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The two-stage rifting history of the West Antarctic Rift System: a reappraisal from structural and thermochronological investigations in North Victoria Land

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The West Antarctic Rift System it is one of the largest extensional provinces on Earth. Despite this, uncertainty still persists on its structure and evolution. In particular, recent interpretations propose a Cenozoic age of the rift system, in contrast with previous two-stage models involving rift initiation in Cretaceous times. To further contribute to better understanding the evolution of rifting, we carried out a combined structural and apatite fission track study of the western shoulder of the West Antarctic Rift System, in the coastal area of the Ross Sea between the Reeves and the Mawson glaciers. Structural data indicate that the onshore fault pattern is dominated by N-S striking right-lateral strike-slip to transtensional fault systems and their related subsidiary fault populations in the damage zones. Thermochronological data support a Cenozoic age for these fault and, in particular, the onset of the oblique rifting event at about 50 Ma, in Eocene times. Apatite fission track analyses also indicate the occurrence of an older cooling/exhumation event in Cretaceous times, in agreement with thermochronological data from other areas of the rift shoulder and with plate tectonics reconstructions. When integrated with the Cenozoic syn-tectonic magmatic framework available in the literature, structural and thermochronological data suggest that, during the Cenozoic oblique-rifting stage, North Victoria Land underwent progressive fragmentation into narrow NW-SE oriented crustal/subcrustal slivers. We propose that the post rift transfer of dextral shear from the mid oceanic ridge in the Southern Ocean to the Antarctic Plate interior has triggered such an unexpected geodynamic scenario in passive margin environments.