Morphometric characterization of monogenetic volcanic cones of the Chichinautzin and Michoacán-Guanajuato monogenetic volcanic fields in Mexico

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Morphometric characterization of volcanic edifices is one of the main approaches providing information about a volcano eruptive history, whether it has one or more eruptive vents or if it had any sector collapses. It also provides essential information about the physical processes that modify their shapes during periods of quietness, and quite significantly, about the volcanoes' ages. In the case of monogenetic activity, a volcanic field can be characterized by the size and slope distributions, and other cone's morphometric parameter distributions that may provide valuable information about the temporal evolution of the volcanic field.

The increasingly available high-resolution digital elevation models and the continuously developing computer tools have allowed a faster development and more detailed morphometric characterization techniques. We present here a methodology to readily obtain diverse volcanic cone shape parameters from the contour curves such as mean slope, slope distribution, dimensions of the cone and crater, crater location within the cone, orientation of the cone's principal axis, eccentricity, and other morphological features using an analysis algorithm that we developed, programmed in Python and ArcPy. Preliminary results from the implementation of this methodology to the Chichinautzin and Michoacán-Guanajuato monogenetic volcanic fields in Mexico have permitted a preliminary estimation of the age distribution of some of the cones with an acceptable correlation with the available radiometric ages. A large part of the Chichinautzin region DEM was obtained from a LIDAR survey by the Mexican National Institute of Statistics and Geography (INEGI).