Stratigraphy of the Tarutao and Machinchang Formations

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The Cambro-Ordovician Tarutao and Machinchang Formations each consists of about 3000 m of predominantly clastic deposits which are part of the miogeosynclinal shelf sediments of the southern Yunnan-Malayan Geosyncline. These two equivalent formations have no known base and each can be differentiated into three members (i.e. lower, middle and upper) with the middle member further subdivided into three submembers.

The lower member (450 m+ in Tarutao; 1620 m+ in Langkawi) is a coarsening upward sequence of rhythmically interlayered graded siltstones and mudstones interbedded with thicker bedded clayey sandstones. Rare cross-bedding, small load structures, ripple marks, slumped bedding and small burrows are found in this member. This member is interpreted to be an offshore shelf deposit affected by occasional storms.

The middle member consists of abundantly cross-bedded, medium to thick beds of coarse to fine sandstones, conglomerates and rare coarse acid tuffs and fine heavy mineral bands in its lower submember (500 m+ in Tarutao; 575 m in Langkawi) which is interpreted as

estuarine channel lag deposits cutting upper shore face deposits. The middle submember (700 m+ in Tarutao; 340 m in Langkawi) is of thin to medium, wavy-bedded, fine to medium grained cross-bedded sandstones with occasional pebbly, argillaceous and fine tuffaceous intercalations. It is interpreted as an upper estuarine facies. The upper submember (750 m in Tarutao; 700 m+ in Langkawi) is of fine to very fine grained, thick straight-bedded sandstones with thin to thick intervals of very fine acid tuffs and is increasingly arqillaceous up-section. The sandstones are usually parallel laminated or low angle planar cross-bedded with occasional heavy mineral and fragmentary trilobite and brachiopod fossil bands. This submember is interpreted as upper shore face to beach deposits belonging to a series of barrier-beach complexes.

The upper member (575 m in Tarutao; 420 m in Langkawi) is a fining upward sequence of siltstone, mudstone (some tuffaceous) and very fine sandstone with minor thin limestone intercalations. Trilobite and brachiopod fossils of Uppermost Cambrian to Lowermost Ordovician age and various types of shallow-marine trace fossils are present in this member. It is interpreted as an open back-barrier lagoon deposit. It grades upwards into the shelf limestones of the Setul and Thung Song Formations.

The overall interpretation of the facies sequence is that of a high-destructive, wave-dominated delta which had built over an offshore shelf deposit to produce a series of barrier-beach sands aligned parallel to the shore line with subdued channel sands cutting across them.

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