

Methane seep event recognized from microfossil assemblages of the Torigakubi Spur

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The Torigakubi Spur offshore Joetsu in the eastern margin of the Japan Sea has a developed gas chimney mound with rough surface spreading in the east west direction. This study sample is two piston cores (core length: 4-5 m) taken at 1K17 cruise from the east and west (water depth; 550 to 600 m) of the central part of methane seep area observed on the Torigakubi Spur many times. PC 1704 in the west is located on the mound slope, PC 1706 in the east is on the mound, both located outside the area of the methane seep or gas chimney. These age models were created based on the boundary ages (A/B; 8 ka, B/C; 16 ka) in the A to C diatom zones and the AMS ¹⁴C age using planktonic foraminifera. Among them, unique benthic foraminiferal fossils (*Rutherfordoides* sp.) associated with methane concentration were confirmed with the abundance of suboxic species, from the core depth of 340 cm of PC 1706 collected in the eastern part of the chimney center on the methane seep mound. The ¹⁴C age value of planktonic foraminiferal shells extracted from the same sample was estimated to be 23.28 ka. Furthermore, over the upper 320 to 240 cmbsf, *Rutherfordoides* sp. continues to be distributed at a low frequency among poor number of benthic foraminifera assemblages characteristic of the Last Glacial Maximum (LGM) stage. These benthic foraminifera mostly have tiny specimens with a long diameter of less than 100 μm. *Rutherfordoides* section recognized in PC 1706 corresponds to 24-20 ka from the ¹⁴C age and is consistent with the distribution of the cold diatom zone (C zone). Therefore, the methane seep area is estimated to spread by several hundred meters with the sea level drop on the survey chimney mound of the Torigakubi Spur. These occurrences are similar to the results of the Umitaka Spur where the relationship between negative anomalies with carbon isotope and *Rutherfordoides* species is discussed. On the other hand, PC 1704 collected from the mound slope where crumbling cliffs are frequently observed in the periphery gave some different sedimentation ages from PC 1706 on the mound top. Especially, the sedimentation rate of the upper (younger) than 96 cmbsf where the ¹⁴C age (22.04 ka) was calculated is three times or more slower than the lower (older) one in PC 1704. Such an anomaly low sedimentation rate is expected to be due to the formation process of a steep slope accompanying the growth of hydrate mound during LGM.

Keywords: Torigakubi Spur, foraminifera, methane seep