Geophysical Research Abstracts
Vol. 18, EGU2016-9918, 2016
EGU General Assembly 2016

The Role of Crustal Tectonics in Volcano Dynamics (ROCTEVODY) along the Southern Andes: seismological study with emphasis on Villarrica Volcano

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The Southern Andean margin is intrinsically related to the Liquiñe-Ofqui Fault Zone (LOFZ), a 1000 km-long dextral strike-slip arc-parallel fault on which most of the volcanic centers of the Southern Volcanic Zone (SCVZ) of the Andes are emplaced. At large spatial (10^2 - 10^3 km) and temporal (10^5 - 10^7 yr) scales, regional tectonics linked to partitioning of the oblique convergence controls the distribution of magma reservoirs, eruption rates and style, as well as the magma evolution. At small scales in space ($< 10^2$ km) and time (10^{-1} - 10^2 yr), stress transfer mechanisms between magma reservoirs and seismically-active faults are though to transiently change the regional stress field, thus leading to eruptions and fault (re)activation. However, the mechanisms by which the interaction between (megathrust and crustal) earthquakes and volcanic eruptions actually occur, in terms of generating the relationships and characteristics verified at the long term, are still poorly understood.

Since 2007, the Southern Andean margin has presented an increase of its tectonic and eruptive activity with several volcanic crisis and eruptions taking place in association with significant seismicity clusters and earthquakes both in the megathrust and the LOFZ. This increased activity offers a unique opportunity to improve our understanding of the physical relation between contemporary tectono-volcanic processes and the long-term construction of the LOFZ-SVZ system. Taking advantage of this opportunity by means of an integrated analysis of geodetic and seismological data through finite element numerical modeling at the scale of the entire margin and for selected cases is the main goal of project Active Tectonics and Volcanism at the Southern Andes (ACT&VO-SA, see Tassara et al. this meeting). Into the framework of the ACT&VO-SA project, the complementary ROCTEVODY-Villarrica project concentrates on the role that inherited crustal structures have in the volcano dynamics. The focus is on Villarrica volcano, which is emplaced at the intersection of the main NNE-branch of the LOFZ and the NW-SE inherited Mocha-Villarrica Fault (MVF). The extensional characteristics of previous eruptions at Villarrica contrasts with the dextral strike-slip motion of LOFZ and the compressive regime dominated by the subduction. Then, this projects aims to understand how the NW-SE inherited structures interacts with their intra-arc counterpart to allow the emplacement of volcanic edifices under the present day compressive stress regime. This goal will be achieved through the analysis of a seismic database for Villarrica volcano that combines data from a dense local network and the network of the Chilean volcanic observatory. These data will allow us to identify long period events and tremor signals from which we plan to perform a wave field characterization to extract information about fluid flow and seismic source, together with a precise location of tectonic crustal events. We will present preliminary results and a conceptual model to explain the role of the different structures at interplay in the region and their relation with volcano dynamics.