

MINERAL COMPOSITIONS AND ASSEMBLAGES IN CHONDRULES OF INDARCH EH4 CHONDRITE. G.V.Baryshnikova, K.I.Ignatenko, and A.K.Lavrukhina; V.I.Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, Moscow, USSR

In continuation of our studies on characteristic features and composition of minerals in chondrules of various structural types from chondrites of different chemical groups, a detailed petrographic and mineralogical analysis of chondrules and constituent minerals in thin sections of Indarch EH4 chondrite has been carried out by means of optical microscope and electron microprobe.

Chondrules have been classified according to the structure into microporphyritic olivine-pyroxene (POP) and pyroxene (PP), excentroradial pyroxene (RP), barred pyroxene (but rare) and granular pyroxene (GP). According to the main minerals composition and their assemblages, all chondrules are subdivided into two groups:

1. Porphyritic (POP,PP) chondrules. They contain feldspathic (labradorite-andesine) mesostasis of variable composition which change both within a chondrule and between the chondrules: Ab 47-50, Ab 55-70 and rarely Ab 93-95. They are characterized by presence of clinoenstatites of two types (see Table) which differ in content of minor elements. Clinoenstatite I (En I) contains more of TiO_2 , Al_2O_3 , Cr_2O_3 , MnO, CaO, and less of Na_2O as compared to clinoenstatite II (En II). These data correlate well with definitions in (1), where "blue" and "red" clinoenstatites are distinguished by cathodoluminescence. The first one corresponds to En II and the second to En I.

2. Non-porphyritic (GP,RP) chondrules. They differ markedly in composition of mesostasis with contents of Ab 97 up to almost pure albite, with varies slightly within a chondrule and between separate chondrules (Table). Clinoenstatite has a mixed composition (En 97-98.7) intermediate between En I and En II as compared to porphyritic chondrules. Nevertheless it is to noted that there are inclusions of En I and En II in GP and RP chondrules. Several unique chondrules stand out which refer neither to the first nor to the second type. For the first time in meteorite in a GP chondrules jadeite in the form of crystals in a albite glass was found out. Two chondrules, PP and RP, contain albitic mesostasis with areas of almost pure SiO_2 .

Besides silicate chondrules there are metal-sulfide² assemblages in Indarch chondrite with irregular or rounded (chondrule-like) forms; part of them, perhaps, refer to the so-called nodules. In these assemblages the compositions of the constituent minerals have been determined and their main types defined: 1) Fe,Ni-metal (kamacite) + troilite + perryite + schreibersite + inclusions of plagioclase and SiO_2 ; 2) kamacite + oldhamite (with schreibersite spots) +

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troilite; 3) kamacite with troilite and silicate rims; 4) kamacite + troilite + niningerite (with occasional plates of Mn sulfide). Kamacite contains up to 3 wt.% Si; troilite is characterized by the presence of Cr (1.1-1.7 wt.%) and Ti (0.3-0.42 wt.%). Composition of opaque minerals varies slightly from one assemblage to another, but constant within a separate assemblage.

The differences in composition of main silicate minerals between porphyritic and non-porphyritic chondrules presuppose that there should be two or more types of precursor materials of chondrules with different compositions similarly to that as it was determined for chondrules of ordinary chondrites (2), and also reflects various cooling rates and P,T-conditions, under which chondrules of different mineralogical-structural types have been formed.

References: (1) Leith C.A., Smith J.V. (1982) *GCA* 46, 2083.
(2) Baryshnikova G.V. et al. (1986) *Meteoritika* 45, 62.

Table. Mean compositions (wt.%) of mineral phases in the chondrules of different mineralogical-structural types

	Porphyritic (POP,PP) chondrules			Non-porphyritic (GP,RP) chondrules		
	En I (22)	En II (12)	Mesostasis (7)	Enstatite (15)	Mesostasis (23)	Jadeite (2)
SiO ₂	59.236	59.520	60.030	59.830	68.686	61.115
TiO ₂	0.087	0.008	0.038	0.067	0.008	0.108
Al ₂ O ₃	0.548	0.131	21.744	0.424	18.506	16.990
Cr ₂ O ₃	0.348	0.035	0.040	0.237	0.028	0.368
FeO	1.021	0.418	0.917	0.982	0.456	8.985
MnO	0.118	0.027	0.028	0.091	0.024	0.061
MgO	37.342	38.344	1.002	36.533	0.280	0.129
CaO	0.354	0.081	6.950	0.273	0.077	0.084
Na ₂ O	0.039	0.124	6.308	0.173	9.592	13.903
K ₂ O	0.009	0.015	0.081	0.021	0.176	0.146
V ₂ O ₃	0.029	0.006	0.004	0.020	0.014	0.041
P ₂ O ₅	0.013	0.023	0.006	0.027	0.026	0.073
Total	99.140	98.730	97.138	98.680	97.873	102.003
En	97.70	99.10	Ab 61.80	En 97.75	Ab 98.30	
Fs	1.60	0.70	An 37.70	Fs 1.75	An 0.55	
Wo	0.70	0.20	Or 0.50	Wo 0.50	Or 1.15	

Number of analyses is given in parentheses