REPORT:

HAYABUSA2 RYUGU SAMPLE DISPLAY EXHIBITION

October 26 - November 1, 2023

EARTH-LIFE SCIENCE INSTITUTE
TOKYO INSTITUTE OF TECHNOLOGY

Tokyo Tech Museum

Tokyo Tech

wpi

Sample A0161 from Ryugu

Sample name: A0161
Length: Major axis 2.2 mm
Weight: 2mg

Extracted at second touchdown point “Uchidenokozuchi” by Hayabusa2 on July 11th, 2019

Greetings!

Showcasing a 4.6 billion-year-old sample grain from an asteroid for the public is an exciting opportunity. It took years of precise engineering and efforts by many scientists to achieve this significant success of the Hayabusa2 mission.

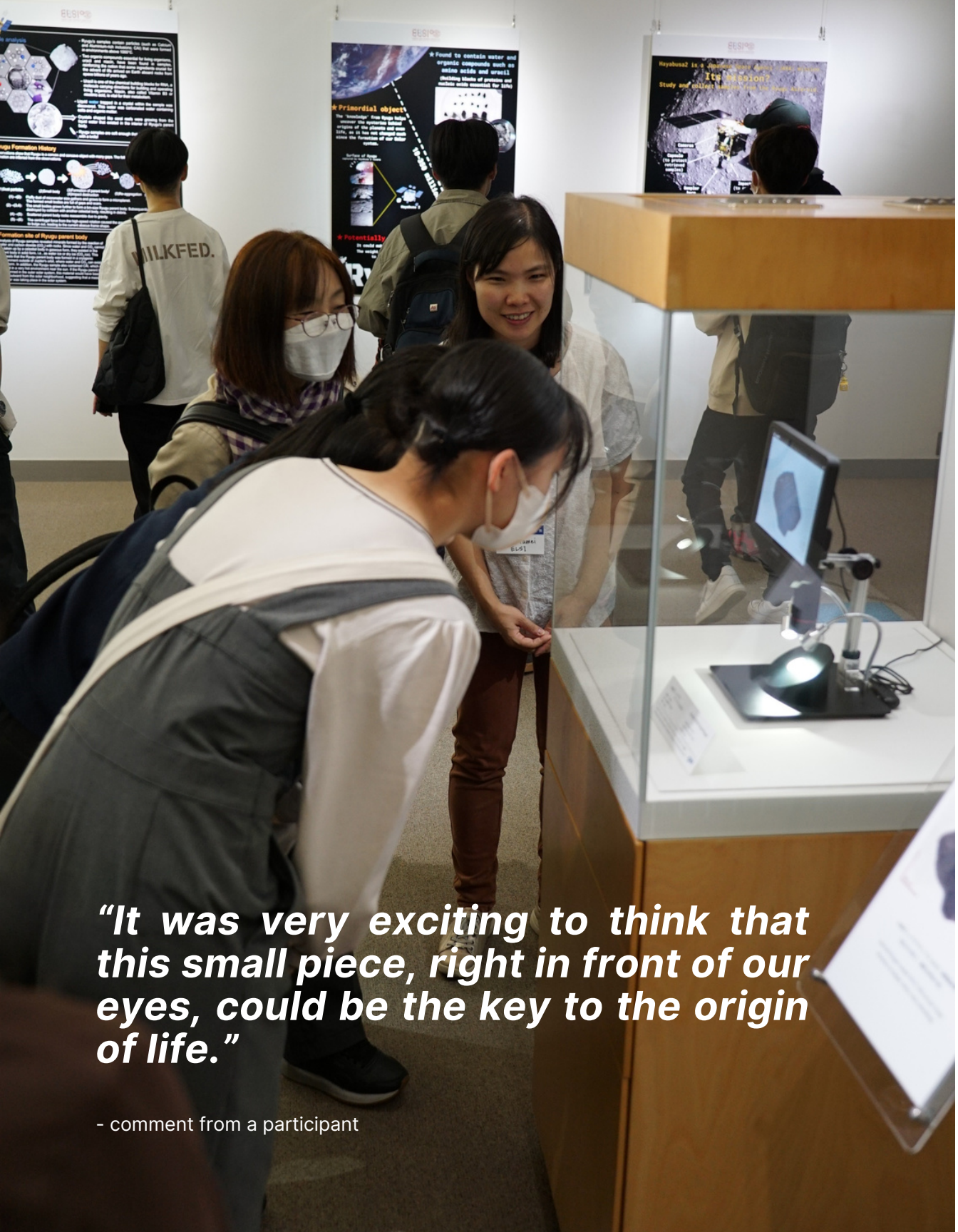
The asteroid explorer Hayabusa2 left Earth in December 2014, journeyed to asteroid Ryugu and touched down on the asteroid to collect samples before returning the samples safely to Earth in December 2020.

Asteroid Ryugu was formed 4.6 billion years ago, shortly after the birth of the Solar System. The samples from Ryugu provide insight into the Solar System's origins and the Earth's beginning before our planet's formation and chemical evolution. Studying the samples is, therefore, an amazing opportunity to unravel mysteries that have been explored throughout the history of humankind.

The results from the initial analysis reveal that samples from asteroid Ryugu are amongst the most primitive materials in the Solar System. This means that the grains are rich in carbon, hydrogen, nitrogen, oxygen, sulphur, and other elements that form organic matter. Evidence of water is also present. Analysis of the organic matter in the Ryugu samples revealed that the sample contains more than 20,000 different organic molecules.

This exhibition was put together as a collaboration of ELSI and Tokyo Tech Museum, with the support of ISAS, JAXA. Numerous researchers, support staff and students helped to coordinate.

Dr. Thilina Heenatigala (ELSI), on behalf of the organising team



“It was very exciting to think that this small piece, right in front of our eyes, could be the key to the origin of life.”

- comment from a participant

Overview

Hayabusa2 is an asteroid sample-return mission operated by the Japan Aerospace Exploration Agency (JAXA). It is a successor to the Hayabusa mission, which returned asteroid samples for the first time in June 2010. The capsule that returned to Earth on December 6, 2020, had 5.4g of materials collected from the asteroid Ryugu at two different sites. Earth-Life Science Institute (ELSI) proposed to the Institute of Space and Astronautical Science (ISAS) at JAXA to lend a sample grain from the returned samples for public engagement. With the sample grain, ELSI partnered with the Tokyo Tech Museum to coordinate an exhibition from 26 October to 1 November to coincide with the annual Tokyo Tech Festival (Koudaisai). The exhibition was held in the 2nd floor display room at the Tokyo Tech Centennial Hall.

ELSI's research theme, 'Origins of Life and Earth,' is well inlined with space missions such as Hayabusa2. The samples give new insight and bring us closer to understanding 'Origins of Life.' The exhibition was an effort to connect these scientific and engineering endeavours closer to society by creating a once-in-life opportunity for the public to see an asteroid grain and to learn directly from the scientific community. ELSI researchers and graduate students provided explanations and answered questions throughout the exhibition period. As a societal engagement effort, the opportunity to connect with science and scientists was conducted in the 'Dialogue Model' in science communication. Moreover, these engagements were done in bilingual, in English and Japanese, to make it more accessible to the participants.

The exhibition featured; the Ryugu sample grain from the second touch-down, the special canister that carries samples, an enlarged 3D model of a sample from the first touch-down, videos of the Hayabusa2 mission, and six bilingual posters. The posters were created by graduate students of ELSI as a part of the 'science communication course' assignment—the posters featured an introduction to Hayabusa2, an introduction to Ryugu asteroid, and science from Ryugu samples.

Exhibition Setup

The asteroid sample grain and other exhibited items were carried directly from ISAS-JAXA to the Tokyo Tech Museum.

Opening ceremony of the exhibition.

Planning

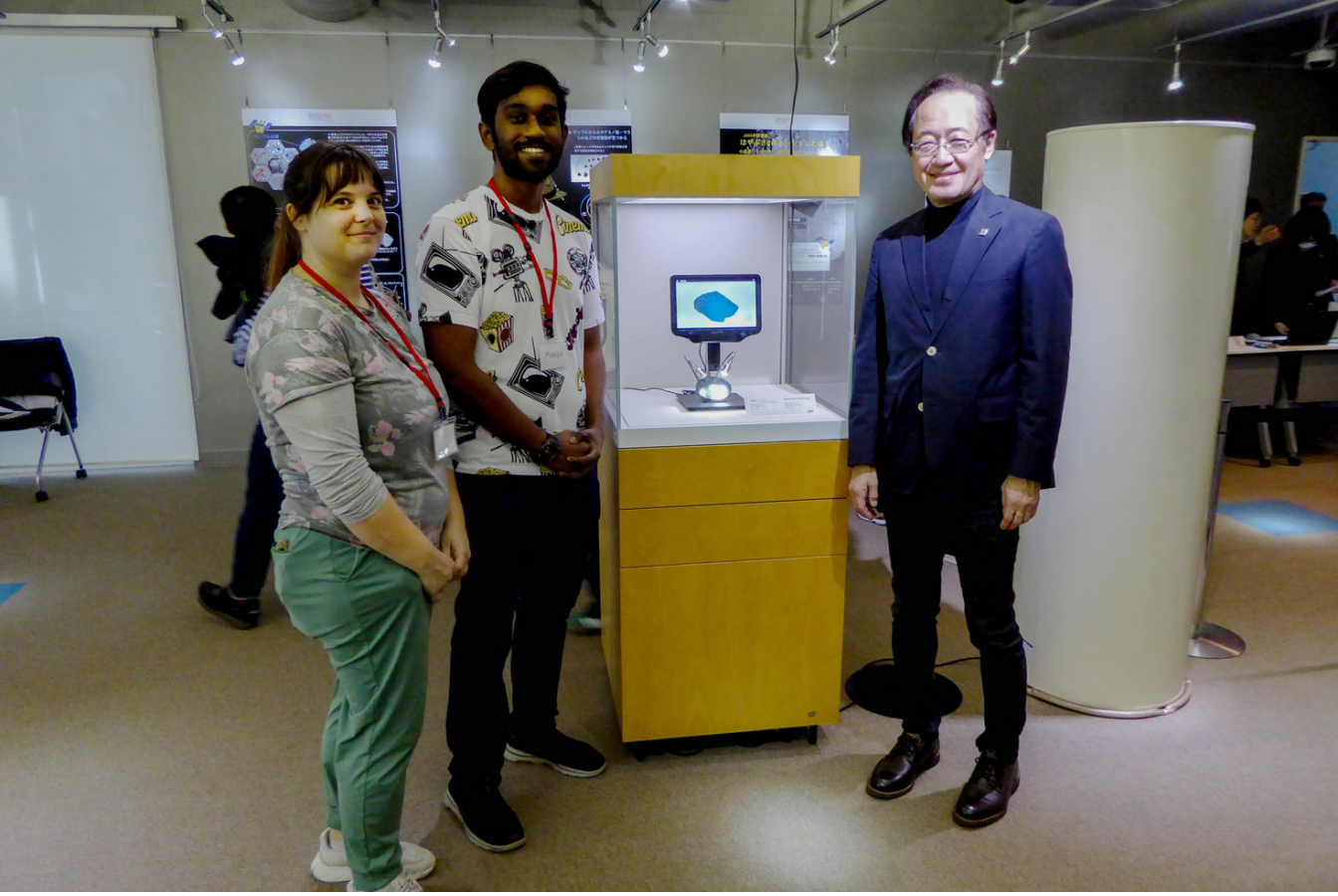
The exhibition planning started in June 2023 with frequent communications and meetings between ELSI and Tokyo Tech Museum. The experienced museum experts were responsible for exhibition layout design and curation, while the ELSI team worked on logistics with JAXA, content production, and promotion. The organising team met every 2-3 weeks at the museum and ELSI. The project lead, Dr. Thilina Heenatigala, coordinated the sample and exhibition details lending with the JAXA curation team.

An invitational-only VIP opening ceremony was held on October 26, with a gathering of executives from universities, research institutions, and other organisations. ELSI Professors Hidenori Genda and Yamei Li introduced Hayabusa2 and Ryugu research to the visitors in Japanese and English, respectively, while ELSI Prof. Tomoaki Matsuura officially opened the exhibition.

The exhibition was held during the annual Tokyo Tech Festival, which gathers many people, so it was essential to manage the crowd. A ticketing system through the Peatix system was adopted, with up to 100 tickets per hour being issued. By the time of the exhibition, all the tickets were sold out.

The exhibition was an opportunity for the ELSI community to engage with society. As a coordinated effort, several ELSI researchers and graduate students joined the exhibition to provide explanations and answers to questions raised by the visitors. ELSI graduate students created posters in English and Japanese as a part of their coursework.

The organising committee created a roaster of staff assignments to guide the visitors towards the exhibition room, check in the tickets, and provide scientific explanations.



Promotion Strategy

The exhibition aimed at various societal actors, from school students to the public, Tokyo Tech members, and VIPs. The organisers coordinated a multilayered promotional plan to reach multiple audiences through several websites, social media, internal communication tools, direct invitations, and printed posters. The general public was directed to one website - the Tokyo Tech Festival (Koudaisai)- with information about the exhibition and registration URLs. The registration was set up on the Peatix site, which allows hosting event registrations. The exhibition information was published on both ELSI and the Museum websites. After publishing all the different websites, ELSI promoted the exhibition through ELSI's social media channels: X (formerly Twitter), Facebook, and LinkedIn. A total of 24 social media posts were published. Furthermore, organisers communicated the exhibition details via the university's internal Slack channel to attract the university members, communicated with all the department chairs and circulated them to ELSI members. The exhibition was also featured on the Tokyo Tech website and calendar.

Apart from online promotions, the organisers also used printed posters for promotions. The bilingual posters were displayed at the following locations: campus notice boards in Ookayama, Ishikawadai and Midorigaoka, campus libraries in Ookayama, Suzukakedai, Tamachi, ELSI building, Museum building, Taki Plaza at the Ookayama campus, Ota ward office, and the Ookayama train station.

Promotion Strategy

URLs:

- Tokyo Tech Festival (Kodaisai) website:
  - https://koudaisai.jp/ryugu
- Tokyo Tech calendar: (in English)
  - https://www.titech.ac.jp/english/event/2023/067621
- Tokyo Tech calendar: (in Japanese)
  - https://www.titech.ac.jp/event/2023/067538
- Tokyo Tech website for students: (in English)
  - https://www.titech.ac.jp/english/0/students/news/2023/067661
- Tokyo Tech website for students: (in Japanese)
  - https://www.titech.ac.jp/0/students/news/2023/067659
- Tokyo Tech website for faculty: (in English)
  - https://www.titech.ac.jp/english/0/staff/news/2023/067662
- Tokyo Tech website for faculty: (in Japanese)
  - https://www.titech.ac.jp/0/staff/news/2023/067660
- ELSI website: (in English)
  - https://www.elsi.jp/en/news_events/events/2023/hayabusa2_ryugu_sample/
- ELSI website: (in Japanese)
  - https://www.elsi.jp/news_events/events/2023/hayabusa2_ryugu_sample/

Exhibition Posters (English Edition)

The exhibition had two separate posters aimed at the public and university members.

“We felt the deep connection between many countries in the world of science and technology when I heard that not all samples are handled by domestic research institutions alone but are shared with the rest of the world.”

- comment from a participant

ELSI researchers and visiting scholars engaged with the participating public to introduce and discuss Hayabusa2, Ryugu, and their relevance to Origins of Life.

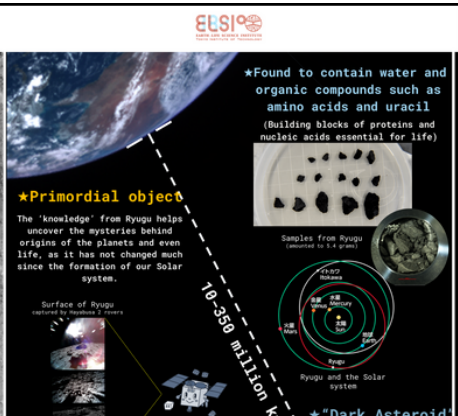
Outcome

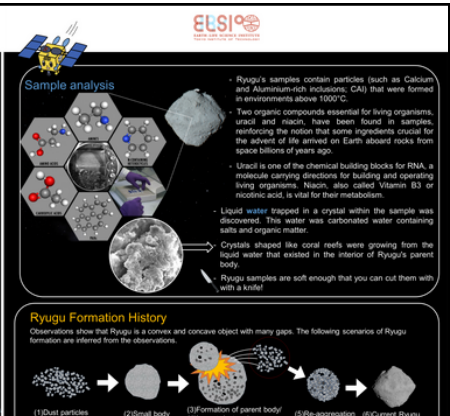
The exhibition days of 28 and 29 October were a part of the Tokyo Tech Festival (Koudaisai). The organisers used a ticketing system through the Peatix website to mitigate the crowd. More than a thousand tickets were sold out for the two days. Overall, about 1,500 participants attended the exhibition. This includes two groups of high school students.

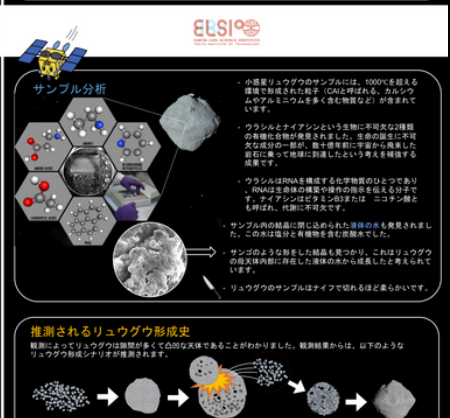
The exhibition was also well attended by the scientific community, scientists, graduate students of Tokyo Tech, and other universities.

Due to the demand of interest, some people were let into the exhibition without tickets, depending on the availability of space at the exhibition venue.

ELSI graduate students engaged with the public.







Information posters created by ELSI graduate students.

Special Lecture

JAXA's Strategic Small-Body Sample Return Program: From Hayabusa/Hayabusa2 to MMX

A special lecture by JAXA's Dr. Tomohiro Usui was held at ELSI on 25 October before the exhibition.

Held on 25 October 2023
Speaker: Dr. Tomohiro Usui, JAXA-ISAS
Host: Dr. Thilina Heenatigala, ELSI
Venue: Mishama Hall, ELSI

A special lecture by JAXA's Dr. Tomohiro Usui.

Comments from the participants:

生徒が期待した、ELSIの先生、学生の皆様の解説を伺いつつの見学ができ、また、重ねる質問にも快く応じていただき、たいへん感激しておりました。すでによそでサンプルを見たことがある者もおりましたが、東工大で、ELSIで、展示を見たかったのは生解説、実にこの点だったそうです。とてもわかりやすく教えていただいて、日頃、独学で見聞きし、調べている内容に筋が通る思いがしたそうです。

私も、産地直送(凄い時代が到来したものです！)のあの微小なかけらから、ご研究の先生方が数多くの発見を取り出すことを思い、感動しつつ、奇跡を見る思いで拝見しました。持ち帰ってきてくださった、はやぶさ２プロジェクトにありがたく思い、今、サンプルのご研究に携わる先生方、皆様への尊敬をあらためて深くしています。続く、MMXのサンプルリターンにも大きな期待を寄せています。
（高校教員）

[machine translated from Japanese to English and edited for clarity]

The students were very impressed that they could visit the exhibition with the explanations provided by the ELSI researchers and graduate students, and could ask several questions. Some of them had already seen the sample elsewhere, but they wanted to see the sample with scientific explanations at the Tokyo Tech and ELSI. The researchers and graduate students gave them very clear explanations, and they felt that what they saw, heard and studied on their own made systematised knowledge.

I, too, saw the sample that was directly brought from the asteroid Ryugu - an amazing time has come! - and was moved by the thought of the many discoveries that the researchers could extract from those tiny fragments. I watched them with the feeling of seeing a miracle. I am grateful to the Hayabusa2 project for bringing the sample grains to Earth, and I deeply respect all the researchers involved in the study of the sample. I have great expectations for the MMX sample return that will follow.
(A high school teacher)

ELSI graduate students engaged with the public.

Comments from the participants:

土曜日は小惑星リュウグウのサンプル特別展示を見学させていただき、ありがとうございました。実際にサンプルを見たときに、頭で理解していたよりも小さく、驚きました。2mmと数値上では理解していたつもりでしたが、今回の展示で大きさをやっと実感することができました。すぐ目の前にある、この小さい欠片が生命の起源に辿り着く鍵になると思うと、とてもワクワクしました。

私達の質問にもとても分かりやすく答えてくださり、例えば、サンプルを入れた容器のことを質問したときには容器の中の湿度がサンプルに大きな影響を与えることを教えてくださいました。他にも、容器の話だけでも普通では知り得ない、サンプルの収容などの奥深い技術やその難しさまでお聞きでき、とても濃密な時間でした。

また、サンプルの全てを国内の研究機関だけで取り扱うのでなく，世界に共有することをお聞きした時には、科学技術の世界での、多くの国同士の深い繋がりも感じました。

今まで知らなかった研究の世界について知れたこと、また、生命の起源という大きな謎の鍵がELSIの先生方を始めとして、最先端で活躍される多くの方々によって見つけられ、一歩一歩近づいていく様子が実感できて、とても貴重な体験ができました。
本当にありがとうございました。
(高校生)

Comments from the participants:

[machine translated from Japanese to English and edited for clarity]

Thank you very much for letting us see the special exhibition of samples from the asteroid Ryugu on Saturday. When we actually saw the sample, we were surprised to see that it was smaller than we had understood in our heads - we thought we understood it numerically to be 2 mm, but this exhibition made us realise just how small it was. It was very exciting to think that this small piece, right in front of our eyes, could be the key to the origin of life.

The ELSI researcher and graduate students answered our many questions very clearly. For example, when we asked about the containers in which the samples were placed, they told us that the humidity in the containers greatly affected the samples. It was also a very intense time, as we could hear about other profound techniques, such as housing the samples and the difficulties involved, which we would not usually know just by talking about the containers.

We also felt the deep connection between many countries in the world of science and technology when I heard that not all samples are handled by domestic research institutions alone but are shared with the rest of the world.

It was a very valuable experience for us to learn about the world of research that we had never known before and to realise how the key to the great mystery of the origin of life is being found by many people working at the cutting edge, including the ELSI researchers, and how we are getting closer to the answer step by step.
Thank you very much.
(High school students)

Acknowledgement

The unique opportunity of bringing a piece of an asteroid to the public and scientific community was possible due to the tireless efforts of many people who helped with the organising. From Tokyo Tech Museum: Isao Satoh, Taisuke Yamazaki, Sachiko Hattori, Fumie Yamanaka, Yoshiro Asai, Hiroko Sasaki, Miyuki Johira, and Akiko Shimokado. From ELSI: Kei Kurita, Taneaki Matsumoto, Ayako Nomura, Satoko Kinoshita, Kanako Yagame, Yoshihiko Koeda, Terumi Matsukawa, Minako Shirakura, Shigeru Masuda, Harumi Tanaka, and Akiko Tanaka. From ISAS-JAXA: Tomohiro Usui and Tomoko Ojima. From ELSI scientists: Tomoaki Matsuura, Hidenori Genda, Li Yamei, Trishit Ruj, Shintaro Kadoya, Mahendran Sithamparam and students Haruka Nakagawa, Courteney Monchinski, Shunsuke Nozaki, Selene Cannelli, Ikuto Nakamura, Yusuke Mizukami.

“I am grateful to the Hayabusa2 project for bringing samples back, and now I have a renewed and deep respect for all the researchers involved in studying these samples. I have great expectations for the MMX sample return that will follow.”

- comment from a participant

The report was produced for Earth-Life Science Institute (ELSI) by Thilina Heenatigala, with content provided by Minako Shirakura and Shigeru Masuda. November 2023. www.elsi.jp
Photo credit: ELSI.