period 0.3 sec., this deflection being recorded photographically on a rotating drum. Bursts were recorded with thicknesses of 10, 20, 30 and 40 cm. of lead above the chamber, the sides of which were throughout surrounded with 10 cm. of lead to prevent showers from the walls and ceiling of the room from reaching the chamber. The chamber was placed with its axis of symmetry vertical, and calculations showed that the passage of about twelve ionizing rays through the chamber from a point above it would, on the average, produce a sudden displacement of 0.5 mm. in the trace on the film. We have reasons, however, for suspecting that many of the shower particles which originate in the lead above the chamber and strike the lead walls around the chamber—which is long in comparison with its radius—are scattered back into the chamber, possibly accompanied by secondary rays, with the result that a kick of 0.5 mm. may correspond to a burst of a very few rays, possibly as few as three or four. Our results, however, do not rest on this assumption.

The accompanying diagram shows the rate of production of bursts, corresponding to kicks of between 0.4 and 0.6 mm. (Curve 1), and that for kicks greater than 0.6 mm. (Curve 2). The limits of error indicated for each experimental value on the diagram refer to the standard deviation. The general form of the Rossi curve for thicknesses of lead less than 10 cm. is indicated for purposes of comparison (broken curve). It will be seen that the curve for the smallest bursts has a very pronounced maximum at about 20 cm., a value agreeing within the limits of experimental error with those obtained by the observers who have obtained a noticeable maximum with the use of counters. The curve for the larger bursts is, on the other hand, nearly flat.

This suggests that the failure of some observers to obtain the second maximum with counters is due to the fact that the probability of detection of a shower with most counting systems increases with the number of ionizing rays in the shower, so that with some arrangements of counters and for large thicknesses many of the observed coincidences would be due to many-particle showers. This would tend to result in a curve which was fairly flat like Curve 2. The suggestion seems to be supported by the results of Swann and Ramsey², who used an elaborate system comprising a large number of counters capable of recording only double coincidences, and who obtained with tin a definite broad maximum as

marked as that of Curve 1. Schmeiser and Bothe³ found that their curves for iron and lead showed a less pronounced second maximum when the lower two counters of their triple-coincidence system were farther apart. They therefore attributed their peak to small-angle 'hard showers', but the assumption of small angles between the shower particles seems unnecessary. We suggest that separating their lower two counters favoured the detection of the larger showers to a greater extent, so that the curve then obtained was more like Curve 2 than Curve 1.

We have obtained preliminary results for iron which already indicate that the same effects occur as with lead, though at greater thicknesses, as would be expected. Full details of this work will be published elsewhere in due course.

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¹ vide Froman, D. K., and Stearns, J. C., *Rev. Mod. Phys.*, **10**, 133 (1938).

² Swann, W. F. G., and Ramsey, W. E., *Phys. Rev.*, **58**, 477 (1940).

³ Schmeiser, K., and Bothe, W., *Ann. Phys.*, **32**, 161 (1938).

Geologists in War-time

I HAVE read with interest Prof. H. H. Read's account (*NATURE*, Jan. 10, p. 39) and the leading article in *NATURE* of March 14 on the lack of use of geologists in the present emergency, and can fully support the criticisms advanced. Included under the general designation 'geologist', however, are a number of other highly trained specialists the neglect of whom is not mentioned in these articles, but who are equally at a loss in their attempts to use their specialized knowledge to increase the war effort.

Every university department of geology includes on its staff, or on that of an associated department, petrologists and mineralogists, who must accept the decision that their first contribution is to continue the training of science students. Even where a reduction of staff leaves little time free from teaching duties during term, this pressure of work relaxes during the necessary vacations. The "fundamental dependence of industry upon mineral products", stressed by Prof. Read, does not end, however, when the raw material has been located, won and transported to the factory. In the chemical (including explosive) industry, the abrasive, refractory, ceramic and metallurgical industries, for example, process control and associated research must continue throughout manufacture and can most easily be achieved by the use of the chemical, optical and X-ray methods in which the petrographer, mineralogist and crystallographer are skilled.

Early in 1939 I played a small part in drawing up for the appropriate authority (on multipage documents each prepared in quadruplicate) a scheme for the utilization of the equipment, resources and staff of a particular laboratory; from that time three years ago the few problems which have reached that laboratory have done so through unofficial and accidental personal contacts. For the rest, the resources of the laboratory remain unutilized, the teaching staff chafe under a sense of complete frustration, while my carefully prepared quadruplicates doubtless languish untouched in some remote pigeon-hole.

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