GEOCHEMICAL AND THERMOLUMINESCENCE STUDIES OF DHOFAR 008, L3.2/3.3 CHONDRITE.

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Introduction. Unequilibrated ordinary chondrites are the most primitive material among the ordinary chondrites. They contain very unusual materials – inclusions and objects which have primitive characteristics and preserved traces of nebular processes. Their classification is sometimes difficult because the material is strongly unequilibrated and heterogeneous. Here we report results of petrographic and chemical investigations, oxygen isotope composition, and thermoluminescence (TL) sensitivity of the unequilibrated chondrite Dhofar 008.

Results. Three individual samples weighing in total 2200 g were found in the Dhofar region in the desert of Oman. The stones have a brownish-black fusion crust and are somewhat weathered, with a weathering grade of W2. Shock effects correspond to stage 3.

The meteorite has a nice chondritic texture. It consists mainly of well defined chondrules, sometimes with rim, and matrix. Average chondrule diameter is 600 µm, in the low range of average chondrule sizes for the L group [1]. All types of chondrules occur in Dhofar 008 but porphyritic ones are dominant and most of them contain glass. Investigation of chemical composition of minerals showed that Fa of olivine varies in a wide range – 1.3-50.4 mol.% (18.7 in average for 70 analyses) with PMD > 42. Several chondrules demonstrate a strong zoning with olivine (Fa29) in the core and Fe-rich olivine (Fa79) in the rim. Pyroxenes are represented by low-Ca pyroxene Fs 2.1-27.6 mol.%, (13.4 in average for 70 analyses) but pigeonite and augite also occur. The average Fa of olivine and Fs of orthopyroxene are in the range for H chondrites [2].

Accessory minerals in Dhofar 008 are Ca-rich pyroxene, troilite, chromite, taenite and kamacite. Co content in kamacite is 0.4-1.7 and PMD of Co is 12.5. The range of Co contents in kamacite includes the ranges for H, and L chondrites [3].

Bulk chemical composition of Dhofar 008 and comparison with data for average H, L and LL chondrite finds [4] showed that this meteorite has the typical characteristics of L group chondrite: Fe(met) – 5.80 wt.%, FeO – 16.6 wt.%, Mg/Si-0.85; Al/Si-0.06; Ca/Si-0.07; Fe(tot)/Si –1.07.

Oxygen isotopic compositions of Dhofar 008 is almost in the range of LL group near and most closely resembles those for Tieschitz (H/L) [5]. Dhofar 008's $\delta^{18}O$ is +5.67 ‰ , $\delta^{17}O$ +3.81 ‰ (for Tieschitz $\delta^{18}O$ +5.55 ‰ , $\delta^{17}O$ +3.83 ‰).

X-ray-induced thermoluminescence (TL) may be used to determine the subtype of unequilibrated ordinary chondrites. A good correspondence of results is observed in meteorites with known subtypes with data determined by the TL method [6]. A sample of the Dhajala meteorite was used as a standard: the height of peak (I) and the intensity of luminescene (S-the area under the peak) of this sample were set as 1. TL registration results in two samples of Dhofar 008 suggest the meteorite corresponds to petrological type 3.2/3.3.

Based on bulk chemical composition and TL study, Dhofar 008 belongs to the L group of chondrites of 3.2/3.3 petrological type. PMD of Fa olivine and PMD of Co content correlate with TL sensitivity and also confirm this petrological type. Olivine and pyroxene compositionally belong to the H group and oxygen isotopic compositions are also far from the range of L chondrites. These uncertainties might be due to the high heterogeneity and unequilibration of this meteorite, which may contain material from several different reservoirs.

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