THE WONGWIBINDA COMPLEX: A HTLP METAMORPHIC TERRAIN

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The Late Carboniferous Wongwibinda Complex (WC) is a region of high temperature low pressure (HTLP) metamorphic rocks that occur in association with granites of the Hillgrove Plutonic Suite within the Tablelands Complex of the southern New England Fold Belt. The WC exhibits a metamorphic progression from relatively unmetamorphosed sedimentary rocks to high-grade schists with migmatites abutting the Abroi Granodiorite/Gneiss. This project aims to understand the tectonic processes that generate HTLP terrains by studying the evolution of the WC. An interdisciplinary approach is being employed studying the interaction between deformation, metamorphism, partial melting and magmatism.

The Wongwibinda Complex is composed mainly of the Girrikool Beds and their metamorphic equivalents, the Ramsbeck schists and associated migmatites. The Girrikool Beds are a thick (15-20 km) turbidite sequence of interbedded, siliceous, intermediate- to fine-grained psammites and pelites. In order to better confine the age and character of this sequence, U-Pb and Hf-isotopes were measured from zircon separated from rock samples and a TerraneChron drainage survey from the Complex. The survey identified well-defined populations at ~40 Ma, ~250 Ma, and ~290 Ma and a broad population at ~330 ± 20 Ma. Respectively, these populations reflect known ages of Tertiary Basalts, I-type plutons, S-type plutons and the ~310–350 Ma broad peak is interpreted as provenance for the sedimentary rocks being an Early to Late Carboniferous volcanic arc. A small number of grains yielding Proterozoic and Archean ages are likely to have been inherited by the magmatic/volcanic rocks from which the Girrikool sediments were derived.

Detrital zircon grains from a weakly metamorphosed metapsammite (333.7± 3.6 Ma), an unfoliated metapelitic cordierite hornsfels (330.6±7.5 Ma) and a migmatite (325.9±6.4 Ma) adjacent to the Abroi exhibit a U-Pb age distributions similar to the TerraneChron alluvial samples and suggest deposition of the sediment at less than or equal to ~320 Ma. A second migmatite sample yields a younger age (306.9±8.6Ma) probably reflecting lead loss due to metamorphism.

EMP monazite chemical dating of an unfoliated cordierite hornfels (311 ± 8.4Ma), a cordierite augen schist (292 ± 2.8 Ma) and the migmatite (297 ± 4.3 Ma) suggests the peak of metamorphism shortly followed deposition of the sedimentary protoliths at ~320 Ma.

Two zircon concentrates from strongly foliated/gneissic and relatively unfoliated samples of the Abroi Granodiorite/Gneiss were analysed and returned U-Pb ages within error: 291.2 ± 2.3 Ma and 293.6 ± 3.5 Ma respectively. Each sample has few inherited grains. Zircon grains show no evidence of metamorphic effects such as overgrowths of new zircon or dissolution of igneous zircon. The Hf data for these samples indicate a mix of juvenile and crustal components with an average Hf model age of 1.8 Ga. The disparity in age data between emplacement of the Abroi at ~293 Ma and early metamorphism of the metasediments at ~311 Ma suggests that metamorphism largely pre-dates the emplacement of the Abroi Granodiorite/Gneiss by at least a few million years and possibly up to 15 million years.