Rosetta: Deciphering the Origin of Our Solar System

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Launched 10 years ago in March 2004, the European Space Agency's Rosetta became the first spacecraft to orbit a comet on August 6, 2014[1]. Rosetta will remain with comet 67P/Churyumov-Gerasimenko as the comet orbits the Sun, and will deploy a lander to the surface in November. This mission is an international endeavor – NASA has provided 3 of its 11 instruments, and U.S. scientists are partnering on several non-U.S. instruments. The spacecraft is named after the famous *Rosetta Stone*, which was key to sorting out the civilization of ancient Egypt. In a similar fashion, Rosetta is envisioned to shed light on the oldest building blocks of our Solar System, namely comets. The probe's lander is aptly named Philae, for the island on which an obelisk with a bilingual inscription that enabled the hieroglyphs of the Rosetta Stone to be deciphered was discovered. Appropriately, the spacecraft carries a micro-etched nickel disk donated by the Long Now Foundation that is inscribed with over 13,000 pages of text in over 1,500 different languages[2].

Once considered omens of disaster ("bad star") by many ancient civilizations, comets are now best described as "dirty snowballs" (or "icy mudballs") that have spent most of the 4.6-billion-year history of the Solar System in its frozen outer reaches, thus preserving a more or less pristine record of the earliest composition of our Solar System. In antiquity, many believed comets foretold the future; today, we think they can help us understand the past. Comets are thought to have helped deliver water, and perhaps the ingredients for life, to the Earth during a period of catastrophic collisions of asteroids and comets with larger Solar System bodies about 4 billion years ago.

As comet Churyumov-Gerasimenko approaches closer to the Sun in its orbit, the lander will provide information on the chemical and physical properties of a selected area of the comet's surface, while the main spacecraft will analyze the dust grains and gas flowing from the comet's nucleus as it is heated by the Sun. The planned experiments will provide insight into the origin and history of comets, as well as the origin of the Earth's oceans and atmosphere. By measuring in great detail the nature of organic compounds (molecules rich in carbon, hydrogen, oxygen, and nitrogen), including complex organics, Rosetta is also expected to shed light on the early path to life on Earth. Beyond the insights comets provide into our origins, there is a very practical aspect to the study of comets – someday we may need to divert or destroy a comet that is headed toward Earth, and the more we know about a comet's structure and operation, the better our chances of protecting life on our planet!

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[1] See rosetta.jpl.nasa.gov and www.esa.int/rosetta

[2] See rosettaproject.org/disk/concept