

FLUOROPHLOGOPITE IN THE EH CHONDRITE Y-82189.

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Introduction: Enstatite chondrites commonly include many unusual minerals, such as niningerite and perryite, reflecting highly reducing conditions, and occasionally also contain fluororichterite [e.g., 1-2]. Lin and Kimura [3] first reported another F-bearing phase, fluorophlogopite, from the EH chondrite Y-82189. This phase was also reported from the enstatite meteorite NWA 1235 [4]. Here we report the mineralogical and chemical features of fluorophlogopite in Y-82189 and discuss the implications of its presence for the genesis of this enstatite chondrite.

Petrography and mineral chemistry: Y-82189 is an EH melt rock, consisting predominantly of euhedral enstatite grains [3]. It also contains several grains of subhedral fluorophlogopite, 10-30 μm in size, which occur among enstatite, coexisting with albite and quartz [5]. It contains 45.1-46.5 wt.% SiO_2 , 9.4-10.4 wt.% Al_2O_3 , 0.2-1.2 wt.% FeO , 27.4-28.8 wt.% MgO , 0.6-1.4 wt.% Na_2O , 9.1-9.9 wt.% K_2O , and 8.9-9.4 wt.% F, with an average chemical formula of $(\text{K}_{0.85}\text{Na}_{0.11})_{0.96}(\text{Mg}_{2.93}\text{Fe}_{0.03})_{2.96}(\text{Si}_{3.18}\text{Al}_{0.80})_{3.98}\text{O}_{10}\text{F}_{1.99}$. The phlogopite contains virtually no OH and Cl. The Raman peaks at 1093, 685, 368, 319 and 202 cm^{-1} , are consistent with those of phlogopite [6]. Moreover, the spectra showed no peak in the OH region at $\sim 3600\text{-}3800\text{ cm}^{-1}$, consistent with the presence of F rather than OH.

Trace elements: Concentrations of REE and other trace elements were determined using SIMS. The phlogopite shows subchondritic, flat REE patterns, except for Eu, which is below detection. Ba and Zr concentrations are enriched compared to CI values. The Ba enrichment is due to similar partitioning behavior as K. High Zr concentrations may reflect preferential partitioning into phlogopite rather than enstatite and plagioclase [7].

Discussion: Low concentrations of FeO in the phlogopite show that it crystallized under highly reducing conditions. Our observations suggest that phlogopite, like enstatite, crystallized from a melt, which is consistent with the flat REE patterns [6]. This also supports the origin of Y-82189 as an EH melt rock [3]. On the other hand, the source of F is problematic. Floss et al. [8] found fluoroedenite in a winonaite, and suggested that a possible source of F was fluorapatite. However, apatite has never been reported from any pristine EH chondrites. More likely phlogopite formed from other pre-existing phases with trace amounts of F.

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