This absence of sound suggests uneven refraction at an inversion in the troposphere. From the area of audibility it would appear that the inversion extended over the Taranaki Bight, but did not extend southward over the Canterbury Plains. The anticyclonic weather conditions which had prevailed for several days were favourable for the establishment of an inversion.

ANDREW THOMSON.
Meteorological Office,
Wellington, New Zealand, Aug. 26.

MR. THOMSON'S report with regard to the sounds proceeding from the New Zealand Earthquake of June 17, 1929, is of great interest.

It is usual for sounds to be heard coming from the ground in the neighbourhood of the epicentre of an earthquake, but I have found no earlier reference to sounds transmitted through the air to great distances from such an origin.

One difficulty in understanding the phenomenon is that owing to the high velocity of sound in rocks, waves coming from below and refracted into the air must pass upwards nearly vertically. (Gutenberg, "Grundlagen der Erdbebenkunde", p. 35, gives 13° as the maximum inclination to the vertical.) No possible constitution of the atmosphere would permit the return of such waves to the ground.

Mr. Thomson remarks that the times he has computed for the passage of the initial aerial disturbance from Murchison to various places are on the average such as are found for the 'abnormal' audibility of explosions. The average time in his table is 828 seconds for the average distance 224 km. According to observations in England,[1] the time of passage of the sound from gunfire to a distance 224 km. would be about 760 seconds, that is, the delay as compared with normal transmission of sound is 100 seconds as compared with Thomson's 168 seconds. In rough estimates such a difference is to be expected. It should be noted, however, that the more accurate observations show that von dem Borne's hypothesis is not tenable. It is now believed that abnormal audibility is to be explained[2] by the high temperature of the layers between 40 km. and 60 km. above ground from which the air waves return to earth.

Mr. Thomson lays stress on the fact that the sounds were heard to the north-east of the epicentre and not to the south-west. In this connexion it may be pointed out that the earthquake occurred during the New Zealand winter and that transmission to north-east in the southern hemisphere is analogous to transmission to south-east in the northern hemisphere.

According to War-time experience, the firing on the Western Front was heard in England in summer, in Switzerland in winter. It appears that in our part of the world the zone of abnormal audibility is to be found to the north-west of the source of sound in summer and to the south-east in winter. It is not unlikely that a similar rule holds good in New Zealand, abnormal audibility being possible to the south-west in summer and to the north-east in winter.

I hope that interest in the subject will be stimulated by the experiences related by Mr. Thomson and that an experimental investigation of the transmission of air waves to great distances will be undertaken in New Zealand.

F. J. W. WHIPPLE
(Superintendent).
Kew Observatory,
Richmond, Surrey, Oct. 15.

[1] Int. Research Council. Commission on Solar and Terrestrial Relationships. 2nd Report, 117; 1929.
[2] NATURE, 111, 187; 1923; 118, 309; 1926.

Vacuum Spark Spectra in the Extreme Ultra-Violet down to 100 A.

USING a vacuum spectrometer for the extreme ultra-violet, designed by Prof. M. Siegbahn and built in this laboratory, we have succeeded in obtaining and measuring optical spectra down to 100 A. Especially in the region below 600 A., the increase in intensity and dispersion is considerable. A single exposure (time of exposure 5-15 min.) on a Schumann plate 260 mm. in length gives the region up to 1250 A. with dispersions of 3·5 A./mm. at 100 A. and 6·5 A./mm. at 1000 A., a concave grating on speculum metal with 571 lines per millimetre being used.

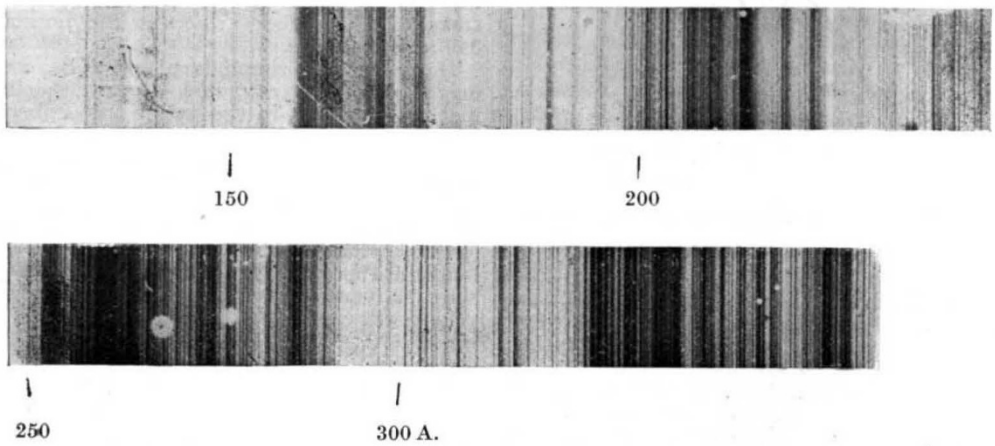

FIG. 1.—Spark spectrum of copper (lower end). Enlarged 4 times.

On a spectrogram of copper (Fig. 1) taken with a slit width of 0·005 mm., all the lines given by Millikan (Millikan and Bowen: *Phys. Rev.*, **23**, p. 1; 1924) down to 155·7 A. are found as intense line-groups. Our measurements on this element extend to 126 A. and include about one hundred and forty lines below 200 A.

An investigation of the lighter elements from lithium (3) to fluorine (9) has revealed hitherto unknown spectral series of highly ionised atoms. The lines reported by Millikan and Bowen are generally found within their limits of error. Especially below 400 A. they are, however, separated into two or more components. But we have not been able to check the lines at 136·6 A. and 144·3 A. ascribed by Millikan to oxygen, which have hitherto been considered as the shortest wave-lengths measured in optical spectra.

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