

Australia-SE Asia collision, the Wallace Line and Wallacea

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Today, Australia is colliding with the SE Asian part of Eurasian plate. Sadly, the expression of this collision, and the subduction that led up to it, has become known to the world because of the devastation caused by earthquakes and volcanic eruptions in the region and the consequent loss of life. However, the collision zone in eastern Indonesia is fascinating to earth scientists because we can observe the processes that lead to the formation of mountains, and to life scientists because the islands of the region, and the seas around them, contain an exceptionally diverse and unusual fauna and flora. Life and geology are intimately linked in this region.

Eastern Indonesia illustrates mountain building in progress. 45 million years ago Australia began to move rapidly north, and from that time there was subduction beneath the SE Asia margin from Sumatra eastwards. In the Early Miocene, at about 23 million years ago, an Australian continental promontory collided with the SE Asian margin in eastern Indonesia and the collision continues today. However, collision has not led simply to elevation of mountains but to a topographic mixture of high mountains and deep basins. Since 15 million years ago subduction of oceanic lithosphere in the Banda region has caused major extension, and later there was collision of the Banda volcanic arc with the southern margin of the embayment. In the Sulawesi region and Banda Arc islands there has been dramatic uplift and subsidence in the last 5 million years.

Alfred Russel Wallace was an explorer and biologist in the 19th century who travelled widely in what he called the Malay archipelago (today's Malaysia and Indonesia). He first recognised the division which today bears his name, the Wallace Line, which broadly separates Australian and Asian faunas. Wallace is now recognised, with Charles Darwin, as a major contributor to our understanding of the theory of evolution. He was not a geologist but he certainly appreciated the role of geology in influencing the distributions of animals and plants in the region.

Biologists have given the name Wallacea to the area east of the Wallace Line which is effectively the region between the Asian and Australian continental shelves. Wallacea is special because of its unusual endemic faunas; their origin and how they are distributed remains a puzzle, but it appears that geological and tectonic processes have contributed. Wallacea is geologically the most complex part of the Indonesian archipelago and has seen the most significant changes in the distribution of land and sea in the last few million years as result of subduction and collision.

Wallace travelled extensively in the Malay archipelago over several years in the mid 19th century with local guides using small boats. I have worked during the last 30 years in the places that Wallace saw and travelled in the region by similar means. Despite the impact of the modern world many parts of the region are still much as Wallace saw them. I will illustrate some of the places that Wallace visited in eastern Indonesia, outline the history of this geologically dynamic region, and offer some suggestions as to why it may act as a major control of the global climate and contain the most diverse biota on Earth.