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Volcanic and Topographic Evolution of the Sierra San Francisco, Baja California Sur, Mexico

The Sierra San Francisco (SSF) is a Neogene volcanic range along the topographic crest of the Baja California peninsula in northern Baja California Sur, Mexico. The SSF is ~55 km long (NW-SE) and ~30 km wide and its highest peaks exceed 1500 m elevation. The SSF has a long history of volcanism and has been eroded by deep, rugged, radially-draining canyons. The development of SSF topography is intimately associated with the volcanic evolution of the range.

The SSF is a large and complex dacitic adakite dome complex largely built of a thick, up to 800 m, stratigraphic succession of dacitic tuff breccias with minor interbedded basaltic andesite lavas. These deposits overlie rare exposures of aeolian sandstone of unknown age. The tuff breccias represent block-and-ash-flows and lahars generated from steep-sided pelean dacite and andesite domes, with three radiometric dates of 11-10 Ma. This intermediate sequence is unconformably capped by widespread bajaite mafic lavas, 5.5-4.5 Ma.

SSF topography evolved dramatically since the late Miocene:

- 1) From 11-10 Ma, adakite domes erupted across the central SSF, locally along NNW faults. Thick sequences of bedded tuff breccias accumulated around the domes and are radially inclined away from source domes. The duration of this volcanism is unknown.
- 2) From 10-5 Ma, deep erosion of the pyroclastic strata formed a range-wide radial drainage network, with channel depths of up to 130 m or more.
- 3) From 5.5-4.5 Ma, voluminous bajaite lavas from cinder cones and dike vents flooded the top of the range and flowed down the radial drainages with flow distances up to 12 km. Vents are strongly aligned along steep NNW normal faults.
- 4) After 4.5 Ma, erosion removed interfluvial tuff breccia not armored by younger mafic lavas. Today, the long, steep-sided, lava-capped ridges are inverted topographically.

At Santa Martha, an area in the central SSF with the highest concentration of domes, hydrothermal alteration of the volcanic deposits during and after the dome volcanism caused severe material weakening and slope failure within the volcanic center. The area is now a distinctive erosional basin, partly filled with clay-rich landslide deposits.

Comparable volcanic history and topographic development are likely to have occurred in a dome field of similar age and size at Santa Agueda, 60 km SE of Santa Martha.