

TECTONO-MAGMATIC PULSES AND POST-LARAMIDE HISTORY OF SUBDUCTION IN WESTERN MEXICO

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The Sierra Madre Occidental of western Mexico is the largest silicic volcanic province on earth. Over 95% of the province consists of silicic ignimbrites and domes covering about 300,000 km² with an average thickness of 1 km. The volcanic activity followed the sub-horizontal subduction of the Farallon plate beneath North America during the Laramide orogenesis. Most of the SMO rocks were emplaced during two magmatic pulses at 30-28 Ma and 23-21 Ma, which also correspond to the main extensional episodes. The first pulse is recognized over the entire province. The second episode is observed in the southern half of the province and to the west of the previous one. In both cases extension affected the active volcanic area with a very high rate of magma emplacement (~1 km³ per km² in 1 My). The tectono-magmatic pulses are concurrent with episodes of fast spreading at the Pacific-Farallon ridge and the area affected by the 23-21 Ma episode roughly correspond to the upper mantle region where seismic tomography imaged two parallel fragments of the Farallon slab. We propose that the 30-28 Ma episode was triggered by the initial rollback of the previously sub-horizontal Farallon slab whereas the 23-21 episode was driven by the detachment of the lower part of the slab. Both mechanisms of slab removal may have induced: 1) an upraise of hot material that produced a partial melting and thermal softening of the lower crust, 2) trench retreat and extension in the upper crust, and 3) episodes of fast spreading at the ridge.