The evolution of the dimensions and morphology of lava flows from a volcano: A case study on the Lonquimay Volcanic Complex, Southern Andes of Chile

Rayen Gho[1,2], Angelo Castruccio[1,2]

[1]Universidad de Chile, Chile, [2]Centro de Excelencia en Geotermia de los Andes (CEGA), Chile

E-mail: acastruccio@gmail.com

The morphology, dimensions and petrography of ancient lava flows can be used to extract the flow conditions during an eruption. Consequently, the study of a set of lava flows from a volcano can give important clues about the variations through time of such parameters as the effusion rate and the factors controlling it.

Lonquimay Volcanic Complex (LVC) is located in the Southern Volcanic Zone of Chile, and has been active mainly during the Holocene. Its eruptive products are mainly andesitic in composition. The LVC is composed by a main stratocone with an estimated volume of 20 km^3 and a fissure system with pyroclastic cones and craters with a NE orientation and extending 10 km to the east from the main cone (Cordon Fisural Oriental, CFO).

The main cone is divided into 5 units ranging from late Pleistocene to the present. Lava flows from the older units reach up to 15 km from the vent and morphologically are mainly Aa flows, with minor amounts of pahoe-hoe. On the other hand, lava flows from Unit 5 (the youngest unit) are only up to 3 km length with a blocky morphology. All the lavas from the volcano have a similar chemical composition and crystal contents are very uniform.

The CFO zone is where most of the historic activity of the LVC has taken place. Lava flows are up to 10 km with compositions ranging from andesite to dacite with a blocky morphology. Crystal contents are slightly less than in the main cone.

Lava flows from the main cone show a progressive shortening in length and a decrease in total erupted volume as lavas get younger. Lava morphologies and petrography suggest a crustal control on lava dynamics of younger lava flows, opposed to a viscous internal control for older lava flows. Our observations indicate that the oldest lava flows were erupted with higher effusion rates than the younger ones. This can be attributed to the construction of the edifice with the consequent increment in lithostatic pressure. Last eruptions from the volcanic complex are being erupted laterally from the CFO as magmas are unable to ascend through the main cone.

Our results indicate that the construction and growth of a volcanic edifice auto-impose the effusion rate, location of vents, morphology and final length of the lava flows erupted.