



Water on Asteroid Bennu

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Recent, observations by **NASA's OSIRIS-REx (Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer)** spacecraft has found that the asteroid Bennu has lots of accessible water.

- OSIRIS-REx mission had arrived at asteroid Bennu after a two-year journey in December 2018.
- OSIRIS-REx was launched from Cape Canaveral, Florida on September 8, 2016.
- The OSIRIS-REx mission is not the first to ever visit an asteroid and attempt a sample return — Japan has done (Hayabusa Mission) it before and Europe (Rosetta Mission) has managed to land on a comet.

Rosetta Mission

- Rosetta Mission was launched by the European Space Agency in 2004 to explore Comet 67P/Churyumov-Gerasimenko and to study the nucleus of the comet and its environment.
- Rosetta was the first mission ever to orbit a comet's nucleus and land a probe on its surface. It was also the first spacecraft to fly alongside a comet as it head towards the inner Solar System

Mission

- The Mission **aims to study asteroid Bennu, collect a sample and return it to Earth in 2023.**
- The mission will spend 2.5 years, mapping its surface and studying its composition.
- In mid-2020, scientists will direct Osiris-Rex to drop down to the asteroid and grab at least 60g of regolith, or "topsoil".
- This will be packed away in a sterile capsule to be returned to earth in 2023.

Mission Objective

The OSIRIS-REx name is an acronym of the mission objectives, which are:

- **Origins:** Return and analyze a pristine carbon-rich asteroid sample
- **Spectral Interpretation:** Provide ground truth or direct observations for telescopic data of the entire asteroid population
- **Resource Identification:** Map the chemistry and mineralogy of a primitive carbon-rich asteroid
- **Security:** Measure the effect of sunlight on the orbit of a small asteroid, known as the Yarkovsky effect. This effect is the slight push created when the asteroid absorbs sunlight and re-emits that energy as heat, could change the trajectory of asteroids.
- **Regolith Explorer:** Document the regolith (layer of loose, outer material) at the sampling site at scales down to the sub-centimeter

Significance of Mission

- **Origins of the Solar System**

- In order to understand the origin and evolution of the solar system.
- As Earth formed, and afterward, objects like Bennu may have delivered the molecules of carbon and water to our planet. By studying Bennu, we can better understand how life originated on earth.

- **Protecting Earth**

- Bennu is one of the most potentially hazardous asteroids currently known to Earth. Bennu has a 1-in-2,700 chance of impacting earth during one of its close approaches to Earth in the late 22nd century.
- Close observations by OSIRIS-REx will help get more information about Bennu's journey and help scientists working on safeguarding our planet against hazardous asteroids.

- **Mining, LaunchPad, and Future Explorations**

- The recent discovery of water will help to explore the possibility of using asteroids as refueling stations for spacecraft on the way to deeper destinations in space.

As water can be split into its constituent hydrogen and oxygen which can be used as fuel in rockets.

- Water could also be harvested for providing water to astronauts.
- Asteroids contain a range of valuable minerals, there is a possibility of mining asteroids in the future.

About Bennu

- The asteroid was discovered by the Lincoln Near-Earth Asteroid Research (LINEAR) survey on September 11, 1999.
- It was originally named as 1999 RQ36.

- The name Bennu comes from an Egyptian deity related to the Sun, often depicted as a gray heron.
- Bennu is a 500-meter wide asteroid in an elliptical orbit around the sun. It is a carbonaceous asteroid composition including a large amount of carbon.

Why Bennu?

- **It's close to Earth**
 - Bennu's orbit is close in proximity to Earth's, even crossing it. The asteroid makes its closest approach to Earth every 6 years.
 - It also circles the Sun nearly in the same plane as Earth, which makes it simple to launch the spacecraft out of Earth's plane and into Bennu's plane.
- **It's the right size**
 - Small asteroids, with diameters of 200 meters or less, spin very fast. This rapid spinning makes it difficult for a spacecraft to match an asteroid's velocity and collect samples.
 - Bennu's size makes it approachable and makes landing possible.