

Geophysical Investigations of Cerro Negro Volcano, Nicaragua: Insights on magmatic plumbing systems

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Cerro Negro near León, Nicaragua is a very young (163 years), relatively small basaltic cinder cone volcano that has been unusually active during its short lifespan (recurrence interval 6-7 years). Multiple explosive eruptions have deposited significant amounts of ash on León and the surrounding rural communities. While there have been a number of studies investigating the geochemistry, stress regime, and hazard implications of the volcano, subsurface structures have only been studied by shallow soil gas surveys. These studies have raised several questions as to the proper classification of Cerro Negro and its place in the regional stress regime. Should Cerro Negro, very young but very active, be considered a short lived, low intensity polygenetic cinder cone on the Cerro La Mula-Cerro Negro alignment, or as the early stages in the development of a longer lived, higher intensity stratovolcano? Is Cerro Negro a separate entity from neighboring Las Pilas-El Hoyo with a separate magma source, or merely the newest vent on the Las Pilas-El Hoyo volcanic complex? While surface features at Cerro Negro follow definite alignments that correspond to the regional stress regime, is this pattern continued and controlled by similar mechanisms at depth? In order to address these questions, we collected both gravity and magnetic data on Cerro Negro volcano in February and March of 2012 and 2013 in an attempt to delineate deep structures at the volcano. The gravity survey included a tight grid on Cerro Negro itself, an irregular grid of several stations on Las Pilas-el Hoyo, and several distal stations forming a ring approximately 24 x 31 km around Cerro Negro. Magnetic data was collected along several profiles within 3 km of Cerro Negro.

Analysis of gravity and magnetic data have revealed a marked NE-SW regional gravity trend, a 5 km³ positive anomaly beneath the neighboring Las Pilas-El Hoyo volcanic complex, a NNW trending linear anomaly beneath the Cerro Negro-Cerro La Mula alignment, and a 3 km³ positive anomaly to the southeast of Rota volcano. These findings suggest that eruptions at Cerro Negro may be tapping a large magma reservoir beneath Las Pilas-El Hoyo, implying that Cerro Negro should be considered the newest vent on the Las Pilas-El Hoyo volcanic complex. As such, it is possible that the intensity of volcanic hazards at Cerro Negro may eventually increase in the future to resemble those pertaining to a stratovolcano.