Palaeocene palaeogeography of Borneo: constrains on tectonic modelling of Tertiary basins

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In Early Palaeocene time, the whole of south and east Borneo was a broad peninsular landmass extension of Sundaland, along whose northern margin the Rajang Group (Belaga and Crocker formations) was sedimented.

The pre-Tertiary outcrops of Thailand, Peninsular Malaysia and Sumatra comprised Palaeozoic and Mesozoic strata and extensive S-type granites and acid volcanic rocks. This part of Sundaland and its Tertiary basins may therefore be classified as cratonic.

By contrast, the pre-Tertiary outcrops of the Borneo Sundaland peninsula comprised predominantly Cretaceous volcanic and I-type plutonic rocks (Schwaner Mountains), uplifted imbricated ophiolite complexes and associated Cretaceous deep water strata (e.g. Meratus, Semitau Ridge, Upper Kutei, Labuk-Darvel Bay). The pre-Cretaceous basement is fragmentary and unrecognized throughout much of the region. The Peninsula therefore was not cratonic, and its Tertiary basins cannot be so classified. No primary (igneous) source has ever been found for the placer diamonds, which have been dispersed by the Late Cretaceous and Cainozoic fluvial system. Their primary source must lie within the cratonic part of Sundaland from which the rivers flowed.

The record of subaerial weathering and erosion of the Early Tertiary landmass is preserved in the Palaeocene to Mid Eocene early graben phase of the Tertiary basin evolution. The first sediments preserved are granite-provenenced commonly redbed coarse clastics e.g. in Sumatra, Thailand, Malay, Natuna (The cratonic part). Equivalent redbed sediments occur extensively in the Borneo basins (e.g. Upper Kutei, Meratus,

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Kangean). Locally-derived ophiolite provenance is characteristic. All Sundaland basins, from north Thailand to eastern Borneo, contain important Palaeogene lacustrine source rocks. A mature drainage system carried siliciclastics from cratonic Sundaland through the Borneo grabens to be deposited as turbidites off the rapidly shelving coast.

The Rajang Group of Sarawak and Sabah should be correlated with the Palaeogene continental-deltaic deposits. Turbidites should also exist along the other margins of the Peninsula, but they have been involved in ongoing accretionary tectonics and not yet uplifted. The Rajang Group is readily identifiable because it has been compressed and uplifted as an orogenic belt between the Sundaland Peninsula and the Luconia - Dangerous Grounds microcontinent, pushed southwards by the opening South China Sea Basin, and concomitant anti - clockwise rotation of the Sundaland Peninsula. Only when the Rajang Orogenic Belt was significantly uplifted, did it become a new provenance for Miocene siliciclastics deposited in the basins of Sarawak, Brunei and Sabah.

The basins of Kalimantan should be classified in their early development together with those of Cratonic Sundaland (e.g. Malay, Gulf of Thailand, Sumatran, Sunda). The later development of the non-cratonic Sundaland Peninsular basins experienced important vertical tectonics, in which ophiolite and melange belts rose up within and subdivided the basins during Late Miocene time (e.g. Meratus, Semitau). The "circular" Miocene basins of Sabah are also a product of vertical tectonics and larger basins became subdivided by melange ridges. Melange is extensive in Borneo, but should not be equated with accretionary tectonics. For example, the Semitau Ridge cannot be interpreted as an accretionary prism, because it contains blocks of granitoids. The extensive Late Oligocene - Miocene melange and volcanism of Borneo are both products of the non-cratonic nature of the basement. Thin lithosphere and high heat flow resulted in dramatic vertical instability causing subsidence, topographic inversions and marginal basin development. These events cannot readily be accommodated within conventional plate tectonic models, which are based on the normal thickness lithosphere and heat flow of cratonic regions.