
135Cs is produced in the rapid neutron capture process (thought to occur in supernovae) with a production ratio of ~0.6 relative to stable 133Cs, which is estimated to be about 85% r-process in the bulk solar system reservoir (BSS) [1]. Inferred ab initio BSS abundances of other unshielded extinct radionuclides, 107Pd (t_m = 9.4 Ma, [2]), 182Hf (13 Ma, [3]), and 129I (23 Ma, [4]) in the early solar system are consistent with a model in which most of these nuclides are contributed to the protosolar reservoir very near in time to the birth of the sun following a long r-process separation ("free decay") interval of ~10^8 yr, as expected if the solar system formed in the vicinity of a massive star association generated during the passage of a galactic spiral density wave. Because of its relatively short mean-life (3.3 Ma), 135Cs is a critical test nuclide for this "late input" scenario. For a late input r-process fraction, N_r/N_f = 1 x 10^-4, for Cs (inferred from 129I, assuming constant N_r/N_f in the mass region), the late-input model predicts 135Cs/133Cs > 3 x 10^-5 for a decay interval of less than one half life (2.3 Ma) between synthesis and the origin of the solar system. Live 26Al (1 Ma) in the early solar system suggests the possibility of an even shorter time-scale.

135Ba/138Ba relative precisions of ±25 ppm (2σ_m), normalized to 136Ba/138Ba = 0.109540, are achievable by averaging the results of 6 multiple 100 ng multicollector runs with ±60 ppm (2σ_p) external reproducibility (fig. 1). The use of 138Ba in the normalization is justified at this level because 138Ba/138Ba from the decay of 138La is only 2.5 ppm in BSS, and because the meteorites included in this study have identical bulk La/Ba to within uncertainties of ±1-25%. La/Ba in our terrestrial standard "1154", a Gorda ridge basalt, is 1.8 x CI: hence A138*Ba/138Ba relative to Orgueil is < 2 ppm, (probably << 2 ppm).

Six runs each of Ba separated from whole rock samples of the Orgueil (fig. 2) and LEW 86010 (fig. 3) meteorites, having 133Cs/135Ba ratios of 1.3 and 0.0 respectively, reveal a statistically resolved difference of 45±35 ppm (2σ) in 135Ba/138Ba (fig. 4). We interpret this difference as evidence for live 135Cs in the early solar system at an ab initio level: 135Cs/133Cs = (3±2) x 10^-5. Further higher-precision measurements are planned to evaluate this tentative conclusion.

The LEW 86010 data is in close agreement with the terrestrial normal (fig. 4). 53Mn - 53Cr chronometry indicates that the LEW 86010 angrite crystallized from a melt at the same time (to within ~2 Ma) as the formation of the refractory Ca, Al-rich inclusions in the Allende meteorite (at ~4566±2 Ma [5]) during a very early (essentially ab initio ) period of solar system history. If 135Cs was indeed present in the early solar system at the level inferred, then 2 major conclusions follow: (i) A supernova contributed newly synthesized r-process matter into the protosolar reservoir within ~5 Ma of the Cs/Ba fractionation recorded in LEW 86010; (ii) The strong Cs depletion in the bulk earth reservoir (133Cs/135Ba ~0.1) took place very early in solar system history. If this volatile-loss was pre-accretion (viz., in the nebula or planetesimals), then the accretionary chronology of the earth is not constrained. However if it is a consequence of accretion, then a very tight time constraint of ~5 Ma (rel. to LEW 86010) is obtained for accretion of most of the earth's mass.