

PB-PB DATING OF CHONDRITE INCLUSIONS

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The recent report of $^{238}\text{U}/^{235}\text{U}$ variability in early solar system objects [1] casts doubt on all published Pb-Pb ages for meteorites and makes clear the future necessity for precise and accurate U isotopic compositions for materials being dated by the Pb-Pb method. To calibrate early solar system chronology, we are dating single Efremkova CAIs, single chondrules from Allende and a single AOA from Allende. Inclusions were extracted from their host matrices using a wire saw (dry) and dental drills. Matrix free inclusions were coarsely crushed, sieved and hand picked in distilled water. A progressive dissolution method parsed Pb into fractions that were spiked with ^{202}Pb - ^{205}Pb and analyzed mainly in ion counter peak-jumping mode on a Thermo-Scientific Triton. Pb-Pb results for the complex, fine-grained CAI E22 that lacks Wark-Lovering rim and any features of melting and recrystallization, corresponds to an age of 4570.0 ± 0.2 assuming a $^{238}\text{U}/^{235}\text{U}$ ratio of 137.88. A companion Al-Mg study of Efremovka CAIs (including E22) indicates CAIs in Efremovka and Allende formed within a brief interval of <10,000 years with an $^{26}\text{Al}/^{27}\text{Al}$ of $\sim 5 \times 10^{-5}$ [2]. Combined with a published younger Pb-Pb age for CAIs [3], this confirms variability of the U isotopic composition in CAIs. An AOA yields a Pb-Pb age of 4566.4 ± 0.9 Ma, assuming a $^{238}\text{U}/^{235}\text{U}$ ratio of 137.88. This age is marginally younger than the CAI age CAI [3]. This could reflect a younger formation age, disturbance or variable U isotopic compositions. Two single chondrules have yielded ages of 4567.06 ± 0.3 and 4567.3 ± 0.7 , assuming a $^{238}\text{U}/^{235}\text{U}$ ratio of 137.88. The more precise age of 4567.06 ± 0.3 Ma is only slightly younger than the CAI age of [3]. Ion microprobe Al-Mg analyses from the second half of this inclusion indicates an $^{26}\text{Al}/^{27}\text{Al}$ ratio of only 1×10^{-5} . The discordance between the Pb-Pb age and the Al-Mg age relative to CAIs could be the result of preferential resetting of the Al-Mg systematics or a lower $^{26}\text{Al}/^{27}\text{Al}$ abundance in the chondrule forming region relative to the CAI forming region, consistent with the conclusion of [2]. Future U isotopic measurements by MC-ICP-MS of these inclusions will provide assumption-free absolute Pb-Pb ages.

Reference: [1] Brennecka G. et al. 2010. *Science*. 327: 449-451. [2] Larsen K. et al. 2010. *73rd Annual Meteorological Society Meeting Abstract Volume*, this volume. [3] Amelin Y. et al. 2010. *41st Lunar and Planetary Science Conference*. pp. 1648-1649.