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Abstract 2-04p

# Shallow structure of the hydrothermal system at Taal volcano (Philippines) inferred by detailed electrical resistivity tomography

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Since 1572, Taal volcano in the Philippines (14°N, 121°E) has erupted 33 times, causing around 1,700 casualties in total during the most violent eruptions as those of 1749, 1911, and 1965. Seismic activity increased during the period 1991-1994 and was accompanied by ground deformation, opening of fissures and surface activity. Since 2005, the Philippines Institute of Volcanology and Seismology (PHIVOLCS, http://www.phivolcs.dost.gov.ph/) and the Inter-Association of Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV, http://www.emsev-iugg.org/emsev/) jointly work on understanding the volcano dynamism and on monitoring the activity.

In March 2010 the shallow structure was investigated by Electrical Resistivity Tomographies (ERT) performed on the northern flank of the volcano and in the crater (Fig. 1). Most measurements were collected using a remote method based on laboratory-made equipment fashioned at Aristotle University of Thessaloniki. The methodology allows getting information at great depths, in cases where using a multi-core cable with fixed electrode spacing is not possible (Fig. 2).

Two geothermal fields located on the northern flank and inside the crater of the volcano have been studied and electrical tomographies delineate high and low resistive bodies till a depth of 250 m (Fig. 3 and Fig. 4 respectively).

Interpretation of the resistivity models suggests that hydrothermal fluids appear to originate from inside the northern part of the crater and flow upward till the ground surface (Fig. 5). Moreover, acidic water from the Main Crater Lake infiltrates the ground and penetrates inland. On the northern flank of the crater, hydrothermal fluids, cross the crater rim and produce hydrothermal exchanges with the outer northern geothermal field mineralizing the northern crater rim and making it mechanically weaker.

The consequence on an extended hydrothermal system near the sub-surface inside and outside the crater is that a rapid dyke injection or high temperature gas release could lead to sudden phreatic explosions and to a mechanical destabilization of the northern crater rim.

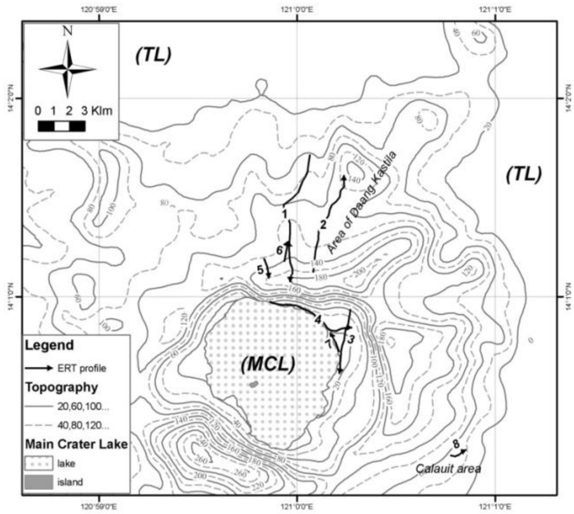


Fig. 1: Layout of ERT lines numbered 1 to 8 on the topographic map of Taal Island.

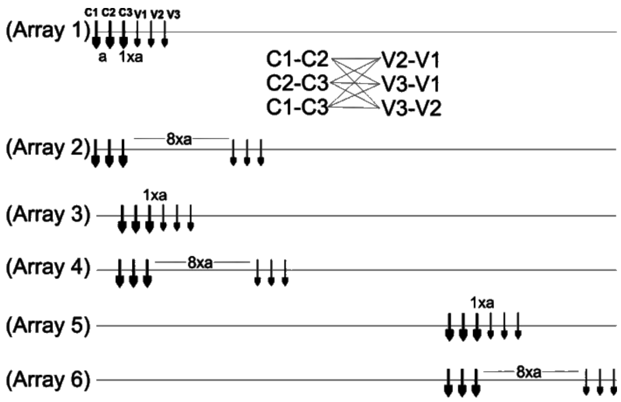


Fig. 2: Synthetic method used during the remote dipole-dipole approach. Dipole spacing is 50m and maximum current-potential separation (8*a) is 400m.

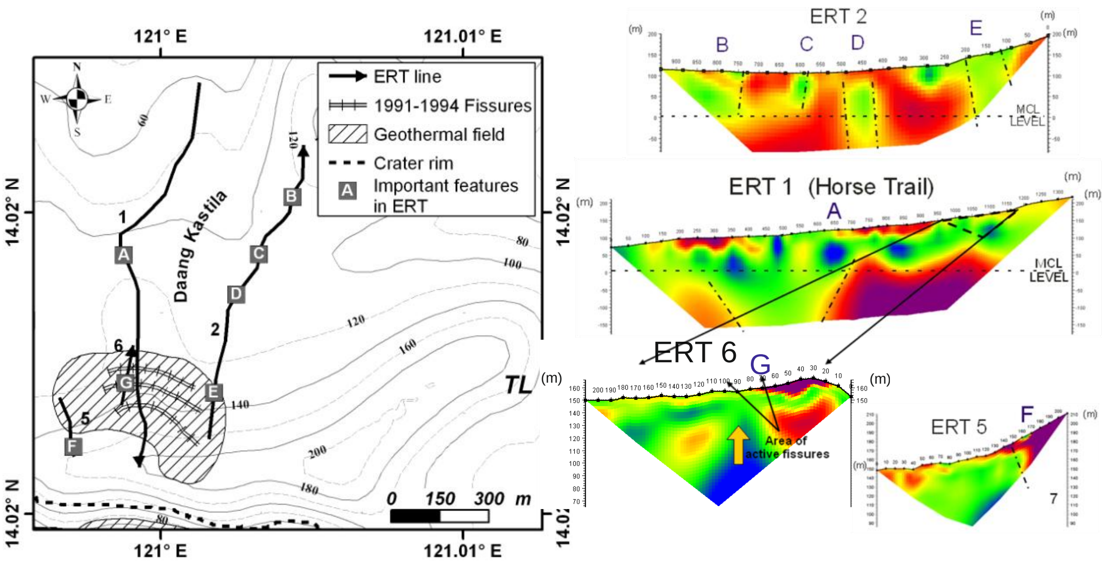


Fig. 3: (Left) ERT1, 2, 5 and 6 measured on the northern volcano flank (Daang Kastila area). A to G markers show the location of important features detected. (Right) Inversion model of ERTs. Markers A...G show the most important features.

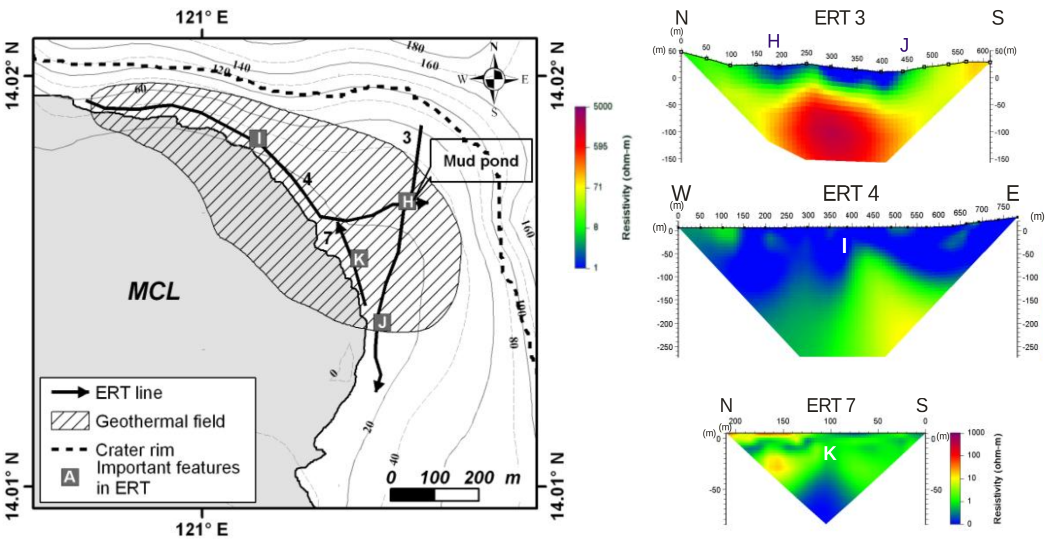


Fig. 4: (Left) ERTs 3, 4 and 7 measured in Main Crater area. Markers H, I, J and K show the location of important features detected. (Right) Inversion model of ERTs.

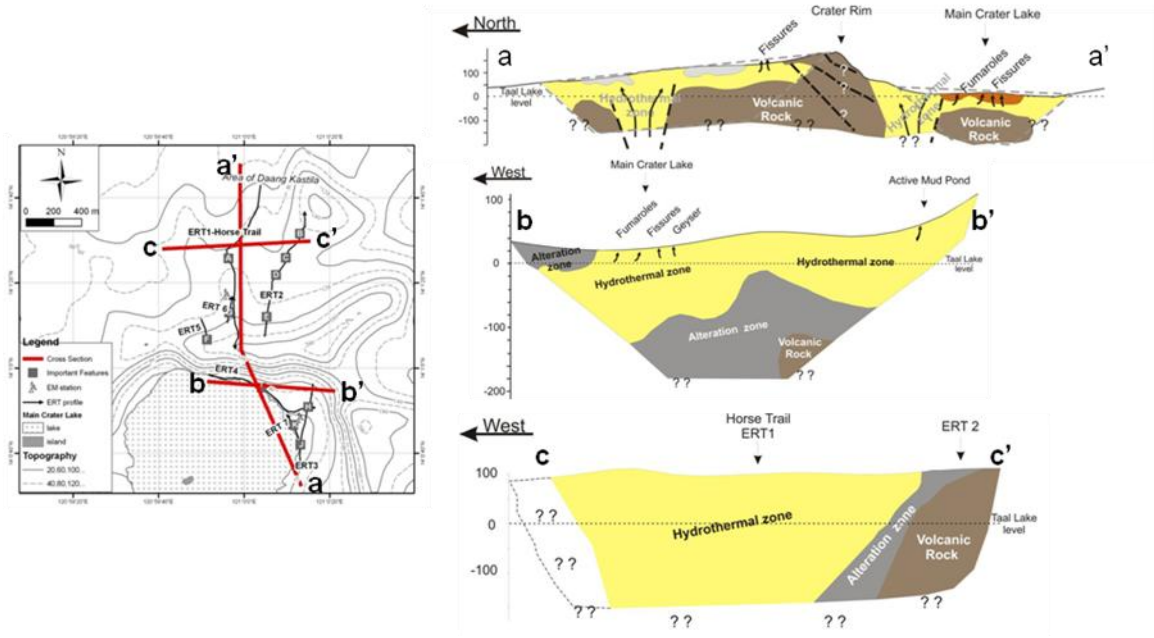


Fig. 5: Interpretation of the Electrical Resistivity Tomographies

(after Fikos et al., in press in Bull. Volcanol., 2012).