Subsurface structures associated to volcanic systems are, in some cases, a density anomaly that has an associated potential field signal. Geophysical techniques can identify such signal and invert it to produce sub-surface density anomaly distribution models. Here, we present a 3D inversion model of an area of 5000 km² in Southern Bolivia using gravity data from 143 new and 60 previous regional benchmarks. Volcanic activity in this region has evolved from very large silicic volcanic systems that generated huge volumes of ignimbrites to, more recently, the eruption of silicic lavas that built large composite cones. Assuming a density contrast of ±150 kg m⁻³ our results show a predominantly low-density volume that extends down, at least, 15 km depth to a region that other regional geophysical data indicate is the top of the Altiplano-Puna magma body (APMB) – a thick region of hot partially molten rock. Within this volume, a large strong negative anomaly is identified beneath the large Vilama caldera system whereas other smaller strong negative anomalies root up towards Uturuncu and Soniquera, two of the most recent volcanic edifices. Smaller superficial anomalies are, in some cases, related to hydrothermal systems or regional tectonic features. The geometries and distribution of these anomalies can provide great insights into the extent and geometries of the sub-surface volcanic systems, including magma chambers. As an example, the negative anomaly identified beneath Uturuncu comprises, at around 15 km depth, the identified source of the on-going measured surface deformation, which is attributed to a magmatic intrusion.