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Tracking Basin Inversion in the RetroArc Foreland Basin: Integrated Provenance Studies in the Cacheuta Basin, South-Central Andes

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Integrated stratigraphic, sedimentologic, geochronologic and thermochronologic analyses of Neogene sedimentary successions yield a high fidelity record of orogenic exhumation and basin inversion within the retroarc foreland basin of the south central Andes. Neogene synorogenic strata of the Cacheuta basin south and west of Mendoza record episodic sediment flux produced during eastward thrust belt propagation. Initial basin subsidence is constrained as Early Miocene (19.20 ± 0.26 Ma) by U/Pb geochronology on a tuffaceous sandstone near the base of the succession. Provenance analysis identifies detrital contributions, in decreasing order of abundance, from syndepositional Miocene volcanism, Cordillera Frontal (Permo-Triassic clasts and detrital zircon), Precordillera (distinct green lithic arenite), Cordillera Principal (distinctive Jurassic conglomerate, Cretaceous fossiliferous limestone, and Tertiary hornblende andesite clasts) and Cordillera Costal (Jura-Cretaceous zircon). Sediment influx and depositional rate vary systematically upsection, with the highest sedimentation rates reflecting elevated volcanism and rapid accumulation of tuffaceous sediment, and lower sedimentation rates corresponding to progradation of conglomeratic units dominated by Cordillera Frontal rhyolite, Precordillera metasedimentary clasts, and, to a lesser extent, Cordillera Principal carbonate and conglomerate clasts.

Detrital apatite (U-Th)/He thermochronology records the initiation of rapid basin inversion at ~4-5 Ma. Detrital apatite (U-Th)/He ages in strata younger than ~9.7 Ma match syndepositional zircon U/Pb ages, and apatite ages in strata older than ~9.7 Ma progressively decrease downward, and are consistently younger than volcanic tuff U/Pb ages. The oldest strata yields a distinct cluster of closure ages at ~4-5 Ma, interpreted to reflect exhumation during eastward propagation of the thrust system.

Basin evolution in the Cacheuta basin differs markedly from basins to the north and south. The Cacheuta basin straddles the transition zone between flat slab subduction to the north and normal slab subduction to the south. To the north, subsidence in the Manantiales basin was initiated at 16.8 ± 0.2 Ma, concurrent with significant volcanic activity, which was followed by rapid subsidence characterized by progradation of locally derived (Cordillera Frontal and Precordillera) with a paucity of syndepositional zircon. To the south, subsidence in the Atuel basin initiated at ~14 Ma, with rapid syn-volcanic subsidence between 10-12 Ma, and culminating in a distinct coarse clastic pulse characterized by the progradation of boulder conglomerates derived from the Cordillera Principal.



