

Panel Summary #1

Proposal Number: 0550402

Panel Summary: _The panel viewed favorably the objective of locating seismicity across the mega-thrust and surrounding accretionary wedge. Documenting the local structure and linkage with onshore studies are both excellent. Linkage to anomalous GPS data is important. This is an important bench-marking exercise in itself. The success of similar work done on the Costa Rican margin by Susan Schwarz et al. bodes well for the proposed project. The project will be optimal if it can be linked to EarthScope onshore. It would be desirable to have at least some broad band instruments if possible, but the problems associated with this addition are appreciated. The OBS spacing appears to be adequate. The proposal appears to be very cost effective with a single PI. _Broader Impacts of the proposed work are good. These include the involvement of graduate students and linkages to major programs such as EarthScope and USArray. This project addresses a major seismic hazard of wide societal significance.

Context Statement

Panel/Program Summary (November 2005) __A 46-member panel for Ocean Sciences Research met November 14-18, 2005 to discuss 401 projects submitted to the August 15, 2005 target date. The sub-panels of Biological Oceanography, Chemical Oceanography, Physical Oceanography, and Marine Geosciences, reviewed 133, 65, 94, and 112 projects, respectively. Included in these were 19 CAREER, 14 CLIVAR, 10 RIDGE2000, 18 Ocean Drilling Program, and 2 Ocean Technology and Interdisciplinary Coordination projects. Multi-disciplinary projects were considered by an appropriate cross-section of the whole panel and in some cases by other panels outside of the Ocean Sciences Division. __The Program summary (see PO comments) was prepared by the Program officer responsible for your proposal from notes taken during the panel discussion and subsequent consideration within the Program. __Success Rates, Funding Considerations and Resubmittal _In November 2005, the Marine Geology and Geophysics Program had resources to support about 25% of the proposals submitted, which meant that some highly-rated proposals were declined. Funding recommendations are based on the merit review process that, in OCE, includes both mail and panel review as well as review by NSF program officers. Mail reviewers are typically experts in a particular field, technique, and/or area and provide advice on an individual proposal. Panels consider their own assessment of the proposal, the mail review comments, and the panel discussion, and provide advice

within the context of all the proposals being considered by the panel. Because the panel's time is limited, the panel may choose not to discuss a proposal when it is felt that the mail reviews provide adequate feedback to the principal investigator. Funding recommendations are based primarily on mail reviewer and panel advice but also consider availability of funds, program balance, appropriateness and balance within special programs, geographic distribution of awards, educational infrastructure, gender and minority status, and the existing commitments of the principal investigator.

__In accordance with NSF policy outlined in the NSF Grant Proposal Guide, the Division of Ocean Sciences will not accept resubmitted proposal that are not substantially revised. The NSF Grant Proposal Guide can be accessed at: <http://www.nsf.gov/pubsys/ods/getpub.cfm?gpg>. It is recommended, but not required, that principal investigators discuss resubmissions with the cognizant program officer.

Review #1

Proposal Number: 0550402

Performing Organization: Oregon State University

NSF Program: Marine Geology and Geophysics

Principal Investigator: Trehu, Anne M

Proposal Title: Monitoring seismicity associated with a possible asperity on the Cascadia megathrust

Rating: Very Good

REVIEW:

What is the intellectual merit of the proposed activity? ____ What are the broader impacts of the proposed activity? ____ Summary Statement __ I am generally enthusiastic in supporting any proposal to conduct OBS surveys along the Cascadia subduction zone, let alone a proposal by a highly competent researcher. The proposed work is very timely and will have a large impact to our understanding of the geodynamics of this plate margin and seismic hazard. Whether the Cascadia megathrust exhibit any seismicity today is controvertical (so is the nature of the Petrolia earthquake). Detecting and accurately locating events offshore is the only way to resolve the issue, and an OBS monitoring survey is probably the best approach. __ I have a slight concern about the level of "home work" in designing the survey, but I think Anne Trehu will have no difficulty getting it well organized very quickly. Seismicity around the deformation front at Cascadia is very low, and therefore there is a real chance that very few events are recorded during the proposed survey period. Although constraining the current level of seismicity (regardless of high or low) is always a significant scientific result, the project may be made much more productive by expanding its scope to use the OBS network to study a few other things as well. Should we also consider a control-source survey when the OBS's are recoring? Can we make use of teleseismic

signals recorded by the OBS's? Can we make good use of transform fault events? Should we try our best to include a few broadband OBS's at strategic locations? PGC/UVic once had a joint project CASSIS with JAMSTEC to conduct a major OBS survey. It is unfortunate that the project was cancelled a couple of days before sailing due to a misunderstanding on whale issues. However, they did spend a year designing the OBS layout before the cancellation. The PI may wish to talk with George Spence to see if some of the CASSIS ideas can be applied to this newly proposed survey.

Review #2

Proposal Number:	0550402
Performing Organization:	Oregon State University
NSF Program:	Marine Geology and Geophysics
Principal Investigator:	Trehu, Anne M
Proposal Title:	Monitoring seismicity associated with a possible asperity on the Cascadia megathrust
Rating:	Excellent

REVIEW:

What is the intellectual merit of the proposed activity? __Trehu proposes a two stage deployment of short period OBSs that will cover an extremely interesting portion of the Cascadia subduction zone forearc and the outer-rise region of the Juan De Fuca Plate. This is essentially the perfect proposal. It will acquire a novel dataset that will address both fundamental earthquake physics questions and improve our understanding of the spatially variable seismic hazard along the Cascadia subduction zone. The observations made in the past few years by Wells et al., Song and Simons, and others are truly remarkable. They indicate a level of inherent predictability in the spatial distribution of seismic slip over multiple earthquake cycles that is one of the most encouraging observations to date suggesting that deterministic physical/geological properties can be used to characterized at least some important properties of future large earthquakes. The application of these observations to cascadia provides the rational for the site selection made by the PI. The proposed region will cover the transition between two regions expected to have relatively large and minor slip respectively during the next great earthquake. In California, the portion of the San Andreas that ruptured in 1857 is essentially unidentifiable on plots of seismicity at the $M > 2$ level while the creeping section is the most seismically active part of the plate interface. This simple analogy suggests that the proposed deployment should record a clear difference in

microseismicity rates between the two regions. ___My only complaint is that the P.I. should've asked for more instruments and hence a denser station spacing that would allow for a lower detection threshold. As major OBS experiments go, this one is extremely cheap. Moreover, the noise levels will be relatively high. Given that it is much more societally useful than some deployment at a mid-ocean ridge, it doesn't seem fiscally unreasonable to commit 20 -30 short period instruments to it if they are available. OCE should request a revised budget from the PI/OBSIP for a denser deployment. ___In summary, OCE-MG+G would be crazy not to do this experiment in the time frame proposed so it can link up with earthscope. Moreover, it's highly likely that the results of this experiment could be used to refine plans for the instrument deployments done as part of the Neptune/OOI experiment. Given the high cost of extension cables in those systems, it's quite likely that doing this experiment will help focus future cabled arrays and actually save NSF money in the long term. ___What are the broader impacts of the proposed activity? ___Understanding the along-strike variations in coseismic slip that will occur in future M8-9 earthquakes has huge societal implications. If the Wells/Song and Simons theory is correct, we are tantalizingly close to this objective. This project will be one very important piece of the detailed hypothesis testing needed to make this leap. ___Summary Statement

Review #3

Proposal Number: 0550402

Performing Organization: Oregon State University

NSF Program: Marine Geology and Geophysics

Principal Investigator: Trehu, Anne M

Proposal Title: Monitoring seismicity associated with a possible asperity on the Cascadia megathrust

Rating: Excellent

REVIEW:

What is the intellectual merit of the proposed activity? __The topics to be addressed are at the forefront of research in plate boundary processes and tectonic seismology. __What are the broader impacts of the proposed activity? __The potential for significant progress is very high. The PI has a proven track record as an educator and mentor to students. __Summary Statement __The is a well written and carefully thought out proposal to conduct a seismic investigation of plate coupling and subduction zone processes. The basic request is to fund deployment of an OBS array and to analyze the data. __A significant strength of the proposal is the wide-ranging, integrated, multidisciplinary approach. The data to be collected and proposed science span a number of subfields. The questions to be addressed are equally broad, and it is clear that the PI has done her homework in the sub-disciplines. Fault stability and the seismogenic zone are discussed in terms of frictional stability, as appropriate. The proposed work will improve our understanding of the heterogeneity and basic geometry (updip/downdip/along-strike limits) of the seismogenic zone, and these results will help to illuminate the physical processes that define the seismogenic zone. The data to be collected will also provide important new information on Cascadia tremor and the aseismic slip events. Moreover, recent geodynamic models for plate coupling, and the relationship between basin geometry and gravity, will be tested with the new data. _This proposal addresses an impressive set of questions,

and in each case the potential for significant progress is very high.

___The PI is first rate and has extensive experience in all aspects of this work. Trehu has demonstrated significant leadership in many facets of seismology and plate boundary processes and she has been a leading role-model and mentor for students. ___I rate this proposal E based on the proposed science, the clarity of the proposal, the likelihood of success, and the breadth of potential impact for the Geosciences.

Review #4

Proposal Number: 0550402

Performing Organization: Oregon State University

NSF Program: Marine Geology and Geophysics

Principal Investigator: Trehu, Anne M

Proposal Title: Monitoring seismicity associated with a possible asperity on the Cascadia megathrust

Rating: Very Good

REVIEW:

What is the intellectual merit of the proposed activity? __Trehu proposes to deploy 16 short-period ocean bottom seismometers for two 1-year-long deployments to monitor seismic activity of the continental margin and adjacent oceanic plate to understand better the subduction processes along the megathrust. The earthquake locations and temporal distributions are to be correlated with structural information to test different models of plate coupling. Specifically, a buried basement ridge within the subducting oceanic plate abuts against the crystalline rocks within the overriding continental plate. Is the buried ridge a region of strong contact (asperity) that would be locked, void of seismic activity within the contact region, but surrounded by seismic activity in the immediate surrounding weaker contact? Or, based upon a recently proposed model that associates forearc basins and accompanying gravity lows as strong patches, is the buried ridge actively generating seismic events? __Observations of subduction in central Oregon include a number anomalous data points. The long-known lack of uplift onshore, the occurrence of seismic events both just offshore in the oceanic plate and small thrust events along the megathrust, and seafloor geodetic results showing convergence rate less than expected. The subduction processes in this region are intriguing, perhaps atypical of what occurs elsewhere along the Cascadia subduction zone. The seismic experiment proposed by Trehu could add to the emerging possibility that this is a region of

atypical subduction. The PI is well accomplished with marine experiments and would likely succeed here. I notice the proposal is for 2006 shiptime and OBS units. While it seems too late for the proposal I think the PI has good reason û the deployment of the USARRAY would be contemporaneous û to go for this time frame. I suspect shiptime allocation requires the most lead time to organize, but the request is modest, 6 day per year of a locally available medium ship, and might be arranged. ____

What are the broader impacts of the proposed activity? __The broader impacts are primarily how this would contribute to hazard assessment of the CSZ and perhaps most importantly significantly leverage the NSF Earthscope program.

Summary Statement __I give this proposal a very good rating.

Review #5

Proposal Number:	0550402
Performing Organization:	Oregon State University
NSF Program:	Marine Geology and Geophysics
Principal Investigator:	Trehu, Anne M
Proposal Title:	Monitoring seismicity associated with a possible asperity on the Cascadia megathrust
Rating:	Very Good

REVIEW:

What is the intellectual merit of the proposed activity? __This proposal requests funds for two 1-year deployments of 16 short period OBSs offshore of the Cascadia Margin. The intellectual merits of this proposal are significant and its results have a high probability of impacting a number of ongoing studies within the region. The project is obviously strengthened by the significant volume of background data on the structure of the margin and staging of the US array on land. __Micro-earthquakes data are an important tool in addressing the frictional properties of the subduction interface. Although in recent years there have been a handful of events located within the proposed study area (detected by land-based seismic stations), present results cannot discern if these events are associated with the plate boundary. The proposed array should provide our first picture of the distribution of micro-seismic activity along the shallow interface and define the up dip limit of the locked zone. __I have two criticisms of this project: a) From a statistical standpoint, the 2-month gap in monitoring is not ideal. b) There appears to be an active source component, as mention in the first paragraph of section C.5; however, it is poorly described. Each OBS can be ranged to after deployment without the use of airgun shots and it is not clear what the purpose of the reflection work is or what system will be used? No additional ship time for this appears to be requested in the first year. I suspect that this work is not critical to the project, and that the existing ORWELL data will be sufficient for the

construction of a 3-D velocity model. ____

What are the broader impacts of the proposed activity? __This work will provide important constraints to aid in the design and site selection of geodetic and seismic instrumentation to be eventually deployed as part of a cabled observatory within the region. Support is also requested for a graduate student and undergraduates will participate in the cruises. ____

Summary Statement __This project will elucidate the position of the locked zone and frictional characteristics of the plate interface. This work has important implications for hazards within the region and I would strongly recommend it be funded.