PHYSICAL CHARACTERIZATION OF VERY YOUNG ASTEROID FAMILIES.

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Introduction: Much of what we observe in the asteroid belt today is the result of collisions between asteroids. Up to now, ejecta from a few tens of major collisions have been discovered in the main belt. These groups of fragments are called asteroid families. To identify an asteroid family, researchers look for clusters of asteroid positions in the space of the proper orbital elements (a,e,i). Most of the observed asteroid families are old (hundreds of millions to billions of years) and have been substantially eroded and dispersed by (1) secondary collisions (e.g., [1]), (2) chaotic orbital evolution (e.g., [2]), and (3) semimajor axis mobility due to sunlight (i.e. Yarkovsky effect; e.g., [3]). These effects make it problematic to determine the conditions that existed immediately after the family break-up event. Fragments produced by recent collisions, on the other hand, have suffered little erosion in the interim period and therefore provide more direct information about the break-up event itself. So far we know of three asteroid families with ages between 1 and 10 Myr. These are (1) the Iannini cluster (1-5 Myr old), (2) The Karin cluster (5.75 ± 0.05 Myr old), and (3) the Veritas family (8.3 ± 0.1 Myr old). The ages of these families were determined by numerical integrations of asteroid orbits backward in time (e.g., [4]) and by showing that the orbits were nearly identical at the time of family formation.

Recently [5,6], four very young families were discovered: the Datura, Emilkowalski, 1992 YC2, and Lucascavin clusters are 450 ± 50, 220 ± 30, 50-250, and 300-800 kyr old, respectively. To date, these clusters are the only known asteroid families younger than 1 Myr. The Datura cluster is a group of seven asteroids while the three other new families are groups of three objects each. All these objects have diameters in the ~ 1-11 km range with >60% of the objects having D< 2km.

These discoveries offer an excellent opportunity for physical studies of young families whose members have suffered limited erosion. It is known that a planetary surface exposed to space weathering effects (solar wind ion irradiation, cosmic rays and interplanetary dust bombardment) changes in color and spectral characteristics. The effect, in the inner part of the solar system, is a progressive darkening of the surfaces, and a reddening of the reflectance spectra. In the case of these families we expect the surfaces to be young (quite unweathered). Especially, the relatively precise dating of the fragmentation events will allow us to put a time tag on the effects of space weathering.

We will present visible (0.45-0.95 μm) and near-infrared (0.7-2.5 μm) spectroscopic observations for **1270 Datura** and **14627 Emilkowalski** and a visible spectrum for **21509 Lucascavin**.

Observations: The observations presented here were performed (November 2006) in the visible at the European Southern Observatory (La Silla, Chile) with the 3.58 m New Technology Telescope (NTT) and in the near-IR (January 2008) with the 3m NASA Infrared Telescope Facility (IRTF) on Mauna Kea. In the visible, we used the grism 1 (150 gr/mm) in the RILD arm of EMMI to cover the 0.4-1.0 μm wave-length range with a slit width of 1.5". In the near-IR, the run was remotely conducted from the Observatory of Paris. The spectrograph SpeX combined with the 0.8 x 15 arcsec slit was used in prism mode for acquisition of the spectra in the 0.7-2.5 μm wavelength range.

Results: We will show that the surfaces, even if young, have already undergone some significant amount of space weathering (SW). These observations prone a fast acting SW process responsible for these reddish colors.

References: [1] Bottke W. F. et al. (2005) *Icarus, 175*, 111. [2] Nesvorny D. et al. (2002) *Icarus, 157,* 155. [3] Vokrouhlicky D. et al. (2006) *Icarus, 182,* 118. [4] Nesvorny D. et al. (2002) *Nature, 417*, 720. [5] Nesvorny D. et al. (2006) *Science, 312,* 1490. [6] Nesvorny D. & Vokrouhlicky D. (2006) *AJ, 132,* 1950.