

Cenozoic multiphase basin evolution in the Interandean Valley of Ecuador during arc magmatism and uplift in the northern Andes

The Latacunga-Ambato Basin in the Interandean Valley defines a modern 2.5-3-km-high hinterland region in the Andes of Ecuador that represents a record of Cenozoic sediment deposition, arc magmatism, and Andean crustal shortening. Multiphase basin evolution commenced with retroarc marine sedimentation that produced an upward-coarsening succession of submarine fan to deltaic deposits of the middle Eocene-lower Oligocene Apagua and Rumi Cruz Formations. Detrital zircon U-Pb geochronological data reveal maximum depositional age (MDA) values of 44-36 Ma, with age peaks consistent with coeval Andean arc magmatism and recycled Paleogene basin fill. The Paleogene strata are unconformably overlain by non-marine volcanic-rich deposits of the Miocene Zumbagua Formation, revealing a >10 Myr hiatus related to non-deposition or erosion, potentially linked to eastward advance of Andean shortening and/or arc magmatism into the eastern Western Cordillera. Middle to late Miocene sedimentation involved proximal alluvial fan to distal fluvial conditions in an intra-arc basin setting with sediment provenance signatures from calc-alkaline igneous centers within the coeval magmatic arc (MDA values of 14-6.5 Ma). A separate phase of Pliocene-Quaternary basin evolution occurred during intense Andean volcanism, shortening, and focused flexural subsidence in the Interandean Valley, potentially linked to increased plate coupling due to Carnegie Ridge subduction. Initial pre-kinematic deposition of ash-flow conditions of the Latacunga Formation occurred with subsequent structural partitioning of the intra-arc basin by east- and west-vergent steep monoclines above basement-involved blind thrust faults. Latacunga deposition of syn-kinematic fluvial-lacustrine conditions occurred during growth of the steep monoclines, followed by post-kinematic deposition of the late Quaternary Chalupas tuff and younger volcanics. Detrital zircon MDA values of 2.25-1.5 Ma elucidate pre-kinematic basin development followed by 1.5-0.5 Ma syn-kinematic active landscape development. Sediment provenance of the Latacunga Formation is consistent with the surrounding active volcanic and reworked older basin fill.