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Space

Asteroid haul returns to Earth

NASA's OSIRIS-REx mission has brought back materials from asteroid Bennu that could help us understand how the solar system formed, report **Leah Crane** and **Alex Wilkins**

SAMPLES from the asteroid Bennu have been successfully retrieved by NASA, after a capsule containing about 250 grams of the space rock touched down in the desert near Salt Lake City, Utah, on 24 September. Scientists hope that Bennu, which is older than Earth, could help explain how the solar system formed.

The capsule has been making its way home since 2020, when NASA's OSIRIS-REx spacecraft extracted samples from the asteroid. The final, riskiest part of the mission involved the capsule's controlled freefall through Earth's atmosphere, following its release by OSIRIS-Rex at about a third of the distance between Earth and the moon.

"Studying these organic molecules might help us understand what could have seeded life on Earth"

Reaching speeds of 44,500 kilometres per hour, the capsule used its heat shields and two parachutes to protect its cargo and control its descent towards the ground, touching down at a leisurely 18 kilometres per hour.

"Boy, did we stick that landing," said OSIRIS-REx's principal investigator Dante Lauretta in a press conference. "It was just sitting right there, a few tens of feet right off a nice road, a perfect place for the helicopters to land. It didn't move, it didn't roll, it didn't bounce, it just made a tiny little divot in the Utah soil."

Within 90 minutes of the landing, NASA located the capsule and helicopters transported it to a makeshift clean room in a military hangar, where scientists injected a continuous flow of nitrogen into the container to keep the sample free of contaminants from Earth.

OSIRIS-REx's sample-return capsule landed safely in Utah on 24 September

On 25 September, the capsule made its way by plane to NASA's Johnson Space Center in Houston, Texas, where researchers will carefully prise apart the canister and categorise the sample inside. Once the rocks have been weighed and inventoried, they will be given to research groups around the world to investigate further.

OSIRIS-REx launched in 2016 and entered orbit around Bennu in 2018. Scientists chose Bennu as a target primarily because it is relatively close to Earth – at the time of launch, it was about 225 million kilometres away, and in the intervening years it got as near as 50 million kilometres away.

Because of its regular close approaches, Bennu is classified as a near-Earth object. It isn't expected to smash into our planet any time soon, but there is about a 0.057 per cent chance of a collision in the next 300 years. Bennu is some 490 metres across, so if it did hit Earth, it could cause significant damage.

NASA/KEEGAN BARBER

By understanding the asteroid's makeup, scientists hope that it will be easier to divert it with an impact strike, similar to NASA's DART mission, if needed.

Another reason it is of interest is that it is one of the most primitive known space rocks. "Asteroids like Bennu are time capsules from the early solar system," says Anjani Polit at the University of Arizona, who is part of the OSIRIS-REx team. Such asteroids probably clustered together to form our solar system's planets.

Bennu, in particular, hosts large concentrations of carbon, the main ingredient of organic molecules, which in turn are the building blocks for life as we know it.

"We're pretty sure that there will be organic molecules in these samples," says OSIRIS-REx scientist Michelle Thompson at Purdue University in Indiana. "Studying these organic molecules might help us understand what organics were around in the early solar system that could have seeded life on Earth."

Similar samples have been returned by Japan's Hayabusa 2 spacecraft, which visited an asteroid called Ryugu.

Having material from more than one asteroid should help us understand what was around 4.5 billion years ago when the solar system formed, says Thompson. "I honestly feel like a kid on Christmas Eve," she says. "I'm about to wake up and get all these gifts of samples from Bennu." ▮

Psyche mission also aims for an asteroid

As one mission comes to an end, another is about to start. NASA is scheduled to launch its Psyche mission to an asteroid – also called Psyche – on 5 October.

The target asteroid is less than 300 kilometres across and takes about five Earth years to complete an orbit around the sun, and the closest it gets to us is about three times the distance between our planet and Mars. If all goes well with the launch, the spacecraft is expected to arrive at Psyche in 2029.

We know almost nothing about Psyche's surface, its origins or even its composition. What we do know is that it is probably almost all metal, most of which is likely to be iron. Metallic objects like Psyche could be a key ingredient in the formation of rocky worlds like our own. Earth and other terrestrial planets have iron cores, but we have never been able to study one in detail because they are so deep underground. The mission may be our first chance to see a planetary core directly. LC