Geological Evolution of Peninsular Malaysia

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Peninsular Malaysia can be divided into 3 longitudinal belts, Western, Central and Eastern, each of which has its own distinctive characteristics and geological development. The Western Belt can be subdivided into a northwest sector and a Kinta-Malacca sector. The northwest sector is underlain by clastics, limestones and minor volcanics. The time of the Langkawi folding phase of Koopmans (1965) is revised from Devonian to mid-Permian and this phase is not only confined to southeast Langkawi but covers the whole of Langkawi and Terutao area and extends southeast into mainland Kedah forming a northwest trending belt called the Patani Metamorphics. There is some evidence for a Devonian phase of folding and uplift as well but evidence for it is not strong. The post mid-Permian saw deposition of carbonates and clastics in this sector and the whole region was uplifted by the culminating late Triassic orogenic event which affected the whole of the peninsula. In the Kinta-Malacca sector, there was deposition of argillaceous and calcareous sediments in the early Palaeozoic followed by more limestone deposition in the Kinta region but by clastics in the Kuala Lumpur area. There is evidence foa a post-Silurian event of folding and metamorphism in the Kuala Lumpur area, possibly Devonian. In the Kinta region there is scant evidence to date this tectonic event. There is no known Mesozoic sediment in this sector.

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The Central Belt is underlain predominantly by Permian-Triassic clastics, volcanics and limestones. Pre-early Devonian deposition of coarse clastics, argillaceous sediments chert and other rock types occur in the marginal belt forming the foothills of the Main Range Granite. Ultramafic bodies were emplaced in this foothills belt and the whole belt was regionally metamorphosed probably during the Devonian. The Taku Schists and adjacent areas occupy the northern part of the Central Belt and it exposes mainly schists, amphibolites and phyllites. The regional metamorphic rocks adjacent to the Taku; Schists include the Triassic. Rocks assemblage inside the Taku Schists has little similarity to those of the Permian-Triassic outside and it is possible that they represent pre-Permian rocks. The Taku Schists and adjacent areas suffered uplift, recumbent style folding and regional metamorphism during the late Triassic. In the rest of the Central Belt, this late Triassic orogenic uplift also terminated marine sedimentation. Continental deposition began soon after and continued up to the early Cretaceous. During the late Cretaceous, the continental deposits were uplifted and gently folded.

The Eastern Belt is largely underlain by Carboniferous and Permian clastics and volcanics. A phase of regional metamorphism, folding and uplift probably occurred in the late Palaeozoic (Permian?) followed by deposition of an older series of continental deposits such as the Murau and Redang conglomerates. The pan-peninsula late Triassic orogenic event uplifted the Eastern Belt. This was followed by deposition of a younger series of continental deposits which are only gently dipping and probably they were uplifted in the late Cretaceous.

Significant plutonic acid magmatism occurred during the early Permian, late Permian/early Triassic and the late Triassic in the Western Belt, late Triassic and late Cretaceous in the Central Belt and late Permian/early Triassic and late Triassic in the Eastern Belt. Volcanism occurred in all 3 belts. In the northwest sector of the Western Belt, acid volcanism occurred during the late Cambrian and Ordovician. In the Central Belt significant acid to andesitic volcanism occurred in the Permian and Triassic. In the Eastern Belt Carboniferous-Permian acid volcanism was widespread. After the cratonization of the peninsula, volcanic activities continued to be manifested in the late Mesozoic, early Tertiary and Pleistocene in the Central and Eastern Belts. The later volcanic activities tend to be basic.

Various models have been proposed to explain the 3 fold division of the peninsula and their geological features. Models involving both eastward and westward subduction at the foot of the Main Range and collision have been suggested. An aborted rift model interpreting the Central Belt to be an aborted graben has also been proposed. The suggestion that the Foothills Formation rocks include ophiolites and tectonic melange has yet to be substantiated by field evidence. The margins of the belts are not sharp or easily delineated. Various interpretations have been suggested for the boundaries of the three belts. Sedimentological and structural characteristics of the rocks adjacent to the margins of the belts can be best explained by vertical movement along northsouth striking faults. The tectonic reconstruction of the peninsula has been and will continue to be a subject for speculation. Many of the tectonic

schemes proposed depend on a great deal of assumptions and some of the desirable features required by these schemes appear to be lacking or possibly yet to be uncovered. The geological evolution of the peninsula needs to be considered together with the adjacent regions including onshore and offshore Thailand and Indonesia and advances in the geology of these regions can contribute to a better understanding of Peninsular Malaysian geology.

Since the 1970s there has been a rapid increase in the geological knowledge of Peninsular Malaysia both onshore and offshore. This increase has been made possible by the expansion of activities of the Geological Survey, local universities and the petroleum and mining industries. During this period there has also been much progress in the advancement of geological knowledge of the Southeast Asian region and the science of geology itself has witnessed much development and growth in knowledge and theories. Under these favourable conditions it would appear that efforts to reconstruct the geological evolution of Peninsular Malaysia would have been made easier. However, the opposite is nearer to the truth. More knowledge has put restraints on many tempting generalizations which one would have boldly made and in fact more knowledge has often begged for even more knowledge. Under these circumstances, this paper will give an account of the essential features of the Peninsular Malaysian geology and followed by discussions on the geological evolution (mainly tectonic) including those proposals made by various authors earlier.

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