ANALYSIS OF METEORITE SPECTRA IN THE MID-INFRARED. S. N. Dameron[1] and T. H. Burbine[2], [1]Department of Astronomy, University of Massachusetts, Amherst, MA, 01002, USA (sndameron@yahoo.com), [2]Department of Astronomy, Mount Holyoke College, South Hadley, MA 01075, USA.

Introduction: Minerals have a variety of absorption features in the visible, near-infrared, and mid-infrared wavelength regions [1,2]. Except for a few spectral studies in the mid-infrared such as the one done by Lim et al. [3], most asteroids have been only observed in the visible and near-infrared spectral regions due to the difficulty in obtaining reflectance spectra at longer wavelengths. The use of the Spitzer Space Telescope now makes it possible to collect and study asteroid spectra with very sensitive instruments over a broader wavelength range than can normally be observed on Earth [4]. To try to determine how well meteorites can be differentiated in the mid-infrared wavelength region, we are analyzing the spectral properties of meteorites from 0.3 to 25 µm.

Samples: The meteorites in this study were mainly from the Smithsonian Institution's Analyzed Meteorite Powder Collection (USNM 7073). The meteorites were originally ground into a powder so that they could be analyzed by wet chemistry for elemental concentrations [5]. Most of the meteorites are ordinary chondrites [6].

The samples were measured at Brown University's Keck/NASA Reflectance Experiment Laboratory (RELAB). The resulting reflectance data is a combination of spectra taken with a bidirectional reflectance spectrometer for visible to near-infrared wavelengths and a Nicolet 870 Nexus FTIR spectrometer for near- to mid-infrared wavelengths. All spectra are publicly available on the RELAB website.

Computational Technique: A computer program developed by Jonathan Leachman, an Associate Software Specialist in the Computer Science Computing Facility at the University of Massachusetts at Amherst, was used to determine the band minima in each meteorite spectrum. It was designed to search for ascending and descending number sequences and to determine the minimum band in each. The program accepts a number of parameters that narrow the minima result set, one of which is a "depth" parameter that defines the minimum magnitude of descension of a band.

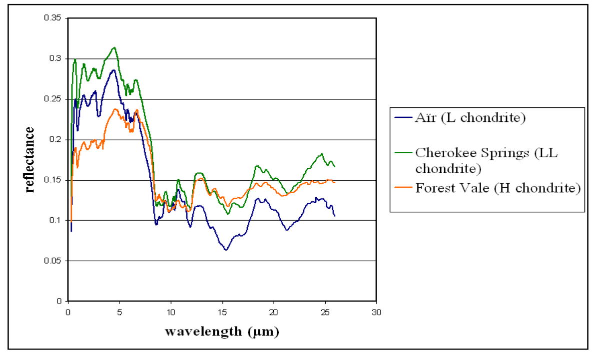

Figure 1. H, L, and LL chondrite spectral features. The band minima for H, L and LL chondrites occur at slightly different wavelengths.

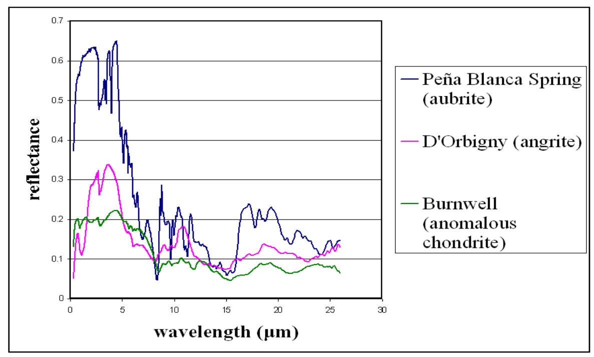

Figure 2. An aubrite, an angrite, and Burnwell (an anomalous chondrite). The aubrites have many more band minima than other meteorite classes in the 0.3 to 25 µm range.

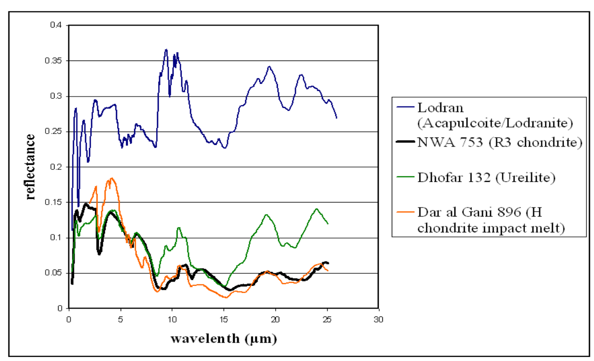

Figure 3. An R chondrite, a ureilite, an acapulcoite/lodranite, and an H chondrite impact melt. The R chondrite and the Ureilite have less spectral features than the other meteorites.

Results: The meteorites are grouped according to their class. Table 1 gives a listing of the average number of band minima found in each class. The aubrites have the largest number of band minima. There was only one R chondrite and it had the least number of band minima.

Meteorite Class	Number of Band Minima
Aubrite	40
L chondrite	31
H chondrite	27
LL chondrite	27
Acapulcoite/Lodranite	26
Angrite	23
Burnwell	19
H Chondrite Impact Melt	15
Ureilite	11
R Chondrite	8

Table 1. Meteorite classes and the average number of band minima found from 0.3 to 25 μm.

The H, L, and LL chondrites have similar absorption features, but their features are slightly shifted in wavelength from each other as seen in Figure 1. It is also interesting to note that the H chondrite impact melt (Dar al Gani 896) has significantly less band minima than the H chondrites.

Currently, we are working on identifying what is causing these spectral features. Spectral features appearing between 8.5-12 μm is attributed to Si-O stretching. The 16.5-25 μm region is due to deformation or bending modes. Bands in the 12 to 18 μm region are due to Si-O-Si, Si-O-Al and (Si, Al)-O-(Si, Al) symmetric stretching motions. Spectral features appearing near 2.9 μm and 6.1 μm are due to H-O-H bending vibrations [2].

References: [1] Burns R. G. (1993) *Remote Geochemical Analysis: Elemental and Mineralogical Composition*, 3-29. [2] Salisbury J. W. (1993) *Remote Geochemical Analysis: Elemental and Mineralogical Composition*, 79-98. [3] Lim L. F. et al. (2005) *Icarus, 175,* 385-408. [4] Emery J. P. et al. (2005) *LPS XXXVI,* Abstract #2072. [5] Jarosewich E. (1990) *Meteoritics, 25*, 323-337. [6] Burbine T. H. et al. (2003) *Antarctic Meteorite Research, 16,* 185-195.

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