BIDIRECTIONAL REFLECTANCE CHARACTERISTICS OF BLACK CHONDRITE METEORITES. D.T. Britt and C.M. Pieters, Box 1846, Brown University, Providence, RI 02912.

Introduction: Black chondrite meteorites are sub-group of ordinary chondrites characterized by high shock, low gas-retention ages, and strong optical alteration [1,2]. Previous work has shown that the optical properties of these meteorites include a low albedo, very subdued absorption features, and a flattened spectrum [1]. Black chondrite meteorites are indistinguishable from the range of normal ordinary chondrites in metal content and silicate composition, but spectrally they are more similar to other low-albedo meteorites such as ureilites and carbonaceous chondrites [1]. Spectra analyzed by Gaffey [1] of three normal ordinary chondrites and four black chondrites are shown in **Figure 1**. Normal ordinary chondrites are characterized by albedos in the range of 0.15 to 0.30, modest charge-transfer absorptions in the visible, and two Fe^{2+} crystal-field absorptions at approximately 0.95 and 1.9 microns indicating sub-equal amounts of low-calcium pyroxene with olivine. Black chondrites show albedos of <0.15 and absorption features that have been attenuated to varying degrees. The optical alteration apparent in black chondrites is thought to be a result of the distribution of shock-produced sub-micron grains of Fe-Ni metal and troilite [1,3]. The distribution of this opaque fraction has been suggested to cause variations in the spectral characteristics of black chondrites [3]. Because of their low albedo and subdued to nonexistent absorption features, black chondrites have been suggested as possible compositional analogs for some low-albedo C-type asteroids if these characteristics are commonly produced during regolith processes on meteorite parent bodies [4]. The spectral characteristics of ten additional black chondrites are reported here along with an examination of their spectral variation and the spectral effects of terrestrial weathering on these meteorites. All samples were crushed to bulk powders with a particle size of <250 micons. For all samples bidirectional reflectance spectra were obtained using RELAB at a geometry of i=30 degrees, e=0 degrees.

Discussion: Shown in **Figure 2** are the bidirectional reflectance spectra of six black chondrite meteorites collected as falls. The characteristics of low albedo, relatively flat spectra, and subdued absorption features are evident in all samples, but there are variations in the degree of attenuation in absorption features and in the slope of the UV drop-off. In the darkest and most flat spectra, such as Gorlovka, Tadjera, Pervomaisky, and Orvinio, the 0.95 micron absorption band is barely noticeable and the 1.9 micron band often disappears. In these spectra identification of the silicate assemblages and calculation of the olivine/pyroxene ratio thus becomes very difficult to impossible. In the brighter spectra, such as Farmington and Castalia, the 0.95 micron absorption feature is evident but the 1.9 micron feature continues to be very weak making mineral identification difficult. All samples exhibit variations in the slope and wavelength of the UV drop-off, ranging from a very rapid drop for Farmington and Gorlovka to a much more gradual slope for Castalia. Some black chondrites, such as the samples Castalia and Pervomaisky, contain areas of strongly differing albedo, called here light and dark areas. Shown in **Figure 3** are the spectra of the light/dark areas of these two meteorites. The light areas exhibit spectral characteristics typical of normal ordinary chondrites, while the dark areas show the low albedo, subdued absorption features, and flattened spectra typical of black chondrites. The spectral effects of terrestrial weathering on black chondrites are illustrated in the spectra of four black chondrites collected as finds shown in **Figure 4**. On the basis of the Salisbury and Hunt [5] spectral test for weathering and microscopic examination of the samples McKinney is the least weathered and Tailban is the most affected by weathering. The general effect of terrestrial weathering on black chondrites is to increase albedo, strengthen the absorption features, and change the slope of the UV drop-off. In hand sample a weathered black chondrite appears a "rusty brown" color. In the infrared a weathered sample exhibits strong absorptions near three microns due to water. In general, pristine black chondrite meteorites are characterized optically by low albedo, flattened spectra, and subdued absorption features. The degree of attenuation in the absorption features can vary, as can the slope and wavelength of the UV drop-off. Since black chondrites obtained their distinctive characteristics prior to their arrival at Earth, identification of the causes(s) of these observed properties will clearly be very important in developing an understanding of any optical effects regolith processes may have on their asteroidal parent bodies.

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References: [1] Gaffey M.J. (1976) *JGR 81*, 905-920. [2] Heymann D. (1967) *Icarus 6*, 189-221. [3] Britt D.T., et al. (1989) *Proc. 19th Lunar Planet. Sci. Conf.*, (in press). [4] Britt D.T., et al. (1989) *LPC XX*, these volumes. [5] Salisbury J.W. and Hunt G.R. (1974) *JGR 79*, 4439-4441.

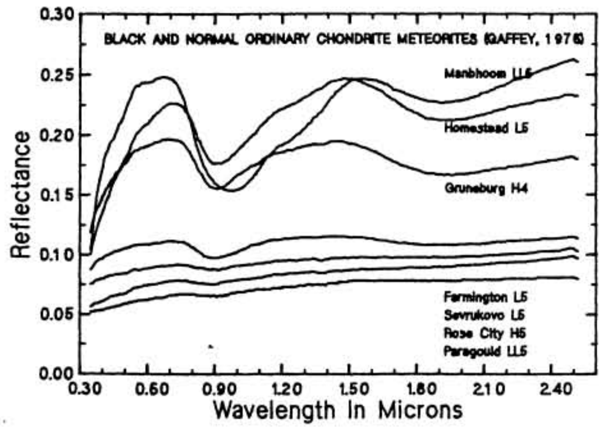

Figure 1: Directional-hemispherical reflectance spectra of four black and three normal ordinary chondrite meteorites from Gaffey (1976).

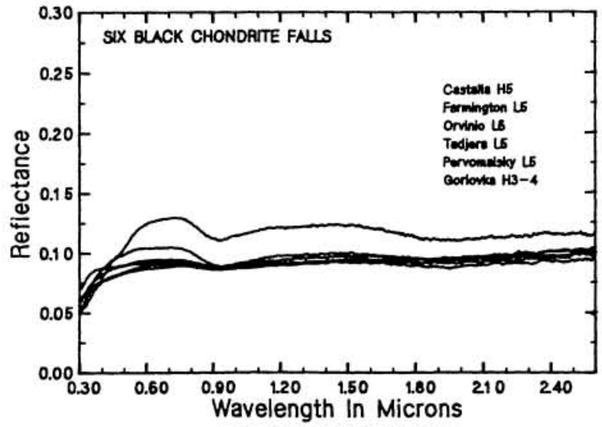

Figure 2: Bidirectional reflectance spectra of six black chondrite meteorites collected as falls.

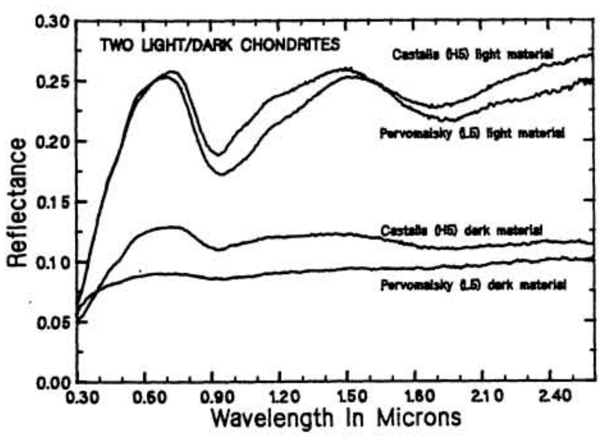

Figure 3: Bidirectional reflectance spectra of the light and dark portions of two black chondrite meteorites. Both meteorites were collected as falls.

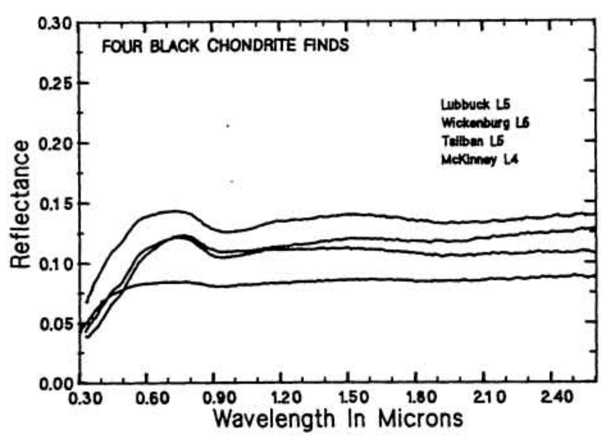

Figure 4: Bidirectional reflectance spectra of four black chondrite meteorites collected as finds.