SHERGOTTITE LEAD ISOTOPE SIGNATURE IN CHASSIGNY AND THE NAKHLITES.

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Introduction: The nakhlites/chassignites and the shergottites represent two differing suites of basaltic martian meteorites. The shergottites have ages ≤ 0.6 Ga and a large range of initial $^{87}Sr/^{86}Sr$ and $\varepsilon(^{143}Nd)$ ratios. Conversely, the nakhlites and chassignites cluster at 1.3-1.4 Ga and have a limited range of initial $^{87}Sr/^{86}Sr$ and $\varepsilon(^{143}Nd)$ [1]. More importantly, the shergottites have $\varepsilon(^{182}W) < 1$, whereas the nakhlites and chassignites have $\varepsilon(^{182}W) \sim 3$ [2]. This latter observation precludes the extraction of both meteorite groups from a single source region. However, recent Pb isotopic analyses indicate that there may have been interaction between shergottite and nakhlite/chassignite Pb reservoirs.

Pb Analyses of Chassigny: Two different studies have investigated $^{207}Pb/^{204}Pb$ *vs*. $^{206}Pb/^{204}Pb$ in Chassigny: (i) TIMS bulk-rock analyses of successive leaches and their residue [3]; and (ii) SIMS analysis of individual minerals [4]. The bulk-rock analyses fall along a regression of SIMS plagioclase analyses that define an errorchron that is older than the Solar System (4.61±0.1 Ga); i.e., these define a mixing line between Chassigny's principal Pb isotopic components (Fig. 1). Augites and olivines in Chassingy (not shown) also fall along or near the plagioclase regression [4]. This agreement indicates that the whole-rock leachates likely measure indigenous, martian Pb, not terrestrial contamination [5]. SIMS analyses of K-spars and sulfides define a separate, sub-parallel trend having higher $^{207}Pb/^{206}Pb$ values ([4]; Fig. 1). The good agreement between the bulk-rock analyses and the SIMS analyses of plagioclases also indicates that the Pb in the K-spars and sulfides cannot be a major component of Chassigny.

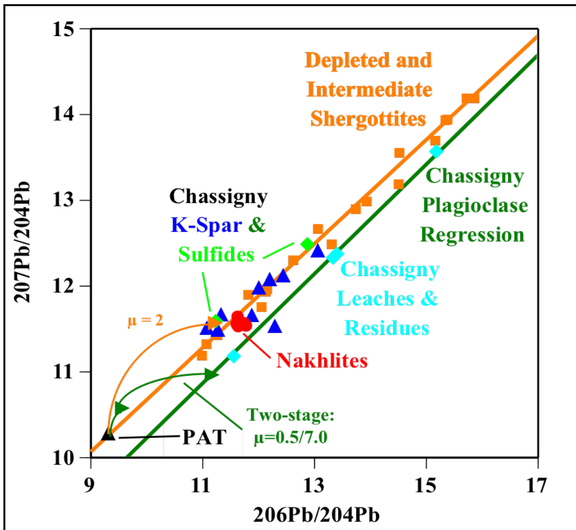

Figure 1. $^{207}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$ for Chassigny K-spar, sulfides, leaches, and residues from [3,4]. Bulk-rock analyses fall along regression (green line) of SIMS plagioclase analyses [4]. Possible two-stage evolution model from PAT shown. K-spars and sulfides fall along distinct line (orange line) defined by depleted and intermediate shergottites.

The depleted reservoir sampled by Chassigny plagioclase is not the same as the solar system initial (PAT) and requires a multi-stage origin. Here we show a two-stage model (Fig. 1) with a $^{238}U/^{204}Pb$ (μ) of 0.5 for 4.5-2.4 Ga and a μ of 7 for 2.4-1.4 Ga. This is not a unique model but does produce a Pb composition that falls on the plagioclase regression at 1.4 Ga, the approximate igneous age of Chassigny [1]. It should be noted that low-μ single-stage models are not capable of producing sufficiently radiogenic $^{206}Pb/^{204}Pb$ at 1.4 Ga.

Relation to Shergottites: The Chassigny K-spars and sulfides fall along a second mixing line defined by leaches and residues of depleted and intermediate shergottites [6]. This mixing line falls above the plagioclase regression. Therefore, we also interpret the radiogenic component of this mixing line to represent indigenous martian Pb. It is possible that the depleted and intermediate shergottites and the Chassigny plagioclases sample radiogenic Pb from the the same source, i.e., the mixing lines may intersect at high $^{206}Pb/^{204}Pb$.

Both K-spar and sulfide are late-stage phases. At the time of their crystallization, the Chassigny system appears to have remained open to a depleted shergottite Pb reservoir. The depleted component of the shergottite mixing line can be generated by a single-stage evolution from PAT (4.5 to 1.4 Ga) in a reservoir having a μ ~2. A similar model for the most depleted shergottites is also possible: μ = 1.5 for 4.5 to 0.3 Ga.

Nakhlites: Nakhlite analyses plot between the shergottite and Chassigny plagioclase regressions [3]. So again, members of the nakhlite/chassignite suite show affinities to shergottite Pb.

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