Mineral dust fluxes over the last 340kyr derived from the Dome Fuji ice core

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Climate changes over the past 340 kyr are preserved in a 1st ice core (2503m length) from Dome Fuji (77º19'S, 39º42'E), Antarctica. In this research, we measured total (dissolved+particulate) concentration of metals in this core and clarified the variation of the concentration and flux of aerosol accompanying the climate change. Focusing on the depth applicable to the terminations, an ice block with about 7cm thickness and 70g mass was cut from the core at 0.5-1kr intervals. In order to collect the particles in a sample completely, a piece of ice was wholly evaporated to dryness in a Teflon vessel and the residue was decomposed by using the microwave acid digestion method with nitric acid and hydrofluoric acid. The sample was finally made to 10ml of 0.1N HNO_3 solution, and the concentrations of Al, Fe, Mn, Ca etc. were measured by ICPMS and ICPES. The total concentration of Al (t-Al) in the core was high in the period of glacial maximum compared with the interglacial. This variation was coincide with the result of particulate Al (p-Al, >0.45μm diameter) from the Dome C core. The t-Al concentrations in the Dome Fuji core were ranged from 3.94 to 276ppb, and the maximum value was more than 2 times larger than that of p-Al in the Dome C core. The result, if it is not due to local variation, indicates that the significant part of Al in Antarctic ice sheet would be fine particles less than 0.45μm diameter. The slopes of the regression line and contribution factors between t-Al and other elements were 0.61 and 94% for t-Fe, 0.014 and 94% for t-Mn, 0.0069 and 91% for t-Ba, 0.0052 and 90% for t-Sr and 0.47 and 86% for t-Ca, respectively. The result indicates these elements in the ice core were mostly originated in crustal materials. Estimated mineral dust fluxes to Dome Fuji were 21.7±11.9 mg m^{-2} yr^{-1} in LGM and 2.56±1.91 mg m^{-2} yr^{-1} in Holocene. These values were comparable to predicted values by a climate model and were approximately three orders of magnitude smaller than the presumed fluxes in the mid-latitude region.

Nitrate-dependent deep subsurface biosphere and nitrite accumulation in an inland fore-arc basin, Japan

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Microbes are widespread in deep subsurface settings and potentially controlling migration of radionuclides from subsurface to near surface environments. However, the evaluation of *in situ* biogeochemical and microbiological characteristics is difficult due to problems associated with access and disturbance during sampling. In addition, microbiological study must be intimately linked to geochemical, lithological, and hydrological characterizations. To overcome these difficulties, we carefully designed a multi-disciplinary drilling program targeting a tectonically stable and lithologically defined inland sedimentary basin in Japan. Boring of whole-round cores from depths down to GL-350 m by using deoxygenated and aseptic drilling fluid was followed by installation of a multi-packer system and various hydrological tests. Geochemical and microbiological characterizations were conducted by using the same core and groundwater samples. It was revealed that nitrite was highly enriched in pore-waters extracted from ~300- and ~350-m deep tuffaceous and muddy sandstones, respectively, where microbial activity for denitrification was at 3.5-3.7 nmol/N_2O/g dry sediment/day, and that based on results from polyphasic analyses (16S rRNA gene sequences and polar fatty-acid profiles), *Pseudomonas* spp. are dominant. Hence, it is evident that subsurface microbes exert indirect controls on radionuclide migration by manipulating the redox state of groundwater.