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3D modelling of the Tejeda Caldera cone-sheet swarm, Gran Canaria, Canary Islands, Spain

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Cone-sheet swarms provide vital information on the interior of volcanic systems and their plumbing systems (e.g. Burchardt et al. 2013). This information is important for the interpretation of processes and dynamics of modern and ancient volcanic systems, and is therefore vital for assessing volcanic hazards and to reduce risks to modern society. To more realistically model cone-sheet emplacement an approximation of their 3D shape needs to be known. Most cone-sheet swarms are not sufficiently exposed laterally and/or vertically, however, which makes it difficult to determine the geometry of a cone-sheet swarm at depth, especially since different shapes (e.g. convex, straight or concave continuations) would produce a similar trace at the surface (cf. Burchardt et al. 2011, and references therein).
The Miocene Tejeda Caldera on Gran Canaria, Canary Islands, Spain, hosts a cone-sheet swarm that was emplaced into volcaniclastic caldera infill at about 12.3-7.3 Ma (Schirnick et al. 1999). The dyke swarm displays over 1000 m of vertical exposure and more than 15 km of horizontal exposure, making it a superb locality to study the evolution of cone-sheet swarms in detail and to determine its actual geometry in 3D space.
We have used structural data of Schirnick (1996) to model the geometry of the Tejeda cone-sheet in 3D, using the software Move® by Midland Valley Ltd. Based on previous 2D projections, Schirnick et al. (1999) suggested that the cone-sheet swarm is formed by a stack of parallel intrusive sheets which have a truncated dome geometry and form a concentric structure around a central axis, assuming straight sheet-intrusions. Our 3D model gives insight into the symmetries of the sheets and the overall geometry of the cone-sheet swarm below the surface. This visualization now allows to grasp the complexity of the Tejeda cone-sheet swarm at depth, particularly in relation to different possible cone-sheet geometries suggested in the literature (cf. Burchardt et al. 2011, and references therein), and we discuss the implications of this architecture for the feeding system of the Tejeda volcano and the associated temporal variations of cone-sheet emplacement.

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