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Lithological units of Chiles Volcano

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Chile's volcano (4748m a.s.l.) belongs to the Chiles-Cerro Negro Volcanic Complex and is located on the Western Cordillera of Ecuador, 130 km NE of the Quito on the border between Ecuador and Colombia. Since 2014, signs of unrest have been characterized by intense seismic activity and small amounts of ground deformation. This study present new results from the lithological characterization of Chiles volcano in order to improve the understanding of its eruptive behavior.

Chiles is a volcano composed mainly of lava flows of different sizes, distributed radially along its flanks. New data on its lithology were obtained through fieldwork, and in the analysis of the petrology, geochronology and geochemical characteristics of its eruptive products.

The data obtained in the present work have allowed us to conclude that Chiles volcano consists of two main litho-stratigraphic units separated by almost 200 ka of quiescence.

CHILES I consists of three sub-units: Chil-1a comprises andesitic-basaltic lava flows (55-61 SiO₂ wt. %) outcropping to the N, with an age of approx.. 572 ka; Chil-1b comprises the most extensive lava flows of andesitic and dacitic compositions (63-65 SiO₂ wt. %) outcropping on the S and SE side, with ages of approx. 400 ka; and Chil-1c comprises rhyodacitic lava flows (68-70 SiO₂ wt. %) on the W and E flanks, with an ages of approx. 271 ka.

CHILES II consists of three sub-units: Chil-2a corresponds to andesitic lava flows (59-63 SiO₂ wt. %) on the SW and SE flanks, with ages between 75-60 ka; Chil-2b comprises lava flows of acid andesite and dacitic compositions (63-67 SiO₂ wt. %), with ages between 57 and 45 ka; and Chil-2c comprises lava flows of rhyodacitic composition (68-71 SiO₂ wt. %) on the E side of the edifice, with ages between 40 and 20 ka.

Accordingly, although Chiles volcano has not experienced eruptive activity during the Holocene, it is possible that it will in the future and should not be considered an extinct volcano. In case of a new activity, effusive behavior is the most likely scenario while the magma composition could range from andesitic to rhyodacitic. This information is critical for hazard assessment.