

Exploring Magnetotelluric Data as a Geothermal Assessment Tool in the Caja del Rio Near Santa Fe, New Mexico

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Abstract

Magnetotelluric (MT) data collected during June 2011 at Summer of Applied Geophysical Experience (SAGE) was used as a geothermal assessment tool in the Caja del Rio. This area is part of the Cerros del Rio volcanic field in the Rio Grande rift approximately 25 km northwest of Santa Fe, New Mexico. Geothermal indicators nearby include exposed vents, high $^3\text{He}/^4\text{He}$ ratios in the groundwater, rift related faults, and a $58^\circ\text{C}/\text{km}$ thermal gradient (Manning, 2009) which slightly exceeds thermal gradients measured in Albuquerque, New Mexico over comparable depths. We present one-dimensional inversion models of the MT data collected from four sites by SAGE 2011 in the Caja del Rio area. The models suggest a depth of 2 km to the basement, in agreement with previous models supporting water-bearing Santa Fe Group sediments above a low-porosity, impermeable basement rock. The 2011 SAGE MT data was also used to estimate the depths of a mid-crustal conductor ranging from 10 to 14 km. We propose to extend the interpretation by Wannamaker et al. (2008) that a mid-crustal conductor for the Eastern Great Basin represents the 500°C isotherm, to the Caja del Rio area. This analysis supports geothermal prospects by explaining in part the high thermal gradients in the Caja del Rio.