

[EE] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS04]Nankai Trough Seismogenic Zone Experiment toward the final challenge

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The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) is a multidisciplinary investigation of fault mechanics and seismogenesis along the megathrust at the Nankai Trough subduction zone, and includes reflection and refraction seismic imaging, direct sampling by drilling, in situ measurements, and long-term monitoring in conjunction with laboratory and numerical modeling studies. During the past 11 IODP expeditions off Kii Peninsula since 2007, 15 sites have been drilled by D/V "Chikyu" down to depths from 100s of meters to more than 3000 meters below seafloor, where the inner and outer wedge of the Nankai margin has been sampled extensively, and two state-of-the-art real-time downhole observatories are now in operation. NanTroSEIZE is now at the final stage with only two more expeditions planned for another downhole observatory installation at the toe site in early 2018, and for resuming riser drilling toward the megathrust at ~5200 meters below seafloor starting from late 2018.

In this session jointly held with AOGS, we expect presentations on scientific outcomes from the NanTroSEIZE project and discussions toward the final challenge. We welcome presentations on, but are not limited to, seismic imaging, borehole logging and monitoring, chemical analyses of pore water and mud gas, lithology, structures, physical properties and laboratory experiments of cuttings and core samples, and theoretical and numerical modeling.

[SSS04-P05]Frictional properties of accretionary sediments/rocks and their implications for the transition of aseismic to seismic faulting at the Nankai Trough Subduction Zone

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In order to examine the shallow transition of stable aseismic to unstable seismic faulting along the megathrust at the Nankai Trough subduction zone, which is estimated to occur at temperatures of 100~150°C, we conducted triaxial friction experiments on the following samples at effective confining pressures of 12~120 MPa and temperatures (T) of 50~200°C, and at displacement rates (V) changed stepwise among 0.1155, 1.155 and 11.55 $\mu\text{m/s}$. We used accretionary mud, incoming basalt and sand, and subducting chert samples collected from the Nankai Trough and the Japan Trench for experiments at $T \leq 100^\circ\text{C}$, while mudstone, sandstone, basalt and chert samples collected from the Shimanto belt in Eastern Shikoku for experiments at $T \geq 150^\circ\text{C}$. We then fitted the friction data for each step change in V by the rate- and state-dependent friction constitutive law, and obtained the optimized (a & b) value, i.e., an indicator of frictional stability, at each V .

The results show that steady-state friction coefficient μ_{ss} decreases with increasing content of clay minerals at $T \leq 100^\circ\text{C}$, while such tendency becomes weak at $T \geq 150^\circ\text{C}$. For a given sample, μ_{ss} decreases with increasing T from 50°C to 100°C, while it increases with increasing T

from 150°C to 200°C, the amount of which tends to be greater for samples with larger amounts of clay minerals.

Our results also show that $(a - b)$ value tends to increase with increasing content of clay minerals at $T \leq 100^\circ\text{C}$, whereas $(a - b)$ value tends to decrease with increasing content of clay minerals at $T \geq 150^\circ\text{C}$. The former is attributable to the stabilizing effect of clay minerals, while the latter is possibly due to the effects of dissolution–precipitation creep favored at lower V_s and in the presence of clay minerals. For a given sample, $(a - b)$ value tends to decrease with increasing T , which is also likely due to the effects of dissolution–precipitation creep favored at higher T_s or lower V_s .

$(a - b)$ value is positive for all samples at 50°C. At 100°C, $(a - b)$ value is still positive for mud, while it is ≈ 0 for basalt and negative for chert. Then $(a - b)$ value is negative for most samples at $\geq 150^\circ\text{C}$, and all samples exhibited stick-slip at 200°C. Thus in all types of sediments/rocks faulting is stable and aseismic at 50°C, while unstable and seismic at 200°C, demonstrating the shallow transition of aseismic to seismic faulting along the megathrust with increasing T . Our results also show that the transition T is different among different types of sediments/rocks. The transition T increases with increasing content of clay minerals from $< 100^\circ\text{C}$ for chert with a trace amount of clay minerals, through $\approx 100^\circ\text{C}$ for basalt with a moderate amount of clay minerals, to $> 100^\circ\text{C}$ for mudstone with a significant amount of clay minerals.