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Life beyond Earth? Potential habitats in the solar system keep popping up

'Munchkin' moon of Saturn is the latest spot that has researchers buzzing

It's an ice-encrusted munchkin of a moon, only 314 miles in diameter. Its face is so smooth and nearly crater-free that it probably got a facelift. It's a satellite of Saturn, called Enceladus, and the latest hot spot in the quest to answer one of astronomy's most intriguing questions: Is there life in the solar system beyond Earth?

Where once scientists set their sights on Mars as the most likely place to hunt for such evidence, their list of potential habitats now includes at least five others: three moons of Jupiter and now Saturn's Titan and Enceladus.

This expanding list is due, in part, to more data coming from spacecraft scouting Earth's extended neighborhood. It also stems from a better understanding of how life can exist in extreme environments.

To be sure, any inhabitants scientists find would most likely be microbes, not little green men. And the case for such biological havens is far from ironclad.

"There's always a big caveat," says David Grinspoon, a planetary geologist at Southwest Research Institute (SwRI) in Boulder, Colo. "We're profoundly ignorant about what makes a good habitat, since we only know of one place for life" - Earth.

Still, researchers have learned a great deal about the weird environments harboring life on Earth. Thus, "when we explore in depth with an orbiter and really hang out and get to know the place, we find pockets in the system that might be promising for life," Dr. Grinspoon adds. "The Saturn system is turning out to be surprisingly fecund."

The list of potential habitats began to expand with the Galileo mission to Jupiter in the 1990s. That mission added three Jovian moons to the list: Europa, Ganymede, and Callisto. Now, the US-European Cassini mission to Saturn has added the moons Titan and Enceladus.

For astrobiologists, the Cassini mission's biggest surprise yet is Enceladus. Researchers had already inferred from Voyager 2's flyby in 1981 that its smooth surface meant it had gotten a facelift, perhaps 100 million years ago. Fresh material from beneath its icy crust welled up and spread across the moon. But that in turn implied heat to generate slush or liquid water - and no one could figure out its source.

Fast forward to 2005, when Cassini stunned researchers with infrared images of a hot

spot on the surface at the moon's south pole. Hot, in this case, is still frigid: minus 183 degrees Celsius (minus 297 degrees F.). But that's 20 degrees warmer than the surrounding area. The polar area also is scarred with cracks that release water vapor and tiny ice crystals. Researchers estimate that some of the formations are only 10 to 1,000 years old. Changes on the surface of the Jovian moons, by contrast, look far older, perhaps 100 million years or more.

And Cassini scientists have uncovered simple organic molecules in the cracks of Enceladus. To this day, the heat source remains an enigma, says John Spencer, an SwRI scientist whom colleagues credit with discovering the hot spot. What's generating the heat? "That's what we're all scratching our heads over," he replies.

No matter. Enceladus apparently has the fundamental chemical recipe for life, says University of Arizona planetary scientist Robert Brown, who heads the team using Cassini's mapping spectrometer. The moon has simple organic molecules, such as methane, ethane, and ethylene. Scientists see tantalizing hints of nitrogen. It hosts liquid water below the surface.

"Add a pinch of phosphorous," Dr. Brown says, and you have all you need to make DNA - or perhaps some other DNA-like molecule capable of carrying information. At Enceladus, this stew would have had plenty of time to simmer for 4.5 billion years and "form some of the most basic building blocks of life," he adds.

It's not clear that's happened at Enceladus, he says. "But if we're going to run all over the solar system looking at places where those constituents have been for the past 4.5 billion years and where the cocktail might have cooked into something interesting, then Enceladus has to be part of that mix."

As does Titan, adds Grinspoon. Until the Cassini mission and the successful touchdown of the European-built Huygens probe, many researchers held that the hydrocarbon-rich moon was a chilled look-alike for Earth before life emerged. The quest was for clues to the origins of life, not a search for life itself.

That view is changing, at least for Grinspoon. "What do you need for life? You need an energy source, liquid reservoirs, and you need some basis for complex chemistry," he says. "Does Titan have what it takes? The answer is: yes."

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By Peter N. Spotts, Staff writer of The Christian Science Monitor

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