QUANTIFYING THE SPATIAL RELATIONSHIP BETWEEN ERUPTIVE CENTERS AND FAULTS

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The spatial distribution of volcanic eruptive centers (vents) is inferred to be strongly influenced by the presence and motions of faults. It is typical for researchers to conclude a genetic relationship based on the qualitative assessment that a close spatial association exists between faults and volcanoes. In an effort to test that assertion, we have quantified the spatial relationship between volcanic eruptive centers and concurrently active faults from three well-described volcanic fields. Specifically, we studied the Coso Volcanic Field of southern Owens Valley, California, the Camargo Volcanic Field of southeastern Chihuahua, Mexico, and a portion of the Michoacan-Guanajuato Volcanic Field of the Trans-Mexican Volanic Field in central Mexico. Completion of this preliminary study of the spatial relationship of faults and volcanoes required the use of digital geologic maps of the volcanic fields. Fault traces and vent locations were compared by measuring the distance and direction to the nearest fault for each eruptive center within a volcanic field. Where possible, determinations of strain and extrusion rates were also used to place our results into a geologically reasonable context. In each volcanic field studied, we observe that only about 5% of eruptive centers are present within 0.5 km of fault traces. Moreover, we observe that eruptive centers are most likely to be close to the middle distance between two faults. In other words, the largest concentrations of eruptive centers are as far as possible from the faults. This is best exemplified by the Camargo Volcanic Field which is divided into three segments, southwestern, central, and northeastern, where only the central region contains abundant faults. Here, not only are the largest clusters of eruptive centers present in the southwestern and northeastern regions (76.5%), but these regions are horsts indicating that the magma plumbing systems do not intersect the faults even at depth.

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