東南極ドロンニングモードランドの氷下環境のレーダ診断
- 最古の氷の掘削地点のサイト調査 -

藤田秀二 [1]、P. Holmlund[2], K. Matsuoka [3], 榎本浩之 [4,1], 福井幸太郎 [1,*], 中澤文男 [1], 杉山慎 [5], S. Surdyk[1]
国立極地研究所
ストックホルム大学
ノルウェー極地研究所
北見工業大学
北海道大学低温科学研究所
**現在、立山カルデラ砂防博物館*

Radar diagnosis of the subglacial conditions in Dronning Maud Land, East Antarctica
- a site survey for drilling the oldest ice -

Shuji Fujita[1], P. Holmlund[2], K. Matsuoka[3], H. Enomoto[4,1], K. Fukui[1,*], F. Nakazawa[1], S. Sugiyama[5], and S. Surdyk[1]
[1] *National Institute of Polar Research, Tokyo, Japan*
[2] *Department of Physical Geography and Quaternary Geology, Stockholm University, Stockholm Sweden*
[3] *Norwegian Polar Institute, Tromsø, Norway*
[4] *Kitami Institute of Technology, Kitami, Japan*
[5] *Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan*
*now at: *Tateyama Caldera Sabo Museum, Toyama, Japan*

In order to better understand the spatial distribution of subglacial environments, ground-based radar profiling data were analyzed for a total distance of ~3300km across Dronning Maud Land, East Antarctica. The relationship between geometrically corrected bed returned power $[P^{c}_{bed}]_{dB}$ in decibels and ice thickness H was examined. When H is smaller than a critical value that varies according to location, $[P^{c}_{bed}]_{dB}$ tends to decrease relatively smoothly with increasing H, which is explicable primarily by the cumulative effect of dielectric attenuation within the ice. However, at locations where H is larger than the critical H values, anomalous increases and fluctuations in $[P^{c}_{bed}]_{dB}$ were observed, regardless of the choice of radar frequency or radarpulse width. In addition, the amplitude of the fluctuations often range 10-20 dB.We argue that the anomalous increases are caused by higher bed reflectivity associated with the existence of subglacial water. We used these features to delineate frozen and temperate beds. Approximately two-thirds of the investigated area was found to have a temperate bed. The beds of the inland part of the ice sheet tend to be temperate, with the exception of subglacial high mountains. In contrast, the beds of coastal areas tend to be frozen, with the exception of fast-flowing ice on the subglacial lowland or troughs. We argue that this new analytical method can be applied to other regions. We also found that a 20-km-wide bed in the subglacial high mountains of an inland plateau near Dome Fuji is frozen, suggesting the existence of very old ice above the bed.

References

Fujita, S., Holmlund, P., Matsuoka, K., Enomoto, H., Fukui, K., Nakazawa, F., Sugiyama, S., and Surdyk, S., Radar diagnosis of the subglacial conditions in Dronning Maud Land, East Antarctica, The Cryosphere Discuss., 6, 1781-1837, doi:10.5194/tcd-6-1781-2012 (http://www.the-cryosphere-discuss.net/6/1781/2012/), 2012. The paper is in press for The Cryosphere.