

ICE-WEDGE FORMATION IN SEYMOUR ISLAND  
(MARAMBIO ISLAND), ANTARCTIC  
PENINSULA REGION (ABSTRACT)

Takeei KOIZUMI<sup>1</sup> and Masami FUKUDA<sup>2</sup>

<sup>1</sup>*Department of Geography, Tokyo Gakugei University,  
1-1, Nukuikitamachi 4-chome, Koganei 184*

<sup>2</sup>*Institute of Low Temperature Science, Hokkaido University,  
Kita-19, Nishi-8, Kita-ku, Sapporo 060*

The depth of permafrost, defined as continuous, in the upper terrace in Seymour Island (Marambio Island) near James Ross Island in the Weddel Sea, exceeds 180 m. In continuous permafrost regions in Arctic and Antarctic regions, ice-wedge is a common feature. Ice-wedge is a wedge-shaped ground ice developed into the frozen ground. The origin of ice-wedge is frostcracking caused by thermal contraction in cold environment. In the wintertime, the upper part of frozen ground is cooled to  $-30^{\circ}\text{C}$  or lower temperature. Then the frozen ground tends to shrink and large shear stress causes cracks due to fracture of the frozen layer.

In spring and summer, melt water percolates into open cracks and *in-situ* freezing takes place. Repeated cycles of crack development and melt water during the winter months cause the ice to grow into the frozen ground. The severe winter coldness and the warm summer melting ice account for the formation of ice-wedge. The characteristics of ice-wedge were studied by excavation of frozen ground using the rock breaker and the boring machine at three different locations on the upper terrace (+200 m above sea level).

The vertical profile of ice-wedge shows it is 180 cm deep and 40 cm wide at the top. Compared with ice-wedge in Arctic regions, ice-wedge in Seymour Island is smaller than the latter. Ice structure of ice-wedge with oriented air bubbles in it is clearly visible. The high salt concentration is observed by the chemical analysis of melt water. Especially concentration of NaCl is half sea water.

Ice-wedge has grown into the Tertiary bedrock. Formation of new frost cracks was monitored by changing the distance between two poles over the ice-wedge head. Widening of cracks by 2 mm was observed in midwinter. This observation implies the ice-wedge formation is active under the present climatic conditions. However, the water content in the upper active layer is very small and a little water is supplied during the summer season. Thus, the growth rate of ice-wedge is lower than that in Arctic regions. The age of ice-wedge is estimated as older than 10000 years based upon the comparison with those in Arctic environment.

*(Received March 31, 1989; Revised manuscript received May 10, 1989)*