



GR Focus

# Updated Gondwana (Permian–Cretaceous) earth history of Australia

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## Abstract

Permo-Carboniferous glaciation, confined to icecaps and mountain glaciers, was followed by Permian coal measures and Early Triassic barren measures and redbeds, in the east terminally deformed in the mid-Triassic. Coal deposition resumed during the Late Triassic, and tholeiite was erupted in the southeast. After rifting, the western margin was formed by the opening of the Indian Ocean at 156 and 132 Ma. At 140 Ma, a brief glaciation affected central Australia. By the 99 Ma mid-Cretaceous, the southern margin was finally shaped by the opening of the southeastern Indian Ocean, the shoreline retreated to the present coast from the maximum Aptian shoreline of an epeiric sea, and the Eastern highlands were uplifted to produce the present morphology of Australia.

New data relate to the Permo-Carboniferous and Early Cretaceous glaciations, the Kiaman Reversed Paleomagnetic Interval, events about the Permian–Triassic boundary, including possible impact craters, advances in palynology, invertebrate paleontology, macrofloral paleontology, and paleobiogeography, the provenance of sediments by U–Pb ages and host-rock affinity of zircons, stable-isotopes and biomarkers in petroleum systems, coal environments, calibrating the time scale with U–Pb ages of zircons, fission-track thermotectonic imaging, geothermal energy, and terranes split off the western margin.

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*Keywords:* Permian–Cretaceous; Australia; Gondwanaland; Pangea; Gondwana facies; Paleogeography; Tectonics

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## 1. Introduction

A strati-tectonic account of Permian–Cretaceous Australia, from Veevers (2000a), is updated with new data about the Permo-Carboniferous and Cretaceous glaciations, events about the Permian–Triassic boundary, and determining provenances by U–Pb age spectra and host-rock affinity of detrital zircons.

The Gondwana facies of Pangea, represented in Australia by the Innamincka regime, is bracketed by the global events associated with the mid-Carboniferous (320 Ma) collision of Gondwanaland and Laurasia and the mid-Cretaceous (99 Ma) swerve of the Pacific plate. Australia's history over this span of time is that of the southeastern part of Pangea with adjoining Antarctica, India, and prospective terranes along the Tethyan margin.

This review of 320 to 99 Ma Australian earth history is organised in three parts: 1) the setting in Pangea; 2) the 320–99

Ma Innamincka regime and comparison with the Gondwana succession of India; and 3) the terminating 99 Ma events. The main sources of information are Veevers (2000a, 2004). Some of the figures are given in colour in Veevers (2005a,b).

A final section updates the Gondwana earth history of Australia with an extensive review of new data.

### 1.1. Pangean setting — Fig. 1

In the Sakmarian (288 Ma) Early Permian, Australia (dark shading) occupied the eastern part of southern Pangea or Gondwanaland. By 320 Ma, Gondwanaland had merged with Laurasia in Pangea along the equatorial suture of the Marathon–Ouachita–Appalachian–Variscan orogen (stipple). Pangea was set within the oceanic domain of Panthalassa including the equatorial bight of Paleo-Tethys (Rogers and Santosh, 2004) (Fig. 1).

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