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THE CONCENTRATIONS OF SOME REFRACTORY AND VOLATILE ELEMENTS IN CaS OF ENSTATITE CHONDRITES.

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Oldhamite, being the carrier of REE in enstatite chondrites, may provide unique clues to the origin and history of the enstatite chondrites. We have previously reported that oldhamite grains from Qingzhen (EH3) contain 80% of the REE in the bulk rock [1], and this phase is highly enriched in several other refractory elements such as Sc, Th, and Hf. Perhaps surprisely, oldhamite is also enriched in the volatile chalcophile elements Se, Br, and Zn. This suggests interactions at low temperature [2]. Here we report INAA data for the REE, Sc, Se, Br, and Zn in CaS extracted from five enstatite chondrites (Qingzhen EH3, St. Marks EH5, Atlanta EL6, Hvittis EL6, and Pillistfer EL6) using a diamond drill attached to a standard microscope. Nine CaS grains from Qingzhen were analyzed, two from St. Marks and one from each of remaining meteorites.

We found that the REE abundances in CaS from higher petrologic types are much lower than from unequilibrated enstatite chondrite Qingzhen (Table 1). Similarly, the abundances of Sc, Se, Br, and Zn in the CaS from Qingzhen are higher than that in CaS grains from equilibrated chondrites. Since both refractory and volatile element abundances decrease with petrologic type, the high abundances of these elements must reflect primary (i.e., premetamorphic) processes. We conclude that (1) the CaS grains from enstatite chondrites are not simply residues of an evaporative process, as suggested by thermodynamic models for the REE patterns observed in the CaS [1,3–7], since such material would be depleted in volatiles;

TABLE 1. CI-normalized element abundances in CaS extracted from enstatite chondrites.

	Qingzhen EH3	St. Marks EH5	Atlanta EL6	Hvittis EL6	Pillistfer EL6
La	81	20	<26	43	27
Ce	82	43	78	32	57
Sm	57	13	5.4	67	42
Eu	112	24	20	23	7.3
Yb	95	49	<45	52	34
Lu	45	<39	<39	36	22
Sc	11	2.6	3.1	1.4	2.2
Se	10.6	4.2	1.9	3.3	3.1
Br	7.2	<2.3	<3.0	<0.78	<0.67
Zn	3.6	2.8	<0.45	<0.64	0.11

and (2) metamorphism has caused considerable redistribution of the trace elements among the minerals in most enstatite chondrites.

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