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IODP Proposal Cover Sheet

603-CDP3

☐ **New** ☑ **Revised** ☐ **Addendum**

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Title:	**NanTroSEIZE: The Nankai Trough Seismogenic Zone Experiment Complex Drilling Project**		
Proponent(s):	**Gaku Kimura, Harold Tobin, and the NanTroSEIZE Working Group (24 Co-Proponents)**		
Keywords: *(5 or less)*	**Seismogenic zone, earthquakes, tsunamigenesis, fault mechanics**	Area:	**Southwest Japan margin**

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Permission to post abstract on iSAS Web site: ☑ Yes ☐ No

Abstract: (*400 words or less)*

This Complex Drilling Project (CDP) proposal describes the rationale and scientific objectives for an integrated program of geophysical and geologic studies, non-riser drilling, and riser drilling designed to investigate the aseismic to seismic transition of the megathrust system and the processes of earthquake and tsunami generation at the Nankai Trough subduction zone. **Our fundamental goal is the creation of a distributed observatory spanning the up-dip limit of seismogenic and tsunamigenic behavior.** This will involve sampling and instrumenting key elements of the active plate boundary fault system at several locations off the Kii Peninsula, where the plate interface and active mega-splay faults – implicated in tsunamigenesis – are accessible to drilling within the region of coseismic rupture in the 1944 Tonankai M8 great earthquake. The most ambitious objective is to access and instrument the Nankai plate interface within the seismogenic zone to advance our knowledge of fundamental aseismic and seismic faulting processes and controls on the transition between them. The strategy of NanTroSEIZE differs fundamentally from that of other proposed deep fault drilling programs because we will document the evolution of fault zone properties by trading time for space along the dipping plate boundary.

We propose 3 distinct phased IODP drilling efforts: **Phase 1** – *Inputs to the seismogenic zone system*, investigating variations in the sediments, oceanic crust, and fluids input to the plate boundary system; **Phase 2** – *Mega-splay (OOST) fault drilling* to sample and instrument thrusts which splay from the basal décollement up through the forearc, in order to characterize fault properties transecting the aseismic to seismic transition from 1 to 3.5 km depth shallow; and **Phase 3** – *Sampling and instrumenting the plate interface* (décollement) at ~ 6 km below seafloor, in a region predicted to be within both the zone capable of generating seismogenic behavior and in the zone of co-seismic slip in the 1944 great earthquake. Long-term monitoring of a wide range of phenomena will be a major part of the effort, to detect signals of fault zone processes in the near-field. In addition, ongoing seismological and geodetic arrays in the vicinity as well as in the deep boreholes, geologic studies, laboratory and modeling efforts are all integral components of the NanTroSEIZE project, essential to success in achieving project objectives.

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Scientific Objectives: (*250 words or less*)

The principal scientific objective of the proposed drilling is to acquire data bearing on and testing the following key hypotheses:

1. Systematic, progressive material and state changes control the onset of seismogenic behavior on subduction thrusts.

2. Subduction zone megathrusts are weak faults.

3. Within the seismogenic zone, relative plate motion is primarily accommodated by coseismic frictional slip in a concentrated zone.

4. Physical properties, chemistry, and state of the fault zone change with time during the earthquake cycle.

5. The mega-splay (OOST) thrust fault system slips in discrete events which may include tsunamigenic slip during great earthquakes.

Proposed **NanTroSEIZE** efforts will test models for the frictional behavior of fault rocks across the aseismic – seismogenic transition, the composition of faults and fluids and associated pore pressure and state of stress, partitioning of strain spatially between basal interface and splays, temporally between coseismic and interseismic periods, and between infraseismic and aseismic events vs. seismic events. Long-term borehole observations potentially ultimately will test whether interseismic variations or detectable precursory phenomena exist prior to great subduction earthquakes.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

In various combinations, the following non-standard measurements are desired for sites covered by this CDP:

During Drilling and Casing Installation: Logging/measurement while drilling, drill stem & wireline pressure/permeability tests, cross-hole hydrologic tests, offset/walkaway vertical seismic profiling, cross-hole seismic.

Long-Term Borehole Observatory Monitoring: Array temperature measurement, pressure measurement in packer-isolated intervals, array measurement for short-period, three-component seismometry, bottom-hole broadband and strong motion seismometry, bottom hole strain, multi-level tilt, and long-term fluid collection for biological and geochemical measurements. Many of these measurements will need to be made at temperatures of ~ 80 – 150+ C.

Proposed Sites:

SEE INDIVIDUAL PROPOSALS FOR EACH PHASE FOR SITE DESCRIPTIONS