NEW HAYABUSA2 AND OSIRIS REX CURATION FACILITIES AT NASA JOHNSON SPACE CENTER

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Asteroids are made up of rocky material that is left over from the formation of our solar system [1]. This material holds the key to unlocking information about the history of the planets and our sun. Hayabusa2 and OSIRIS-REx are two sample return missions that have collected rocky material from carbonaceous asteroids which are rich in water, carbon, and organic compounds [1]. Hayabusa2 is a spacecraft that collected samples from asteroid Ryugu launched by the Japan Aerospace Exploration Agency (JAXA). Samples were returned to Earth in December 2020 and 10 percent of the collected material is currently housed in a state-of-the-art laboratory at NASA Johnson Space Center (JSC) dedicated to Ryugu material [1]. OSIRIS-REx is a spacecraft launched by NASA that collected samples from asteroid Bennu. The samples are on their journey to Earth and will arrive in September 2023. They will be stored in a separate cleanroom dedicated to Bennu material. From these two missions, scientists will examine dust particles and rocky material to research clues on how the early solar system formed and how life began [2]. Because these samples are so precious and rare, it is important to keep them free from Earth contamination.

In September of 2020, a massive construction project began to provide curation facilities to meet the needs of two incoming asteroid collections, Hayabusa2 and OSIRIS-REx. Despite numerous setbacks caused by the coronavirus pandemic, these facilities have been completed in the fall of 2021. Some of these setbacks included strict PPE requirements, keeping safe working distances as well as access to the facilities as NASA was operating under a Stage 3 condition in response to the pandemic. These facilities will provide curation laboratories to safely house the precious asteroid samples as well as facilities to manipulate samples, do sample preparation and process samples into and out of the labs for future studies by the scientific community. The lab suite consists of several different rooms including an initial anteroom (ISO 7), a staging area (ISO 7), two gowning areas (one for OSIRIS-REx and one for Hayabusa2; both ISO 6)), the Haybusa2 Curation Laboratory (ISO 5), the OSIRIS-REx Curation Laboratory (ISO 5), an ultramicrotomy laboratory (ISO 7) and a thin section laboratory (not a cleanroom). To maintain cleanliness levels necessary for these lab spaces quarterly to monthly Balazs organic and inorganic sampling has been conducted on a regular basis before, during and after the construction project to monitor the cleanliness levels in the new labs that will house the asteroid samples. These new facilities feature a Ruuvi (Grafana) monitoring system that measures temperature, humidity, and pressure of the lab suite. This is a small puck shaped sensor that sends signals to the Grafana cloud where the data can be plotted and set up on dashboards within the lab suite. These sensors are easy to set up and install and they run off a cell battery that is good for 3-5 years before needing replacement. This system can deliver text messages and emails to the appropriate personnel when values fall outside of set limits. In addition to the monitoring system, this new lab suite features viewing windows from several different locations and sliding motion censored doors. We have obtained some state-of-the-art equipment to outfit the lab spaces (desiccators, microscopes, ultramicrotome) and are in the process of outfitting the suite with additional items such as: nitrogen gloveboxes, additional desiccators, micromanipulators, etc. The Hayabusa2 samples provided to NASA by JAXA included 23 millimeter sized grains and 4 containers with finer material. OSIRIS-REx is expected to return as much as 400 grams of asteroid Bennu. Samples will be stored in a nitrogen glove box and separated into nitrogen sealed transfer containers. Small Bennu and Ryugu particles will be handled and prepared (e.g., ultra-thin sections for scanning electron microscopy (SEM) or transmission electron microscopy (TEM)) using an Axis Pro micromanipulator and Leica EM UC7 ultramicrotome. Analyzing samples at the atomic scale will provide greater insight to the origins of the solar system and life formation on Earth. All the curation preparation for these sample collections is essential to ongoing research and efforts to understand our solar system, both nowand for future generations.

References:

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