Sears D. W. G. (1998) The case for asteroid sample return. *Meteorit. Planet. Sci.* **33**, A140-A141.

THE CASE FOR ASTEROID SAMPLE RETURN. D. W. G. Sears, Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville AR 72701, USA (cosmo@uafsysb.uark.edu).

Over two decades ago the case was successfully made that asteroid sample return was not justified because (1) we had representative samples of asteroids in our laboratories in the form of the meteorites, (2) there was too much uncertainty as to which asteroid should be sampled, and (3) the mission was too technically challenging. It is argued that none of these arguments are valid today. There is now a very strong case for

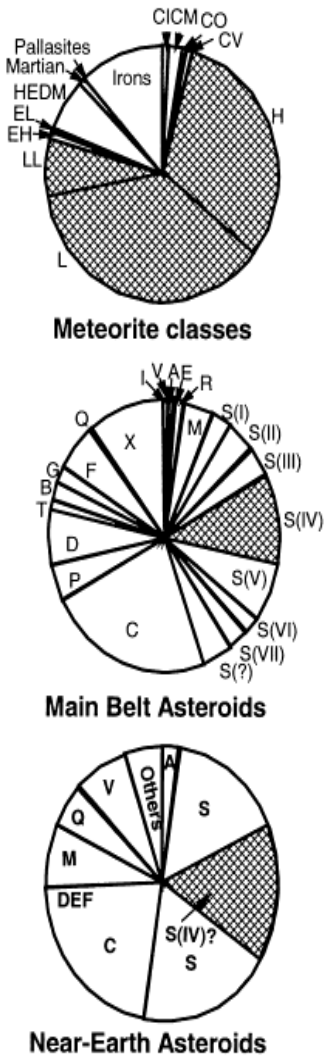

Fig. 1. Distribution of meteorites and asteroids over the classes. The statistics are fairly good for the meteorites and main-belt asteroids, but include only ~40 NEAs. The only asteroid match for H, L, and LL chondrites is the Q class and, possibly, the S(IV) class. The distributions for the main belt asteroids and NEAs are remarkably similar.

ies. Clearly the priority should be to sample a C and an S asteroid for representative material and a Q asteroid for potential ordinary chondrite material.

The major technical consideration is the energy requirement of the mission. The large energy requirement of main-belt missions does not apply to near-Earth asteroids. The energetics for reaching many NEAs are more favorable than for Mars, and several are energetically more favorable than for the Moon. There are NEAs that are C, S, Q, and even V (Vesta-like). The number of known NEAs has increased considerably in the last decade or so, and continues to grow, and the distribution of the NEAs over the spectral classes is remarkably similar to that of the main belt (Fig. 1).

The strategy for exploring new worlds has been likened to a geologist exploring a new field. Meteorites are flotsam and what is required now is some knowledge of their likely "outcrops." Terrestrial geologists first map the field, select representative samples, and perform little or no analysis of the samples in the field. They return the samples to the laboratory for sophisticated analysis. In the case of the asteroids, spectral reflectivity data are equivalent to mapping and sample selection. Asteroid-to-asteroid differences are much larger than differences on an asteroid, so that at this stage only a grab sample is required. Surface samples will be most helpful in understanding the astronomical and meteorite data. Even if the first asteroids sampled are not meteorite parent bodies, the information gained will provide "ground truth" for meteorite studies and new data on primitive solar system materials.