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Interplay between regional tectonics and volcano spreading at the Colima Volcanic Complex (Mexico)

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The evolution of volcanoes is strictly related to the regional tectonics and the mechanical properties of their substratum, that can be deformed by the load of a thick volcanic pile inducing faults and folds in the basement and changes in the kinematics of regional faults. We investigated the relationships between regional tectonics and the influence of the volcano load at the Colima Volcanic Complex (CVC). The CVC is currently the most active Mexican volcano, located in the western sector of the Trans Mexican Volcanic Belt, inside the active Colima Rift, a regional N-S-striking extensional structure more than 100 km long and 10 wide. The Colima Rift is filled by a $\sim$1 km-thick sequence of quaternary lacustrine sediments, alluvium, and colluvium, mostly underling the about 3000 m thick volcanic pile of the CVC. The volcanic complex is made of a chain of three andesitic stratovolcanoes whose activity started at about 1.7 Ma and migrated southward following one of the main structure of the Colima Rift. In this work we present the results of a detailed morphostructural and field study of Quaternary faults and fractures in the CVC and surroundings area, including also the regional structures of the Colima Rift. Also we present a simple numerical model of the gravity-induced stress and strain in the CVC. This study attempts to characterize the geometry, kinematics, and dynamics of the deformation features in the area, and relate it with the volcano structure, the geology of the substratum, and the geodynamic setting of the region. Our model considers that the observed deformation of the CVC and surroundings results from the interplay between the active regional tectonics (mainly N-S oriented, Colima Rift) and the volcano load over a weak substratum, that facilitates the spreading of the volcano moving southward and forming curved faults roughly E-W oriented. In this frame, both regional tectonics and volcano spreading combine to bring about the structural architecture of the CVC and the structural control over its volcanic activity and flank instability. These recognized structures can drive eruptions and sector failures of the CVC that can affect a densely populated area, representing a potential high risk for more than 500,000 people.