The distribution of mantle material in the main belt

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We expect there to have been many differentiated asteroids in the Main Asteroid Belt (MB) earlier in the solar system's history because the diversity of iron meteorites imply the existence of over 60 distinct parent bodies [1]. Searches have been performed to identify basaltic crust material (spectral V-type asteroids) in the outer MB (e.g., [2–5]). Many basaltic bodies distributed throughout the MB have been discovered within the past decade. The olivine-rich mantles of differentiated asteroids should have produced substantially greater volumes (and therefore substantially greater numbers) of remnant asteroids compared with basaltic and iron samples. Yet olivine-rich asteroids (A-types) are one of the rarest asteroid types [6,7].

An alternative way to search for differentiated bodies that have been heavily or completely disrupted is to identify these spectral A-type asteroids, characterized by a very wide and deep 1-micron absorption indicative of large amounts ($>$ 80 %) of olivine. They are close spectral matches (although much redder due to space weathering) to Brachinite or Pallasite meteorites (e.g., [8]) and are thought to represent mantle material or core-mantle boundary material of disrupted differentiated asteroids. [9] proposed that these asteroids are only found among the largest because most were "battered to bits" due to collisions, so smaller A-types were below our detection limit.

Using the Sloan Digital Sky Survey Moving Object Catalog to select A-type asteroid candidates, we have conducted a near-infrared spectral survey of asteroids over 12 nights in the near-infrared in an effort to determine the distribution and abundance of crustal and mantle material across the MB. From three decades of asteroid spectral observations, only $\sim$10 A-type asteroids have been discovered. In our survey, we have detected $>$ 20 new A-type asteroids thus far throughout the belt, tripling the number of known A-types. We present these spectra and their distribution throughout the MB. We estimate the total mass of mantle material present in the belt today and discuss the implications.

Acknowledgements: This material is based upon work supported by NASA under grant number NNX12A L26G and through the Hubble Fellowship grant HST-HF-51319.01-A.

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