THE GEOLOGY OF THE ADELAIDEAN-KANMANTOO GROUP SEQUENCES IN THE EASTERN MOUNT LOFTY RANGES

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SUMMARY

The metamorphosed sedimentary sequence of the Precambrian Adelaide Supergroup in the eastern Mt. Lofty Ranges closely resembles its lower grade stratotype in the western Mt. Lofty Ranges. Although rocks have been metamorphosed from biotite to high andalusite grade, the nature of the original succession can still be deduced. Stratigraphic thicknesses in the eastern and western sequences differ, however. The thickness of the Torrens Group metasediments in the eastern sequence above the Stoneyfell Quartzite equivalent is over four times that found in its type area. In contrast, the overlying Sturt Group is less than half the thickness of the stratotype whilst the Marino Group is only slightly thinner in the eastern sequence.

In the region between Birdwood and Mt. Barker Creek, the Lower Cambrian Kanmantoo Group is in fault contact with the Adelaide Supergroup, the lower levels of the basal unit of the Kanmantoo Group (the Carrickalinga Head Formation) being absent. A conformable succession of Kanmantoo Group strata, closely resembling the lithologies in the type area on the south coast of Fleurieu Peninsula, occurs to the east of this contact. Evidence for a fault contact disproves earlier interpretations that the Kanmantoo Group unconformably overlies older strata in parts of this region and confirms the existence of the Nairne Fault. Furthermore, it is doubtful whether the Kanmantoo Group unconformably overlies older strata elsewhere in the eastern Mt. Lofty Ranges. Where there is a break in the normal Kanmantoo Group succession (which exhibits a remarkable constancy of facies), faulting is probably the cause.

A well developed penetrative schistosity (S_2) occurs throughout the Nairne-Mt. Barker Creek area, being related to a deformation phase F_2 which produced tight assymetric folds with easterly-dipping axial planes (paralleled by S_2) during the Early Palaeozoic Delemarian Orogeny. An earlier deformation (F_1) with accompanying metamorphism, earlier than generally recog-

nized in the Mt. Lofty Ranges is evident in the schists. Metadolerite dykes in the area were probably emplaced pre-S_2 to early syn-S_2.

Petrological examination of the metasediments in the Nairne-Mt. Barker Creek area revealed that critical minerals present in metashales of appropriate bulk composition are andalusite, staurolite and almandine whereas cordierite is absent. The origin of andalusite and staurolite is unresolved. Fibrolite ($\pm$ minor coarse sillimanite) is present in all andalusite-bearing rocks. The sillimanite problem is examined through the well developed textures in peraluminous schists.

Green hornblende, diopside and scapolite occur in calc-silicates. Green hornblende, high-An plagioclase and minor epidote are present in the metadolerite dykes.

P-T conditions at the peak of metamorphism (based on mineral assemblages and metamorphic textures) were probably around 3.5 to 3.75 kb and 500 to 550°C (close to the andalusite-sillimanite phase boundary and near the Al_2SiO_5 triple-point). Temperatures of metamorphism deduced from the garnet-biotite geothermometer and more generally from muscovite compositions are compatible with this range. Fibrolite probably formed just within the upper limits of the andalusite stability field. It is uncertain, however, if fibrolite formed as a stable mineral under these P-T conditions or whether it formed metastably, perhaps as a result of rapid reactions induced by sudden temperature increases.

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