INFRARED DIFFUSE REFLECTANCES OF SOME HYDROUS MINERALS: ABSORPTION BANDS NEAR 3 μm; M. Miyamoto, College of Arts and Sciences, University of Tokyo, Komaba, Tokyo 153, Japan.

UV-Visible-near IR diffuse reflectances (0.25-2.5 μm) of minerals and meteorites have been used to interpret mineral assemblages of planetary surfaces (1). Spectral reflectances of some minerals, however, do not show strong absorption bands in this wavelength region (2), because major absorption bands correspond to the crystal field splitting energy of a particular transition metal. Infrared diffuse reflectances may give us additional information on identification of surface materials (3,4), because major absorption bands are caused by vibrations of ions. The absorption band near 3 μm may be useful for detecting the presence of hydrates (or hydroxyl) produced by aqueous activity on planetary surfaces, because absorption band near 3 μm is due to OH stretching vibration. Although transmission spectra are usually measured in the IR region, diffuse reflectance spectra may be apparently different from transmission spectra because diffuse reflectance properties depend on particle grain size, grain shape, grain packing, and illumination geometry (5). We measured infrared diffuse reflectances of some hydrous minerals to characterize absorption features.

Spectral reflectance measurements were made with a JASCO FT/IR-3 Fourier transform infrared spectrophotometer equipped with a diffuse reflectance attachment. Spectra were taken from 3950 to 400 cm^{-1} at a resolution of 4 cm^{-1}. The incident angle of illumination was 45^o and an aluminum-coated mirror was used as a standard. We passed dry air into the spectrophotometer. Details of measurements are described in (3). We took small fragments out of several parts of a cm-size chip of each mineral. The fragments were crushed and ground in an agate mortar, and sieved by a 100 μm sieve. The powder sample was dried at 110^oC for 16 hours to remove adsorbed water from the surfaces of grains.

Figs 1-3 show the results of infrared diffuse reflectances of some hydrous minerals. Absorption bands due to OH vibration can be seen near 3600 cm^{-1}. Spectra are normalized at the reflectance of 2500 cm^{-1}. Table 1 summarizes reflectance minima near 3 μm. Goethite, gypsum, analcime, and opal show relatively broad absorption band near 3 μm compared with the other minerals. Minerals which contain (crystal)water have a tendency to show absorption bands in longer wavelength region.

We have measured infrared diffuse reflectances of serpentine-olivine mixtures to study the relationship between the band strength near 3μm and amount of serpentine (6). The band strength is related to the amounts of serpentine. Only 1 wt% of serpentine in the serpentine-olivine mixture can be detected by the absorption feature of the 3 μm wavelength region. This result shows that the absorption band near 3 μm is sensitive to the presence of hydrous minerals.

In conclusion, we can detect the presence of small amounts of hydrous minerals by using the absorption feature near 3 μm. It may be difficult to distinguish mineral species by absorption minima near 3 μm.

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Miyamoto, M.

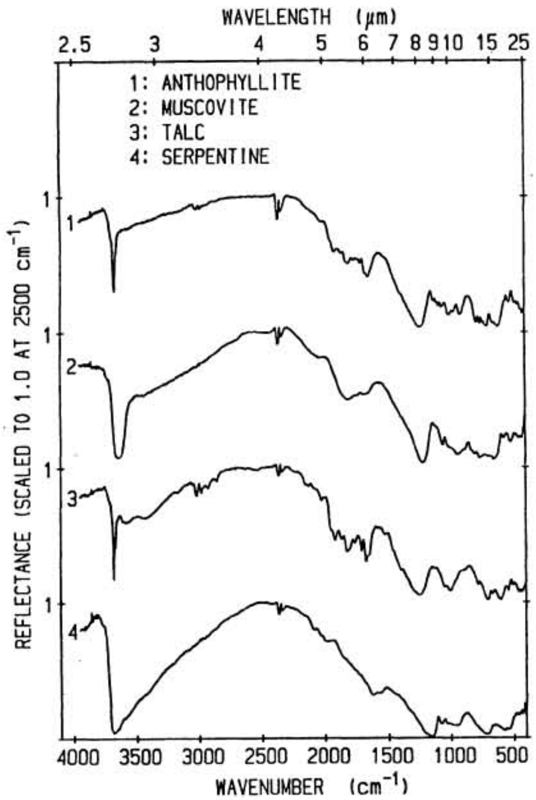

Fig. 1

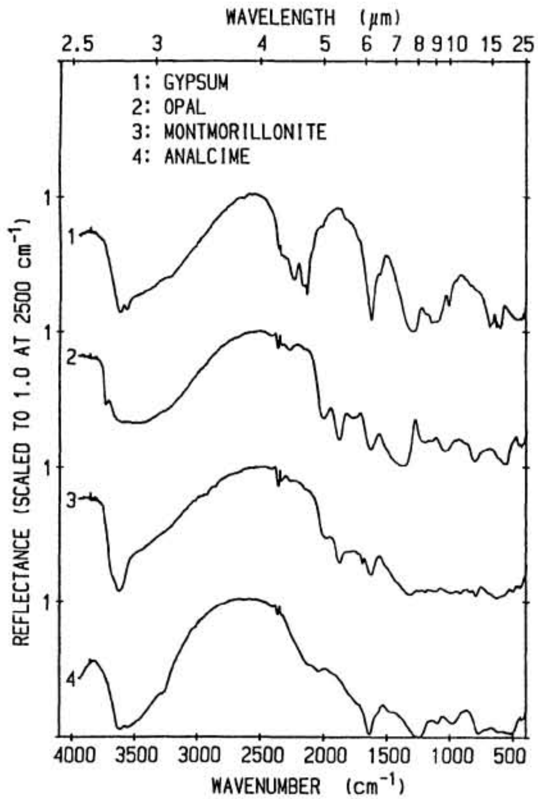

Fig. 2

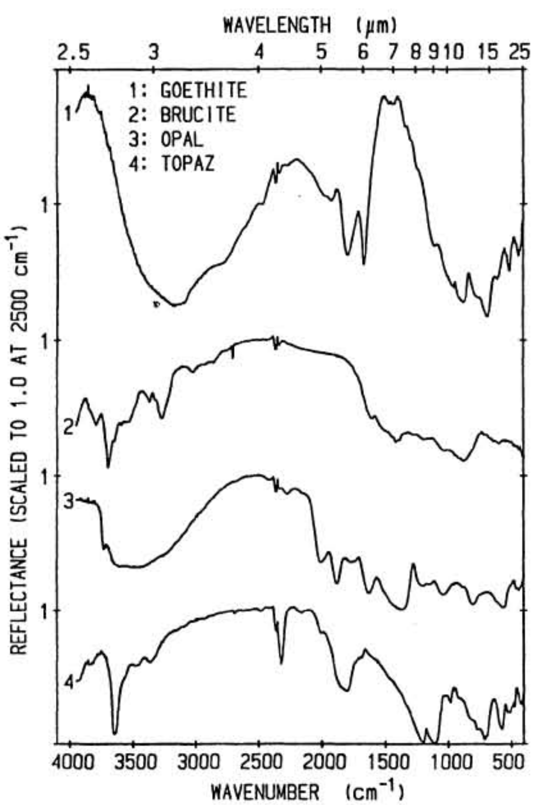

Fig. 3

Table 1. Reflectance minima near 3 μm

Goethite	3170 cm^{-1}
Brucite	3696
Topaz	3645
Epidote	3375
Anthophyllite	3668
Tremolite	3673
Hornblende	3656
Muscovite	3640
Biotite	3587 (3661,3556)
Pyrophyllite	3675
Talc	3677
Chlorite	3579 (3419)
Serpentine	3683
Gypsum	3617 (3563)
Opal	3460
Montmorillonite	3623
Analcime	3617 (3550)