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**THE SPATIAL DISTRIBUTION OF HEAVY METALS (Al, Mn, Fe,
Cr, Pb and Zn) IN SABAH DEEP SEA SEDIMENT, MALAYSIA**

By,

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**A project report submitted in partial fulfillment of requirements for
degree of Bachelor of Science
(Marine science)**

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**RESEARCH PROJECT REPORT APPROVAL
AND VALIDATION FORM I AND II**

I certified that the report of this final project entitled:
THE SPATIAL DISTRIBUTION OF HEAVY METALS (Al, Mn, Fe, Cr, Pb and Zn) IN SABAH DEEP SEA SEDIMENT, MALAYSIA by **Prisyela Kaling**, Matrix No. **UK 9127** has been read and all the alteration and correction recommended by examiners have been done. This final draft has submitted and has been accepted as fulfillment of the requirement for **Bachelor of Science (Marine Science)** under the Faculty of Science and Technology, Kolej Universiti Sains dan Teknologi Malaysia.

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LIST OF ABBREVIATIONS

Symbols

%	Percent
Ø	Phi
°	Degree
±	Plus minus
C	Celsius
g	Gram
wt.	Weight dry
kg ⁻¹	Pre kilogram
cm	Centimeter
Km	Kilometer
ppm	Part per million
µg/g	microgram per gram
nmol/kg	nona mole per kilogram
pmol/kg	pico mole per gram
NE	Noutheast
SE	Southeast
OC	Organic carbon
EF	Enrichment factor
<i>I_{geo}</i>	Geoaccumulation index
ICPMS	Inductivity Coupled Plasma Mass Spectrometer

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ABSTRACT

The sediment from a deep sea area off Sabah was studied for their heavy metal contents. Twenty four samples of surface sediment were collected during February and March 2005. The sediment characteristics and concentrations of Al, Fe, Mn, Cr, Pb, and Zn were determined. Comparison of heavy metals between two sediment size fractions (<63 μm and <40 μm) included in this study. The sediment was dominated by medium silt whereas the sorting was classified as poorly sorted. The sediment is considered as undisturbed sediment but controlled by the seasonal monsoon. Concentrations of heavy metals were generally lower than average shales. The concentration of heavy metals for size <63 μm were 1.47% to 7.25% (Al) ; 1.17% to 2.38% (Fe) ; 9.8 $\mu\text{g/g}$ to 15.70 $\mu\text{g/g}$ dry wt (Pb) ; 124.21 $\mu\text{g/g}$ to 4708.21 $\mu\text{g/g}$ dry wt.(Mn) ; 2.91 $\mu\text{g/g}$ to 82.79 $\mu\text{g/g}$ dry wt. (Zn) ; and 2.31 $\mu\text{g/g}$ to 808.84 $\mu\text{g/g}$ dry wt. (Cr). Meanwhile, the concentration of heavy metals for size <40 μm were 0.58% to 5.46% (Al) ; 1.53% to 2.38% (Fe) ; 18.85 $\mu\text{g/g}$ dry wt to 10.65 $\mu\text{g/g}$ dry wt (Pb) ; 62.21 $\mu\text{g/g}$ to 4285.06 $\mu\text{g/g}$ dry wt.(Mn) ; 2.91 $\mu\text{g/g}$ to 82.79 $\mu\text{g/g}$ dry wt.(Zn) ; and 42.27 $\mu\text{g/g}$ to 513.26 $\mu\text{g/g}$ dry wt.(Cr). The correlation between organic carbon and sediment mean size was almost negligible. Meanwhile, the correlation of organic carbon and heavy metals were negligible metals except Fe in <63 μm whereby the correlation was low ($r^2 = 0.257$). Enrichment factor (EF) and geoaccumulation index (I_{geo}) indicated that heavy metal concentration were of background levels.

ABSTRAK

Sedimen dari perairan laut-dalam Sabah telah dikaji bagi penentuan kandungan logam. Dua puluh empat sampel sedimen permukaan telah diambil semasa Februari dan Mac 2005. Kriteria sedimen dan kepekatan Al, Fe, Mn, Cr, Pb, and Zn telah dikenalpasti. Perbandingan logam berat antara pecahan saiz (<63 μ m dan <40 μ m) terkandung dalam kajian ini. Sedimen tersebut telah didominasi sebagai kelodak sederhana di mana struktur sedimennya diklasifikasikan sebagai bersisih lemah. Sedimen ini dipertimbangkan sebagai sedimen yang tidak dikacau (Undisturbed) namun dikawal oleh perubahan monsun. Kepekatan logam berat adalah lebih rendah daripada purata logam di bumi. Kepekatan logam bagi saiz <63 μ m adalah 1.47% kepada 7.25% (Al); 1.17% kepada 2.38% (Fe); 9.8 μ g/g kepada 15.70 μ g/g berat kering (Pb); 124.21 μ g/g kepada 4708.21 μ g/g berat kering.(Mn); 2.91 μ g/g kepada 82.79 μ g/g berat kering (Zn); dan 2.31 μ g/g kepada 808.84 μ g/g berat kering. (Cr). Manakala, bagi kandungan logam berat bagi saiz <40 μ m adalah 0.58% kepada 5.46% (Al); 1.53% kepada 2.38% (Fe); 18.85 μ g/g kepada 10.65 μ g/g berat kering (Pb); 62.21 μ g/g kepada 4285.06 μ g/g berat kering (Mn); 2.91 μ g/g kepada 82.79 μ g/g berat kering (Zn) dan 42.27 μ g/g kepada 513.26 μ g/g berat kering (Cr). Korelasi antara karbon organik dan min saiz sedimen hampir boleh diabaikan. Manakala, korelasi antara karbon organik dan logam berat boleh diabaikan kecuali Fe (<63 μ m) di mana korelasinya rendah iaitu ($r^2 = 0.257$). Faktor Pengkayaan dan indeks geoakumulasi menunjukkan kepekatan logam berat berada pada tahap asalnya.