High time-resolution analysis of dust in the Dome Fuji deep ice core, Antarctica: A relationship between dust and calcium ion

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Microparticles (dust) in deep ice cores in polar area are well-known as an indicator of terrestrial materials. Dust concentration variations in deep ice cores depend on variations of dust origin areas and atmospheric transport intensity. Iizuka *et al.* (2004, 2006) reported that the short cycle signals such seasonal to a several years on Na^{+} and Ca^{2+} preserved in the Dome Fuji deep ice core. We conducted the high time-resolution analysis of dust in the Dome Fuji ice core, Antarctica to study for possible paleoclimate indications of a relationship between dust and Ca^{2+}, which are indicators of terrestrial materials, in the Holocene (core depth:294.960 m-295.460 m: 9.6 kyr BP), last glacial maximum (LGM: 540.725 m- 541.250 m: 22.0 kyr BP), interstadial (1011.350 m-1011.850 m: 58 kyr BP), stadial (1122.000 m-1122.473 m: 68 kyr BP), Eemian (1765.500 m-1765.973 m: 131 kyr BP) and glacial (2203.990 m-2204.500 m: 222 kyr BP) periods. Dust concentrations in the ice cores are the lowest in the Holocene samples (mean: 11.6 ppb), secondly in the Eemian samples (15.3 ppb) and the highest in the LGM samples (387 ppb), respectively. Correlation between dust concentrations and non-seasalt (nss) Ca^{2+} concentrations in the cores are the highest in the LGM samples (r=0.91) and secondly in the glacial samples (r=0.82), respectively. But, the correlations were not clear in the Eemian (r=0.13), interstadial (r=0.25) and Holocene (r=0.26) core samples. The nss-Ca^{2+}/dust mass ratios, which indicated the ratio of soluble Ca in dust, were the highest in the Eemian samples (0.20$\pm$0.14: mean$\pm$standard deviation) and the lowest in the LGM samples (0.067$\pm$0.010), secondly in the stadial samples (0.089$\pm$0.059), suggesting that mineral composition of calcium in dust varied in different climate stages. Especially, standard deviation of the mass ratios were much greater in the Eemian and Holocene samples than other samples, suggesting that mineral composition of calcium in dust changed in seasonal to several years scale. On the other hand, it seems that variation of mineral composition of calcium relative stabilized in the LGM samples, because standard deviations of the nss-Ca^{2+}/dust ratio were smaller than in other climate stages.