



Flank collapses at Nevado de Toluca volcano, Trans-Mexican Volcanic Belt: relationships between instability and structural and geological setting

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Nevado de Toluca volcano is an andesitic-dacitic composite volcano of Late Pliocene-Holocene age that poses potential hazards to more than 25 million inhabitants, including large cities such as Toluca and Mexico. Nevado de Toluca volcano is located in the central sector of the Trans-Mexican Volcanic Belt, an active continental volcanic arc, and is affected by three main fault systems that control the volcano geological evolution and increase the instability of volcano flanks; above all the active E-W striking Tenango Fault System. An in depth analysis of geological evolution, structural setting, sector collapses and instability of Nevado de Toluca volcano has been conducted to better understand how these catastrophic events evolve and their relationships with the volcano evolution and the kinematics of basement structures. The investigation methodology comprises morphological analysis, satellite images interpretation, geological mapping and stratigraphical and structural fieldwork. The geological mapping has been carried out at 1:25,000 scale; the resulting geological map, supported by the definition of an accurate stratigraphy, allowed us recognition of relationships between volcano evolution, structural setting and sector collapses in the 2.6 Ma of documented Nevado de Toluca evolution. The volcano has suffered several collapses ranging in volume from less than 0.1 to 3 km³ and generating deposits reaching up to 75 km from the source. Particularly, the recent explosive activity of Nevado de Toluca, started about 50 ka ago, has been associated with at least 4 sector collapses occurred eastward and westward due to tectonic dissection and summit dacitic domes

growth and destabilization. These catastrophic events have been strongly controlled by transtensive kinematics of the E-W striking Tenango Fault System in the last 50 ka, which deeply influenced the growth and instability of Nevado de Toluca volcano. The knowledge acquired on Nevado de Toluca volcano can be used as a guide to interpret the evolution and hazard of other volcanic edifices located in the Trans-Mexican Volcanic Belt or other continental volcanic arcs.