

THE MALIAU BASIN, SABAH: GEOLOGY AND TECTONIC SETTING

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GEOLOGICAL SURVEY OF MALAYSIA

New field data were collected from the Maliau Basin that is entirely composed of the lower to middle Miocene Tanjong Formation. The rocks are mainly grey to black, often carbonaceous mudstone; fine-to medium-grained, grey to brownish grey sandstones; siltstone; coal seams and minor beds of conglomerate. Light-coloured coarse-grained, friable sandstone occurs locally as thick to massive beds. The sandstone beds contain ripple marks, other current features, and organic imprints. Sole markings may also occur and consist of groove, load and flute casts. Some strata display tabular and trough cross beds, bedding-parallel as well as bedding-transgressive burrows and up to metres wide sandy palaeo-channels. Palaeocurrents ran mainly in NE-SW direction. In the south-central part and in the rest of the surveyed area, palaeo-current sense was towards northeast and towards southwest, respectively.

The presence of carbonaceous material and coal seams indicate an estuarine to brackish environment of deposition. The thick coal seams suggest origins in poorly drained swamps. The arenaceous palaeo-channels, trough cross-beds, and one occasion of crescentic flute marks on a sandstone bedding surface are consistent with deltaic/tidal flat surroundings. Pollen and spores from mudstone representing the middle and lower parts of the formation indicate Early Miocene age. Among the trace fossils were determined *Chondrites* sp., *Granularia* sp., and *Ophiomorpha* sp. Foraminifera include *Quinqueloculina* sp. and *Rotalia* sp.

Thirty one coal seams ranging in thickness from a few centimetres to 1.8 m were recorded from 24 localities. The thicker seams are more frequent in the middle and lower parts of the formation. The ISO-tests of two coal seams indicate generally low moisture content; one has also low ash content and corresponding high, gross calorific value. The great thickness of the Tanjong Formation, estimated at 12 km, and the widespread presence of carbonaceous mudstone favour the occurrence of hydrocarbons. Structural traps may be provided by northeast striking fault zones flanking the Maliau Basin on the west and east sides. The basinal structure and the presence of a sufficiently large watershed are favourable for developing hydropower in the Maliau Basin.

The outer rim of the Maliau Basin, represented by the Lutong Ridge, shows a rounded outline 25 km across, but the morphology and bedding attitudes within the basin indicate that the basinal structure is not concentric. The basinal centre is close to the southern outer rim while bedding-strikes intersect obliquely the trends representing Lotung Ridge. These features may have resulted from a depositional area that steadily decreased in size and a southward migrating depocentre during the development of the Tanjong Formation. Bedding dips vary between 10 and 20 degrees; occasional steeper dips are found associated with gravity faults. Long joints spaced a metre or so apart form two to three vertical fracture sets in the sandstone. Some of the prominent lineaments on aerial photographs are parallel to the major joints. Folds are extremely rare and occur near fault zones.

The Maliau Basin is part of the Tarakan Trough, an early-middle Miocene aulacogen belonging to the Makassar rift system. By 13 Ma (Middle Miocene) spreading of this system came to a halt; the Makassar rift arm by the arrival of Sulawesi terranes from the east, and the Tarakan aulacogen by welding of the East Sabah Terrane to Borneo.