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Meso-Cenozoic exhumation of Patagonia between latitudes 40 and 45 °S constrained by low-temperature thermochronometry

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The study of the Cretaceous - Cenozoic tectonic evolution of the Patagonian Andes and their foreland represents a great opportunity to investigate the effects of coupling between deep lithospheric processes and near-surface deformation. Low-temperature thermochronological systems are ideally suited for detecting events involving rocks in the uppermost part of the lithosphere because they record time and rates of cooling related to exhumation of the top few kilometres of the crust. The Patagonia region, although being characterized by a general continuity of the Andean orogen along its strike, shows an appreciable internal tectonic segmentation (marked by a variable position of the magmatic arc and of the deformation front in the retroarc area) at various latitudes. This complex structural architecture has been interpreted as the result of different processes acting since the Late Cretaceous. The present-day configuration of the southern Andes is interpreted to have been controlled by alternating stages of flat- and steep-slab subduction, which controlled shortening and upper plate extension stages, respectively. In this study, we used new apatite fission track (AFT) and (U-Th)/He (AHe) data in the northern Patagonia region (at latitudes between 40° and 45°S) in order to analyse and compare the exhumation patterns from the frontal part of the orogen and from the adjacent foreland sector, as well as to gain new insights into the timing and modes of coupling vs. uncoupling of the deformation between the fold and thrust belt and its foreland. The obtained data indicate a markedly different unroofing pattern between the 'broken foreland' area and the adjacent Andean sector to the west. Late Miocene to Pliocene cooling ages from the frontal part of the northern Patagonian Cordillera correlate well with a recent shortening and exhumation stage that took place in the thrust belt during steep-slab subduction and rollback. On the other hand, AFT and AHe data obtained for the 'broken foreland' unravelled significant burial associated with sediment load, followed by erosional unroofing and exhumation since the Late Cretaceous.