Chikyu Shallow Core Program (SCORE)

Proposal Cover Sheet

Received date	08 Nov. 2021
Proposal No.	007-R3
New / Revised	Revised

(Above For Official Use Only)

Basic Information

Title:	Impacts of active gas hydrate system on the near-seafloor environment in Tsushima Basin
Keywords: (5 or less)	Tsushima Basin, Gas hydrate, Gas chimney, Stability of gas hydrate, Methanogenesis
Area:	Southeastern Tsushima Basin, Japan

Lead Proponent:	Hitoshi Tomaru
Affiliation:	Department of Earth Sciences, Chiba University
Address:	1-33 Yayoi-cho, Inage-ku, Chiba 263-8522, Japan
Phone:	+81-43-290-2862
E-mail:	tomaru@chiba-u.jp

☒ Permission is granted to post the coversheet/site table on www.j-desc.org

Scientific Objectives (250 words or less)

Gas hydrate forms under the low temperature-high pressure condition with abundant hydrocarbons and ubiquitously deposits on the continental margins. Therefore, the formation of gas hydrate causes solidification of marine sediment as well as accumulation of methane. In contrast, the dissolution of gas hydrate weakens the sediment structure and releases a considerable amount of methane, which results in the drastic change of seafloor-subseafloor sedimentological/biogeochemical environments. The gas hydrate has, of course, been a topic of natural gas resources. However, such environmental impacts are also an essential issue in earth sciences.

Recent expeditions on the southeastern Tsushima Basin found a distribution of numerous gas chimney structures below the seafloor. These were formed by the strong and continuous upward flux of methane and other organic products thermogenically/biogenically generated in deeper sediments, in which various

biogeochemical reactions are also active. These are often accompanied with mound structures formed by large gas hydrate growth and/or collapsed topographies caused by local gas hydrate dissolution. In addition, the sea-level fall during the late Quaternary certainly reduced the seafloor pressure. It triggered the dissolution of gas hydrate followed by a massive methane emission, significantly impacting on the seafloor topography, benthic macro/micro-biological communities, and steady-state material (water, dissolved species, etc.) migration through the gas chimney. This proposal aims at 1) elucidating how the gas hydrate system (amount, distribution, stability, etc.) has changed in response to the global environmental changes and 2) understanding the linkages between shallow and deep biosphere responsible for the gas-accumulated system.

Proposed Sites

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)	Primary or alternate
TBGH-1	36° 05.9739'N 132° 06.3472'E	1168	100	Primary
TBGH-2	36° 05.2160'N 132° 05.9910'E	1135	100	Primary (Reference)
TBGH-3	36° 06.2394'N 132° 06.6960'E	1170	100	Alternate

[Note: Only shallow-penetration coring (about <100 m below seafloor) is available.]

Non-standard Measurements

Because cores are expected to include a large amount of gas hydrate at some intervals, core surface temperature must be measured with an infrared camera on the core cutting area soon after core retrieval (before any sampling). Some gas hydrate-bearing intervals should be collected before X-ray CT and stored in liquid nitrogen or deep freezer. Geophysical/geotechnical analyses (cone penetration test, shear strength measurement, etc.) are required to be conducted onboard as well as routine samplings

of sediment, gas, interstitial water, etc. including samples for microbiological analyses because the dissolution of gas hydrate deforms the sediment structure and changes the geochemical characteristics of sediment, gas, interstitial water from those in the subseafloor condition.

A downhole temperature profile is requested to determine the stability field of gas hydrate and to assess the activity of microbes. Therefore, *in situ* temperature should be measured using APCT-3 sensor equipped with HPCS core shoe.

Microbial contamination assessment is also requested using perfluorocarbon tracers and/or fluorescent microsphere beads at some selected depth interval (or hole).

[Note: Please describe above any non-standard measurements needed to achieve the proposed scientific objectives. Standard measurements are X-ray CT, Multi-sensor core logger, and split surface image.]

List previous drilling in area

N/A

List potential hazards and preferred weather window

Methane concentration in the target sedimentary sequence is high and the temperature-depth condition is well within the gas hydrate stability, gas hydrate may occur. Although free-gas accumulation is often encountered just below the base of gas hydrate stability (~140 mbsf at TBGH-1), this proposal does not penetrate it.

Proponent List

First Name	Last Name	Affiliation	Country	Expertise
Hitoshi	Tomaru	Department of Earth Sciences, Chiba University	Japan	Geochemistry
Katsunori	Yanagawa*	Faculty of Environmental Engineering, The	Japan	Microbiology

		University of Kitakyushu		
Naoto	Ishida	Center for Advanced Marine Core Research, Kochi University	Japan	Stratigraphy, Physical property
Haruka	Takagi	Department of Earth Sciences, Chiba University	Japan	Stratigraphy, Micropaleontology

[Note: For proponents who do not have J-DESC memberships, please put an asterisk (*) AFTER his/her last name.]