

EXTRACTION OF AIR BUBBLES IN ANTARCTIC ICE
CORE SAMPLES AND DETERMINATION OF
METHANE CONCENTRATION (ABSTRACT)

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In the polar region, during the process of snow-firn-ice transition, the air in the snow is isolated from the atmosphere and enclosed in the ice as bubbles. The trapped air is expected to contain trace gases which represent the atmospheric concentrations at the time of ice formation. In order to study the change of the chemical state of the atmosphere and the climate in the past, we have initiated the analysis of trace gases in Antarctic deep ice core samples.

An ice core sample was cut into several pieces after the removal of surface layer (1 cm) in the cold room at -20°C in NIPR. About 100 g of ice was placed in a greaseless glass flask which was sealed with a Viton O-ring and equipped with a glass-Teflon valve. The flask was first evacuated with the ice kept at dry ice temperature, then the valve was closed and the ice was thawed. After shaking the flask, the thawed water was refrozen quickly at liquid nitrogen temperature, leaving the dissolved air and trace gases (at equilibria at 0°C) trapped in the ice. The released air was dried by passing through a cold trap at -100°C and transferred into a pre-evacuated stainless steel sample loop or small flask by using an all-stainless steel bellows pump. The extracted gas was analyzed with a gas chromatograph equipped with a flame ionization detector for methane and a mass spectrometer for other gases. The correction was made for the unavoidable and reproducible contamination of trace amount methane from the stainless steel bellows in the pump. The amount of air and trace gases remaining in the refrozen ice was also taken into account.

The averaged methane concentration in the ice core drilled in 1984 at Mizuho Station, was found to be 0.75 ± 0.02 ppmv at 330 m depth, which has been estimated to be about 3600 years old. This value is less than half of the present atmospheric concentration observed at Syowa Station in Antarctica. Since a number of horizontal cracks are found in the core samples, we are trying to estimate the effect of modern air contamination after the drilling by means of analyzing other components in the bubbles.

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