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Variability in the topography, exhumation and structural style through a 600 km transect along the Transantarctic Mountains Front, Antarctica

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The Transantactic Mountains (TAM) form the western boundary of the West Antarctic Rift System (WARS), one of the largest continental rift domain on Earth, starting in the Mesozoic and still active today (Fitzgerald, 2002). The TAM are commonly regarded as the most prominent topographic expression of a rift-related rift shoulder uplift around the word (Wannamaker et al., 2017). Nonetheless, the unique topographic characteristics such as high elevation with numerous summits up to 4000 m, an along-strike length up to 3500 km and an oblique tectonic regime, make the TAM an unusual rift shoulder.
Morphotectonic evolution of the TAM has been commonly interpreted as genetically linked to WARS extension and numerous models have been proposed, spanning from unloading during lithosphere break (Stern and Ten Brink, 1989) to lithosphere necking (van der Beek et al., 1994) while dynamically supported topography by mantle flow at the edge of the Antarctic craton has been also invoked for the northern Victoria Land (Faccenna et al., 2008). More recent studies, based on the evaluation of a thicker crust, propose that the TAM are a remnant of an already high elevation plateau (Bialas et al., 2007).
Although the proposed models fit well with the TAM general topographic characteristics, the along strike variation in topography, amount of exhumation and style of deformation all together suggest a more complex geodynamic scenario that has never been deeply investigated.
Here we show a topographic analysis of a 600 km long transect along the TAM Front that has been combined with regional patterns of existing thermochronological data, integrated with some new apatite fission-track thermochronology and structural data from the Royal Society Range. It represents a first attempt to identify long wave-length tectonic signals in the present topography of the TAM rift shoulder. The results pointed out that the Royal Society Range experienced a greater amount of rock uplift and denudation with respect to the surrounding regions during the late Eocene/early Oligocene times, in connection with a major episode of transtensional tectonics distributed along the TAM front. The detected along strike variability in tectonic, erosion and geomorphic characteristics may reflect geodynamic complexities and they have to be taken into account in any further model.

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