TRACE ELEMENT CHEMISTRY OF GRAIN-SIZED FRACTIONS IN PESYANOE METEORITE AND SOME IMPLICATIONS REGARDING ORIGIN OF AUBRITES. Z.A. Lavrentjeva, A.Yu. Lyul. V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry, RAS, Moscow, E-mail: lavza@mail.ru

Introduction. Aubrites are achondrite meteorites that are mostly polymict breccias consisting mostly of FeO-free enstatite, with minor albitic plagioclase, FeO-free diopside and forsterite, metallic Fe, Ni, troilite, and host of rare accessory minerals that formed under highly reducing conditions. Their extremely reduced oxidation state and oxygen isotope composition links them to enstatite chondrites. The exact nature of this link is unclear. Some studies suggest formation as cumulates during mantle differentiatin of an enstatite chondrite-like parent body. Other studies interpret aubrites as restites from partial melting of enstatite lithologies. Most studies agree that aubrites originated on at least one parental body similar to, but different from both the EH and EL chondrite bodies. While of the 27 aubrites, 15 are fragmental breccias, 6 are regolith breccias, and 6 are described as nonbrecciated, their ingredients are clearly of igneous origin and formed by melting and fractional crystallization possibly of a magma ocean. This is indicates by the occurrence of variety of lithic clasts of igneous origin, and by the REE and other element distributions [1]. Most aubrites have negative Eu anomalies. Whole-rock REE patterns with Eu anomalies have been used as one of the major arguments [2, 3].

To receive more information about features of the aubrite component compositions, the trace element contents in separated grain-sized fractions from Pesyanoe achondrite were determined by INAA. The Pesyanoe aubrite (fell 1933, Russia) is a gas-rich polimict regolight breccia [4] consisting of several pyroxenitic lithologies, clastic and melt breccias, melt rocks, glass spherules and exotic chondrite inclusions [5].

Results and discussion.

"Fine-grained" fractions ("matrix", 1<d<45 μm) (Fig.1a,1b).

The fine-grained fractions are enriched in lithophilic by factors Na (1.2-1.5xCI); Ca (1.1-1.9xCI); Sc (1.6-1.7xCI) and are depleted in siderophilic Ni, Co, Fe, Au, Ir (0.002-0.2xCI) elements. REE analyses of fractions showed that they have high REE concentrations with a light (1.0-2.7xCI) and heavy (1.5-3.3xCI) rare earth elements (LREE and HREE) enriched and with both positive (Fig. 1a, 1b) and negative (Fig.1b) Eu- anomalies.

"Coarse-grained" fractions (100<d<160 μm) (Fig. 1e).

The coarse-grained fractions are depleted in Na (0.4-0.8xCI) versus (1.2-1.5xCI) in fine-grained fractions and are depleted in siderophilic Ni, Co, Fe, Au, Ir (0.01-0.1xCI) elements. The REE patterns have HREE enrichment – $(Lu/La)_{\text{fractions 1, 2}} / (Lu/La)_{CI}$ = 1.3 ; 1.6, respectively, with negative Eu anomalies.

"Mean-grained" fractions (45<d<71μm; 71<d<100 μm) (Fig. 1c,1d).

Na abundances of dark (1.0-1.2xCI) are higher than of light (0.7-0.9xCI) lithologies. Fractions are enriched in Sc (1.5-1.8) and are depleted in siderophilic Ni, Co, Fe, Au, Ir (0.002-0.08xCI) elements. The REE patterns have HREE enrichment relative LREE and CI chondrites with positive Eu and positive Yb (Fig.1d) and negative (Fig.1c) Eu-anomalies.

The refractory siderophile element Ir (0.001-0.02xCI) are distinctly more depleted in all fractios than "normal" siderophiles Ni (0.006-0.07xCI) and Au (0.01-0.2xCI). A similar trend is show by eucrites [6] as well as lunar dunite, mare basalts, and pristine highlad rock [7,8]. Inasmuch as the Pesyanoe aubrite also shows this trend, it appears that the aubrite pattern is at least consistent with an ognious origin.

On the basis of the data presented here, the accessore minerals (oldhamite and plagioclase) are the major REE carrier in the aubrites. Plagioclase is the only mineral measured with a positive Eu anomaly and LREE enrichment [9]. All other phases have negative Eu anomalies and diopside, alabandite, and some oldhamite have HREE enrichment trends. Oldhamite is the major REE carrier in the aubrites [10]. From observed differences of compositions of grain-sized fractions from Pesyanoe it follows that our trace element data reflect processes on the surface on the parent body, it is possible and melting processes. All of these data, together with results from previous studies, indicate that aubrite are igneous rocks, brecciated, that are thought formed by to melting, fractionation, and differentiation of enstatite chondrite-like precursor lithologies.

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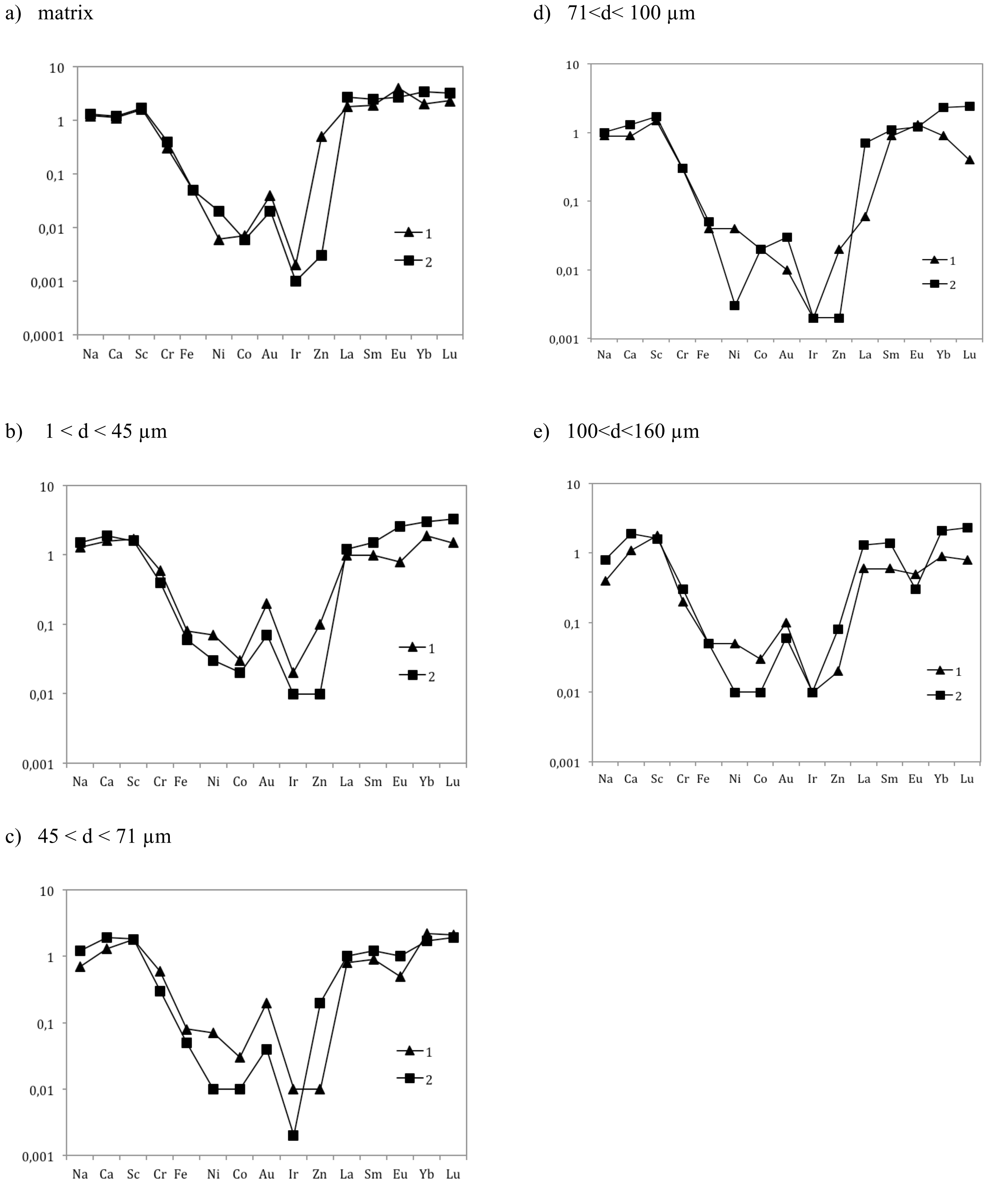

Figure 1 (a, b, c, d, e). CI – normalized trace element abundance patterns of grain-sized fractions from Pesyanoe aubrite. 1 - light and 2 -dark lithologies.