VISIBLE AND NEAR-INFRARED SPECTRAL SURVEY OF CARBONACEOUS CHONDRITES AND ITS APPLICATION TO HAYABUSA2.

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Introduction: We have expanded our visible and near-infrared (VNIR) spectral survey of meteorite chips of the National Institute of Polar Research (NIPR) [1, 2] to include carbonaceous chondrite (CC) in the US collections with possible applications to Hayabusa2 mission, which is currently on its course to its target asteroid Ryugu.

Experimental: In this study, 43 Antarctic CC chip samples have been newly loaned from the US collections. Bidiectional VNIR reflectance spectra of these US CC chip samples were obtained at 30-deg incidence and 0-deg emergence angles at every 5 nm over the range of 0.3-2.6 μm, and biconical FTIR reflectance spectra at 4 cm^{-1} resolution over the range of 1-100 μm. For this study, the field of view of the VNIR spectra was about 4 mm.

Results and Application to Hayabusa2 Mission: Plotted in Figs. 1 are previously compiled or measured spectra of relatively fresh CC powder and chip samples [3, 4] and select reflectance spectra of US CC chip samples measured in this study. Hayabusa2 spacecraft is equipped with two visible to infrared spectral sensors: ONC-T and NIRS3. As done in our previsou study [3] these spectral data were converted to four band data each of those instruments, and the following band strength (*BS*) and scaled reflectance (*SR*) parameters were calculated:

$$BS_{UV} = lnR_{390} - lnR_{550}\ ,\ \ BS_{700} = lnR_{700} - (160\ lnR_{550} + 150\ lnR_{860}) / 310 \text{ (for ONC-T)},$$

$$SR_{2750} = R_{2750} / R_{2650}\ ,\ \ SR_{2850} = R_{2850} / R_{2650}\ ,\ \ SR_{2950} = R_{2950} / R_{2650} \text{ (for NIRS3)},$$

where R_λ denotes reflectance at λ nm in wavelength.

Shown in Fig. 2 are plots of BS_{UV} and BS_{700} values, and principal components 1 and 2 of SR_{2750}, SR_{2850}, and SR_{2950}, similar to our previous study [3] for all the CC spectra in Fig. 1. These plots suggest that combined ONC-T and NIRS3 band data may allow distinguishing up to 9 CC types of CI, CM, CR, CH, dehydrated CI/CM/CR, Unusual CM, CV/CO, CK, and Tagish Lake.

Acknowledgment: Meteorite samples were kindly loaned from NASA Johnson Space Center or Smithsonian National Museum of Natural History. Reflectance spectra were measured at RELAB, Brown University. Part of this research was supported by JSPS KAKENHI grant number 24540493 and NASA SSERVI to T. H.

References: [1] Hiroi T. et al. (2011) Polar Sci., 5, 337-344. [2] Hiroi T. et al. (2016) Polar Sci. (in press). [3] Hiroi T. et al. (2016) LPS, XLVII, Abstract #1084. [4] Hiroi T. et al. (2015) LPS, XLVI, Abstract #1105.

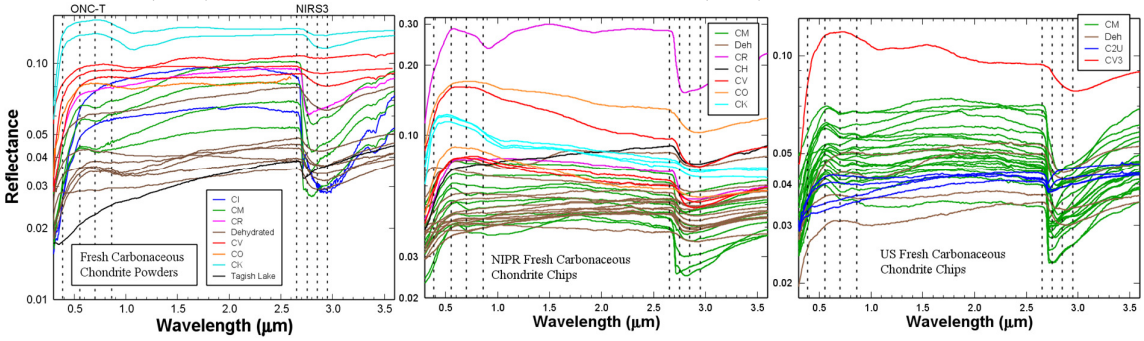

Fig. 1. Reflectance spectra of fresh CC powder samples (RELAB database), Antarctic CC chip samples recovered by NIPR, and those by US, plotted with select wavelength bands of Hayabusa2 onboard instruments ONC-T and NIRS3.

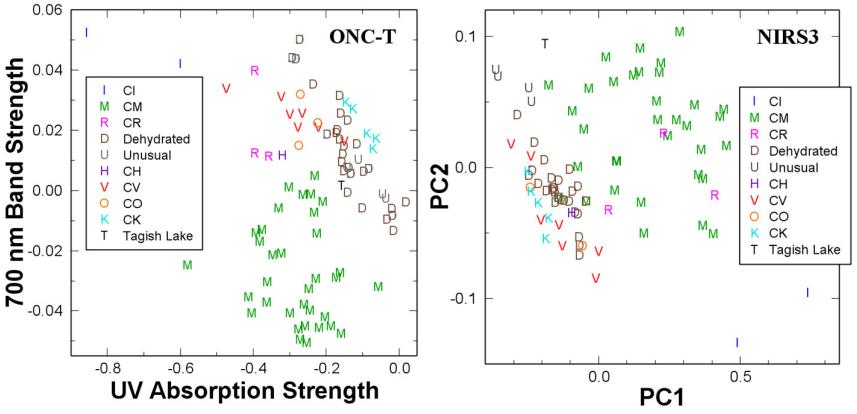

Fig. 2. Plots of the absorption band strengths at UV (390 nm) and 700 nm of ONC-T, and the principal components 1 and 2 of the scaled reflectances at 2750, 2850, and 2950 nm of NIRS3 bands for the CC spectra shown in Fig. 1.