THE GEOCHEMISTRY AND SEDIMENT CHARACTERISTICS IN PAHANG, SOUTH CHINA SEA, MALAYSIA

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MASTER OF SCIENCE

KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA

2006

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Thesis Submitted in Fulfillment of the Requirement for the Degree of Master of Science in the
Kolej Universiti Sains dan Teknologi, Malaysia

March 2006

This thesis is especially dedicated to my parents, my brothers and sister, my main supervisor and committee and lastly all my dearest friends,
Thanks for everything!

Abstract of the thesis presented to the Senate of Kolej Universiti Sains dan Teknologi Malaysia in fulfillment of the requirements for the Degree of Master of Science.

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A geochemical study was conducted in Pahang South China Sea (SCS) '*Coastal Oceanographic Study of South China Sea*'. Study area coverage consisted of 44 stations throughout the Pahang South China Sea nearshore. Seven transects were divided into seven stations each except for transect 7 (T7) which contained only two stations. Samples were collected for 2 seasons, the pre-monsoon season (October 9 to 17, 2003) and post monsoon season (April 4 to 12, 2004).

In summary, the study indicates that the sediment in Pahang SCS was dominated by moderately coarse sand, with the sediment structure classified as poorly sorted. Sediment varied from muddy to very coarse; this was due to weak sediment portion. Finer sediment was commonly found in the coastal zone area, particularly adjacent to the river mount. The source of sediment was predominantly from the river and propagated along the coast of Pahang SCS. Meanwhile, the geochemistry of Pahang

SCS was significantly different between the pre-monsoon and post-monsoon seasons. However, some abundance elements like Al, Mn, Fe and Li did not show any significant changes between seasons.

The correlation between sediment mean size and organic carbon was averagely weak during the pre monsoon season (r^2 = 0.002 to 0.827) and close to negligible during the post-monsoon season (r2 = 0.009 to 0.156). The same situation was experienced in the correlation of organic carbon and heavy metal concentration; where both seasons indicated an almost negligible correlation.

The determination of pollution status by enrichment factor (EF) using Al and Li as reference elements showed that most elements were naturally arriving. One noteable exception was Cd which indicated severe pollution. Similar results were also obtained using the geoaccumulation index (I_{geo}), which highlighted extremely high levels of Cd in the Pahang SCS. A few stations situated along the coastal zone indicated high concentrations of heavy metals, particularly Zn, Cu and Pb. Anthropogenic activities along the coastal areas of Pahang may contributed to these high concentrations.

The sedimentation rate in Pahang SCS was determined by using the nuclide method of ^{210}Pb. Two cores samples taken from Station 8 and Station 29 indicated sedimentation rates in Pahang SCS of 0.17cmyr^{-1} and 0.24cmyr^{-1} respectively. Results obtained were considered high in comparison with some sedimentological studies taken within Malaysia. This high sedimentation rate is believed to have been caused by river deposition during the monsoon season, when the river flow velocity might be two to three times greater than during the non monsoon season.

Abstrak tesis yang dikemukakan kepada Senat Kolej Universiti Sains dan Teknologi Malaysia sebagai memuhui syarat mendapat Ijazah Sarjana Sains

PENENTUAN KRITERIA GEOKIMIA DAN KARAKTERISTIK SEDIMENT DI PERAIRAN PAHANG,LAUT CHINA SELATAN, MALAYSIA.

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Satu kajian geokimia telah dijalankan di Perairan Laut China Selatan 'Coastal Oceanographic Study of South China Sea'. Kawasan kajian merangkumi 44 stesen bermula dari utara hingga selatan perairan tersebut. Stesen kajian adalah berjarak 5 km dari persisiran pantai dan 50 km kearah laut lepas. Dalam kajian ini, aktiviti penyampelan telah dijalankan sebanyak 2 kali iaitu pada musim pra-monsun dan selepas monsoon iaitu pada 9 hingga 17 oktober 2003 dan 4 hingga 12 april 2004.

Secara ringkasnya kajian ini menunjukan kriteria sedimen di Laut China Selatan, Pahang didominasi oleh pasir sedehana kasar dan di klasifikasikan sebagai struktur sediment yang bersisih lemah (poorly sorted). Kriteria sedimen adalah bervariasi dari berlumpur hingga ke pasir kasar dan menyebabkan penstrukturan sedimen menjadi lemah. Sedimen halus biasanya dijumpai di zon persisiran pantai sepanjang perairan Laut China Selatan Pahang terutamanya kawasan berhampiran dengan muara sungai.

Sedimen ini didapati diangkut dari sungai ke sepanjang Laut China Selatan. Manakala, perubahan geokimia di perairan Pahang adalah ketara selepas mengalami impak daripada monsun timur laut. Walaubagaimana pun, beberapa unsur timbunan seperti Al, Mn, Fe dan Li tidak menunjukkan sebarang perubahan yang ketara selepas dilanda perubahan musim.

Hubungan Korelasi di antara min saiz sedimen dan karbon organik adalah secara puratanya lemah atau rendah ketika pra-monsun dan hampir boleh diabaikan selepas musim monsun yang mana masing-masing menunjukkan nilai r^2 dari 0.02 ke 0.827 dan 0.009 ke 0.156. Keadaan yang sama juga dialami oleh korelasi di antara organik karbon dan logam berat yang mana menunjukkan hubungan korelasi yang boleh diabaikan.

Faktor pengkayaan (EF) dan Indek geoakumulasi (I_{geo}) menunjukkan kebanyakkan logam adalah berasal dari sumber semulajadi kecuali Cd yang mewakili status pada tahap pencemaran yang membimbangkan. Kepekatan logam berat menjadi semakin berkurangan selepas musim monsun. Ini kemungkinan disebabkan oleh kehadiran arus dasar sewaktu musim monsun, lalu mengakibatkan sedimen diangkut ke laut lepas.

Walau bagaimanapun, kajian ini juga mendapati nilai EF dan I_{geo} yang rendah tidak bermakna tiada pencemaran berlaku. Beberapa stesen yang terletak berhampiran zon persisiran pantai menunjukkan nilai kepekatan logam berat yang tinggi terutamanya Zn, Cu dan Pb. Sumber-sumber ini kemungkinan berpunca dari pengumpulan sisa-sisa terbuang di persekitaran presisiran pantai seperti perlombongan pasir, sisa

kumbahan, pembuangan sisa pepejal dan juga toksid berjadual terutamanya daripada perindustrian berat.

Kadar sedimentasi di perairan Laut China Selatan, Pahang dikenalpasti melalui analisa nuklied ^{210}Pb. Dua teras (St.8 dan St.29) berukuran 24 cm telah dianalisa bagi mendapatkan gambaran penimbunan sedimen secara keseluruhannya. Dengan itu, keputusan teras St.8 dan St.29 menunjukkan kadar sedimentasi masing-masing adalah 0.17 cm/tahun dan 0.21 cm/tahun. Keputusan yang diperolehi dianggap tinggi jika dibandingkan dengan kadar sendimentasi yang dikaji oleh beberapa saintis di Negara ini. Kadar sedimantasi yang tinggi dipercayai berpunca dari penyebaran sedimen dari sungai terutamanya sewaktu musim monsun di mana halaju arus sungai adalah 2 atau 3 kali ganda lebih tinggi berbanding luar musim monsun.