

Investigation of sugars in meteorites

*Yoshihiro Furukawa¹, Yoshito Chikaraishi², Naohiko Ohkouchi³, Nanako O. Ogawa³, Tomoki Nakamura¹

1. Graduate School of Science, Tohoku University, 2. Institute of Low Temperature Science, Hokkaido University, 3. JAMSTEC

Sugars are essential components of DNA and RNA and also are essential substrates of glycolysis. Ribose is especially an important sugar as the sole component in RNA that supports both genotype and phenotype of primordial life. Investigations of sugars in meteorites have been conducted since more than 50 years ago. However, no extraterrestrial sugar that composes life has been found from any astronomical samples including meteorites, although several sugar-related compounds have been detected from meteorites. This would be preliminary because of the low concentration, difficulty in extraction, and the absence of suitable derivatization for gas chromatographic separation. Therefore, we developed a protocol to extract and analyze sugars in meteorites. We have also investigated the compound-specific carbon isotope ratios ($\delta^{13}\text{C}$ values) of sugars. All meteorites have some possibilities of biological contamination, since they have been collected on the terrestrial environment filled with biota. Thus, the evaluation of the source of sugars in meteorites (i.e., biological or extraterrestrial) is significantly important. Biological sugars all have negative $\delta^{13}\text{C}$ values (against VPDB). Conversely, soluble organic compounds in meteorites like amino acids, nucleobases, amines, and sugar-related compounds all have positive carbon $\delta^{13}\text{C}$ values. Thus, the isotope ratios are an essential indicator for the evaluation of the origin of sugars in meteorites. In this presentation, we show the results of identification and carbon isotope ratio analysis of sugars for two CR2 chondrites. We also report the mineral composition, and chemical state of C in insoluble organic matter in these meteorites.

Keywords: ribose, sugar, meteorites