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The Popocatepetl stratovolcano_deep and shallow strructure from magnetic prspecting studies

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We present results of a magnetic investigation of the Popocatépetl volcano and its surrounding areas. Data acquisition began in 1995 with an aeromagnetic survey and a series of ground surveys. The results provide a better understanding of the magnetic properties and sources, and its relation with the surface geology and structure.
The area investigated documents existence of 4 aeromagnetic domains, each characterized by their associated anomalies, magnetization intensities, spectral wavelengths and location. The volcanic chain is identified with an aeromagnetic domain, characterized by isolated anomalies over volcanic structures, some visible and others covered by debris avalanche deposits and volcanic flows.The Popocatépetl volcano is characterized by a dipolar magnetic anomaly, associated with a magnetic high. A magnetic low is correlated with a weakness zone, associated with a major fault with a NE-SW orientation. In addition, a magnetic distortion is present at the NW portion of the present cone, corresponding to the oldest paleostructure recognized on the Popocatépetl. Towards the SW, other anomalies associated with the deep structures occur. The aeromagnetic alignments have a preferential direction NE-SW 50°- 60°
3-D aeromagnetic models show a series of bodies associated with different anomalies. The Popocatepetl anomaly, is formed by a body composed of two parts, a vertical one that almost reaches the crater (with a length of 4,450 m and maximum thickness of 530 m), and a lower elongated body with NE-SW direction (2,900 m) and NW-SE direction (1,750 m) and an average thickness of 1,570 m. A depth estimate of the sources by the average radially power spectrum, yields 4,000 m for deep sources, 1,300 m for intermediate sources and 530 m for the shallower ones.
The ground magnetic investigation delimits the Popocatépetl and Iztaccíhuatl stratovolcanoes, which are correlated with contrasts of magnetic lows aligned in an N-S direction. Results show three magnetic zones based on their wavelength and amplitude. The first, W of the Popocatépetl and Iztaccíhuatl stratovolcanoes, associated with tuffs and alluvial deposits, the second to the center, correlated mainly with volcanic rocks and the third to the E, correlated with tuffs and volcanic breccias. The results of the ground magnetic study indicate that the Sierra Nevada is limited to E and W by fault zones and that it could be considered as a "horst" structure.
The results of this study illustrate the potential of the aeromagnetic method to investigate active volcanic structures with abrupt topography andlimited access. The 3-D modeling algorithms allow us to improve the interpretation of the subsurface structure.