Barium and Sr isotope compositions in carbonaceous chondrites

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To further evaluate the distribution of nucleosynthetic isotope anomalies in bulk solar system samples, precise Ba and Sr isotope compositions were determined by TIMS in chondrites (Murchison CM2, Allende CV3, Kainsaz CO3, Forest City H5, St. Severin LL6) and a HCl leachate from Murchison. Of the bulk samples, only the carbonaceous chondrites display slight enrichments in the r-process dominated nuclides ^{135}Ba and ^{137}Ba. The HCl leachate from Murchison shows a much larger r-process isotope excess of 249, 136 and 59 ppm for ^{135}Ba, ^{137}Ba and ^{138}Ba, respectively. None of the samples displays resolvable anomalies for the rare p-only nuclides ^{130}Ba and ^{132}Ba, outside the external reproducibility of 175 and 104 ppm (2 sd). Stable Sr isotopes in Allende and Murchison (bulk and HCl leachate) display normal compositions within 49 ppm (2 sd; ^{86}Sr/^{88}Sr rel. to ^{84}Sr/^{88}Sr). The above Ba and Sr isotope data are in accord with previous data by Hidaka et al. (2003), Carlson et al. (2007) and Andreasen & Sharma (2007).
Discussion and conclusions: Testruns using a container-less laser fusion method (Pack et al. 2007) indicate that the anomalies do not result from incomplete sample digestion. The Murchison HCl leachate shows that the anomalous Ba resides in chemically labile carrier phases and that Sr is either not abundant in these phases or isotopically normal. This is remarkable, since Ba and Sr feature a similar condensation temperature and chemical behaviour and may imply that the production of Sr and Ba r-process isotopes is decoupled. Also, Ba and Sr p-process isotopes are normal and apparently decoupled from Sm isotopes (Andreasen & Sharma 2006). Carbonaceous chondrite leachates display large isotope anomalies in the refractory elements Ba, Mo, Zr, Os that are (nearly) balanced in the bulk samples. This requires that dust in the carbonaceous chondrite source region was never completely vaporized.
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