REFRACTORY FORSTERITE-RICH OBJECTS IN THE METEORITE SEVERNY KOLCHIM (H3).

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Refractory forsterite-rich objects were described previously in carbonaceous (predominantly), ordinary and R chondrites [1-5]. Refractory forsterite was also found in the sparse chondrules in some unequilibrated chondrites. Forsterite-rich objects are enriched by ^{16}O and refractory elements, and are considered to be one of the earliest refractory inclusions in chondritic meteorites. However, forsterite-rich objects in ordinary chondrites have not been studied sufficiently. We found numerous forsterite-rich objects in the Severny Kolchim meteorite (H3). We also studied the magnesian chondrules in these meteorite samples.

The refractory inclusions were studied using the scanning electron microscope SM 6390LV (Jeol) with an INCA Energy 450 X-Max 80 and the electron microprobe analyser Cameca SX100 in the Common Use Center of the UB RAS "Geoanalyst" (Ekaterinburg, Russia).

Forsterite-rich objects range from 50 to 300 μm in size. They consist of low-Fe forsterite with or without low-Fe enstatite.

More than half of the forsterite-rich objects that have been found are clastic or rounded and consist only of low-Fe forsterite (FeO 0.4-2.0 wt%). The forsterite contains the high "refractory" elements CaO 0.5-1.0 wt%, Al_2O_3 0.1-0.4 wt% and low MnO <0,05 wt%. The refractory forsterite grains are zoned: the core is the low-Fe forsterite, the rim is increased by FeO up to 2-5 wt%, and is reduced by CaO and Al_2O_3.

Some refractory forsterite-rich objects consist of low-Fe forsterite (f <0.01 CaO ~ 0.5 wt%) and low-Fe enstatite (FeO 0.5-2.5 wt%). Enstatite contains CaO to 0.5 wt% and Al_2O_3 to 1.5 wt%. We also observed isolated clastic grains consisting only of low-Fe enstatite (f <0.01) with a size of 40 μm and CaO contents of 2.33 wt%, Al_2O_3 1.68 wt%, TiO_2 0.16 wt% and Cr_2O_3 0.54 wt%.

We investigated magnesian chondrules in the Severny Kolchim meteorite. The chondrite size is 100-400 μm. Magnesian chondrules consist predominantly of low-Fe enstatite (FeO 0.5-2 wt%) with or without forsterite (FeO 2.5-13 wt%). Mesostasis in such chondrules is no more than 10 Wol%. Ca-pyroxene is located on the borders of enstatite and mesostasis. In enstatite from the magnesian chondrules, the content of the refractory elements varies from low to high depending on the iron content: CaO 0.1-0.6 wt%, Al_2O_3 0.2-1.2 wt% and TiO_2 0-0.2 wt%, MnO content varies from <0.05 to normal 0.3- 0.4 wt%. Low-Fe forsterite contains low "refractory" elements CaO <0.05 wt%, Al_2O_3 <0.01 wt% and normal MnO contents of 0.4 wt%.

Thus forsterite-rich objects and magnesian chondrules were studied in the Severny Kolchim meteorite. The magnesian chondrules are probably an intermediate link between the refractory inclusions and the widespread ferromagnesian chondrules. The mechanisms of the formation of the enstatite rim in the forsterite-rich objects are not understood. It is possible that was forsterite replaced by enstatite as a result of the forsterite – nebula interaction. Furthermore, there was a successive crystallisation of the forsterite into enstatite.

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