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Introduction: Li abundance in pyroxenes from the Zagami and Shergotty martian meteorites [1], suggested that Li was lost by their parent magmas. Such a behavior suggested the involvement of an aqueous fluid during the crystallization of the meteorites because of the strong affinity of Li with water-rich fluids [2]. Because Shergotty and Zagami are petrographically similar, it was crucial to extend these observations to shergottites of different types. Therefore we studied in detail the Li behavior in the Northwest Africa 480 shergottites (NWA 480) using the CRPG-CNRS ims 3f ion microprobe. In addition to Li abundance measurements, Li isotopic composition were determined. Lithium concentrations and isotopic compositions were measured in individual grains of pyroxene, and in a few maskelynites and Ca-phosphates grains.

Results: In pyroxenes Li abundances are nearly constant from core to rim with concentrations ranging between 3 and 4 µg/g (figure 1). In contrast, a significant isotopic zoning is observed with δ^7Li values increasing within single crystals from ~ −17 ‰ in the core to ~ +10 ‰ in the rim, most of the variability being observed in the core (figure 1). Plagioclase (now maskelynite) and phosphate crystals, which co-crystallized with the pyroxene rims, display similar δ^7Li values.

Discussion: Because of the incompatible behavior of Li, the present constancy of Li concentrations within zoned pyroxenes rules out any simple crystallization model in a closed system for Li. The large Li isotopic variations observed within pyroxenes support this conclusion. There is no evidence in support of secondary alteration of NWA 480 to explain the Li isotopic variations, which thus most likely reflect magmatic processes on Mars.

Degassing might explain the Li systematics observed in NWA 480 pyroxenes. Because Li has a strong affinity with water-rich fluids, a significant loss of Li from NWA 480 parental melt can happen upon melt emplacement and cooling. Such a Li loss could compensate the effect of crystal fractionation and thus help to maintain constant the Li content of the melt. Li isotopic fractionation is anticipated to accompany this process, ^{7}Li being depleted relative to ^{6}Li in the volatile phase. The magnitude of the isotopic change of the fractionating melts is difficult to predict because it depends on the value of the Li isotopic fractionation and on the amount of Li loss, but at first glance it seems consistent with the increase of δ^7Li values observed in NWA 480 pyroxenes with increasing fractionation. First order calculations indicate that ~60 % of Li was lost by the magma during its crystallization. The knowledge of Li partitioning coefficient between silicate melt and fluids may unable to quantify the amount of fluid that degassed.The present data suggest that degassing prevailed not only during the crystallization of shergottites like Zagami and Shergotty, but also during the crystallization of the other types of basaltic shergottites [3].

References: [1] Lentz at al. (2001), *Geochim., Cosmochim. Acta, 65*, 4551-4565*,* [2] Brenan et al. (1998), *Geochim. Cosmochim. Acta* 62, 3337-3347 [3] Beck et al. (2004), *Geochim., Cosmochim. Acta,* in press.

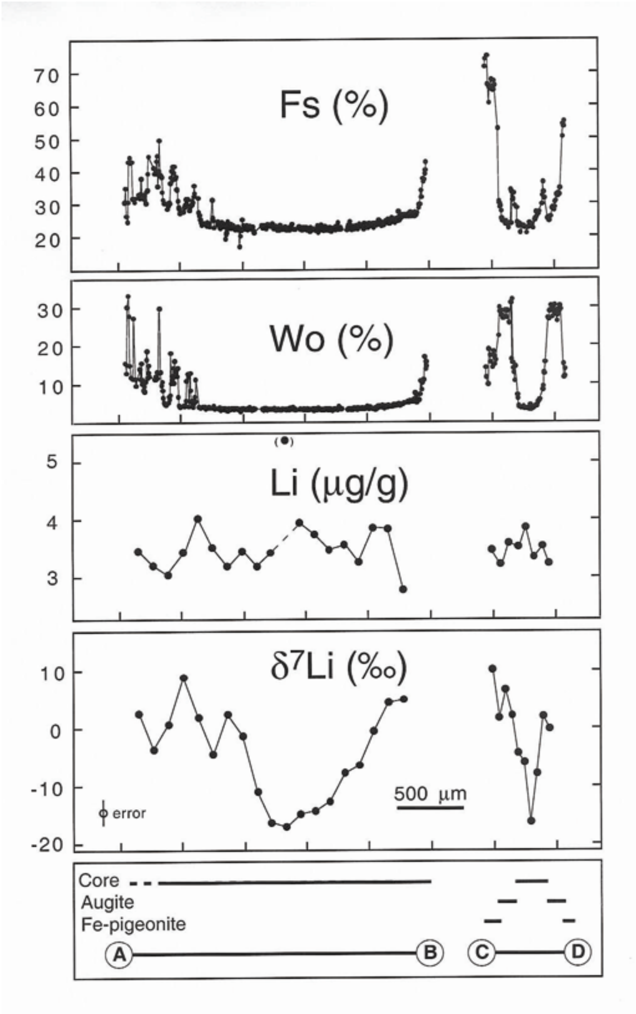

Figure 1: Ferrosilite (Fs), Wollastonite (Wo), Li abundances and Li isotopic composition profiles in a pyroxene from the NWA 480 shergottite. The observed Li isotopic zoning is strong (between δ^7Li = *-20*‰ in the core *to* δ^7Li = *+10*‰ in the rim*) with no appearant correlation with Fs, Wo or Li abundances.*