CA ISOTOPIC ANOMALY IN PLANETARY MAGMA

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We have improved the TIMS measurement of minor Ca isotopes by obtaining a large Ca ion current around 1.5nA. After correct for fractionation by normalizing 42/44, the 2 sigma precision for 43/44, 46/44, and 48 /44 are now 0.3, 7.5, and 0.6 epsilon units respectively. These uncertainties were factors of 5 to 15 times smaller than those reported previously. This new capability enabled us to re-examine, with unprecedented clarity, Ca isotopes' nucleosynthetic origin, interstellar transport, and the final incorporation into the solar system. Prior to this, Ca isotopic anomalies were only endemic to Ca-AI-Inclusions in carbonaceous chondrites in which the smaller the sample sizes are the larger the amplitude of anomalies. Such a trend can be understood if Ca-48 was carried in rare grains and the fluctuation of the number of these grains would naturally give rise to such a pattern. Surprisingly, our new experiments revealed also a new trend among the bulk meteoritic samples. Namely, relative to earth, two urelites and two angrites all of them have Ca-48 anomalies as low as 2 epsilons (i.e. a 7 sigma effect) whereas one ordinary chondrite had a positive anomaly. These anomalies are only a bit smaller than those found in CAIs. However, the achondrites presumably solidified from large scale melting on planetary bodies hundreds of km in size thus should not have retained any detectable heterogeneities due to fluctuating rare carrier grains. Similar anomalies in Cr-54 and Ti 50 have recently been discovered by Trinquier *et al*. (*Science, 324*, 374 2009). Our discovery of Ca-48 anomalies, but no anomaly in the tiny Ca-46, that correlate with the Ti-50 and Cr-54 indicate that these nuclides originated from the rare n-rich NSE, not neutron capture. It remains a mystery as to how to keep this component made only in a rare type of SNIa from completely mixed in the solar system. It lends some support to the speculation that there was a nearby supernova at the formation time of our solar system.