Cosmogenic ^{10}Be production during low sea-level periods of ice ages in underwater rocks from the Tugaru Strait, Japan

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Introduction

The formation of land bridge during ice age is one of the key issues in understanding post-glacial movement of human being in the world. The land bridges between Japan and the Eurasian continent including Korea and Far East Russia are important in studying the migration of people in the Japanese islands, and of origination and spread of Paleolithic and Neolithic culture in East Asia. Our preliminary study is designed to determine the feasibility of using cosmogenic nuclides as a dating tool in the investigation of land bridges between the continent and Japan during the past glacial ages.

Results

Cosmogenic nuclide production of ^{10}Be and ^{26}Al was investigated using underwater rock samples obtained from the Tsugaru Strait between Honshu (Aomori) and Hokkaido (Hakodate), the two main islands of Japan. Sedimentary rock samples from depth (water + rock) range between 3,760 g cm^{-2} and 6,140 g cm^{-2} were obtained. The ^{10}Be concentrations obtained from this depth range were determined to be from 8 x 10^4 and 8 x 10^3 atoms/g SiO_2. The ^{10}Be results are much greater than those of the steady state underground production at the relevant depths, indicating the effect of pre-exposure by neutron spallation during the past glacial period. Especially, a sample having a shallow rock dpeth, not the current water depth, indicated relatively high ^{10}Be concentration. This confirms that pre-exposure by neutron spallation with respect to sea level change can be detected by measuring cosmogenic nuclide concentration from underwater rocks. The measured ^{10}Be data were simulated using a model calculation, which has been developed by parameters of sea level change, uplift rate, and erosion rate of this study. This model could be an essential tool in understanding cosmogenic nuclide production underwater for exposure dating applications.

Conclusions

The data of our preliminary study confirm that the investigation of land bridges of the world can be feasible using underwater production of cosmogenic nuclides, and this study will provide new guidance in further investigation of land bridge studies using cosmogenic nuclides.

Acknowledgement: This study was supported in part by JSPS Grant-in-Aid (#12874064).

Subseafloor microbial diversity in the Peru Margin (ODP Leg. 201)

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The subseafloor environment has been proposed to be the largest biosphere on Earth, as based on estimates of cells in marine sediment cores recovered by the Ocean Drilling Program (ODP). However, it is not well-known what kinds of microorganisms are present, how do their distributions relate with geological settings, and how do their metabolic activities impact the global geochemical cycles. The ODP Leg. 201 took place in the eastern equatorial Pacific and Peru coastal margin in 2002, and was the first expedition in ODP history targeted mainly on microbiology and biogeochemistry in the subseafloor biosphere.

In this presentation, we show the vertical profile data of the results from culture-independent molecular ecological surveys in ODP sediment core columns collected from the two drilling sites, 1227 and 1230, located on the land slope of the accretionary wedge in the Peru Trench. The sediment cores recovered from Site 1230 contained high organic carbon and methane, whereas those from Site 1227 contained low concentrations of these chemical components. Bulk prokaryotic nucleic acids were extacted and purified from each sediment, and 16S rRNA genes (rDNA) were amplified by PCR using domain specific primers. The analyses of rDNA sequences of clone libraries, quantitative-PCR for archaeal and bacterial rDNA, and T-RFLP fingerprint analysis revealed the previously unknown vertical distribution and diversity of Archaea and Bacteria in two geologically discrete subseafloor environments. On the basis of the results from molecular microbiology and biogeochemistry of ODP Leg. 201, the ecological significance of subseafloor microbial life will be discussed.