A COMPARISON OF THE CLASS DISTRIBUTION OF ASTEROIDS IN THE MAIN BELT AND NEAR-EARTH VICINITY.
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Introduction: The asteroid population in the solar system consists of the Main Belt Asteroids (MBAs) located at 2 – 4 AU and the Near-Earth Objects (NEOs) located at <1 – 1.3 AU. It has long been thought that the NEOs are a subset of the main belt asteroids, but with the discovery of large numbers of new NEA this conclusion should be frequently revisited. Here we compare the two populations using their taxonomic classes as the basis for comparison (Fig. 1).

Type	% of Classified MBAs	
B	4.22	C & C-like Asteroids 50%
C	11.44	
Cb	2.33	
Cg	0.50	
Cgh	0.83	
Ch	8.28	
X	9.33	
Xc	8.61	
Xe	2.28	
Xk	2.12	

Type	% of Classified MBAs	
S	31.06	S & S-like Asteroids 43%
Sa	1.89	
Sk	0.89	
Sl	2.72	
Sq	3.00	
Sr	0.83	
V	2.0	
A	0.94	
D	0.50	All Other Asteroids 7%
K	1.72	
L	1.89	
Ld	0.72	
O	0.06	
Q	0.06	
R	0.22	
T	1.56	

Fig. 1 *Grouping of the classifications for the MBAs. There is considerable compositional heterogeneity among these oldest relics of the solar system*

Background: Within the NEO population, Apollos ($a \geq 1.0$ AU, $q \leq 1.0167$ AU), Atens ($a < 1.0$ AU, $Q > 0.983$ AU) and Amors ($a \geq 1$ AU, $1.017 < q \leq 1.3$ AU) at the time of writing stands at ~5300. Lifetimes for objects in these orbits are short, $10^6 – 10^7$ years [1, 2], which indicates that the population must be continually resupplied. Potential sources are short period comets, such as Halley and the Jupiter-family comets [3, 4], and the main belt asteroids. Models of the collisional history of asteroids in the main belt suggest that most NEAs probably originate in the main belt [5]. A statistical comparison of NEA and MBA might help resolve this issue.

Experimental: We obtained taxonomy classification information for the main belt and near-Earth asteroids from the NASA Planetary Data Systems [6] and Near Earth Objects – Dynamical Site [7] databases. The results appear in Fig. 2. While there are important similarities. Most striking, is the similar abundance of S asteroids in each population, but also the A, B, Cb, D, Sk, Sl and T groups seem similar. Some groups are too small to call. However, more striking are the number of major disagreements indicated by arrows in Fig. 2.

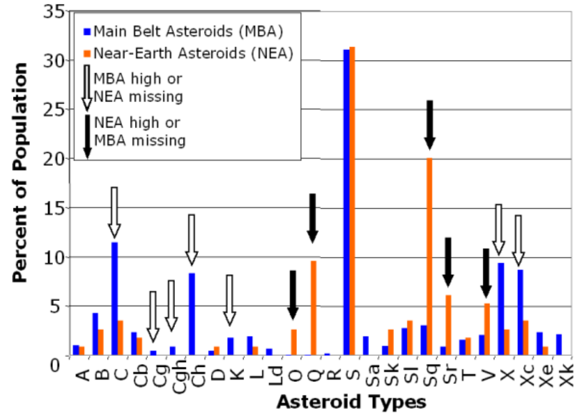

Fig. 2. *Comparison of the MBA and NEA populations based on taxonomic class. Note the variance in the abundances of the classes between the populations (indicated by arrows).*

We performed a chi square analysis of the MBA and NEA class distributions to see if they came from the same major population. There are ~1800 well classified MBA and ~300 NEA. We adopted the null hypothesis that the two populations are identical and obtained obtained a chi squared value of 399, greater than 38 which is the chi squred value for rejection of the hypothesis at the 0.05 level. In other words, we must rejected our null hypothesis and conclude that at the 5% level of confidence that the two populations are different. The NEA are not representative of the main belt. Either a different source is involved, or different sources are being sampled differently, for example a few major MBA impacts are feeding the NEA population. Cosmic ray exposures ages of chondrite meteorites suggest this might be the case since they show that a few major events disrupted the parent bodies of these major classes [6].

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