

## Structure of the Kenny Hill Formation, Kuala Lumpur and Selangor

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Tjia (1974) from his study of sedimentary structures in one outcrop of the Kenny Hill formation postulated that the sedimentary succession is overturned and suggested that the major structure is either isoclinal or recumbent folding. This interpretation of the overall structure of the Kenny Hill formation agrees with E.H. Yin's views (cited by Stauffer 1973, p. 90) that repetition of sections within these rocks due either to strike faults or unrecognized folds must be present. If this isoclinal or recumbent folding does not exist on a major scale, then current ideas not only as to the formation's stratigraphic thickness but also its age and stratigraphic relationships to the adjacent rocks need to be revised, as the evidence for both these postulations are based to a large extent on differences in structural style between the intensely deformed Kuala Lumpur Limestone and the gently folded structures normally ascribed to the Kenny Hill formation. We, however, do not believe that repetitive sequence through strike faulting or recumbent folding is a major feature of this formation and it is the purpose of this note to present evidences in support of this viewpoint. Some of the evidences cited in this note in support of our belief, especially those relating to small scale sedimentary structures have been recorded before by one of us (EBY) in an unpublished thesis (Yeap, 1970).

Bedding in the Kenny Hill formation commonly dips less than 30°. Folding of the beds giving rise mainly to gentle or open folds is evidenced from changes in dip directions in different outcrops though occasionally a few smaller folds may be observed. This simple tectonic structure is complicated in a few localities either by faulting or the presence of sedimentary structures. Faulting besides causing vertical or horizontal displacements of the beds also affects their dips at the vicinity of the fault plane. The most spectacular fault displaying this feature is exposed at a cutting beneath an electricity pylon at the Happy Garden housing estate off Old Kuchai Road (GR\* 478739). Here the beds near the fault plane have been dragged from a gentle inclination to their present vertical position. The effects of these faults are only local and no evidence could be found to suggest that faulting in the Kenny Hill formation could give rise to overturning of the beds on a large scale.

Sedimentary slump features are visible in a number of localities. These may range from small scale slumps or rip-up structures to fairly large structures (up to 50 m) with tight recumbent folds. The best outcrops for viewing these recumbent folds are at i)

\*GR refers to Grid References on the New Series Topographic Map, Sheets 94 and 93 published by the Director of National Mapping, Malaysia.

Overseas Union Garden (GR 474733) and ii) at the housing estate, Shah Alam (GR 291717). At both these localities, it is clear from the rocks adjacent to these recumbent folds that these features are only of limited extent. These "slump folds" occur only in the siliceous or thinly bedded cherty horizons and the adjacent sandstone and mudstone beds are unaffected by the slumping and have the usual low dips.

The orientations of organic tubes and burrows which are widespread in the shales of the Kenny Hill formation always indicate that the beds are still in their upright sequence. These simple non-branching and cylindrical burrows with diameters approximately 1 cm initially run parallel to the bedding for about two to three centimeters and then bend perpendicularly downwards and run for an appreciably longer distance before terminating. The fillings of the burrows are usually of sand and most show curved laminations, less than 0.2 mm thick, with the concave ends directed towards the openings. These burrows are generally found in shaly beds, with their openings and their curved laminated sandy fillings directed towards the top bedding planes.

Other sedimentary structures found in the sediments of the Kenny Hill formation further support the presence of an upright succession. Graded beds which are fairly common, show normal upwards grading from coarse or medium-grained sand containing a few granule size materials to fine or very fine grained sand. In a few instance, the beds grades from medium grained sand to dark coloured shaly material. Medium scale cross-bedding showing a normal succession occurs at the base of the Kenny Hill sediments directly overlying the Kuala Lumpur Limestone at Salak South (GR 512724).

The rocks of the Kenny Hill formation are almost entirely devoid of any tectonic features indicative of intense compression or stretching such as slaty cleavage, boudinage or tectonically deformed clasts or mineral grains. If the succession is isoclinally folded, at least some of these tectonic features can be expected to be present. The only suggestion of a cleavage in these rocks is the development of an incipient cleavage in the phyllitic mudstone, a rock which if intensely folded can be expected to develop a more pronounced slaty cleavage or schistosity. Stretched and flattened pebble size clasts do exist but these clasts are composed invariably of clay and the matrix surrounding these clasts is quartzose. The deformation of these soft clasts is most likely due to burial or to the gentle folding and does not necessitate any strong tectonic compression. The more competent quartz clasts occasionally found together with these flattened clay clasts do not show any signs of stretching or flattening whatsoever. Organic tubes and burrows are also remarkably well preserved with their original cylindrical form undeformed, suggesting further the absence of strong folding movement.

All the features described above makes it unlikely that repetition of sections with overturned successions exists on a major scale within the Kenny Hill formation or that the exposed thickness of the unit is appreciably greater than its true thickness. The thickness of at least 1200 m given by Yeap (1970) seems therefore to be a more realistic value than the lower figure of 300 m obtained by assuming repetition of the sequences.

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The interpretation of the sedimentary structures at Bukit Pantai by Tjia (1974) as indicative of overturned succession is contradictory to all the other features found in the Kenny Hill rocks and further evidences as to the reliability of these sedimentary structures as indicators of facing directions in these rocks seem warranted, especially as this interpretation has several important implications on the stratigraphy, structural history and geology of the Kuala Lumpur and adjacent areas.

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