Exhumation and basin evolution of the Puna Plateau of NW Argentina revealed by a multi geo-thermochronological approach

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Timing of deformation and resulting sedimentation patterns in the Altiplano-Puna Plateau-Eastern Cordillera of the southern Central Andes are the subject of ongoing debate. In the Bolivian Altiplano, sedimentation into a foreland basin system commenced during the Paleocene. Farther south in the Puna and Eastern Cordillera of NW Argentina, a lack of data has precluded a similar interpretation. The Salar de Pastos Grandes basin in the Puna Plateau contains ca. 3.5 km of Tertiary fluvial-alluvial deposits. Of those, 2 km comprise Eocene alluvial and fluvial strata of the Geste Formation. Provenance data document Ordovician quartzites and minor phyllites and schists source rocks. Detrital zircon U-Pb ages from both the Geste Formation and from underlying Ordovician quartzite cluster in the 900-1200 Ma (Grenville) and late Precambrian-Cambrian (Panafrican) ranges. Late Eocene (~37-34 Ma) grains are also present and document volcanic contamination, thus constraining the depositional age of the hosting strata. Detrital apatite fission track (AFT) data show dominance of grains with Paleocene-late Eocene and Cretaceous ages, requiring rapid (>~1 mm/yr) source exhumation during this time. This is supported by double dating of the same apatites by U-Pb geochronology that reveals mainly Devonian to Precambrian apatite crystallization ages. Triple dating of the same apatites by (U-Th)/He show Eocene and 30 - 10 Ma ages suggesting partial annealing due to burial of the deepest strata. (U-Th)/He and AFT from cobbles preserved in equivalent units farther west within the Plateau in the Salar de Arizaro area document early Eocene (46. 2 ± 3.9 Ma) and Cretaceous (107.6 ± 7.6, 109.5 ± 7.7 Ma) ages. Thermal modeling of the Eocene cobble suggests relatively fast cooling between ca. 60 and 50 Ma, whereas modeling of the Cretaceous cobble shows monotonic and slow cooling. (U-Th)/He ages show a similar Eocene (48 - 55 Ma) signal representative of a detrital signature rather than cooling following burial. These data suggest that the investigated strata never reached burial T higher than ca. 60-80 ^{o}C, implying a maximum original basin thickness of ca. 2-3 km. Our study suggests that the whole Plateau interior may have been the site of Eocene syn-tectonic deposition on top of ca. 70 km wide thick-skinned and thin-skinned composite orogenic wedge in which deformation propagated unsteadily eastward.

Contrasting isotopic (Sm-Nd) signatures in an equivocal bimodal igneous complex (Ossa-Morena Zone, SW Iberia)

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Petrography and Elemental Geochemistry

The spatial association of mafic (from gabbros to granodiorites) and felsic (syenites and granites) rocks in the Elvas region (Portugal) has been interpreted as a bimodal plutonic complex and thought to represent an example of the alkaline magmatism related to the intracontinental rifting regime that affected these terrains of the Ossa-Morena Zone (SW Iberia) during the Early Palaeozoic. Based on the elemental chemistry of primary clinopyroxenes and representative whole-rock analyses (e.g. REE contents), the Elvas mafic massif show a transitional character between alkaline and non-alkaline fields. The felsic group is represented by peralkaline syenites with sodic and sodic-calcic inosilicates, as well as hedenbergitic oversaturated facies similar to the A-type granitoids.

Isotopic (Sm-Nd) Data and Conclusions

The Sm-Nd data show that the mafic and felsic igneous rocks spatially associated in the Elvas region do not represent a comagmatic suite. Assuming an age of 480 My for these rocks (by analogy with similar plutonites in the same region and geological context: [1] and [2]), the felsic facies ($+2.5 < \varepsilon Nd_{480} < +3.4$) reflect petrogenesis associated to time-integrated depleted mantle sources, whereas the mafic ones ($-3.8 < \varepsilon Nd_{480} < -1.1$) derived from time-integrated enriched sources which may have a mantle origin, and may be related with strong crustal contamination. Even though they probably represent diverse expressions of the same geodynamic event, these mafic and felsic rocks request completely distinct magmatic sources and differentiation processes.

[1] Lancelot & Allégret (1982) *N. Jahr. Min. Mh.* **H.9**, 385-394. [2] Lopes *et al.* (1993) *Terra Nova* **5**, Ab. Sup. 6, p. 10.