



Seismic tomography reveals magma chamber location beneath Uturuncu volcano (Bolivia)

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Uturuncu volcano belongs to the Altiplano-Puna Volcanic Complex in the central Andes, the product of an ignimbrite “flare-up”. The region has been the site of large-scale silicic magmatism since 10 Ma, producing 10 major eruptive calderas and edifices, some of which are multiple-eruption resurgent complexes as large as the Yellowstone or Long Valley caldera.

Satellite measurements show that the hill has been rising more than half an inch a year for almost 20 years, suggesting that the Uturuncu volcano, which has erupted last time more than 300,000 years ago, is steadily inflating, which makes it fertile ground for study.

In 2009 an international multidisciplinary team formed a project called PLUTONS to study Uturuncu. Under this project a 100 km wide seismic network was set around the volcano by seismologists from University of Alaska Fairbanks. Local seismicity is well distributed and provides constraints on the shallow crust. Ray paths from earthquakes in the subducting slab complement this with steep ray paths that sample the deeper crust. Together the shallow and deep earthquakes provide strong 3D coverage of Uturuncu and the surrounding region.

To study the deformation source beneath the volcano we performed simultaneous tomographic inversion for the V_p and V_s anomalies and source locations, using the non-linear passive source tomographic code, LOTOS. We estimated both P and S wave velocity structures beneath the entire Uturuncu volcano by using arrival times of P and S waves from more than 600 events registered by 33 stations. To show the reliability of the results, we performed a number of different tests, including checkerboard synthetic tests and tests with odd/even data.

Obtained V_p/V_s ratio distribution shows increased values beneath the south Uturuncu, at a depth of about 15 km. We suggest the high ratio anomaly is caused by partial melt, presented in expanding magma chamber, responsible for the volcano inflation. The resulting V_p , V_s and the ratio reveal the paths of the ascending fluids and melts, feeding the magma chamber.

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