Pb-Pb isotope systematics in an Allende chondrule

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Precise dating of chondrules by long-lived (i.e., ^{207}Pb-^{206}Pb) and extinct (e.g., ^{26}Al-^{26}Mg) 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 (R_{1-4}) were then fully dissolved. Blank corrected $^{206}Pb/^{204}Pb$ 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 R_{1-3} 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 R_4 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.

Sulfate mineral assemblages from Mars-analog environments I: Indicators of general environmental conditions

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Modern acid saline lakes in southern Western Australia, Victoria, and northern Chile, as well as the Jurassic Navajo Sandstone and the Permian Opeche Shale and Nippewalla Group, contain sulfate minerals including gypsum, jarosite, and alunite. Comparisons between these different sulfate-producing environments using coupled remote sensing, field work, petrography, spectroscopy, and geochemistry have allowed us to trace the various formation processes and evaluate the “fingerprints” left by different environments and conditions. In Western Australia and Victoria, gypsum precipitates from shallow lake water and groundwater and is reworked and redeposited in dunes and sandflats. Sediments are rapidly cemented by jarosite, alunite, iron oxides, and halite precipitated by shallow acid saline groundwaters. In Chile, acid saline lakes and groundwater also precipitate and rework gypsum and alunite, but in a high-elevation, active volcanic setting. The Jurassic Navajo Sandstone contains localized jarosite, natrojarosite, alunite, anglesite, and tschermigite as late diagenetic / hydrothermal phases. The Permian red beds and evaporites contain depositional and early diagenetic gypsum, anhydrite, glauberite, and polyhalite. General environmental interpretations can be made elsewhere in terrestrial and extraterrestrial rock records based on a comparative sedimentology approach of sulfate assemblages (as beds, grains, randomly-oriented crystals, grain coatings, etc.), as a complement to careful petrography, spectroscopy, and geochemical analyses.