SPECTROSCOPIC SURVEY OF THE INNER BELT PRIMITIVE BACKGROUND POPULATION.
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Introduction: Near-Earth asteroids (NEAs) are main belt asteroids whose orbits have been perturbed by gravitational interactions with planets so that they now orbit in the vicinity of Earth. To study the main belt origins of NEAs, and particularly the origins and likely compositions of (101955) Bennu and (162173) Ryugu, the PRIMitive Asteroid Spectroscopic Survey (PRIMASS) was formed. Bennu and Ryugu likely formed from primitive (p_V < 0.15), low inclination (i < 8°) asteroid populations in the inner main belt (IMB) [1]. A population that is capable of delivering NEAs but has not been studied extensively before is the background population, i.e., asteroid that have not been classified into dynamical families by [2].

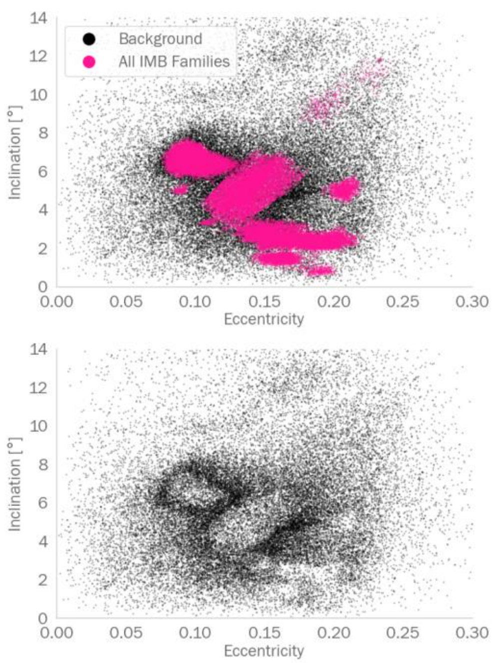

Figure 1. *IMB families (pink) and background population (black). Asteroids cluster in halos around the family locations, suggesting that the families and the background are related.*

Figure 1 shows eccentricity vs inclination of IMB asteroids. Objects categorized into dynamical families are shown by pink points, and black points are background asteroids. Clusters of pink points represent dynamical families. In the bottom panel, we remove the family asteroids leaving behind just the background. The background objects form distinct halos around the locations of the families. Furthermore, the sizes of background asteroids are correlated with eccentricity but anti-correlated with inclination [3]. This evidence suggests that family and background asteroids originated from a few large primordial planetesimals.

In this study, we test if the background is similar or different from the families in the same region by spectrally characterizing the primordial background population and comparing our results with the population of primitive IMB families already observed and published by PRIMASS.

Observations: We obtained a representative sample of the background population by observing asteroids identified to be a part of a primordial background family (PBF) by [4]. We used the NASA Infrared Telescope Facility and the Telescopio Nazionale Galileo to obtain new NIR (0.8-2.5 μm) spectra of 55 background objects. We also present visible (0.4-0.9 μm) spectra of 20 background objects obtained from the SMASS and S3OS2 surveys using the Small Bodies Data Ferret supported by the NASA Planetary Data System. Sixteen of the sampled objects have both visible and NIR spectra. The orbital locations of the asteroids presented are shown by diamonds in Figure 2. Our sample covers the same range of orbital elements that the primitive families do.

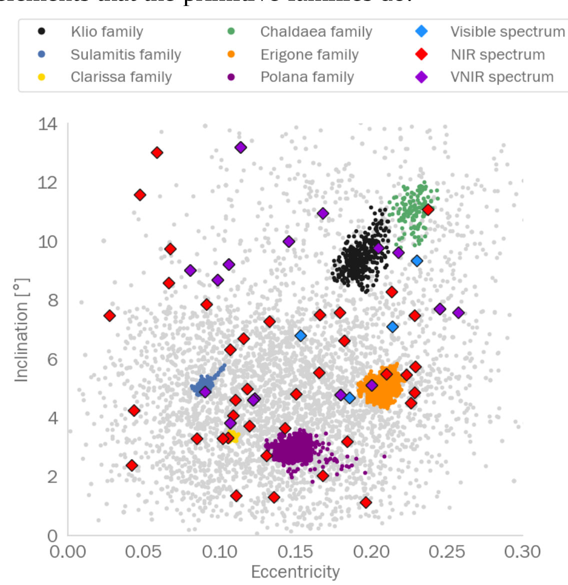

Figure 2. *Primitive IMB families (colored points) and background asteroids (grey points). Asteroids observed in this*

study are shown by diamonds. Blue diamonds indicate visible spectra, red diamonds indicate NIR spectra, and purple diamonds indicate both visible and NIR spectra.

Results: Analysis of our background sample includes Bus-DeMeo taxonomy determination, measurements of spectral slope and curvature of each spectrum, calculation of band depth and center of the 0.7 µm absorption band associated with hydrated minerals, comparison with the spectra of primitive IMB families, comparison with the spectra of NEAs Bennu and Ryugu, and comparison with the spectra of meteorites for a first order constraints on composition.

Our sample of the background is spectrally similar to the families at similar inclinations, providing further evidence that at least some of the background and the families originated from the same source. There is diversity within our sample of the background, which suggests that the entire background did not originate from one single body. Our spectral comparisons also show that the background is the most likely source of asteroid (162173) Ryugu (Figure 3). Though the spectrum of asteroid (101955) Bennu is comparable to our B-type spectra, our B-type background objects are all high inclination while Bennu has i~6°. For this reason, we do not believe that the background is the source of Bennu; the Polana/Eulalia complex remains the more likely source of this NEA [7,8].

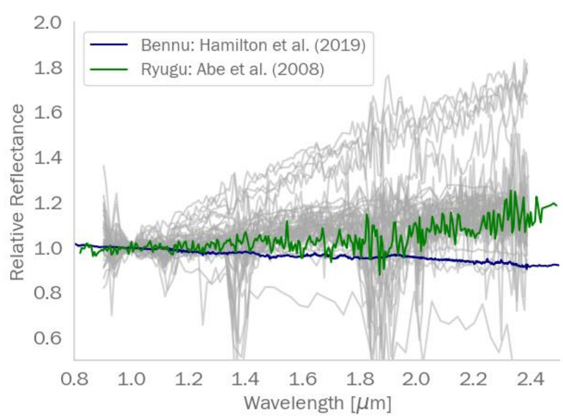

***Figure 3**. Comparison of the spectra of Bennu and Ryugu from [5] and [6] with the spectra of our sample. The Ryugu spectrum is very similar to the rest of the background objects. The Bennu spectrum is similar to the high-inclination B-types in the sample.*

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