Neogene Basin Evolution in the Las Peñas basin, Salagasta Region, Mendoza, Argentina

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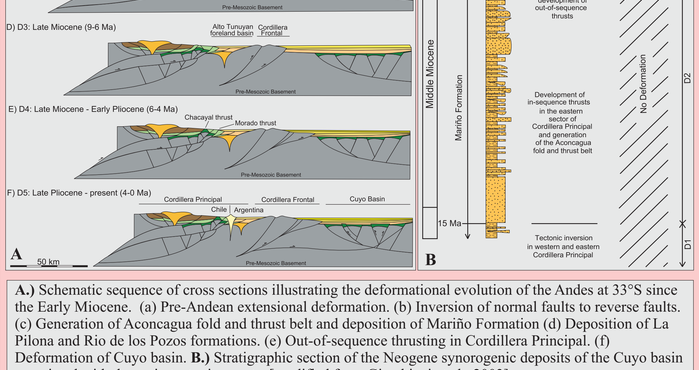
ABSTRACT

A succession of clastic strata in the Salagasta region, northwest of Mendoza, Argentina, was deposited in the Miocene Las Peñas basin. These strata represent sediments from the Andean foreland basin unroofed by migration of the fold and thrust belt. The coarsening upward sequence and sedimentary structures indicate a fluvial depositional environment and evolution from a distal to proximal retroarc foreland basin.

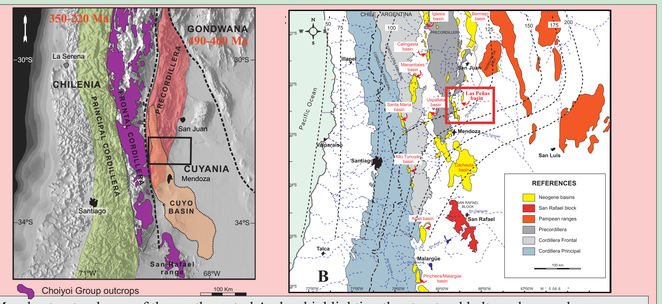
Three detrital zircon samples were examined from the Salagasta section to determine the timing of uplift in the Andes at this latitude. The samples display detrital zircon populations derived from syndepositional volcanism, Miocene Farallones Group, Permian Choiyoi Group, and early Paleozoic Villavicencio Fm. The lowest sample contains syndepositional zircon indicating a maximum depositional age of 8.75 Ma and a major population derived from the Permian Choiyoi Group, suggesting uplift of the Cordillera Frontal at this time. The middle sample contains peaks representing syndepositional volcanism (ca 8 Ma) as well as an introduction of early Palezoic Villavencencio Fm. suggesting uplift of the Precordillera between 8.75-8 Ma. The upper sample is dominated by a strong Miocene peak reflecting sediments from the Farallones Fm, but lacks syndepositional volcanic sediments, suggesting derivation from the Cordillera Principal during a period of waning volcanism.

PURPOSE

Detrital zircon provenance data from synorogenic Neogene foreland basins of the southern Central Andes (28-35°S) can be utilized to constrain the timing and pattern of orogenic exhumation of the Andean system. The Nazca plate varies in subduction angle along the continental margin and therefore strongly influences the evolution of adjacent foreland basins. The Las Peñas basin is the easternmost exposed basin associated with the flat slab segment. Basin comparisons between the flat, transitional, and normal segments will allow for a greater understanding of the patterns involved in basin development, timing of structural deformation, and how the subduction angle influences deformation. Analyzing the stratigraphy and detrital zircon geochronology of the Las Peñas basin in the Salagasta region will allow for future comparisons with basins from the transitional and normal subduction segments.

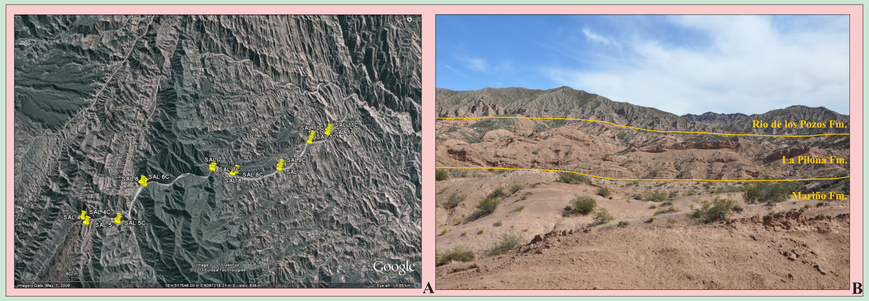


A.) Digital elevation model of South America. Note the distinct segmentation of the Andes at the latitude of Mendoza, Argentina. **B.)** Seismic data indicates the depth to the subducting Nazca plate and displays the segmentation of the slab.



A.) Morphostructural map of the south-central Andes, highlighting the structural belts and general age distribution in the region (Giambaigi et al., 2008, ages from Ramos, 2006). **B.)** Neogene basin location map showing the morphostructural belts and the position of depocentres in the retroarc foreland region. Contours illustrate the depth to the subducting slab. Note the location of the Salagasta region within the Las Peñas basin.

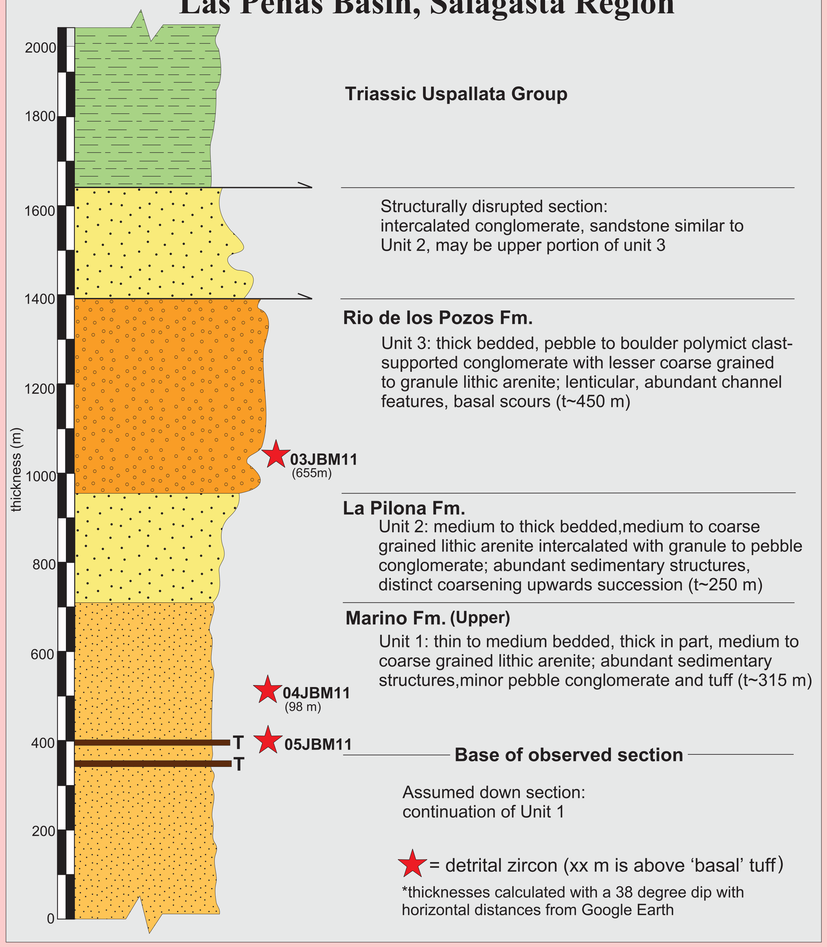
A.) Schematic sequence of cross sections illustrating the deformational evolution of the Andes at 33°S since the Early Miocene. (a) Pre-Andean extensional deformation. (b) Inversion of normal faults to reverse faults. (c) Generation of Aconcagua fold and thrust belt and deposition of Mariño Formation (d) Deposition of La Pilona and Rio de los Pozos formations. (e) Out-of-sequence thrusting in Cordillera Principal. (f) Deformation of Cuyo basin. **B.)** Stratigraphic section of the Neogene synorogenic deposits of the Cuyo basin associated with the main tectonic events. [modified from Giambiagi et al., 2003]



A.) Traverse through stratigraphy of the Las Peñas basin in the Salagasta region. Yellow markers indicate sample locations. [Google Earth]. **B.)** Photo of the examined section displaying the contacts between the Neogene synorogenic sedimentary units.

STRATIGRAPHIC SECTION

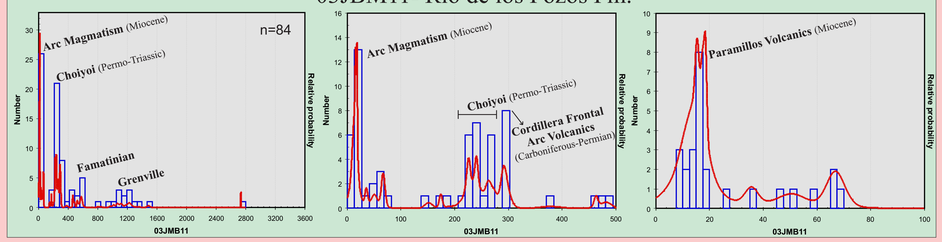
Las Peñas Basin, Salagasta Region



A.) Tuff bed within fine-grained sandstones and siltstones from the Mariño Fm. and location of detrital zircon sample 05JBM11. **B.)** Intercalated medium grained sandstone and pebble conglomerates of the La Pilona Formation that represents the transition zone between the Mariño Fm. and the Rio de los Pozos Fm. **C.)** Pebble to boulder polymict, clast-supported conglomerate of the Rio de los Pozos Fm. **D.)** Thrust contact at the top of the measured section with the distinctly red, Triassic Uspallata Group structurally overlying the Rio de los Pozos Fm. **E.)** Salagasta region, Las Peñas basin stratigraphic section.

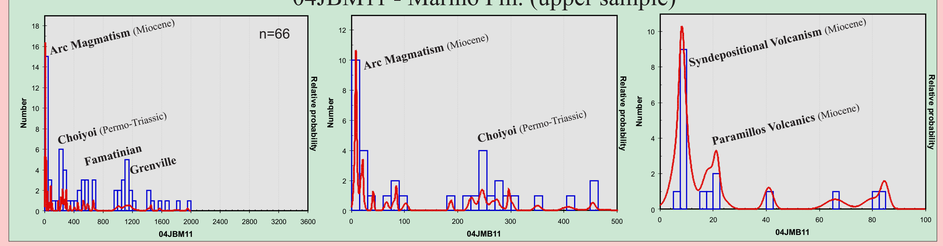
DETRITAL ZIRCON GEOCHRONOLOGY

03JBM11- Rio de los Pozos Fm.



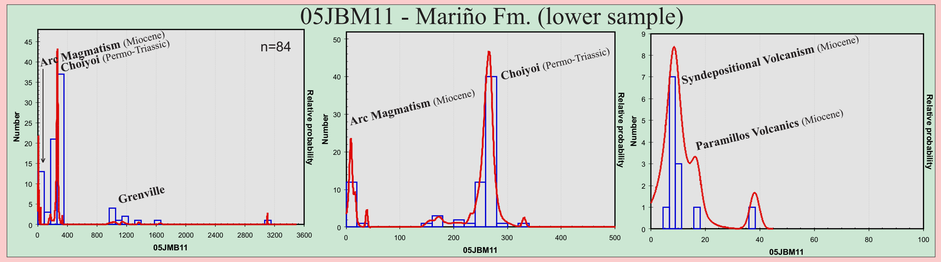
This sample is from a sandy interbed within the conglomeratic Rio de los Pozos Formation. Note persistent Grenville and Famatinian peaks. Major Choiyoi peak has expanded to include late Carboniferous to Permian subpopulation, which definitively attests to major uplift of the Cordillera Frontal. TransAndean Miocene volcanic rocks are a volumetrically significant source. Note lack of syndepositional zircon influx.

04JBM11 - Mariño Fm. (upper sample)



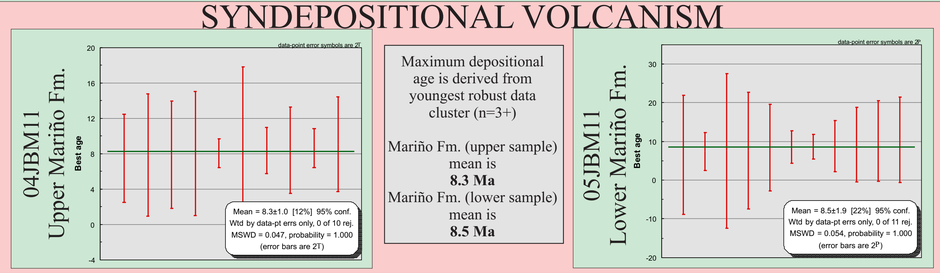
This sample is from a well-sorted fluvial sandstone of the upper Mariño Formation. Note presence of both Grenville and Famatinian populations derived from Cuyania. Robust Choiyoi Group peak suggests derivation from Cordillera Frontal. Early Miocene peak may reflect erosion of transAndean Miocene volcanic arc represented by the Paramillos Fm. Major ca 8.3 Ma peak attests to continued syndepositional volcanisim.

05JBM11 - Mariño Fm. (lower sample)



This sample is from a waterlain tuffaceous bed in the upper Mariño Formation. Small Grenville population is inferred to be derived from the Cuyania composite terrane. Large population of ca 250-300 Ma grains suggests derivation from Choiyoi Group of the Cordillera Frontal. Small 160-220 Ma population suggests minor influx from JuraCretaceous arc of the Cordillera de la Costa. Note strong syndepositional volcanic peak (ca. 8.5 Ma).

SYNDEPOSITIONAL VOLCANISM



INTERPRETATIONS

Sedimentology and Stratigraphy:

- The stratigraphic section displays the classic coarsening-upward succession of a rapidly prograding clastic wedge in a retro-arc foreland basin. The succession consists of, from bottom to top:
  - upper Mariño Fm.: medium to coarse grained sandy braided fluvial system with distinct tuffaceous intervals
  - La Pilona Fm.: transitional succession consisting of a coarsening upward sequence of coarse-grained sandstone and granule to pebble conglomerate deposited in a braided fluvial to distal alluvial fan system.
  - Rio de los Pozos Fm.: pebble to boulder conglomeratic unit representing medial to proximal alluvial fan system

Detrital Zircon Geochronology:

- the source of the Mariño Fm. yields distinct detrital zircon populations of Grenville and Famatinian age, probably representing sediment derived from the Cuyania composite terrane. PermoTriassic populations represent the Choiyoi Group, potentially indicating sediment derivation from a newly emergent Cordillera Frontal.
- The upper Mariño Fm. contains a robust detrital zircon population of upper Miocene age, providing a maximum depositional age of ~8.5 Ma, interpreted to represent significant syndepositional volcanism.
- the coarsely conglomeratic Rio de los Pozos Fm. displays a dramatic increase in the amount of PermoTriassic Choiyoi Group detritus, including a distinctive subpopulation of Carboniferous-Permian grains definitively linked to the Cordillera Frontal. The percent of TransAndean Miocene volcanic grains also significantly increases. These detrital zircon signatures, coupled with the very coarse grained nature of the formation are indicative of a major contractional pulse unroofing the Cordillera Frontal at <8.3 Ma

ACKNOWLEDGEMENTS

We would like to thank the TIES Argentina study abroad program and the Hostel Alamo for coordinating our stay in Mendoza; Mark Pecha and the helpful staff at the University of Arizona LaserChron Lab; Sam Taylor and Todd Lau for excellent geochronologic lab assistance.

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