Report on Physical Investigations.

By

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The unusually severe weather of the last eight months has made it impossible to continue the observations in the Channel with any degree of regularity; only two trips have been made since that in June, of which a preliminary report was published in the last number of the *Journal*. The first of these, in November, included station VIII of the previous cruise, off the Bill of Portland in mid-channel, and the previous stations XIII and XIV, in Start Bay, also station I off Bolt Head. Besides these, soundings were taken at an additional station in mid-channel, south of Start Bay, and at four points in Start Bay itself, near land. The cruise was unfortunately interrupted by a gale which necessitated taking shelter for thirty-six hours in Portland Roads.

The second trip was made on March 1st and 2nd, with the view of obtaining temperature observations as nearly as possible at the annual minimum. After sounding at stations I and XIV, and making an unsuccessful attempt at station XIII, we were again compelled to return to Plymouth by unfavourable weather.

As regards temperature observations, the additional data show that in November the distribution is extremely uniform, and in general the temperature is rather more than 2° F. warmer than in June. In March, again, the few observations obtained indicate a general fall of about 8° F. since November. In neither case was the abnormal distribution found in Start Bay in June reproduced (see previous paper, *Journal* M. B. A. ii, 2, p. 159) and its reappearance next summer may be looked for with interest, as it seems to suggest that in the western portion of the Bay, a large mass of water is partially cut off from the general circulation, and subjected to the heating action of the sun's rays without mechanical mixing.

During the cruise in November, sixteen samples of bottom and

surface water were collected. These have been subjected to the most careful examination of which the resources of the Laboratory will permit. The total halogen, calculated as chlorine, and the alkalinity of each sample has been determined, as well as the density both by Buchanan's hydrometer and the Sprengel tubes. The examination of these samples has shown that the water over the area under consideration is normal Atlantic water throughout. The mean value of "D" *i. e.* the ratio of the excess of density of sea-water at 0 °C. over that of distilled water at the same temperature, to the amount of chlorine in the sea-water, is 1·4553, with the limits 1·450 and 1·457, a result in complete accordance with the value found by Dr. Gibson for what he believed to be Atlantic water, contrasted with water from other areas, as for example the Arctic Ocean, which gave a markedly higher value. The close agreement of these determinations, made under considerable disadvantages, affords strong proof of the importance of a thorough examination by a chemical specialist of a limited number of samples of water from the great oceans of the globe. It seems possible to determine, once for all, the values of D for each of the great oceanic basins, and from these to ascertain at any time the source of supply of special currents in any particular area.

The chlorines of twenty-seven of the samples collected in June last were determined before the publication of the previous paper, but were not included in it, as it was then intended to make a series of density determinations with the Sprengel tubes. It was, however, found impossible to make these determinations, and a comparison was therefore made between the Sprengel tube determinations of the second series and the densities of the same samples as found by the hydrometer, reduced to 15·56° C. as compared with pure water at 4° C., and then again reduced to 0° C. and referred to pure water at 0° C., by the help of Dittmar's tables. The results thus calculated differed from the Sprengel-tube values by −0·00013, giving a correction almost identical with Dittmar's "hydrometer error." It would seem, however, that the numerical agreement is accidental, and these experiments have led to a more extended investigation at present in progress. Accepting the correction +0·00013 for the present, and applying it to the hydrometer determinations of the June samples, the mean value of D is 1·4550 with the limits 1·453 and 1·457, a further confirmation of Dr. Gibson's results.

So far as the present inquiry is concerned, it may therefore be assumed that the water of the English Channel is Atlantic water pure and simple, and the alkalinity determinations do not show any variation in its "strength" by dilution with fresh water or otherwise. The chief interest accordingly centres round the temperature

observations, which although already very suggestive, are still too few in number to merit detailed discussion.

Considerable progress has already been made in collecting material for investigating the mixture of waters in the local estuaries at different states of the tide, but the results are not yet ready for publication.

Meteorological Observations at M.B.A. Laboratory, Plymouth, 9 a.m. and 9 p.m.

{ Lat. 50° 21′ 49″ N. / Long. 4° 8′ 21″ W. }

Height of cistern of barometer above mean sea level 125·93 feet.
„ rain gauge „ „ 117·67 „
„ „ „ ground 0·62 foot.

Month.	Mean barometer at 32° F. and sea level.	Temperature.				Dew point.	Elastic force of vapour.	Relative humidity per cent.	Wind.									Cloud amount mean.	Sunshine hours.	Ozone 0—10.	Rainfall inches.	Rainy days.	Rainband 0—8.
									Direction. No. of days.								Mean force, 0—12						
		Mean max.	Mean min.	Dry bulb.	Wet bulb.				N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.						
1891																							
October .	29·727	57·1	46·7	52·0	49·6	47·3	·331	84·6	2	6	1	2	7	7	3	1	2	2·7	5·5	118·68	4·5	8·385	21	—
November .	29·831	50·4	41·1	45·2	43·6	41·6	·268	87·5	8	7	1	1	3	6	2	1	1	1·8	6·5	59·57	4·4	4·190	19	3·3
December .	29·993	50·0	42·1	45·8	44·4	42·7	·284	89·5	2	1	2	3	4	10	4	2	3	2·5	6·6	55·32	5·6	5·170	23	3·4
1892																							
January .	29·924	44·6	36·0	39·6	38·2	36·2	·217	87·8	4	7	0	2	1	5	6	4	2	1·3	6·5	67·79	4·5	1·866	12	2·9
February .	29·802	47·1	38·8	42·5	40·7	38·3	·238	85·9	3	6	2	4	3	4	2	3	2	1·9	6·8	86·17	4·1	3·120	15	3·1
March . .	30·023	45·4	34·5	39·5	36·4	32·0	·187	75·0	1	16	5	1	2	2	1	0	3	1·2	5·4	157·70	4·6	1·171	7	—