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Constraints on the geometry of the shallow magmatic system of Tenerife Island (Canary Islands)

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The geological evolution of Tenerife (Canary Island) involves the construction of a basaltic shield (<12Ma to Present) and the Central Complex (> 3.5 Ma to Present). Towards the end of the main shield-building episode (Old Basaltic Series), volcanic activity migrated to the central part of the island. This lead to the formation of shallow magma chambers and the construction of the Central Volcanic Complex through a series of cycles always characterized by a similar events sequence: 1) continuous ascent of mantle-derived basaltic magmas; 2) formation of discrete shallow phonolitic magma chambers and related eruptions; 3) a final caldera-forming event destroying the constructed volcanic edifice and the associated magmatic reservoir; 4) eruption of basaltic magmas in the central part of the island; and 5) formation of a new shallow magma chamber. As the latter may emplace at a new location, the locus of phonolitic volcanic activity migrated to other sectors of the central part of Tenerife. During the last 1.56 Ma years, this long-term (>200 ka) cycle of phonolitic explosive activity has repeated thrice culminating in the Ucanca, Guajara and Diego Hernandez overlapping vertical collapses; altogether referred to as Las Cañadas Caldera. The present Teide-Pico Viejo complex is interpreted to be the beginning of the fourth cycle. The objective of this work is to determine the geometrical constraints (including volume, depth, location and shape) of the shallow magmatic reservoirs active during each eruptive cycle. For this, we use new fieldwork data collected along Las Cañadas caldera wall where an important amount of phonolitic dykes have been identified. These include cone-sheets, radial and concentric dykes. The cross cutting relationship between the different dyke families indicate several intrusion episodes from diverse magma sources during the construction of the Central Complex. New 3D Finite Element Model results obtained provide a first-order characterization of the different shallow magma chambers from where the diverse dyke families were injected. Furthermore, these results allows us to confirm that the formation of the overlapping Las Cañadas collapse caldera was related to migration of the associated magma chambers. This work was supported by the European Commission (FP7 Theme: ENV.2011.1.3.3-1; grant 282759: VUELCO).