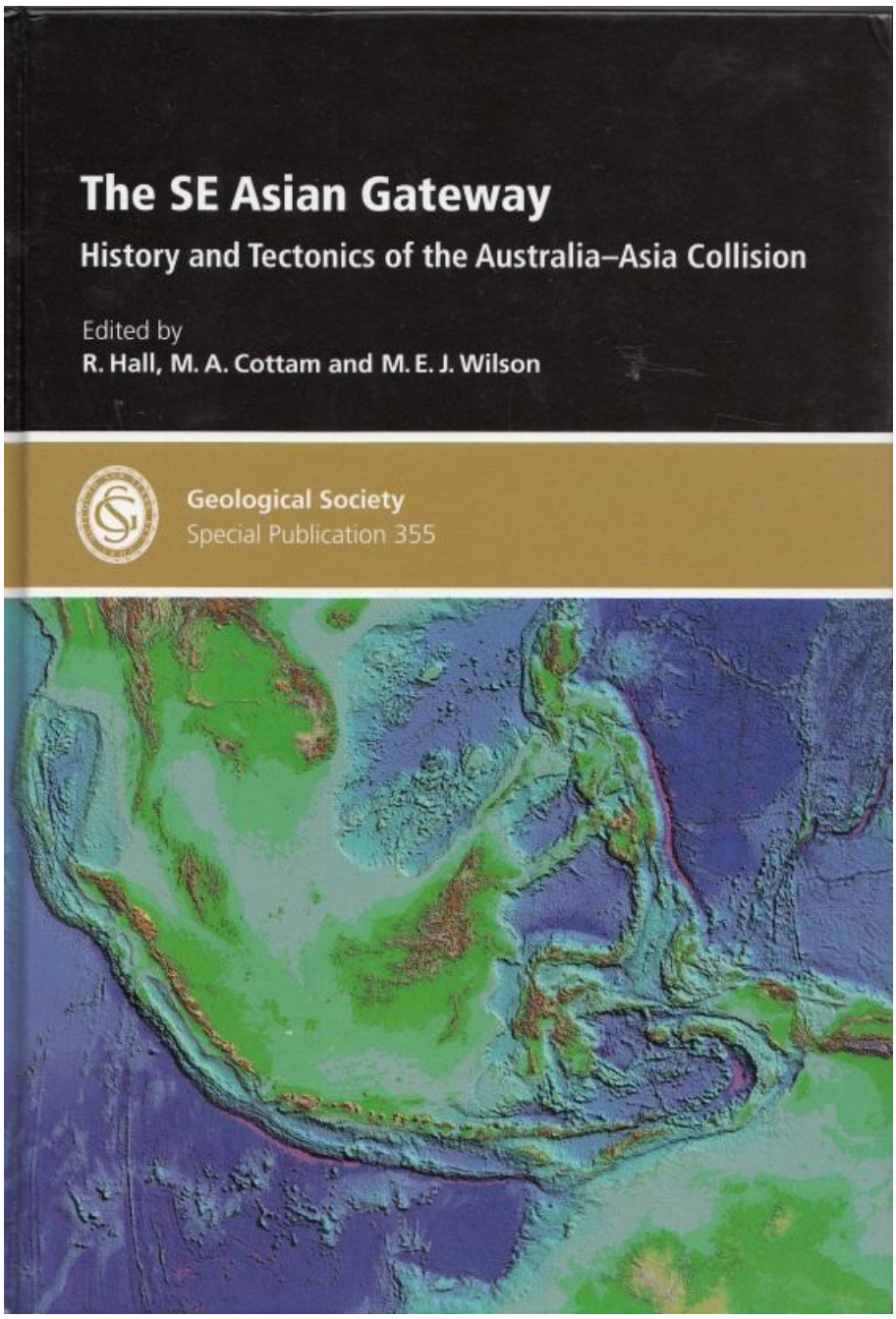
Book Review

The SE Asian Gateway: History and Tectonic of the Australia-Asia Collision

Edited by
R. Hall, M. A. Cottam & M. E. J. Wilson
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The 18 papers collected here are the result of a conference organised by the Geological Society of London in September 2009 on the connections between geology and biodiversity within 'The Indonesia Through flow Area', where currents from the Pacific Ocean flow to the Indian Ocean. They have been arranged to first explain and discuss the Palaeozoic and Mesozoic geological development of the region, and then its Cenozoic history which provides the background to understand the present Indonesia.

The fragmentation of Gondwana and the assembly of these fragments in SE Asia accompany the gradual closure of the Paleo-, the Meso- and the Ceno-Tethys Oceans. **Metcalfe**'s review highlights a new understanding of the SE Asia basement structures composed of terranes by the South China-, the Indo-China-East Malayan, the Sibumasu- and the west- and the east Borneo blocks and their sutures. The SW Borneo and/or East Java-West Sulawesi blocks are the missing 'Argoland' that separated from NW Australia in the Jurassic and accreted to SE Sundaland in the Cretaceous. **Clements et al** discuss a widespread regional unconformity suggesting topography at the end of the subduction period, due to which the Upper Cretaceous-Paleocene rocks are almost completely absent throughout Sundaland. **Granath et al.** show an unexpectedly thick sedimentary section

beneath the unconformity in the Java Sea, which was deposited while the basement block was still part of the Australian margin. **Hall** interprets the Neogene collision leading to the Cenozoic subduction beneath Indonesia being influenced by the rifted continental margin of Australia and by an oceanic embayment, leading to subduction rollback into that embayment. Such young deformation also results from lower crustal flow enhancing the effects of sediment loading and driving uplift of mountain ranges in northern Borneo and Sulawesi. **Kopp,** using new seismic sections, reviews subduction along the Java margin showing variations in an east-west direction. **Widiyantoro et al** show a 'hole' and a possible 'tear' in the subducting slab beneath East Java.

Sulawesi, close to the centre of Wallacea is composed of parts of pre-Neogene Sundaland and Australian crust, added from the Cretaceous onwards. The active strike-slip Palu Koro fault in West Sulawesi, with spectacular surface expression, seismicity and young deformation is a poorly understood hazard. **Watkinson** compares rocks on both sides and discusses the enigmatic wide Gorontalo (Tomini) Bay with a number of small islands including the Togian islands. The latter have recently been investigated by **Cottam et al** to understand the origin of the bay and its volcanic history. They revealed the collisional contact of the ophiolite with one of the micro continental fragments in Eastern Indonesia, possibly sliced of from New Guinea's 'Birds Head' and carried east along the Sorong-Fault zone. This interpretation is doubted by **Watkinson et al**, based on recent offshore multibeam and seismic data. Collectively these studies show that previous models for tectonic development of Sulawesi require substantial re-evaluation.

Studies on Timor and the Banda arc generated many ideas and controversies about arc origin, nature of the crust within the arc and the age of collision. The Savu basin north of the transition oceanic subduction to arc-continent collision, is discussed by **Rigg & Hall** with the aid of new seismic. The basin is underlain by Australian continental crust that was incorporated in the SE Asia margin in the Cretaceous. Subduction of part of the Australian continent resulted in uplift of Sumba and deformation of deep water deposits Audley**-Charles** summarises the results of Pliocene collision of the volcanic Banda Arc with the Australian margin. Detached parts of the Australian margin were stacked up beneath the leading edge of the fore-arc, as shown by the highest nappes of the Banda allochthon.

The last remaining equatorial gateway between the Pacific and Indian oceans is the 'Indonesian Trougflow'. **Tillinger** discusses the causes of this flow, the controls on shallow and deep flow and the variations in different passages. The relation between the monsoons and the El Niño-Southern Oscillation is reviewed and modelled in terms of restricting the through flow. The long-term history of the Indonesian Througflow, linked to global climate and to variations in sea surface temperatures, salinity and water mixing over the last 14ka, are studied by **Holbourn et al** with benthic and planktonic foraminifera. Termination of deep water flow restricted the Indonesian Gateway from the Early Miocene, which coincided with major changes in the global climate system, including rapid Late Oligocene warming followed by a brief pulse of glaciation. The long term development of the Indonesian Through flow is controlled by the geologic history of the region. **Von de Heydt & Dijkstra** discuss studies of control by the geological history and analyse the effect of increasing pressure of atmospheric greenhouse gasses and open tropical gateways.

Whether Pliocene plate tectonic changes such as the northward movement of New Guinea caused changes in temperature and salinity between the South and the North Pacific waters was earlier reviewed and is now further assessed by **Morley & Morley,** based on palynological studies from cores in exploration wells in the Makassar strait. They record vegetational and climate changes over the last 30 ka. **Lelono & Morley** use palynomorph assemblages to determine Oligocene climate changes in the East Java Sea. Finally **Wilson** reviews the very diverse shallow marine biota in the Indonesian waters of which a large proportion is related with coral reefs and associated habitats. Carbonates are valuable to trace environmental and climatic variations, but have in the Indonesian waters barely been studied. Wilson reviews changes on annual, decades, centennial and millions of year's timescales, and discusses the effects of terrestrial runoff, nutrient upwelling, tectonics, volcanism and human activity.

This publication offers a great variety of new processes, new views of the timing of large scale plate tectonic changes, the geological development of specific areas and a wealth of new ideas with which older models can be updated. The importance of the Indonesian Through flow and its impact on annual and longer-term regional and global climates are shown. The environmental history is unravelled from the biota in the rocks. In this special publication a genuine cross fertilisation takes place between the regions geological, oceanographically and climatic history. Strongly recommended to anybody interested in the latest development in geological and oceanographical thinking in SE Asia.