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Longevity of a large magma body beneath Uturuncu Volcano, Bolivia, as constrained by surface lineaments, stress models and InSAR

T. R. Walter and M. Motagh

Dept. Physics of the Earth, GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany, email: twalter(at)gfz-potsdam.de

The presence of numerous voluminous ash-flow eruptive products implies that numerous major magma bodies have been present within the Central Andes, however, it is not understood how these magma bodies develop and change as a function of time. At Uturuncu volcano, SW Bolivia, we investigate optical remote sensing data and perform a detailed GIS lineament analysis, showing that a girdle of river streams and faults encircle the volcano at distance of up to 25 km. Using numerical stress models we consider a magma body beneath and find the lineaments best explained by a deflating sill-shaped magma body at 22±8 km depth. However, current surface uplift in the region as detected by InSAR data suggests that magma inflation occurs. We invert a stack of 11 InSAR data spanning the time period 2003-2008 and find that the strength and pattern of deformation can be explained by an inflating sill-shaped magma body at 24±6 km depth. Thus independent analysis of lineament and InSAR data suggest the presence of a large sill-shaped magma body 20-25 km beneath Uturuncu. Our findings imply that extended magma bodies may exist, deflate and inflate, over long time spans without the expression of volcanic eruptions at the surface and without receiving much attention – and may bear a major hazard potential because of the considerable dimensions and volumes of magma temporarily stored in the shallow crust.