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Partial melting of continental crust during West Gondwana assembly

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Rocks attributed to the assembly of West Gondwana in Brazil are common and crop out in several terranes in eastern coast. Among them, the Itatins Complex is a granulite-facies unit that occurs in the Southern portion of Ribeira Belt, in São Paulo State, Brazil. The complex is composed mainly of migmatitic orthogneiss and paragneiss, formed in an open-system, and features of partial melting range from “in-situ” to larger domains where melt has accumulated.

The orthogneiss unit is typified by biotite granulite with the assemblage $\text{Opx} + \text{Bt} + \text{Pl} + \text{Kfs} + \text{Qtz} + \text{Ap} + \text{Zrn} + \text{Mag-ilm}$. Leucosome, comprising $\text{Pl} + \text{Kfs} + \text{Qtz} + \text{Bt} + \text{Ap} + \text{Zrn}$, forms lenses parallel to the metamorphic foliation and veins discordant to the structure. Mafic granulite ($\text{Opx} + \text{Hbl} + \text{Pl} + \text{Qtz} + \text{Mag-ilm} \pm \text{Grt} \pm \text{Cpx}$) occurs as metric-sized schollen surrounded by leucosome. The paragneiss unit is represented by an (Spl)-Sil-Grt-Bt diatexite with banded and folded structure. Leucosome occurs as layers and veins cutting the previous structures and both display the same mineral assemblage ($\text{Pl} + \text{Kfs} + \text{Qtz} + \text{Zrn} + \text{Ap} + \text{Mnz}$). The residual domains of the paragneiss rock are composed of $\text{Grt} + \text{Bt} + \text{Pl} + \text{Qtz} \pm \text{Opx}$.

Pseudosection modeling of the rocks allied to Grt-Opx geothermobarometry indicates metamorphic peak at 850 °C and 0.8 GPa. If we assume an open-system regime for the complete metamorphic event, the amount of melt predicted by modeling is below 30 mol % at the beginning of granulite facies. The volume of leucosome in the outcrops visited is in excess of this, thus we conclude that part of the metamorphic path occurred as a closed-system but then changed to open-system, which allowed melt to migrate and accumulate.

Zircon geochronology shows that the protolith of the biotite granulite (granodiorite) formed at *ca.* 2100 Ma and was metamorphosed at *ca.* 600 Ma. Dating zircon cores in the paragneissic unit shows a wide range of sources for the sedimentary protolith (640 Ma, 700-800 Ma, 1000 Ma and 2000-2400 Ma). Analyses from zircon rims and monazite crystals confirm the neoproterozoic age (595-605 Ma) of the granulite facies metamorphism recorded in the Southern Ribeira Belt, which is attributed to the Gondwana assembly.