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THE TERRANE APPROACH TO TECTONIC ANALYSIS IN THE EAST AUSTRALIAN TASMANIDES

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Tectonostratigraphic terranes in the Tasmanides of eastern Australia have mostly been defined using criteria that stress a distinctive stratigraphic sequence, and hence a different geological history, for these individual fault-bounded or otherwise tectonically isolated units. A stratigraphic link, rather than paleogeographic compatibility, is viewed as the necessary criterion for considering sequences to belong to a common terrane.

More recent maps of the Tasmanides generally show fewer terranes than earlier schemes, the reduction arising from factors including: (i) the recognition that the rocks constituting some supposed terranes (eg Nambucca) can be stratigraphically linked to overlap sequences elsewhere, (ii) the discovery of outcrops preserving primary relationships between units that had previously been considered to be everywhere in fault contact (eg Young and Mooney Mooney), (iii) joint lithostratigraphic and biostratigraphic correlation of sequences in supposedly distinct terranes (eg Howqua, Tabberabbera, Wagga-Omeo and part of Molong-Monaro that are now considered part of the Benambra terrane), and (iv) identification of the same lithostratigraphic unit, structural sequence and metamorphic pattern on either side of postulated terrane boundaries (eg the Gilmore Fault between Tumut and Wagga-Omeo).

In contrast to the North American Cordillera, neither faunal analysis nor palaeomagnetic data provide conclusive evidence that any of the Tasmanide terranes are far travelled, but there are diverse indications that adjacent terranes were sufficiently separated to have developed independently. The difference between now juxtraposed Ordovician quartzose clastics of the Benambra terrane the coeval mafic arc rocks of the Parkes terrane provide one such example. Similarly provenance contrasts suggest that the Tamworth-Yarrol terrane remained beyond the outboard edge of the stabilising Lachlan assemblage until the middle Carboniferous, but the distance of

separation remains unquantified. Differences, mainly with respect to the validity of provenance linkage, exist in interpretation of the terranes found east of the Yarrol-Tamworth terrane. The eastern Shoalwater terrane, characterised by the presence of quartzose sandstone, is the least satisfactorily linked into a para-autochthonous depositional setting.

Granite geochemistry has been used in a novel attempt to delineate buried terranes in southeastern Australia. Compositionally distinctive lower crustal units have been identified and termed 'basement terranes'. There are interpreted as fragments of continental crust or microplates that were assembled in the Late Proterozoic or Early Palaeozoic. However the units are not of the same status as tectonostratigraphic terranes for relationships other than the fault-juxtaposition of elements of differing geological history migh equally explain the differences in source region composition.

Structural and other data have also been used in support of the existence of exotic units at depth, although in some interpretations the emplacement of the units has been related to relatively young underthrusting.

The presence of mid-crustal detachments, inherent in recent thrust models of the Tasmanides, provides one explanation for why proposed lower crustal boundaries do not coincide with boundaries between exposed terranes.

The relationship between terrane accretion and deformational episodes in the Tasman Fold Belt is complex, although there are some clear links. Late Cambrian west-directed thrusting of probable passive margin deposits and ultramafic sheets onto the edge of the Precambrian craton (Delamarian orogeny) may have accompanied the formation of a complex heterogeneous amalgam of ocean floor, oceanic island arc, seamount and microcontinental rocks further east. Unfortunately these elements are greatly obscured by later cover and the main evidence for this early assemblage, except in Tasmania, comes from isolated fault slices. Early Silurian deformation (Benambran orogeny) coincided with amalgamation of the Benambra terrane with the Parkes terrane. The accretion of the Tamworth-Yarrol terrane to the Lachlan 'super terrane' in New South Wales is indicated by a flood of granitic and metamorphic detritus entering the latter from the former in the middle Carboniferous. However, if docking gave rise to the deformation that affected the Tasman at this time then it involved a mechanism that portitioned all of the upper crustal strain into the Lachlan.

In the latter it is manifest by structures up to 750 km removed from the terrane boundary but there is no sign of deformation of this age in the Tamworth-Yarrol terrane. Alternatively, increasing evidence for a widespread Middle Devonian unconformity in the Tamworth-Yarrol terrane, and the presence of a widespread break of broadly similar age in the Lachlan and in central Queensland, could be an indication of earlier docking than is currently favoured. There is no obvious docking episode that corresponded with the widespread deformation of the New England Fold Belt and tectonic elements to its west in the Late Permian to Middle Triassic. The most eastern (outboard) terrane of the Tasmanides, the Gympie terrane, probably accreted in the Middle Triassic although the independent status of the latter has recently been disputed.

The definition of terranes throughout the Tasman Fold Belt has led neither to major advances in the understanding of the tectonics of this section of Gondwanaland, nor to scientific sterility. The terrane approach has been useful in emphasising the need for more information concerning the timing and magnitude of movements on major faults, and assumed palaeogeographic linkages between tectonic units are undergoing critical assessment. However disputes as to where the burden of proof lies in palinspastic reconstruction rather miss the point, which should be the clear enunciation of the uncertainties in time and space implicit in reconstructions.

(This is a contribution to IGCP Project 267, Palaeozoic Terranes in the Circum-Pacific Orogens).