MODELING THE MINIMUM SIZE OF CM PARENT BODIES.

R. F. Coker[1] and B. A. Cohen[2]. [1]Los Alamos National Laboratory, X-2, MS T087, Los Alamos, NM 87545, USA (robc@lanl.gov), [2]University of New Mexico, Department of Earth and Planetary Sciences, MSC03-2040, Albuquerque, NM 87131, USA.

Introduction: We continue our development of an asteroid thermal model that includes radionuclide heating, the effects of heats of reaction and volumetric changes due to serpentinization and the radial transport of liquid water and water vapor [1-4]. The heat input from radionuclides goes as the volume of the asteroid while the heat sink effects of the surroundings go as the surface area of the asteroid. Thus, for a given nebular temperature and initial composition, a potential parent body must be of at least some minimum size in order for it to heat up to the point of water melting in order to allow hydration reactions to occur.

The Models: We use a canonical model for an asteroid which accretes at a heliocentric distance of 3 AU. The initial void and ice fractions are taken to be 16% and 10% by volume, respectively. We use 10%, which is at the low end of likely ice fractions, in order to determine a lower limit to the required asteroid size for hydration (larger ice fractions produce less radionuclide heating and thus require larger parent bodies). We assume a pore size of 50 m and permit radial transport of water vapor via diffusion and the radial transport of liquid water via capillary action. For the ambient nebular temperature, we use [5] $858\ R^{-1.13}t^{-1.1}$ K where R is the asteroid's heliocentric distance in AU and t is the time of formation in Myrs. At ~ 0.9 Myr after the collapse of the solar nebula, the nebula temperature is ~ 275 K; if a potential parent body accretes any earlier, ice is highly unlikely to be present at all. In the absence of the solar nebula, the asteroid would be heated by the sun to ~150 K; this is the temperature to which the nebula cools by 1.5 Myr. Thus, except for very large asteroids, not including the nebula would result in larger minimum parent body sizes.

Results: Asteroids that are smaller than about 3 km in diameter are found to never have hydration reactions. Even if they accrete at a temperature of ~ 270 K, asteroids smaller than ~3 km diameter do not generate sufficient heat to balance heat loss to the nebula and thus they never produce liquid water. For larger asteroids, the minimum size depends on the time the body forms since not only is the nebula hotter (and so less of a heat sink) at earlier times but the radionuclide heating is also stronger. We find that for our canonical setup, the minimum diameter for a potential CM parent body is ~$20t^{0.9}$-14.5 km for asteroids forming t Myrs after nebula collapse. We will present these results (valid up to at least 20 km) as well as those for different setups.

References: [1] Cohen, B.A. and Coker, R.F. 2000. *Icarus* 145:369-381. [2] Cohen, B.A. and Coker, R.F. 1999. *Meteoritics & Planetary Science* 34:A26. [3] Cohen, B.A. and Coker, R.F. 2000. Abstract #1935. 31st Lunar & Planetary Science Conference. [4] Coker, R.F. and Cohen, B.A. 2001. *Meteoritics & Planetary Science* 36:A43. [5] P. Cassen 1994. *Icarus* 112: 405-429.