

IODP Proposal Cover Sheet

992 - Pre

Prince William Sound Subduction and Climate

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Title	Understanding megathrust earthquake hazards and post-LGM climate change along the southern Alaska margin through scientific drilling		
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Keywords	Alaska, megathrust, paleoseismology, climate, landslides	Area	Prince William Sound, Alaska

Proponent Information

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Abstract

We outline drilling targets in three areas of the Prince William Sound region of Alaska, USA, that can test hypotheses and address fundamental issues in subduction zone and climate science. We aim to develop a paleoseismic and paleoclimate record from the LGM to the present, evaluate marine paleoseismic techniques and compare to terrestrial records, and establish the timing of deglaciation from distal to proximal sites and examine if post-LGM ice loss was catastrophic or gradual. With these data we also will address the completeness of the marine paleoseismic record, examine megathrust earthquake variability, the mechanical conditions governing potentially-tsunamigenic splay faulting, and submarine landsliding and the relationships between climate change, glacial retreat, and sea level rise after the LGM. We infer we can likely collect MIS3 and possibly older interglacial sediments and develop a missing history of climate in that time period. The three areas are:

(1) Port Valdez - we focus on developing a history and an understanding of the mechanics of large submarine landslides, compare it to the terrestrial paleoseismic history, and test if the frequency of landsliding or the volume of landslides is higher during neoglacial time (last 3-4 kya). We will also develop a proximal climate record after deglaciation.

(2) Central Prince William Sound Basin - our goal is to collect the complete post-LGM climate and sedimentary record, establish the timing of deglaciation, and compare it with other areas and test if glacial retreat was catastrophic or gradual. Preliminary work indicates we can develop a 10,000 year record of megathrust earthquakes. Lastly, pre-LGM sediments should give a high-latitude record of MIS3 climate, and establish slip rates and timing of abandonment of megasplay faults.

(3) Junken Trough - we will constrain the rates and progression of megasplay faulting and evaluate the mechanical properties of the fault zones by drilling through the megasplay fault zone. The sites should penetrate three glacial cycles, which would lead to the development of a high-latitude glacial and interglacial climate record.

We have virtually all of the needed site characterization data, and the scientific and geophysical framework for investigations is well established. The proponent team has experience with Alaska drilling, tectonics, and glacial climate and an array of expertise to meet the challenges of drilling and the science questions. This is a unique opportunity to meet two of the goals of the IODP science plan with the same drillsites at these world-class targets.

Scientific Objectives

We aim to use scientific drilling to develop a paleoseismic and paleoclimate record from the LGM to the present, evaluate marine paleoseismic techniques by comparison to terrestrial records, and establish the timing of deglaciation from distal to proximal sites and test if post-LGM ice loss was catastrophic or gradual. With these data we also will also examine megathrust earthquake variability, the mechanical conditions governing the role of potentially-tsunamigenic splay faulting, and submarine landsliding, and the relationships between climate change, glacial behavior, and sea level rise after the LGM. We are further optimistic that we can sample MIS 3 to 6 sediments, developing a missing climate history in that time period. We propose drilling multiple holes in three locations.

- (1) Port Valdez - we aim to develop a history and understanding of the mechanics and frequency of submarine landslides. We will develop a proximal climate record after deglaciation, albeit punctuated by submarine landslides, and test for any relationship between climate state and landslide frequency and volume.
- (2) Central Prince William Sound Basin - we aim to collect a complete post-LGM climate and earthquake record, with additional constraints on pre-LGM climate and megasplay faulting slip rates.
- (3) Junken Trough - we will evaluate rates and progression of megathrust splay faulting and evaluate mechanical properties of the fault zones by drilling through the megasplay fault zone. These sites should penetrate several glacial cycles, which would enable development of an ice-proximal record of high latitude climates through glacial interglacial cycles.

Non-standard measurements technology needed to achieve the proposed scientific objectives

Proposed Sites (Total proposed sites: 3; pri: 3; alt: 0; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
PWSPV-01A (Primary)	61.1124 -146.4608	238	265	0	265	The Port Valdez sediments will contain a proximal record of post-LGM climate change and submarine landslides. With drilling, we will develop a history and an understanding of the mechanics of submarine landsliding, compare this record to the terrestrial paleoseismic history, and evaluate the completeness of the record and the frequency of landslides. We will develop a unique proximal climate record after deglaciation, albeit punctuated by submarine landslide debris, to be compared to more distal sites to understand the timing and rates of deglaciation around the northern Pacific.
PWSCB-01A (Primary)	60.5267 -146.8098	425	300	0	300	The Central Prince William Sound basin sediments will contain a complete record of post-LGM climate change. This site will also help us test rates and timing of deglaciation in the north Pacific, and sample possible MIS 3 and older interglacial sediments. Preliminary work indicates there is also a high-resolution paleoseismic record, which has the potential of giving us a 10,000 year record of megathrust earthquakes, and further developing the field of marine paleoseismology.
PWSJT-01A (Primary)	59.538844 -148.189458	206	250	0	250	Evaluate rates and progression of megathrust splay faulting and evaluate the mechanical properties of the fault zones by drilling through the megasplay fault zone. This site should penetrate three glacial cycles, which would lead to the development of a high latitude glacial and interglacial climate record. Moreover, timing of LGM deglaciation at this site is critical to understanding of LGM ice sheet collapse was catastrophic or gradual.