

The origin of the 'circular basins' of Sabah, Malaysia

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Surface mapping, dating and radar image study of strata in southern Sabah (northern Borneo) have made it possible to revise the stratigraphy and reinterpret the structure and tectonic evolution of the area. Early Miocene regional unconformity may be equivalent to the Deep Regional Unconformity recognised offshore, below which the succession can be resolved into an Eocene accretionary complex age overlying an ophiolitic basement, and an upper Paleogene deep-water succession which formed in a forearc. The Paleogene deposits underwent syn-depositional deformation, including the development of extensive mélanges, all of which lie below the unconformity. Localised limestones were deposited followed after a period of uplift and erosion in the Early Miocene, followed by an influx of clastic sediments deposited in delta and pro-deltaic environments in the Middle Miocene. These deltaic to shallow marine deposits form two coarsening-upward successions, mapped as the Tanjong and Kapilit Formations. The total thickness of these two formations remaining in the southern Sabah Basin amounts to 6,000 m, about half of previous estimates.

The Early Miocene unconformity is interpreted to be the result of deformation and uplift following underthrusting of continental crust of the South China Sea which terminated Paleogene subduction beneath North Borneo. Renewed subsidence led to the development of a major Miocene depocentre above the older forearc accretionary complex. A new tectonic model is proposed for southern Sabah whereby a major transpressional deformation probably occurred during the Late Pliocene and the Tanjong and Kapilit Formations were deformed into broad NW-SE-trending synclines separated by narrow anticlines. The anticlines are sub-parallel to major faults and associated with high angle reverse faults, and positive flower structures. Secondary fold-faults formed oblique to the major faults. The structural style suggests that the NW-SE trending faults acted as major left-lateral transpressional zones and possibly produced large-scale contractional duplexes. The faults may in part be reactivated basement structures. This deformation uplifted the area and is termed here the Meliau Orogeny. Renewed extension during the Quaternary caused some sequence repetition and widened the original synclines. The 'subcircular- to elliptical-shaped basins' of the Meliau, Malibau and Tidung areas are structurally controlled synclines and interpreted as remnants of a single large basin, deformed in the NW-SE trending transpressional fault zones.