

SEDIMENTOLOGICAL AND HEAVY METAL STUDIES OF THE GULF
OF THAILAND, EAST COAST PENINSULAR MALAYSIA, SABAH
AND SARAWAK CONTINENTAL SHELF SEDIMENTS

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DOCTOR OF PHILOSOPHY
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TESIS

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GULF OF THAILAND, EAST COAST PENINSULAR MALAYSIA,
SABAH AND SARAWAK CONTINENTAL SHELF SEDIMENTS**

By

NOR ANTONINA BTE ABDULLAH

**Thesis Submitted in Fulfilment of the Requirement for the Degree of
Doctor of Philosophy in the Faculty of Science and Technology
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy.

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DEDICATION

Chairman : Associate Professor Dr. Abdul Halim, Ph.D.
Faculty : Science and Technology

This thesis is dedicated to my family

Two hundred and sixty sediment samples were collected from four cruises of the MV SEAPDEC (September, 1995 and April, 1996) from the continental shelf areas of the Gulf of Thailand and East Coast Peninsular Malaysia and in April and September, 1997 off Sabah and Sarawak. The samplings were carried before and after the Northeast monsoon to investigate its effects on sediment characteristics and heavy metals distribution. The sediments were analyzed for their sedimentological characteristics (mean size, sorting, skewness and kurtosis), using dry sieving and laser diffraction techniques; mineralogy, using petrographic microscope and X-ray diffractometer (XRD) and heavy metals, using an Atomic Absorption Spectrophotometer.

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January, 2001

Chairman : Associate Professor Dr. Hj. Noor Azhar Mohd. Shazili, Ph.D.

Faculty : Science and Technology

Two hundred and sixty sediment samples were collected from four cruises of the MV SEAFDEC (September, 1995 and April, 1996) from the continental shelf areas of the Gulf of Thailand and East Coast Peninsular Malaysia and in April and September, 1997 off Sabah and Sarawak. The samplings were carried before and after the Northeast monsoon to investigate its effects on sediment characteristics and heavy metals distribution. The sediments were analyzed for their sedimentological characteristics (mean size, sorting, skewness and kurtosis), using dry sieving and laser diffraction techniques; mineralogy, using petrographic microscope and X-ray diffractometer (XRD) and heavy metals, using an Atomic Absorption Spectrophotometer.

Generally, Gulf of Thailand sediments are finer, poorly sorted and more peaked during the post-monsoon season while during the pre-monsoon, the sediments are nearly

symmetrical. The Peninsular Malaysia sediments however, are coarser, poorly sorted and nearly symmetrical during the pre-monsoon while during post-monsoon, sediments become finer, poorly sorted and positively skewed. A similar trend was observed for the Sabah and Sarawak sediments. With respect to distance from the shorelines, the whole area studied exhibit similar trend, that is, nearshore sediments are coarser than mid and offshore sediments. *values may be attributed to anthropogenic inputs.*

Results of mineral analysis of the sand fractions showed that the East Coast of Peninsular Malaysia sediments are dominant with quartz (stations 74, 76, 78 and 80) while quartz and calcite are dominant in the Gulf of Thailand, Sabah and Sarawak regions. The low contents of Al in the above mentioned stations also support these findings. In the silt and clay fractions however, smectites are dominant in the study areas followed by illite and kaolinite.

Results for the heavy metal analysis indicate that in general, there are differences observed in heavy metal contents in the study areas. In the case of Al, Cr, Cu and Mn, significantly higher values ($p > 0.05$) were observed in the East Coast of Peninsular Malaysia, Sabah and Sarawak than in the Gulf of Thailand during the pre-monsoon, while Fe and Cd contents were quite similar in those areas during this period. An anomaly was noted for Zn where it was the predominant metal observed in the study areas during both the pre and post-monsoon seasons.

The Northeast monsoon, granulometry, texture and mineralogy of the sediments as well as its different debouching rivers in the study areas may cause the variability observed

on the heavy metal contents. Heavy metals to Al ratios showed higher and sometimes lower values when compared to the earth's crust. Cu:Al ratio shows enrichment at the Upper Gulf of Thailand that exceeds the normal crustal abundances. The enrichments may be due to its debouching rivers which drained their particulates to the Upper Gulf of Thailand. Pb:Al ratios were found to be higher than the natural values of the earth's crust. The higher values may be attributed to anthropogenic inputs.

Pengerusi: Prof. Madya Dr. Hj Noor Azhar Mohd. Shazili, Ph.D.

Fakulti : Sains dan Teknologi

Sebanyak dua ratus enam puluh sampel sedimen telah diambil daripada 4 pelayaran MV SEAFDEC (Southeast Asian Fisheries Development Centre) pada September, 1995 dan April, 1996 di kawasan pentas benua Teluk Siam dan Pantai Timur Semenanjung Malaysia dan April dan September, 1997 di Sabah dan Sarawak. Penyampelan telah dilakukan sebelum dan selepas monsun bertujuan mengkaji ciri-ciri enapan dan taburan logam berat. Sampel enapan telah dianalisa untuk penentuan ciri-ciri sedimentologi (min. sorting, skewness dan juga kurtosis) dengan menggunakan kaedah penapisan dan juga teknik pembiasan laser; mineralogi dengan menggunakan mikroskop petrografik dan X-ray difraktometer; paras kandungan logam berat dengan menggunakan Spektrofotometer Serapan Atom.

Umumnya, enapan Teluk Siam adalah lebih halus, kurang sorted dan lebih peaked selepas monsun, manakala sebelum monsun enapan adalah hampir simetri. Enapan