# Evaluating the subseafloor fluid circulation model of Middle Valley, Juan de Fuca Ridge

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Currently, fluid circulation patterns and the evolution of rock/fluid compositions as circulation occurs in subseafloor hydrothermal systems are poorly constrained. Sedimented spreading centers provide a unique opportunity to study subsurface flow because the sediment acts as an insulating blanket that limits: (a) potential flow paths for seawater to recharge the aquifer in permeable upper basaltic basement and (b) points of altered fluid egress, as well as trapping heat from the cooling magma body below. This allows for a range of thermal and geochemical gradients to exist near the sediment-water interface. Models of circulation patterns in this type of hydrologic setting have been generated (eg. Stein and Fisher [1]) however existing fluid chemical data have not been fit to the models to prove/disprove their viability. We address this issue by integrating the rich data sets from Middle Valley on the Juan de Fuca Ridge, allowing us to comprehend circulation and elemental exchanges at multiple scales. Middle Valley hosts a variety of hydrologic regimes within the local system: including areas of fluid recharge (Site 855, Wheat and Fisher [2]), active venting (Site 858, Butterfield *et al* [3]), recent venting (Site 856, Mottl *et al* [4]) and a section of heavily sedimented basement located between recharge and discharge sites (Site 857).

We will present results based on thermal and geochemical data from the Active Area of Venting (Sites 858 and 1036) collected during Ocean Drilling Program Legs 139 and 169. These drilling data coupled with a post-drilling heat flow survey resulted in a model of active, high temperature, fluid venting (264ºC) within a hydrothermal discharge area focused by a basement high (Stein *et al* [5] Stein and Fisher [1]). Here we use the basis of the existing model, along with fluid compositional data collected from sediment pore waters and high temperature hydrothermal vents, to elucidate finer scale controls on secondary fluid flow within the sediment section at Site 858/1036.

[1] Stein & Fisher (2001) *JGR Solid Earth* **106**, 8563-8580 [2] Wheat & Fisher (2007) *GRL* **34**, L20602 [3] Butterfield *et al* (1994) *Proc. ODP Sci. Res.* **139**, 395-410 [4] Mottl *et al* (1994) *Proc. ODP Sci. Res.* **139**, 679-693 [5] Stein *et al* (1998) *Geology* **26**, 1115-1118