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# The Goose Lake Meteorite and the Goose Lake Fragments

THE metallographic structure of the main mass of the Goose Lake meteorite has been described by Henderson and Perry[1]. The meteorite was discovered in the autumn of 1938 and was removed from the site in May 1939. The site was re-examined in 1960, when a large number of small, partly corroded, fragments were discovered in and around the place from which the main mass had been removed. The circumstances under which the fragments were found, together with a preliminary description of their structure and some suggestions about their origin, can be found in ref. 2.

We have examined a number of typical fragments weighing 0·2–0·4 g which were made available to us by Dr C. P. Butler and we have also examined the 72 g slice of Goose Lake [B.M. 1959, 951] which was made available to us by Dr Hey of the British Museum (Natural History).

The slice [B.M. 1959, 951] appears to have suffered distortion of the surface layers all round the smooth outside surface of the meteorite and this distortion extends inwards to a depth of about 0·5 mm. At a number of places within the distorted layer there appear to be relics of kamacite granulation, but the patches of granulation extend only to a depth of 0·1–0·2 mm below the present outer surface of the meteorite. The granular patches may be the relics of a heat alteration zone which was produced during atmospheric flight, in which case the zone of kamacite granulation has been almost completely removed by subsequent terrestrial corrosion and/or abrasion. In this context one source of terrestrial damage which must not be overlooked is the surface deformation which may arise when a heavy mass of iron is hauled about by chains during the recovery process.

In [B.M. 1959, 951] two small areas of non-metallic phase were present. The smaller was situated about 3 mm below the present surface of the meteorite and the larger was nearby but situated about 12 mm below the surface. Each consisted of schreibersite with swathing cohenite, and, as is shown in Fig. 1, the cohenite has undergone partial decomposition into graphite and ferrite at places where the cohenite was cracked. Furthermore, the range of plessite structures encountered within the slice included the spheroidal form which was figured by Henderson and Perry[1], but more usually the large fields of plessite showed complex structures with comb-like, spindle, bainitic and fine pearlitic plessites coexisting to a greater or less extent as is shown in Fig. 2. Our own observations on the

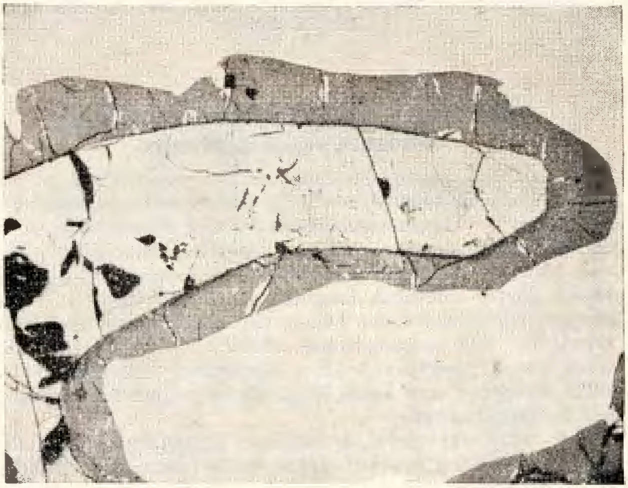

Fig. 1. Schreibersite surrounded by cohenite in [B.M. 1959, 951] (× *c.* 75). Etched in alkaline sodium picrate reagent. The schreibersite shows grey with cracks and holes (black); the cohenite has stained dark but shows unstained ferrite and black graphite along the radial cracks. The matrix is kamacite (smooth grey).

Fig. 2. An example of the complex decomposition morphology of plessite in the Goose Lake meteorite [B.M. 1959, 951] (× *c.* 55). Etched 2 per cent 'Nital'.

Canyon Diablo meteorite[3] suggest that fine pearlitic plessite is usually found in the vicinity of cohenite. The main kamacite bands of Goose Lake contained occasional rhabdites.

The Goose Lake fragments (GLF) are always corroded to a greater or less extent and seven of the least corroded fragments were examined metallographically. In no fragment was unambiguous granulation of the kamacite visible, but they all showed a greater or less degree of mechanical distortion of the type reported by Butler[2]. Moreover, mechanically distorted versions of all the types of structure noted above for the main Goose Lake mass have been found in the fragments. For instance, Fig. 3 shows a distorted area of fine pearlitic plessite in (GLF)1, while Fig. 4 shows cohenite in (GLF)12, and in the same fragment an earlier generation of relatively large hexagonal nodules of graphite was found embedded in the kamacite out of contact with the cohenite. A similar graphite nodule from (GLF)6 is shown in Fig. 5.

From this examination it would appear that the structure of the Goose Lake fragments is not inconsistent with the structure of the main Goose Lake mass. Where there are differences they are differences of amount rather than of character. For instance, in the fragments the decomposition of cohenite to graphite and ferrite seems to be slightly more complete than is the case with the two examples of cohenite which are present near the surface

Fig. 3. Example of mechanically deformed fine pearlite plessite from fragment (GLF)1 (× *c.* 290). Etched 2 per cent 'Nital'.

Fig. 4. Decomposed cohenite in fragment (GLF)12 ( × *c.* 290). Etched in alkaline sodium picrate reagent. Undecomposed cohenite is stained dark. At cracks in the cohenite the compound has decomposed into black graphite and light polycrystalline ferrite. Some grey corrosion product is present at the interface between cohenite and the kamacite matrix (right side of photograph).

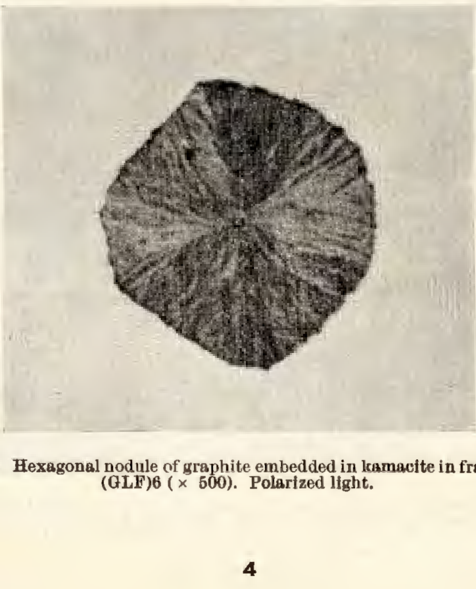

**Fig. 5. Hexagonal nodule of graphite embedded in kamacite in fragment (GLF)6 ( × 500). Polarized light.**

of [B.M. 1959, 951] and, furthermore, while the presence of carbon shows itself as cohenite in the slice it is made manifest in some of the fragments by the appearance of both cohenite and nodular graphite. Thus some of the Goose Lake fragments appear to have arisen from carbon rich areas of the main Goose Lake mass, but it remains an open question where those areas of carbon enrichment were located in relation to the size and shape of the present Goose Lake meteorite and how they came to be distributed about the main mass at its place of discovery.

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