Magnetotelluric Studies of the Laguna del Maule Volcanic Field, Central Chile

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Geodetic data has shown that the surface of the Laguna del Maule (LdM) volcanic field in central Chile has been moving upwards at rates >20 cm/yr since 2007 over an area of 200 km^2. It has been hypothesized that this ground deformation is due to an inflating magma body at ~5 km depth beneath the lake (2.8 km b.s.l.). This magma body is a likely source for the large number of rhyolitic eruptions at this location over the last 25 ka. A dense broadband magnetotelluric (MT) array was collected from 2009 to 2015 and included data from a geothermal exploration project. MT phase tensor analysis indicates that the resistivity structure of the region is largely three-dimensional for signals with periods longer than 1 s, which corresponds to exploration depths >5 km. The MT data were inverted using the ModEM inversion algorithm to produce a three-dimensional electrical resistivity model which included topography. Four primary features were identified in the model: 1) A north-south striking, 10 km by 5 km, low-resistivity zone (<5 Ωm) northwest of the inflation centre at a depth of ~5 km (2.8 km b.s.l.) is interpreted as a zone of partial melt which may be supplying material to account for the observed ground deformation; 2) A shallow low-resistivity feature ~400 m beneath the lake surface (1.8 km a.s.l.) and spatially coincident with the inflation centre is interpreted to be a zone of hydrothermal alteration; 3) A thin, low-resistivity feature to the west of LdM at a depth of ~250 m (2.2 km a.s.l.) is interpreted to be the clay cap of a geothermal system; 4) A large, low-resistivity zone beneath the San Pedro Volcanic Complex to the west of LdM at a depth of ~10 km (8 km b.s.l.) is interpreted to be a zone of partial melt.

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