Geophysical Research Abstracts, Vol. 9, 05467, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05467

Magmatic controls on the evolution and eruptive risk of Las Cañadas volcanic complex in Tenerife

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The central volcanic complex of Las Cañadas on Tenerife was constructed between 3.5 Ma and 196 ka ago and comprised a number of eruptive centers supplied by magmas of evolved compositions from shallow chambers. Continuation of the construction of the Tenerife central volcanic complex is evidenced by the presence of the active Teide-Pico Viejo Complex at the interior of Las Cañadas caldera, which has undergone several phonolitic and basaltic eruptions during the last 5000 years. Las Cañadas central volcanic complex is situated at the intersection of linear rift zones with high concentration of magmatic fissures. Vertical subsidence and landslides episodically modified the structure of volcanic edifices resulting in incrementally-build collapse caldera. Stratigraphic units of its wall are cross-cut by numerous intrusions with a wide range of geometries and orientations, among which three structural types can be distinguished. Radial dikes are subvertical, trend normal to the corresponding sector of caldera rim and indicate variations in magma flow from vertical to horizontal radial. Cone sheets dip at 30º to 90º towards the local magmatic centre and indicate magma flow towards the periphery of sheet system. Ring dikes are subvertical, parallel to the caldera rim sector and indicate subvertical magma flow. Upper part of the caldera wall exposes magmatic conduits associated with proximal welded fallout deposits. Conduits range in their geometries from flaring upward pipes representing eruptive vents to cylindrical plugs corresponding to deeper portions of magmatic feeders. Elongated domes were emplaced from underlying magmatic fissures suggesting evolvement of eruption dynamics from explosive to effusive. Besides the intrusions of the central complex, Las Cañadas caldera also exposes dikes related to development of the rift zones. They are mafic in composition, dip at 70º to 90º, coincide in trend with alignments of monogenetic basaltic spatter and cinder cones of the rift zone and commonly

served as their feeders.

Structural characteristics and distribution of intrusions together with the directions of magma flow indicate that at least three distinctive magma chambers were located within the area of the caldera before it collapsed. Besides the occurrence of conduit-vents on the caldera wall suggests location of shallow magma reservoirs beneath the caldera rim with minimum volumes of the transferred magma (estimated from the analyses of eruptive products) ranging between $25x10^4$ and $50x10^4$ m^3 for different vents. The system of Teide and Pico Viejo volcanoes formed within Las Cañadas caldera experienced a number of recent eruptions with magma supplied by independent chambers. Experimental petrology study suggests that during the last 200 ka at least four magma chambers of highly varied volume from 1 to 20 km^3 developed at different crustal depths ranging from 3 to 6 km.

This study shows that evolution of Las Cañadas complex was characterised by development of magma chambers of varied volume and location that supplied the extensive system of central and satellite intrusions and eruptive vents. The complex is situated at the intersection of the rift zones comprising axes of focused magma source in the island and increasing magma transport within Las Cañadas domain. Superimposed stress fields related to the central complex and rift zones result in an abundant magma emplacement in the complex ultimately pointing at the high volcanic risk in the region. The identification of locations of magma-storing chambers, transporting fissures and eruptive vents allows recognition of areas most vulnerable to the potential volcanic hazard.