ABSORPTION BANDS NEAR 3 μm IN DIFFUSE REFLECTANCE SPECTRA OF CARBONACEOUS CHONDRITES: COMPARISON WITH CERES AND PALLAS; K. Sato and M. Miyamoto, Mineralogical Institute, Graduate School of Science, University of Tokyo, Hongo, Tokyo 113, JAPAN

Absorption features of 3 μm hydration bands of carbonaceous (C) chondrites were compared with those of C-type asteroids, Ceres and Pallas, to study the amount of hydrous minerals on their surfaces. The intensity of the 3 μm band of Pallas is similar to those of thermally metamorphosed C chondrites. This suggests the possibility that Pallas underwent thermal metamorphism. The intensity of the 3 μm band of Ceres is not similar to those of C chondrites measured.

We measured infrared diffuse reflectance spectra of several carbonaceous (C) chondrites for abundance determination of planetary surface materials. The absorption bands near 3 μm are due to the presence of hydrates and/or hydroxyl ions (OH stretching vibration), and the intensity of the 3 μm bands is related to the amount of hydrous minerals in a sample [e.g., 1]. Therefore, absorption features near 3 μm are important to detect the amount or species of hydrous minerals on planetary surfaces which must be related to the thermal history. Spectra of asteroids Ceres and Pallas show broad absorption bands near 3 μm, suggesting the presence of hydrous minerals in their surface materials [2,3]. Although the spectra of Ceres and Pallas resemble those of CI or CM chondrites, the intensity of the 3 μm bands are weaker than those of CI and CM chondrites. The spectral characteristics of these C-type asteroids should be compared with those of thermally metamorphosed C chondrites and C3-5 chondrites. In this paper, we measured several C chondrites in addition to those by [4].

Samples of C chondrites weighing approximately 50 mg were ground in a corundum mortar and passed through a 100 μm sieve to obtain powder sample for spectra measurements. Each powder sample was dried in a desiccator for at least 48 hours to remove any adsorbed water from the grain surface. Diffuse reflectance spectra were measured in dry-air surroundings by the use of a Fourier transform infrared spectrometer. Details of reflectance measurements are described in [5].

The reflectance spectrum of Ceres has a strong 3 μm absorption feature. Pallas has a 3 μm absorption feature weaker than that in the spectrum of Ceres [6,7,8]. Owing to strong atmospheric absorptions which prevent spectral measurements, telescopic reflectance spectra of asteroids between 2.6 and 2.8 μm are not available. Because we could not calculate the integrated intensity of the 3 μm band of asteroidal reflectance spectra, we utilized the reflectance ratios instead of the integrated intensity to study the intensity and slope of the 3 μm band. The reflectance ratio 2.9/2.53 was calculated by dividing the reflectance at 2.9 μm by that at 2.53 μm. Fig. 1 compares the reflectance ratios, 2.9/2.53 μm vs. 3.2/2.53 μm of C chondrites with those of C-type asteroids. We chose the reflectance at 2.53, 2.9 and 3.2 μm in order to avoid the gap in the spectral data of asteroids and the absorption bands near 3.4 μm due to organic compounds in meteorites. For C chondrites, the results of the reflectance ratios are consistent with those of the integrated intensity of 3 μm band [9] and correlate with the amount of hydrous minerals. The increased intensity of the 3 μm absorption bands is evident in the decreased reflectance ratios.

Although CI and CM chondrites have distinct 3 μm hydration bands at various strengths, thermally metamorphosed C chondrites have 3 μm bands weaker than those of CI and CM chondrites. This results suggest that most hydrous minerals in the thermally metamorphosed C chondrites are dehydrated by thermal metamorphism [10]. CV chondrites have little or no hydrous minerals detectable from the 3 μm band.

For the thermally metamorphosed C chondrites (Fig.1), the reflectance ratios of the 3 μm

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band is close to those of Pallas. This result is consistent with that of spectral comparison between asteroids and meteorites in the visible-near IR wavelength region [2]. It is possible that Pallas was heated sufficiently to dehydrate water-bearing minerals formed at lower temperatures. The size of Pallas also indicates that it could be heated enough to cause thermal alteration [11].

Although the 2.9/2.53 μm ratio of Ceres is similar to those of CR and the thermally metamorphosed C chondrites, the 3.2/2.53 μm ratio of Ceres is different. Since the removal of the asteroidal thermal emission spectra may have an affect on the reflectance at 3.2 μm of asteroids [6], further investigations are needed.

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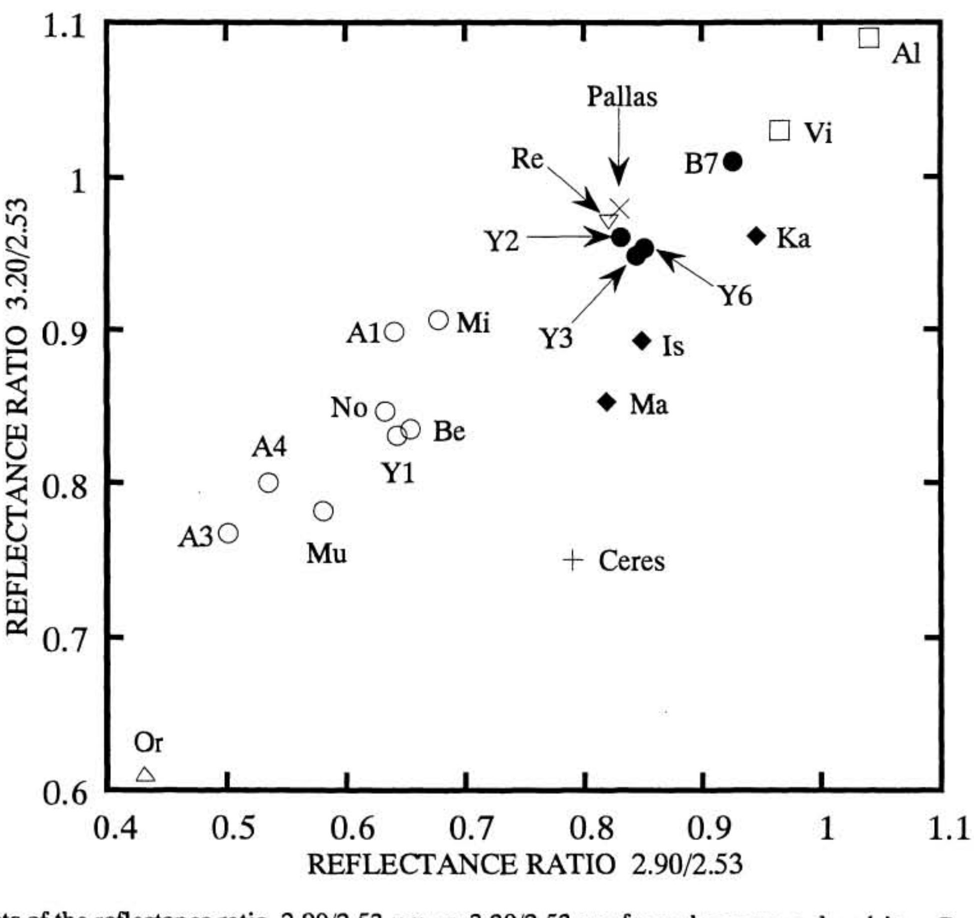

Fig.1. Plots of the reflectance ratio, 2.90/2.53 μm vs. 3.20/2.53 μm for carbonaceous chondrites, Ceres and Pallas. O:CM chondrites, A1: ALH81002; A3: ALH83100; A4: ALH84029; Be: Bells; Mi: Mighei; Mu: Murchison; No: Nogoya; Y1: Y791198. ●:Thermally metamorphosed carbonaceous chondrites, B7: Belgica7904(CM); Y2: Y82162(CI); Y6: Y86720(CM); Y3: Y793321(CM). □:CV chondrites, Al: Allende; Vi: Vigarano. ∇:CR chondrites, Re: Renazzo. Δ:CI chondrites, Or: Orgueil. ◆:Newly measured carbonaceous chondrites, Ka: Karoonda(C5); Ma: Maralinga(C4); Is: Isna(CO3). +: Ceres. ×: Pallas.