

ABSORPTION SPECTRA AND BULK CHEMICAL COMPOSITIONS OF ACHONDRITIC POLYMICT BRECCIAS WITH REFERENCE TO CHARACTERIZATION OF THE SURFACE OF VESTA-LIKE ASTEROIDS. T. Aoyama¹, T. Hiroi¹, M. Miyamoto² and H. Takeda¹,
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Asteroid 4 Vesta shows reflectance spectra similar to those of the HED achondrites (howardites, eucrites, diogenites). Gaffey (1) observed that two areas of the Vesta surface give reflectances similar to diogenite and other areas are covered by eucritic lavas. This observation implies that the surface mineral assemblages may depend on the terrain units of the surface of Vesta and that the variation of the terrain unit may be explained by impacts into the layered crust model of the HED achondrite parent body proposed by Takeda (2). We examined the wavelength position of absorption bands around 900nm seen in the spectra of the HED achondrites to better understand the terrain units of Vesta on the basis of reflectance spectra.

We measured spectral transmittances of 15 thin sections of the HED achondrites to deduce the relationship between the wavelength position of absorption maxima around 900nm of pyroxene and the Mg/Fe ratio of the bulk chemical compositions analyzed by H. Haramura. Measurements were made at the wavelength of every 0.5nm in the Visible-Near infrared region (350-2550 nm), and detailed measurements were made every 0.0625nm in the region from 800nm to 1050nm by using a Beckman UV-5240 spectrophotometer which has a wavelength resolution of better than 0.3nm in the near infrared region. The wavelength position of the absorption maxima around 900nm was determined from the detailed spectra.

Although the HED achondrites contain more than 92 vol% of pyroxenes and feldspars (3), feldspars have only weak absorption bands around 1.2 μ m. Small amounts of olivines do not affect the wavelength position of the absorption bands by pyroxenes (4). Therefore, the HED achondrites could be characterized by the absorption bands of pyroxene around 900nm. The absorption of pyroxene is due to Fe²⁺, and the more FeO or CaO are contained in pyroxene, the longer the wavelength position of the absorption bands will be (5).

Representative spectra of different classes of the HED achondrites are compared in Fig. 1. Detailed spectra show that different classes of the HED achondrites give different wavelength positions of the absorption bands. Because almost all of MgO and FeO in the bulk composition of the HED achondrites are contained in pyroxenes, we plotted the wavelength positions of the absorption bands around 900nm versus the Mg/(Mg+Fe) ratio of the bulk compositions of the HED achondrites (Fig. 2). There is a positive correlation between the wavelength positions of the absorption bands and the Mg/(Mg+Fe) ratio.

Our results strongly suggested that the Mg/Fe ratio of the surface composition of Vesta can be estimated on the basis of the wavelength positions of the absorption bands around 900nm by using the positive correlation seen in Fig. 2. We can also estimate the class of the HED achondrites corresponding to the spectral reflectance of the terrain of the Vesta surface. The surface of asteroids are thought to be covered with materials similar to polymict breccia. According to the layered crust model (2), howardites are richer in MgO and contain deeper components than polymict eucrites. Detailed studies on the spectral characteristics of the Vesta surface will give us information on the distribution of terrain units in terms of the meteorite classes and surface brecciation processes of Vesta

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and to test the layered crust model.

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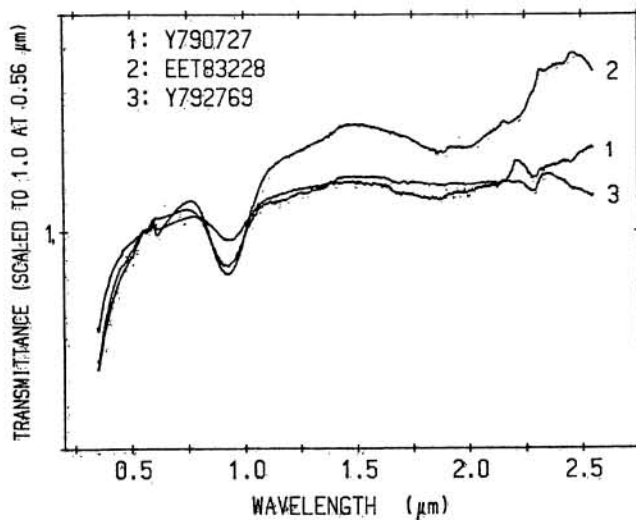


Fig. 1

Comparison of transmittance spectra (350-2550nm) of different types of the HED achondrites.

Y790727 : howardite
EET83228: polymict eucrite
Y792769 : polymict eucrite

Fig. 2

The wavelength position of the absorption band around 900nm vs. Mg/(Mg+Fe) ratio of the HED achondrites.

