Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

ACC029-P01 Room:Convention Hall Time:May 26 10:45-11:35

Depth distribution of microorganisms in the surface pit from accumulation area in McCall Glacier, Alaska.

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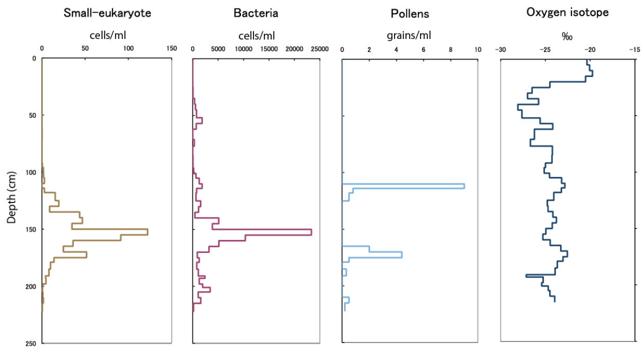
Cold environments, including glacier ice and snow, are known habitats for cold-adapted and psychrophilic microorganisms. Even in accumulation areas, microorganisms can multiply on glacier surfaces, if some melting occur during summer. Therefore, the depth distribution of photosynthesis eukaryote, which propagate on the surface, in an ice core show the location of summer layers and these act as annual markers for ice core dating. On the other hands, recent study show that non-photosynthesis eukaryote (e.g. yeast) also propagate under the snow surface without sunlight and show past melting condition on the glacier. However, ecological information of non-photosynthesis eukaryote is limited. In order to investigate the no photosynthesis eukaryote diversity and relation ship between bacteria in the accumulation area,, because the ecology of accumulation area is more simple than other glacial environment. We had analyzed microbial depth distribution and molecular diversity of microorganisms in surface snow pit in McCall Glacier, Alaska.

We found cercozoa-like small eukaryotes and bacteria are highly concentrated to snow layers from 1.50-1.6 m depth. This layers do not correspond to the summer layers which wind-blown particles (5 kinds of pollens and mineral particle) concentrated by surface melting. These result may indicate that microorganisms are not wind-blown, but also cold-adapted/ psychrophilic species. Furthermore, strong correlation between small eukaryotes and bacteria show that these are ecologically related in glacial habitat.



Keywords: Glacier, Ice core, psychrophilic, Alaska

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Time series analysis of the 800-ka dust records from the EPICA Dome C ice core

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Secular dust records have been hardly paid attention from the viewpoint of Milankovitch theory. In the present study, we address dust records from Antarctica, which may grip a key to the mystery of nonlinear mechanisms for secular climate changes. Dust flux fluctuations have a prominent ˜ 100-ka cycle, which precedes eccentricity cycle as well as changes of ice volume and atmospheric CO_2.

We have analyzed a record of eolian dust from the EPICA Dome C ice core in East Antarctica. This record has some significant features; (a) it covers the past 800-ka, having passed through eight glacial-interglacial climatic cycles, (b) dust peaks with the 100-ka cycle appear during Glacial Maxima, and (c) it has apparently suppressed sawtooth shapes with an exponential change, different from a lot of other records such as ice volume and atmospheric CO_2.

For this dust record, we have performed time series analyses, one of which is for slowly varying components with 10- to several 100-ka periods related to Milankovitch cycles, and another is a high frequency component analysis paying attention to surface parts of the ice core associated with sources and destinations of the dust. The low frequency analysis shows that the dust record reflects well Milankovitch cycles, and there exists the dominant 100-ka signal as can be found in other geologic records. Moreover, when the dust record is displayed in the logarithm, it reveals well apparent sawtooth shapes, which may suggest accumulation effects of dust on climate change. From the high-frequency analysis, periodicities of about 2450- and 4500-yr are found as well as about 300 to 500-yr cycles. Comparing these with records from high latitudes in the northern hemisphere we can evaluate whether the fluctuations are global or local.

Keywords: Milankovitch theory, glacial-interglacial cycle, eolian dust

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Transient climate simulation of Last Millennium using integrated Earth System Model

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Transient climate simulation over last millennium (850AD-1850AD) was performed using an integrated earth system model, MIROC-ESM. The model is a successor version of AR4-participated model, which has improved radiation code, 80-layer atmosphere including stratosphere, aerosol transportation model SPRINTARS, dynamic vegetation component SEIB-DVGM, ocean eco-system and improved snow/ice component. Variation in LAI (Leaf Area Index) is considered as a feedback from vegetation component to climate.

The experiment was basically designed following PMIP3 (Paleoclimate Model Intercomparison Project phase 3) protocol: solar- and volcanic forcings and orbital parameters are given, while CO2 concentration is predicted by the carbon cycle component of the model. Integration was started from Pre-industrial (1850AD) initial values, and spinned-up with 850AD condition.

Since the model has a capability of predicting transitional behavior of vegetation under changing climate, time lags between volcanic forcing and response of vegetation and climate were investigated. Predicted CO2 concentration is rather stable, which agrees with the reconstruction and shows robustness of the carbon cycle (and vegetation) component.

Keywords: Last MIllennium, General Circulation Model, Land system model, Dynamic vegetaion model