

Wide boundaries of microbial life as due to anabiosis

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Gaining more insights to the boundaries in which microbial life can exist came from comprehensive studies of various, especially extreme, terrestrial environments. They differ in their origin, age, temperature, salinity, energy flux and many other factors that are of paramount importance for life sustenance. Microbiological studies of ancient Antarctic glaciers gave experimentally substantiated information on time and the lowest boundary of temperature in which viable pro- and eukaryotic microbial cells survived. Noticeably, the total number of viable microorganisms that are present in Antarctic ice horizons with temperature varying from -50 °C to -2.4 °C and the age range from 0.2 to 500 thousands of years. The existence of microbial cells in so widely ranging temperature and age is regarded as due to super-long anabiosis. Theoretically, there is no difference between microorganisms that existed in the anabiotic state for tens of hundreds to millennia of years if they faced to low temperatures. Hence, wide boundaries of microbial life are associated to the state of anabiosis and this is true not only for deep cold environments, such as Antarctic glaciers. Indeed, sensational findings of viable microorganisms in a variety of terrestrial ancient objects extend our knowledge of life boundaries. Revelations of ancient microbial cells, especially in those habitats where the number of microorganisms is very low, unavoidably concerns the problem of authentication. Therefore, it is great importance to develop and use the methods that exclude contamination of studied samples by outside microflora. At the first stages of microbiological investigations of glacier layers above the Lake Vostok, the method of aseptic sampling from ice cores was developed and tested under the conditions of external contamination by test-microorganisms. Later, different methods, precautions, and criteria were recommended by various authors to ensure the authenticity of microbial cells and/or nucleic acids to be present in ice samples. Undoubtedly, it is necessary for future investigations to develop standards for aseptic sampling and isolation of microorganisms from samples of ancient ice, as well as other environmental objects.