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Neoproterozoic to Early Paleozoic P-T evolution of pelitic granulites from the Larsemann Hills sector, East Antarctica: New insights from phase equilibrium modelling and monazite CHIME dating

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The granulite terrane exposed at Larsemann Hills sector of the Prydz Bay region has been regarded as a Pan-African orogenic belt. A detailed investigation of various granulite rocks in this sector is helpful in understanding the thermal evolution of remnant orogenic belts preserved in the Prydz Bay region of East Antarctica. The present study focuses on deciphering the pressure-temperature-time (P-T-t) history of pelitic granulites from the Larsemann Hills and surrounding exposures. Based on mineralogical assemblages, the studied samples are classified as garnet-spinel-cordierite, K-feldspar-free, and cordierite-free pelitic granulites. The petrographic observations suggest three episodes of metamorphism, M_1, M_2 and M_3, representing HP, HT-UHT decompression stage-1 and cooling decompression stage-2 events, respectively. The mineral assemblage with garnet + sillimanite + rutile ± biotite characterizes the HP episode (M_1), whereas the garnet + cordierite + spinel + K-feldspar + ilmenite ± corundum indicate the decompression heating event (HT-UHT; M_2). Growth of thin cordierite corona around garnet and spinel demarcates the M_3 metamorphism. The application of conventional thermobarometry and pseudosection modelling constrains *P–T* conditions for M_1, M2 and M_3 metamorphic episodes at 10-12 kbar/~700 °C, 6–7 kbar/800–980 °C and 3–4 kbar/500–600 °C, respectively, suggesting a decompression P–T path for the pelitic granulites. CHIME (Chemical isochron method) dating of monazite cores yielded two distinct populations at 950–850 Ma (906 ± 29 Ma) and 700–600 Ma (725 ± 21 Ma, 649±38 Ma), whereas the narrow to wide rims of monazite preserve dominant age populations at 550–450 Ma (501 ± 41 Ma, 473 ± 17 Ma). We infer that the Larsemann Hills sector preserves protracted post-Rodinia thermal history (0.95–0.47 Ga), possibly indicating long-lived Pan-African orogeny that manifested the final amalgamation of East Gondwana.