HEATING EXPERIMENTS (300-700 °C) OF THE MURCHISON (CM2) METEORITE: INFRARED SPECTROSCOPY; M. Miyamoto, Department of Pure and Applied Sciences, University of Tokyo, Komaba, Tokyo 153, Japan.

Heating experiments of the Murchison (CM2) carbonaceous chondrites were performed to get additional information on thermal metamorphism of carbonaceous chondrites, because there found some thermally metamorphosed carbonaceous chondrites with CI-CM affinities among the Antarctic collection(e.g., 1). Murchison chips(about 2g) were ground in a corundum mortar and sieved by a 37 μm tetoron sieve. Each sample(about 20 mg) was heated in H_2 environment(1 atm) for 6 hours at 300-700°C. Diffuse reflectance spectra(2.53-25 μm) of the samples were measured and the results were compared with those of thermally metamorphosed carbonaceous chondrites(2). Details of diffuse reflectance measurements are described in Miyamoto(3).

Spectral changes in the 3 μm band: Fig. 1 shows spectral features around 3 μm of heated samples of Murchison, an unheated sample of Murchison, and an unheated sample of Allende(CV3). The absorption bands near 3 μm (hydration bands) are caused by hydrates and/or hydroxyl ions. As heating temperature increases, the intensity of absorption bands near 3 μm decreases and the 3 μm band disappears in the spectra of the samples of Murchison heated above 500°C. Because the intensity of absorption bands near 3 μm is related to the amount of hydrous minerals contained in the sample, most hydrous minerals in Murchison are dehydrated at 500°C. Although reflectance minimum near 3 μm of the unheated sample of Murchison is about 3560 cm^{-1}(2.81 μm), those of the 300 and 400°C samples are about 3660 cm^{-1}(2.73 μm), which is similar to the reflectance minimum of serpentine (e.g., 4). This result suggests that some hydrous minerals which have longer wavelength position of reflectance minima were dehydrated at 300°C, consistent with the decomposition of tochilinite before coexisting serpentine(5,6,7)

Spectral changes in the 7 μm band: Fig. 2 shows the results of diffuse reflectance spectra near 7 μm. The unheated sample of Murchison shows the 6.9 μm(1450cm^{-1}) band, probably due to primary calcite(8). The intensity of the 6.9 μm band in the spectrum of the 300°C sample is similar to that of the unheated sample of Murchison, whereas the intensity of the 400°C sample is weaker than that of the unheated sample. The 6.9 μm band disappears in the spectrum of the 500°C sample. Therefore, most carbonates in Murchison are decomposed by heating at 500°C.

Metamorphic temperature: The results of heating experiments show that both the 3 μm and 6.9 μm bands disappear in the spectra of the samples heated above 500°C, suggesting that metamorphic temperature is $\geq$500°C for thermally metamorphosed Antarctic carbonaceous chondrites(Yamato(Y-)86720, Y-793321, and Belgica(B-)7904), because they show weaker absorption bands near 3 μm and 6.9 μm compared with Murchison(2). Because heating experiments are for a time short compared with geologic time(9), metamorphic temperature may be lower. Further experiments are needed to explain the presence of the 6.9 μm band in the spectrum of Y-82162(2).

Akai(10,11) proposed metamorphic temperatures of some Antarctic carbonaceous chondrites on the basis of mineralogical observations of the Murchison samples heated in air for an hour at various temperatures; 500-600°C for Y-793321, about 800°C for Y-82162 and Y-86720, >800°C for B-7904. Tomeoka et al.(5) also discussed metamorphic temperatures and proposed that the thermal metamorphism probably occurred at >500 °C in a

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reduced condition. Our results are consistent with previous studies.

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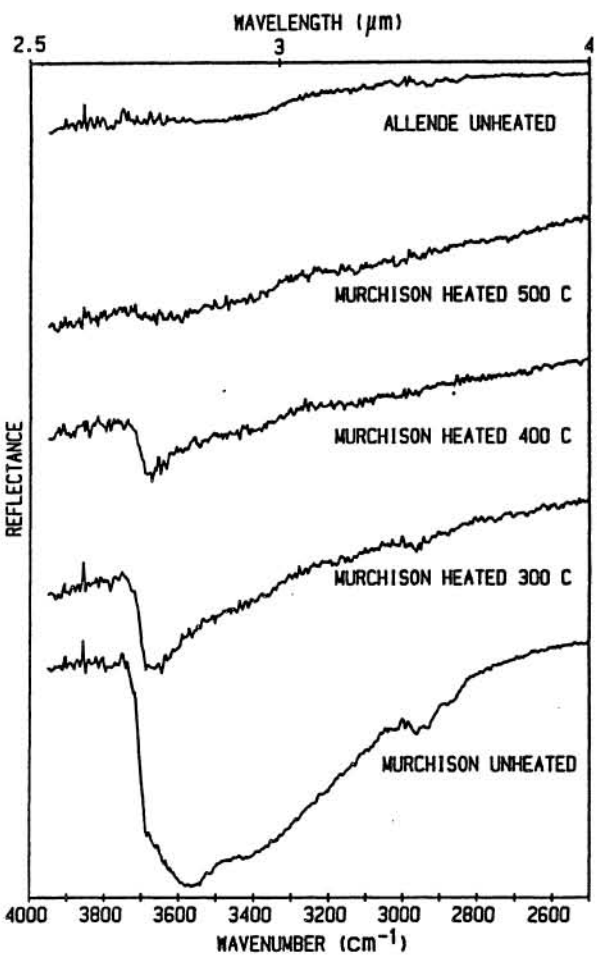

Fig.1. Infrared diffuse reflectance spectra near 3 μm of heated samples (300, 400, and 500°C) of Murchison (CM2), unheated sample of Murchison, and unheated sample of Allende(CV3).

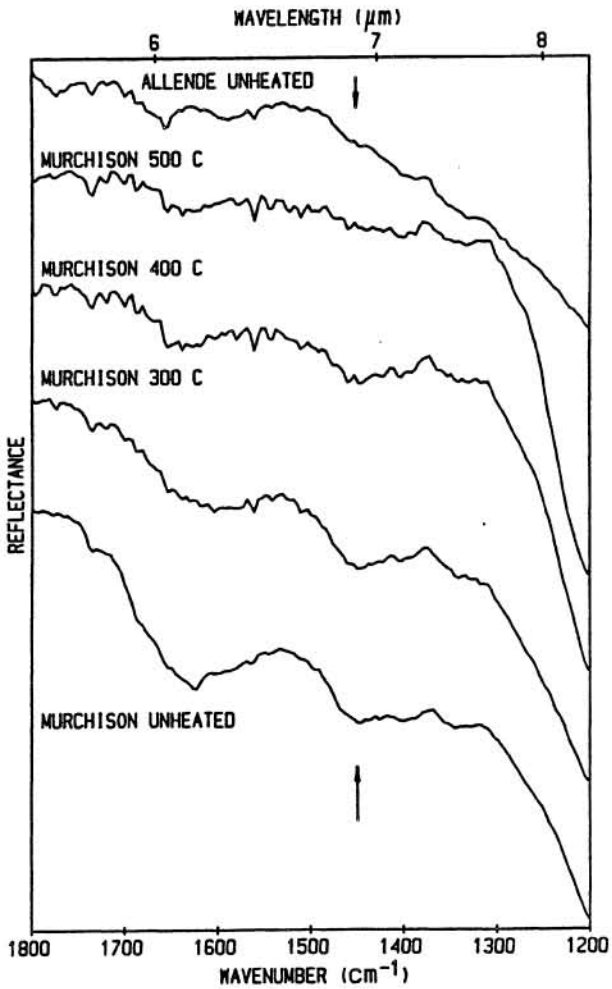

Fig.2. Infrared diffuse reflectance spectra near 7μm. Arrows show the 6.9 μm(1450 cm^{-1}) band.