube was attached to the nose to collect a bottom sample on the same cast that a temperature depth curve was obtained. Finally, a device for bottom sampling alone was developed, again at Woods Hole Oceanographic Institution (Ewing, Woollard, Vine and Worzel, 1946: Worzel, 1947). Samplers of this design were used with good success on both the Atlantic and Pacific Coasts; however, continued use showed the presence of several minor faults. In order to correct these, the writers combined their ideas and those of various others who had used the early instrument and the present sampler was designed and built.

As can be seen from plate 1, the sampler consists of a short, nearly solid body having a hollow barrel in which is located a sampler at the forward end and a tail assembly at the rear. The light towing cable is attached to a hinged arm which during lowering is folded back so that the tow point is about amidships of the instrument. When cocked for sampling the cup protrudes from the barrel about one centimetre and at this position latches open a hinged door against the pressure of a spring. When the sampler strikes bottom the cup is driven back into the barrel, releasing the door, which snaps shut to prevent washing of the trapped sample. During this action a catch is sprung, freeing the after end of the hinged towing arm so that during hoisting the tow point is nearer the forward end of the sampler. This permits the sampler to be retrieved with a minimum of drag, and prevents it from spinning end-over-end when it is hoisted from the water. A negligible amount of maintenance is required, owing to construction from stainless steel, together with the dashpot cushioning effect inherent in the cup action.

In operation, the sampler is slowly lowered overside while the ship is underway. As soon as it strikes water, the winch brake is released so that cable pays out very freely and rapidly. Contact with bottom is indicated by a slight slackening of the cable, and the winch is stopped immediately. The sampler is then hoisted back to the surface and aboard ship.

About four thousand bottom samples have been obtained with this sampler and with an earlier version having a fixed towing point, between depths of a few to about one hundred fathoms. These samples came from bottoms of mud, sand, gravel, rock, and coral. Samples of mud or sand usually are thirty to fifty grams in weight, enough for most types of sedimentary analysis. Most rock and coral samples are smaller and consist of only a few chips but these may be sufficient for identifications. No serious damage has ever resulted from the striking of rock bottom and no sampler has yet been lost. In the collection of bottom samples misses are inevitable, but for the underway sampler the misses are surprisingly low : less than 10 per cent for the four thousand samples obtained so far. These misses result from various causes such as the striking of bare hard rock bottom, reeling in of cable before bottom is reached, and failure to make proper readjustments as wear of sampler parts takes place. The time required for sampling is as short as two minutes per sample in water of thirty fathoms depth. Nearly two hundred samples have been collected during a single day.

In addition to making possible the collection of large numbers of samples per unit time, the underway sampler permits the accurate correlation of bottom materials and bottom topography, because continuous sampling can be carried on simultaneously with the making of a recording echo-sounder trace. After the samples have been examined, their character can be entered at the proper time intervals on the sounding record as shown by plate 2. Many such comparisons have been made and they show the consistent presence of coarse sediment on topographic high spots and finer sediment on surrounding flat areas. It is believed that correlated use of the underway bottom sampler and the recording echo-sounding traces will prove to be a very valuable tool in the understanding of contemporary sedimentation.

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