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Rosetta Mission

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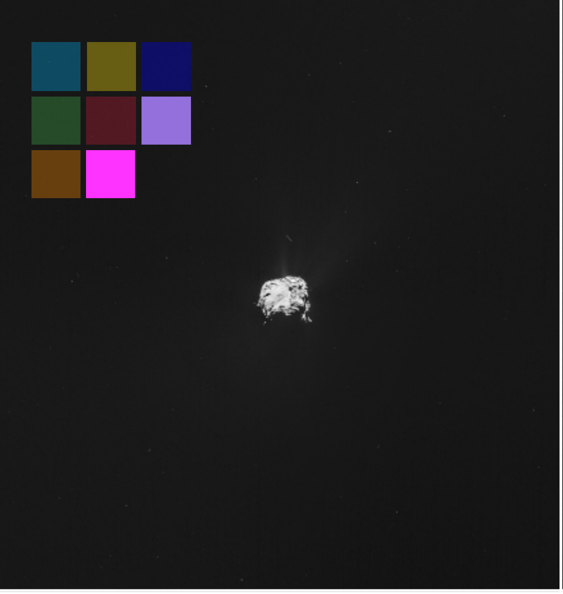
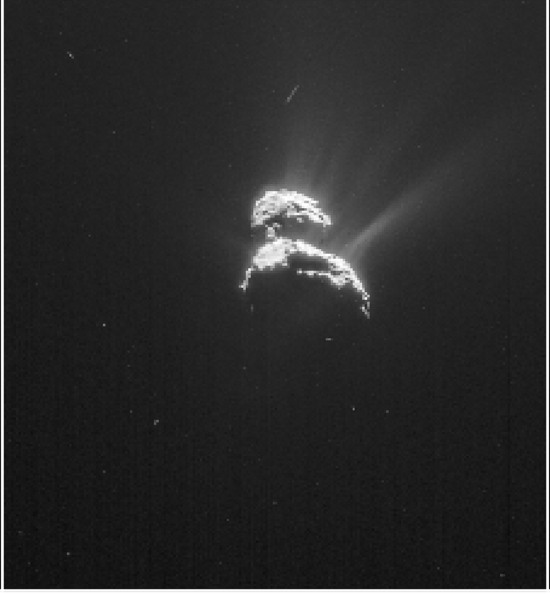
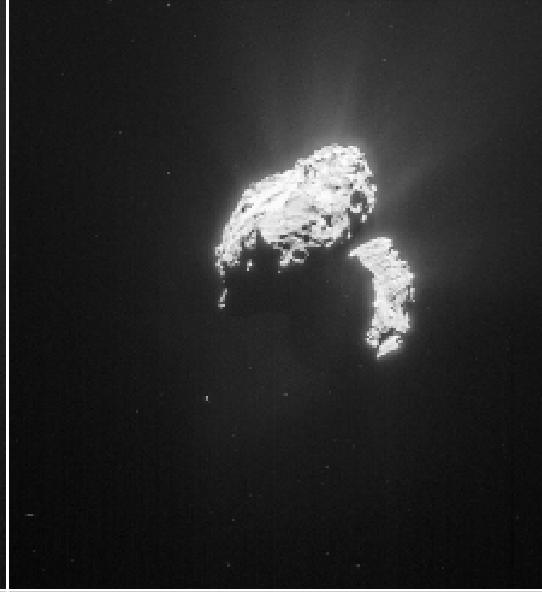


226.5 km



198 km



118.5 km

ROSETTA MISSION

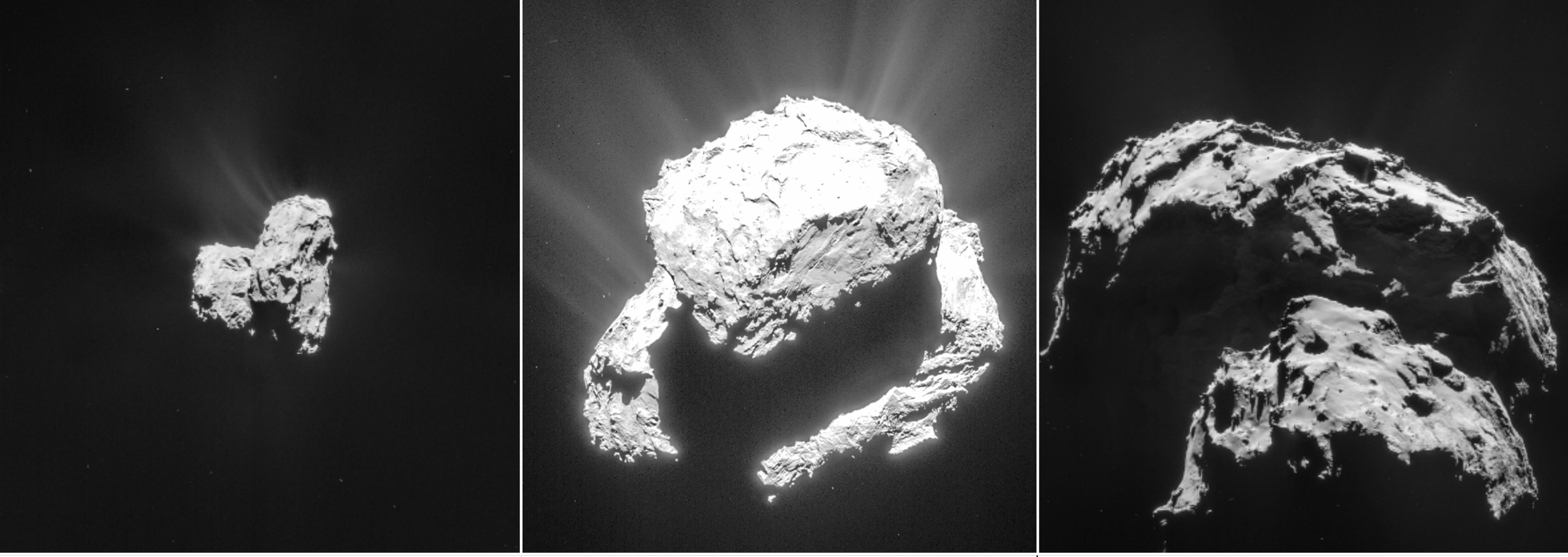
JACOB TURNER

To ancient civilizations, they were a sign of the coming fall of an empire. To us, they are chunks of ice and rock a few kilometers wide that formed just after the birth of our solar system. The vast majority of them orbit the sun at over 150 times the distance of Neptune, the outermost planet. It will take Voyager 1, the most distant human spacecraft to date, thousands of years to reach the halo-like cloud in which they reside. However, these objects are perhaps best known for the select few that are nudged in just the right way by the tidal forces of our galaxy and of passing stars. They are set on new orbital trajectories towards the inner solar system, and make beautiful tails of ice and dust tens of thousands of kilometers long when they get close to the sun. The objects I'm referring to, of course, are comets.

Comets are essential to understanding the history of our solar system in addition to providing spectacular viewing sessions during close approaches. Because they formed in the earliest years of our solar system and have remained in essentially the same state since, they can provide clues to the solar system's early composition, and perhaps to how Earth was able to harbor life in the first place. When our solar system was still only a few hundred thousand years old, it was a very violent place. It was filled with gas and dust that was accumulating into larger bodies such as planets and asteroids, so explosive collisions were very common. The Earth looked nothing like its present self. More closely resembling a giant ball of molten rock due to the constant bombardment of comets, it was not at all hospitable to life. During this time, many of the collisions with the Earth likely involved comets which, being partially composed of ice, may have provided much of the water that is now found on our planet. Taking this idea one step further, there has been speculation that comets may have seeded the Earth with organic molecules, and possibly even amino acids. Organic molecules are somewhat common in interstellar space and even more so in the disks of gas surrounding newly formed stars, so it's not inconceivable to think that comets may be partially composed of these molecules. If we could show that most of the water and/or organic molecules on Earth likely came from comets, it would support the hypothesis that comets are responsible for Earth's habitability.

Perhaps the most incredible possibility is a hypothesis known as panspermia, which suggests that comets may have been what brought life to Earth in the first place. We already know of microscopic creatures that can survive the harsh conditions of space, so life from other worlds could have lain dormant until they found suitable conditions to revive themselves.

In 2004, in order to better understand comets and their potential influence on Earth's history, the European Space Agency launched its Rosetta spacecraft and Philae lander with the hopes of that they would become the first human objects to orbit and land on a comet, respectively.



94.3 km | 71.9 km | 27.9 km

After a 10 year journey, the two spacecraft finally caught up with comet 67p and began their orbit. After three months in orbit, the Philae lander was released from the probe and began its descent towards the comet. Due to the weak gravity of the comet (escape velocity is about 1 meter per second, a casual walking pace), the lander was designed with two thrusters that would guide its descent and two harpoons that would keep it anchored to the surface. Unfortunately, the harpoons did not fire, and the lander ended up bouncing twice before coming to a stop in an area of shade, which prevented necessary sunlight from reaching its solar panels. Without access to a direct energy source, the lander was only active for a little less than three days before entering into a hibernation state.

Fortunately, before beginning its temporary shutdown, Philae was able to discover two important facts about the comet. For starters, there was no change in the magnetic field measurements as the lander descended, meaning that no magnetic field exists on the comet, pointing to a likely lack of an iron core—a common feature among the planetary bodies in the solar system. Additionally, the lander was able to detect organic molecules that included elements like hydrogen and carbon, meaning that comets may have been at least partially responsible for some of the organic molecules found on Earth.

The Rosetta probe was also able to return some very important results regarding water composition. By analyzing the comet's water vapor, the probe discovered that the ratio of the deuterium, also known as heavy hydrogen (hydrogen with both a neutron and a proton in its nucleus), to regular hydrogen was about three times the ratio on earth, meaning that comets were likely not the source of water in Earth's early history.

Though only active for just a few days, the Philae lander was able to teach us much about comets and their role in the history of our solar system. Thankfully, that was not the last to be heard from Rosetta and Philae. On June 13th, Philae came out of hibernation and re-established contact with Earth. What's more, unlike traditional missions in which the orbiting probe crashes into the object's surface after its mission is completed, Rosetta is currently planned to orbit the comet indefinitely. And so, after a brief slumber, Philae has resumed data transmission and we once again await exciting new information from the comet 67p.