



BOOK REVIEWS

Gondwanaland revived and reconstructed

Veevers, J. J. and Powell, C. McA. (editors) 1994. *Permian-Triassic Pangean Basins and Foldbelts along the Panthalassan Margin of Gondwanaland*. Geol. Soc. Am. Memoir 184, Boulder, Colorado, U.S.A. 368 pp. ISBN 0-8137-1184-3. Price: \$100 (hardback).

Revived interest in the Late Paleozoic-Early Mesozoic Pangea megac-continent is arousing increasing research activity on many fronts—global climates, Permian-Triassic stratigraphy and tectonics, continental reconstructions, faunal and floral distribution patterns, etc. This volume investigates the 12,500 km Gondwanaland segment of the Pangean margin, paying particular attention to foreland basin evolution and associated deformation of the supercontinent's margin with the Panthalassan ocean. It is dedicated to the genius of A. L. Du Toit and is a remarkable confirmation of the Samfrau Orogenic Zone and associated Gondwanide foredeep as recognised by Du Toit in 1937.

The book opens with a concise discussion of Panthalassan reconstructions by Powell and Li. The original Du Toit map is reproduced and a new set of tight-fitting mid-Paleozoic-mid-Mesozoic Gondwanaland maps is presented.

A voluminous and detailed chapter covering eastern Australia follows (Veevers, Conaghan and Powell). Comprising 160 pages, 51 figures and more than 500 references, the authors must be congratulated on this gargantuan effort. Numerous meticulously drawn maps portray geological development in 5 to 30 million year time slices; several time-space diagrams are also included. These form the data base for a synthesis which includes a series of detailed paleogeographic and paleotectonic reconstructions extending from northern Queensland to Tasmania. Although well-organised and thought-provoking, I found these reconstructions disappointingly fixest, particularly with respect to Paleozoic marine mafic volcanic rocks in southeastern Queensland. This is one of the few places along the Gondwanaland margin where interaction with Panthalassa might be expected, but no hints of this are shown in the rather conventional reconstructions.

The Permian-Triassic Transantarctic Basin is described by Collinson, Isbell, Elliot, Miller and Miller. Because of snow and ice cover, outcrop is less than 2% of the total area. Nevertheless a convincing case is presented for development of a foreland basin along the entire Panthalassa-Gondwanaland margin of Antarctica. Basin framework and sedimentary facies are well presented with a clear account of paleogeography. However some serious problems appear to remain. For example, although a fold-thrust belt is shown flanking the entire length (3500 km) of the East Antarctic craton, in reality it is only actually recognised in the Pensacola and Ellsworth Mountains segments, a relatively small part of the belt. Elsewhere, Transantarctic Basin sediments are undeformed. Although extrapolated beneath ice in Marie Byrd Land and the Ross Sea, there is no real evidence of a fold-thrust belt beyond the Ellsworth-Pensacola area, where indeed only folds (no thrusting) are shown in the cross-sections. Couple this with the fact that the source of volcanic detritus in the Permian Beacon rocks is interpreted as the Brook Street Volcanic Arc: In the early Permian this arc was of fully oceanic nature and although described in the text as 'nearby', the across-strike distance between the arc and Beacon outcrops shown on the reconstructions is nearly 1000 km.

A chapter on southern Africa presents the evolution of the Carboniferous-Jurassic Karoo Basin. This is classic foreland basin architecture and is presented in a detailed and clear account by Veevers, Cole and Cowan. The craton, foredeep and orogenic belt are all well developed and it is not difficult to see how Du Toit's ideas developed from South Africa as a starting point. Sediment facies and dispersal patterns are explained and the well known Gondwanaland glacial deposits put into context. Unfortunately, the stratigraphic basis for

basin development is presented in highly stylised angular columns which are not easy to interrelate. A sequence of neatly presented paleotectonic/geographic maps summarises the chapter effectively. It is interesting to see how effectively the Falklands fit the regional picture when reconstructed to lie east of the Cape. A hypothetical offshore Permian-Triassic volcanic arc, although required, is shown in a rather fanciful manner.

Chapter 6 covers southern South America. Written by Lopez-Gamundi, Espejo, Conaghan and Powell, this is a crisp and engaging chapter which is clearly illustrated. By this time, the reader is (correctly) anticipating the basin structure, provenance and paleogeographic setting—a reflection on the reality of this enormous foreland basin. Integration of good stratigraphic columns and sandstone petrography with the text is effective and helpful.

The seventh chapter, *Synthesis*, draws the strings together, produces some thought-provoking generalisations, and includes a one-page summary of New Zealand geology. The highlights lie in Gondwanaland-wide synchronicity in sedimentary events. Recognition of widespread glacial episodes is reinforced and in addition we find remarkable linkages between periods of tuff and coal deposition and also complementary contemporaneous 'tuff gaps' and 'coal gaps'. The abrupt inter-regional incoming of red beds at the Permian-Triassic boundary is also striking. Unfortunately the book ends rather abruptly, never really analysing the structure of this spectacular foreland basin complex.

Overall, this memoir rates as a substantial piece of work providing regional detail, good overviews and ideas for future work. Its main shortcoming lies in the lack of discussion of location and nature of the actual Gondwanaland-Panthalassan margin as stated in the title. In a study of this scope, relations in southeastern Queensland, New Caledonia and especially New Zealand should have been addressed much more fully. Here we find shallow marine and truly oceanic sequences, accretionary prisms, island arcs and arc-flanking basins of Permian-Jurassic age.

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Two Special Papers from the Wild West

Seismotectonics of the Central California Coast Ranges. Alterman, I. B., McMullen, R. B., Cluff, L. S. & Slemmons, D. B. (editors) 1994. Geol. Soc. Am. Spec. Paper 292. Price: \$67 (soft back; ISBN: 0-8137-2292-6).

This volume arose from a series of papers at the 1987 GSA Symposium on the Seismotectonics of the Central California Coastal Ranges held in Hawaii (life is tough!). The symposium was convened in conjunction with the U.S. Geological Survey, the Nuclear Regulatory Commission and a number of academic institutions to fill a perceived gap in knowledge concerning the seismotectonics of the Californian plate boundary in this area; the scene was set by constructions such as the Diablo Canyon Power Plant. Although the plate tectonic setting of the area was at that time relatively well-known, the San Andreas discrepancy—that is, the shortfall in plate motion described by existing geological data compared to that described by the geodetic determinations using the Nuvel-1 satellite—pointed an accusing finger at the structures within the Central California Coastal Ranges as potential locations for the missing displacement and hence as potential sources for the release of significant amounts of seismic energy. This volume provides important new knowledge of fault activity in the Quaternary-Holocene for the accused region, providing a better understanding of potentially hazardous seismogenic sources and the kinematics of the plate boundary.