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Pb-Pb isotope systematics in an Allende chondrule

A. BOUVIER^{1*}, M. WADHWA¹ AND P. JANNEY¹

¹School of Earth and Space Exploration, Arizona State Univ., Tempe, AZ 85287 (*audrey.bouvier@asu.edu).

Precise dating of chondrules by long-lived (i.e., ²⁰⁷Pb-²⁰⁶Pb) and extinct (e.g., ²⁶Al-²⁶Mg) chronometers can shed light on processes and timescales involved in early Solar System events. Al-Mg model ages of chondrules of the CV3 Allende indicate that the chondrule formation process may have begun almost contemporaneously with CAI formation [1], and lasted up to at least ~3 My thereafter [2]. Absolute Pb-Pb ages obtained so far for chondrules from Allende (based on leachates and residues from multiple chondrules) are 4566.6 ± 1.0 Ma [3] and 4565.45 ± 0.45 Ma [4].

We have made MC-ICPMS analyses of the Pb isotope compositions of multiple leachates and residues from a single ~1.5 gram ferromagnesian chondrule from Allende to test for potential isotopic fractionation during extensive acid-leaching. The sample was split into 3 inner fractions and 1 rim fraction; each fraction was crushed and acid-washed using increasingly aggressive leaching steps (fraction 1 being the least and fractions 3 and 4 being the most strongly leached). The 4 remaining residues (R₁₋₄) were then fully dissolved. Blank corrected ²⁰⁶Pb/²⁰⁴Pb ratios range from 27 to 3,457 for the leachates, and 807 to 1,534 for the residues. Pb-Pb model ages for each of the residues R₁₋₃ and the most radiogenic leachate are all concordant; taken together, these four data yield an isochron age of 4567.59 ± 0.10 Ma (MSWD=0.18) for this chondrule. The residue from the rim fraction R₄ lies slightly off this isochron and suggests some disturbance of the Pb-Pb system in this fraction. This age is ~0.5 My older than the Pb-Pb age for the E60 CAI [5], but ~0.9 My younger than the best estimate of the CV3 CAI age determined by [6]. We are currently investigating Mg isotope systematics in this same chondrule to determine if Al-Mg and Pb-Pb systems are concordant.

[1] Bizzarro M., Baker J.A. & Haack H. (2004), *Nature* **431** 275-278. [2] Kita N.T., Nagahara, H., Togashi, S. & Morishita, Y. (2000), *GCA* **64** 3913-3922. [3] Amelin Y. & Krot A.N. (2007), *Meteorit. Planet. Sci.* **42** 1321-1335. [4] Connelly J.N., Amelin, Y., Krot, A.N. & Bizzarro, M. (2007), *Workshop on the Chron. Met. & Early Solar Syst.*, abs. 1374. [5] Amelin Y., Wadhwa M. & Lugmair G.W. (2006), *LPSC* abs. 1970. [6] Bouvier, A. Blichert-Toft J., Moynier F., Vervoort J.D. & Albarède F. (2007) *GCA* **71** 1583-1604.