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# Foreland sedimentary record of Andean mountain building during advancing and retreating subduction

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As in many ocean-continent (Andean-type) convergent margins, the South American foreland has long-lived (>50-100 Myr) sedimentary records spanning not only protracted crustal shortening, but also periods of neutral to extensional stress conditions. A regional synthesis of Andean basin histories is complemented by new results from the Mesozoic Neuquén basin system and succeeding Cenozoic foreland system of west-central Argentina (34–36°S) showing (1) a Late Cretaceous shift from backarc extension to retroarc contraction and (2) an anomalous mid-Cenozoic (∼40–20 Ma) phase of sustained nondeposition. New detrital zircon U-Pb geochronological results from Jurassic through Neogene clastic deposits constrain exhumation of the evolving Andean magmatic arc, retroarc thrust belt, foreland basement uplifts, and distal eastern craton. Abrupt changes in sediment provenance and distal-to-proximal depositional conditions can be reconciled with a complex Mesozoic-Cenozoic history of extension, post-extensional thermal subsidence, punctuated tectonic inversion involving thick- and thin-skinned shortening, alternating phases of erosion and rapid accumulation, and overlapping igneous activity.

U-Pb age distributions define the depositional ages of several Cenozoic stratigraphic units and reveal a major late middle Eocene–earliest Miocene (∼40–20 Ma) hiatus in the Malargüe foreland basin. This boundary marks an abrupt shift in depositional conditions and sediment sources, from Paleocene–middle Eocene distal fluviolacustrine deposition of sediments from far western volcanic sources (Andean magmatic arc) and subordinate eastern cratonic basement (Permian–Triassic Choiyoi igneous complex) to Miocene–Quaternary proximal fluvial and alluvial-fan deposition of sediments recycled from emerging western sources (Malargüe fold-thrust belt) of Mesozoic basin fill originally derived from basement and magmatic arc sources. Neogene eastward advance of the fold-thrust belt involved thick-skinned basement inversion with geometrically and kinematically linked thin-skinned thrust structures at shallower levels in the eastern foreland, including well-dated late Miocene growth strata. The mid-Cenozoic hiatus potentially signifies nondeposition during passage of a flexural forebulge or nondeposition during neutral to extensional conditions possibly driven by a transient retreating-slab configuration along the western margin of South America.

Similar long-lived stratigraphic gaps are commonly observed in other foreland records of continental convergent margins. It is proposed that Andean orogenesis along the South American convergent margin has long been sensitive to variations in subduction dynamics throughout Mesozoic-Cenozoic time, such that shifts in relative convergence and degree of mechanical coupling along the subduction interface (i.e. transitions between advancing versus retreating modes of subduction) have governed fluctuating contractional, extensional, and neutral conditions. Unclear is whether these various modes affected the entire convergent margin simultaneously due to continental-scale changes (e.g., temporal shifts in plate convergence, absolute motion of upper plate, or mantle wedge circulation) or whether parts of the margin behaved independently due to smaller-scale fluctuations (e.g., spatial variations in the age of the subducted plate, buoyant asperities in the downgoing slab, or asthenospheric anomalies).