A comparison of dust concentration with high resolution analysis and visible strata in the Holocene and Last Glacial Maximum periods from the Dome Fuji ice core, East Antarctica

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The microparticles (dust) in polar ice cores are well-known as an good indicator of terrestrial materials (Fujii et al., 2003; Lambert et al., 2008). Visible stratigraphical analysis is an established technique in ice core study to estimate annual accumulation rates since the 1960s (Takata et al., 2004). We conducted the high time resolution analysis of dust in the Dome Fuji ice core, East Antarctica to study for possible paleoclimatic indications of annual and/or a few year climate variations and several year events as volcanic eruptions in the Holocene and Last Glacial Maximum (LGM). We also present a comparison of high time resolution of dust concentration and visible strata in the Holocene as a warm climate stage and LGM as a cold climate stage, respectively.

We used the Dome Fuji ice core in the Holocene (depth: 129.91-130.23 m, *ca*. 3.6 kyrBP) and LGM (498.85-499.33 m, *ca*. 19 kyrBP) for measurements of dust concentration and visible strata. High-resolution analysis of dust concentration was conducted from 1 to 7 mm interval in thickness in the ice cores. Dust in the samples was measured particle size and concentration as microparticles by a laser particle counter with 9 channels of particle size ranges (MetOne Inc., Model 211) (Fujii et al., 2003). Visible strata were measured with an optical line scanner before conducting dust measurements (Takata et al., 2003; 2004). Measurement resolution of visible stratigraphic analysis was approximately 0.03 mm per pixel.

The mean concentrations of dust were 4.4 ppbv (Min.-Max.: 0.95 ppbv -10.8 ppbv) in the Holocene and 243 ppbv (95 ppbv -691 ppbv) in the LGM, respectively. These values are approximately 55 times greater in the LGM than the Holocene. We found dust concentration variations in the scale less than several-cm depth in the cores. We also found a large dust peak in the LGM core from 499.163 m to 499.168 m in depth, which was remarkable greater in coarse particle (particle size: >0.98 μm) ratio. The peak was suggested some climate and/or environmental event as a volcanic eruption or dust storm.

We found high correlation between dust concentration and visible strata in the LGM period (r=0.57, p<0.01). On the other hands, the correlation between both sides was unclear in the Holocene period (r=-0.07). It was suggested that at least LGM period, dust concentration affected to scattering intensity of visible strata rather than other factors as air bubbles in ice.

References

Fujii, Y. et al., (2003), A 320 k-year record of microparticles in the Dome Fuji, Antarctica ice core measured by laser-light scattering, Memoirs of National Institute of Polar Research, Special Issue, 57, 46-62.

Lambert et al., (2008), Dust-climate coupling over the past 800,000 years from the EPICA Dome C ice ocre, Nature, 452, 616-619.

Takata, M. et al., (2003), Deveopment of an optical scanner for Dome Fuji II ice core project, Antarctic Record, 47, 328-337. (in Japanese with English abstract)

Takata, M. et al., (2004), Stratigraphic analysis of Dome Fuji Antarctic ice core using an optical scanner, Annals of Glaciology, 39, 467-472.