



Unravelling neoproterozoic metamorphic events in a complex terrain: petrology, phase equilibria modelling and U/Pb geochronology of Embu Complex, Ribeira Belt, South America

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The Embu Complex is one of the most expressive and unknown geotectonic units of the Ribeira Belt (SE Brazil), and its evolutionary history has important implications for the reconstruction of West Gondwana. The Embu Complex is dominated by an amphibolite facies metasedimentary rock assemblage composed of micaschist and migmatitic paragneiss with intercalations of quartzite and calc-silicate, metaultramafic and metamafic rocks. The objectives of this work consist in constraining the P-T conditions to the peak of the main regional metamorphic event recorded in the Embu Complex and assess the regional implications of these data in the context of available geochronological and petrological data and large-scale tectonic processes. We present new petrological, phase equilibria modelling and zircon U/Pb SHRIMP and LA-MC-ICP-MS data obtained in key samples of migmatitic paragneiss and associated quartzite from the Embu Complex. Detailed petrological data indicate that the peak of the main regional metamorphic event recorded in the Embu Complex is represented by a migmatitic paragneiss constituted by a sillimanite + garnet + biotite + quartz + K-feldspar + plagioclase residual assemblage, which reached high-grade metamorphism. Quartzo-feldspathic layers that occur in the area are interpreted as granitic neosomes formed during the anatexis. The presence of granitic leucosome, K-feldspar and sillimanite indicate the fluid-absent muscovite breakdown melting reaction was crossed. X-ray mapping garnet analyses are consistent with the rim-core-rim analytical chemical profiles, both showing a very weak to absent composition zonation from the core to the rim, interpreted as diffusional zoning of garnet, suggesting that thermodynamic equilibrium had possibly been achieved within the peak mineral assemblages at the metamorphic peak stage. Biotite modes on calculated pseudosection modeling in the NCKFMASHTO system using the Perple_X technique constrained the peak P-T conditions to 780 to 808°C at 5.1 to 10 kbar. Metamorphic zircon overgrowths yielded oldest Concordia ages of 825 ± 14 , 792 ± 5 and 788.9 ± 8.5 Ma, interpreted as the time of near peak metamorphism and regional anatexis, which indicate that the main regional metamorphism recorded in the westernmost portion of the Embu Complex occurred in the Tonian. Available geochronological and petrological data and the existence of coeval 810-780 Ma granitic plutons with S-type collisional affinities strongly support the existence of a major Tonian accretionary-to-collisional event in the southern and central Ribeira Belt, which was probably responsible for accretion of Mesoproterozoic exotic terranes to the margin of the Paranapanema Craton. Metamorphic zircon overgrowths with Concordia ages of 566.7 ± 3.7 Ma and 615.2 ± 5.8 Ma were heterogeneously developed, in high-grade and low-grade samples, corroborating the existence of an Ediacaran to Cryogenian metamorphism described for the Ribeira Belt and indicating a complex multiphase metamorphic history for the Embu Complex.