SIMULATION OF POSSIBLE REGOLITH OPTICAL ALTERATION EFFECTS ON CARBONACEOUS CHONDRITE METEORITES; Beth E. Clark, Fraser P. Fanale and Mark S. Robinson, Planetary Geosciences, University of Hawaii at Manoa, 2525 Correa Road, Honolulu, Hawaii, 96822

Introduction: As the spectral reflectance search continues for links between meteorites and their parent-body asteroids the effects of optical surface alteration processes need to be considered. We present the results of an experimental simulation of the melting and recrystallization that occurs to a carbonaceous chondrite meteorite regolith powder upon heating. As done for the ordinary chondrite meteorites [1] we show the effects of possible parent-body regolith alteration processes on reflectance spectra of carbonaceous chondrites (CC's). For this study six CC's of different mineralogical classes were obtained from the Antarctic Meteorite Collection: two CM meteorites, two CO meteorites, one CK, and one CV. Each sample was ground with a ceramic mortar and pestle to powders with maximum grain sizes of 180 and 90 microns. The reflectance spectra of these powders were measured at RELAB (Brown University) from 0.3 to 2.5 microns. Following comminution, the 90 micron grain size was melted in a nitrogen controlled-atmosphere fusion furnace at an approximate temperature of 1700° Celsius. The fused sample was immediately held above a flow of nitrogen at 0° Celsius for quenching. Following melting and recrystallization, the samples were reground to powders and the reflectance spectra were remeasured. **Figure 1** shows the effects on spectral reflectance for a sample of the CM carbonaceous chondrite called Murchison.

Results: The above procedure was followed in order to simulate the possible alteration of meteorite parent-body optical surfaces by heating due to impact or fusion crust development. As can be seen in **Figure 1**, the spectral effects of simulated regolith alteration by melting and comminution are significant. Following alteration the fused sample shows an increase in reflectance of about 40% as well as an apparent band center wavelength shift of about 0.2 microns, from 0.8 to 1.0 microns. This would indicate a correspondingly significant change to the mineralogy of the altered sample. Shown in **Figure 2** are photomicrographs of polished grain mounts of Murchison, before **(a)** and after alteration **(b)**. The altered sample shows typical quench textures and a clear increase in crystal size. In addition, it appears that metallic components in the altered sample have either agglomerated to form larger grains or have been enhanced in total number, possibly by carbon reduction of iron from the mafic silicates. Using an electron microprobe, we are in the process of determining the compositions of both the altered and unaltered sample. With known compositions we will be able to determine the cause of the wavelength shift of the 1-micron band as well as the cause of the apparent metal-enhancement.

Discussion: Until recently, regolith breccias have not been commonly identified among the carbonaceous chondrite meteorites [2, 3]. It is therefore not clear as to what effects weathering in the space environment may have upon carbonaceous chondrite parent body asteroids. The reflectance spectra of faint asteroids such as the P, D, T, C, G, B and F-Types are dark and relatively featureless making it difficult to establish definitive links with known meteorite types. The task is further complicated by surface processes which may be altering reflectance spectra. Some dark asteroids have been shown to spectrally resemble shock-blackened ordinary chondrites [4]. Others have been shown to resemble CM and CV carbonaceous chondrites [5, 6]. The details of the spectra vary significantly [7, 8, 9, 10]. Thus several questions remain unresolved, e.g: How well-sampled is the dark asteroid population? And how representative are the carbonaceous chondrite meteorites of the main belt asteroids? As work progresses we will show the extent to which the possible regolith processes of melting and quenching of CO, CM, CV, and CK carbonaceous chondrites can affect their optical properties and influence the search for their parent body asteroids.

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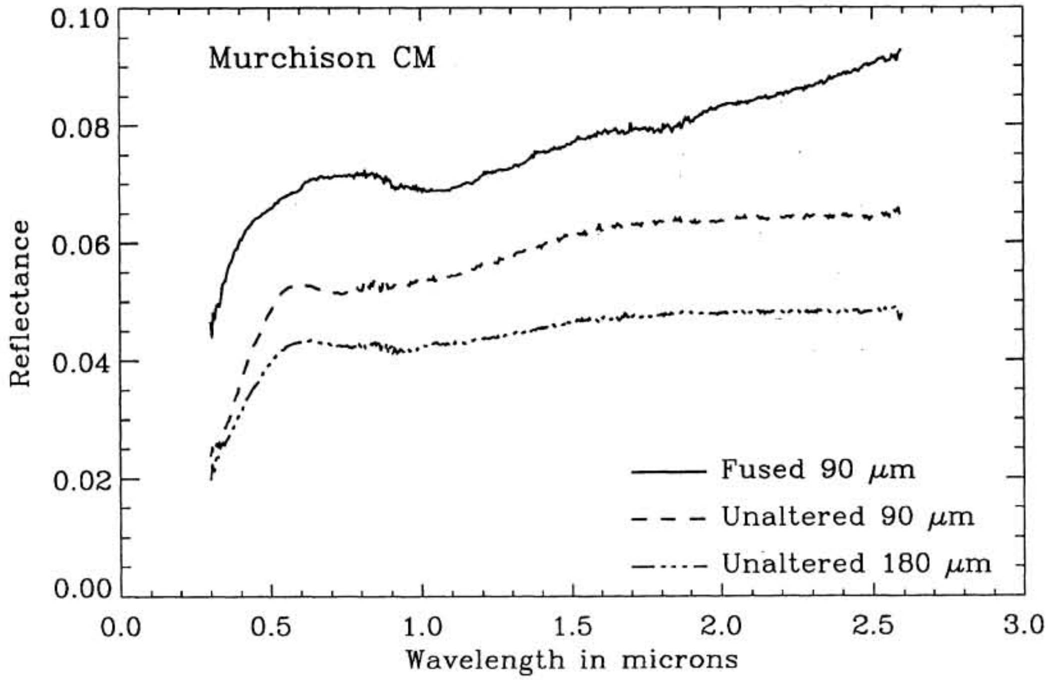

Figure 1 Simulated regolith alteration by melting, quenching and comminution shows significant optical alteration. In this plot the unaltered meteorite powders are compared with the fused portion of the CM carbonaceous chondrite Murchison. Note the apparent wavelength shift of the mafic mineral absorption feature, as well as the dramatic overall increase in reflectance after alteration.

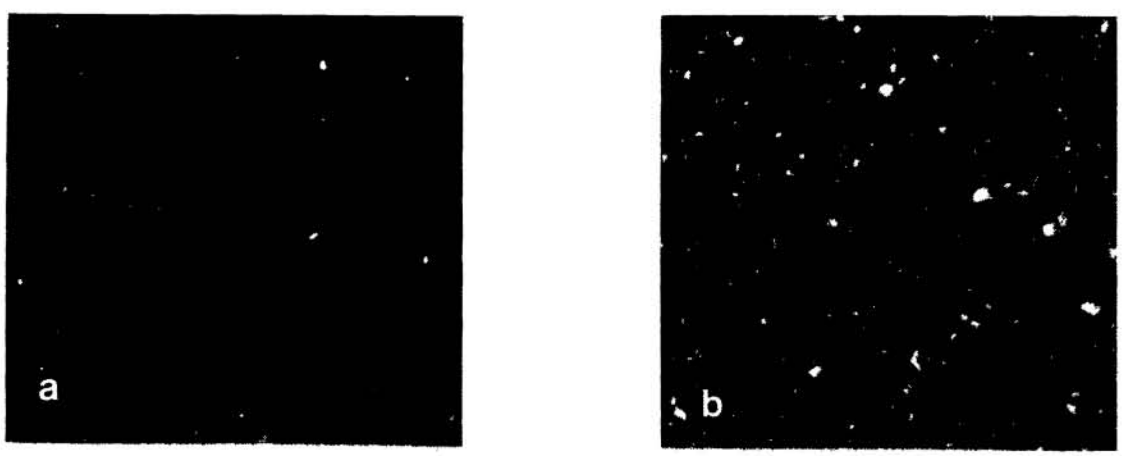

Figure 2 Reflected light photomicrographs of polished grain mount thin sections of the CM carbonaceous chondrite Murchison before (a) and after alteration (b). Note the apparent enhancement of the metallic component seen after alteration by melting and quenching in a nitrogen atmosphere.