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Constraining the timing of crustal thickening using garnet geochronology – An argument against subduction-driven orogenesis in the Dom Feliciano Belt, Brazil

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Metamorphic minerals in the Brusque Complex of the northern Dom Feliciano Belt, Brazil, provide new insights into the timing and mode of regional convergence, challenging a long-lived subduction-collision model for orogenesis. The key evidence for subduction is an extensive linear belt of granitic rocks (the Granite Belt) that intruded the length of the hinterland of the Dom Feliciano Belt between ~630–580 Ma, and that is inferred to represent arc magmatism above the subducting Adamastor Ocean prior to continental collision. The study area comprises supracrustal units of a foreland fold-and-thrust belt outcropping along the western edge of the symmetric Kaoko–Dom Feliciano orogenic system. The integrated study of primary metamorphic mineral assemblages and associated deformation fabrics support the interpretation of a fold-and-thrust belt environment, with early tectonic movement top-to-NW away from the hinterland. P–T estimates constrained by garnet compositions indicate peak metamorphic conditions of 540–570°C and 5.5–6.5 kbar, in line with typical geothermal gradients associated with orogenic metamorphism. The timing of early garnet growth, and by inference the early stages of crustal thickening in the foreland, is constrained by Lu–Hf garnet geochronology at ~660–650 Ma. The data indicate that the onset of metamorphism and deformation in the orogenic foreland occurred ~20–30 m.y. prior to intrusion of extensive granitic magmatism into the orogenic hinterland. The timing of early orogenic thickening in the foreland precludes the interpretation of the Granite Belt as an arc above a large-scale subduction zone in the lead up to orogenesis. Instead, it is interpreted to represent syn-orogenic magmatism typical for hinterland domains in other ancient and recent orogenic systems.

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