

High-grade metamorphism in the north-west Gawler Craton, South Australia

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Quartz + Fe-oxide + sillimanite-rich gneisses from boreholes at Ooldea on the north-western fringe of the Gawler Craton are granulite-facies, aluminous, banded iron formations. Additional phases include hypersthene, garnet, sapphirine, cordierite, biotite, spinel, plagioclase, K-felspar and corundum in varying proportions. The minerals display a great diversity of association, reflecting the complex textural evolution of the rocks.

When compared with published experimental data and P-T grids, the observed assemblages (e.g. opx + sill + qtz) suggest conditions of $P > 10$ kbar and $T = 1000^{\circ}\text{C}$ at relatively high $f\text{O}_2$ (hematite-magnetite buffer) for the thermal peak of metamorphism, though geothermometry and geobarometry are not fully supportive. Textures and some phase relations suggest the possibility of partial melting. The hematite is titaniferous, and in this and other respects the rocks display some similarity with the granulites described from the Labwor Hills, Uganda (Sandiford *et al.* 1987). Compared with the Labwor Hills granulites, however, the sapphirine and quartz association in the Gawler Range examples is only in trace amounts. This, plus the anomalously low (ca. 8%) SiO_2 and high (ca. 65%) Al_2O_3 in the sapphirine may reflect metastability; even if stable, the high Fe^{3+} ($0.8-0.9 \text{Fe}^{3+}/\text{Fe}^{2+} + \text{Fe}^{3+}$) of the sapphirine suggests lower crystallisation P-T than that of some other sapphirine plus quartz-bearing localities (e.g., $\text{Fe}^{3+}/\text{Fe}^{2+} + \text{Fe}^{3+} = 0.33$ for a sapphirine from the Labwor Hills).

Nevertheless, the drill core appears to reflect a somewhat higher P-T than does outcropping terrain of the same (ca. 1700 Ma ?) age, 20 kms distant (to the east), and may represent a crustal slice upthrust on one of the conspicuous NE-SW trending faults characterising the northwestern margin of the Gawler craton.

REFERENCE

Sandiford M., Neall F.B., and Fowell R., 1987. *Contributions to Mineralogy and Petrology*, 95, 217-225.