A Quantitative Estimate of the Upflow of Thermal Waters at a Dextral Strike Slip Zone at Mount Princeton Hot Springs, Colorado, using Geoelectrical Methods

Kyle Richards[1], Andre Revil[2], Mike Batzle[1], Abdel Jardani[3] and Allan Haas[1]
Geophysics Department, Colorado School of Mines, Golden, CO 80401

Abstract. In geothermal fields, open faults and fractures often act as high permeability pathways bringing hydrothermal fluids to the surface from deeper formations. The Mt. Princeton area, in south-central Colorado, is an area that has an active geothermal system closely related to faulting. A right-lateral offset in the Sawatch range-front fault, characterized by a lateral strike-slip fault perpendicular to the main fault, can be observed at the hydrothermally-altered Chalk Cliffs near the Mount Princeton Hot Spring area. DC electrical resisitivity and self-potential measurements were used to identify the preferential fluid flow pathways for the hydrothermal source and provide evidence of the existence of a fault/shear zone that is acting as the dominant flowpath bringing thermal waters to the near-surface aquifer. Complementary results of the resistivity tomography and self-potential data support the presence of a shear zone and reveal its position along the resistivity profiles. Self-potential measurements are also used to estimate the flux and direction of upwelling hot water along the shear zone. A deterministic inverse modeling approach based on the Gauss-Newton method is used to assess the discharge of thermal waters from the near-surface breakdown region of the controlling shear zone. The fault zone was imaged to a depth of approximately 200 meters, with a mean Darcy-velocity in the fault of $7 \pm 2 \times 10^{-7}$ m s^{-1}.

[1] Geophysics Department, Colorado School of Mines, Golden, CO 80401
[2] Geophysics Department, Colorado School of Mines, Golden, CO and LGIT, UMR C5559, Université de Savoie, 73376 Le Bourget-du-lac Cedex, France
[3] Université de Rouen, M2C, UMR 6143, CNRS, Morphodynamique Continentale et Côtière, 76821 Mont Saint Aignan, France