

# Culture of ancient fungi resting in the polar ice cores and future prospects of this research

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This study attempted to culture ancient fungi preserved in the polar ice cores dated from ~1000 to ~9000 years ago. The samples of several hundred grams of ice collected at depths of 97, 470 and 670 m from Mizuho station (70°42'S, 44°20'E; 2230 m a.s.l.) and at depths of 116, 141 and 169 m from Dome Fuji station (77°19'S, 39°42'E; 3810 m a.s.l.) in Antarctica (Fujii, 1985; Dome-F Deep Coring Group, 1998). The ages of these samples were estimated to be ~1000, ~5500 and ~9000 years for the Mizuho ice core (Nakawo et al., 1989) and ~3000, ~4000 and ~5000 years for the Dome Fuji deep ice core (Dome Fuji Ice Core Project Members, 2017) respectively. In addition, an ice core sample from Åsgardfonna in the northeastern part of Svalbard (79°27'N, 16°43'E; 1140 m a.s.l.) (Uchida et al., 1993) was used for the cultivation. The information on the sample depth and age were unclear. In this study, we successfully cultivated fungi from all the samples. The nucleotide sequences were obtained by DNA analyses of the strains. Many of these sequences showed low homology to those registered in the NCBI DNA database, therefore it was believed that ancient fungi were actually obtained. This suggested that the culture of ancient fungi and its DNA analysis enable to be done over time by using deep ice cores such as the Dome Fuji ice core. This allows to study the physiological ecology of ancient fungi and to use decomposition and fermentation characteristics of ancient fungi for industrial purposes. Also, DNA analyses of the ancient fungi may enable to examine the diversity of fungi with climate and environmental changes and to study the evolutionary history on fungi. In our presentation, we will introduce the results obtained and discuss the prospects and developments of the study using the ancient fungi preserved in the polar ice cores in the future.

## References

- Dome-F Deep Coring Group, Deep ice-core drilling at Dome Fuji and glaciological studies in East Dronning Maud Land, Antarctica. *Annals of Glaciology*, 27, 333-337, 1998.
- Dome Fuji Ice Core Project Members, State dependence of climatic instability over the past 720,000 years from Antarctic ice cores and climate modeling. *Science Advances*, 3(2), e1600446, 2017, doi:10.1126/sciadv.1600446.
- Fujii, Y., Drilling an ice core to a depth of 700 m at Mizuho Station, *Kyokuchi*, 41, 29–34, 1985. (in Japanese)
- Nakawo, M, H. Ohmae, F. Nishio and T. Kameda, Dating the Mizuho 700-m core from core ice fabric data. *Proceedings of the NIPR Symposium on Polar. Meteorology and Glaciology*, 2, 105–110, 1989.
- Uchida, T., K. Kamiyama, Y. Fujii., A. Takahashi, T. Suzuki, Y. Yoshimura, M. Igarashi and O. Watanabe, Ice core analyses and borehole temperature measurements at the drilling site on Asgardfonna, Svalbard, in 1993. *Memoirs of National Institute of Polar Research. Special issue*, 51, 377–386, 1996.