he gives "the fluid arrangement of the troilite—forming an arrangement closely resembling the fluid structure of terrestrial rocks ; the lack of an alteration zone ; the unusually varied and in part bizarre relief of the anterior surface", etc.

I have recently polished and etched a full-sized transverse section of this iron. It shows an alteration zone which varies in thickness from up to 2 mm. at the ridges to ¼ mm. or less at the hollows of the surface. This alteration zone can be duplicated, for example, in the iron which fell at Rembang, Java, on August 30, 1919, the interior of which is a normal octahedrite. There appears to be no valid reason for the assumption that the internal structure of N'Goureyma is due to softening or melting in its flight through our atmosphere, or for regarding it as an exception to the general rule that such heat effects are confined to a shallow skin and that the interior remains cold during the fall. In the case of meteorite craters, as at Henbury[3] and Kaalijärv[4], fragments of the crater meteorites are found remarkably distorted in their internal structure by heat and shock, but this effect is attributed not to friction in the air, but to the momentum of exceptionally large and fast meteorites being sufficient for them to reach the ground with much of their cosmic velocity unimpaired, the sudden stop resulting in a great rise of temperature throughout the mass. No such effect is suggested in the case of N'Goureyma.

There remain two possible explanations of the structure of this meteorite. The first, and most probable, is that it is due to plastic flow within a cosmic body approaching planetary dimensions of which the meteorite is a fragment. The other is that, in course of its wanderings, an iron of Zacatecas type approached near enough to the sun to be softened and drawn out. Such an explanation has been suggested by Dr. L. J. Spencer[5] for the 'metabolite' structure of Murnpeowie, but that meteorite does not show the unique 'drawn-out' structure of N'Goureyma, which it is difficult to visualize as a heat effect in free space.

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Nov. 12.

[1] Brezina, A., *Proc. Amer. Phil. Soc.*, Philadelphia, **43**, 245 (1904).
[2] Cohen, E., *Amer. J. Sci.*, [iv], **15**, 258 (1903).
[3] Spencer, L. J., *Min. Mag.*, **23**, 387 (1933).
[4] Spencer, L. J., *Min. Mag.*, **25**, 75 (1938).
[5] Spencer, L. J., *Min. Mag.*, **24**, 13 (1935).

Formation of Widmanstätten Figures in Meteorites

IN a recent communication[1], Prof. E. A. Owen advances a theory to account for the Widmanstätten figures in meteorites. He suggests that the meteorite is heated to a high temperature in its passage through the earth's atmosphere and is then suddenly cooled on coming to rest in the earth and that in consequence a distorted body-centred lattice, in metastable equilibrium at ordinary temperatures, is produced. He supposes further that the Widmanstätten figures grow by "prolonged annealing" at ordinary temperatures in the earth.

It is, however, generally accepted that a meteorite will not be heated appreciably, except near its surface, in the very brief period during which it traverses the earth's atmosphere, most of the heat and liquefied and vaporized portions of the surface being carried off by the air itself. This conclusion rests upon the well-known observation that in an octahedrite it is only near the surface ("the burnt zone") that the Widmanstätten figures are much broken down and confused. The same effect can easily be produced artificially by heating a piece of 'normal' meteoric iron.

The most direct evidence for this contention is provided by such meteorites as Cabin Creek and Charlotte. Both of these were seen to fall and, when examined afterwards, both exhibited normal Widmanstätten figures surrounded by the usual burnt zone.

It may, therefore, be concluded that the heating produced by passage through the earth's atmosphere is insufficient to affect the structure of the meteorite beyond a depth which does not generally exceed half an inch, and that the Widmanstätten structure is one which existed in the body before it traversed our atmosphere.

In view of these facts, Prof. Owen's theory appears untenable.

We hope shortly to publish the results of some extensive studies of the constituents of meteoric iron, which we have made, using thermo-magnetic, micrographic and X-ray methods, and to discuss their significance.

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[1] NATURE, **142**, 999 (1938).

Relationship between Household Income and Food Expenditure

SINCE publishing the results of a study of the consumer-demand for milk among 300 poor working class families in Leeds[1], an analysis has been made of data relating to household income and food expenditure collected during investigation. 'Household income' refers to the money the housewife had for housekeeping purposes and not the total earning of the members of the household. 'Food expenditure' represents the expenditure on all foodstuffs, including groceries, meat, vegetables, milk and similar goods.

The average household income was £1 16*s.* 11*d.* per week, and the average household food expenditure was 19*s.* 1*d.*, or 9*s.* 9*d.* and 5*s.* 1*d.* per head per week respectively. The regression equation connecting income (V) and food expenditure (F) was derived to determine if the relationship between the two factors was linear or curvilinear. The coefficient of income[2] (V^2) was not significant and the equation became

$$F = 0{\cdot}62V - 3{\cdot}83.$$

The correlation coefficient R_{FV} was 0·92. Thus there is a close linear interdependence between income and food expenditure among families examined, and on the average for every 1*s.* change in income food expenditure changed 7½*d.* The partial correlation coefficient $R_{FV \cdot XY}$ connecting income (V) with food expenditure (F) after eliminating changes in the number of adults (X) and children (Y) in the families was 0·85, which indicates that in households of constant constitution there is a close relationship between the factors under consideration.