A COSMIC-RAY ORIGIN FOR CAI BERYLLIUM 10 Steven J. Desch[1] and Harold C. Connolly, Jr.[2], [1]Department of Terrestrial Magnetism, Washington DC, [2]AKingsborough College, Brooklyn NY; Rutgers University; American Museum of Natural History. desch@dtm.ciw.edu

Synopsis: We attribute the short-lived (mean life 2.18 Myr) radionuclide ^{10}Be incorporated live into CAIs at the birth of the solar system, at levels ^{10}Be/^{9}Be ~ 10^{-3} [1-5], to galactic cosmic rays (GCRs). Spallation reactions involving GCR protons and He nuclei account for 20 % of the ^{10}Be, while ^{10}Be GCRs slowed and trapped in the Sun's molecular cloud core account for the other 80 % [6].

Calculation: We have used the calculations of [7] to model the time evolution of the magnetic field strength and column density of gas in a collapsing molecular cloud core. With the magnetic field strength we account for magnetic focusing and mirroring and pitch-angle redistribution. With the column density we calculate the loss of kinetic energy of GCRs as they ionize gas molecules. GCR protons and He nuclei easily enter the cloud core and induce spallation reactions, making ^{10}Be. GCR ^{10}Be nuclei with energies < 10 MeV/n are slowed and trapped in the cloud core, increasing ^{10}Be directly. We use the GCR spectrum of [8], but multiply the flux by a factor = 2, based on multiple lines of evidence that GCR fluxes were 2 times greater 4.5 Gyr ago [6]. Accounting for trapping, production by spallation, and decay, we calculate the time evolution of the ^{10}Be/^{9}Be ratio in a collapsing molecular cloud core. By the time the protoSun formed, we predict ^{10}Be/^{9}Be = $1x10^{-3}$, with =50% uncertainty. Preliminary calculations also indicate that this ratio is spatially homogeneous within the cloud core to << 10 %.

Discussion: We dispute the conclusion that the presence of ^{10}Be implies irradiation of solar nebula material by energetic particles from the early Sun [9]. At least half of the ^{10}Be is attributable to GCRs, and probably all of it. Production of ^{26}Al, etc., by in situ irradiation [9,10] would necessarily overproduce 10Be [6]. The new evidence for live ^{60}Fe in the solar nebula [11,12] suggests a supernova origin for all the radionuclides, except ^{10}Be, which we attribute to GCRs.

The spatial homogeneity of ^{10}Be, and its origin before the formation of the first solar system solids, renders it an excellent chronometer of early solar system events. The spread in ^{10}Be/^{9}Be ratios in CAIs suggests melting spanned =2 Myr, consistent with the spread in ages from Fe-Ni [11], U-Pb [13], and Al-Mg [2] systematics.

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