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### Title

AN IMPROVED INTERSTITIAL WATER SAMPLER1

### Permalink

<https://escholarship.org/uc/item/4xv3z64z>

### Journal

Limnology and Oceanography, 12(1)

### ISSN

0024-3590

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### Publication Date

1967-04-01

### DOI

10.4319/lo.1967.12.1.0163

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Peer reviewed

even though a certain irreducible flotation area would be necessary to prevent overturn in cross seas. For larger instrument loads, larger tubes could be used.

Theoretical calculations of the response of an articulated float do not appear to be available although Peters (1950) has treated an allied problem. Floats can be fabricated cheaply, so a few trial installations should give suitable ranges of design criteria.

Early thought was given to the use of a specially fabricated rubber mattress. (It would be articulated only broadside to the sea.) This might be preferable to the present design, but fabrication of a prototype promised to be prohibitively expensive in this case.

A grant to D. V. Anderson from the Canadian National Research Council helped finance this project.

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### AN IMPROVED INTERSTITIAL WATER SAMPLER<sup>1</sup>

Modifications of filter presses have been used for some time by workers in the petroleum field for extraction of interstitial water from drilling muds. They have been used on sediments by Lusczynski (1961) and Hartmann (1965), who used commercially available pistonless presses, and by Siever (1962), who used a specially designed piston-type press or squeezer. This note describes an inexpensive nonmetallic squeezer suitable for trace metal studies. Several of these squeezers may be operated simultaneously using a simple manifold.

This squeezer is gas-operated and has no piston or moving parts. Gas pressure acting against a rubber diaphragm compresses the sediment and forces interstitial water through filters into a sample bottle. Delrin and nylon are used throughout, resulting in a noncorrodible and easily cleaned squeezer. Pressures up to 200 psi (14 bar) may be used for squeezing and leaks that occur during operation are easily stopped by further compressing the O-ring seals with the

C-clamp squeezer holder. The absence of a filter plate and a drip space minimizes evaporation and gas exchange which usually result from foaming. This squeezer may be operated in any position and may be used for samples of different sizes by varying the length of the retainer section. The cost is about \$50.00.

An exploded view of the apparatus is shown in Fig. 1. Fig. 2 shows the assembled squeezer.

Several squeezers have been operated from the same gas source using an intermediate pressure regulator to supply gas to a manifold consisting of shutoff valves for controlling the gas supply to each squeezer and a needle valve for releasing internal pressure before disassembly. Flexible nylon pressure-tubing [ $\frac{3}{16}$ -inch (4.75 mm) od, 2,500 psi (172 bar) burst pressure] and Swagelok (Crawford Fitting Company, Solon, Ohio) fittings with nylon ferrules were used for all tubing connections. Helium, carbon dioxide, and nitrogen have been used as the squeezing gas. Several discs of Nitex nylon screen placed in the filter well provide lateral permeability and filter support. Membrane filters have been used with the nylon screens and several

<sup>1</sup> Contribution No. 100 from the Chesapeake Bay Institute and the Department of Oceanography, The Johns Hopkins University. This work was supported by U.S. Atomic Energy Commission Contract AT(30-1)3497.

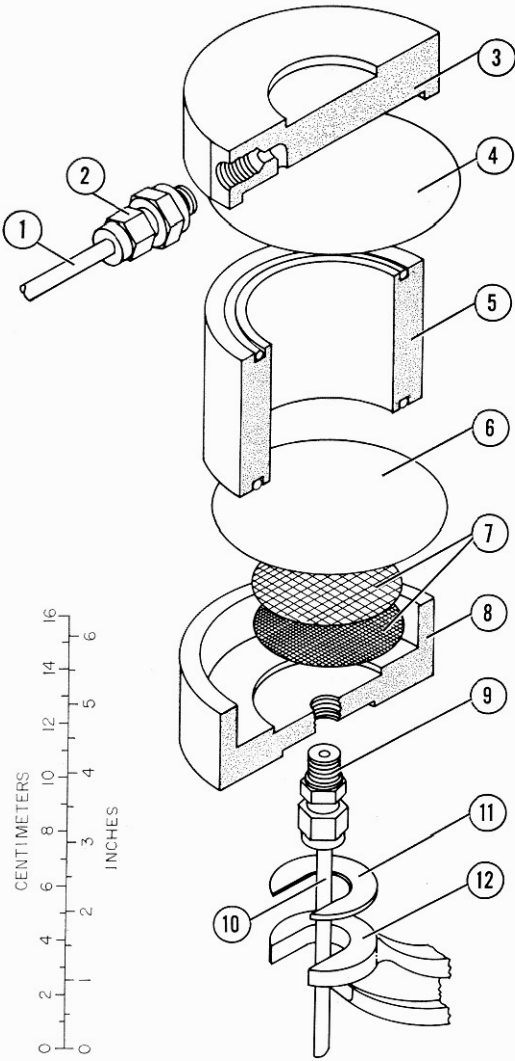


FIG. 1. Exploded isometric drawing of squeezer. 1) nylon gas inlet tube, 2) O-ring seal male plug (Swagelok), 3) Delrin cap, 4) dental dam rubber diaphragm, 5) nylon sample retainer with O-rings, 6) filter, 7) nylon screens, 8) Delrin base, 9) nylon male plug (Swagelok), 10) nylon sample drain tube, 11) rubber or cork pad, and 12) modified C-clamp.

thicknesses of filter paper have been used alone without rupturing. The dental dam rubber diaphragm is quite durable; on several occasions it has molded over sharp shell fragments without tearing. Stepwise

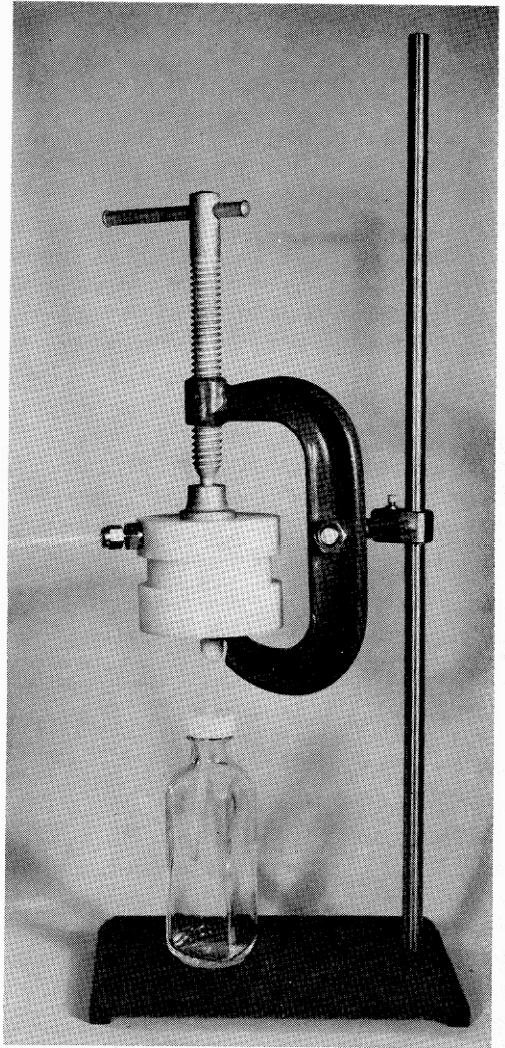


FIG. 2. Assembled squeezer.

increases in pressure over about 30 min appear to minimize the formation of an impermeable cake at the bottom of the squeezer. The amount of interstitial water delivered varies widely with sediment type and squeezing time. Generally about 25 ml/100 g sediment are recovered in 30 to 45 min. Only a small volume of gas is used during squeezing, so this apparatus can be made portable if a small gas cylinder is used.

Mr. E. W. Schiemer is largely responsible

for the design. Machining was done by Mr. D. Del Signore and Mr. J. K. Hooper.

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## PRECIPITATES FROM AUTOCLAVED SEAWATER<sup>1</sup>

Cultivation of marine microorganisms in pure culture requires sterile seawater, commonly prepared by autoclaving. A slight precipitate results during the process, modifying the composition of the seawater. This note presents the results of semiquantitative analyses of these precipitates.

#### MATERIALS AND METHODS

*Source of seawater.* In the preliminary experiments, water distilled in a Barnstead gas-fired still and dispensed to laboratories through tin-plated copper pipes was used to prepare synthetic seawater. Double-distilled water for the later work was prepared in an all-glass system. Synthetic seawater was prepared according to the formula of Lyman and Fleming (1940). Surface seawater was collected in a clean polyethylene bucket from the Scripps Institution of Oceanography pier. Nitric acid-cleaned glassware was used throughout.

*Treatment of seawater.* All seawater samples were filtered through ultrafine fritted-glass and transferred to Pyrex Fernback

flasks which were plugged with nonabsorbent cotton. The flasks were autoclaved at 121C for varying times and allowed to return gradually to a pressure of 1 atm. After a few days at room temperature, the seawater was passed through PH Millipore® filters (0.3  $\mu$  porosity). The bottoms and sides of the flasks were scraped carefully to recover all the precipitate. The filters were then dried at 50C for at least four days. All but 2-3 mg of the precipitate were recovered from the filters, transferred to tared weighing bottles, and dried to constant weight over P<sub>2</sub>O<sub>5</sub> in desiccators at room temperature. The precipitates were analyzed by emission spectrography or neutron activation.

Two-liter samples of seawater were autoclaved at 121C for 15 min in the early experiments, and single-distilled water was used to prepare the synthetic seawater, but double-distilled water was used in the later experiments. After filter-sterilization, 1,500-ml subsamples of synthetic seawater prepared with double-distilled water were dispensed in Pyrex Fernback flasks and autoclaved for 5, 15, 30, and 120 min.

#### RESULTS

Emission spectrographic analyses of the precipitates from synthetic and natural seawater are shown in Table 1. The ranges of values are from seven different samples of natural seawater and preparations of synthetic seawater. Major fractions of the originally present Al, Ti, Cr, Fe, Cu, Ag, Sn, and Pb were precipitated during autoclaving.

<sup>1</sup>Contribution from the Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California. This project was supported by the Division of Water Supply and Pollution Control, U.S. Public Health Service Research Grant WP-00077. Emission spectrographic analyses were performed by Mr. Robert Bell and Mr. Charles L. Chaney at General Atomic Division of General Dynamics Corporation, La Jolla, California and by Mrs. Elisabeth Bingham in the laboratory of Mr. Arthur Chodos, California Institute of Technology, Pasadena. Sincere appreciation is expressed to Mrs. Becky Jo Fredriksson and Mrs. Susan W. Murphy for their technical assistance.