Oroclines in the Tasmanides (eastern Australia): the twisted nature of orogenic belts

Chris Fergusson
GeoQuEST – SEES – UoW

Geoscience Australia magnetics (left)
The Orocline Concept in Geotectonics

PART I

By

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(with 22 text figures)

ABSTRACT

Oroclines are sharp bends (regional-scale) of/within orogenic belts

Orogenic belts are regional elongate rock assemblages characterised by compressional structures and commonly related to plate tectonic processes of plate convergence.
Rollback of a subduction zone – like a paddle in water
Tasmanides – Palaeozoic-Mesozoic orogenic belts (550 to 200 Ma) – eastern third of Australia (modified from Fergusson in press Journal of Geodynamics)

2 examples – Texas and Coffs Harbour oroclines (New England Orogen – south) and Lachlan Orocline (Ross Cayley, Geol Survey of Victoria)

Tasmanides – Palaeozoic-Mesozoic orogenic belts (550 to 200 Ma) – eastern third of Australia (modified from Fergusson in press Journal of Geodynamics)
Late Devonian – Carboniferous tectonic elements
New England Orogen
(modified from Fergusson in press Journal of Geodynamics)
Geoscience Australia,
Geological Survey of Queensland gravity
Seamless geological map of NSW Zone 56 (Gary Colquhoun).
Limestones in hinge of Texas Orocline – but absent from Coffs Harbour Orocline

Structural evolution of the early Permian Nambucca Block (New England Orogen, eastern Australia) and implications for oroclinal bending

Shaanan et al. (2014) Tectonics
Dynamics of continental accretion

L. Moresi\textsuperscript{1,2,3}, P. G. Betts\textsuperscript{1}, M. S. Miller\textsuperscript{4} & R. A. Cayley\textsuperscript{5}

Subduction zones become congested when they try to consume buoyant, exotic crust. The accretionary mountain belts (orogens) that form at these convergent plate margins have been the principal sites of lateral continental growth through Earth’s history. Modern examples of accretionary margins are the North American Cordilleras and southwest Pacific subduction zones. The geologic record contains abundant accretionary orogens, such as the Tasmanides\textsuperscript{4}, along the eastern margin of the supercontinent Gondwana, and the Altaïdes, which formed on the southern margin of Laurasia\textsuperscript{5}. In modern and ancient examples of long-lived accretionary orogens, the overriding the Australian continent\textsuperscript{11} with the present-day subduction zones of the southwest Pacific representing the continued evolution of this accretionary belt. The Tasmanides comprise multiple accreted microcontinents, arcs and back-arc terranes, which now form a collage of contorted geologic belts\textsuperscript{13} that extend the entire length of the Australian continent (Fig. 1a). It represents the ‘type’ setting for a retreating accretionary orogen punctuated by transient episodes of crustal shortening and compressional orogenesis\textsuperscript{7}. Major variation in the geometry and evolution of the accretion are documented along the strike-length of the belt and consequently there is little consensus concerning the tectonic setting

The Narooma Terrane offshore: a new model for the southeastern Lachlan Orogen using data from rocks dredged from the New South Wales continental slope

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ABSTRACT
Eight dredges from the southern New South Wales continental slope sampled the offshore extension of the Lachlan Orogen. Two rock suites were recovered: (1) lower greenish facies limestones, felsic volcanics, sandstones, mudstones and Moruya Suite granodiorite correlate with the onshore Silurian to mid-Devonian orogenic phase; and (2) a strongly deformed greenschist to lower amphibolite facies mafic volcanics, cherts, marbles, pelites and serpentinites correlate in part with the Cambro-Ordovician Wagonga Group of the Narooma Terrane. The mafic volcanic rocks have ocean island, tholeiitic and boninitic basalt affinities. The offshore distribution of ocean island basalt that correlates with medial Cambrian basalt breccias at Batemans Bay suggests a large seamount or seamount complex. The boninites, tholeiites and ultramafics could be part of a forearc-generated ophiolite. The Narooma Terrane basement is interpreted as the part of the boninitic arc postulated to have collided with Vandierland in late early Cambrian time. Mid-Cambrian rifting of the oceanward part of this arc remnant, generated the Albury—Bega Terrane oceanic basement exposed in the Howqua Valley in the west and Melville Point in the east. Overlying are upper—mid-Cambrian to lowermost Ordovician black shale and chert, Lower Ordovician to Giffornian Adamina Group quartz turbidites, and...
Mirror symmetry across the Melbourne Zone – boninites and backarc basin basalts

Problem – how can the island arc form basement to such a widespread turbidite succession?

NSW South Coast continental slope – boninites, Melville Point backarc basin basalt

Cambrian island arc is not basement to Ordovician turbidites but marginal to it
Izu-Bonin-Marianas island arc

ETopo1 data

Legend

- Volcanoes

ETopo1

Value

High : 8271
Low : -10898
Links to related papers

- Macquarie Arc – turbidites
  - [https://www.tandfonline.com/eprint/KQUXTH9qnZevnGvP2isR/full](https://www.tandfonline.com/eprint/KQUXTH9qnZevnGvP2isR/full)
- Oroclines in New England Orogen
Conclusions

• Oroclines – curved structural trends based on lithologic/structural data and on magnetics/gravity datasets – New England and Lachlan oroclines

• Oroclines – caused by collision of continental fragments, seamount chains in combination with other factors (ancestral curves, rollback)