

CARBONACEOUS INCLUSIONS IN THE KRYMKA (LL3) CHONDRITE.

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Two new K1 and K2 carbonaceous inclusions containing "mysterite" were found in the Krymka chondrite. Carbonaceous matter of these inclusion is represented by mixture of submicron grains of olivine, troilite and metal with organic compounds (aliphatic hydrocarbons, nitrogenated carbonyl and aromatic compounds) and is characterized by lack of phyllosilicates, low analytic sum of composition (K1-81.6, K2-77.1 mas.%) and also by existence of superhigh concentrations of Bi (0.5 mas.%), Ag (14.1, 400 µg/g) and Zn (370 µg/g) in some areas. The bulk composition of the carbonaceous matter similar to the C2 carbonaceous chondrites, especially to the composition Renazzo and carbonaceous inclusions from ordinary chondrites. The contents of Ag, Bi, and Zn are considerably higher than the known superhigh concentration in carbonaceous inclusions of ordinary chondrites, including Krymka. The broken surface of K1 inclusion has cryptocrystalline structure. The needle-crystal of iron hydroxide, glassy areas with porous structure, globular aggregates, cubic crystals (chromite?), curved veins of troilite with cracks of shrinkage, inclusions of silicate grains were observed in some areas of K1.

There are holocrystalline-microporphyritic chondrules, its fragments, olivine grains (20-80 µm), troilite and metal grains (20-30 µm) inside of K1 carbonaceous inclusion. The composition olivine and troilite of these chondrules, and also some olivine and kamacite grains in carbonaceous matter don't differ from minerals in the main mass of Krymka meteorite. Kamacite is characterized by low content (mas.%) of Ni (4.4), high of Co (2.4), Cr (0.2), presence of Si (0.2), Mn (0.1) and traces of P. These peculiarities of composition are not specific only for metal in the carbonaceous inclusions, as it was noted earlier. They are characteristic for set of metal grains from chondrules and main part matrix of Krymka chondrite.

From the results of microscopic, electronmicroscopic, X-ray, electron microprobe, neutron activation, gas chromatography, IR- and UV-spectroscopy studies the following conclusions were made. 1) The formation conditions of carbonaceous inclusions matter in Krymka chondrite are similar, but not identical to the ones of C2 chondrites.

2) "Mysterite" is, apparently, organic matter, which had formed complex compounds with volatile components of Ag, Zn and, possibly, Bi on the last stages of gas-dust nebula condensation.

3) Carbonaceous inclusions were formed as a result of active transfer and multiple-stages agglomeration of the finest mineral dust, organic, mineral and chondrule grains, arised at various PT-conditions in the different regions of the nebula.

Preagglomeration histories of K1 and K2 inclusions in Krymka chondrite are different. K1 inclusion is a fragment of carbonaceous chondrite of unknown group, preserved by a cover of carbonaceous dust. K2 inclusion is a splinter of larger fragment of carbonaceous matter embedded in chondrule.

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The data on the chemical composition of the carbonaceous inclusions obtained by different methods are presented in the tables.

Table 1. Electron microprobe analysis of carbonaceous matter from black inclusions in Krymka.

INCLUSIONS				INCLUSIONS			
K1		K2		K1		K2	
rim	matrix			rim	matrix		
SiO ₂	20.6	22.3	21.6	P ₂ O ₅	0.0	0.0	0.0
FeO	41.1	31.2	38.0	TiO ₂	tr.	0.0	0.0
MgO	11.1	23.6	13.9(38.3)*	ZnO	tr.	0.0	tr.
Al ₂ O ₃	0.0	0.0	tr.	Bi	0.0	0.0	0.0(0.5)
CaO	1.0	1.1(21.0)	0.4(4.8)	Ag	tr.	0.0	tr.
Cr ₂ O ₃	0.3	0.4	tr.	Tl	0.0	0.0	0.0
MnO	0.4	0.1	0.4	Ni	1.3	1.0	2.2
Na ₂ O	0.0	0.0	0.0	Co	0.0	0.0	0.2
K ₂ O	tr.	tr.	0.4(0.7)				
FeS	1.1	1.9(5.5)	0.0(13.7)	Σ	76.9	81.6	77.1

* -maximum contents in some points.
tr - ≤0.1 wt.%

Table 2. Neutron activation analysis of K1 carbonaceous inclusion from Krymka chondrite (values are μg/g except as noted).

sample 1		sample 2*		sample 1		sample 2	
2.3 mg		3.0 mg		2.3 mg		3.0 mg	
Ca, %	2.3			Fe, %	25.5		28.3
Na	3810			Ni, %	1.5		1.6
Cr	3420		3630	Co	820		640
Ga	12.4		8.2	Au	0.14		0.20
Cu	20			Ir	0.52		0.57
La	0.47			As	3.6		2.5
Sm	0.21		0.19	W			1.5
Eu	0.1			Sb			0.48
Yb	0.22			Ag	14.1		400
Lu	0.025			Zn	370		≤200
Sc	8.0		9.5	Se	17		18

* - irradiation in Cd-foil