

STRATIGRAPHY, QUATERNARY ERUPTIVE HISTORY, AND HAZARD MAPPING AT NEVADO DEL TOLIMA, CENTRAL CORDILLERA, COLOMBIA.

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Ice-clad and fumarolic Nevado del Tolima volcano (5200m, south of Ruiz, 4°40' N, 75°20' W) includes four units : (1) a plateau-like basement of 1.4 - 1 Ma andesite lava flows; (2) an upper Pleistocene cladera; (3) a dissected upper Pleistocene stratovolcano; (4) a cone-shaped summit volcano made of recent composite domes.

The stratovolcano is built of thick andesite lava flows and pyroclastic-flow deposits (1-0.3 Ma), mostly emplaced toward the south, which cover an old N50°W tectonic scarp of the Central Cordillera. Tolima volcano is displaced towards the SE of the major N20°E strike-slip Palestina fault.

A caldera was created during the upper Pleistocene (ca. 0.3 - 0.2 ma). Evidence are a high arcuate wall-like ridge on the southwest and slabs of lava flows that lean on the outermost extrusions of the summit volcano; thick co-ignimbrite breccias, scoria or pumice or lithic-rich pyroclastic-flow deposits emplaced towards the south, southeast and east, as far as the volcanoclastic fan of Ibagué (150 - 200 m thick at 35 km).

The andesitic and dacitic summit volcano was created within a ca. 2 km-wide crater opened around 14,000 y.B.P.; welded pumice and scoria-rich pyroclastic-flow deposits were emplaced towards the southeast (rio Combeima) and northeast (rio Totare). A cluster of domes was intruded during the Late Glacial and Holocene. Their formation is witnessed by thick block-lava flows towards south and east, pumice or scoria-rich pyroclastic-flow deposits towards east and northeast, especially between 14,000 - 13,000 y. B.P., 11,500 - 9500 y. B.P., and around 4700 y.B.P., as well as by tephra-fall deposits towards the east and northwest (isopleth 1cm at 15 km). Interactions with the ice cap probably triggered debris flows, which filled in part the Combeima and Totare valleys, and formed the Holocene terraces incised in the volcanoclastic fans of Ibagué (30-40 km) and Venadillo (40-50 km). The latest major activity was a plinian explosion which deposited a thick pumice-fall layer at about 3600 y.B.P. (25 cm at 5 km, 1cm at 30 km) towards the west and the northwest. Minor tephra fall and lahars occurred through the historical times, until the 1918 and 1943 small events.

Two hazard-zone maps are presented (1/100,000 and 1/50,000) : tephra fall and lahars, pyroclastic flows and debris avalanches, lava flows and glacial, volcaniclastic flows. Mapping was based on the stratigraphical record, mostly since 14,000 y.B.P. and on historical accounts. 300,000 people live within a 35 km distance around this volcano that has had a more explosive behaviour than Ruiz. In spite of the small ice cap (7 km²), lahars are the most probable hazard, even if any given eruption were weak, because of the steep slope gradient (13%) and probable interactions of pyroclastic flowage with the snow and ice. Besides, scoria flows and debris avalanches can be triggered towards the southeast, and transformed into lahars that would destroy the populated Combeima valley and the lower suburbs of Ibagué (50,000 people at high risk). Detailed hazard warning and awareness programs are to be launched in the Combeima and Totare valleys.