

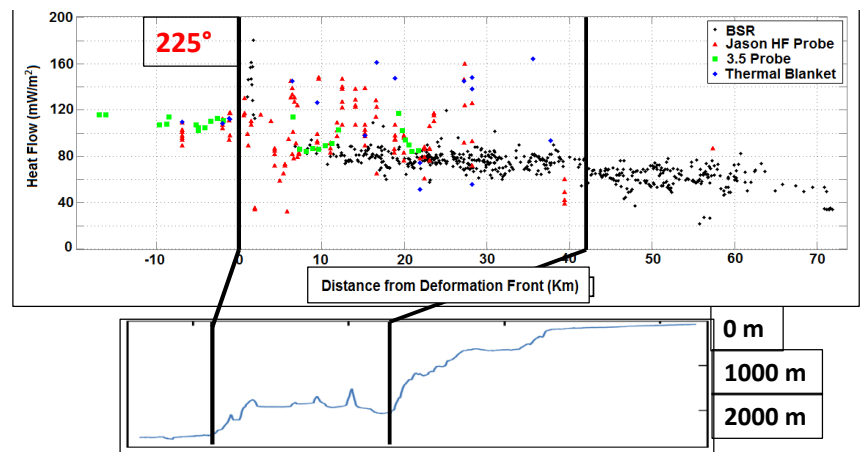
Heat Flow at the Cascadia Subduction Zone

H. Paul Johnson, Evan A. Solomon, Robert N. Harris

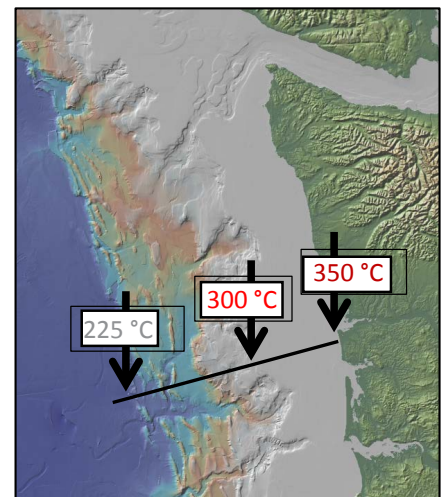
This currently active research grant has the objective of determining the heat flow and fluid flux regime on the Washington State portion of the Cascadia Subduction Zone. The underlying goal of the program is to determine the temperature of the decollement (tectonic plate slip zone), a critical parameter in identifying the potential slip area for the next large megathrust (Magnitude 9) earthquake in the Pacific Northwest. Determining the intersection points of critical isotherms with the decollement will inform temperature-dependent numerical models of the up- and down-slope boundaries of the region where inter-seismic stress is stored.

A field program on the R/V Atlantis, using the Remotely Operated Vehicle Jason II was supported by this GeoPRISMS grant in August, 2013. This 3-week cruise successfully collected an unusual amount of heat flow and fluid flux measurements on a corridor of the Washington margin off Greys Harbor, WA. At the present

time, initial processing of all of the heat flow, fluid flux and geochemical data has been completed, and we are now at the penultimate stage of integrating the diverse data sets and developing numerical models of both fluid circulation and isotherm distribution within the sedimentary wedge. In addition to the heat flow and fluid flux data, we are also processing acoustic backscatter data from the R/V Atlantis EM302 swath bathymetry system to identify areas of high intensity reflections due to authigenic carbonate deposition. These sites represent areas of the Cascadia sedimentary wedge where fluid and methane emissions have been persistent over thousands of years, and will provide a geological history of the evolving hydrologic system within the accretionary prism over time.



Top: Profile of compiled heat flow data from the August, 2013 GeoPRISMS cruise. Black dots are heat flow from Bottom Simulating Reflectors from the Langseth 2012 cruise over the same margin. Red triangles are Jason HF probe measurements, green squares are the OSU long HF probe, and blue dots are UW thermal blankets. Temperature of the incoming plate west of the decollement is 225°C. Middle: bathymetric profile of the margin where the heat flow data were acquired. Bottom, temperatures of the decollement beneath the accretionary wedge of sediments.



Publications and Talks

Johnson, H. Paul, Evan A. Solomon, Robert N. Harris, Marie S. Salmi, and Richard D. Berg. "Heat Flow and Fluid Flux in Cascadia's Seismogenic Zone." *Eos, Transactions American Geophysical Union* 94, no. 48 (2013): 457-458.

Johnson, H. Paul, Evan Solomon, Robert Harris, Marie Salmi and Richard Berg; A Geophysical and Hydro-geochemical Survey of the Cascadia Subduction Zone, *GeoPRISMS Newsletter Issue No. 32* Spring 2014

Hautala, Susan L., Evan A. Solomon, H. Paul Johnson, Robert N. Harris, and Una K. Miller. "Dissociation of Cascadia margin gas hydrates in response to contemporary ocean warming." *Geophysical Research Letters* (2014).

Homola, Kira, H. Paul Johnson, and Casey Hearn. "In situ measurements of thermal diffusivity in sediments of the methane-rich zone of Cascadia Margin, NE Pacific Ocean." *Elementa: Science of the Anthropocene* 3, no. 1 (2015)

Johnson, H. Paul, Una Miller, Marie Salmi, Evan Solomon, Analysis of Bubble Plume Distributions to Evaluate Methane Hydrate Decomposition on the Continental Slope submitted to *G-cubed* June, 2015.

Atwater, Brian F., Bobb Carson, Gary B. Griggs, H. Paul Johnson, and Marie S. Salmi*. "Rethinking turbidite paleoseismology along the Cascadia subduction zone." *Geology* 42, no. 9 (2014): 827-830.

Salmi, M. and U. Miller. *The Silent Subduction Zone*. Ocean Shores Community Environmental Group Meeting. May 1st, 2014. Galway Bay Community Center. Quinault Tribal Nation outreach talk.

Salmi, M., H.P Johnson, E. Solomon, R. Harris. 2014. Heat Flow Survey on the Washington Margin of the Cascadia Subduction Zone. AOGS Annual Meeting, July 28 - August 1st, 2014. Sapporo, Japan

Salmi, M., H.P. Johnson, E.A. Solomon, R.N. Harris. 2014. Heat Flow Survey on the Washington Margin of the Cascadia Subduction Zone. AGU Fall Meeting, 15-19 December 2014, San Francisco, CA

Berg, R.D., Solomon, E.A., Johnson, H.P., Culling, D., Harris, R.N., 2014. Fluid and solute fluxes from the deformation to the upper slope at the Cascadia margin. AGU Fall Meeting, 15-19 December 2014, San Francisco.