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Prolonged high temperature conditions in the middle-lower crust during a collisional orogeny

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Extensive partial melding of the middle to lower crustal parts of orogens, such as the current Himalayan-Tibetan orogen, significantly alter their rheological structure and impose first-order control on their tectonic and topographic evolution. We interpret the late Proterozoic Araçuaí orogen, formed by the collision between São Francisco (Brazil) and Congo (Africa) cratons, in East Brazil, as a deep section through such a hot orogen, based on U-Pb SHRIMP zircon ages and Ti-in-zircon and Zr-in-rutile temperatures from the Carlos Chagas anatectic domain. The Carlos Chagas domain is composed of peraluminous anatexites and leucogranites that typically exhibit interconnected networks of garnet-rich leucosomes or a magmatic foliation. Zr-in-rutile temperatures range from 745 to 820 °C and the average Ti-in-zircon temperature is 722 °C. The geochronological and thermometry data suggest that from ∼600 to 570 Ma this domain was partially molten and remained so for at least 30 m.y., slowly crystallizing between temperatures of ∼820 and >700 °C. This therefore implies that significant crustal thickening must have occurred prior to 600 Ma, with initial continental collision earlier than 620 Ma, a time period enough to heat the crust to temperatures required for widespread partial melting at middle and lower crustal levels.