Meteorite source regions as revealed by the near-Earth object population

R. Binzel[1], F. DeMeo[2], B. Burt[1], D. Polishook[1], T. Burbine[3], S. Bus[4], A. Tokunaga[4], and M. Birlan[5]

[1]MIT, Cambridge, MA USA
[2]Harvard Smithsonian Center for Astrophysics, Cambridge, MA USA
[3]U. Massachusetts, Amherst, MA USA
[4]U. Hawaii
[5]Paris Observatory, France

Spectroscopic and taxonomic information is now available for 1000 near-Earth objects, having been obtained through both targeted surveys (e.g. [1–3]) or resulting from all-sky surveys (e.g. [4]). We first evaluate these results within the framework of taxonomic types in the Bus-DeMeo system [5,6] and subsequently examine meteorite correlations based on spectral and mineralogical analysis (e.g. [7,8]). We correlate our spectral findings with the source region probabilities calculated using the methods of Bottke et al. [9]. The source regions evaluated are Mars Crossers, ν_6 resonance, 3:1 resonance, the Outer Belt, and Jupiter Family Comets.

In terms of taxonomy, very clear sources are indicated: Q-, Sq-, and S-types most strongly associated with ordinary chondrite meteorites show clear source signatures through the innermost main-belt regions. V-types are relatively equally balanced between ν_6 and 3:1 resonance sources, consistent with the orbital dispersion of the Vesta family. Asteroid taxonomy classes interpreted as analogous to meteorites with primitive compositions, B- and C-types, show distinct source region preferences for the outer belt and for Jupiter family comets. Most strongly indicated is a Jupiter family comet source for the D-type near-Earth objects, implying a pronounced likelihood that these "asteroidal" bodies are extinct or dormant comets [10]. Similarly, near-Earth objects falling in the spectrally featureless "X-type" category also show a strong outer belt and Jupiter family comet source region preference; even though they lack albedo measurements, they may be interpreted as originating from among "P-type" primitive objects common in the outer belt. Finally the Xe-class of near-Earth objects, which most closely match the spectral properties of enstatite achondrite (aubrite) meteorites, show a source region preference consistent with a Hungaria origin (confirming [11]) by entering near-Earth space through the Mars crossing and ν_6 resonance pathways.

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