

50,000 Year Old Microbes Revived From Liquid Filled Bubbles In Cave Crystals.

A summary from available literature on the internet.

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Huge gypsum crystals in 'Cave of Crystals', Naica Mine. Note the human figure for scale.
Photo by Alexander Van Driessche

A population of extraordinary microbes classed as extremophiles, has been discovered trapped in bubbles within gypsum cave crystals, deep within the Naica mine in the northern state of Chihuahua, Mexico.

The lead, zinc and silver mine operated by Industrias Peñoles, broke into the submerged 'Giant Crystal Cave' system in April 2000 and had to pump groundwater out of the vast underground caverns to stop the mine flooding. The water was continuously pumped out of the mine at a rate of 22,000 gallons every minute otherwise the caves would quickly flood. Pumping out the water revealed a labyrinth of massive milky-white gypsum crystals. The largest crystal found to date is 12 m (39 ft) in length, 4 m (13 ft) in diameter and 55 tons in weight.

The Giant Crystal Cave system is so beautiful and hot that it is called both 'Fairyländ' and 'Hell' by scientists. It should also be noted that the mine has broken into several other caves containing large crystals at different depths of its workings.

The volcanically heated cave system has temperatures reaching 58°C and humidity between 90 to 99 per cent. Scientist must wear specially designed cool suits and breathing apparatus to enter the cave system.



Scientists must wear specially designed cool suits and breathing apparatus. Photo La Venta Arkive

NASA Astrobiology Institute director, Dr. Penelope Boston, who led the team searching for extremophiles trapped in the Naica mine crystals says, “These organisms have been dormant but viable for a geologically significant period of time, and they can be released due to other geological processes”. The deepest part accessed to collect samples was a chamber called ‘Hell’ at a depth of 300 metre from the surface.

Based on previous research work which dated the oldest crystals at half a million years (500,000 years), they believed the microbes have been trapped within the liquid bubbles somewhere between 10,000 and 50,000 years, shut off from light and oxygen. With no light at depth, any life form must chemosynthesise to survive. In other words they are living on iron, sulphur, and other chemicals in the rocks and water to obtain energy. After being trapped in the crystal, the microbes had continued to survive in a dormant state for tens of thousands of years.

The discovery provides more evidence that microbial life on Earth can endure harsher conditions in isolated places than scientists previously thought possible. The bugs may be a taste of what to expect if alien microbes are found on Mars or Jupiter's moon Europa, which has a global ice-covered ocean.

At the meeting of the American Association for the Advancement of Science, on 17th February 2017 in Boston MA, Penelope said; “This has profound effects on how we try to understand the evolutionary history of microbial life on this planet.” Her talk was titled ‘The Astrobiological Exploration of Earth and Mars.’

This discovery at the Naica Mine ‘Crystal Cave’ raises questions about NASA’s many rigorous steps to sterilize spacecraft, as there are risks that a mission to drill into another world could carry



The volcanically heated cave system has temperatures reaching 58°C and humidity between 90 and 99 per cent.
Photo La Venta Arkive

invasive—and highly durable—Earth creatures along for the ride. Also to be considered is our hunt for alien life on other worlds in our solar system, ‘How do we ensure that life-detection missions are going to detect true Mars life or life from icy worlds rather than *our* life?’

In 2008 and 2009 Dr. Boston and her team collected the samples from pockets of fluid trapped inside the crystals. Experiments conducted in-situ to see if the weird bugs could be cultured were partly successful. Much to their surprise, they were able to ‘wake up’ dormant microbes in that fluid and grow cultures. She said that because of the heat in the cave, their team could only work about 20 minutes at a time before ducking out to a specially constructed ‘cool’ room in the mine



Rigorous steps were taken to prevent contamination.
Photo © Stein-Erik Lauritzen



The large crystals found to date is 12m (39ft) in length and 55 tones in weight. Photo © Stein-Erik Lauritzen

workings, which was about 38°C.

Attempts to classify the bugs showed 90 per cent could not be matched with any other micro-organisms catalogued in available databases. They were also highly diverse, including about 100 different strains made up both of bacteria and other microbes known as archaea.

The NASA team have determined that the organisms are genetically distinct from anything known on Earth, and the most similar microbes are found in caves and volcanic terrain. Dr Boston said the weird bugs are 10 per cent genetically different from their nearest known micro-organisms, which genetically is like comparing humans to fungi.

Dr Boston's work is currently being written up for publication and has not yet been peer-reviewed, which makes it hard for other experts to acknowledge or dispute the claims at this stage. However, Boston's report of reviving microbes is not outlandish as this has been achieved in the past from geological samples, glacial ice, amber many thousands of years old, and microbes trapped in salt crystals possibly half a million years old, notes Brent Christner, a microbiologist at the University of Florida in Gainesville.

One outstanding issue is that nobody knows how long life of any kind can survive when dormant. Even sleeping organisms need food eventually or their cells will start to degrade, and scientists do not yet know if these hardy microbes can slow down their metabolism just enough to survive for millennia. It could be that these organisms are surviving on the limited energy in the enclosed bubble fluid or eating microbes which had previously died.

Microbiologist Purificación López-García of the French National Center for Scientific Research, one of the co-authors of the 2013 study, which identifies microbial life in hot, saline springs deep inside the Naica system, has reservations. "Contamination during drilling with microorganisms attached to the surface of these crystals or living in tiny fractures constitutes a very serious risk."

Dr Boston and her team are confident that the steps they took to prevent contamination are sound. These included; wearing protective suits, sterilizing their drills, and sterilizing the surfaces of the crystals with hydrogen peroxide and, in some cases, fire.

Collecting more samples is pretty well out of the question as the Naica mine ceased operation in early February 2017, after became unprofitable. The Crystal Cave is now flooded with groundwater which will protect the crystals into the future.

The good thing is that the microbes collected, are still actively growing in cultures in laboratory incubators kept at the same temperature as the mine. Boston and her team are hoping that other scientists will keep studying the creatures.

Dr. Boston said, "Natural caves and mines (anthropogenic caves!) give us a window into this hidden planet-within-a-planet that is home to microorganisms that eat rock, transform minerals and metals, and can live in extreme temperatures and chemical conditions that would be lethal to humans."

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