MECHANISM OF WATER DIFFUSION IN SILICA GLASS AT 50 BAR WATER VAPOR PRESSURE. M. Kuroda*[1], S Tachibana[1], N. Sakamoto[2] and H. Yurimoto[1]. [1]Natural History Sciences, Hokkaido University, Japan. [2]Isotope Imaging Laboratory, Hokkaido University, Japan. (Correspondence: minami@ep.sci.hokudai.ac.jp)

Water diffusion in silicate melt is one of the main controlling factors of magmatisms in subduction zones (e.g. degassing and crystallization). Water diffusivity in silicate melts has been known to depend on its own concentration. However, the diffusion mechanism responsible for the observed water concentration dependence has not yet been clarified.

In this study, in order to understand the mechanism of water diffusion in silicate melts, we carried out diffusion experiments of water in silica glass at 650-850℃ and water vapor pressure of 50 bar. Silica glass was used to evaluate the water concentration dependence of water diffusion without any other compositional effects (e.g. NBO/T). Diffusion profiles of ^{1}H and ^{30}Si were measured on the cross section of run product using Cameca ims-6f at Hokkaido University. Ion images of ^{1}H and ^{30}Si along the diffusion profile were also taken with a SCAPS detector attached to Cameca ims-1270 at Hokkaido University. Glasses with known water contents were used for conversion of secondary ion count ratio ($^{1}H/^{30}Si$) to the water content in the samples.

The diffusion profiles of water in silica glass cannot be simply explained by previous diffusion models for silicate glasses, and show much stronger water concentation dependence (Fig. 1). We explain this stronger water concentration dependence of water diffusion in silica glass as follows: (1) The main diffusion species is molerular H_2O, and its relative abundance to OH groups decreases with lowering the water content in the glass; (2) The number of pathways available for diffusion is controlled by the number of NBO determined by the concentration of OH groups. Because the water diffusivity is proportional to the above two factors and both depend on the total water content in the glass, the water concentration dependence of water diffusion is larger than the previous models. The smaller water concentration dependence observed for water diffusion in other silicate glasses can be attributed to the little dependence of NBO concentration on water contents because it is controlled extrinsically by other network modifier cations.

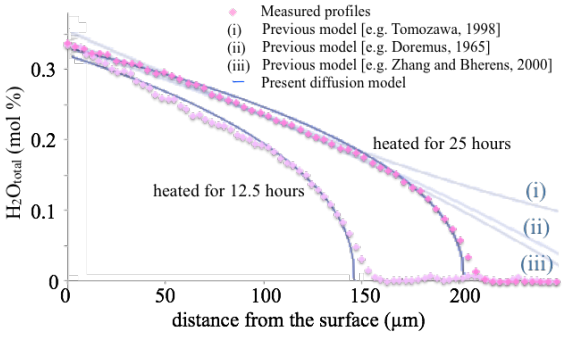

Fig.1 Diffusion profile of water in the sample heated at 850℃ with fitting curves with previous models (i)-(iii) and with the present model.

HAYABUSA2: SAMPLE RETURN FROM C-TYPE NEAR-EARTH ASTEROID (162173) RYUGU. S. Tachibana[1], H. Sawada[2], R. Okazaki[3], Y. Takano[4], K. Sakamoto[2], Y. Miura[5], and Hayabusa2 Project Team. [1]Dept. Natural History Sci. Hokkaido Univ. [2]Hayabusa2 Project, JAXA. [3]Dept. Earth Planet. Sci., Kyushu Univ., [4]Dept. Biogeochemistry, JAMSTEC. [5]Earthquake Research Inst., Univ. Tokyo. E-mail: tachi@ep.sci.hokudai.ac.jp.

Hayabusa2 is an asteroid exploration mission to return surface samples from a near-Earth C-type asteroid (162173) Ryugu [1]. Carbonaceous-type asteroids are expected to preserve the most pristine materials in the solar system that are an interacted mixture of minerals, ice, and organic matter, which would have later evolved to the Earth, ocean, and life, respectively. Space missions are the only way to obtain such pristine minerals, organics and volatiles with geological context. Moreover, because asteroids are the evolved remnants of planetesimals, on-site observation by a spacecraft and analyses of returned samples will provide direct evidence of planet formation and dynamical evolution of the Solar System.

Hayabusa2 launched off on December 3, 2014 and performed a swing-by of the Earth on December 3, 2015, which successfully pushed the spacecraft into the orbit to Ryugu. The spacecraft will get to Ryugu mid 2018, and will fully investigate the asteroid for 18 months, and sample the asteroid at three different locations. The samples from Ryugu will be delivered to the Earth in December 2020. The returned samples will be classified into three categories due to structural design of the Hayabusa2 sampler [1-3]. (1) Millimeter-sized coarse grains stored separately in three chambers, (2) <100 μm-sized fine particles that could be mixed in the sample container, and (3) volatiles released from the samples in the sealed container. Millimeter-sized coarse grains collected at different locations would represent local characteristics of the asteroid surface, and petrologic and mineralogical studies of them would allow us to constrain the history of the asteroid and material evolution in the early solar system. Fine particles would possess the information on the global average surface feature and surface geologic processes such as space weathering and regolith evolution. Volatile components released from the samples would be the first returned volatiles from space and would thus be an important target to investigate the origin and evolution of organic matter and water in the solar system.

Curation work of the returned samples will be first done at the JAXA Curation Facility, which will be the initial sample preparatory work for subsequent studies (phase 1 curation). The curation work for a fraction of the samples will be done in collaboration with institutes outside JAXA for detailed and thorough analysis (phase 2 curation). A different fraction of samples will be investigated by the Initial Analysis team in the Hayabusa2 project to accomplish the scientific goal of the mission [1]. The samples will be analyzed by multiple analysis teams focusing on non-destructive analyses of grains, elemental and isotopic analyses of grains, petrology and mineralogy of coarse and fine particles, chemistry and isotopes of volatiles, and chemistry of organic materials.

References: [1] Tachibana S. et al. (2014) *Geochem. J.* **48,** 571-587. [2] Sawada H. et al. (2015) *Space Science Review* under review. [3] Okazaki R. et al. (2015) *Space Science Review* under review.