Astrobiology News August 2021:
Dwarf Planet Ceres: The Nearest Ocean World?

In 2006, Ceres was reclassified from “asteroid” to “dwarf planet,” since it’s so much bigger and different from its neighbors in the asteroid belt. Ceres is a curious world that has often appeared in pop culture. In the TV series, *The Expanse*, Ceres is inhabited by humans; in the PC Game *Descent*, one of the secret levels takes place on Ceres; and in the video game Destiny -- a favorite of my son, Dennis, who took 2nd place in a Chicagoland Strike Speedrun several years ago -- Ceres was colonized by an alien race called the Fallen, and was later destroyed by a civilization of post-humans who inhabit the asteroid belt.[1]

The designation “ocean world” has been applied to any world, not necessarily classified as a “planet,” that contains a large body of liquid water, not necessarily on the world’s surface. Enceladus, Europa, Titan, Ganymede, and Callisto, moons of gas giants Jupiter and Saturn, have all been determined to have subsurface oceans from measurements made by the *Galileo* and *Cassini* spacecraft.[2] Neptune’s moon Triton, Saturn’s moon Dione, and dwarf planets Pluto and Ceres, have been considered candidate ocean worlds. Located in the asteroid belt between Mars and Jupiter, Ceres is the only one of these located in what’s considered the inner Solar System.

As I’ve been participating (virtually) in my annual Planetary Science Institute (PSI) retreat this week, it seems fitting to report on some recent research on Ceres that was conducted by one of my PSI colleagues. Senior Scientist Dr. Thomas Prettyman recently published a paper in Geophysical Research Letters[3] based on data from NASA’s *Dawn* mission. *Dawn* became the first mission to visit a dwarf planet when it went into orbit about Ceres in 2015.[4] Among its accomplishments, *Dawn* reinforced the idea that dwarf planets could have hosted oceans over a significant part of their history -- and possibly still do. Prettyman, together with PSI colleagues Yuki Yamashita, Norbert Schorghofer, Carle Pieters, and Hanna Sizemore, inferred the distribution of subsurface ice at Occator crater from measurements of hydrogen by *Dawn’s* Gamma Ray and Neutron Detector (GRaND).[5] Occator, a “young” -- roughly 20-million years old -- crater 57 miles in diameter, features prominent bright spots, which the new study reveals to be rich in water ice excavated from the impact that produced the crater. The new results support the interpretation that Ceres’ crust is ice rich, and reinforce an emerging consensus that Ceres has an icy outer shell and subcrustal ocean.[6]

When I think back to the first exoplanets that were discovered - giant worlds in unexpected “star-hugging” orbits, I’m reminded of how much more diverse nature is than we ever anticipate. I suspect that if and when we discover extraterrestrial life, it may be in an equally unexpected environment -- perhaps even in an underground ocean on a world orbiting amongst the “rubble” of the Solar System! The Planetary Science Institute studies the origin, characteristics and evolution of our Solar System, as well as astrobiology and exoplanets. Follow PSI on Facebook (@planetartsci), Twitter (@planetarysci), and Instagram (planetary.sci) to learn more about fascinating developments in all these fields of study.

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[1] https://solarsystem.nasa.gov/planets/dwarf-planets/ceres/overview/
[2] https://www.liebertpub.com/doi/pdf/10.1089/ast.2018.1955
[3] https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094223
[4] https://solarsystem.nasa.gov/missions/dawn/overview/
[5] https://solarsystem.nasa.gov/missions/dawn/technology/science-payload/
[6] https://www.psi.edu/news/ceresicycrust

Although there aren't any Zooniverse projects dedicated to ocean worlds (other than Earth) at this point in time, *Hubble Asteroid Hunter*[7] enables people around the world to help scientists better understand the asteroid population, and also to identify asteroids whose orbits might pose threats to life on Earth.

Until next month,

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[7] https://www.zooniverse.org/projects/sandorkruk/hubble-asteroid-hunter