PROGRESSIVE CHANGES IN MINERALOGY, REFLECTANCE SPECTRA AND WATER CONTENTS OF EXPERIMENTALLY HEATED MURCHISON AT 400, 600, AND 900℃.

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Reflectance spectra of C complex asteroids indicate that asteroidal surface material suffers heating and dehydration to various degrees [1]. In previous attempts to reproduce the effects of heating, Murchison CM2 samples were heated and analyzed for reflectance spectra [e. g., 1] and loss of volatiles [e. g., 2]. In this study, powders (<155μm in grain size) of Murchison was experimentally heated at three different temperatures (400, 600, and 900℃) under vacuum (10^{-7}～10^{-6} torr) at IW fO_2. The unheated and heated Murchison samples were examined by powder XRD for mineralogy, FT-IR spectrometer for reflectance spectra, and Karl Fischer titration method to quantify water contents released at 105, 200, 300, 400, 600, 800, and 950℃. In addition, powders (<155μm in size) of naturally heated and dehydrated carbonaceous chondrite samples Jbilet Winselwan [3] and Dho 735 [4, 5] were measured for reflectance spectra and water contents.

XRD analysis revealed that unheated Murchison consists mainly of serpentine, tochilinite, olivine, and low-Ca pyroxene. At 400℃, tochilinite is decomposed and, at 600℃, serpentine is decomposed to form secondary low-crystalline olivine. At 900℃, FeNi metal starts to form and the olivine becomes highly crystalline. Water contents of Murchison are decreasing with increasing temperature: total water contents are 10.0, 6.5, 1.2, and 0.6wt% for unheated, 400℃, 600℃, and 900℃ sample, respectively. Water contents of Jbilet Winselwan and Dho735 are 5.0 and 2.4wt%, respectively. Since temperatures of heating at asteroids are estimated to be 300-500 [3] and around 900℃ [5] for Jbilet Winselwan and Dho 735, respectively, water with low retentivity has already escaped from meteorites. However, for instance, in the case of Dho 735, 96% of water (2.3wt%) is released at <950℃ in Karl Fischer titration analysis, indicating that most of water in Dho 735 is absorbed and rehydrated water. The rehydrated water shows the highest release at 600℃ and thus is tightly bounded to the sample.

Reflectance spectrum of unheated Murchison shows that the depth of 3.0μm band becomes shallower with increasing temperature from unheated to 600℃. But it becomes deeper again at 900℃ because of the presence of absorbed and rehydrated water whose release pattern peaked at 400℃. When the effects of absorbed and rehydrated water are corrected, the depth of 3.0μm band well correlates with water contents. The results of this study are applicable to estimation of mineralogy and the water contents of C-type asteroids based on reflectance spectra.

References: [1] Hiroi T. et al. 1993. *Science,* 261, 1016-1018. [2] Garenne A. 2014. *Geochimica et Cosmochimica Acta,* 137, 93-112. [3] Nakamura T. et al. 2014. *Antarctic Meteorites,* XXXVII, 54. [4] Ivanova M. A. et al. 2010, *Meteoritics and Planetary Science,* 45, 1108-1123. [5] Nakato A. 2012. Doctoral dissertation, Tohoku University.