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I usually get funny looks when I say the word astrobiology. After all, how can we expect to study the origins and distribution of life throughout the universe when we don't even know that it exists outside of this planet? We must first decide what questions are the most important to ask, and how to go about asking them. For astrobiologists, these are questions like: What are the signs that an environment once held life? What is necessary for life to begin and survive, even in the harsh conditions on planets like Mars?

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MARS ON EARTH: ASTROBIOLOGY IN PAVILION LAKE AND THE ARCTIC

Finding the answers begins right here on our home planet. On Earth, astrobiologists are studying the unlikely life surviving in extreme environments — places so cold, so dry, or so bizarre we once thought them completely uninhabitable.

These environments are great analogues for extraterrestrial terrains. By studying them, we can gain insight into what might be going on elsewhere in the solar system.

My personal search for the extraterrestrial on Earth took me to British Columbia, to work with the Pavilion Lake Research Project. By most measures, Pavilion Lake is completely normal, with an ordinary pH, temperature, and mineral content. Yet the lake hosts a collection of bizarre carbonate structures called microbialites, formed by a variety of microorganisms, which may someday help us detect past or current life on other planets.

Microbialites look like coral, but without the tropical color schemes. Such structures were once common on the surface of Earth, but these days they are typically only found in extremely salty water. What, then, were these microbialites doing in Pavilion Lake?

I came face to face with the microbialites while SCUBA diving alongside researchers from NASA, the Canadian Space Agency, and several universities. This year, for the first time, the Pavilion Lake Research Project also brought in a pair of Nuytco Deep Worker submersibles to explore the lake where divers could not.

Combined with ongoing biochemical experiments in the lake, our new knowledge of microbialite distribution will eventually help us see the big picture. We hope to piece together how these microbialites are being formed, and why their structures are so varied.

After a month in British Columbia, I left with a small contingent of Pavilion Lake researchers to journey to the high Arctic. Two days of travel northward brought us, by twin-otter plane, to Axel Heiberg Island. Our camp revealed a striking panorama of tundra, with two colossal glaciers slowly slicing their way into the valley between iron-colored mountains. Located barely ten degrees of latitude from the North Pole at 80°N in the Canadian High Arctic, Axel Heiberg truly is otherworldly.

Of course, it was exactly this resemblance to another planet which lured me to Axel in the first place. Our team was led by Dr. Chris McKay, a planetary scientist at NASA. We set up base camp at the McGill Arctic Research Station— which acronyms quite nicely to "M.A.R.S." With M.A.R.S. as home base, we set out collecting samples for astrobiological research.

Temperatures on Axel Heiberg get as low as –40°F, several degrees colder than Mars's warm weather. This overlap of temperatures makes Axel Heiberg a great place to study what might be possible on Mars despite its subzero environment, especially in the search for sources of liquid water. Water is an important piece in the puzzle of extraterrestrial life, since most life on Earth needs some form of water to survive.

Axel Heiberg's perennial springs, therefore, are some of the most interesting features on the island for astrobiologists. The springs come right out of the ground, about half an hour's hike from our camp. Some look like little streams flowing down the side of the hill, others look like seeps oozing up from below, and still others look like ponds bubbling as if they were tiny Jacuzzis. Don't let the Jacuzzi effect fool you, though—the springs are actually quite cold. They flow liquid year-round, despite an average annual air temperature of 5°F.

The springs make their way to the surface by way of tube-like structures of gypsum salt. By the time the springs reach the air, they have picked up so much salt that they are three times the salinity of saltwater. The salt acts like an antifreeze, allowing the springs to stay liquid even when the weather is well below the normal freezing temperature of water.

Sources of liquid water may be the obvious places to look for life, but life can flourish even where the water is perpetually frozen—underground, or even in colonies inside giant chunks of rocks or salt. It seems life will find a niche no matter how unbelievable the environment. To me, a community of microorganisms living where nothing else can is one of the most compelling scientific beauties I can imagine on Earth. I'd pick a barren, frozen desert over a teeming jungle any day, and Mars is the most enticing desert I know.

I am so thankful to Mr. Burch for giving me the opportunity to work with some of astrobiology's most inspiring scientists and explorers. I hope to continue pursuing astrobiological field work at the ends of the Earth—and, perhaps someday, elsewhere in the solar system. My Burch experience will serve as an excellent launch pad.

Pun intended.