【Grant-in-Aid for Scientific Research (S)】

Can seamount subduction weaken locking of megathrust earthquake? Test at 2 seamounts in Nankai Trough

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Project Information	Project Number : 24H00020 Keywords : slow earthquake, seamount subduction, optical fiber, heat flow, Scientific ocean drilling	Project Period (FY) : 2024-2028

Purpose and Background of the Research

●Outline of the Research (Fig. 1)

In the Nankai Trough, frequent slow earthquakes (fluctuations with a longer duration than normal earthquakes) occur, some of which are closely related to the subduction of seamounts. Hyuga-Nada, having no magnitude-8 class earthquake, is subducted by the Kyushu-Palau Ridge, a long line of seamounts. We believe that the seamount subduction fractures surrounding strata and reduce their strength, resulting in strain release as slow earthquakes. We will install fiber-optic strain gauges, water pressure gauges, seismometers and thermometers near the subducted seamount to detect deformation around the seamount and the occurrence of slow earthquakes. Numerical modeling will be used to evaluate the effect of seamount subduction on the occurrence of slow earthquakes. Since slow earthquakes can be related to the readiness of a large earthquake, we will start observations and monitoring now toward the next Nankai Trough earthquake that is anticipated to occur with a probability exceeding 70% within the next 30 years.

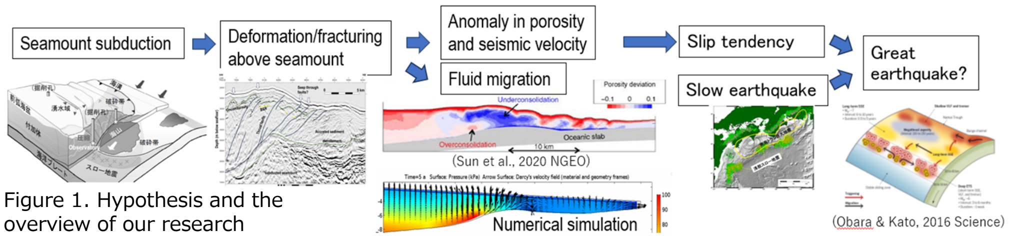

Figure 1. Hypothesis and the overview of our research

●State & property around subducted seamount (Fig. 2)

We try to understand conditions around the seamount through surveys on seafloor, drilling, and onshore. We will test the hypothesis that the subduction of the seamount will fracture the surrounding strata, causing pore fluid to flow into it and reduce its strength (Fig. 3).

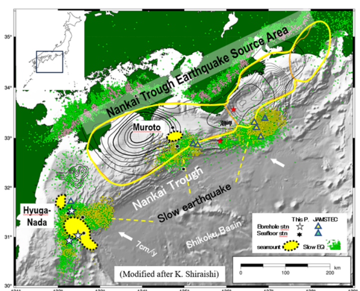

Figure 2. Source area of Nankai Trough earthquake Subducted seamounts are shown as yellow regions.

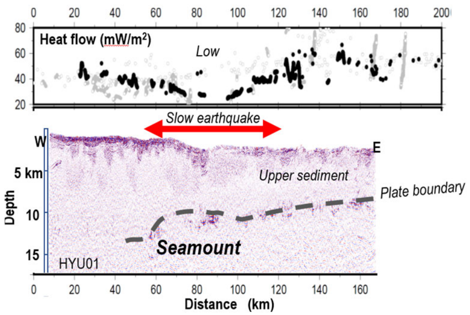

Figure 3. Vertical cross section around subducted seamount in Hyuga-Nada. Low heat flow above seamount may be the result of fluid flow above seamount.

●Detection of slow earthquakes around subducted seamount (Fig. 4)

We conduct observation/monitoring of strain on the seafloor using fiber-optic strain gauges, etc., to detect and determine where and how slow earthquakes occur.

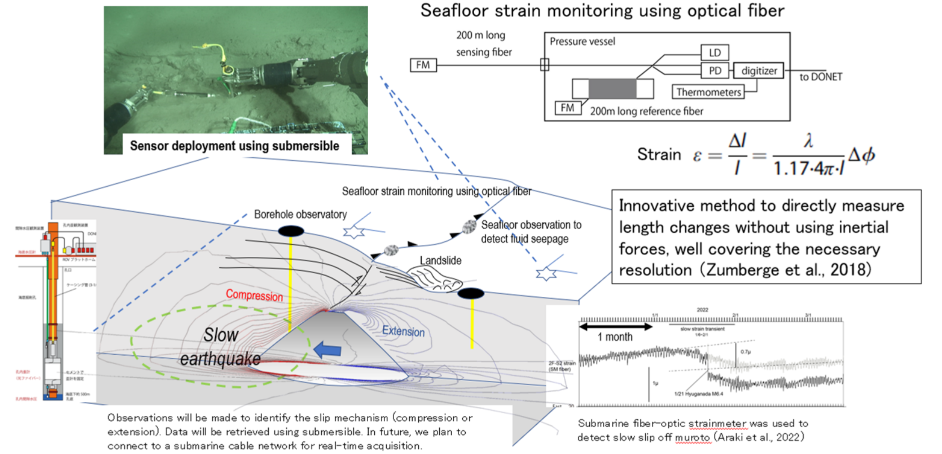

Figure 4. Image of the observation system around subducted seamount to detect slow earthquakes.

Expected Research Achievements

● Glabing the facts around seamount subduction (Fig. 5)

Seafloor surveys: Structural deformation and fluid behavior below seafloor. Onshore outcrop surveys: Past subducted seamounts and reconstruct their deformation history. Drilling: Present stratigraphic deformation above subducted seamount.

● Precise monitoring of slow earthquakes (Fig. 4)

Optical-fiber strain, fluid pressure, seismicity, temperature monitoring near the subducted seamount to detect deformation & slow earthquake around the seamount.

● Depicting the effect of seamount subduction on slow earthquake (Fig. 1)

Model the degree of weakening in the seismogenic zone caused by seamount subduction. By comparing with observed slow earthquakes, we evaluate the effect of seamount subduction on the mode of plate convergence.

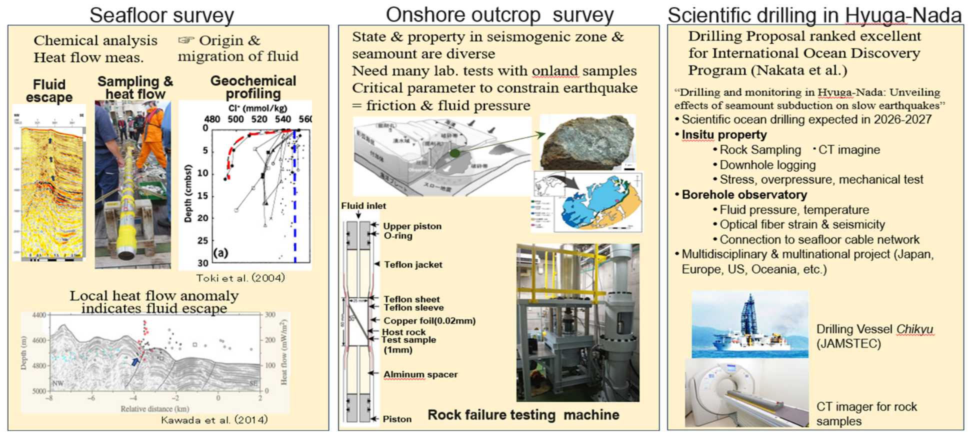

Figure 5. Overview of various surveys around the subducted seamount.

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