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Volcano-structural evolution of Teide (Tenerife, Canary Islands): field data constraints.

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Teide is the only active stratovolcano in the Canaries. Its outstanding morphology strongly departs from a typical stratovolcano, having two prominent NE and NW flank bulges, and a flat summit area. Different hypotheses of Teide evolution disagree on the role of deformation processes in controlling volcano morphology. We present field structural and stratigraphic data, as well as analogue models, to test the hypothesis on the volcano's structural evolution.

On the NE bulge the oldest lava flows have clear morphological evidence that they are younger than the slope break. We have found several tumuli on these lava flows and discard their previously proposed origin as dome eruptive vents, one of the main alleged evidences for an origin of the NE bulge as a covered flank vent. On the N flank the same "tumuli-forming" lava flows unit crop out below other lava flows cut by the northern summit scarp. These stratigraphic relationships point to a younger age for the summit scarp than for the NE bulge, which argues against both structures being genetically related by flank spreading. However, our analogue models of volcano deformation over a weak core indicate that summit faulting still occurs in the late deformation stages when lateral bulge has fully developed. "Tumuli-forming" lava flows could be contemporaneous to NE flank spreading and could have covered the flank bulge, only to be later faulted by summit structures. On the NW bulge the morphology of flank covering block-and-ash flow deposits and inter-bedded lava flows (Las Calvas unit) indicate their emplacement on a steep slope, post-dating the bulge formation. Moreover, we find penetrative fractures affecting these volcanoclastic and lava flow deposits. The extensional nature of this radial and tangential fracturing could be caused by bulging of the deposits, indicating long-lived progressive bulging of this flank. On the flat summit area we have found structural evidence of bulging due to a cryptodome intrusion that could also have contributed to the formation of the bounding scarps. There is other field evidence of dome intrusions at different altitudes along the volcano eastern flank in the same ENE-WSW structural direction of the Teide-Pico Viejo alignment and of the dykes at the Pico Viejo crater walls.

Our field data provide some new constraints for the debate of the structural evolution of Teide volcano, and seem to point to a prominent role for flank spreading and dome intrusion. However, radiometric dating of selected units and further analogue modelling are necessary to integrate our field observations in a coherent model of Teide volcano structural evolution.