

New observations on the recent activity from Sumaco Volcano, based on geochronology, stratigraphy and geochemistry

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Sumaco Volcano is a stratovolcano located in the northern Sub-Andean area of Ecuador, 105 km from the capital city of Quito. On the basis of morphology, the volcanic edifice of Sumaco consists of three phases called: PaleoSumaco, Sumaco Reciente and Sumaco Actual, differentiated mainly by two scars that represent debris avalanches. The first scar has a semicircular shape open to the north of the volcano, located at 2800 masl. The second scar with a flat appearance is located at the top of the edifice, at approximately 3500 masl. The goal of this research is to contribute to a greater knowledge of the evolution and structure of the volcanic edifice and to verify its recent activity.

Nine stratigraphic sections have been realized in the surroundings of the volcano identifying at least 5 layers of ash coming from it. The ash layers are mainly characterized by white pumice, augite crystals, plagioclase, sometimes hornblende and traces of biotite. In addition, they present gray lithics of basaltic composition with pyroxene phenocrysts and few plagioclase. The amount of volcanic glass is very low in almost all samples. The layer of ash "SUM-JS-44", was dated by 14C obtaining an age of 4370 +/- 30 years BP. The layer of ash "T3" identified in the section Vinillos with a composition similar to the ash layers of Sumaco, has an age between 45-42 ky. In the north-western area of the volcano, 4 layers of ash with more acid composition were identified than the Sumaco tephra deposits and therefore have their origin in other volcanoes.

The drill core analysis obtained from the "Guagua Sumaco" lagoon allowed us to identify 9 ash layers, 7 of them are from Sumaco and the other two are levels of re-worked ash but it has not been possible to identify their source. In the drill core, it was possible to date a layer of peat (OL3) on which 6 deposits of ash from the Sumaco volcano lie. The top age of this level of peat is 360 +/- 30 years BP. This allows us to relate that the Sumaco volcano experienced six eruptive pulses, associated with a single eruptive event, during the last 360 years.

Several volcanic deposits belonging to the Sumaco volcano were characterized, including 4 deposits of debris avalanches (DAE-RS, DAE-LP, DAE-RG and DAE-CHC). The deposit DAE-RS has been possible to date it through remains of charred wood found inside the matrix of the deposit, the result of the radiocarbon analysis indicates an age over 43.5 ky. Avalanche deposits have mixing facies.

The DAE-RG avalanche deposit located in the current valley of the Guamaní River, south of Sumaco, could be related to the avalanche event that collapsed the upper part of the volcano. The rocks of this deposit present crystals of hauyana within their mineral paragenesis and if we consider that apparently younger and more differentiated rocks are at the summit, we could correlate this deposit with the event that formed the current cone of Sumaco. Other outcrops of avalanches located to the East and Southeast of the volcano (DAE-RS, DAE-LP and DAE-CHC) present an older aspect with more mafic rocks, without the presence of hauyana crystals in their mineral composition; these outcrops are possibly related to the oldest avalanche related to PaleoSumaco.