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A SUCTION PIPE FOR SAMPLING MID-WATER AND BOTTOM ORGANISMS IN THE SEA

by

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15 MAY 1969

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A SUCTION PIPE FOR SAMPLING MID-WATER AND BOTTOM ORGANISMS IN THE SEA

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ABSTRACT

A suction pipe for sampling mid-water and bottom organisms in the sea is described. The device can be used from a stationary ship for taking samples at water depths greater than 100 m. If used at the bottom from 25 kg to 50 kg of sediment can be collected in ten minutes, suggesting that the equipment is suitable for quantitative research.

INTRODUCTION

During the past few years, different sorts of suction devices and pumping systems have been used at sea to sample plankton [Ref. 1], to filter large amounts of water [Refs. 2 and 3], to study the behaviour of animals living at the bottom [Ref. 4], and to sample sediments and the bottom fauna of the oceans [Refs. 5, 6, and 7]. Suction devices have also been mounted on submarines (Barham, personal communication).

These devices have been designed to provide fast, accurate and large-scale sampling at different depths, mainly in shallow waters. They use electric pumps, jets of water, or, more recently, compressed air.

The suction device described here uses compressed air, but more effectively than previous devices. It is designed to be used from a stationary ship in order to sample the sonic scatterers of different layers of water or sediment at depths greater than 100 m. The particular layer to be sampled is chosen according to the scattering recorded by the ship's precision graphical recorder (PGR).

The trials started in 1966 and are still in progress. The suction pipe has already proved successful for rapidly filtering large volumes of water and sampling large amounts of sediments at different depths.

1. DESCRIPTION OF EQUIPMENT

The suction pipe [Fig. 1] consists of an injector, to the top and bottom of which are bolted stainless steel tubes of 10 cm bore.

The injector [Fig. 2], also of 10 cm bore, has an air inlet nozzle connected to the on-board air compressors by a rubber hose. The speed of the air flowing from the injector into the upper tube can be regulated by means of the threaded adjuster.

The lower tube is 2 m long and ends in a flange on which weights can be placed. The upper tube must be at least 6.5 m long, and has a check valve on top. A metal frame can be easily fitted over the top of the tube and covered with a net — or several nets of different mesh sizes — for collecting bottom samples. A modified plankton net, with no frame, is used for filtering water.

The suction pipe is suspended by two wire ropes of 10 mm diameter that are secured to the injector and pass through a fairlead fixed to the upper tube and thence to a shackle on the suspension cable.

The suction pipe, including the collector funnel used for bottom sampling, is over 9 m long, and weighs 160 kg without ballast. In a calm sea it can be lowered and recovered in a vertical position in a few minutes by using ship winches. It can be also used in sea state 5, if lowered and recovered in a horizontal position by means of an A-frame.

The pressure of the air supply to the suction pipe is controlled by a regulator on deck. It was found advisable to use a pressure

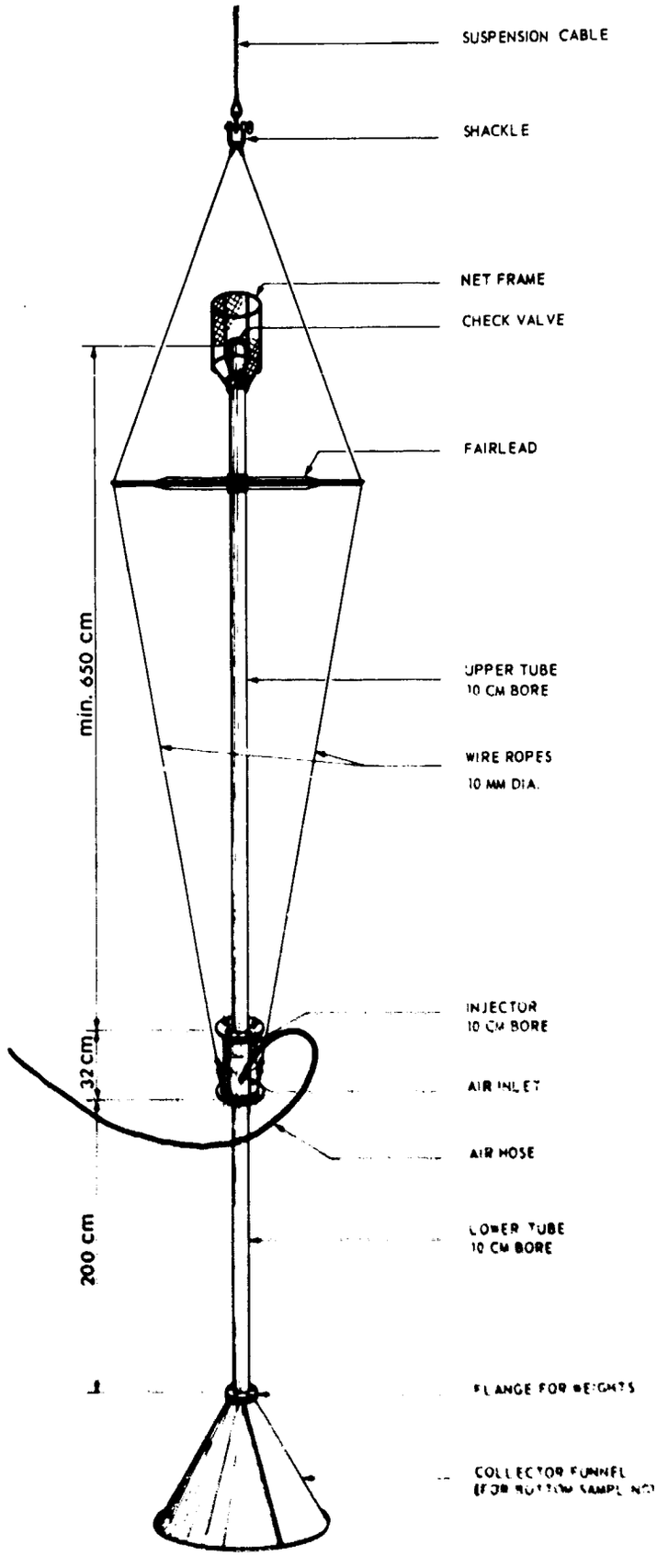

FIG. 1 SUCTION PIPE (not to scale)

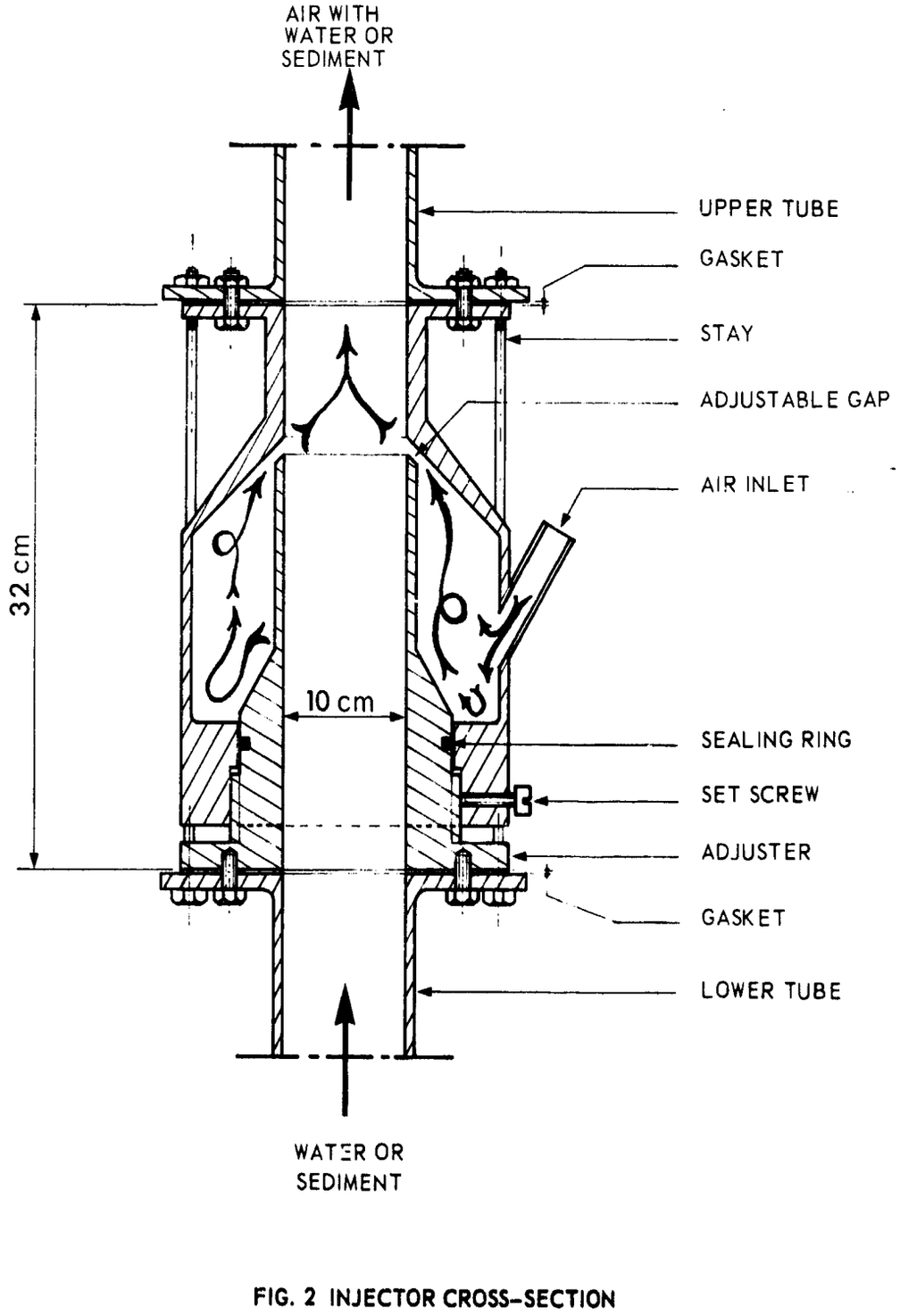

FIG. 2 INJECTOR CROSS-SECTION

greater than that needed to compensate for the depth of the water. Regulator outlet pressures of up to 14 kg/cm^2 were used during the trials, and the compressors on board the ship kept the pressure in the air receivers almost constant (21-22 kg/cm^2).

2. TEST RESULTS

To test the suction rate of the pipe a flowmeter (10 cm bore) was fitted to the bottom of the lower tube. The results are reported in Table 1.

TABLE 1

TRIALS IN THE LIGURIAN SEA IN SEPTEMBER 1967

Suction depth (m)	Average air pressure at the regulator outlet (kg/cm)	Water flow in 10 minutes (m^3)			Average efficiency of suction (%)	Average speed of water in the pipe (m/s)
		Min.	Max.	Av.		
25	7.2	12.4	12.5	12.5	100.0	2.6
50	8.5	10.6	11.1	10.9	87.2	2.3
75	10.6	9.6	10.0	9.8	78.6	2.1
100	12.3	8.4	9.0	8.6	69.1	1.8

Hence, if the ship is moving over the bottom at one knot, in ten minutes the pipe will sample a strip of 24 m^2 in area, pumping different volumes of water according to the depth of sampling.

In spite of the speed of the water flowing through the pipe and the bubbling of the compressed air, most planktonic animals, such as pelagic and bathypelagic Copepods, Amphipods, Ostracods, some Euphausiids and Stomatopod larvae, Pteropods, eggs and fish larvae (Leptocephalus, Syngnathidae), were collected alive and in good shape. Siphonophora, pelagic Tunicates, Chaethognats and some fish larvae (Stomiatidae) suffered heavy injuries. The pipe, however, proved successful in sampling plankton swarms and detritus.

To sample bottom fauna and sediments for qualitative studies the pipe should stand just over the bottom or penetrate a few centimetres into it. For quantitative studies the ship must be stationary, and a metal funnel must be fitted to the bottom of the pipe [Fig. 3]. A funnel of 1.5 m diameter, and 1 m height, would sample a bottom area of 1.7 m^2. The suction pipe is then over 10 m long and weighs 225 kg. The level of the pipe above or below the sea bed can be checked at the PGR [Fig. 4].

Ten-minute trials were made at depths up to 120 m on sandy and muddy bottoms. Using the same nets, the amount of sediment collected ranged between 25 kg and 50 kg.

The fauna collected near or inside the bottom during various trials included Sponges, Sea Anemones, Annelids, Amphipods, Isopods, Decapods (Alpheus, young crabs, hermit crabs), Mollusca (Chitons, Sea snails, Bivalves), Briozoa (Myriozoum, Hippodiplosia, Retepora), Brachiopods (Terebratula vitrea), Echinoderms, such as brittle stars, starfishes, sea urchins, (Echinus acutus) and sea cucumbers, Ascidians, fish larvae, and young fish.

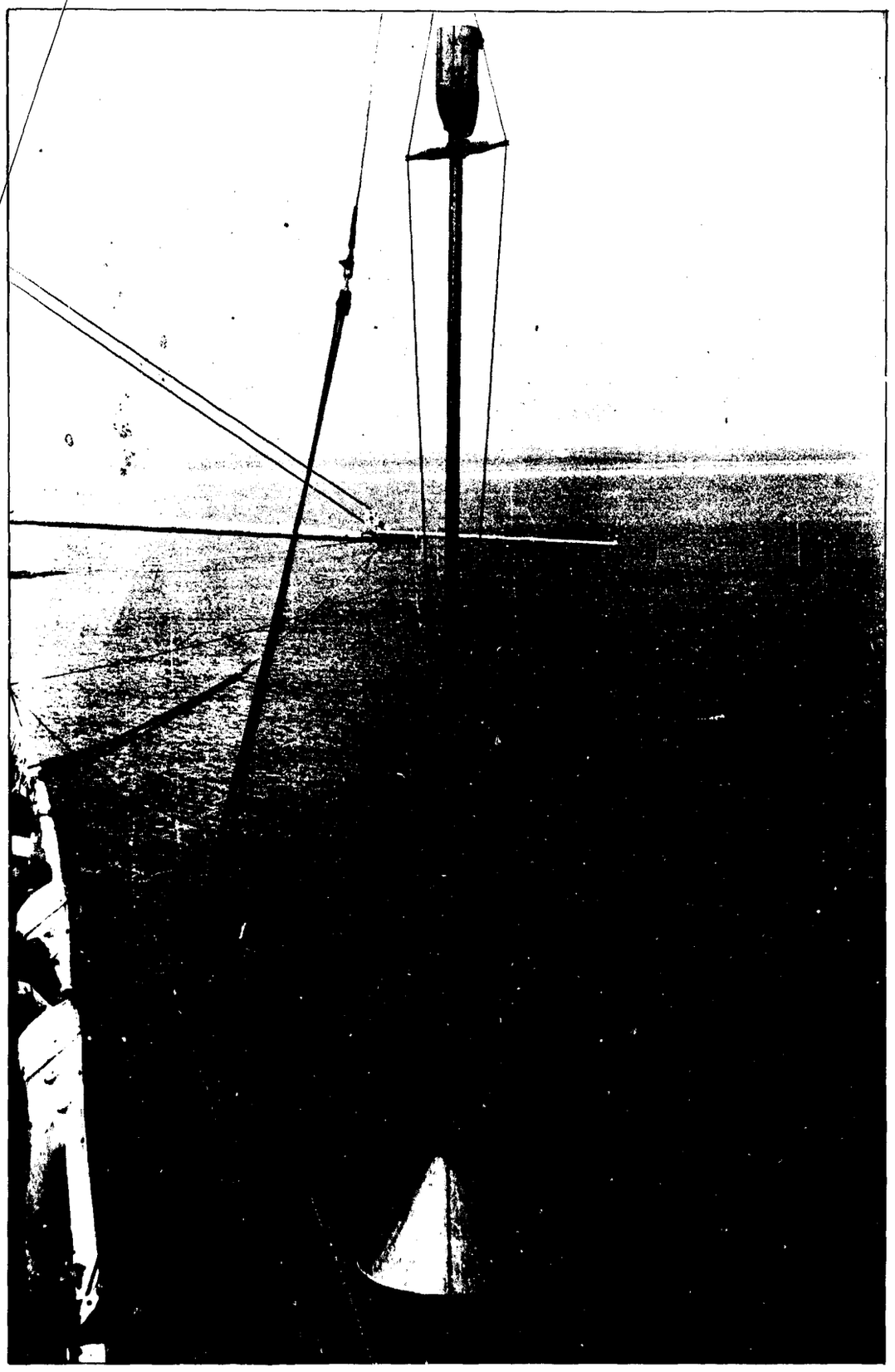

FIG. 3 THE SUCTION PIPE OUTBOARD AND READY TO BE LOWERED FOR BOTTOM SAMPLING

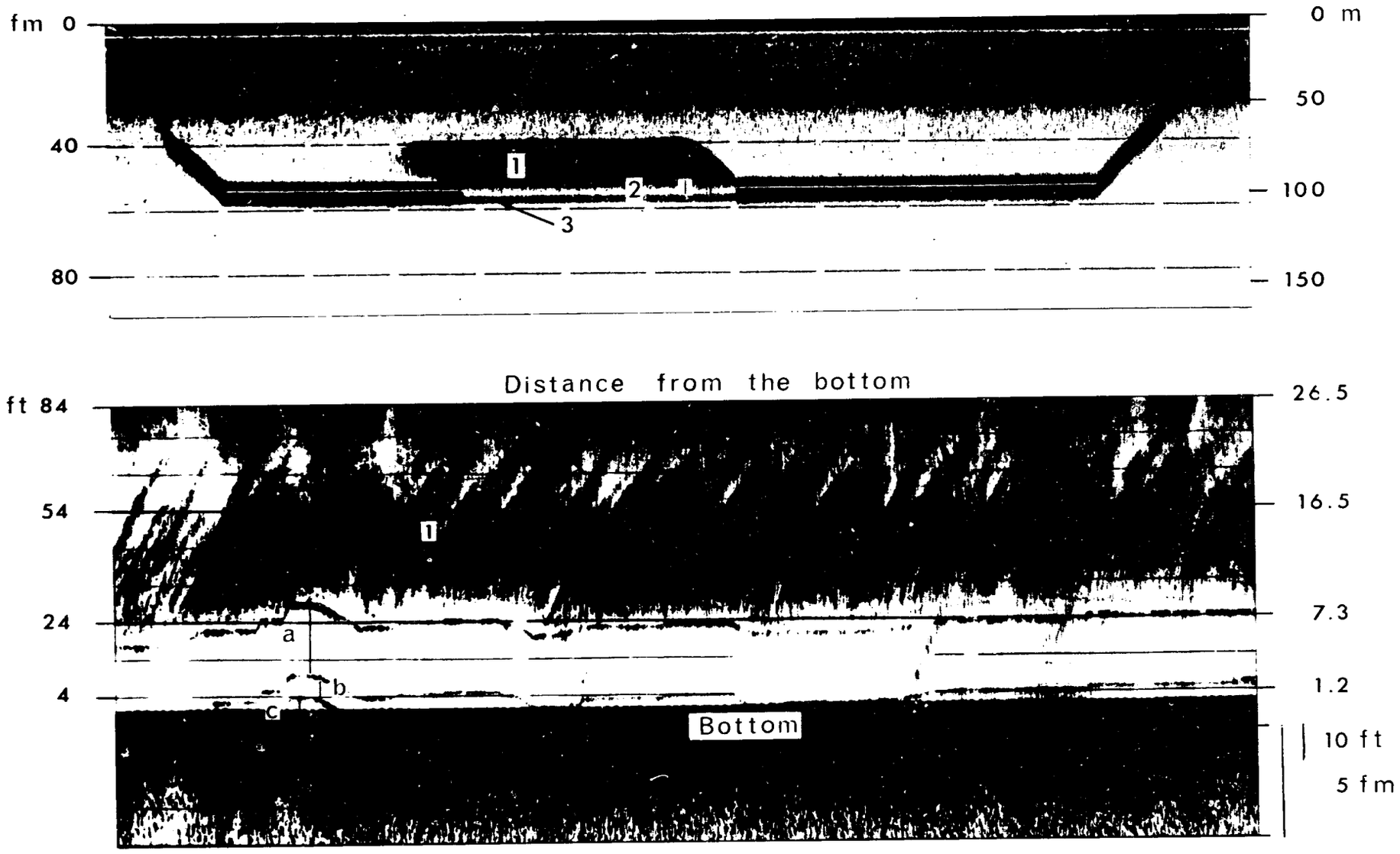

FIG. 4 CHECKING THE SUCTION LEVEL OF THE PIPE IN MID-WATER AND INTO THE BOTTOM

1: Air bubbling when the pipe is working
2: Length of the pipe
3: Surface of suction

a. Upper tube
b. Injector and lower tube
c. Funnel

The brittle stars, Annelids and Briozoa collected were mostly damaged, although hermit crabs with eggs and without shell, for instance, were found in good shape. Calcareous algae were also collected in large quantities.

Some elements of the bottom fauna were found in the nets still alive and in good shape, irrespective of the amount and quality of sediment collected. With other animals, some suffered no injuries and some, even of the same taxonomic group, were partially or badly damaged.

Owing to the large amount of sediment easily picked up, it seems that the suction pipe should be used for quantitative research, mainly to sample macrobenthos.

ACKNOWLEDGEMENTS

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