High-grade Paleoproterozoic reworking in the southeastern Gawler Craton, South Australia*

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SUPPLEMENTARY PAPERS


* Appendix 2 (*) in the text and listed at the end of the paper] is a Supplementary Paper; copies may be obtained from the Geological Society of Australia’s website (www.gsa.org.au) or from the National Library of Australia’s Pandora archive (http://nla.gov.au/nla.arc-25194).
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APPENDIX 2: Mineral chemistry
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Mineral compositions of assemblages in metabasites and felsic shear zones were obtained using a Cameca SX51 Electron Microprobe, located at the University of Adelaide. Quantitative analyses were run at an accelerating voltage of 15 kV and a beam current of 20 nA.

**Garnet**

Mafic garnet analyses showed homogeneous compositions. Cores and rims typically have $X_{Fe}$ \[Fe/(Fe+Mg+Mn+Ca)\] values ranging between 0.43 and 0.51. $X_{Mg}$ values between 0.06 and 0.2. $X_{Mn}$ values between 0.007 and 0.062 and $X_{Ca}$ values between 0.31 and 0.41. Felsic garnet analyses also show homogeneous compositions with $X_{Fe}$’s of 0.66 to 0.8, $X_{Mg}$ values between 0.03 and 0.13, $X_{Mn}$ between 0.06 increasing to 0.27 in the cores and $X_{Ca}$ values between 0.01 and 0.02.

**Clinopyroxene**

Clinopyroxene in all samples analysed plots within the diopside region of the Ca–Mg–Fe quadrilateral (Morimoto 1989). $X_{Mg}$ [Mg/(Mg+Fe) cations] is in the range 0.5 to 0.76. Among the non-quadrilateral components Al₂O₃ may be up to 5.1 wt% but is typically below 4 wt%. $X_{jd}$ [Na/(Na+Ca+Mg+Fe₉₂)] component is never more than 0.09.

**Hornblende**

All amphibole is interpreted to be metamorphic in origin. All analysed amphiboles fall into the calcic amphibole group (Leake et al. 1997), having Ca₉ ≥ 1.65, Na₉ ≤ 0.18 and (Ca+Na)₉ ≥ 1.65. The majority of analysed amphiboles had (Na+K)₉ ≥ 0.5 and plotted within the ferropargasite–pargasite region on a $X_{Mg}$ vs Si diagram. The small subset which had (Na+K)₉ values <0.5 plotted within the ferrohornblende to magnesiohornblende field. Al₂O₃ content varies between 6.3 and 15.1 wt%, SiO₂ between 38.8 and 49 wt%, and TiO₂ between 0.16 and 1.99 wt%. $X_{Mg}$ ranges from
0.26 to 0.67. The second generation of hornblende, which grew during post-peak replacement of garnet, have low wt% Ti and $X_{Mg}$ values.

**Mica**

Biotite occurs in the felsic shear zones as a foliation defining mineral. $X_{Na}[Na/(Na+K)]$ ranges between 0 and 0.15. $X_{Fe}[Fe/(Fe+Mg+Al^{VI}+Ti)]$ is between 0.56 and 0.73, $X_{Al}^{VI}$ between 0.08 and 0.2, and $X_{Ti}$ between 0 and 0.04. Muscovite occurs as a retrograde mineral that overgrows the shear fabrics. $X_{Na}[Na/(Na+K+Ca)]$ ranges from 0.02 to 0.03. $X_{Fe}$ between 0.07 and 0.13, $X_{Al}^{VI}$ between 0.84 and 0.92, and $X_{Ti}$ of 0.

**Feldspar**

Metamorphic plagioclase from the mafic assemblages exhibits a complete solid solution from oligoclase to labradorite. An (Ca) content typically varies from An$_{19}$ to An$_{67}$. Plagioclase grains typically show core to rim zoning going to more An-rich compositions (typically An$_{25}$ in the core to An$_{39}$ at the rim in sample SB3). From textural relationships it is likely that increasing anorthite content is related to the breakdown of the grossularite component of garnet.

Plagioclase from the felsic shear zone fabrics tends to be predominantly albitic in composition with one sample being Al$_{60}$ but the rest ranging between Al$_{78}$ to Al$_{98}$. The K-feldspar component of the shear zones ranges in composition from Or$_{87}$ to Or$_{98}$ with a minor albite component constituting the remainder.

**Ilmenite and titanite**

Ilmenite occurs in the mafic assemblages as both inclusions in titanite and within the first generation of metamorphic hornblende. Ilmenite contains an $X_{Fe}[Fe/(Fe+Mg+Mn)]$ value between 0.85 and 0.98 with an Fe$^{3+}$ component of ~0 up to 0.08 (Droop 1987). $X_{Mn}$ ranges between 0.01 up to 0.06 and an $X_{Mg}$ of 0.

Titanite occurs as an abundant accessory mineral in the mafic assemblages and is interpreted to be metamorphic in origin. Titanite compositions are typically standard with only minor substitution of Al$^{3+}$ and Fe$^{3+}$ for Ti with $X_{Al}[Al/(Al+Fe+Ti)]$
values between 0.03 and 0.05, and $X_{Fe}$ values between 0 and 0.02. Titanite also contains up to 34 ppm U and 36 ppm Th.