Late Mesozoic and Cainozoic tectonic features

2.1. GENERAL

The region is covered extensively by seas (Fig. 2.1). However, not all are of similar character. The 200-m water depth is a useful demarcation isobath between shallow seas that cover the continental shelf and the deeper more oceanic seas. South-east Asia has a number of marginal seas (Bostrom, 1978), where the water depth exceeds 3 km; these abyssal plains are floored by oceanic crust.

The marginal seas are separated by island or remnant arcs (Karig, 1972) made up either of volcanic or accretionary wedge material. In addition, the arcs may be complicated by the inclusion of continental fragments that have been rifted from the larger continental masses of Asia and Australia, and carried away by seafloor spreading.

The two main shelf sea regions are the Sunda Shelf, which is a submarine extension of continental South-east Asia, connecting the peninsular landmasses with Sumatra and Borneo, and the northwards extension of Australia as the Sahul Shelf, extending north to the Timor Trough. This shelf extends to link up with New Guinea via the Arafura Sea. Detached fragments of the Australian platform occur in the islands of Sumba and eastern Sulawesi (Pigram and Panggabean 1984; Hutchison 1987b). Continental fragments occupy much of the South China Sea and are assumed to have been detached from the China shelf between Hainan and Taiwan. These fragments include north-east Palawan, and several submarine banks such as the Reed Bank and Luconia Shoals (Taylor and Hayes 1983).

Low sea levels during the Pleistocene Great Ice Age resulted in the landmasses extending 21 thousand years ago to the 120 metre isobath (Hanebuth et al. 2000; Voris, 2000). The continental shelf, extending to the 200 metre isobath is probably wholly a result of the low sea levels and shoreface sedimentation during the past 140 thousands of years (Fig. 2.1).

2.2. WALLACE’S LINE AND ITS MEANING

The eminent English naturalist Alfred Russel Wallace divided South-east Asia into Oriental and Australian faunal domains by a line which became known as Wallace’s Line (Fig. 2.29). West of the line, the fauna and flora have distinct Asian affinities: east and south-east of the line they have Australian or Oceanic affinities. From 1863 to 1880 Wallace drew the line between Bali and Lombok, extending between Borneo and Sulawesi (then called Celebes) and between the Philippines and Indonesia. In 1910, he revised it to lie east of Sulawesi (George 1982). Sulawesi presented difficulties to Wallace, which have even today not been resolved, for its fauna and flora seem to have affinities with both Asia and Australia. The present-day consensus is that western Sulawesi was formerly a part of South-east Asia, and the eastern part, which is largely of ophiolite, was uplifted as a result of collision of the Banggai-Sula Spur, a westwards displaced continental fragment of New Guinea. Wallace’s Line, in geological terms, therefore runs through central Sulawesi (Audley-Charles 1982).

All terrains east of Wallace’s Line were previously remote from South-east Asia, and have been drifting northwards since about 90 Ma when Australia separated from Antarctica and began its northwards drift which accelerated to about 8 cm a⁻¹. Their flora and fauna had ancestral roots in the supercontinent of Gondwanaland. The collisions of these terrains with those of South-east Asia began only about 15 Ma, and the Sahul Shelf collided with the Timor Trough at only 3 Ma (Audley-Charles 1982). As the Australian terrains approached South-east Asia, dispersal of fauna and flora across the narrowing seas that separated them caused some intermingling of the previously distinct fauna and flora. This explains the difficulties that Wallace had in drawing a definite line in the neighbourhood of Sulawesi (Fig. 2.29).

The picture is further complicated because India separated from Gondwanaland (Australia) about 120 Ma, and began its drift northwards, eventually to collide with Tibet about 50 Ma. This allowed fauna and flora of Gondwanaland origins to reach Asia and disperse into South-east Asia. There is also a possibility that other smaller landmasses of South-east Asia may have drifted away from Gondwanaland. There is a growing