Tardigrade brought back to life after being frozen for thirty years

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Acutuncus antarcticus, an individual representing the SB-3 strain, showing Chlorella sp. inside its stomach. Scale bar, 100 μm. Credit: *Cryobiology* (2015). DOI: 10.1016/j.cryobiol.2015.12.003

(Phys.org)—A trio of researchers with Japan's National Institute of Polar Research has found that a microscopic creature known as a tardigrade,

was able to "come back to life" after being frozen for over thirty years. In their paper published in the journal *Cryobiology*, the team reports on where the tardigrade was found, how it was frozen, the technique they used to thaw the creature and how its offspring fared.

Tardigrades (also known as water bears, because of the shape of their head) are one of the hardiest creatures on Earth, they can be frozen, boiled, put in a vacuum, dried to the point of having almost no moisture left in their body, and still return to living a normal life once put back into a normal environment. They can also apparently survive being frozen for decades, no worse for the wear. The team in Japan reports that two tardigrades were found among a sample of moss collected at Showa Station in Antarctica in November 1983—both were put into a freezer and kept at approximately minus 20 degrees C. Then, in 2014, the team decided it was time to thaw them to see if they could be revived, and if so, how well they fared.

Both tardigrades (named SB-1 and SB-2) were placed in a warm environment and allowed to thaw—both showed signs of life on the first day. SB-2 failed to fully revive, but SB-1began to move around in just under a week and was back to its old self by the end of two weeks—it later laid eggs which hatched normal healthy tardigrades. The team reports that the original moss sample also contained a tardigrade egg, which was also frozen under the same conditions as the adult tardigrades, and it was thawed as well. They report that the egg eventually hatched and that the tardigrade from it survived to adulthood and eventually would up laying eggs of its own, which in turn hatched several healthy offspring.

This new effort marks a record number of years for revival of a tardigrade after being frozen (the previous record was nine years), but not for any creature—the current record holder is a nematode that survived being frozen for almost 39 years. Such creatures are able to

withstand such conditions because they put themselves into a state known as cryptobiosis, which is where all metabolic processes stop.

More information: Megumu Tsujimoto et al, Recovery and reproduction of an Antarctic tardigrade retrieved from a moss sample frozen for over 30 years, *Cryobiology* (2015). DOI: 10.1016/j.cryobiol.2015.12.003

Abstract

Long-term survival has been one of the most studied of the extraordinary physiological characteristics of cryptobiosis in micrometazoans such as nematodes, tardigrades and rotifers. In the available studies of long-term survival of micrometazoans, instances of survival have been the primary observation, and recovery conditions of animals or subsequent reproduction are generally not reported. We therefore documented recovery conditions and reproduction immediately following revival of tardigrades retrieved from a frozen moss sample collected in Antarctica in 1983 and stored at −20 °C for 30.5 years. We recorded recovery of two individuals and development of a separate egg of the Antarctic tardigrade, Acutuncus antarcticus, providing the longest records of survival for tardigrades as animals or eggs. One of the two resuscitated individuals and the hatchling successfully reproduced repeatedly after their recovery from long-term cryptobiosis. This considerable extension of the known length of long-term survival of tardigrades recorded in our study is interpreted as being associated with the minimum oxidative damage likely to have resulted from storage under stable frozen conditions. The long recovery times of the revived tardigrades observed is suggestive of the requirement for repair of damage accrued over 30 years of cryptobiosis. Further more detailed studies will improve understanding of mechanisms and conditions underlying the long-term survival of cryptobiotic organisms.