

## Hydrothermal Circulation In Fault Slots With Topography

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Circulation of hydrothermal fluid is often likely to be confined within a permeable fault slot. Examples are (1) the Lost City Hydrothermal Field (LCHF) at 30° N in the Atlantic, which is likely to be controlled by large E-W faults related to the Atlantis transform fault, and (2) large normal faults bounding the Hess Deep rift in the East Pacific, which contain intense hydrothermal metamorphic assemblages in lower crustal gabbros formed at 200-350 °C. This type of circulation could occur anywhere where steep faults cut the oceanic crust, including large near-axis normal faults, transform faults and faults at subduction bend zones, and could be the major way in which the upper mantle and lower crust are hydrated.

Previous 2-D modelling of the LCHF shows that seafloor topography and permeability structure combine together to localise the field near the highest point of the Atlantis Massif. Our new models are 3-D, based on a 10km cube with seafloor topography of ~ 2km affecting both the fault slot and impermeable wall rocks. We use a constant basal heatflow corresponding to the near conductive thermal gradient measured in IODP Hole 1309D, 5km north of the LCHF, and a constant temperature seafloor boundary condition. Permeability in the slot is varied between  $10^{-14}$  and  $10^{-15}$  m<sup>2</sup>. Generic models not based on any particular known topography quickly stabilise a hydrothermal system in the fault slot with a single upflow zone close to the model edge with highest topography. Venting temperature falls with increasing slot permeability, and if the depth of hydrothermal circulation is reduced. These temperatures correspond to prehnite-chlorite assemblages seen in fault rocks at Hess Deep, but are higher than those observed at the LCHF. Work is continuing to vary permeability, fault slot geometry and topography to better match the conditions in the Atlantis Massif.