This abstract is part of the session of 10-minute talks

The last gasp of King Leopold: new insights into the evolution of the West Kimberley

by

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Constraints on the timing and conditions of metamorphism and deformation in the King Leopold Orogen are limited due to a lack of geochronology and thermobarometry. Existing models associate strike-slip fault movement and coeval metamorphism with the poorly constrained 1400–1000 Ma Yampi Orogeny. The Billyarra Shear Zone is a high-strain zone that crosscuts sedimentary rocks of the Marboo Formation. Pelitic rocks in this zone have a peak metamorphic assemblage comprising garnet, staurolite, muscovite and biotite. Garnet and staurolite occur as porphyroblasts with inclusion trails aligned in a strong foliation defined by biotite–muscovite–quartz, supporting interpretations that peak metamorphism and deformation were coeval. Interpreted pressure (*P*)–temperature (*T*) estimates predict peak metamorphic conditions of 580–630°C and 5–6 kbar along a clockwise *P–T* path, consistent with crustal thickening to a depth of about 13 km (Fig. 1a). In situ laser ablation split stream analyses of monazites aligned in the foliation yield a $^{238}U/^{206}Pb$ date of 502 ± 3 Ma (Fig. 1b), interpreted as the age of deformation and associated metamorphism. These results indicate a significantly different and more complex geological history of the shear zones than previously recognized. The fault movement occurred at c. 500 Ma and was accompanied by high-grade metamorphism and crustal thickening, possibly related to the final stages of the 670–510 Ma King Leopold Orogeny.

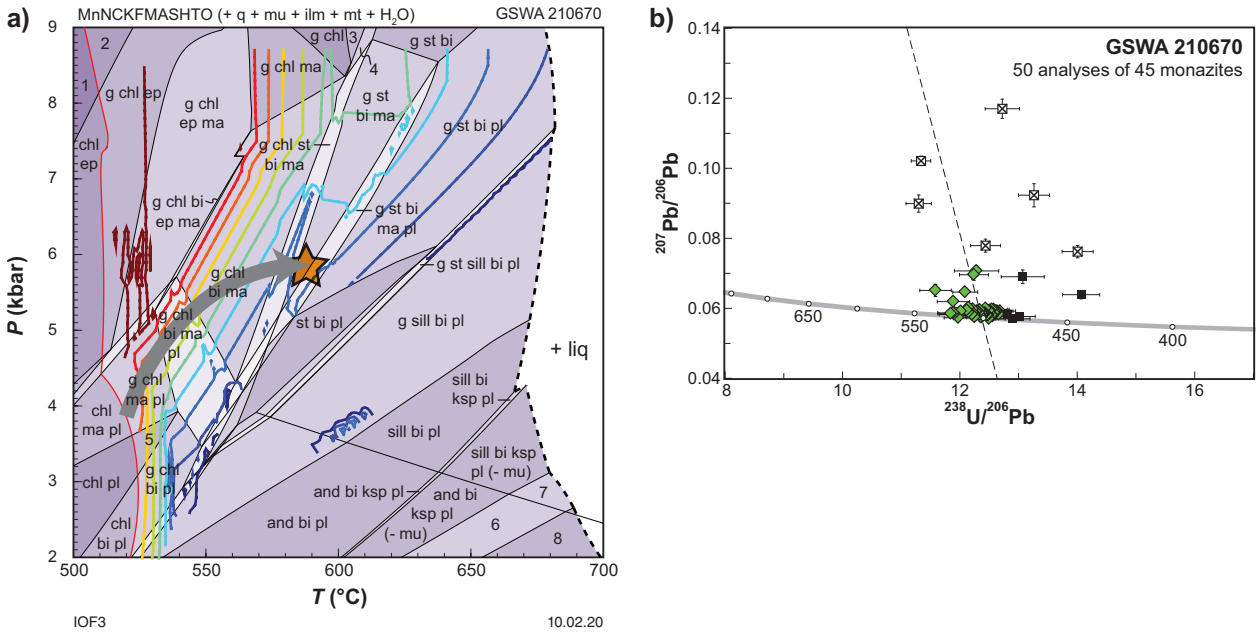

Figure 1. **Analytical data for metamorphic monazite in GSWA sample 210670: a) *P–T* pseudosection; b) U–Pb analytical data, not corrected for common Pb. The dashed line indicates a regression from initial Pb through data in Group M (metamorphic monazites). Green diamonds indicate Group M; black squares indicate Group P (radiogenic-Pb loss); crossed squares indicate Group D (high common Pb). All analyses were conducted in situ, to preserve the textural relationship of the monazite to surrounding minerals, allowing for direct dating of deformation and peak metamorphism. Abbreviations: and, andalusite; bi, biotite; chl, chlorite; ep, epidote; g, garnet; ilm, ilmenite; ksp, K-feldspar; liq, liquid (silicate melt); ma, margarite; mt, magnetite; mu, muscovite; pl, plagioclase; sill, sillimanite; st, staurolite**

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