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Zircon and monazite U–Pb petrochronology: unravelling partial reset and metamorphism in an upper-amphibolite facies semipelitic metatexite

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The integration of U–Pb zircon and monazite geochronology with trace element and metamorphic *P–T* data ('petrochronology') is now a common way of constraining the detailed evolution of metamorphic rocks and orogens. However, a challenge still remains for conducting geochronology and petrochronology for samples that have undergone partial isotopic reset. We address filling this gap by analysing discordant and concordant zircon and monazite from melt-poor and -rich domains of a semipelitic metatexite within the interference zone between the Neoproterozoic to Cambrian Brasília and Ribeira orogens, SE Brazil. Despite numerous previous studies in the area, unresolved questions remain on: (a) the maximum depositional ages for the protolith sediments; and (b) the age and timescale of metamorphic events. Resolving these issues will allow for a much more thorough understanding of the tectonic evolution of this part of west Gondwana. In order to account for the partial reset/open system behaviour of the rocks and the U–Pb system, we link age and geochemistry of zircon and monazite to the growth of garnet, xenotime, and the anatectic melt evolution, as well as utilise zircon discordance modelling. In addition, we integrate this with 1-D thermal modelling of the crust and results from phase equilibria forward modelling in the (LREE, P, F, Y, Th, Mn)NCKFMASHTO system. We propose: (a) a maximum deposition age of 750 Ma, which contrasts with the age of 680–640 Ma currently proposed for the studied rocks; (b) at least 140 Myrs of evolution for the Brasília-aged metamorphism (700–560 Ma); and (c) that the Ribeira orogeny is restricted to a discrete static Cambrian overprint (520–500 Ma) in the investigated area. From linking phase equilibria modelling and silicate mineral evolution to multi-stage zircon and retrograde monazite growth, continental collision is constrained to 630–620 Ma. More broadly, this study shows that 'seeing through' the partial isotopic resetting requires careful assessment and processing of the datasets, and highlights that zircon cores and rims do not exclusively represent, respectively, inheritance and metamorphic domains.