Revisiting Toba Caldera: an insight from regional magnetotelluric data

Lukman Sutrisno¹, Fred Beekman¹, Yunus Daud², and Jan Diederik Van Wees¹,³

¹Utrecht University, the Netherlands
²Universitas Indonesia, Indonesia
³TNO, the Netherlands

Regional magnetotelluric (MT) survey had been conducted to image resistivity structures beneath Toba Caldera, Indonesia. A crustal-scale 2D inversion model is generated from ten MT stations with extended recording time, deployed along NE-SW regional line to cross perpendicularly both the Caldera and the nearby regional strike-slip fault system, the Sumatran Fault. High resistivity background is likely related to Palaeozoic rocks which is basement of the Tertiary sediments and the Quaternary volcanics. The most noticeable conductive anomaly is located between 10-20 km deep, interpreted as the main magma reservoir beneath the region. An intermediate, less than 10 km deep, less conductive anomaly beneath the Caldera is interpreted as shallow magma chamber affected by the last major eruption. Shallow, less than 2 km-deep conductive layers are associated either with hydrothermal clay cap beneath the Caldera, or sedimentary formations of the nearby basins. Other conductive anomaly is spatially associated with the Sumatran Fault which located 15 km away from the Caldera. Parameter plots of some stations are consistent with the orientation of basement structures, while the others may be affected by more complex caldera structures. A conceptual model of magma plumbing system beneath the Caldera is then interpreted from the combination of regional resistivity structures, surface geology, and available seismic tomography.