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Comparison of magmatic structures beneath Redoubt (Alaska) and Toba (Northern Sumatra) volcanoes derived from local earthquake tomography studies

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We present the results of seismic tomography studies of two different volcanoes – Mt. Redoubt and Toba caldera. These two subduction related volcanoes have different ages and scales of eruption activity. Velocity model beneath the Redoubt volcano is based on tomographic inversion of P- and S- arrival time data from over 4000 local earthquakes recorded by 19 stations since 1989 to 2012 provided by the Alaskan Volcano Observatory (University of Fairbanks). Just below the volcano edifice we observe an anomaly of high Vp/Vs ratio reaching 2.2 which is seen down to 2- 3 km depth. This indicates a presence of partially molten substance or fluid filled rocks. We can suggest that anomaly area matches with volcano magma chamber.

One of the previous velocity models of Toba caldera was obtained by Koulakov et al. (2009) and was based on data recorded by temporary network from January to May 1995. In this study this "old" dataset was supplemented with "new" data recorded by a temporary network deployed in approximately same area by GFZ-Potsdam from May to November 2008. We have manually picked the arrival times from the local events recorded by the later experiment and then performed the tomography inversion for the combined dataset using the LOTOS code (Koulakov, 2009). In the uppermost layers we observe strong low-velocity P- and S-anomalies within the Caldera which can be interpreted by the presence of think sediments filling the caldera. In the lower crust and uppermost mantle we observe a vertical anomaly of low P- and S-velocities which probably represent the path of conduits which link the caldera area with the slab. Similar to Redoubt volcano, resulting velocity model of Toba has an increased value of Vp/Vs ratio that indicates a presence of magma reservoir.

Comparison of the tomographic results obtained for the completely different volcanic systems helps in understanding some basic principles of feeding the volcanoes.

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