

Pre-Lab Reading: Water in Rocks?

Q. Could the water in Earth's oceans have originated in space rocks?



Remember that in the last unit, we read about the composition of meteors called *chondrites* and *achondrites*, focusing on how iron or other minerals are the primary components of these types of space rocks. We also recognized that the mineral composition of meteors (on average) closely resembles the average amounts of the very same minerals found in the Earth itself.

This was further evidence for our model—that our planet Earth was built from space rocks.

But one other key piece of information was also included in that reading:
“Many chondrites contain water-related (hydrrous) minerals, such as clays.”

➔ Water! But how *much* water could we actually “squeeze” out of a space rock?

A number of astro-geologists and other scientists have measured the water content of small meteors found after impacts or explosions of objects entering our atmosphere. In 2005, however, a Japanese space probe actually landed on a large meteor that orbits the sun in a path that crosses right through the orbit of the Earth. “Itokawa” (named after a Japanese rocket scientist) belongs to a group called the “Apollo asteroids”—objects who orbit the sun close to Earth and regularly cross its orbital path. Though these “near earth asteroids” obviously hold special interest and concern, Itokawa itself never comes closer to Earth than 5 times the distance from the Earth to the Moon.

After the space probe landed on Itokawa and returned to Earth in 2010, it carried with it several samples of rock from the meteor’s surface. The team analyzing the fragments hoped to learn more about the content of meteors, especially those thought to represent the remains of the inner solar system space rocks that make-up the Earth, that is, meteors like Itokawa. Interestingly, the analysis team found water in small but significant amounts—occurring at about 500 to 1,000 ppm (parts per million) in the samples.

More recently a team of French researchers obtained a number of meteorites called “enstatite chondrites”—the sort that formed the Earth. Their tests showed amounts of water that surpassed the Itokawa data, with concentrations from 2,000 to 12,000 ppm. Still not much water, but more than previously thought.

Could this fairly tiny amount of water in space rocks be the source for the water in the Earth’s vast oceans? What would you want to know in order to make some sort of a calculation? Chat with your group and record a couple of questions. Be ready to share out or follow your teacher’s instructions as we work to try to make sense of where the Earth’s oceans may have come from.

Adapted from several sources:

Hazen, R. (2012). The Story of Earth.

Meteor image (Wikimedia commons) can be found at the Wikipedia article, “Meteorite” (<https://en.wikipedia.org/wiki/Meteorite>)
 Image, “Faucet Waterdrop:

URL: <https://www.maxpixel.net/Faucet-Waterdrop-Water-Water-Drop-Drop-Tap-Black-158968>
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Learn more about the research studies:

Jin, Z., & Bose, M. (2019). New clues to ancient water on Itokawa. *Science advances*, 5(5), eaav8106.

Piani, L., Marrocchi, Y., Rigaudier, T., Vacher, L. G., Thomassin, D., & Marty, B. (2020). Earth’s water may have been inherited from material similar to enstatite chondrite meteorites. *Science*, 369(6507), 1110-1113.