



The Ordovician Macquarie Arc and its accretion to Gondwana

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The Ordovician Macquarie Arc was accreted onto the eastern part of the accretionary Lachlan Orogen of SE Australia in the Early Silurian Benambran Orogeny. Before that, it had developed as an intraoceanic arc about 1000 km east of the Gondwana margin and opposite a ~ 1000 km long part of Gondwana - proto-Pacific plate margin that was characterised by high angles of convergence. Other parts of the margin were characterised by transform faulting. The Macquarie Arc began about 490 Ma and evolved in four magmatic phases separated by hiatuses. Early-Middle Ordovician arc development was in response to west-dipping subduction. Subduction was probably to the east in the early Late Ordovician. In the middle-late Late Ordovician, subduction could have been to the east or west, or the arc may have been under transtension. Arc rocks now occur in 4 structural belts separated by younger rift basins reflecting later Silurian-Devonian crustal extension. These belts are flanked to the east and west by Early-Middle Ordovician turbidites (continental margin, craton-derived terranes) and Late Ordovician starved black shales. The lack of provenance mixing indicates the arc and continental margin sequences represent separate (super) terranes formed hundreds to thousands of km apart and juxtaposed along major faults in the Early Silurian Benambran Orogeny, when the Macquarie Arc collided with a thick Ordovician sedimentary wedge located on the Gondwanan continental margin. Ordovician palaeogeography constrains models of arc accretion. Possible arc reversal in the early Late Ordovician might reflect the beginning of closure of former backarc basin. The ultimate end of subduction was probably the northwards strike-slip transport of a continental margin terrane along the eastern margin of Gondwana, into a position outboard of the Macquarie Arc. Ensuing oblique compression drove the Macquarie Arc over

and under its backarc basin and led to a combination of thrusting and major strike-slip faulting within, inboard and outboard of the arc in two phases. The first phase of deformation–exhumation, at 443–439 Ma, was more intense in the continental margin terrane and was followed by local extension and the formation of transient syn-post accretionary Llandovery basins filled with mixed arc and continental margin detritus. These were deformed in the second (435–430 Ma) phase of the Benambran Orogeny. The ‘missing’ outboard forearc basin and accretionary prism were translated hundreds of kms north, to underlie the New England Orogen, to be subsequently exhumed along major faults.