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Decoding the *P–T–t–d* evolution of the Pur-Banera belt, Aravalli Craton, India: Insights from phase equilibria modelling and zircon-monazite geochronology of metapelites

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The Pur-Banera belt in the Bhilwara region of the Aravalli Craton, India, constitutes a Mesoproterozoic rift-related supracrustal sequence. The belt, while containing psammitic, calcareous and ferruginous metasediments, is dominated by garnet–staurolite–kyanite-bearing metapelites. Here we integrate data on deformation structures with pseudosection modelling and zircon–monazite geochronology to decipher the *P–T–t–d* evolution of these metapelites. The metapelites record three distinct deformation events. The first two produced a $S_1//S_2$ foliation, and a younger event of dextral shearing produced crenulations superimposed on the foliation. Textural and compositional data indicate two stages of growth of garnet, whose core compositions were significantly altered during peak metamorphism. The textures combined with pseudosection modelling and conventional thermobarometry reveal that the garnet cores grew during staurolite-grade prograde metamorphism, followed by a second stage of garnet growth (syn-D_2; 7.3–7.9 kbar and 665–690°C) during kyanite-grade peak metamorphism. Fibrolite grew in the matrix during post-peak readjustments due to uplift and decompression, whereas fluid-induced retrograde metamorphism (480–540°C) resulted in the formation of euhedral staurolite prisms and narrow rims around garnet porphyroblasts. Detrital magmatic zircons yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1827 ± 7 Ma (95% confidence) indicating a Palaeoproterozoic igneous source rock for the sediments. Monazite U–Th–(total) Pb ages indicate the timing of commencement of prograde metamorphism at ~1.3 Ga, peak metamorphism at ~1.2–1.1 Ga, and fluid-induced retrograde metamorphism at ~0.85–0.75 Ga. Our combined results indicate that the metapelites experienced two deformation events during the closure of the Pur-Banera basin and the consequent burial of the sediments to lower crustal depths. These were followed by uplift and exhumation, and fluid-induced retrograde metamorphism during shearing. Southwestward tilting of the rocks during the D_3 event, and subsequent erosion, have exposed rock units in the western, central and southeastern parts of the belt which were buried deeper than those in the southwestern parts. This explains the observed northeastward increase in the metamorphic field gradient along the NE–SW strike of the belt.