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IODP Proposal Cover Sheet

537-CDP7

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

Please fill out information in all gray boxes

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Title:	CRISP- Costa Rica seismogenesis project: investigating convergent margin seismogenesis		
Proponent(s):	Baumgartner, Peter, Bilek, Susan, Brueckmann, Warner, Castillo, Pat, Clift, Peter, Deyhle, Annette, Dixon, Tim, Fehn, Udo, Fisher, Donald, Fulthorpe, Craig, Harris, Robert, Kastner, Miriam, Kinoshita, Masa, Lewis, Jonathan, Matsumoto, Takeshi, McIntosh, Kirk, Morgan, Jason, Morris, Julie, Patino, Lina, Schwartz, Susan, Snyder, Glen, Ranero, Cesar, Scholl, David, Vannucchi, Paola, von Huene, Roland		
Keywords: *(5 or less)*	Seismogenic zone, Subduction factory, subduction erosion	Area:	Costa Rica

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Permission to post abstract on IODP-MI Web site: ☒ Yes ☐ No

Abstract: (*400 words or less)*

CRISP is a project to understand the initiation of large earthquakes and seismic rupture by drilling on either side of the updip limit of seismogenesis. The shallow dip of the subduction zone off southern Costa Rica and relatively high subducting plate temperature cause this seismogenic environment to rise to drilling depth. Materials, temperature, lithification, fluid flow and chemical changes that occur down the subduction zone are hypothesized to cause the transition from stable to unstable slip that ultimately results in great earthquakes. Along the erosional convergent margin of Costa Rica the seismogenic plate interface is surrounded by eroded debris rather than by trench sediment.

CRISP involves the only known erosional end-member of convergent margins within reach of scientific drilling. Samples of the fault rock and observations of dynamics will be integrated with laboratory experiments to test 5 principal hypotheses as stated below in the scientific objectives. CRISP is structured in 2 programs that systematically lead to deep riser drilling of the seismogenic zone. The non-riser drill Program A will provide cores to characterize lower plate igneous basement rock and its hydrology. Paleo-depth indicators will allow a first estimation of eroded debris and trench sediment thickness input by the subduction channel into the seismogenic zone. Instruments will be deployed in the holes to record microseismicity and monitor fluid pressure. Program B involves 3.5-km and 6.0-km-deep holes that are engineered from results of Program A. Program B riser drilling samples the subduction channel along the plate interface and characterizes conditions in the zone of **stable slip** and then conditions in the zone of **unstable** slip. This provides observations to determine physical and mineralogical transformations and dynamic changes causing unstable slip. The riser-drilling sites are in 500m and 1000m deep water and in an area of optimum operating conditions nearly year around. Osa Peninsula provides the opportunity to expand investigation farther down the seismogenic zone with land drilling to ~7km should that become attractive in the future. With a low sediment supply, fast convergence rate, abundant seismicity, subduction erosion, and a change in subducting plate relief along strike, CRISP offers excellent opportunities to learn causes of earthquake nucleation and rupture propagation. It complements other deep fault drilling (SAFOD and NantroSeize) and investigates the first order seismogenic processes common to most faults and those unique to erosional margins.

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Scientific Objectives: (*250 words or less*)

The proposed drilling and accompanying geophysical programs will acquire data to test 5 key hypotheses:

1) Landward of the frontal sediment prism the transition from stable to unstable slip is accomplished by a transition from a fluid-rich broad fault-damage zone to a thinner and drier slip zone.
2) Fluid pressure gradient and fluid advection localize locking of erosional plate boundaries temporarily and spatially
3) Fault mechanics associated with the transition from stable to unstable slip are influenced by lithology, physical properties, and structure of eroded materials in the subduction zone
4) Fluid chemistry, P-T conditions and residence time affect the state of eroded basement material through alteration, diagenesis, and low-grade metamorphism influencing the transition from stable to unstable slip.
5) Variability in subducted plate relief and subduction channel thickness, affect material properties and fluid distribution triggering seismicity and controlling rupture propagation.

The deployment of observatories will provide capability to monitor any near-field precursory signals that indicate the stage of a rupture zone in an earthquake cycle. A physical properties map along the plate interface derived from seismic attributes and calibrated with the drill holes will indicate whether areas of locking offshore and potential hazardous earthquake locations can be identified from remote geophysical information.

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

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	