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THE NEW MINERALOGICAL DATA ON THE ŁOWICZ METEORITE

The only mesosiderite, known from the area of Poland, fell down in the vicinity of Łowicz on the night of 11 - 12 March 1935. Thorough investigation of the Łowicz meteorite was published in Archiwum Mineralogiczne in 1938.

According to the current investigation it can be stated the Łowicz meteorite is a mesosiderite with a variable ratio of metallic to silicate phase. Neumann lines can be observed in the metallic phase. The chemical composition of the iron part of meteorite is as follows: Fe - 91.09 wt%, Ni - 8.51 wt%, Co -0.50 wt% (Thugutt 1938). Mainly kamacite and separations of taenite and plessite represent it. Schreibersite occurs within the metallic phase. Among the silicate phases the following minerals have been found; ilmenite, chromite with ilmenite, ilmenite layers, troilite (quite often with eutectic structures in the metallic phase), and a mineral with rutile features (Jaskólski 1938). Transparent phases are represented mainly by olivine, 17.9 wt% FeO, and porphyrocrystalls of plagioclase - anorthite, which composition is similar to bytownite and augite, determined as bronzite and diopside (Kołaczkowska 1938, Thugutt 1938).

The meteorite itself has not been investigated lately, there have been only some investigations concerning the area of its dispersion (Lang 1971). A.S. Pilski (1995) mentioned occurrence of some doubtful achondrites called Łowicz on the Polish meteorite market.

The investigated material consists of two “typical” fragments of the Łowicz meteorite, a part of a metallic nodule, a separate meteorite (collection of OPiOA 41) and a small part of achondrite donated by S. Jachymek.

The meteorite fragment has been examined in transmitted and reflected light and investigated under the microprobe by CAMECA SX – 100.

Microscopic investigations confirmed previous results concerning “typical” fragments of the meteorite.

The metallic phase is represented by kamacite (Ni approx. 5 wt% and Co 0.5 – 0.7 wt%). The other phases contain taenite and tetrataenite with nickel contents up to approx. 51 wt%. Schreibersite occurs in metallic and silicate phases (53-54 wt% Ni). The troilite phase, rich with kamacite inclusions, is the result of thermal destruction of troilite due to collision, which caused partial disintegration of ferrous sulfide and evaporation of some sulphur. The chromite phase, rich with Al, Mg, Ti and Mn occurs in silicate components. It contains very often tiny ilmenite layers –

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the results of admixture. Ilmenite enriched with Mg and Mn occurs not only in chromite, but also forms separate grains accompanying troilite, Ti oxides (e.g. rutile). Olivines, with molecule contents fo: 72.54-72.78% and fa: 26.69 – 26.91%, are the other minerals. Feldspars are represented by plagioclase having composition similar to bytownite: a) ab: 25.99%; or: 2.31%; an: 71.70%; b) ab: 10.61%; or: 0.30%; an: 89.01%.

Pyroxenes are represented by two members of the enstatite – ferrosilite series: a) wo: 3.45%; en: 60.54%; fs: 36.01% (clinoenstatite) and b) wo: 3.78%; en: 67.39%; fs: 28.83%.

Fluoroapatite, co-occurring with silicate minerals, is enriched with MgO (3.64 wt%) and Na_2O (1.45 wt%). Apart for them, columnar crystals of SiO_2 have been observed.

Silicate inclusions occur in large metallic nodules. In most cases, mineral phases are olivines, pyroxene, bytownite, apatite, SiO_2, chromite granules with ilmenite layers, ilmenite, TiO_2 and troilite. Within the metallic phase, inclusion which where two phases of silicate melt and a gas bubble has been found (Fig. 1). The inner melt phase consist of Si, Mg, Fe, Ti, Al, Ca, O and contains microlites of olivines. The outer layer, which is in contact with kamacite, is devitrified and consists of microlites of ilmenite, potassium feldspar, olivine and pyroxene. Such inclusions prove directly existence of silicate melt phase during the last stage of the meteorite matter formation.

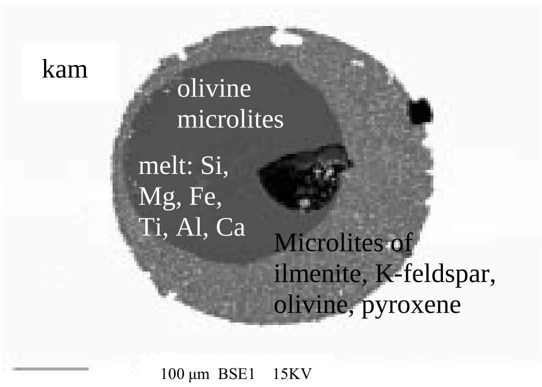

Fig.1. Inclusion of two silicate melts in kamacite, inner black space in this inclusion is after gas phase.(kam – kamacite)

The achondrite fragment of Łowicz varies significantly from the other parts called "typical". The basic difference is small contents of metal and different type of orthopyroxene representing an enstatite series, different than the pyroxene in the "typical" Łowicz meteorite - wo: 0,95 – 1,32%; en: 79,04 – 79,77%; fs: 19,13 – 19,86%; with significant contents of Cr_2O_3 (0,4 –0,8 wt%). Enstatite accompanies fluoroapatite rich with Mg and Na, chromite without ilmenite inclusions and a small amount of SiO_2. Thermally changed troilite with iron inclusions is the main non-transparent mineral. It occurs as small grains dispersed in intergrowth spaces in the orthopyroxene. Schreibersite connected with the metallic or troilite phase is quite rare. The metallic phase is composed of small kamacite veins with taenite and tetrataenite. Occurrence of taenite and tetrataenite as rims around kamacite grains is a characteristic feature of the metallic phases. The share of the metallic phase in the achondrite fragment is lower than 1% of the volume.

CONCLUSIONS

Content of nickel in the metallic phase of Łowicz meteorite is very various. The phases richest in nickel have been found in the achondrite fragment. The ratio Ni/Co proves the general rule: the higher contents of nickel – the lower one of cobalt.

The occurrence of tetrataenite, fluoroapatite, rutile, and another polymorph of TiO_2, SiO_2 and melt inclusions have been found for the first time in the Łowicz meteorite.

The position of the metallic phase of the Łowicz mesosiderite against other mesosiderites of the systems: Ge-Ga; Ge –Ni; Ir –Ni; Ir – Ga (Wasson et al.1974) proves it does not differ from the compact group of mesosiderites.

The Łowicz meteorite is a brecciated mesosiderite, formed after collision of two or more different bodies when one of them contained a metallic core. The main part of the "typical" Łowicz meteorite, where silicate phases relate to cumulate eucrite, was formed due to mixing and partial melting. The achondrite rock relating to diogenite matter, which occurs as separate parts „cemented" with the typical meteorite, varies from the main meteorite mass.

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