

## MORPHOLOGY AND SPATIAL ANALYSIS OF THE MONOGENETIC VOLCANOES ON PUNA PLATEAU (NW ARGENTINA)

Sommer, C.A.<sup>1</sup>, Báez, W.<sup>2</sup>, Haag, M.B.<sup>1</sup>, Arnosio, J.M.<sup>2</sup>

<sup>1</sup>Universidade Federal do Rio Grande do Sul, <sup>2</sup>Universidad Nacional de Salta

**ABSTRACT:** Monogenetic volcanoes are among the most common landforms found on Earth. They are usually formed by short-lived eruption of basaltic to andesitic lava and can be classified according to the edifice morphology, which depends upon endogenous (magma composition, volatile content, ascent rate) and exogenous (structural setting, amount of external water, wind and terrain slope) factors. Several studies have shown that the morphology of monogenetic volcanoes and their spatial distribution reflect important parameters about the field dynamics and its controls. Despite its importance, few works have addressed important questions related to the spatial distribution of these landforms and their morphology in the Puna Plateau (24° - 27° S, Central Andes), the largest plateau formed in the absence of a continental collision. The main objective of this study consists of the identification and characterization of hundreds of Miocene-Pliocene monogenetic volcanoes that occur throughout the Puna region. The methodology involved the identification and classification of the landforms using GoogleEarth® and ArcMap®. Each landform was classified according to its morphology and defining key parameters such as the basal width (W<sub>co</sub>), height (H<sub>co</sub>) and flank slope (S<sub>co</sub>) were measured using imagery and topographic (SRTM 30-m) data. We also performed several analyses through a point pattern analysis (ppa) approach, including Kernel Density (KD), Average Nearest Neighbor (ANN) and the Standard Deviation Ellipse (SDE). In the studied area we identified 289 monogenetic volcanoes, with a predominance of cinder cones (75%), followed by lava domes (16%), phreatomagmatic structures (8%) and lava flows (2%). Cinder cones present a roughly elongated morphology with many breached edifices associated with lava flows that show diverse flow features. Some cones overlap each other or can be grouped by lineaments related to possible dike/conduit feeding systems, which display a preferred NW-SE orientation. Cinder cones also exhibit a wide variation on their morphometric parameters, with W<sub>co</sub> ranging from 200 to 3800 m, H<sub>co</sub> from 2 to 308 m and S<sub>co</sub> from 2 to 30°. Lava domes display a variety of morphologies and sizes, often associated with fall deposits and local or regional lineaments. Due to Puna's irregular topography, many *coulees* develop in the region, while *tortas* are restricted to flat areas as saltpans. Both landforms contain pressure ridges and flowing structures assisting paleoflow determinations. The phreatomagmatic structures occur on the south border of the plateau. Tuff rings dominate the hydrovolcanic landforms, often associated with basement blocks and depressed regions whereas maars show extensive fall deposits denoting a higher explosivity of this events. Fissural lavas are rare in the studied area, with only three occurrences in the whole plateau. The ppa reveals that the monogenetic volcanism in this region is characterized by a low density of eruptive centers placed along local (NW-SE) and regional (NNE-SSW) lineaments, with a high clustering degree (ANN with R-statistic of 0.51) and a directional anisotropy trending NNE-SSW (SDE with 160-340° trend). The geomorphologic expression of this volcanism results in the formation of cinder cones and associated lava flows, which can be grouped in seven main clusters along the Puna Plateau.

**KEYWORDS:** MONOGENETIC VOLCANISM, CENTRAL ANDES, PUNA PLATEAU.