INFRARED DIFFUSE REFLECTANCE SPECTRA OF SOME HYDROUS CARBONATES;
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We measured infrared diffuse reflectance spectra(2.53-25 μm) of some hydrous carbonates to study terrestrial weathering-produced carbonates in Antarctic meteorites and to give additional information on identification of carbonates in planetary surface materials(e.g., Mars). Terrestrial hydrous carbonates measured were hydromagnesites from four localities, artinites from three localities, and nesquehonites from two localities. Identification was made by the X-ray powder diffraction method. Details of diffuse reflectance measurements are described in Miyamoto(1).

Absorption bands near 7 μm: The spectra of Antarctic ordinary chondrites usually show faint absorption bands near 7.4 μm(1350cm^{-1}) probably due to the presence of hydrous Mg-carbonates which were formed by terrestrial weathering(2,3,4). Figs. 1 and 2 show infrared diffuse reflectance spectra of hydrous carbonates and anhydrous carbonate, calcite. The spectra of three artinites we measured show absorption bands near 7.4 μm similar to those of Antarctic ordinary chondrites(4), although carbonates usually show absorption bands around 7 μm. The spectra of the hydromagnesites and nesquehonites we measured do not show the 7.4 μm band.

In the absorption spectra measured by White(5), artinite shows an absorption band near 7.6 μm(1320cm^{-1}), but neither nesquehonite nor hydromagnesite shows the 7.4 μm band. Two absorption spectra among three hydromangesites measured by van der Marel and Beutelspacher(6) show shoulder absorption bands near 7.4 μm.

Artinite is one of the most likely candidates for the cause of the 7.4 μm band found in the spectra of Antarctic ordinary chondrites, because artinite shows relatively strong absorption bands near 7.4 μm among the hydrous carbonates reported. However, the presence of artinite is not reported in weathering-produced carbonates on Antarctic ordinary chondrites, although hydromagnesite and nesquehonite are detected(3). Because hydrous carbonates have complex phase relation and hydrous carbonates except for artinite may show the 7.4 μm band, we need further studies to determine the mineral phase which causes the 7.4 μm band.

Absorption bands near 4 μm: The spectra of anhydrous carbonates (calcite, aragonite, dolomite, ankerite, magnesite, breunnerite, siderite) usually show absorption bands near 3.5 and 4 μm(Fig. 1)(e.g., 7). However, hydrous carbonates show no spectral contrast in this wavelength region, different from anhydrous carbonates(Fig. 1).

The spectra of Mars obtained by the Mariner 6 and 7 spacecraft do not show absorption bands near 3.5 and 4 μm(8) and there has been no direct detection of carbonates on Mars in this wavelength region(9,10). Recently, Roush et al.(11) detected the CO_3^{2-} complex in Martian atmospheric dust in the spectra near 7 μm. The 6.7 μm(1490cm^{-1}) absorption band is suggestive of the CO_3^{2-} anionic complex in a crystal structure more complicated than calcite(11). Emission peak centered near 6.1 μm(1640cm^{-1}) in the spectra of Mars is attributed to hydrated surface materials(11). The 7.3 μm (1370cm^{-1}) absorption band is assigned to the presence of CO_2 gas in the Martian atmosphere(11). The presence of SO_4^{2-} or HSO_4^- is detected in the 3.8 μm region (12) and in the 9 μm region (11).

As was pointed out by Gooding (13), studies of Antarctic weathering of

meteorites might lend useful insight into analogous processes such as low-temperature aqueous alteration occurring on other planetary bodies.

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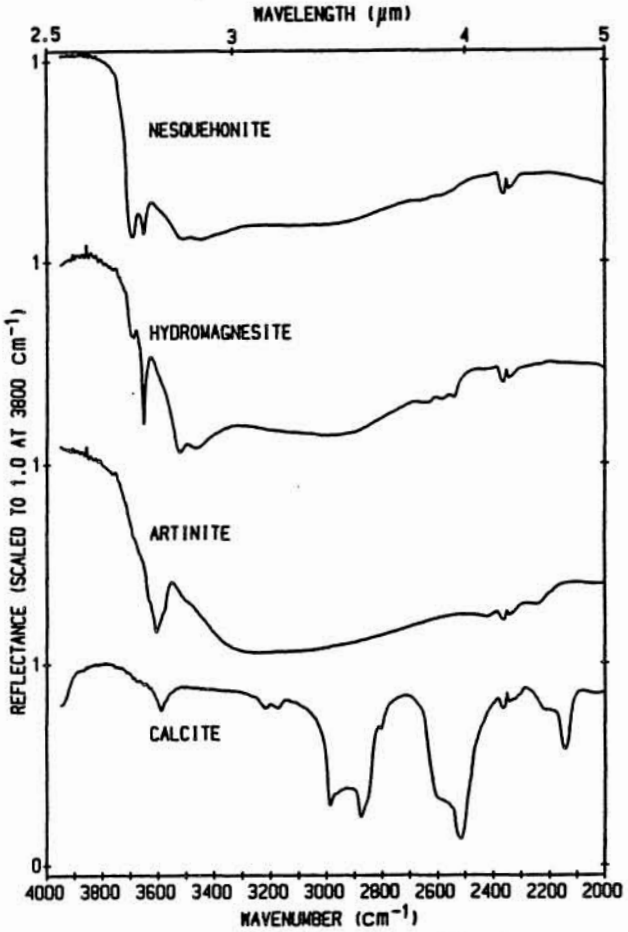

Fig.1. Infrared diffuse reflectance spectra from 3950 to 2000 cm^{-1} of some carbonates.

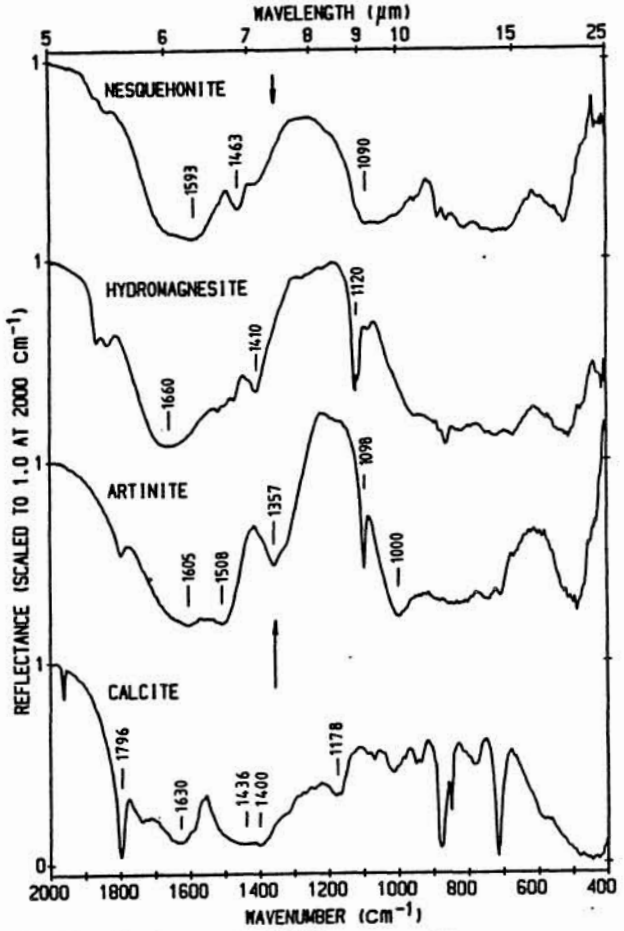

Fig.2. Infrared diffuse reflectance spectra from 2000 to 400 cm^{-1} of some carbonates. Arrows indicate the 7.4 μm(1350 cm^{-1}) band