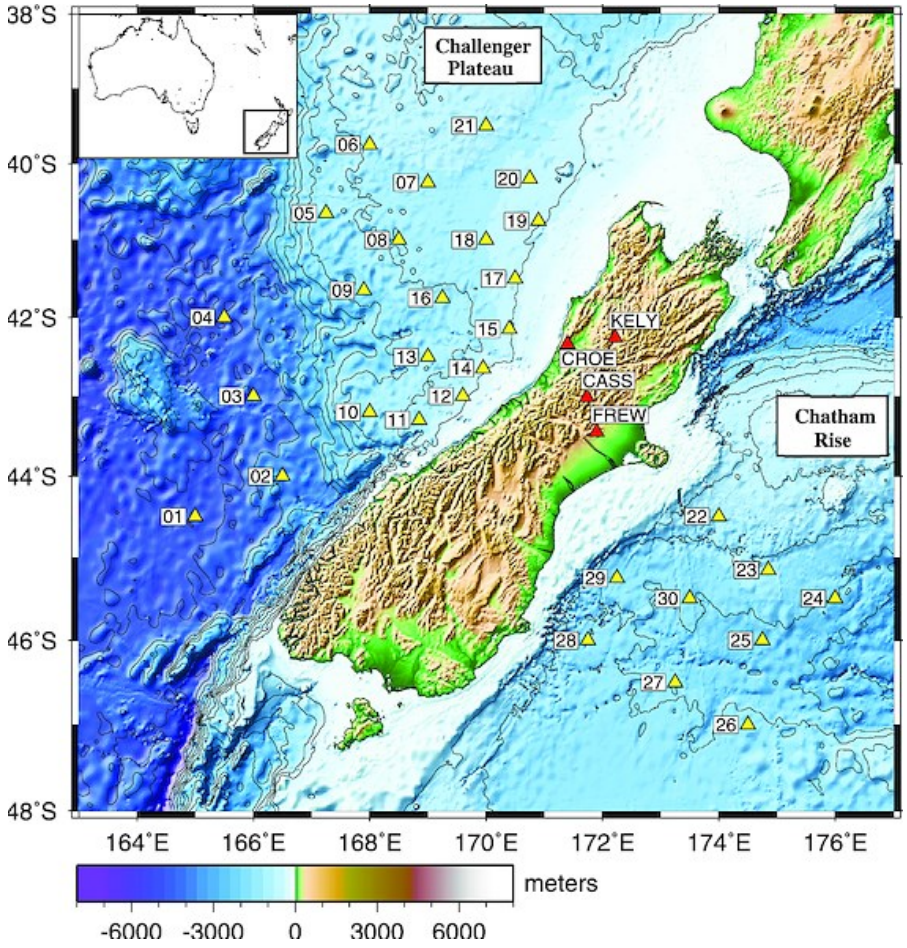
OBSIP Experiment Archive

Year:	2009
Experiment Name:	Marine Observations of Anisotropy (MOANA) Constraining Mantle Rheology, Mantle Flow, and Crust/Mantle Coupling Beneath New Zealand
Principal Investigator(s):	Anne Sheehan (UC Boulder) Martha Savage (U of Wellington) Tim Stern (U of Wellington) Peter Molnar (UC Boulder) John Collins (WHOI) Brad Hager (MIT) Greg Hirth (Brown)

Experiment Summary: (Taken from NSF Abstract Award #0409564): One of the critical questions in Continental Dynamics is: "What is the rheology of the system?" Do rocks deform in the ductile regime by diffusion creep (with strain rate proportional to stress), or by dislocation creep (where doubling the stress increases strain rates ~10 times)?. Is the lower crust relatively strong, with efficient coupling of strain between the crust and mantle, or weak, as in the classic "jelly sandwich" model? Is the upper mantle strong, as expected for dry peridotite, or weak, due to high volatile content? Is deformation in the upper mantle localized along shear zones beneath crustal faults, or distributed, as in thin viscous sheet models?



This is a project that will use seismic anisotropy to measure strain in the mantle and that when combined with mineral physics, to constrain deformation mechanisms and therefore to constrain rheology.

Continued Next Page

OBSIP Experiment Archive

...Continued

Year:	2009
Experiment Name:	Marine Observations of Anisotropy (MOANA) Constraining Mantle Rheology, Mantle Flow, and Crust/Mantle Coupling Beneath New Zealand
Principal Investigator(s):	Anne Sheehan (UC Boulder) Martha Savage (U of Wellington) Tim Stern (U of Wellington) Peter Molnar (UC Boulder) John Collins (WHOI) Brad Hager (MIT) Greg Hirth (Brown)

Experiment Summary: ...The PIs maintain that the strike-slip system in New Zealand is the best place to study these relationships because the signal is large and simple with constraints at the surface provided by geology, GPS, and known relative plate motions for the last 45 million years. Specifically the project involves: 1) Deployment of 30 Ocean Bottom Seismographs; 2) Measurement of seismic anisotropy using a variety of techniques (shear-wave splitting, surface wave dispersion, Pn and Sn travel times, and receiver functions); 3) Calculations of mantle finite strain fields that might be responsible for anisotropy, constrained by relative plate motions and observed strain in New Zealand and considering a variety of vertical and lateral distributions of temperature and deformation mechanisms; and 4) Combination of laboratory, theoretical and seismological constraints on anisotropy to bound the conditions under which dislocation creep occurs.

Cruises:
1/29/2009 - 2/6/2009:
30 SIO broadband ocean bottom seismographs were deployed via the R/V Thomas Thompson.
1/26/2010 - 2/17/2010:
28 of the instruments were recovered using the R/V Roger Revelle, one instrument was trawled up in June/ July 2010 and was eventually returned, and one instrument washed ashore at an unknown sate and was recovered in 2011.

Data:
Data from all OBSIP instruments deployed is archived under temporary network code ZU at the IRIS DMC.

Downloads/Links:

OBSIP Workshop Presentation

JGR Publication

G-Cubed Publication