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Paleogeographic Evolution of the Southeast Asia Palaeozoic Carbonate Complexes

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Abstract

Amalgamation and accretion of Southeast Asia continental blocks has occurred during the Late Devonian to Late Cretaceous tectonic movements, its consequences led to the closure and opening of oceanic basins, and orogeny. The Southeast Asia carbonate complexes shared the same regional tectonic history of uplifting, faulting and compressional strains. The main Terranes of the present Southeast Asia were located within the palaeo-Thethys in an equatorial latitudinal setting in Permian period and the geological dating of the carbonates imply presence of regional relationship between carbonate buildups. Paleomagnetic data in northwestern Malaysia, biogeographic evidence throughout India, Australia, and China with palaeoclimatic conditions in the region were favored carbonate growth and might suggest that the Palaeozoic limestone formed continuous carbonate chain in the region, from Malaysia to Thailand. In addition to the microfossils, the absence of siliciclastics within the limestone sequences and syndepositional slope structures are considered as evidences for deeper depositional setting.

Current research is focused on checking the continuity of the carbonate complexes in the region and aims at establishing a reference stratigraphic section of the upper Paleozoic carbonate units of Kinta Valley. Furthermore we will be characterizing and testing a chemostratigraphic method to reveal the chemical signature of the sequences.

Southeast Asia is the result of combination of many continental blocks that came together during Late Devonian to Late Cretaceous (Metcalfe, 1998). The consequences of plate movements were closure and opening of oceanic basins and orogeny. The Southeast Asia carbonate complexes shared the same regional tectonic history of uplift, faulting and compressional strain. The Sibumasu terrane is among the few continental blocks oriented in a northwest to southeast direction during accretion of the Southeast Asia continental blocks. The south China/Indochina super terrane and the Simao Terrane were located within the palaeo-Thethys in equatorial latitudes during the Permian (Metcalfe, 2002). The palaeoclimatic conditions in this setting may have favored carbonate growth during the Permian period. Moreover, the paleontological dating of the carbonate rocks in the region indicates Upper Paleozoic age (Ingham and Bradford, 1960; Wong, 1991; Lee, 2004). Hence, the presence of the terranes in an equatorial setting and the geological dating of the carbonates in the region could imply presence of relationship between these buildups.

Even though Paleomagnetic studies indicate that the northwestern part of peninsular Malaysia was part of eastern Gondwanaland, other proxies such as biogeographic study also documented the same phenomenon for the other continental slivers. This was supported by biogeographic evidence throughout the region including India, Australia, and China. Similarities between Palaeozoic limestones in southern Thailand and in northwestern peninsular Malaysia might suggest that the Palaeozoic limestone formed a continuous carbonate chain in the region.

With some structural measurements on the relict limestone hills of the Kinta Valley it is believed that there was a relationship between the palaeogeographic distributions of Southeast Asia carbonates (Malaysia, Thailand). Even though there were tectonic movements till the Triassic, it is assumed that it did not alter the general spatial distribution of the Southeast Asia carbonate systems. Platform carbonate systems with shelfal depositional setting have been described in Thailand (Ueno and Igo, 1997). The depositional environment of the north Perak carbonate systems was interpreted as deeper water basin (Wong, 1991) and this might be extended to the Palaeothethys Ocean. The absence of

siliciclastics within the limestone sequences is considered as potential evidence for a deeper setting near isolated carbonate platforms.

Syndepositional slope structures, such as slumps, debris flows and turbidites commonly occur in the Kinta valley limestones and are indications of a paleoslope deposition. The paleoslope was oriented approximately north to south and dipping to the west of the current Western Belt of peninsular Malaysia (Pierson, 2009).The importance of knowing the paleogeographic distribution of the carbonate sequences is that it might provide clues to a Paleozoic exploration targets. Hitherto there is no major attempt to make a correlation on the Paleozoic limestone outcrops except Hutchison (1968) who applied geochemical and thermoluminescence approaches in the western Malaysian limestone outcrops in which he did not include the Kinta valley limestones.

The current research in SEACARL is focused on checking if the hypothesis of a large regional carbonate complex is true or not by applying integrated research approaches. The project aims at establishing a reference stratigraphic section of the upper Paleozoic carbonate sequences and associated siliciclastic units of Kinta Valley. Furthermore we will be characterizing and test a chemostratigraphic method to reveal the chemical signature of the sequences.

References

Cocks, L.R.M., Fortey, R.A., Lee, C.P, (2005) A review of the Lower and Middle Paleozoic biostratigraphy in west peninsular Malaysia and southern Thailand in its context within the Sibumasu Terrane. Journal of Asian Earth Sciences, 24, Elsevier Science Ltd., 703-717.

Hutchison, C.S. (1968) physical and chemical differentiation of west Malaysian limestone formations. Geological society of Malaysia, Bulletin No.1, 45-56.

Ingham, F.T., and Bradford, E.F. (1960) *The geology and Mineral Resources of the Kinta Valley*, Perak. Geological Survey Headquarters, Perak, Ipoh, 1-77.

Lee, C.P., Mohd., H. L., Kamaludin, H., Bahari, M. N., and Rhashid, K. (2004) Stratigraphic Lexicon of Malaysia. Geological Society of Malaysia, 3-33.

Metcalfe, I. (1998) Palaeozoic and Mesozoic geological evolution of the SE Asia Asian region: multidisciplinary constrains and implications for biogeography. Biogeography and geological evolution of SE Asia, pp. 25-41.

Metcalfe, I. (2002) Permian tectonic framework and paleogeography of SE Asia. Journal of Asian Earth Sciences, 20, Elsevier Science Ltd., 551-566.

Pierson J.B., Askury, A. K., Chow, W. S. & Zuhar, Z.T.H. (2009) Palaeozoic Hydrocarbon Plays in and around Peninsular Malaysia: any chance of exploration success? PETRONAS technology Journal; 2, 16-25.

Ueno, K., Igo, H. (1997) Late Paleozoic foraminifers from the Chiang Dao Area, northern Thailand: geologic age, faunal affinity, and paleobiogeographic implications. Proceedings of the 13th international congress on the Carboniferous and Permian, Krakow, Poland, 1997, pp. 339-358.

Wong, T.W. (1991) Geology and Mineral resources of the Lumut-Teluk Intan area. Geological Survey Headquarters, Perak Darul Ridzuan, 1-15.