THE PECULIARITIES OF CHEMICAL COMPOSITION OF NONMAGNETIC GRAIN-SIZED FRACTIONS FROM PILLISTFER EL6 ENSTATITE CHONDRITE. Lavrentjeva Z.A., Lyul A.Yu. V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow, lavza@mail.ru

Introduction: The enstatite chondrites (EC) are most reduced meteorites and classified into the high-siderophile group EH and low-siderophile group EL [1], characterized by abundant Fe-Ni metal, nearly Fe-free silicates, and unusual sulfides [2]. This has led scientists to believe that they might have formed from an accretionary feeding zone located relatively close to the sun. The EC have also been linked with the origin of the earth because of their similarity in oxygen isotope compositions [3]. Texturally the EL chondrites appear to have experienced much higher levels of metamorphic alteration than HL chondrites of similar equilibration temperatures. A reconstruction of the thermal history of brecciated EL6 chondrites Rubin proposes that accretion and subsequent thermal metamorphism of the EL6 parent body caused in to be heated to temperatures of ca. 1273 K [4, 5]. Many EL6 chondrites have been shocked and partly melted [6]. Most EL6 chondrites have been strongly affected by impact melting and/or brecciation [7]. To receive more information about features of composition of EL6 chondrites, to assess the effects of nebular fractionation and metamorphism, the trace element contents in non-magnetic grain-sized fractions from Pillistfer EL6 chondrite was determined by INAA.

Results and discussion: Under consideration are peculiarities of elemental composition of nonmagnetic grain-sized fractions extracted from Pillistfer EL6 enstatite chondrite. The analysis of the chemical composition of the obtained data showed that:

1) All “ultra- and fine-grained” fractions (Fig.1) are enriched in lithophilic Na (1.0 – 9.8 x CI); Ca (3.0 – 4.2 x CI); Sc (1.2 – 2.2 x CI); Cr (1.0 – 2.8 x CI); La (1.7 – 3.3 x CI); Sm (2.8 – 3.7 x CI); Eu (2.0 x CI); Yb (1.4 – 2.6 x CI); Lu (2.8 – 3.3 x CI) and depleted in siderophilic Fe (0.01 -0.05 x CI); Co (0.04 - 0.1 x CI); Ni (0.04 – 0.1 x CI); Ir (0.04 – 0.09 x CI); Au (0.09 – 0.1 x CI). Perhaps, such distribution of elements in these fractions a result of nebular metal-silicate fractionation. Distinctive feature of REE distribution in these grain-sized fractions is the high abundances of light and heavy REE with negative and positive Eu-anomalies. The positive and negative Eu – anomalies in REE patterns of these fractions are associated perhaps with oldhamite and plagioclase. In “ultra-fine grained” fractions (A,B,C) the abundance Ni (0.04 – 0.09 x CI) and Co (0.04 – 0.08 x CI) are lower than Au (0.1 x CI). A distribution of Au in these fractions is permanent. The (Ir/Au)Pillistfer / (Ir/Au)CI ratio in “ultra- fine-grained” fractions varies from 0.4 to 0.7. This fact supports the opinion that, the main processes controlling of composition “ultra-fine-grained” fractions was nebular fractionation and the fractionation in situ probably result from thermal metamorphism.

2) “Mean-grained” nonmagnetic fractions F (71<d < 100 µm ) (with accessory minerals) (Fig. 2.) are enriched in lithophilic (Na (2.4 x CI); Ca (3.3x CI); Cr (2.8 x CI); La (3.1 x CI); Sm (3.7 x CI); Eu (2.0 x CI); Yb (2.3 x CI); Lu (2.9 x CI) and depleted in siderophilic Fe (0.04 x CI); Co (0.1 x CI); Ni (0.1 x CI); Ir (0.09 x CI); Au (0.1 x CI)). This fraction (F) has a Eu minimum (Eu(EuCI)/ (SmF/SmCI) = 0.5, and are cosmic (LaF/LaCI)/ (LuF/LuCI) ratio ~ 1.0.

Fig.1. CI chondrite–normalized of trace element abundance patterns of nonmagnetic “ultra- and fine grained” fractions from Pillistfer EL6 enstatite chondrite: A – fraction 1<d < 25 µm; B - fraction 25<d < 45 µm; C – fraction 35<d < 45 µm; D - fraction < 45 µm;

Fig.2. CI chondrite–normalized of trace element abundance patterns of nonmagnetic “mean-grained” fraction F (71<d < 100 µm ) (with accessory minerals) from Pillistfer EL6 enstatite chondrite.
“Mean-grained” nonmagnetic fractions G (71<d<100 µm) (Fig. 3) (without accessory minerals), on the contrary, are depleted in lithophile elements and are enriched in siderophile elements.

Fig. 3. CI chondrite–normalized of trace element abundance patterns of nonmagnetic “mean-grained” fractions E (45<d<71 µm) and G (71<d<100 µm) (without accessory minerals) from Pillistfer EL6 enstatite chondrite.

(3) “Coarse-grained” nonmagnetic fraction H (100<d<160 µm) and fraction I (160<d<260 µm) (Fig.4.) are enriched in lithophilic Na (1.0 – 1.2 x CI); Ca (1.0 – 1.3 x CI); Sc (2.2 – 2.3 x CI); Cr (0.5 – 1.0 x CI); Sm (0.6 – 1.0 x CI); Eu (1.3 – 1.8 x CI); Yb (2.3x CI) and depleted in siderophilic Fe (0.02 -0.03 x CI); Co (0.08 - 0.2 x CI); Ni (0.06 – 0.1 x CI); Ir (0.1 x CI); Au (0.1 – 0.2 x CI).

Fig. 4. CI chondrite–normalized of trace element abundance patterns of nonmagnetic “coarse-grained” H (100<d<160 µm) and I (160<d<260 µm) fractions from Pillistfer EL6 enstatite chondrite.

Distinctive features of trace element distribution in “coarse-grained” fractions (H, I) is the fact that the contents of lithophile and siderophile elements increase with increasing of the grain-size These fractions have REE patterns with positive Eu – anomalies - [(Eu/Sm)H,I/(Eu/Sm)CI] = 2.2; 1.8.

Fig. 5. CI chondrite–normalized of trace element abundance patterns of nonmagnetic “ultra- and fine grained” fraction A (1<d<25 µm) and “coarse-grained” fraction I (160<d<260 µm) from Pillistfer EL6 enstatite chondrite.

(4) Distinctive feature of siderophile element distribution in nonmagnetic “ultra- and fine grained” fraction A (1<d<25 µm) and “coarse-grained” fraction I (160<d<260 µm) (Fig.5.) is that the (Ni/Co)A/(Ni/Co)CI = 1.0, but (Ni/Co)I/(Ni/Co)CI = 0.5 that can be associated redistribution elements between phases.

Conclusions. Based on obtained data, the formation of E chondrites from material subjected to the nebular fractionation metal-silicate and metamorphism is proposed and distinction in the fractionation trends of lithophile and siderophile elements can be associated by their redistribution between different phases of meteorite during metamorphism.