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Differential exhumation of cratonic and non-cratonic lithosphere revealed by apatite fission-track thermochronology along the edge of the São Francisco craton, eastern Brazil

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Lithosphere of cratons and orogens generally reacts differently to tectonic events. Although these differences are mostly clear during the orogenic phases, understanding how they respond to tectonic reactivation is still challenging. Here, we report the first detailed apatite fission-track (AFT) study pinpointing the gradual transition between cratonic and orogenic lithosphere, using the case study of the São Francisco craton (SFC) and the adjacent Araçuaí-West Congo Orogen (AWCO), eastern Brazil. The collision that built the AWCO partially affected the inherited rift structures of the Paramirim Aulacogen, embedded in the São Francisco-Congo paleocontinent. Our data reveal a differential Phanerozoic exhumation between closely interspaced areas affected and not affected by the AWCO deformation. Samples from the SFC present slow and protracted basement cooling during the Phanerozoic, while samples from the orogen display rapid exhumation since the Eocene. An intermediate ~N-S zone of c.40 km shows lower magnitude basement cooling during the Cenozoic, possibly because the propagation of AWCO deformation decreases towards the craton interior. Within the orogen, the Rio Pardo salient is the main reactive structure and probably results from the deformation of a master fault, inherited from its precursor rift. Here, we show how the magnitude of Phanerozoic denudation may be deeply associated with previous events of lithosphere weakening.