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Detrital Apatite Fission Track thermochronology in the southern Puna plateau: evidence for plateau growth and climate change

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Continental plateaus, such as the Andean Puna-Altiplano region, are important in the evolution of collisional and non-collisional mountain belts since they influence atmospheric circulation patterns and thus exert a profound control on precipitation and erosion distribution. The arid central Andean Puna-Altiplano region of Argentina and Bolivia is an orogenic plateau at 3500 m average elevation in a non-collisional mountain belt. Clastic sediments preserved within the plateau suggest that surface uplift of ranges had already started in the Oligocene, contributing to the establishment of internal drainage and to the characteristic high elevation and low internal relief observed today within the Puna plateau. However, existing palaeobotanic data suggest that the plateau had reached only a third of its final elevation by $\sim$20 Ma implying that most of the plateau uplift occurred since. Here we apply sedimentology and apatite fission track (AFTT) thermochronology to late Miocene-Pliocene sediments from the Bolsòn de Fiambalá basin, located at the southern Puna margin, in order to better understand when the plateau reached its final elevation and whether we can detect the signal of such process via the sedimentary record preserved along marginal areas bounding the plateau. Petrographical and paleocurrent data show that the basin was mainly sourced from the Precordillera to the west during the late Miocene and that the southern Puna started to feed the basin at least by early Pliocene time. Our new detrital AFTT data suggest that $\sim$8 Ma-$\sim$6 Ma sediments (Tamberia Formation) are the result of the progressive erosion of western sources characterised by Eocene-Oligocene, Cretaceous and Jurassic ages. From this time, a reorganisation of the palaeodrainage system is recorded with an evolution towards more northern and northeast sources, characterised

by younger detrital AFTT ages (14 Ma). The presence of palaeosols, silicified plant fossils and silt intraclasts in the mid-Pliocene Guanchin formation, suggests a generally arid but seasonal climate. The Pliocene-Quaternary Punaschotter conglomerate marks a partial closure of the basin, which became overfilled and is characterised by a radial drainage pattern. A vertical profile collected at the southern Puna margin show that this range was cooling through the apatite partial annealing zone between 14.7g$\pm$ 0.7 and 23.1g $\pm$ g.2 Ma giving a denudation rate of $\sim$0.2mm/yr. We interpret the youngest detrital signal (14 Ma) detected in late Miocene-Pliocene sediments to be derived from this range. This implies that the southern Puna margin has exhibited similar relief to that observed today since late Miocene time, when the range to the north was shedding similar ages to the one we see today into the basin. We argue that this signal is representative of the final stage of plateau growth and therefore we propose that this part of the Puna Plateau may have already achieved its present elevation by late Miocene time. Humid periods detected regionally in marginal plateau areas in late Miocene time might then be related to orographic effects caused by the presence of a high plateau.