A new meteoric iron found near Kyancutta, South Australia.

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THE local interest aroused by the discovery in 1931 of the meteorite craters near Henbury in Central Australia [1] has led to the finding of a new meteoric iron in South Australia. This is due to the energy and enthusiasm displayed by Mr. R. Bedford of the Kyancutta Museum. According to his letter dated August 23, 1932, the mass was found in June 1932 by a farmer, Mr. L. G. Gardiner, whilst cultivating a sandy paddock 28 miles ESE. of Kyancutta. It was turned up from just beneath the surface. He describes it as weighing 72 lb., and being 17 inches long and roughly triangular in section with a thickness of about 8 inches. The mass is weathered and one face shows four sharply cut hemispherical pits (fig. 2) averaging $1\frac{1}{4}$ inches in diameter and 1 inch in depth. The main mass is now in the Kyancutta Museum.

Kyancutta is in Le Hunte County in the Eyre Peninsula, and a spot 28 miles ESE. is at about 33° 19′ S., 136° 2′ E., just over the border in Buxton Co. The postal address of Mr. Gardiner's farm is Kyancutta, and Mr. Bedford suggests the name *Kyancutta* for this new meteorite.

A nice slice (B.M. 1932, 1564) of the iron weighing 370 grams, together with small fragments and filings (24 grams) for analysis, has been generously presented by the Kyancutta Museum for preservation in the British Museum collection of meteorites. It measures $13\frac{1}{2} \times 6\frac{1}{2}$ cm., with a thickness of 1 cm. The uncut surface at the edge of the slice shows broad and shallow concave areas characteristic of meteoric irons that have weathered while buried in the surface soil. Each concavity marks the area of solution of the iron by free sulphuric acid developed by the decomposition of an enclosed nodule of troilite. The hemispherical pits mentioned by Mr. Bedford are evidently cavities left by troilite. These concave surfaces on the

[1] A. R. Alderman, Min. Mag. 1932, vol. 23, p. 19.

edge of the slice have a thin coating of hard scale, which shows up as a narrow black border on the polished section (fig. 3). The larger sawn surface shows five small nodules or grains of troilite measuring 1 to 5 mm. across; but on the smaller surface none was detected. On both surfaces there are lines or gashes (fig. 3), which bear some resemblance to 'Reichenbach lamellae'. They are about 1 to 3 cm. in length with a thickness of ½ mm. or less. Along these lines rusting of the iron had taken place, with the sweating out of minute brown drops, between the time the piece was sawn and

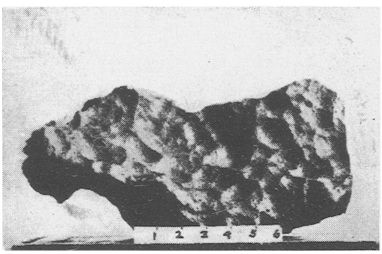

FIG. 1.

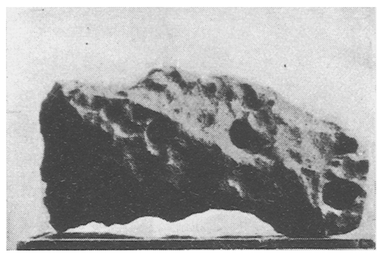

FIG. 2.

Meteoric iron of Kyancutta, South Australia.
Views of opposite sides. Scale of inches.

sent in August and when received in October. 'Reichenbach lamellae' are usually attributed to thin plates of troilite; but here there was no staining of the surface when the iron was treated with nitric acid. The tendency to rusting, with exudation of drops, along these lines is no doubt due to the presence of lawrencite. As seen on the polished and etched section, these lines are parallel to the bars of kamacite, and though most of them extend from the outer surface like cracks, some of them are entirely surrounded.

By smoothing and polishing the smaller of the two sawn surfaces the slice was reduced in weight to 350·4 grams. In working this iron it was found to be very hard—much harder than the Henbury iron, which it otherwise closely resembles; but it is readily malleable. A curious feature came out during the working of the iron. An approximately flat surface was first obtained by filing, and the surface was then ground on an iron plate with emery; but before the whole of the filed surface was levelled out the specimen was polished on a buff with magnesia powder. The filed surface then showed a smooth and brilliant polish; whilst the ground surface was still somewhat dull and it showed distinct indications of the lamellar octahedral structure of the iron. On etching with very dilute nitric acid the lamellar octahedral structure was brought out prominently on the ground surface but less prominently on the filed surface. Further, the kamacite bands on the ground surface displayed a very marked oriented sheen when viewed at different angles with respect to the reflected light; whilst on the filed surface this was scarcely noticeable. Under the microscope the kamacite bands in the filed

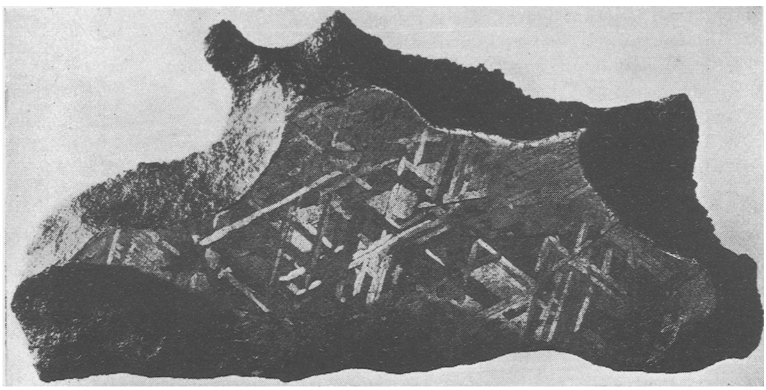

FIG. 3. Etched slice of the Kyancutta meteoric iron. $\times \frac{3}{4}$.

area show well-marked Neumann lines in several directions; but on the ground area these are scarcely perceptible. The structures to be seen in the microscopical examination of polished metal surfaces evidently depend largely on the method of preparing the surface. These differences are in part brought out in the photograph of the polished and etched surface (fig. 3). The section is approximately parallel to a face of the octahedron and the bands of kamacite shown in the etched figures ('Widmanstätten figures') have an average width of 1 mm., so that the iron is to be classed as a medium octahedrite. Very narrow bands of taenite are evident, and there are also the usual areas of plessite.

A digression on the term 'Widmanstätten figures' may not be here altogether out of place. As a form of terminology it seems scarcely necessary to describe the lamellar octahedral structure and the resulting etched figures common to all octahedral irons. It is, in any case, an awkward word the spelling of which is difficult to remember, while not a single one of the many spellings that have been given is correct! The following is a list of the many forms that have been used, tracing back from the present time to the earliest use in 1813.

Widmanstätten figures (Encycl. Brit., 11th edit., 1911; Webster Dict., 1918).
Widmannstätten figures (Encycl. Brit., 9th edit., 1883; Encycl. Dict., 1902).
Widmanstättensche Figuren (Brockhaus Lex., 1903).
Widmanstätten'sche Figuren (Tschermak; Brezina; Cohen).
Widmannstättensche Figuren (Partsch, 1843; Handw. Naturwiss., 1915).
Widmanstætten (figures de) (S. Meunier, 1884).
Widmannstætten (figures de) (Larousse; S. Meunier, 1882, 1909).
Widmannstaettian figures (Encycl. Dict., 1902).
Widmannstaett's figures (Encycl. Dict., 1902).
Widmannstättian figures (Flight, 1887; Century Dict., 1899).
Widmannstätten's figures (Steenstrup, 1884).
Widmanstätt's figures (Steenstrup, 1877).
Widmanstädtsche Figuren (Chladni, 1819).
Widmannstädten'sche Figuren (Schweigger, 1813).

The first published mention of these etching figures was made in 1812 by K. A. Neumann,[1] who had developed them on sections of the Elbogen meteorite by etching with nitric acid. He states, on the information of E. F. F. Chladni, that the 'Streifen' (stripes) so produced had previously been obtained on the Agram (= Hraschina) meteorite by Herr von Widmanstädten (p. 207). In a note added by Chladni to this paper the name is spelt Widmannstädten (p. 204). The first definite application of this name to the figures was made in 1813 by J. S. C. Schweigger,[2] in an editorial note based on information supplied by Neumann; he gave the form Widmannstädten'sche Figuren. Later, in 1819, Chladni published a paper entitled 'Ueber die Widmanstädtschen Figuren',[3] which was said to be an extract from pp. 314–319 of his classical work 'Feuer-Meteore' (Wien, 1819). But in the latter, although there is mention of the 'Streifen' discovered by von Widmanstädten, the term Widmanstädtsche Figuren does not appear. C. von Schreibers (after whom schreibersite was named) in his 'Stein- und Metall-Massen' (Wien, 1820) also mentions the 'Streifen' discovered by von Widmanstätten (p. 1), but on p. 70 he spells the name von Widmannstätten. It was at Schreiber's request that von Widmanstätten (or Widmannstätten), Director of

[1] K. A. Neumann, Ann. Physik (Gilbert), 1812, vol. 42, p. 207; reprinted from [Hesperus, Prag, 1812, no. 55].

K. A. Neumann (1771–1866), Professor of Chemistry at Prag. Not J. G. Neumann after whom Neumann lines were named. Cf. Min. Mag., vol. 22, pp. 277–278.

[2] J. S. C. Schweigger, Journ. Chem. Physik (Schweigger), 1813, vol. 7, p. 174.

[3] E. F. F. Chladni, Journ. Chem. Physik (Schweigger), 1819, vol. 26, pp. 196–202.

the Royal Porcelain Works in Vienna, tried in 1808 the effect of heat on a slice of the Agram iron. He then found that the figures could be more easily developed by etching with nitric acid, and he afterwards etched several of the meteoric irons in the Vienna collection; but he himself published nothing on the subject.

As a matter of fact the name of the man who has been commemorated in this connexion for the past hundred and twenty years was not Widmanstätten, Widmannstätten, Widmanstädten, or Widmannstädten, as given by his contemporaries, but that of a noble family, Widmanstetter, of Graz in Styria. His full name and title were Alois Joseph Franz Xaver Beckh, Edler [Baron] von Widmanstetter. He was born at Graz on July 13, 1754, and died in Vienna on June 10, 1849.

But to return to the Kyancutta meteorite. The following are the results of a detailed chemical analysis (Fe : Ni : = 12·4) made by Mr. M. H. Hey, with the chlorine distillation method,[1] on the filings; and the specific gravity of 7·73(5) was determined by him by hydrostatic weighing of the slice of 350·4 grams.

Fe.	Ni.	Co.	Cu.	S.	P.	Cl.	C.	Insol.	Total.
90·57	7·30	0·39	trace	1·12	nil	trace	0·13	0·22	99·73

In chemical composition and in structure the Kyancutta iron shows a very close similarity to the Henbury iron.[2] Both are medium octahedrites containing about $7\frac{1}{2}\%$ of nickel (Fe : Ni about 12 : 1). The locality of the new find lies about 620 miles south by east of Henbury, and the suggestion that this iron might be a transported mass of the abundant Henbury iron is not considered to be at all likely. Mr. Bedford with his knowledge and experience of the Henbury irons would have at once detected any attempt made to pass off a planted mass. Medium octahedrites with this percentage of nickel are in fact the most common type of meteoric iron. The iron from the meteorite craters discovered in 1932 at Wabar in the Arabian desert is of this type and so is the Piedade do Bagre from Brazil recently described in this Magazine,[3] and many others. The suggestion of transportation (which might perhaps apply in the case of the undue proportion of irons found in the United States of America) is therefore not entertained.

[1] M. H. Hey, Min. Mag., 1932, vol. 23, p. 13.

[2] A. R. Alderman, Rec. S. Austr. Mus., 1932, vol. 4, p. 555. [Min. Abstr., vol. 5, p. 159.]

[3] L. J. Spencer, Min. Mag., 1930, vol. 22, p. 271.