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The control of basement structures on the evolution of the Nevado de Toluca volcano

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Nevado de Toluca is an andesitic to dacitic stratovolcano of Late Pliocene-Holocene age. The volcano is located in the central sector of the Trans-Mexican Volcanic Belt. The Nevado de Toluca basement is characterized by three main fault systems that intersect close to the volcano edifice. The Taxco-Querétaro fault system is oriented NNW-SSE and is characterized by horsts and grabens exposed to the south of the volcano, the kinematics of which is known to be transform and normal until Pliocene. The San Antonio fault system, running NE-SW, principally consists of a wide graben located westwards of Nevado de Toluca, with transform and normal movements until Pliocene. Finally, the Tenango fault system forms a complex set of faults oriented E-W with left oblique-slip kinematic actives during the Holocene.

The relationships between Nevado de Toluca volcano and its basement structures have been investigated; the methodology consists of morphostructural analysis based on aerial photographs and satellite images, structural fieldwork, and geological mapping. Particularly, the definition of an accurated stratigraphy coupled with a 1:25,000 scale geological map, allowed us to recognize the relationships between volcano evolution and structural settings.

During fieldwork we mapped lithostratigraphic units and we grouped them using synthemic units, based on main and wide unconformities. Within the volcanic succession belonging to the Nevado de Toluca volcano we recognise two main unconformities. Each unconformity is related to 1 Ma gap in the volcanic activity, and associated to eruptive style and geochemical composition changes. Therefore, we can divide more

than 2.6 Ma Nevado de Toluca volcano evolution in three supersynthems.

The geological and structural analyses clearly show that each of the three fault systems has greatly affected the Nevado de Toluca volcano during its evolution. In fact, each supersynthem is controlled by only one of the described fault systems and the change of structural pattern corresponds to a prolonged hiatus of inactivity (about 1 Ma). Moreover, the influence of the basement structures on the volcano is showed by the domes alignment in the southern flank, the direction of numerous sector collapses and in a more general view the whole volcano architecture.

This methodology, used to better understand the influence of the tectonic setting on the Nevado de Toluca volcano evolution, can be applied successfully to other volcanoes to explain changes in the volcanic eruptive styles or prolonged hiatus within the volcanic sequence.