

DEVELOPMENT OF A SIMPLE SYSTEM FOR TOTAL GAS  
EXTRACTION AND MEASUREMENT OF POLAR  
ICE CORES (ABSTRACT)

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The total gas content in polar ice cores is considered a good indicator of surface elevation of the past ice sheet, and it has been measured intensively with the cores from Greenland and Antarctica (*e.g.* D. LAYNAUD and C. LORIUS: *Isotopes and Impurities in Snow and Ice Symposium* (IAHS Publ., No. 118), 326, 1977).

A conventional system to measure the total gas content was demonstrated by C. C. LANGWAY, Jr. (*Physics of the Movement of the Ice* (IASH Publ., No. 47), 336, 1958). The gas is released by melting the sample in kerosene and is introduced into a gas burette to measure its volume. The system is simple, inexpensive and light so that it has been widely adopted in particular for the field use. With this method, however, gross error of the measurement is rather large, which is caused mainly by the reading error of the burette and the error in the amount of air dissolved in the melt (D. RAYNAUD: *The Climatic Record in Polar Ice Sheets*, ed. by G. de Q. ROBIN, Cambridge Univ. Press, 79, 1983).

An ice core of 700 m long was recovered, in 1983 and 1984, at Mizuho Station, East Antarctica by the 24th and 25th Japanese Antarctic Research Expeditions. Because of the drilling technique, however, quite a number of horizontal fine cracks with spacings of about 2 to 5 mm had been formed by the time the core was pulled out to the surface (M. NAKAWO and H. NARITA, *Mem. Natl. Inst. Polar Res.*, Spec. Issue, **39**, 141, 1985). Since a sample for the measurement of total gas content has to be cut out from the core so as to avoid the cracks, the sample becomes only several grams in weight. With samples of this limited size, the measurement error becomes relatively large.

A new system, hence, was developed with which the total gas content can be measured more accurately. With this system, the gas is extracted by crushing the sample under vacuum, and the total gas content is obtained by measuring the pressure increase, caused by the gas release from the sample. The system allowed to measure the total gas content with higher precision of one order of magnitude than the conventional system.

Another advantage of the new system lies in that no melting takes place during the gas extraction and the measurement. It is possible, hence, the collected gas can be subjected to the gas composition analysis, which is not allowed for the gas by the conventional system, because the gas composition would change through the melting of the sample, in particular soluble gases in water such as CO<sub>2</sub>.

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