RECORDS OF EARLY SOLAR SYSTEM EVENTS INFERRED FROM Al-Mg ISOTOPE SYSTEMATICS IN CV3 CHONDRITES. R. K. Mishra[1] and M. Chaussidon[1], [1]Centre de Recherches Pétrographiques et Géochimiques, (CRPG - CNRS) Vandoeuvre Les Nancy, Nancy, France 54501.

Introduction:

The earliest datable rocks formed in the solar system are the Calcium, Aluminum-rich inclusions (CAIs) for which an age up to 4568.2 ± 0.2 Myr can be calculated from the U-Pb system, taking into account possible variations of the U isotopic ratio [1, 2]. However, there is still a large uncertainty on the timing of CAI formation and on their high temperature history as rocks in the nebula gas. Short-lived radioactive nuclides are another piece of the puzzle and can in theory be used to put additional constraints on relative chronology of the putative high temperature events that CAIs registered during their transport in the accretion disk. Recent developments either by MC-ICPMS or multi-collector ion microprobe have allowed to reach unprecedented precision for Mg isotopic compositions [3-9] making short-lived ^{26}Al the most useful tool to establish relative chronology. These developments have furthered the cause of temporally resolving early Solar system events occurring on time scales of ≈10 - ≈100 kyrs. This should allow for the first time to try to match astronomical observations of young stellar objects and their disks with events recorded and meteorites and having taken place during the birth of the Solar system. In theory, the high precision ^{26}Al -Mg systematic of CAIs gives access to the age of the last melting event (slope of the ^{26}Al isochron) but also to the model age of the CAI precursors (initial of the ^{26}Al isochron) as for chondrules [3, 5]. Here we report high precision ^{26}Al-Mg studies of CAIs in order to make progress with some outstanding pending questions, namely : 1) what are the level and scale (spatial & temporal) of ^{26}Al and Mg isotopes homogeneity in the early Solar system, 2) at what rate homogenisation was achieved, 3) what was the timing and duration of the high temperature events recorded by CAIs, 4) what are the genetic (or not) relationships between various types of CAIs and any possible temporal correlation.

Samples and Analytical procedure: A suite of different types of CAIs from carbonaceous chondrites primarily from CV3 were analysed for Al-Mg isotope systematics. A ~20nA O^- primary beam accelerated at 13kV were used to sputter secondary positively charged ions of various of ^{24}Mg, ^{25}Mg, ^{26} Mg and ^{27}Al at a mass resolution of 2500 for isotopic analysis in a multicollection mode using FC's at L'2, C, H1, and H'2. The sample was kept at 10kV while an energy window of 50eV was used. A low vacuum of > $3x10^{-9}$ helped suppressing hydride contribution below significant levels. Terrestrial standards of Burma spinel, MORB, San Carlos olivine, and synthetic glass standards (Bacati, Px, An) with composition similar to analogous minerals in CAIs were analysed at regular intervals to ascertain mass fractionation during the analysis of meteoritic sample. The instrumental mass fractionation (1/β) varied between 0.511 and 0.523 during different analytical sessions but was mostly in a narrow range during a given session. The external reproducibility on δ^{26}Mg* was ~0.018‰ (σ/√n; n~12).

Results: 8, 5, and 1 CAIs from Vigarano, Efremovka, and Axtell have been analysed and precise initial δ^{26}Mg*$_0$ and ^{26}Al/^{27}Al have been obtained and is shown in a Mg evolution diagram (Fig. 1.). Most of the analysed CAIs belong to the typical type B but also a few fine grained melilite, and/or spinel rich and a CAI of fluffy type A has also been analysed. In addition, the other refractory inclusion- amoeboid olivine aggregate (AOA) and an Al-rich chondrule from Efremovka were also analysed to look for possibe systematic amongst the spectrum of early Solar System objects. Analysed CAIs of different types and AOAs formed or were last melted within up to ~ 2Myr after the formation of the Solar system 4568.2 Myrs ago. Generally speaking in most of the analysed CAIs the inferred initial ^{26}Al/^{27}Al and δ^{26}Mg*$_0$ follow the expected trend of lower ^{26}Al/^{27}Al with higher δ^{26}Mg*$_0$ suggestive of a homogeneous distribution of Al and Mg isotopes in the early solar nebula and of a closed system evolution of each CAI

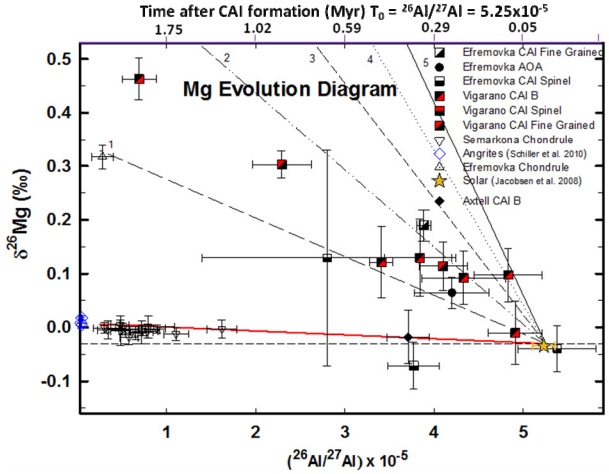

Fig. 1. Data obtained in the present study along with the those reported in [3,7,10] for chondrules, bulk CAI and Angrites respectively.

or of its precursors. Precise determination of the bulk Al/Mg of each of these objects is going on. This parameter is essential to model the growth of radiogenic ^{26}Mg in each object and, from this, to infer the history of each object, to constrain the timing of the high temperature events and the level of Al, and Mg isotopes homogeneity in the source region of CAIs.

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