A COMPARATIVE STUDY OF MAGNETIC AND NONMAGNETIC PHASES IN ABEE (EH4): REPRESENTATIVE OF EH PARENT BODY. Z.A. Lavrentjeva, A.Yu. Lyul, N.A. Shubina, G.M. Kolesov. V.I. Vernadsky Institute of Geochemistry and Analytical Chemistry, RAS, Moskow, Russia.

Introduction. Among known planetary materials, enstatite (or E-) chondrites are truly a breed apart. They are highly reduced, with < 1 mol percent FeO in their silicates, in contrast to other chondrites as well as Earth, Mars, and Venus, which have FeO contents in the 10-40 % range [1]. And they contain many unique minerals [2] that imply highly reducing, anhydrous conditions. Like ordinary chondrites, they are classified into petrologic types 3 to 6 (or 7). However, Zhang et al [3] showed that the petrologic types of enstatite chondrites are not always consistent with the geothermometry or mineral chemistry is related to the conditions during brecciation after metamorphism to have determined petrologic types. On the other hand, some melt rocks or melt breccias have recently been discovered in E chondrites [4,5,6]. Abee are characterized as impact melt with ghosts of chondrule-bearing clasts [5]. Its internal structure is a myriad of granulated, metal-rimmed, varying-sized clasts embedded in a dark gray, fine-grained groundmass. Since its initial description [7] Abee has been in subject of more than 31 studies focusing on brecciation, diamonds reportedly of solar nebula origin [8], the oxygen depleted environment where it formed [9] and many parent body studies.

Samples and method. In the present paper the results of elemental abundances in separated grain-sized magnetic and nonmagnetic fractions from Abee are reported. The fractions were selected by handpicking under microscope and by particle-size analysis. Their elemental composition was determined by INAA using a technique for numerical substraction of the matrix element backgrounds [10]. The tables show the average element enrichment factors relative to C1 (11).

Results and discussion. Of 10 grain-sized fractions of Abee EH4 analyzed for siderophile elements, 3 magnetic (metal, schreibersite) fractions have ratios [(Fe/Ni)A/(Fe/Ni)C1]=0.7(mean) less than cosmic and nonmagnetic (sulfides, silicates) fractions – 2.1 (mean) greater then cosmic. This fact supports the opinion that the main process controlling of the composition magnetic phase was sulfurization of metal in protoplanetary nebula. The Abee enstatite chondrite show a typically igneous siderophile element pattern with Ir more depleted than Au and Ni (magnetic fractions- Ir (2.5 -3.0 xC1), Au (5.0 – 6.8 x C1), Ni (4.5 – 5.2 x C1); nonmagnetic fractions Ir (0.08 – 0.2 xC1), Au (0.2 -5.4 xC1), Ni (0.1 – 3.7 x C1). Rare earth elements (REE) measurements in Abee show that all fractions with positive and negative Eu-anomalies are deficient in light REE [Lu (A)/Lu (C1) / La (A) / La (C1)] mean = 2.5 (magnetic) and 1.6 (nonmagnetic fractions). Neither the Eu anomaly nor the light REE depletion can readily explained by nebular condensation at least in solar gas [12]. Perhaps the positive and the negative Eu – anomalies in grain-sized fractions REE patterns are associated with oldhamite. The model of formation of oldhamite, the most REE-enriched phase in EH chondrites, is disputed. Detailed ion probe analyses of individual oldhamite grains revealed various REE patterns, indicating mixing and equilibration of oldhamite

precursors [13]. The Abee EH4 is characterized by enrichment of Zn (1.1 x C1), Na (1.6 x C1) and Ca (1.1 x C1) in fine-grained nonmagnetic fraction (<45 μ). Perhaps, these fraction has niningerite and richterite. The presence in Abee normal zoning in niningerite [14] is due to fast
A comparative study cooling in the solar nebula or in the parent body or both.

Conclusion. From observed differences of compositions of magnetic and nonmagnetic fractions it follows that our trace element data accord with idea that Abee EH4 reflect main process – sulfurization of metal in protoplanetary nebula and, perhaps, that it may have undergone an igneous event. Abee`s brecciated structure [4,5,6] is a vivid representation of a violent and complex sequence of impacts – large angular clasts of partly melted material with igneous oldhamite-rich dark inclusions, all embedded within a previously melted, but similar, groundmass.

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Table 1. The average element enrichment factors of magnetic fractions of Abee enstatite meteorite.

Fractions (μ)	Na	Ca	Sc	Cr	Fe	Ni	Co	Au	Ir	Zn	Se	La	Sm	Eu	Yb	Lu
45<d<71	0.2	0.2	0.1	0.3	3.5	5.2	5.3	6.8	3.0	0.5	0.3	<0.4	0.1	<0.5	<0.6	<0.8
71<d<100	0.4	0.2	0.2	0.3	3.4	4.9	5.2	5.0	2.7	0.6	0.5	<0.3	0.2	<0.3	<0.6	<0.8
100<d<160	0.6	0.2	0.1	0.2	3.2	4.5	4.9	5.8	2.5	0.4	0.2	<0.3	0.2	<0.3	0.5	<0.8

Table 2. The average element enrichment factors of nonmagnetic fractions of Abee enstatite meteorite.

Fractions (μ)	Na	Ca	Sc	Cr	Fe	Ni	Co	Au	Ir	Zn	Se	La	Sm	Eu	Yb	Lu
1 <d <45	1.6	1.1	1.3	1.9	0.7	0.3	0.3	0.4	0.1	1.1	2.0	0.8	1.0	0.9	1.1	1.1
45 <d <71	1.6	1.3	0.9	1.3	0.4	0.1	0.1	0.2	0.08	0.8	1.3	0.7	1.2	0.8	1.2	1.3
71 <d <100	0.8	0.7	0.9	1.4	0.6	0.2	0.2	0.3	0.06	0.9	1.5	0.6	0.5	0.7	0.6	0.6
100<d<160	1.0	0.8	0.9	1.5	0.7	0.4	0.4	0.6	0.2	0.9	1.5	0.6	0.6	0.7	0.7	0.7
160<d<260	1.2	0.8	0.9	1.5	0.6	0.3	0.3	0.4	0.2	0.8	1.3	0.6	0.7	0.6	0.8	0.8
260<d<360	0.4	0.7	0.6	0.8	2.2	2.8	2.9	3.7	0.1	0.7	1.0	0.2	0.2	0.2	0.3	0.3
> 360	0.3	0.6	0.6	0.8	2.8	3.7	3.9	5.4	0.2	0.4	0.8	<0.2	0.2	0.2	<0.4	<0.6