Variation of stable carbon isotope ratio of aromatic diterpenoids during Paleogene time in Northeast Japan

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The Paleogene terrigenous sedimentary rocks from MITI Sanriku-oki borehole drilled in Pacific Ocean offshore Northeast Japan and Tertiary coal and coaly shales exposed in Sakhalin and Japan generally contain aromatic diterpenoids. Retene and diaromatic totarane are the most common compounds among various aromatic diterpenoids, which are derived from resinous materials of gymnosperm (C_3 plants). Time series variation of compound specific $\delta^{13}C$ of retene, diaromatic totarane, and plant wax-derived *n*-alkanes (C_{27}, C_{29}, and C_{31}) during Paleogene to Neogene time was determined in the present study to investigate the environmental change on land during Paleogene time.

The $\delta^{13}C$ of n-alkanes ranging from –34 to –28‰ do not show any significant variations with geologic age during Paleogene time. However, the $\delta^{13}C$ of retene and diaromatic totarane showed comparatively wide range of variation after Cretaceous. Their $\delta^{13}C$ gradually decrease from –30 to -25‰ during Paleocene and early Eocene time, and increase from –30 to –25‰ during middle Eocene to late Eocene time. The samples of middle Eocene are characterized by the highest $\delta^{13}C$ more than -25‰. The difference of $\delta^{13}C$ between *n*-alkanes and aromatic higher plant biomarkers are the highest in the samples of middle Eocene time. Several environmental factors can affect the $\delta^{13}C$ of higher land plants. We concluded that higher $\delta^{13}C$ of resinous compounds in middle Eocene plants are due to much utilization of dissolved CO_2 for biosynthesis of their resins.

According to paleoenvironmental study based on various microfossils (JNOC, 1998), the middle Eocene sedimentary rocks of MITI Sanriku-oki were formed in deltaic to shallow marine environment. Although outcrops of Paleogene sedimentary rocks are limited in northeast Japan, the $\delta^{13}C$ of resinous compounds suggest that swamp and marsh were widely distributed on land in Eocene time. This is consistent with that Asian coals and coaly shales, including Japanese ones, were mostly formed in Eocene time. Non-marine sediments on land are often difficult to be preserved as strata since they are easy to be eroded due to tectonics. The $\delta^{13}C$ of higher plant biomarkers in deltaic and shallow marine sediments can provide information of vegetation and geography on land. Our results in the present study support that swamp and marsh were widely distributed in south western margin of the Eurasian Continent during Eocene time.

References

Japan National Oil Corporation (JNOC) (1998) Report on the MITI Sanriku-oki drilling, p.48. (in Japanese)

Spatial variability of natural radionuclides, ^{7}Be and ^{210}Pb in the Antarctic ice sheet

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Introduction

Study of the snow accumulation rate is one of the basic requisites for understanding of the surface mass balance on the Antarctic ice sheet. Here we show and discuss the regional distributions of ^{7}Be (half-life 53days) and ^{210}Pb (half-life 22yrs) concentrations in the ice sheet along the study route from the coast, S16 (69°02'S, 40°04'E, 591 m a.s.l.), to Dome Fuji station (77°19'S, 39°42'E, 3810 m a.s.l.), 1000 km inland in the Antarctica.

Results

The concentrations of ^{7}Be in the snow cover along the study route were high in the coastal region, 0.6-2.0 km a.s.l., and in the inland plateau region, 3.6-3.8 km a.s.l. (Figure 1). The depth profiles of ^{210}Pb in the firn layer of these two regions mostly obeyed to the theoretical radioactive decay. However, the profiles obtained in the katabatic wind region, 2.0-3.6 km a.s.l., have significant fluctuation.

Conclusions

These results suggest that the ice sheet at the coast and the inland plateau of the Antarctica accumulate sequentially in circumstance of relative calm wind but the accumulation at the intermediate, steep slope zone is largely disturbed by severe katabatic wind.

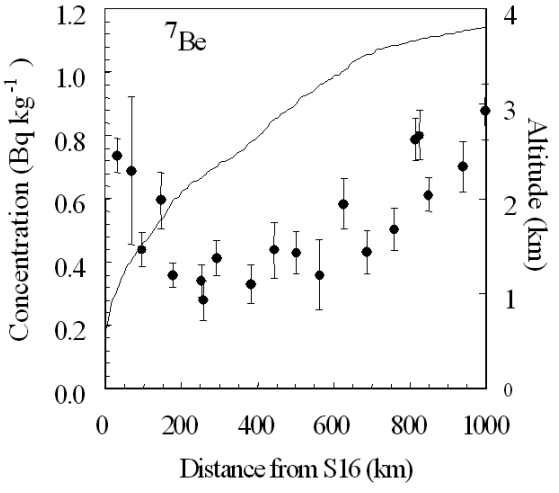

Figure 1: The distribution of the concentrations of ^{7}Be in snow cover along the study route. Error bars are given for each point. Variation of the altitude is also indicated by the solid line.