THE KORONIS FAMILY: POSSIBLE EVIDENCE FOR A RECENT CATASTROPHIC DISRUPTION; R. P. Binzel, Planetary Science Institute.

Families of asteroids first discovered by Hirayama (1) represent likely cases for the catastrophic disruption of a large parent body sometime after the initial formation of the solar system. Because all but the largest asteroids are believed to be collisional fragments, understanding the process of catastrophic disruption of large parent bodies is of fundamental importance in the investigation of collisional evolution of the asteroid belt. Laboratory experiments have been performed in which meter-sized basalt targets have been disrupted by high speed projectiles. However, the validity of extrapolating these experiments upward by many orders of magnitude to the size range of the asteroids is very uncertain.

An observational survey conducted by the author (2) has yielded rotational lightcurves for more than forty asteroids known to be members of the Eos and Koronis families. Each lightcurve provides information on the asteroid's rotation rate and shape. The observed rotation rate gives a measure of the asteroid's angular momentum which is comprised by two components: the initial angular momentum resulting from the catastrophic disruption and angular momentum gained (or perhaps lost) by collisions subsequent to the time of formation.

Eos family asteroids have a significantly higher mean rotational frequency than Koronis family asteroids. Results from a numerical model for the collisional evolution of rotational angular momentum (3) suggest that this difference may be accounted for by different relative ages for the two families. The distribution of rotation rates in the Eos family is consistent with a Maxwellian distribution, the limiting distribution for a collisionally evolved population. A model derived age for the Eos family indicates it may have a formation age comparable with the lifetime of the solar system. In addition to a lower mean rotation rate, the Koronis family rotational frequency distribution also shows a narrower dispersion than the Eos family. Collisional modeling results suggest that this indicates that the Koronis family is less collisionally evolved and therefore younger than the Eos family.

Additional observational evidence suggests a younger relative age for the Koronis family. The distribution of Eos family lightcurve amplitudes gives a consistent fit to the distribution of shapes of fragments from laboratory collision experiments, assuming random orientations for the principal axes of the fragments. The distribution of lightcurve amplitudes for Koronis family asteroids has a higher mean and gives a very poor fit to the laboratory fragment distribution. However, a consistent fit to the Koronis family lightcurve amplitude distribution can be obtained if the random orientation

assumption is *removed*. Therefore the higher amplitudes in the Koronis family may be explained by a preferential low obliquity alignment of their spin vectors which results in their being preferentially observed at near-equatorial (maximum lightcurve amplitude) aspects. This preferential low obliquity alignment hypothesis can be tested observationally by re-observing Koronis family asteroids at ecliptic longitudes 90 degrees away from their original observations. If the hypothesis is correct, then the observed lightcurve amplitudes should be nearly invariant with respect to ecliptic longitude.

A preferential alignment of rotation axes among Koronis family members would reflect the direction of the parent body's rotational angular momentum vector. A relatively young formation age for the family would be deduced because subsequent collisions have not yet been sufficient to re-orient the spin vectors of the members.

The necessary observational tests are now being planned. If the Koronis family proves to be the result of a recent (<2 Gy?) catastrophic disruption event, such a recent "natural laboratory" experiment could strongly constrain models for asteroid collision outcomes.

This research was supported by NASA Grant NGR 44-012-152. Observations were made at the University of Texas McDonald Observatory.

(1) Hirayama, K. (1918). *Astron. J.* **31**, 185-188.
(2) Binzel, R.P. (1987). Submitted to *Icarus*.
(3) Binzel, R.P. (1986). Ph.D. thesis, University of Texas.