TESTING THE BUS-DEMEO ASTEROID TAXONOMY USING METEORITE SPECTRA. T. H. Burbine\(^1,2\),
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**Introduction:** Asteroids are usually classified by the shape of their reflectance spectra in the visible and near-infrared wavelength regions. The most widely used classification system is the Bus-DeMeo taxonomy \(^1\), which was developed using asteroid reflectance spectra. Even though the Bus-DeMeo taxonomy only classifies asteroids into groups according to their spectral properties, the apparent correlation between the taxonomic classes and asteroids’ mineralogies enables the use of the classifications to estimate asteroid compositions, even though these correlations are not 100% definitive.

We seek to relate the known mineralogies of meteorites to the classifications of the Bus-DeMeo taxonomy by applying the latter to ~1,500 meteorite reflectance spectra from the NASA RELAB (Reflectance Experiment Laboratory) spectral database \(^2\). We hope to find correlations between different meteorite groups and asteroid classes to understand how well each asteroid class is able to group meteorites with similar mineralogies based on their reflectance spectra.

**Data:** Meteorite reflectance spectra (including spectra from lunar and Martian meteorites) from the RELAB spectral database were downloaded. Our goal was to use meteorite reflectance spectra from samples that could potentially represent the surface of an asteroid. Spectra that were labeled as terrestrially weathered or rusted were not used. Reflectance spectra were included for both powders and chips/slabs because so little is known concerning the range of surface properties of asteroids. Our dataset is dominated by HEDs (howardites, eucrites, diogenites), ordinary chondrites (H, L, LL), and CM chondrites but includes a wide range of meteorite types.

**Analysis:** Each meteorite spectrum was classified according to the Bus-DeMeo taxonomic system. The meteorite reflectance spectra were primarily classified using a UNIX-based version of the Bus-DeMeo web-based classifier, which can classify multiple spectra at once. Spectra that were not uniquely classified are given a set of possible classifications. For those cases, it was necessary to run them individually through the web-based program, followed by visual classification. The visual classification of spectra opened up some uncertainty in the process because different people may visually classify any given spectrum differently even with given guidelines.

**Results:** We calculated the percentages of matches for each Bus-DeMeo class for members of a particular meteorite group. We discuss here many of these asteroid classes and the meteorites that have spectra that are given that classification.

**V-types:** V-type asteroids are typically linked with HED meteorites due to their distinctive low-Ca pyroxene absorption features. Approximately 90% of V-type matches are with HEDs (Figure 1), which consistent with the prevailing opinion about the composition of V-types.

![Figure 1](image.png)

**Figure 1.** Pie chart showing the percentage of each meteorite type classified as V-types. We use three letter abbreviations for the meteorite types except for Martian meteorites.

**D-types:** D-type asteroids are typically linked with organic-rich carbonaceous chondritic material due to their red spectral slopes and high abundances among Jupiter Trojans, which are located at ~5.2 au. Approximately 50% of D-type matches are with CM chondrites (Figure 2). The high percentage of matches with CM chondrites is most likely due to the large number of CM chondrites and the rarity of more fragile carbonaceous chondritic material in our dataset.
**Figure 2.** Pie chart showing the percentage of each meteorite type classified as D-types. We use three letter abbreviations for the meteorite types except for iron meteorites.

**Sq-types:** Sq-types are typically linked with ordinary chondrites due to these bodies having spectral characteristics intermediate between S- and Q-types. S-types typically have reflectance spectra consistent with space-weathered ordinary chondrites while Q-types typically have reflectance spectra similar to unweathered ordinary chondrites. Approximately 90% of Sq-type matches are with ordinary chondrites (Figure 3), which is also consistent with the prevailing notion about Sq-types.

**Figure 3.** Pie chart showing the percentage of each meteorite type classified as Sq-types. We use three letter abbreviations for the meteorite types except for Martian meteorites.

**B-types:** B-types are typically linked with Type 1 or 2 carbonaceous chondritic material due to their relatively featureless spectra and blue spectral slopes. A huge range of meteorites have spectra that are classified as B-types (Figure 4). Interestingly, a relatively large percentage of matches are with lunar meteorites, though these tend to be spectra of chips or slabs. We do not believe a large percentage of B-types are lunar material; however, extremely space-weathered mafic material could be represented among B-types. A relatively large percentage (15%) of matches are also with aubrites. Aubrite surface compositions, which tend to have high visual albedos (~0.4-0.5) [3], can potentially be ruled out if the visual albedo of the asteroid is low.

**Figure 4.** Pie chart showing the percentage of each meteorite type classified as B-types. We use three letter abbreviations for the meteorite types except for Martian meteorites.

**Conclusions:** Our study puts constraints on how well the Bus-DeMeo taxonomy groups objects with similar mineralogies. As expected, the Bus-DeMeo taxonomy is better at mineralogically classifying a body when the spectrum has “strong” absorption bands but does much worse with a spectrum that has “weak” to “absent” absorption features.

**Acknowledgments:** THB would like to thank the Remote, In Situ, and Synchrotron Studies for Science and Exploration 2 (RISE2) Solar System Exploration Research Virtual Institute (SSERVI) (NASA grant 80NSSC19M0215) for support. This research utilizes meteorite reflectance spectra acquired at the NASA RELAB facility at Brown University.