

Antarctic bacteria survive millennia

Bacteria that may be as much as a million years old have been found alive in rock and ice from hundreds of feet beneath the surface of Antarctica. They were found in core samples gathered as part of the Dry Valley Drilling Project, a multi-national investigation of Antarctica's evolution (SN: 1/26/74, p. 60), by Roy E. Cameron and Frank A. Morelli, both of the Darwin Research Institute and Jet Propulsion Laboratory in California. The find was announced this week by the National Science Foundation.

The bacteria may be the oldest living forms ever found on earth. A 1960 finding of dormant bacteria in 180-to-230-million-year-old salt crystals met with scientific disfavor, says Cameron, because the research did not rule out the possibility that the salt had recrystallized much more recently.

Like scientists examining samples brought back from the moon, Cameron and Morelli must rule out the possibility of outside contamination before they can be certain of their results. They have already ruled out the most obvious sources—bacteria carried down the coring tubes by the drill lubricant or introduced later by human contact. They are reasonably confident of their findings, but, Cameron points out, there are several hundred lesser sources that must also be considered.

The bacteria seem to represent about three to five different types. One, recovered from 86 meters down in the mouth of Taylor Valley, an ice-free valley formed by the retreat of a glacier, is a rod-shaped organism gathered by Cameron early this year, late in the Antarctic scientific season. Cameron finds it similar in appearance to a type of bacteria known as coryneform, commonly found in air, land and water forms. Morelli's finds were of rod- and club-shaped bacteria, discovered in samples taken at 130, 230, 330 and 430 meters down on Ross Island to the southeast.

The ages of the bacteria cannot be accurately pinned down until geophysical studies date the different depths in the core samples, which cover a span ranging from at least 10,000 to as much as a million years ago.

The bacteria were lying dormant at temperatures from about 7 to 19 degrees F., says Cameron. To take samples from the frozen cores, the tubes were first swept with a butane torch to remove any possible contamination, then drilled in the side with a heated bit, after which sterile cotton swabs were used to sample the freshly ex-

posed material. The bacteria, apparently shocked into activity by the heat, were already moving when they were discovered under a microscope.

"We were sort of flabbergasted," says Cameron. "We had never worked with material that was this old and frozen. We didn't expect this at all." All but one of the types of bacteria have not only lived, but reproduced, with one type forming an unusual ring-shaped colony.

The survival of the bacteria in extreme conditions could be important in the search for life on other worlds, such as Mars. If the Viking robot, which will carry life-detection experiments to the Martian surface in 1976, finds no life, says Cameron, there are now some grounds for looking beneath the surface. He suggests that a permafrost layer on Mars might be far enough down that life-encouraging moisture escapes from it less slowly.

The Antarctic findings further underscore the hardiness of bacteria, which have been found in hostile conditions ranging from high alkalinity to no oxygen. Even so, Cameron points out, a given species may be found on a sunny slope yet not on the shady side of the same ridge as little as a meter away.

An important resource for such studies is now in danger. As a result of NASA's tight-budget personnel cut-

ting, both Cameron and Morelli are being "involuntarily terminated" from JPL in a few weeks. Cameron, who has been with NASA for 13 years, has been coordinating research that uses JPL's Antarctic Simulator, a large "cold room" that contains six tons of frozen soil and water samples gathered since 1966 from Antarctica and another 20 tons from warm desert regions around the globe. "It's the world's major stockpile of soil and water samples for microbiological studies of extreme environments," Cameron says, "and there is a strong probability that they will be destroyed or disposed of."

The reason is that the stockpile may be cost-cut right out of existence. "JPL has said in a letter to the NSF [which sponsors the U.S. Antarctic Research Program] that they can no longer afford to maintain the Antarctic Simulator after July 1."

The samples stored there were gathered largely from depths of one meter and less, Cameron says, which means that it would be virtually impossible to replace them with samples from the same areas that have not been contaminated by man. The operating cost of the facility is less than \$3,000 a year, he says, and it could even be duplicated elsewhere for under \$25,000. "It's just a plain waste," he says with a sigh. □

Technology seeks pyramids' secrets

The ancient Egyptians believed in life after death. In the afterlife, they thought, the deceased would need the artifacts of daily life, from combs and makeup kits through household furniture, money and items of transport. The tombs of the wealthy, especially those of the kings, were lavishly provided with such things.

The tombs have thus been quite literally a mine of information for archaeologists interested in the life and customs of ancient Egypt. However, only one royal tomb, that of the relatively minor pharaoh Tutankhamen, has ever been found intact. In the millennia that the tombs have existed, grave robbers have often got there before archaeologists.

For the last eight years an Egyptian-American group of physicists and archaeologists has been searching for another royal tomb, that of Chephren. Unlike Tut, who died before he had hardly ruled, Chephren, the son of Cheops, was a man of whom history takes note. If his tomb were discovered intact, it would be one of the major archaeological finds of the century. It would also be somewhat ironic because, unlike Tut's tomb, which was overlooked by robbers because its entrance

lay buried under the debris of someone else's tomb building, Chephren's has been a tourist attraction throughout almost the 4,500 years since it was built. It is the Second Pyramid at Gizeh.

The investigating scientists are from



X-rays, radar seek Chephren's tomb.