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Evidence for magmatic and hydromagmatic activity in monogenetic centers: Tilocálar volcano, northern Chile

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Tilocálar volcano corresponds to two monogenetic centers located at the SE of Salar de Atacama Basin, northern Chile. These monogenetic centers are known as Tilocálar Norte (TCN) and Tilocálar Sur (TCS) are the result of the basic magma rise to the surface along the compressional structures of the N-S striking Tilomonte ridge developing an asymmetrical folding, which folds the Tucúcaro Ignimbrite. These volcanoes are built over a basement constituted by Ordovician granitoids, Oligocene-Eocene conglomerates, and sandstones, which are covered by Pliocene Tucúcaro Ignimbrite. TCN is located on the frontal limb of easternmost Tilomonte ridge and corresponds to four andesite lava flows and one small dome (El Maní). They have a maximum extension of 3.9 km to N and 1.2 km to SW from the emission center, and maximum bulk volume (MBV) of 0.53 km³, whereas El Maní is located on an extensional position of a NW-SE lineament to 300 m SW from the TCN emission center, covering 619 m² area and a MBV of 3,016 m³. El Maní has mafic and felsic products associated with mingling between original magma source related to the TCN lava flows and shallow crustal melts that generated products of the Tucúcaro Ignimbrite during a local transtensional regime. TCS is located on top of the hinge zone of Tilomonte ridge and is composed of pyroclastic deposits, lava flows, and an explosion crater. The pyroclastic deposits are characterized by two agglutinated basaltic andesite scoria fall units, which cover 2.2 km² area with a MBV of 0.3 km³. Four (to the W) and two (to the E) lava flows have been recognized, reaching up 1.8 and 1.4 km length from their emission centers, respectively. The lava flows correspond to basaltic andesite that covers an area of 3.56 km² and a MBV of 0.44 km³. On the other hand, an explosion crater is located 1.2 km SW from the TCS emission center. The crater has a diameter of 288 m (NS) x 363 m (EW), which is surrounded by individual conglomerates, sandstones, granitoids and tuff fragments that are laying on the present day ground surface around the crater rim. Tilocálar volcanoes were formed by a) a mild magmatic volatile-driven explosive phase, related to the emission of agglutinated scoria, b) an effusive phase (lava flows and dome), and c) an explosive phase that formed an explosion crater, probably related to phreatic activity (as so far no juvenile pyroclasts have been identified that could support direct magma and water interaction, hence phreatomagmatism).