Received 1 October 2010

IODP Proposal Cover Sheet

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☐ **New** ☒ **Revised** ☐ **Addendum**

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Please check if this is Mission proposal ☐

Title:	Kanto Asperity Project: Geological and Geophysical Characterization of the Source Regions of Great Earthquakes and Slow Slip Events		
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Keywords: *(5 or less)*	Great Earthquakes, Slow Slip Events, Tectonics, Geophysical Monitoring, Asperity	Area:	Central Japan margin

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Permission to post abstract on IODP Web site: ■ Yes ☐ No

Abstract: (*400 words or less)*

The Kanto Asperity Project proposes a drilling and long-term monitoring program in the southern Kanto region of southeastern Japan with the aim of determining the characteristics of the plate boundary in and around the source regions (asperities) of great earthquakes and slow slip events (SSEs). This region (Tokyo Metropolitan Area) is a densely populated economic center that has been subjected to repeated great earthquakes. Recent progress in the development of supercomputers has enabled the simulation of earthquake and SSE generation cycles, but the parameters are not based on scientific data, and are not sufficiently reliable to assess the hazards associated with future earthquakes. The establishment of a realistic earthquake-generation model is of crucial importance in mitigating the danger posed by earthquake geohazards.

Three different types of slip events have occurred at the depth of seismogenic zone; the 1923 Taisho Kanto earthquake, 1703 Genroku earthquake, and SSEs off Boso Peninsula. In the cases of Nankai and Cascadia, SSEs occur at deeper levels than the asperities, and the location can be controlled by temperature and pressure. The Boso SSEs occur at the same level as the asperities, raising the possibility that the conditions (materials, fluids, or surface roughness) in the Kanto region are different to those encountered at Nankai and Cascadia.

Our main objectives of this Complex Drilling Project (CDP) are to understand why the different types of events occur side by side at almost same depth (in same P-T conditions) (Objective 1) and to establish realistic earthquake-generation models using data on each step of the process of natural earthquakes (Objective 2).

This CDP consists of the two programs. Program A proposes ultra-deep drilling to intersect plate boundaries in the Boso SSE region and the Taisho asperity, in order to compare the geological materials at the two sites. Coring and logging at plate boundaries would also yield realistic frictional properties and effective normal stress, as derived from experiments on recovered materials and from measurements of pore pressure, respectively. Program B proposes long-term monitoring (borehole observatories) for recording in detail crustal deformations and seismicity during 2-3 cycles of Boso SSEs, enabling testing of the hypothesis that SSEs can be used to assess the validity of earthquake generation models. Once Program B has yielded earthquake generation models from SSE ones, we can verify and improve the models by directly determining the values of parameters as part of Program A.

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Scientific Objectives: (*250 words or less*)

To achieve the main scientific objectives 1 and 2 stated in Abstract, programs A and B will test the following hypotheses.

For Objective 1:

Hypothesis 1-1: The different types of slips arise from different input materials.

Hypothesis 1-2: Coupling strength depends on elapsed time after subduction.

- Ultra-deep drilling to intersect plate boundaries in the Taisho asperity and the SSE region to compare core materials, diagenetic and metamorphic conditions, pore-water chemistry (which may control diagenetic, metamorphic reactions and cementation) between SSEs and areas of normal seismicity from a similar depth. (Program A).

For Objective 2:

Hypothesis 2-1: The Boso SSEs can be used to assess models of earthquake generation.

- Long-term monitoring for recording in detail of tilt, pressure, and seismicity during 2-3 cycles of Boso SSEs, to establish physical model of SSE cycle so as to interpret the observed spatio-temporal behavior of the SSEs. The model of SSEs is applied to that of earthquake generation (Program B).

Hypothesis 2-2: Constitutive parameters obtained from fault zone materials and pore pressure in the fault zone can be incorporated into numerical simulations of earthquakes.

- Ultra-deep drilling to intersect plate boundaries to yield realistic frictional properties and pore pressures, as derived from experiments on recovered materials and by logging, respectively (Program A).

Either program helps us to establish a realistic model. Taken together, the results of Programs A and B would provide comprehensive knowledge of the fault and allow us to markedly improve models of the earthquake generation cycle.

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

Extensive logging (Vp, Vs and anisotropy), in situ experiment, such as pore pressure, hydraulic properties and stress tensor, VSPs, and oriented cores are necessary for the initial values for geodetic and seismic monitoring. Long-term monitoring observatories will require tiltmeters, broadband seismometers, accelerometers, and pressure gauges installation.

Proposed Sites:

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