PARTICULATE MATTER IN THE OXYGEN-MINIMUM LAYER[1]

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In view of the interest in oxygen distribution in the ocean, it seems advisable to bring to light some observations which were made in the 1930's but which were never published. Some of these

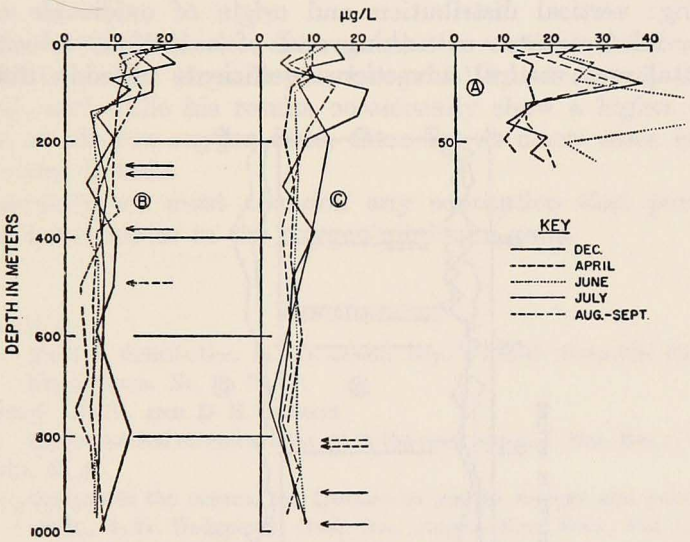

Figure 1. Particulate nitrogen in micrograms per liter at Sts. A, B and C, during 1937–38. Arrows indicate levels of oxygen minimum.

data were collected at the same time as those previously reported by Rakestraw and Carritt (1948).

Water samples were collected five times during 1937–38 from three key stations: St. A, on the Continental Shelf about 30 mi SE of Montauk Point (Lat. 49°40′ N; Long. 71°45′ W); St. B, in the slope water northwest of the current of the Gulf Stream (Lat. 39°00′ N; Long. 70°40′ W); St. C, in the Sargasso Sea southeast of

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the Gulf Stream (Lat. 35°30′ N; Long. 67°30′ W). Samples were taken during 1939 also at Sts. B and C.

Determinations of "particulate-nitrogen" were made by a method previously described (von Brand, 1935). While these analytical results are in terms of micrograms of nitrogen in particulate matter contained in one liter of water, they afford at least a relative comparison of the content of total organic particulate matter in the water. Results are shown in Figs. 1 and 2.

It is scarcely necessary to indulge here in a general discussion of the origin of the oxygen-poor layer, since past and current views on this question have been adequately summarized by Richards (1957). Many factors undoubtedly contribute to this phenomenon, including: vertical distribution and origin of oxidizable organic matter, relative rates of sinking and of oxidation, velocities of horizontal and vertical advection, coefficients of eddy diffusion,

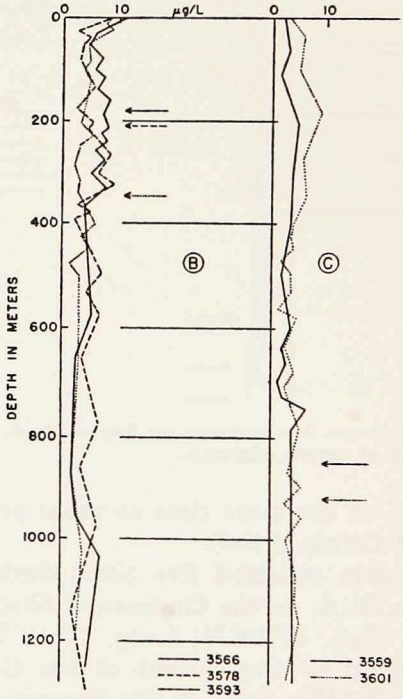

Figure 2. Particulate nitrogen in micrograms per liter at Sts. B and C, during 1939 Arrows indicate levels of oxygen minimum. Numbers correspond to ATLANTIS stations

variation of rate of oxidation with temperature, pressure and oxygen concentration, etc. In fact, the very nature of the determinative factors will doubtless vary from place to place.

Several of the theoretical pictures which have been proposed (Seiwell, 1938; Wattenberg, 1939) postulate an accumulation of organic particulate matter at the level of greatest stability, near the bottom of the thermocline, and it has been supposed that this is important in determining the depth of the oxygen-minimum zone. However, inspection of Figs. 1 and 2 shows no such relation. Obviously the vertical distribution of particulate matter is irregular but, although it seems to be more abundant near the surface, there is certainly no indication of any accumulation in the zone of low oxygen.

Jerlov (1953) has also determined the vertical distribution of particulate matter (organic plus inorganic) by an entirely different method, and while his results occasionally show a higher concentration in the low-oxygen zone, there are as many cases in which the reverse is true.

Apparently we must abandon any conception that particulate matter accumulates in the oxygen-minimum zone.

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