High-precision Al-Mg systematics in Forsterite-bearing Type B CAIs

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Forsterite-bearing Type B inclusions (FoBs) are a type of Ca-Al-rich inclusion (CAI) with isotopic and petrologic properties indicating significant degrees of melt evaporation (see [1] and refs therein). We previously showed that FoBs define an evolutionary sequence from sintered aggregates of fine-grained pyroxene + spinel + melilite + forsterite, to highly melted and partially melt-evaporated objects [1]. However, unknown until now is the age relationship between FoBs and other – more-refractory – CAIs. Here we report high-precision, Al-Mg isotope internal isochron data for seven diverse [1] FoBs in order to address the latter question.

The samples were analysed using the WiscSIMS Cameca ims 1280 ion probe (see [2] for experimental details). Only low Al/Mg (most <3) phases were analyzed so far: pyroxene, spinel, olivine, and Mg-rich melilite. Future analyses of anorthite and aluminous melilite are planned.

The isochrons are generally well-defined (all but 2 have MSWD <1), giving initial $^{26}Al/^{27}Al$ ratios that range from $(5.6\pm0.5)\times10^{-5}$ in the most primitive FoB, Allende SJ101 (within error of canonical [3]), to $(4.2\pm0.4)\times10^{-5}$ in another primitive Allende inclusion, ALVIN. Two Efremovka FoBs, E60 and E64, have (resp.) initial $^{26}Al/^{27}Al = (5.3\pm0.3)\times10^{-5}$ (sl. higher than anorthite-based value obtained by [4]) and $(5.0\pm0.3)\times10^{-5}$. NWA 3118 #4N has initial $^{26}Al/^{27}Al = (4.9\pm0.3)\times10^{-5}$. The most extensively melted and volatilized FoBs, Vigarano 3137 and Allende TS35-F1, have intermediate initial $^{26}Al/^{27}Al$, $(4.7\pm0.3)\times10^{-5}$ and $(4.6\pm0.2)\times10^{-5}$ respectively. Anorthite in Vigarano 3137 is completely disturbed [5].

There is no correlation between isochron slope and degree of melting or evaporation in the FoBs. Because the range in initial $^{26}Al/^{27}Al$ ratios overlaps completely with that for other CAIs [6], melting and re-processing of FoBs and other types of CAIs occurred contemporaneously and continuously, over a period of ~200,000 years.

[1] Bullock E. S. *et al* (2012) *MAPS*, **47**, 2128-2147 [2] Kita N. T. *et al* (2012) *GCA* **86**, 37-51 [3] Jacobsen B. *et al* (2008) *EPSL* **272**, 353-364 [4] Amelin Y. *et al* (2002) *Science* **297**, 1678-1683 [5] MacPherson G. J. and Davis A. M. (1992) *Meteoritics* **27**, 253 [6] MacPherson G. J. *et al* (2012) *EPSL* **331**, 43-54