and the original primary lead into a common neck loses its significance in assigning the smaller follicles to one category or another and they may have all the characteristics of secondary follicles. To assess their significance in population studies, further observations on the differentiation of these follicles would be welcome.

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¹ Lyne, A. G., *Nature*, **179**, 825 (1957).

² Wildman, A. B., and Carter, H. B., *Nature*, **144**, 783 (1939).

³ Carter, H. B., *Animal Breeding Abstracts*, **23**, No. 2, 101 (1955).

Vernal Sloughing of Sludge Deposits in a Sewage Effluent Channel

VERNAL sloughs in polluted streams, associated with the break-up of *Sphaerotilus* growths and *Carchesium* colonies, have been recorded by Hawkes¹. These growths collect silt and humus and, on becoming detached from the stream bed, release large amounts of organic material into suspension.

In April 1954, masses of chironomid tubes were observed floating in the effluent channel of a sewage works using the activated sludge process. The tubes were composed of sludge which had settled on the bed of the channel and the tube-masses were several inches in diameter. This vernal sloughing of the channel bed was associated with the first spring emergence of *Chironomus riparius*, Meigen. The larvæ of this midge were present in densities exceeding 100,000/m.² in the winter, spring and early summer of 1954.

Recently, when the effluent temperature was approximately 10° C., sludge was collected containing large numbers of larvæ and placed in a glass tank at approximately 20° C. After a few days the surface layer, the upper zone of which was composed of chironomid tubes, broke away from the deeper layers (Fig. 1), the surface layer being buoyed up by entrapped gas bubbles. Fig. 2 shows conditions after emergence of the midges, the tube layer having separated completely from the rest of the deposit. An analysis was made of the gas evolved by the sludge (Table 1). Its composition is similar to that produced by a group of Thames Estuary muds investigated by Grindley², with more than 70 per cent methane.

The large quantity of gas produced at the higher temperatures^{2,3} is prevented from escaping by the thick layer of chironomid tubes, and the accumulation of bubbles underneath and within these tubes eventually causes the layer to break off in large masses. High densities of larvæ are necessary for the formation of the tube layer, and its instability, as the upper zone of the deposit, seems to be increased by the emergence of the midges. It is possible that the irrigation currents produced by the larvæ facilitate

Fig. 1. Break-up of sludge deposits resulting from gas formation

Fig. 2. Separation of the tube-layer after a midge emergence

to some extent the removal of gas bubbles from the tube-layer matrix. The slough is particularly associated with the first spring emergence, when water temperatures are rising and when the tube-layer produced by over-wintering larvæ is especially well developed. This tube-layer incorporates much of the solid matter which settles during the winter period.

Thermograph records of the effluent kept from April 1954 until August 1955 indicated that the temperature was rarely higher than 20° C. in the summer or lower than 10° C. in the winter. In April 1954 the effluent temperature varied between 13° and 16° C.

The release of large quantities of organic matter from the benthos is likely to lower the dissolved oxygen concentration in the water and may produce conditions adverse to fish. Furthermore, the superficial resemblance of these tube masses to untreated sewage solids may give rise to complaints from riparian owners.

I should be glad to receive any further observations concerning this vernal sloughing associated with the emergence of midges.

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¹ Hawkes, H. A., paper presented to the Inst. Sew. Purif. (Jan. 1957).

² Grindley, J., *Dock Harb. Author.*, **38**, 79 (1955).

³ Rudolfs, W., *Indust. Eng. Chem.*, **30**, 337 (1938).

Table 1. ANALYSIS OF GAS EVOLVED BY SLUDGE

Gas	Volume (per cent)
Carbon dioxide	7.4
Methane	74.7
Oxygen	0.2
Hydrogen sulphide	0
Hydrogen	0
Nitrogen	17.7