

The Changes of Sedimentation Rates Based on Tephrochronology in the Late Pleistocene Sediments off Joetsu, Japan

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Introduction

The sedimentation rate of the muddy sediment distributed over a submarine surface part is calculated using time markers contained in a core sample, such as tephra, the value of the ^{14}C and a horizon of crowd change of a microfossil, in many cases. For example, Suganuma et al. (2006) computed sedimentation rate from the eruption age value of tephra using the core of the northwestern Pacific Ocean. On the other hand, in Katayama and Itaki (2007), spatial distribution of sedimentation rates was estimated in the large area in the eastern Japan Sea off Akita, using depths of reflectors on 3.5 kHz sub-bottom profiler (SBP) records and estimated ages of the reflectors. Clarifying spatial distribution and its changes of sedimentation rate enable us to know change of the mass transfer system by environmental change. In this research, sedimentation rates were calculated from the eruption age value of tephra for 7 core samples with calm depositional environment extracted in the Joetsu basin circumference region.

Study area

The Joetsu basin located in the east of the Toyama trough is composed of various kind of geomorphology such as Umitaka spur, Joetsu knoll, submarine canyon. There is methane hydrate in the top part of Umitaka spur and Joetsu knoll (Matsumoto et al., 2011). The core samples extracted at such various geographical feature places consists of muddy sediments, such as sediments carried by the river, Kosa and a living thing. Since methane hydrate was inserted into the sediment as for the core extracted by methane hydrate area, most sedimentation structures do not remain and it was not able to identify a tephra layer. The cores extracted at the lower part of a slope or a submarine canyon contains the slump sediments and the landslide sediments, tephra in these cores were referred to lack or rework. In this research, 7 cores with calm depositional environment are used.

Calculation and the variation pattern of sedimentation rate

The sedimentation rate between tephra was calculated from the eruption age of the adjacent two tephra. For all 7 cores, the sedimentation rate between tephra layers was found and the variation pattern was clarified. The variation pattern of sedimentation rate was divided into four groups as compared with the oxygen isotopic curve. For the group 1, its sedimentation rate increased from MIS3 to MIS2 and decreased at MIS1. The group 2, unlike the group 1, has a high sedimentation rate at MIS1. For the group 3, its sedimentation rate decreased from MIS3 to MIS2 and increased at MIS1. For the group 4, its sedimentation rate increased from MIS2 to MIS1.

Relation between change of sedimentation rate and submarine geomorphological settings

By comparing sedimentation rate between cores, the flux of the sediment was discussed. The group 1 is the cores extracted by the physiographic rise. Sediment supply from land increased the low sea level periods and decreased the high sea level periods. Therefore, sedimentation rate of the group 1 changes depending on the quantity of sediment from land. It is thought that the group 2 has sediment supply from land and a continental shelf slope since it is located in the lower part of a continental shelf slope. The group 3 is the core extracted in the physiographically low place. In MIS1, since sedimentation rate is high, it is thought that sediment supply from the surrounding slopes. Since the group 4 was the cores extracted by the submarine canyon, it is thought that sedimentation rate increased by sediment supply from the continental slope at MIS2 and by sediment supply from land at MIS1. Moreover, change of the sedimentation rate which suggests that the methane hydrate decomposed at MIS2 was not recognized.

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