Mg ISOTOPE MEASUREMENTS OF A STARDUST CAI: NO EVIDENCE OF ^{26}Al.. J. Matzel[1], H. A. Ishii[1], D. Joswiak[2], I. Hutcheon[1], J. Bradley[1], D. Brownlee[2], P. Weber[1], E. Ramon[1], J. I. Simon[3], N. Teslich[1], G. Matrajt[2], K. D. McKeegan[4], and G. MacPherson[5]. [1]Lawrence Livermore National Laboratory, Livermore, CA. E-mail: matzel2@llnl.gov. [2]Univ. of Washington, Seattle, WA. [3]Univ. of California, Berkeley, CA. [4]Univ. of California, Los Angeles, CA. [5]Smithsonian Institute, Washington, D.C.

The discovery of inner solar system materials in comet 81P/Wild 2 [1,2] underscored the importance of radial transport of material over large distances in the early solar nebula. Key questions concern the relationships between the inner solar system materials found in Wild 2 and other primitive extraterrestrial objects, and the timescales of formation and processing of Stardust materials. Among the particles returned by Stardust, a few <15 µm CAIs (Ca-Al-rich inclusions) were discovered. We measured the Al-Mg isotope systematics of a ~5µm CAI nicknamed Coki to relate the timescales of formation of cometary inclusions to their meteoritic counterparts.

Coki's mineralogy is dominated by anorthite and includes small (<200 nm) spinel grains enclosed in Al-Si-rich glass and Al-rich diopside. Mineralogy and chemical composition were determined by TEM. In preparation for the isotopic measurements, we used a FIB (focused ion beam instrument) to selectively remove Mg-rich minerals surrounding the anorthite grain and to back-coat the section with Pt as a stable substrate for the isotopic measurements [3]. The Al-Mg isotope measurements were performed on the NanoSIMS 50 at LLNL with a 3 pA O^- primary beam focused to 200 nm spatial resolution and an MRP of ~4000. All measurements were made in isotope imaging mode. Regions of interest (ROIs) were selected based on the ^{27}Al/^{24}Mg ratio; four ROIs span a ^{27}Al/^{24}Mg range of 8 to 564. The data for all ROIs fail to show evidence of excess ^{26}Mg at the 2σ uncertainty level and define an upper limit of $(^{26}\text{Al}/^{27}\text{Al})_o$ $<7\times10^{-6}$. We interpret the lack of excess ^{26}Mg as indicating that Coki formed >2 Ma after formation of CAIs with the canonical ^{26}Al/^{27}Al ratio.

The anorthite-dominated mineralogy and lack of resolvable ^{26}Mg excess suggest that Coki is comparable to type C CAIs in chondritic meteorites [4]. Type C CAIs are thought to form by mingling of CAI and chondrule precursors during a late-stage melting event in a ^{16}O-poor nebular region [5]. The only other CAI described from Stardust (Inti) more closely resembles type B CAIs in its mineralogy and ^{16}O-rich isotope composition [2]. Thus, further study (O isotope data from Coki or Mg data from Inti) may indicate a different environment of formation for the two Stardust CAIs. The Coki Mg data offer the first chronologic information of any kind on cometary material and provide insight into the formation of comets and the timing of radial mixing in the solar nebula. Large scale radial mixing from the inner reaches of the solar system to the Kuiper Belt appears to have occurred as late as several Ma following CAI formation.

References: [1]Brownlee, D. et al. 2006. *Science* 314:1711-1716. [2]McKeegan, K.D. et al. 2006. *Science* 314:1724-1728. [3]Ishii, H.A. et al. 2009. Abstract #2288. 40th Lunar & Planetary Science Conference. [4]MacPherson G. 2008. *Treatise on Geochemistry* 1:201-246. [5]Krot A.N. et al. 2007. *Meteoritics & Planetary Science* 42:1197-1219.