

---

# Press Releases

---



April 23, 2015  
JAMSTEC

## **Changes in Benthos Community on Artificial Hydrothermal Vent Field Produced by Seafloor Drilling -Emergence of New Habitat with Migration and Reproduction of Deep-sea Benthos-**

---

### **Overview**

Dr. Ryota Nakajima, Postdoctoral Researcher, Department of Marine Biodiversity Research at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Asahiko Taira, President) and his team monitored the benthic ecosystem of hydrothermally active areas in the Okinawa Trough at 1,060m depth, where scientific drilling was performed by the Deep Sea Scientific Drilling Vessel *Chikyu* on September 2010. The monitoring started before the drilling operation and lasted 40 months thereafter. As a result, it elucidated impacts of habitat alteration on hydrothermal vent communities and the primary processes concerning the formation of deep-sea hydrothermal-vent ecosystems.

Changes in hydrothermal vent communities depend on variations of physical and chemical properties in hydrothermal fluid flow. However, case studies that recorded these processes had been previously limited to observational data of faunal assemblages resulting from seafloor volcanic activities. Based on quantitative observation and evaluation, this study revealed the mechanisms of formation of new deep-sea benthic communities around new artificial hydrothermal vents by migration and recruitment following changes in the seafloor environment, as a result of alterations in the flow of hydrothermal fluid following drilling operations.

This study was carried out jointly by Department of Subsurface Geobiological Analysis and Research (D-SUGAR), the Research and Development Center for Submarine Resources, and the Center for Deep Earth Exploration (CDEV) at JAMSTEC, and was partly supported by the Environment Research and Technology Development Fund (S9 Project).

The results from this study was published in *PLOS ONE*, an online scientific journal, on April 23<sup>rd</sup> (JST).

Title : Post-drilling changes in seabed landscape and megabenthos in a deep-sea hydrothermal system, the Iheya North field, Okinawa Trough

Authors: Ryota Nakajima<sup>1\*</sup>, Hiroyuki Yamamoto<sup>2</sup>, Shinsuke Kawagucci<sup>2, 3, 4</sup>, Yutaro Takaya<sup>2</sup>, Tatsuo Nozaki<sup>2, 5</sup>, Chong Chen<sup>6</sup>, Katsunori Fujikura<sup>1</sup>, Tetsuya Miwa<sup>2, 7</sup>, Ken Takai<sup>2, 3, 4</sup>

Affiliation: <sup>1</sup> Department of Marine Biodiversity Research, JAMSTEC, <sup>2</sup> Research and Development Center for Submarine Resources, JAMSTEC, <sup>3</sup> Laboratory of Ocean-Earth Life Evolution Research (OELE), JAMSTEC, <sup>4</sup> Department of Subsurface Geobiological Analysis and Research (D-SUGAR), JAMSTEC, <sup>5</sup> Department of

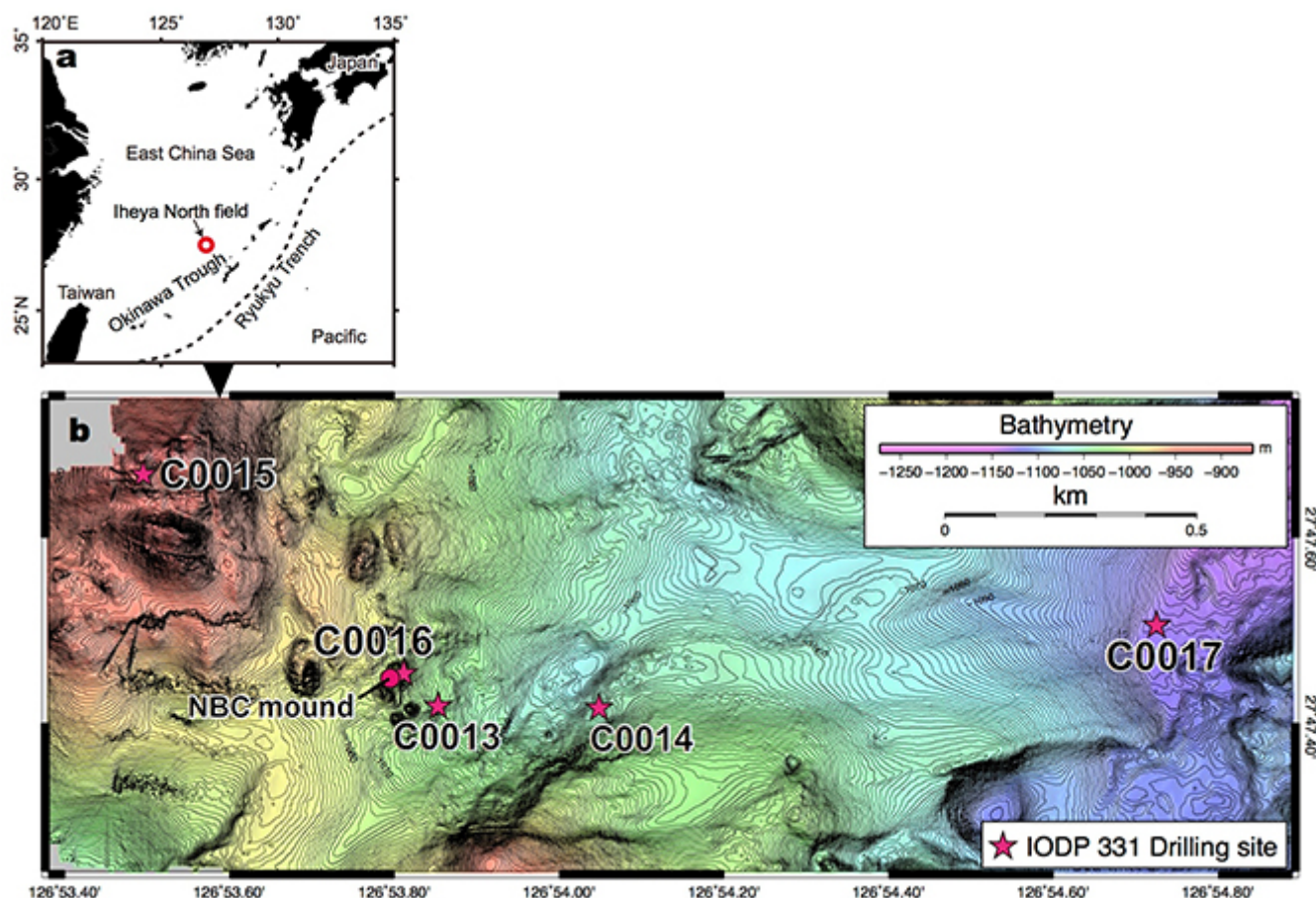


Figure 1: Iheya North field in Okinawa Trough. Shown here are North Big Chimney (NBC) mound, an activity center of the vent field and drilling sites during the IODP 331 Expedition.

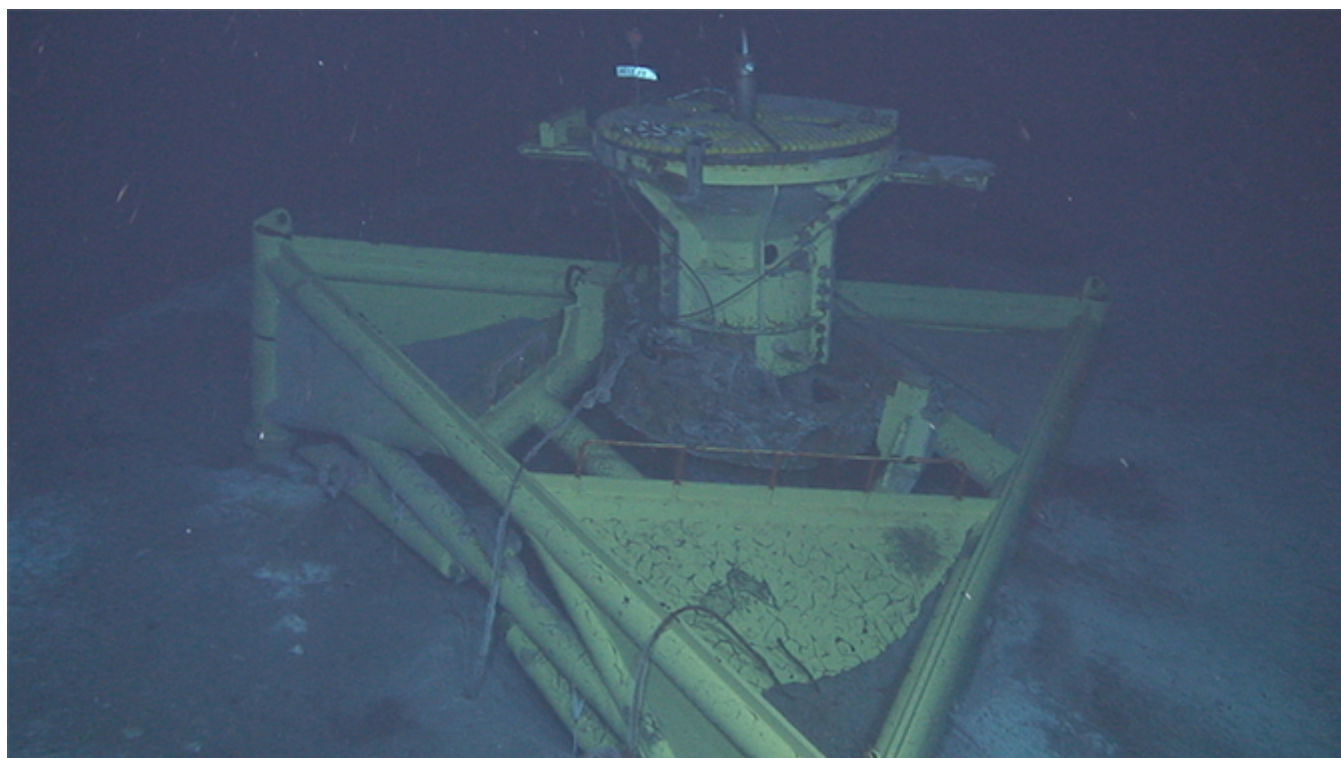




Figure 2: Equipment of artificial hydrothermal vents

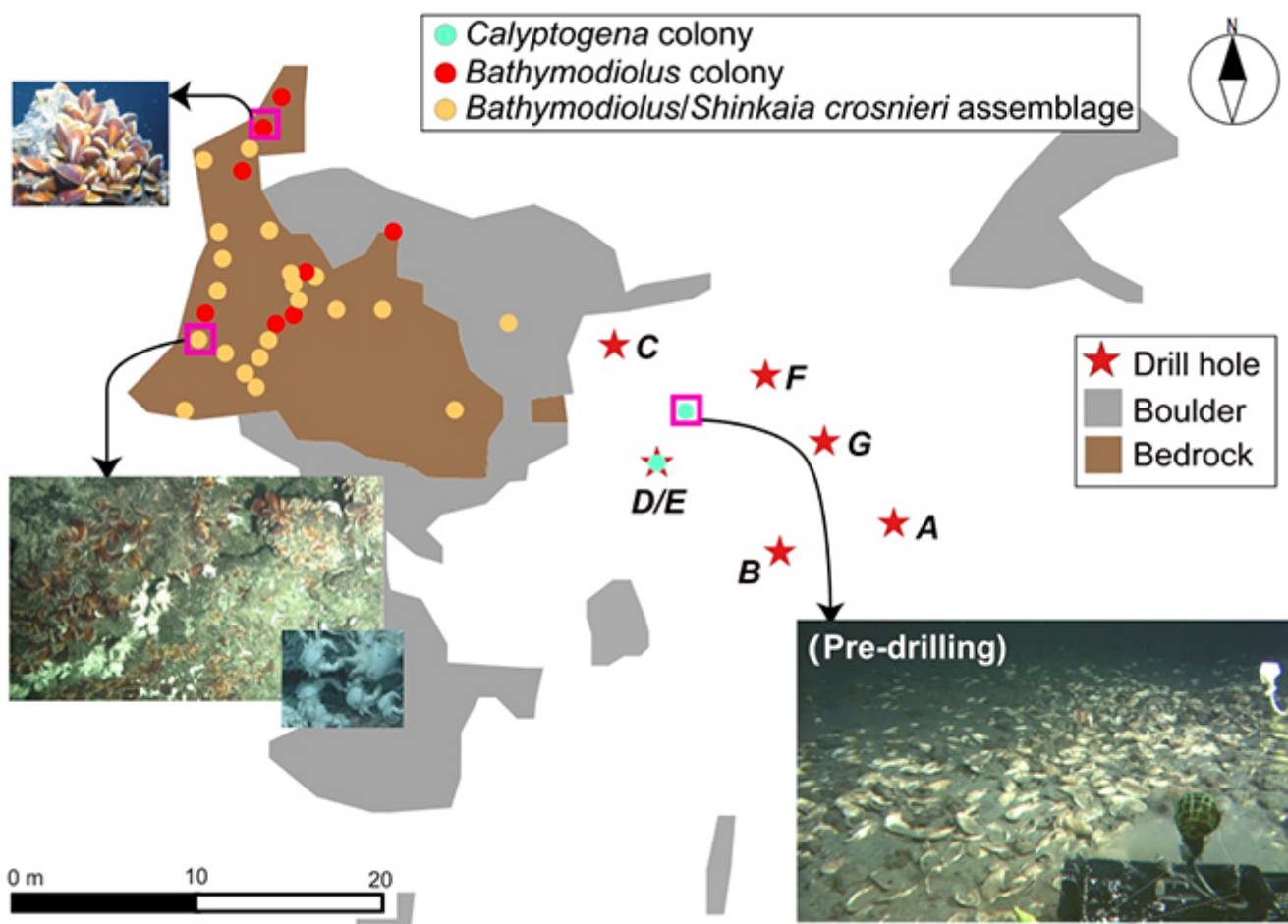


Figure 3: Habitat map around the drilling site C0014. Before the drilling operation, the seafloor around the drill holes A-G were covered with soft sediments with distribution of *Calyptogena* colonies (mostly dead) as shown in the bottom right of photo. Moving more than 20km toward west from the drilling site, the seafloor bedrock increases, and benthos living near the hydrothermal vents such as *Shinkaia crosnieri* and *Bathymodiolus* mussels are inhibited there.

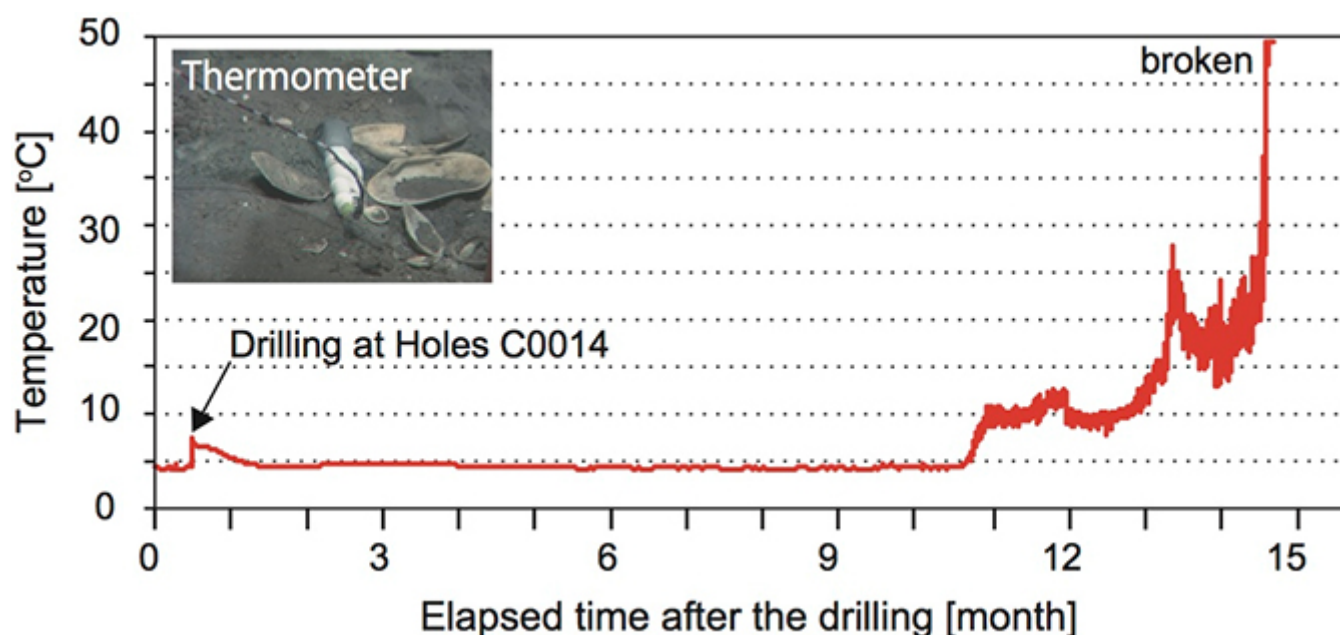


Figure 4: Temperature changes around the artificial hydrothermal vents (quoted with modification from Kawagucci et al. 2013. Inserted with permission of ©Wiley and Sons)

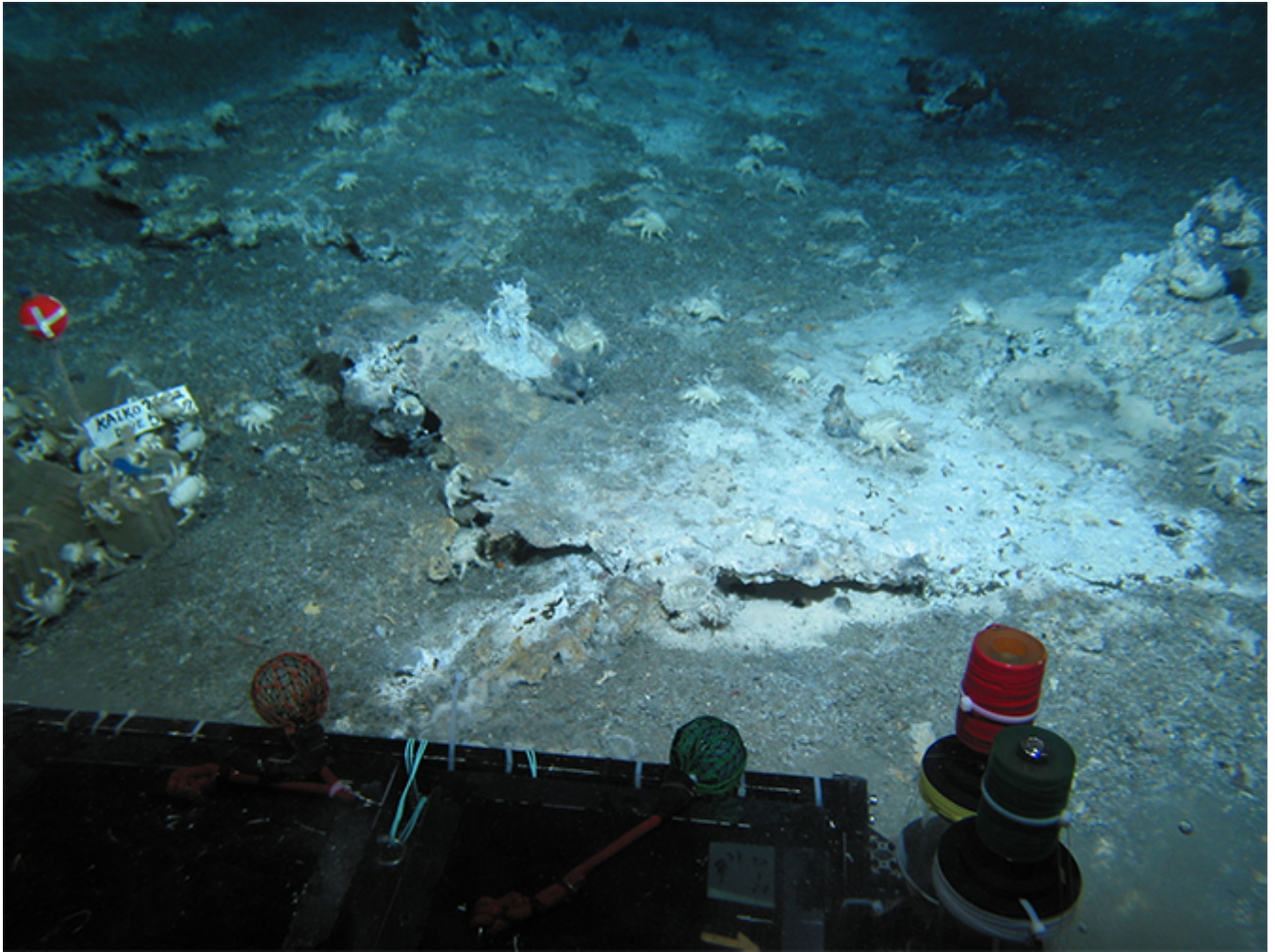


Figure 5: The soft sedimentary seafloor was hardened with fissures after 38 months of the drilling operation.



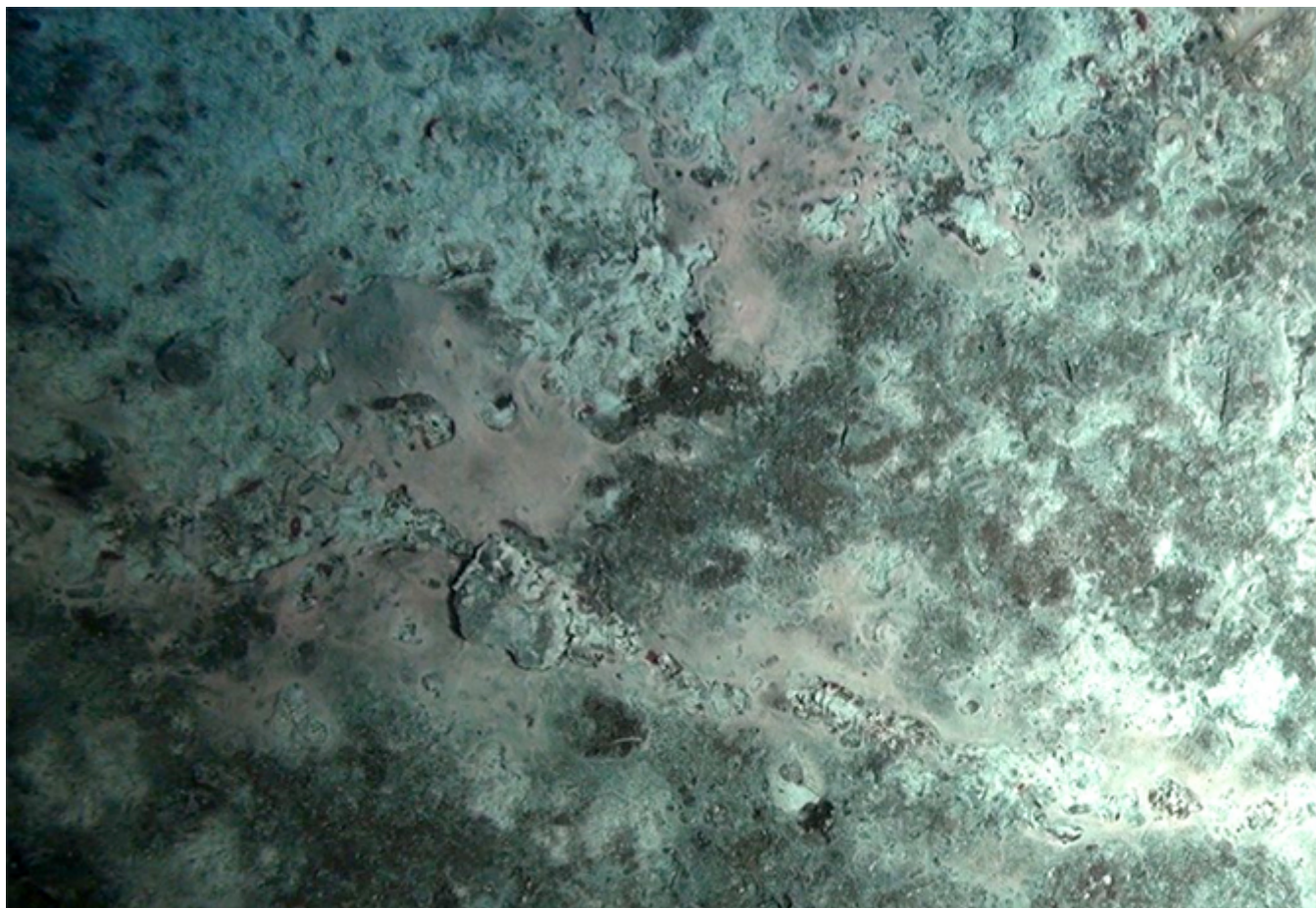


Figure 6: Seafloor covered by microbial mats (16 months after the drilling operation)

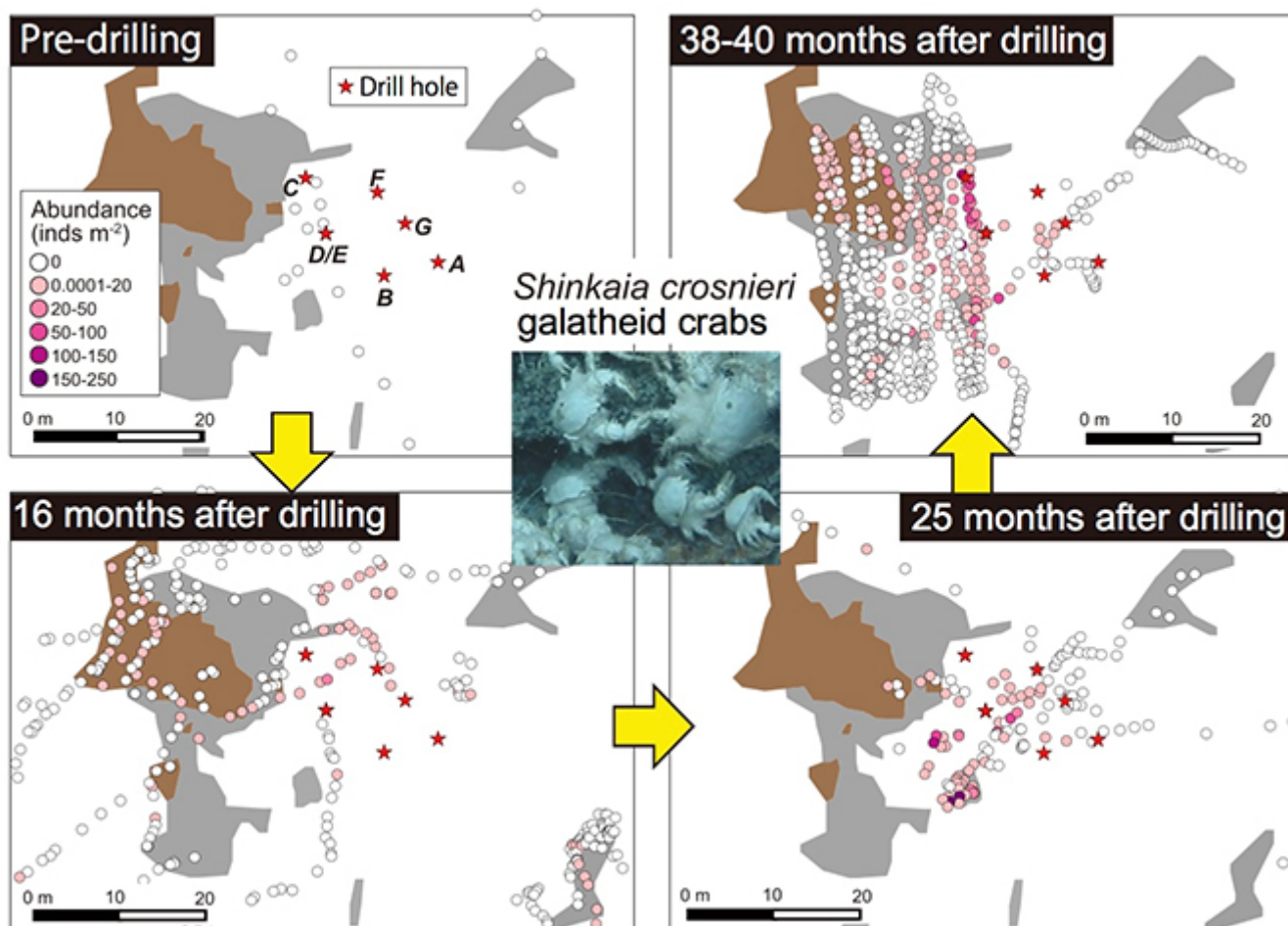


Figure 7: Changes in distribution of *Shinkaia crosnieri* galatheid crabs

## References

Kawagucci S, Miyazaki J, Nakajima R, Nozaki T, Takaya Y, Kato Y, Shibuya T, Konno U, Nakaguchi Y, Hatada K, Hirayama H, Fujikura K, Furushima Y, Yamamoto H, Watsuji T, Ishibashi J, Takai K (2013). Post-drilling changes in fluid discharge pattern, mineral deposition, and fluid chemistry in the Iheya North hydrothermal field, Okinawa Trough. *Geochemistry, Geophysics, Geosystems* **14**: 4779-4790.

Nakajima R, Komuku T, Yamakita T, Lindsay D.L, Jintsu-Uchifune Y, Watanabe H, Tanaka K, Shirayama Y, Yamamoto H, Fujikura K (2014) A new method for estimating the area of the seafloor from oblique images taken by deep-sea submersible survey platforms. *JAMSTEC Report of Research and Development*, **19**: 59-66.

Takai K, Mottl MJ, Nielsen SH (2012). IODP Expedition 331: Strong and expansive subseafloor hydrothermal activities in the Okinawa Trough. *Scientific Drilling* **13**: 19-27.

Watsuji T, Yamamoto A, Motoki K, Ueda K, Hada E, Takaki Y, Kawagucci S, Takai K (2015). Molecular evidence of digestion and absorption of epibiotic bacterial community by deep-sea crab *Shinkaia crosnieri*. *The ISME Journal* **9**: 821-831.

Changes in Benthos Community on Artificial Hydrothermal Vent Field Produced by Seafloor Drilling (Video)

### Contacts:

(For this study)

Ryota Nakajima, Postdoctoral Researcher, Department of Marine Biodiversity Research

(For press release)

Hiroyasu Matsui, Manager, Press Division, Public Relations Department