starting at any point on the freezing point against depth curve, we plot a second curve giving the temperatures of a column of liquid in convective equilibrium, there would be a certain depth at which these two curves become tangential. This means that below this depth the freezing point gradient is less than the adiabatic gradient, which is, as is well known, the correct condition for the existence of permanent convection currents in a liquid radioactive column cooled slowly at the top and in contact at its highest point with its own solid.

On re-reading Prof. Holmes's paper and carefully examining his curves, I see that the latter view is what he expressed and I should like to take this opportunity of apologising to him for misrepresenting his real opinion in my recent paper on "Some Difficulties in Current Views of the Thermal History of the Earth"[2]. There is, I think, little doubt that the requisite condition will be satisfied at some depth in the crust. The available data are insufficient to fix the depth, but such as they are, point to a value of some hundreds of kilometres[3].

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[1] *J. Washington Acad. Sciences*, **23**, No. 4, April 1933.
[2] *Sci. Proc. Roy. Dub. Soc.*, **21**, (N.S.), No. 2, 10, Jan. 1934.
[3] Jeffreys, H., "The Earth", 2nd Ed., p. 141; and Poole, H. H. and Poole, J. H. J., *Phil. Mag.*, p. 666, March 1928.

Surface Markings of the Henbury Meteorites

DR. L. J. SPENCER, in describing the Henbury meteorites[1], states: "The surface markings . . . in all cases appear to be the result of sculpturing by weathering processes. No clear evidence was detected that the original surface on any of the masses had been preserved." Having examined nearly all the irons found at Henbury both by our parties from the Kyancutta Museum and by prospectors and others, I consider that Dr. Spencer's statement needs qualification.

The irons buried to considerable depths are certainly rusted and have lost all resemblance to the original surface markings, and the same is true, to a less extent, of the buried portions of those irons which were only partly exposed; whilst other rusted irons have been at one time buried, but exposed later by lowering of the ground surface. Omitting further reference to these rusted irons, there remain two groups of material which I regard as exhibiting clearly the original surface markings.

The clearest evidence of unweathered condition is found in many of the twisted 'slugs' torn from crater meteorites in landing or in the subsequent explosion. These have cuts, scratches and bruises which cannot be attributed to wind erosion or other forms of weathering, but are as clear and fresh as if recently made. This evidence, if accepted, indicates a probability that some of the 'individual' irons may be in equally fresh condition, and several such have been actually found. (See Plate XV, Fig. 10, l.c.) These 'individual' irons show a variety of surface markings. Apart from the rust-pitted, partly-buried surfaces, and the 'pock-marks' which are admittedly the result of atmospheric weathering, these markings may be classified as (1) blebs, bosses and rounded ridges, somewhat resembling brain convolutions, (2) 'gouge-marks', well shown in the plate mentioned, (3) wide, very shallow concavities. I am inclined to relate these three types respectively to the forward, lateral and hinder parts of the meteorite in flight; but all three types are not necessarily present on a particular specimen, the variation being perhaps due to the amount of rotation and the general shape.

An interesting point is that the size of these markings corresponds roughly with the size of the iron. Thus the 'gouge-marks' in the iron of 33 lb. shown in the plate mentioned average $\frac{3}{8}$ in. across; those on a very perfect little 4 oz. iron are only $\frac{3}{16}$ in.; and those on the largest iron I have seen average an inch. This grading of size would be difficult to explain on the assumption of atmospheric weathering, but on that of flight-pitting it may be accounted for by the fact that small irons would lose their velocity and incandescence in the upper rarified air, whilst large ones would retain these in the lower denser levels.

The totally different surface markings of an 'individual' meteorite and a 'slug' cannot be accounted for by weathering. Irons of both kinds, lying on the surface, have been exposed to identical conditions, and had a substantial thickness of iron been removed by weathering, the surface sculpturing of both varieties should tend to approximate, as is admittedly the case with buried and rusted irons.

Not only do the best of the individual irons show these clearly defined forms on their exposed surfaces, but in many instances, especially in recesses of pits, there remain traces of a peculiar even scale, which I regard as the original scale formed in flight. This, in common with the remainder of the exposed surface, is covered by a limonite glaze of secondary origin, due to hydration of a thin film of the original surface scale and iron; this glaze forms an extremely hard protective patina and may be responsible for the perfect preservation of the surface features.

The flight pitting of an iron meteorite differs from that of a stone one. Stone is only subjected to incandescence and gaseous flow (compare the 'welding torch' of an oxy-acetylene blowpipe); whereas iron is subjected to oxidation as well (compare the 'cutting torch' in which an additional nozzle sprays oxygen on to the incandescent metal). Nor will the flight pitting of irons which have been observed to fall necessarily duplicate the features of the Henbury irons, which are known by their crater effects to have been of exceptionally high velocity.

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[1] *Min. Mag.*, Sept. 1933, p. 390.

THE preservation of the fine series of material, now in the meteorite collection of the British Museum, from the meteorite craters recently discovered near Henbury in Central Australia, is entirely due to the energy and enthusiasm of Mr. R. Bedford. This material, 1,000 lb. in weight, was collected by him, and he has given much thought and study to the matter on the spot. The numerous individual masses of meteoric iron show a considerable variety of surface forms and markings which are certainly puzzling. Some of them he admits are due to subærial erosion and some to subterranean weathering. But others he believes are the original surfaces; that is, those resulting from the friction and burning of the meteorites during their brief flight through the