VOLCANOLOGY ABSTRACTS

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Volcanic Processes Influencing Development of Geothermal Resources

High-temperature geothermal resources occur primarily in zones of volcanism along spreading ridges, above subduction zones, and at intraplate melting anomalies. In these regions of crustal magmatism, thermal energy is transferred upward by conduction and by the coupled processes of magma movement and hydrothermal circulation of meteoric and ocean water. Favorable geothermal targets occur where basaltic magma injected repeatedly into the crust creates long-lived magmatic systems producing intermediate and silicic magmas through a complex set of processes dominated by fractionation and crustal contamination. These derivative magmas of low density and high viscosity are more likely than basalt to accumulate in the upper crust as stable heat sources driving overlying hydrothermal convection systems.

Geothermal reservoir geometry in volcanic terranes results from the complex interaction of active volcano-tectonic processes and older volcanic stratigraphy and structure. Hot springs tend to occur at relatively low elevations at the distal ends of obliquely upflowing tongues of hot water, commonly along structurally favorable zones. Frequently, the principal geothermal reservoir is a deeper zone of primary hydrothermal upflow that is offset toward the youngest volcanic rocks. Therefore, in developing a geothermal field, the ages, volumes, and spatial relations of young volcanic rocks must be considered.

Volcanic hazards must be considered in siting and constructing surface geothermal facilities. Both the potential for various types of eruptions and the impact of magma-induced ground deformation on sensitive structures must be evaluated.