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Transport of Heat by Hydrothermal Circulation in a Young Rift Setting: Observations from the Auka and JaichMaa Ja'ag' vent Field in the Pescadero Basin, Southern Gulf of California.

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New heat flow measurements collected throughout the Auka and JaichMaa Ja' ag' hydrothermal vent fields in the central graben of the Southern Pescadero Basin, southern Gulf of California, indicate that upflow of hydrothermal fluids associated with active rifting dissipate heat in excess of 10 W/m^2 around faults that have a few tens-of-meters of displacement. Heat flow anomalies slowly decay to background values of ~2 W/m^2 at distances of ~1 km from these faults following an inverse square-root distance law. We develop a physical model of the Auka vent field based on the fundamental Green's function solution of the heat equation. The model includes the effects of circulation in the porous networks of faults and the lateral seepage of geothermal brines through the fault walls to surrounding hemipelagic sediments. We use an optimal fitting method to estimate the reservoir depth, permeability, and circulation rate. Our model indicates the heat source is at a depth of ~5.7 km; permeability and flow rates in the fracture system are ~10^{-14} m^2 and 10^{-7} m/s, respectively, and ~10^{-16} m^2 and 10^{-8} m/s in the basin aquitards, respectively. Model scaling laws point to the importance of faults in controlling sediment-hosted vent fields and slow circulation throughout low permeability sediments in controlling the brine's chemistry. Although the fault model seems appropriate and straightforward for the Pescadero vents, it does seem to be the exception to the other known sediment-hosted vent fields in the Pacific.