Metamorphism of layered firn at Dome Fuji, Antarctica: Evolution of relations between Near-infrared reflectivity and the other textural/chemical properties

*Shuji Fujita[1,2], Kumiko Goto-Azuma[1,2], Hiroyuki Enomoto[1,2,3], Kotaro FUKUI[1,7], Motohiro Hirabayashi[1], Akira Hori[3], Yu Hoshina[4,8], Yoshinori Iizuka[5], Yuko MOTIZUKI[6], Hideaki Motoyama[1,2], Fumio Nakazawa[1], Shin Sugiyama[5], Sylviane Surdyk[1], Kazuya Takahashi[6]

1.National Institute of Polar Research, Research Organization of Information and Systems(ROIS), 2.Department of Polar Science, The Graduate University for Advanced Studies (SOKENDAI), 3.Kitami Institute of Technology, 4.Nagoya University, 5.Institute of Low Temperature Science, Hokkaido University, 6.RIKEN, 7.Now at: Takteyama Caldera Sabo Museum, 8.Now at: National Institute for Environmental Studies Center for Global Environmental Research

Evolution of polar firn was investigated at sites at Dome Fuji, to better understand signals of deep ice cores. Using samples from a 4-m-deep pit and a 122-m-deep core, relations between major textural and chemical properties, such as Near-infrared light reflectivity R, density ρ, microwave dielectric anisotropy Δε, and concentration of major ions, were investigated at a depth range of 0 –122 m, with high spatial resolutions. At the near-surface depths, we found: (i) Fluctuations of R , ρ, and Δεare positively correlated; (ii) Δεranges 0.03 –0.07 at depths immediately below the snow surface at ~0.1 m; (iii) These properties of R, ρ, and Δεare not correlated to major ions. With increasing depths during reported phenomena of density crossover, the positive corrlation of R to Δεpersistently remains with a slight decrease. Besides, R becomes weakly negatively correlated to concentration of Na^+ which is the sea salt marker. These facts suggest that textural features of the near-surface depths are preserved in both R and Δεat a depth range immediately below bubble-close-off, being weakly affected by reported softening of ice by Cl- ions. We therefore suggest that optically layerd features in ice cores are directly linked to the metamorphism.

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