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The last pieces of the primitive inner belt puzzle: Klio, Chaldaea, Svea, and Chimaera

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Abstract

In the present work we have studied the smallest primitive families within the inner main belt: Klio, Chaldaea, Chimaera, and Svea. We have observed a total of 73 objects: 30 in the Klio family, 15 in Chaldaea, 20 in Chimaera, and 8 in Svea. These data is part of our PRIMitive Asteroid Spectroscopic Survey (PRIMASS).

1. Introduction

The inner part of the main asteroid belt, bounded by two major resonances, namely the ν_6 secular resonance and the 3:1 mean motion resonance (2–2.5 AU), is considered the principal source of near-Earth asteroids [1]. Primitive families in this region were identified as potential sources for near-Earth asteroids (101955) Bennu and (162173) Ryugu, targets of the sample-return missions OSIRIS-REx and Hayabusa2, respectively [2,3,4]. Four of them, located at proper inclinations $i < 10°$, have already been studied by our group: the Polana-Eulalia complex [5,6], Erigone [7], and Sulamitis & Clarissa [8]. The remaining four, at higher proper inclinations ($i > 10°$), have not yet been compositionally studied: Klio, Chaldaea, Chimaera, and Svea (Fig. 1). We have characterized and analized these families within the context of PRIMASS, in order to wrap up the puzzle of the origins of Bennu and Ryugu.

2. Data

We obtained visible spectra (0.5–0.9 μm) for a total of 73 asteroids within the Klio, Chaldaea, Chimaera, and Svea collisional families, using the instrument OSIRIS at the 10.4m Gran Telescopio Canarias, located at the

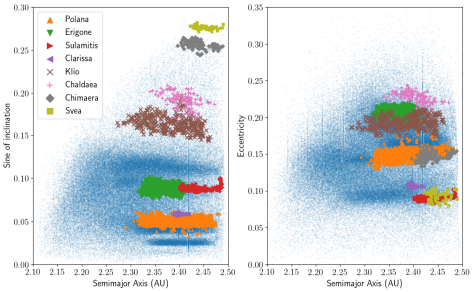

Figure 1: Proper semi major axis (a) versus proper sine of inclination (left) and proper eccentricity (right) for the eight primitive families in the inner main belt. The high-inclination families, studied in this work, are Klio (brown), Chaldaea (pink), Chimaera (grey), and Svea (yellow).

El Roque De Los Muchachos observatory (La Palma, Spain). We have performed a taxonomical classification of these objects, as well as an anlysis of the possible presence of absorption bands related to aqueous alterations, comparing the results with the primitive families in the inner main belt that have already been studied.

3. Summary

We show that Klio, Chaldaea, and Chimaera have moderately red spectral slopes, with aqueous alteration absorption bands centered around 0.7 microns, belonging to the group of primitive families known as Erigone-like. In contrast, Svea shows no 0.7 micron features and neutral–blue spectral slopes, thus being a Polana-like family. While all four families might be related to Ryugu, the only family studied in this work that might be related to Bennu is Svea.

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