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DISCUSSION AND CORRESPONDENCE

VISIBLE SOUND WAVES

The following notes, written by Lieutenant Thomas T. Mackie, 123d Field Artillery, A. E. F., describe a phenomenon which must have been observed rarely, if ever before, and it seems to be very much worth while to put the circumstances on record.

On one or two occasions within recent years the occurrence of sound waves visible to the naked eye under peculiar atmospheric conditions has, I believe, been reported; yet the event is so unusual that I have been persuaded to describe a similar one which I witnessed at the front on the opening day of the Meuse-Argonne offensive.

During the days immediately preceding the attack my regiment moved into position in a wooded area opposite Montfaucon, characterized by the roughness of the terrain, a jumble of high hills cut up by narrow and deep valleys. The battery to which I belonged was sent into position at the head of one of these valleys, enclosed by very steep slopes, and having roughly the shape of a V with the open end to the south. Some four or five hundred yards to our rear and approximately on a line with the extremities of the arms of the V was a battery of six-inch rifles.

For several days the weather had been more or less rainy and wet, and the morning of September 26 found us covered by a very heavy bank of fog which entirely excluded the sun. Soon after the attack opened, I had occasion to go to the top of one of the hills which flanked our position, and at a certain definite level above the battery a very considerable disturbance in the fog was noticeable after each discharge of the heavy rifles behind me. The visibility was such that the flash of the discharge could not be seen, but each time before the report reached us a band of greater density was clearly visible in the fog, moving with great rapidity up the valley toward us in the form of an arc. Its arrival was simultaneous with that of the sound of the discharge. This arc of greater fog density was perhaps six feet from its anterior to its posterior edge, and of about the same depth. It followed closely an altitude of some sixty or seventy feet above the floor of the valley and was clearly visible from both above and below that plane, but no similar phenomena were visible in any other plane.

The recent researches of Professor D. C. Miller, and others have shown that the muzzle wave from a large gun carries in its front a narrow region of compression immediately followed by a relatively wide region of expansion. From the above account, it would appear that the air was saturated with water vapor at a particular level, and that the expansion in the wave produced a visible increase in the fog density, the effect disappearing immediately again, owing to the subsequent re-evaporation when the air regained its normal pressure and temperature. The conditions of the terrain were very favorable to the concentration of a great amount of energy into the wave-front, and this was probably assisted by a sound-mirage effect. The upper layers of air being warmer than the lower the sound wave-fronts would be so bent as to tend to keep the energy near the earth's surface. The "experiment" was thus being conducted under such circumstances and on such a scale as can not readily be reproduced in the laboratory, and would rarely occur anywhere.

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DRIFT BOTTLES AS INDICATING A SUPERFICIAL CIRCULATION IN THE GULF OF MAINE

In his "Explorations in the Gulf of Maine" H. B. Bigelow[1] has found evidence of a circulation of the water in the gulf. Since this evidence depends chiefly on the contours of the osohalines and the distribution of plankton, the direction and rate of movement of the drift bottles to be described, obtained incidentally in another investigation may be of importance in adding to this evidence. During the summer of 1919 as part of the hydrographic work in the Bay of Fundy by the Biological Board of Canada, 330 drift bottles were set out in the bay. Sixteen of these bottles have been picked up on the shores of the Gulf of Maine. The

[1] *Bull. Mus. Comp. Zool.*, Vol. 58, p. 29; Vol. 59, p. 149; Vol. 61, p. 163

distribution of the bottles which left the Bay of Fundy from two of these sets is shown in the figure, where the interrupted lines merely join the points of setting out and finding of the bottles, and are not intended necessarily to indicate the course which the bottle may have taken. The bottles were set out between June 18 and September 26 in sets spaced in lines across the bay at various distances from on the Cape Cod peninsula, the other two on the coast of Maine. (See figure which shows only the bottles of the first two sets.)

The times when the bottles were found are significant since they establish a minimum rate for the drift. Seven out of the eleven bottles which went to Cape Cod were found between 70 and 80 days after being put out, the shortest time being 73 days. The distance

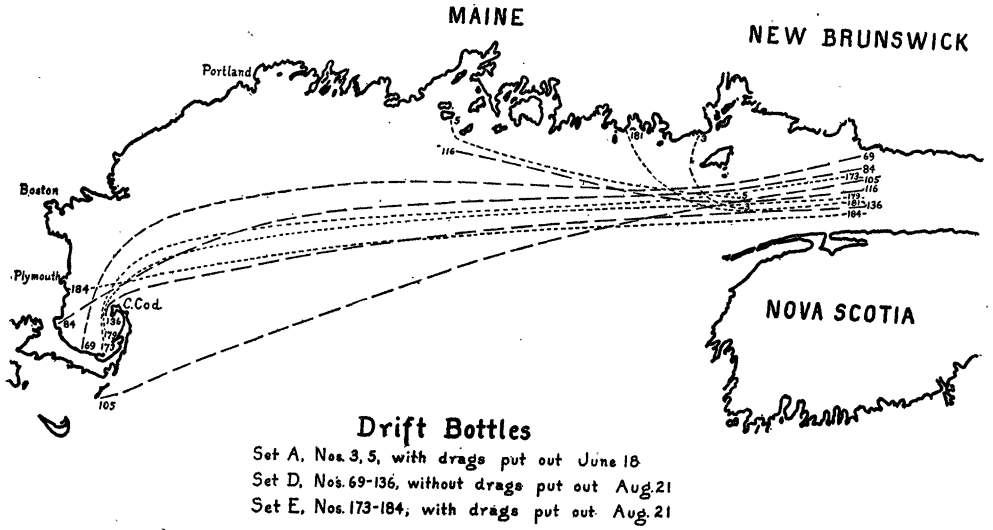

FIG. 1.

its entrance. Each bottle contained a Canadian postcard on which was printed besides the address of the Biological Station the offer of a reward to the finder who wrote the time and place of finding and posted the card. The bottles were of two kinds; two-ounce bottles and eight-ounce bottles; to the latter a galvanized iron drag was attached to hang at a depth of three fathoms, the object of the drag being to minimize the direct effect of the wind. Fifty-five of these latter bottles with drags were set out and six have been found and reported from outside the Bay of Fundy, to date (August 6, 1920). Three of these were picked up on the Cape Cod peninsula, the rest on the coast of Maine. Of the two hundred and seventy-five bottles without drags, ten have been reported from outside the bay. Eight of these ten were picked up in a straight line from the Bay of Fundy is about 300 nautical miles. The rate of the drift was therefore about four nautical miles per day.

The drift of these bottles, set out at various times during the summer, indicates a surface movement of the water from the Bay of Fundy through the northwestern part of the Gulf of Maine and striking Cape Cod, the rate of this drift being about four nautical miles per day.

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SCIENTIFIC BOOKS

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