## Letters to the Editor.

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### Velocity of Deep Currents in the South Atlantic.

IN view of the great difficulty with which the speed of a deep current is measured, the following investigation is of considerable interest. The observations on which it is based were made by Mr. H. F. P. Herdman and me in the R.R.S. *Discovery II.* during the recent passage home from the Antarctic.

Vertical sections were made along the 30th meridian from 60° S. to 15° N. showing the distribution of temperature, salinity, oxygen, phosphate, nitrate, and nitrite content, and of the hydrogen-ion concentration. They show that the surface water found in the region of the West Wind Drift between 41° S. and 50° S. sinks rapidly below the surface along its convergence with the warmer sub-tropical water in 41° S. After sinking, it spreads northwards as a poorly saline layer between the depths of 500 and

| Latitude. | Depth of Minimum Salinity. Metres. | Oxygen Content in the Salinity Minimum. C.c./litre. |
|---|---|---|
| 46° 42·5′ S. | 330 | 6·02 |
| 43° 08′ S. | 410 | 5·94 |
| 38° 10·5′ S. | 800 | 5·45 |
| 34° 08′ S. | 910 | 5·19 |
| 31° 16·25′ S. | 940 | 4·86 |
| 26° 06·5′ S. | 850 | 4·59 |
| 21° 13′ S. | 850 | 4·24 |
| 15° 37′ S. | 700 | 4·08 |
| 09° 47′ S. | 750 | 3·50 |
| 03° 17·75′ S. | 690 | 3·36 |
| 02° 59·25′ N. | 740 | 3·06 |
| 08° 54·25′ N. | 800 | 2·18 |
| 14° 27·25′ N. | 800 | 2·37 |

1500 metres and covers the whole of the South Atlantic. It is then generally known as Antarctic Intermediate Water. As it sinks, it carries with it large quantities of dissolved oxygen, which are used up by the living animals and by the oxidisable matter in the water as it flows northwards. The accompanying table shows the depths of the minimum salinity values which represent the nucleus of the Antarctic intermediate layer, and also the oxygen content of the water in these depths, for different latitudes.

Owing to differences in the temperature and the quantity of phytoplankton, the amount of dissolved oxygen in the surface of the West Wind Drift varies from season to season, and the amount which sinks and flows northwards must also vary. Fig. 1 shows the oxygen content of the Antarctic Intermediate Water plotted against latitude. It will be seen that the oxygen content decreases rapidly in the water as it flows northwards, but the points which represent the determinations lie on a curve which shows well-defined maxima and minima.

The water in the West Wind Drift has its maximum oxygen content in the spring, and the maxima on the curve represent the oxygen content in the water which has left the surface in successive years.

It is thus possible, by measuring the distance between two maxima on the curve, to find the distance the water has travelled in a year. The minima can be treated similarly.

Fig. 2 shows the velocities which have been calculated in this way. The circles represent velocities calculated from the maxima, and the crosses those calculated from the minima. The difference between

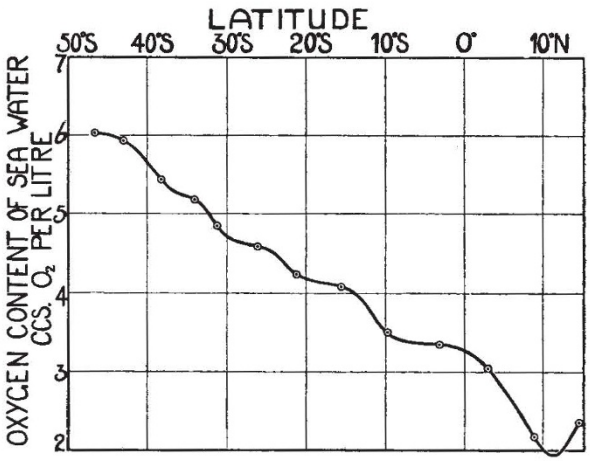


FIG. 1.—Variation of the oxygen content of the Antarctic Intermediate Water with latitude.

the two curves can be explained if the cold water which sinks in winter flows more quickly than the warmer water which sinks in summer. This might be the case owing to greater density of the cold water.

The conclusions reached are:

1. The stream of Antarctic Intermediate Water takes approximately five years to cover the 3300 miles between 40° S. and 15° N.

2. The northerly and principal component of its velocity increases from an average value of 1·2 miles per day in 40° S. to 2·5 miles per day in 7° S.

3. South of 20° S. there is a difference between the velocities of the water which sinks in winter and in summer.

4. The oxygen in the Antarctic Intermediate Water is used up between 40° S. and 10° N. at the rate of 1 c.c./litre in about 850 miles.

A similar method of investigation is being used to find the velocity of the North Atlantic Deep Current flowing southward at a depth of 2000–3000 metres.

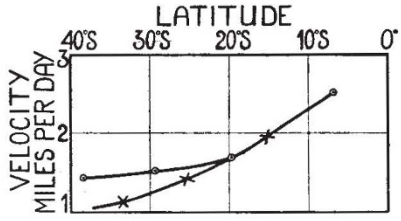


FIG. 2.—Variation in the velocity of the Antarctic Intermediate Current with latitude.

The curve of oxygen content is, however, affected by the influence of the Mid-Atlantic Ridge on the deep water movements, but a possible figure for the velocity of the deep current is 2·2 miles per day in 10° S.

This method of measuring current velocities in the Atlantic Ocean is described by Wattenberg[1] for the North Atlantic Deep Current, but no figures are given.

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[1] Wattenberg, "Die Deutsche Atlantische Expedition, Gesammelte Expeditionberichte", 1925–27, p. 139.