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Microbe Can Survive at 226 Degrees

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Associated Press

WASHINGTON - Some may like it hot, but nothing likes it hotter than a weird microbe known as Strain 121. The one-celled organism, captured from a magma vent at the bottom of the Pacific Ocean, can survive 266 degrees, a temperature no other known life form can tolerate.

The as-yet-unnamed microbe was able to reproduce and grow vigorously at about 250 degrees, the typical temperature used in autoclaves to sterilize medical instruments, said Derek R. Lovley, a University of Massachusetts microbiologist who was the senior author of a study appearing Friday in the journal Science.

"It has been the dogma in microbiology for 120 years that that temperature would kill any living organism," Lovley said.

But not Strain 121.

In laboratory experiments, Lovley and his co-author, Kazem Kashefi, subjected Strain 121 to higher and higher temperatures and it survived each test.

"We just kept increasing the temperature and it kept living," he said. "Finally, we put it into the autoclave which was supposed to kill everything, but when we pulled it out it was still alive and, in fact, had grown. It amazed us."

Previously, the most heat tolerant organism known was Pyrolobus fumarii, a microbe recovered in 1997 from a thermal pool in Italy.

Lovley said Pyrolobus fumarii stops growing at a temperature of 235 degrees and is killed after one hour in an autoclave at 250 degrees.

Strain 121, however, seems to enjoy the torrid temperatures inside an autoclave. In 24 hours at 250 degrees, the microbe not only lived, but doubled in number.

When the temperature was raised to 266 degrees, Strain 121 stopped growing, but it did survive. When the superheated specimen was cooled down to a mere 217 degrees, still above the boiling of water, the microbe was alive and able to grow.

"It will survive that high temperature (266 degrees) but it will not multiply, at least that we could detect," Lovley said.

Both Strain 121 and Pyrolobus fumarii are members of the unusual life domain known as Archaea. Living organisms are divided in three domains, based on their genetic makeup and cell structure. People, plants and animals are in the Eukaryotic domain, and most germs are in the Eubacteria domain. The third domain, Archaea, are microorganisms that generally live in extreme conditions of heat, cold, pressures or acidity and have a DNA structure unlike the other two.

Strain 121 was found in samples taken from the stream of water and chemicals spewing from a natural chimney, or smoking vent, in the Juan de Fuca Ridge off the northwest coast of the United States. These chimneys, in about 1 1/2 miles of water, are built up on the ocean floor by superheated water ejected through vents from magma chambers below. They spew water heated to more than 300 degrees, along with dissolved minerals such as sulfur and iron.

Lovley said Strain 121 uses iron oxide in the vent streams to metabolize organic molecules. In effect, he said the microbe uses iron in the same way that surface-dwelling organisms use oxygen. The very earliest forms of life on Earth, he said, could have been like Strain 121, tolerating high temperatures and using iron for metabolism. Lovley said early in the Earth's history, the planet was iron-rich and oxygen poor, so it is logical that early forms of life could have lived as Strain 121 does now at the bottom of the ocean.

Finding a microbe that can withstand such high temperatures and pressures also increases the hope that there may be life on other planets in the solar system or elsewhere in the universe, Lovley said.

"Raising the temperature of life increases that window where you could expect to find some other life form," he said.

Jan Amend, a Washington University in St. Louis microbial geochemist who is not part of Lovley's team, said the discovery is important because it strengthens the case that early Earth life was sustained using ferric iron instead of oxygen.

He said it also improves the prospects of finding life beyond the Earth.

"Any time you have organisms that live at higher temperatures or at higher pressures, that expands the limits of possibility that there might be life elsewhere in our solar system or beyond," said Amend.

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