KAMACITE-PERRYITE-GRAPHITE ASSEMBLAGES IN THE KAIDUN III METEORITE. V.I.Grokhovsky and A.V.Ivanov. S.M.Kirov Urals Polytechnical Institute, Sverdlovsk, 620002, USSR; V.I.Vernadsky Institute of Geochemistry and Analytical Chemistry of USSR Academy of Science, Moscow, 117334, USSR.

The Kaidun III EH5 clast is one of the components of the heterogeneous breccia Kaidun / 1 /. The pecularities of the microstuctural feature of the Kaidun III are the presence of large (up to 0.8 mm) metal phases, having a complex branched outer shape and developed inner cleavage. Similar metal structure is observed in St. Marks EH5 chondrite / 2 /.

The composition and morphology of the metal was examined in detal using optic microscopy, scanning electron microscopy (SEM), electron probe analysis (EPA) and electron Auger-spectroscopy (EAS).

The metal in Kaidun III is mainly kamacite with the composition (wt. %): 2.7 Si, 0.8 Co, 4.9 Ni. This composition is typical for kamacite of EH condrites. However, kamacite in Kaidun III have long oriented visible without etching lamellaes along which well developed cleavage and crumbs are observed (fig. 1). Auger-spectra of these oriented lamellaes indicate a significant carbon enrichment. It allows to identify them as graphite.

El Goresy / 3 / have recently noted that there is epitaxial intergrowth between kamacite and graphite in the St. Marks EH5 chondrite. The Widmanstätten structure of graphite is known in high-carbon technical Fe-C alloys in the case of the secondary graphite exsolution at temperatures from 650 to 900°C over the stable Fe-C diagram / 4,5 /.

The disperse grains of the another phase enriched in Ni and Si are observed along "kamacite-graphite" boundaries and sometimes along "kamacite-silicate" boundaries (fig. 2). The grains are small (1-3 μm), its composition - 13.3 Si, 3.6 P, 13.2 Fe, 0.1 Co, 70.9 Ni - corresponds to perryite $(Ni_{0.85}Fe_{0.15})_5(Si_{0.75}P_{0.25})_2$. Content of perryite in the metal don't exceed 0.5 vol.%.

The morphology of the coexistent phases and their composition allow to conclude that the assembly "kamacite-perryite" with Widmanstätten lamellaes of the graphite may form at the exsolution of the Fe-solid-solution enriched with C, Ni, Si in temperature range 850-950°C at the very slow cooling rate. Graphite has very slow strength characteristics. The cutting effect of thin graphite plates leads to the separation of the kamacite single crystal into individual micro fragments and crumbs.

Fig. 1

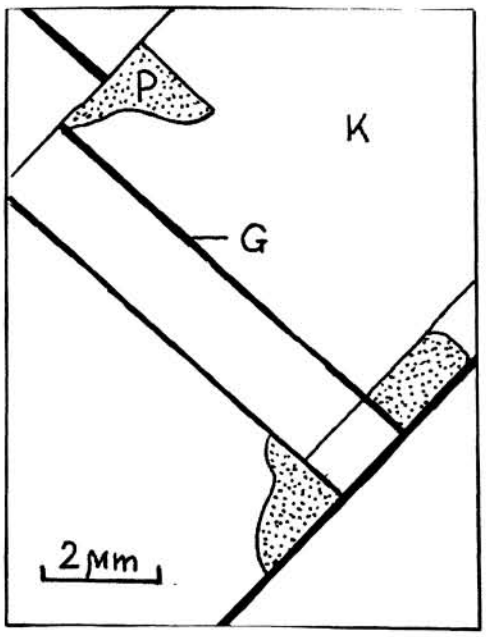

Fig. 2

Fig. 1. The structure of typical metal area in Kaidun III (EH5).
Fig. 2. Schematic illustration of the perryite (P) grains exsoluted along graphite (G) - kamacite (K) boundary.

References:

/ 1 / Ivanov A.V. et al. (1984), Lunar Planet. Sci., XV, p.393.
/ 2 / Ramdohr P. (1973), The opaque minerals in stony meteorites. Berlin.
/ 3 / El Goresy A. (1984) Private communication.
/ 4 / Bynin K.P., Taran Yu.N. (1972) Structure of the cast iron Moscow, Metallurgy-press (in Russian).
/ 5 / Hoffman W., Sistiago I.W. (1955) Arch. Eisenhüttenw. 26, p. 109.