

ARAKI LAB.

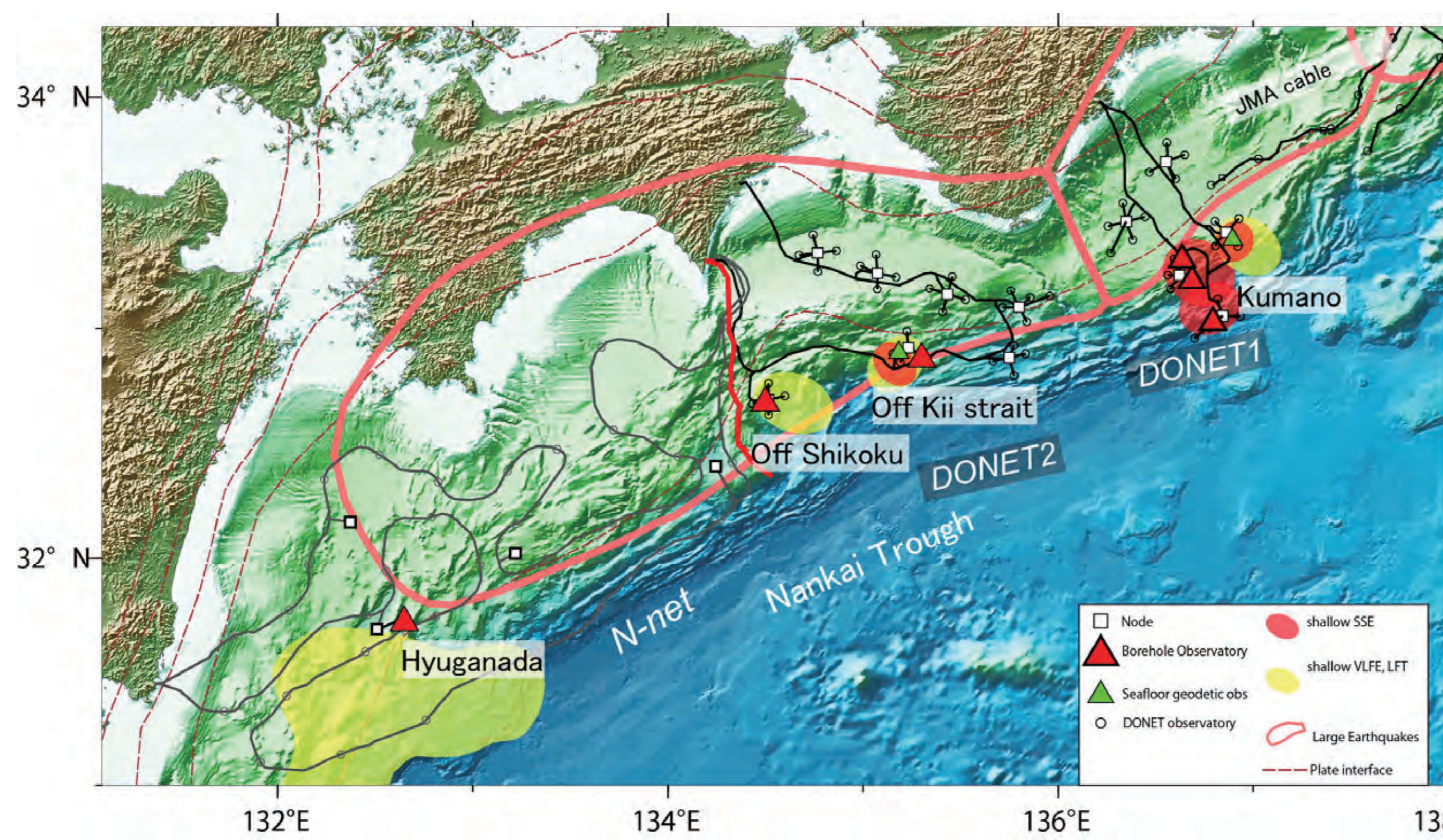
Capturing the Quietly Evolving Preparatory Processes of Megathrust Earthquakes Beneath the Seafloor



Department of Mechanical and Bioengineering
Center for Integrated Underwater Observation Technology

Seafloor Observation

Revealing Ongoing Processes of Megathrust Earthquakes in the Nankai Trough Using Seafloor and Borehole Fiber-Optic Sensing



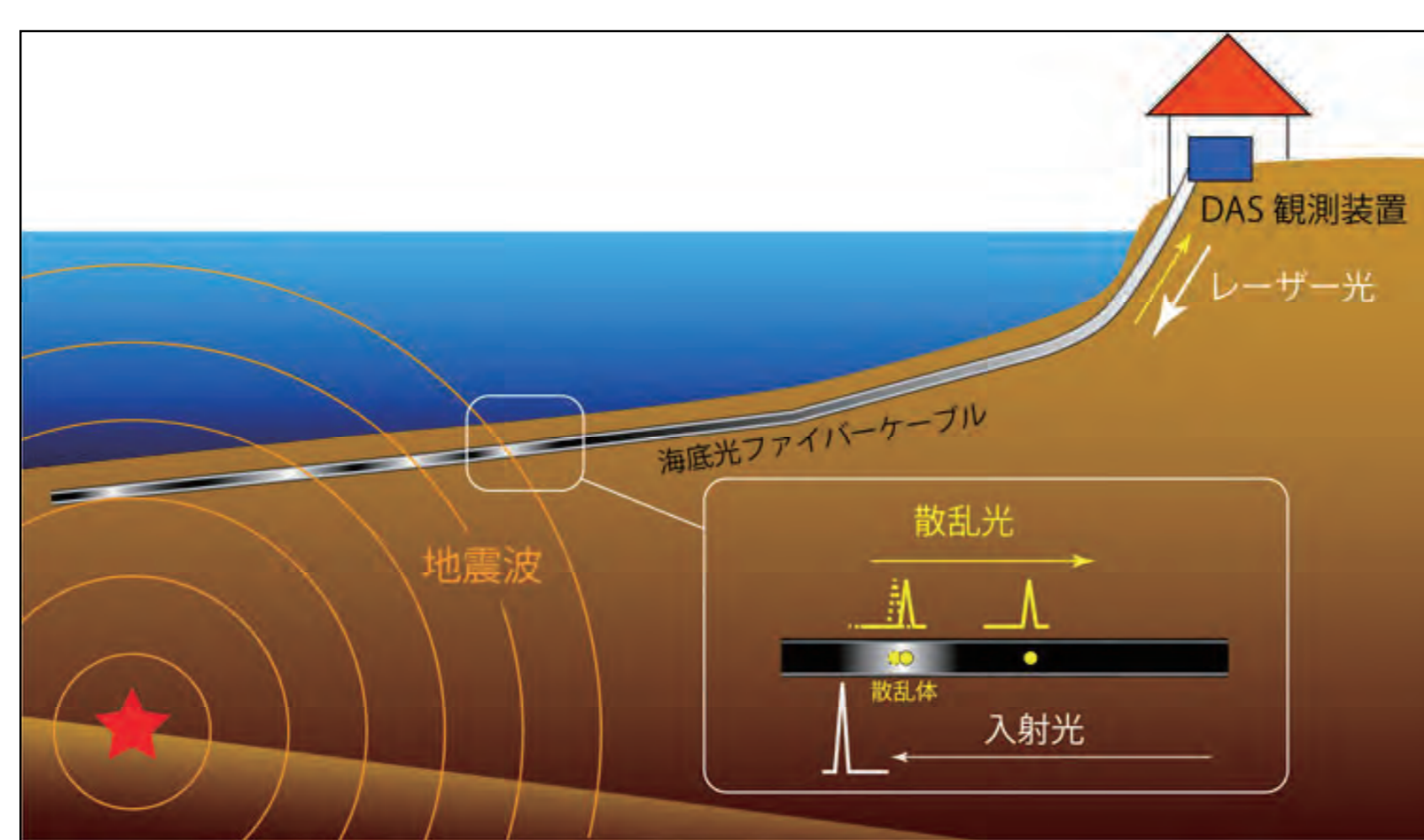
At the plate boundary beneath the seafloor of the Nankai Trough, where megathrust earthquakes recur over long timescales, not only large earthquakes but also slow slip events and slow earthquakes occur frequently.

Recent high-sensitivity observations using seafloor cable networks (left) and borehole observatories (▲) have revealed these phenomena in detail.

Our goal is to understand the physical processes along the plate boundary that lead to large earthquakes by studying these slow deformation events.

By advancing fiber-optic sensing technologies and applying them to submarine communication cables and borehole installations, we aim to observe the plate boundary over wider areas and at higher resolution, enabling a better understanding of its structure and dynamics.

Fiber-Optic Sensing in Submarine Cables



Principle of seismic observation using DAS (distributed acoustic sensing)

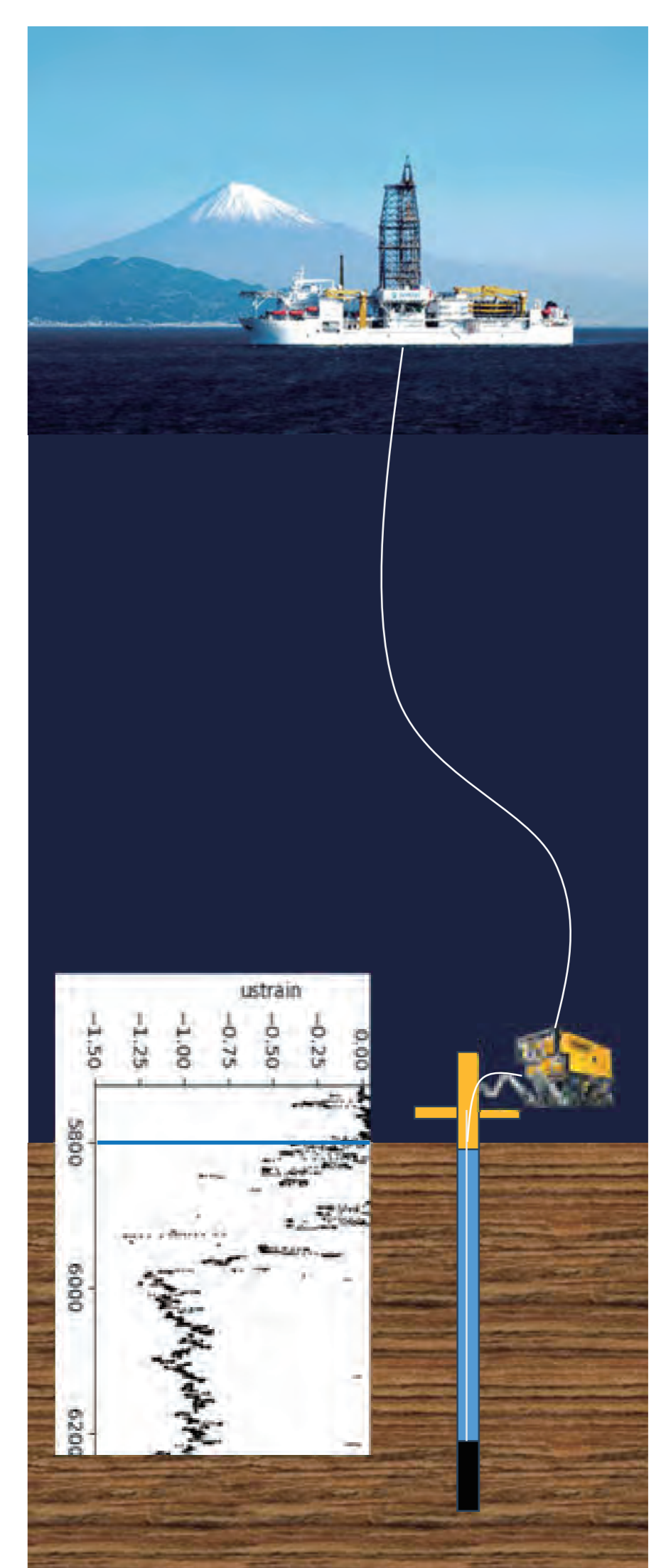


Broadband DAS observation system

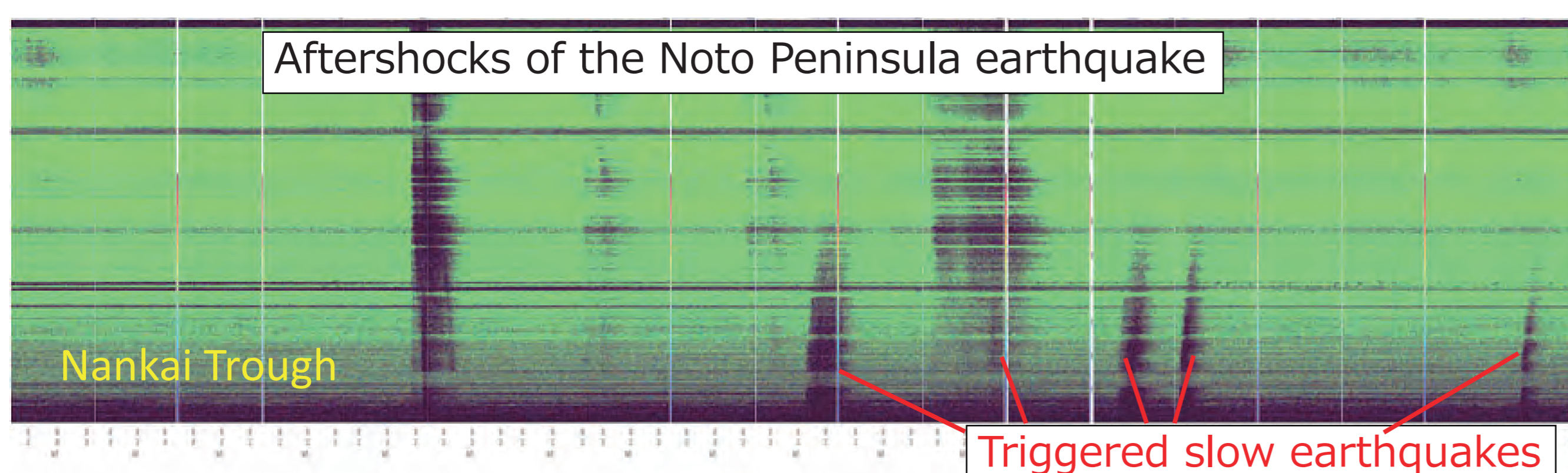
Borehole Fiber Installation



Fiber-optic sensing system (RFAS)



Fiber-optic cables were installed in boreholes using the scientific drilling vessel Chikyuu. Fiber-optic sensing (RFAS) enables direct measurement of subsurface geological structures (right).



Using the broadband DAS system, we detected that slow earthquakes were triggered offshore of the Nankai Trough following the 2024 Noto Peninsula earthquake.