ature at low fields obeys an exponential law $\sigma = \sigma_0 \exp(-eE/kT)$, the activation energy E being 0·15 eV. This value remains constant even though the absolute value of the conductivity varies from one crystal to another, between 10^{-5} and 10^{-6} ohm^{-1} cm.$^{-1}$ at room temperature.

Selenium is anisotropic, and on one particularly thick crystal the conductivity could be measured both along, and at right angles to, the hexagonal c-axis. The latter conductivity was ten times lower than the former; but the activation energy was the same, at least above room temperature. At lower temperatures the conductivity normal to the c-axis fell off more rapidly, corresponding to a higher activation energy. The deviations from Ohm's law in the two directions were similar in magnitude; but the initial increase in resistance above room temperature was not observed with the current flowing normal to the c-axis.

A phenomenon described by Müller, and confirmed here, is an irreversible decrease in conductivity (σ) on taking a crystal through its first heating cycle. This 'annealing' effect manifests itself as a deviation of σ from the exponential law beginning at about 130° C. as the crystal is heated and completed at 210° C. The cooling curve follows another exponential law with the same slope but a value of σ about ten times smaller than before. This curve is then reproducible on reheating. Some tests were made to trace the cause of this effect. It could not be prevented by heating in vacuum instead of in air, nor by changing the rate of cooling. The effect was, however, reduced with a crystal which had received only a minimum of handling (no cleaving or grinding). It is thought that the cause may lie in recrystallization after deformations caused by handling the crystals.

The thermo-electric power θ of the crystals was measured by raising the temperature of one of the contacts by 5–10° C. At room temperature there is a straight-line correlation (of slope k/e) between values of θ and $\log \sigma$ for different crystals and also for the same crystal before and after annealing. Since the formula for θ contains a term $(k/e) \log n$, this correlation indicates that the differences in σ are attributable to differences in the concentration of positive holes, n (selenium is a deficit conductor), the mobility remaining constant. However, no such correlation between θ and $\log \sigma$ was found when a given crystal was tested at different temperatures. θ remained approximately constant, while $\log \sigma$ varied as $1/T$, as mentioned above. This may mean that the simple theory of the thermo-electric effect breaks down, as stated by Greenwood and Anderson[4] with reference to cuprous oxide and stannous sulphide; alternatively, it might be assumed that the temperature dependence of σ is due to a changing mobility, n remaining constant.

Such a behaviour and also the deviations from Ohm's law might possibly be explained by assuming the existence of internal barriers. The observed resistance and its temperature dependence is then mainly due to the barriers, while within the grains the resistance is lower and almost constant. θ, being a bulk property, would then also be constant.

Henkels[5], who simply dismisses crystals grown from the vapour phase as "polycrystalline", claims to have grown true single crystals from the melt, citing as evidence very much smaller deviations from Ohm's law. The values of conductivity and activation energy are, however, very similar to those mentioned above, while one would expect a higher conductivity and smaller temperature dependence in the absence of barriers. It is not stated whether Ohm's law was checked over a range of temperatures.

Clearly a good deal more work, both from the structural side with special X-ray techniques and from the electrical side, is required to clarify the behaviour of these crystals.

A fuller account of this work will be published elsewhere.

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Low-Level Atmospheric Ducts

In a communication in *Nature*[1], I suggested an explanation for the occurrence of low-level atmospheric ducts over the sea, which had been reported by McPetrie and Starkey[2] in conditions of strong winds. It was suggested that the previous history of the air was the governing factor in deciding whether an atmospheric duct would occur. I am indebted to Dr. Starkey for additional information showing the dates of occurrence of various signal strengths in the Cardigan Bay area in strong wind conditions.

For each of the eleven days given, the air was tracked back from the Cardigan Bay area for forty-eight hours. Very strong signals were found to have occurred in air which had travelled mostly over land, finishing with a descent from the Welsh mountains to sea-level in Cardigan Bay. 'Fairly strong' signals were associated with polar air which had been in the area south-east of Greenland forty-eight hours before and had crossed Ireland before reaching Cardigan Bay. Weaker signals accompanied air which originated farther south on the Atlantic and had no land track, while no signal at all was measured in warm-sector air the origin of which was far to the south-west of the British Isles in a region where sea temperatures are high. No signal also was measured on one occasion when the origin of the air might have led one to expect a fair signal; but on this occasion continuous rain in the Cardigan Bay area probably considerably reduced any humidity-lapse which may have existed previously.

The analysis shows clearly the importance of the previous history of the air and, in addition to the effect of the cold origin of the air mentioned in my previous note, the drying effect on the lowest layers of a recent land track is also of great significance.

I am indebted to the Director of the Meteorological Office for permission to submit this note.

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