ing for a few minutes, nearly perfect waterproofing is secured.

The lettering of labels prepared as described is clearer than before treatment, except in the case of lead pencils, and will not run. The paper is stiffer and the whole label will stand wear to a remarkable degree. In the case of labels waterproofed ten years ago, no deterioration can be observed either in alcohol or formaldehyde. The label will not act as a wick if inserted beside the cork.

Celluloid and collodion in quick drying solvents have promise of preserving wet labels, but thus far have not shown themselves as satisfactory or adaptable to usual conditions as paraffin.

A. A. DOOLITTLE

CENTRAL HIGH SCHOOL,
WASHINGTON, D. C.

SPECIAL ARTICLES

ON THE CONTENTS OF OXYGEN IN THE OCEAN ON BOTH SIDES OF PANAMA

IN January, 1922, the Danish *Dana* Expedition had an opportunity of making comparison between the oceanographical (physical and biological) conditions on both sides of Panama.[1]

I mention here only a single feature—the vertical distribution of the quantity of oxygen in the sea.

The oxygen content was determined on board the *Dana* by Dr. N. C. Andersen, using the Winkler titration method.[2]

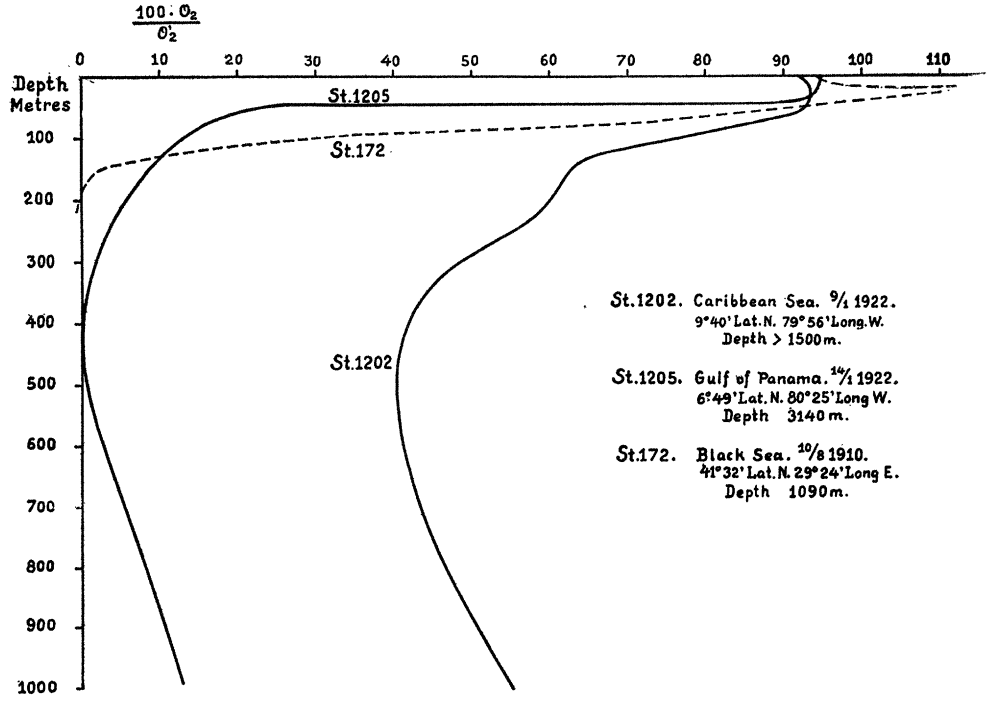
The figure shows the oxygen content at depths from 0 to 1,000 m at two of our stations, one (1,202) on the Caribbean, the other (1,205) on the Pacific side. By way of comparison, I have included a station (172) taken in 1910 from the Danish research steamer *Thor* in the Black Sea.

We see that at the surface the two stations do not differ much, the water in both cases being nearly saturated with oxygen. The similarity, however, goes no farther. The Atlantic (Caribbean) station shows no difference between the surface content and that at 50 m, whereas the oxygen content on the Pacific side has at a depth of 50 m dwindled to only 25 per cent., *i.e.*, even at this slight depth, the water contains only one fourth of the amount of oxygen it *could* contain if saturated therewith. And at a depth of about 150 m, the oxygen content has further diminished to only 10 per cent.

At a depth of 4–500 m we find, for both stations, the minimum value for oxygen content, the quantity

[1] For the hydrographical work of the *Dana* Expedition in the Atlantic and Caribbean, see J. N. Nielsen, "The hydrography of the *Dana* Expedition" (London, *Nature*, 1925).

[2] See "Report on the Danish Oceanographical Expeditions 1908–10 to the Mediterranean and Adjacent Seas," Vol. I, p. 191. Copenhagen, 1912.



thereafter increasing slowly and gradually towards the bottom.[3]

The absolute values show a great difference between the stations; the Atlantic minimum lies between 40 and 50 per cent., whereas the Pacific is close on 0; *i.e.*, at depths between 400 and 500 m, the water here *contains practically no oxygen at all.* We found the same thing at all the *Dana* stations in the Pacific off Panama.

The various deep sea expeditions, from the *Challenger* onwards, which have investigated the quantity of oxygen in the ocean, found similar conditions to those at our Station 1,202 in the Caribbean Sea, with minimum values varying somewhat with the latitude; higher at a distance from and lower near to the equator.

As far as I am aware, however, there is no previous instance on record of the finding of such low values in the open sea as those noted by the *Dana* off Panama in January, 1922.

In partly enclosed basins, such as the Black Sea, for instance, and certain parts of the Baltic, there may, it is true, be a lack of oxygen deep down, as in the case of our *Thor* station 172 in the Black Sea, 1910, where the quantity of oxygen diminished, from saturation at the surface, to only 2.4 per cent. at 150 m depth, and reached 0 at about 200 m. But as shown by the Black Sea curve in the figure here given, there is a shortage of oxygen here from barely 200 m right to the bottom, showing that we have an entirely different type to deal with here in the enclosed Black Sea. It is precisely the characteristic feature of the open sea that the oxygen content, after falling to an intermediate minimum, again increases towards the bottom, as both the Caribbean and the Pacific stations show.

The operations of the *Dana* in the Pacific did not extend far enough outside the Gulf of Panama to afford further information as to the cause of this remarkable shortage of oxygen. Generally speaking, it must be a case of "old" or stale water, *i.e.*, water which has not been in contact with the atmosphere for a long time; its origin, however, I am unable to determine. Another cause of the oxygen shortage is undoubtedly to be found in the wealth of animal life in the intermediate and deeper water layers at these Pacific Stations, as this would of course consume a great deal of oxygen. After working for a long time in the Atlantic, we were surprised at the great quantities of bathypelagic animal forms brought up by our nets on the Pacific side of Panama. And our astonishment was not lessened on learning how small was the amount of oxygen in the water of these deeper layers.

I give here the quantities of plankton in our horizontal hauls at stations 1,205 and 1,202 for those depths at which the same implements were used from both stations, so as to permit comparison of the yield. It should be noted that the depth at which the net actually fished answers roughly to half the length of wire paid out.

Meters of wire out.	Quantity of plankton (ccm).	
	St. 1,205.	St. 1,202.
50	100	350
100	900	250
300	1,000	250
600	1,000	100

At some of the other Pacific stations, the quantity of plankton in the neighborhood of the surface was considerably greater than at station 1,205.

It would, of course, be quite incorrect to conclude, from the above figures, that the paucity of oxygen at the Pacific station (1,205) is the cause of its richer bathypelagic fauna, as compared with the Caribbean station. But the *Dana* stations off Panama undoubtedly show that a wealth of bathypelagic animal life can exist in waters of a lower oxygen content than we had reason to suppose.

It would be very interesting to investigate, by means of large vertical closing nets, the quantity of plankton in that portion of the column of water where the oxygen minimum is situated; the brief stay of the *Dana* on the other side of Panama, however, did not permit of this.

JOHS SCHMIDT

CARLSBERG LABORATORY
COPENHAGEN, DENMARK

[3] To between 30 and 40 per cent. at about 3,000 m depth at St. 1,205.

THE PENNSYLVANIA ACADEMY OF SCIENCE

THE Pennsylvania Academy of Science held its second annual meeting at Harrisburg, Pennsylvania, April 10 and 11. The morning of April 10 was given over to meetings of committees. In the afternoon the president, Dr. O. E. Jennings, of the University of Pittsburgh, gave his address, after which and on the morning of April 11 the following papers were presented:

Sporobolus uniflorus Muhl. in Pennsylvania: E. M. GRESS.

Demonstration of the life history of the earthworm: S. HOFFMAN DERICKSON.

A double turtle of the genus Chrysemys: S. HOFFMAN DERICKSON and V. EARL LIGHT.

Observations on hydra in limestone springs during the winter months: RAY A. TROUTMAN.