

GEOCHEMICAL PROX AND SEDIMENT ACCRETION
OF SEREMBAN COASTAL WATER

ME ANZAM BIN ISMAIL

FACULTY OF SCIENCE AND TECHNOLOGY
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA

2004

2011.03

1100028954

LP 14 FST 2 2004



1100028954

Geochemical proxy and sediment accretion of Terengganu coastal water / Md Nizam Ismail.



PERPUSTAKAAN
KOLEJ UNIVERSITI SAINS & TEKNOLOGI MALAYSIA
21030 KUALA TERENGGANU

1100028954		

Lihat sebelah

HAK MILIK
PERPUSTAKAAN KUSTEM

8
2
57
1
101

Especially to my dad, mom & all of my family

It's doesn't matter where you start but where do you stop

GEOCHEMICAL PROXY AND SEDIMENT ACCRETION OF TERENGGANU
COASTAL WATER

By
Md Nizam bin Ismail

A Project report submitted in partial fulfillment of the requirements for the degree
Bachelor of Science (Marine Science)

Department of Marine Science
Faculty of Science and Technology

This report must be referring as:

Md Nizam, B. I. 2004. Geochemical Proxy and Sediment Accretion of Terengganu Coastal Water. A thesis report submitted to Faculty of Science and Technology in partial fulfillment of the requirement for the degree Bachelor of Sceince-Marine. University College of Science and Technology Malaysia.

No part of this project may be reproduced by any mechanical, photographic, or electronic process, or in the form of photographic recording, nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without permission from the auther and the supervisor of the project.

ANCKNOWLEDGEMENT

Syukur Alhamdulillah, through His blessing I finished my final year project. A special thanks to my Project Supervisor, Assoc. Prof. Dr. Kamaruzzaman bin Haji Yunus for his credence, guidance, comments and support along this last two semester. Thank you very much. My appreciation also goes to Master of Science student Hasrizal Shaari (Mat Jan), Jamil Tajam (Waq's), Willison Kung Yee Son (Willy) and Ong Meng Chuan (Ong) for their assistance and jokes.

Special thanks for my family's at Penang, Kedah, Perak and Kuala Lumpur, especially my parent Ismail Puteh and Zainab Che Amat who have given me a strong support, love, great spirit and invocation for my success during my study in UPMT/KUSTEM. Thank you very much and I love you all.

Not to forget, the staff of Oceanography Laboratory En. Sulaiman, En. Raja, En. Kamari and En. Kamarun. Thank you for your participation during collects on of samples at Terengganu waters and lab work. Lastly my great appreciation to my project mate E-in, Ana, Meng Ho, Dor Jia and Siew Peng, all class mate members, homemate A-din, Zerang, E-ri, Kace, Bulah, Komeng, A-Peng and E-in. And last but not least my best friend A-din. Memories remain.

Thanks everybody. Keep in touch

TABLE OF CONTENT

CONTENT	PAGE
TITTLE PAGE	
ACKNOWLEDGEMENTS	i
TABLE OF CONTENTS	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF ABBREVIATIONS	viii
LIST OF APPENDICES	xi
ABSTRACT	xii
ABSTRAK	xiii
CHAPTER 1	
1.0 Introduction and Objectives	1
CHAPTER 2	
2.1 Sediment Distribution on Continental Shelf	4
2.2 Organic Carbon	6
2.3 Chemical Elements	7
2.4 Selected Chemical Elements	
2.4.1 Aluminium	9
2.4.2 Iron	10
2.4.3 Cuprum	11
2.4.4 Zinc	12
2.4.5 Lead	13
2.4.6 Cadmium	14

2.4.7 Barium	15
2.5 Determination of Sedimentation Rate Using ^{230}Th and $^{230}\text{Th}/^{232}\text{Th}$ Method	16
CHAPTER 3	
3.0 Methodology	
3.1 Sampling Site	18
3.2 Sample Preparation	18
3.3 Samples Digestion Process Using Teflon Bomb Method	18
3.3.1 Blank Factor	19
3.3.2 Standard Sample	19
3.4 Organic Carbon Analysis	19
3.5 Normality Test	21
3.6 Determination of Enrichment Factor	21
3.7 Radiochemical Analysis Procedures	22
3.8 Ion Separation Column BIO-RAD AG 50WX4	23
3.9 Sediment Rate Determination	24
CHAPTER 4	
4.0 Result	26
4.1 Standard Preparation	27
4.2 Data Interpretation from ICP-MS Detection	29
4.2.1 Cobalt	31
4.2.2 Copper	32
4.2.3 Lead	33
4.2.4 Uranium	34
4.3 Organic Carbon Analysis	35

4.4 Determination of Sedimentation Rate and Sediment's Age	37
CHAPTER 5	
5.0 Discussion	
5.1 Normalisation	41
5.2 Enrichment Factor	47
5.3 $^{230}\text{-Th}_{\text{excess}}$ and $^{230}\text{-Th}_{\text{excess}}/^{232}\text{-Th}_{\text{excess}}$ Dating Method	50
5.4 Correlation Relationship between Organic Carbons and Chemical Elements	51
5.5 Heavy Metals	
5.5.1 Cobalt	58
5.5.2 Copper	59
5.5.3 Lead	60
5.5.4 Uranium	61
5.6 Certified References Material	63
CHAPTER 6	
6.0 Conclusion	64
REFERENCES	65
APPENDICES	73
THESIS APPROVAL FORM	86
CURRICULUM VITAE	87

LIST OF TABLES

Table		Page
1	Mean concentration ($\mu\text{g/g}$) of chemical element against depth in TR 1	29
2	Mean concentration ($\mu\text{g/g}$) of chemical element against depth in TR 2	30
3	Mean value of organic carbon (%) against the depth in TR 1	35
4	Mean value of organic carbon (%) against the depth in TR 2	36
5	Sediment's Age of TR 1	39
6	Sediment's Age of TR 2	40
7	EF Mean Value of TR 1	48
8	EF Mean Value of TR 2	49
9	Mean value of elements concentration ($\mu\text{g/g}$) and organic carbon (%) in TR 1	52
10	Mean value of elements concentration ($\mu\text{g/g}$) and organic carbon (%) in TR 2	53
11	Correlation coefficient matrix showing the relationship between concentrations of heavy metals and organic carbon in sediments samples of TR 1	54
12	Correlation coefficient matrix showing the relationship between concentrations of heavy metals and organic carbon in sediments samples of TR 2	55
13	Analyses of certified standard material (NBS 1646a)	63

LIST OF FIGURES

Figure		Page
1	Co Standard Graph	27
2	Cu Standard Graph	28
3	Lead Standard Graph	28
4	Li Standard Graph	28
5	U Standard Graph	28
6	²³² -Th Standard Graph	28
7	²³⁰ -Th Standard Graph	28
8	Depth profile against the concentration of Cobalt	31
9	Depth profile against the concentration of Copper	32
10	Depth profile against the concentration of Lead	33
11	Depth profile against the concentration of U	34
12	Graph of ²³⁰ -Th _{excess} (dpm) versus Depth (cm)	37
13	Graph of ²³⁰ -Th _{excess} / ²³² -Th _{excess} (dpm) versus Depth (cm)	38
14	Normalization graph of Co in TR 1	42
15	Normalization graph of Cu in TR 1	42
16	Normalization graph of Pb in TR 1	43
17	Normalization graph of U in TR 1	43
18	Normalization graph of Co in TR 2	44
19	Normalization graph of Cu in TR 2	44
20	Normalization graph of Pb in TR 2	45
21	Normalization graph of U in TR 2	45

22	Relationship between the content of organic carbons and Co in TR 1	55
23	Relationship between the content of organic carbons and Cu in TR 1	55
24	Relationship between the content of organic carbons and Lead in TR 1	56
25	Relationship between the content of organic carbons and U in TR 1	56
26	Relationship between the content of organic carbons and Co in TR 2	56
27	Relationship between the content of organic carbons and Cu in TR 2	57
28	Relationship between the content of organic carbons and Lead in TR 2	57
29	Relationship between the content of organic carbons and U in TR 2	57

LIST OF ABBREVIATIONS

%	Percentage
^{230}Th	230-Thorium
^{232}Th	232-Thorium
^{234}U	234-Uranium
^{235}U	235-Uranium
$^{\circ}\text{C}$	Degree of Celsius
μm	Mikron
$\mu\text{g/g}$	microgram per gram
λ_{230}	Constant decay ^{230}Th
Ag	Argentum
Al	Aluminium
b	Best fit slope from $^{230}\text{Th}_{\text{excess}}$ graph
Ba	Barium
Ca	Calcium
CaCO_3	Calcium carbonate
Cd	Cadmium
cm	Centimeter
cm/y	Centimeter per year
Cr	Chromium
Cu	Copper
Co	Cobalt
DOM	'Dissolve Organic Matter'
DOC	'Dissolve Organic Carbon'

E	East
EDTA	'Ethylenediaminetetra Acidic'
Fe	Iron
g	Gram
HCl	Hydrochloric Acid
HClO ₄	Perchloric Acid
HF	Hydrofluoric Acid
HNO ₃	Nitric Acid
ICP- AES	'Inductively Coupled Plasma – Atomic Emission Spectrometer'
ICP – MS	'Inductively Coupled Plasma – Mass Spectrometer'
L	Liter
m	meter
M	Molarities
Mg	Magnesium
mL	milliliter
mg/L	milligram per liter
Mn	Manganese
Mo	Molybdenum
N	North
Na	Sodium
Ni	Nickel
nmol/kg	nanomol per kilogram
Pa	Protactinium
pmol/kg	pikomol per kilogram
POC	'Particulate Organic Carbon'

Pb	Lead
²³⁴ Ra	234-Radium
S	Sedimentation rate
SiF ₄	Silicaferrous
SRM	Standard References Material
TOC	'Total Organic Carbon'
V	Vanadium
yr	year
Zn	Zink
ZnS	Zink sulfat

LIST OF APPENDICES

Appendix		Page
1	Sampling Site	73
2	Flow chart of Sample Preparation	74
3	Picture of Teflon bomb Jacket and Beaker	75
4	Picture of Cation Column Separation	76
5	Flow chart of Cation Column Separation	77
6	Analytical Statistic (Paired t-test) of Co	78
7	Analytical Statistic (Paired t-test) of Cu	79
8	Analytical Statistic (Paired t-test) of Pb	80
9	Analytical Statistic (Paired t-test) of U	81
10	Analytical Statistic (2-way ANOVA without replication) of Co	82
11	Analytical Statistic (2-way ANOVA without replication) of Cu	83
12	Analytical Statistic (2-way ANOVA without replication) of Pb	84
13	Analytical Statistic (2-way ANOVA without replication) of U	85

ABSTRACT

Total of two sediment cores were sampled at the Terengganu coastal water within TR 1 (longitude 5°40.4'N and latitude 103°13.0'E) and TR 2 (longitude 5°37.6'N and latitude 103°26.3'E) and concentration of heavy metals (Co, Cu, Pb and U), organic carbon, sedimentation rates and sediment's age were examined in order to determine the geochemical characteristic of these sediments.. The metal data were normalized to Li as a conservative element to compensate for the natural textural and mineralogical variability. Total organic carbon (TOC) was determined by titration with ferrous sulfite, while sedimentation rate and sediment's age were determine with $^{230}\text{Th}_{\text{excess}}$ and $^{230}\text{Th}_{\text{excess}}/^{232}\text{Th}_{\text{excess}}$ ratio method and ICP-MS was used to analyzed geochemical elements. Mean concentration for geochemimal elements are $11.240 \pm 1.032 \mu\text{g/g}$ for Co, for Cu $11.301 \pm 0.882 \mu\text{g/g}$, for Pb $30.484 \pm 6.916\mu\text{g/g}$ and for U $5.323 \pm 0.818 \mu\text{g/g}$ in TR 1, while for TR 2 are $8.380 \pm 2.080 \mu\text{g/g}$ for Co, $8.066 \pm 2.141 \mu\text{g/g}$ for Cu, $18.856 \pm 5.577 \mu\text{g/g}$ for Pb and $4.407 \pm 0.852 \mu\text{g/g}$ for U. Mean values of organic carbon are $1.818 \pm 0.643 \%$ in TR 1, and $1.084 \pm 0.108 \%$ of TR 2. By using $^{230}\text{Th}_{\text{excess}}$ method, the sedimentation rate for study area is 2.59 mm/y and 2.03 mm/y for TR 1 and TR 2, respectively. Hence, sediment's age at depth of 30 cm in TR 1 is 115.955 years old and 147.580 years old for TR 2. Enrichment factor and normalization were used to point out the level of pollution and the origin of sediments in study area and its indicate that all the geochemical elements are from natural sources. Correlation coefficient was used to observe the association between metal and organic carbon, since these two elements showed moderately good and poorly positive in this study.

ABSTRAK

Aktiviti penyampelan telah dijalankan di pesisir pantai Terengganu di TR 1 (longitud $5^{\circ} 40.4'$ U dan latitud $103^{\circ} 13.0'$ T) dan TR 2 (longitud $5^{\circ} 37.6'$ U dan latitud $103^{\circ} 26.3'$ T) dengan 2 sampel teras diambil untuk diuji kepekatan logam berat (Co, Cu, Pb dan U) organik karbon, kadar sedimentasi dan usia sedimen untuk menentukan ciri-ciri geokimia sedimen. Data logam berat dinormalisasikan kepada Li yang bertindak sebagai elemen konservatif untuk perbandingan kepada tekstur semulajadi dan perubahan mineralogi sedimen. Penentuan jumlah karbon organik (TOC) adalah melalui kaedah titratan dengan ferum sulfat sementara kadar pemendapan dan usia sedimen ditentukan melalui kaedah $^{230}\text{Th}_{\text{excess}}$ dan penisbahan $^{230}\text{Th}_{\text{excess}}/^{232}\text{Th}_{\text{excess}}$ dan ICP-MS digunakan untuk penentuan analisa elemen geokimia. Purata kepekatan elemen geokimia untuk TR 1 adalah; $11.240 \pm 1.032 \mu\text{g/g}$ untuk Co, $11.301 \pm 0.882 \mu\text{g/g}$ untuk Cu, $30.484 \pm 6.916 \mu\text{g/g}$ untuk Pb dan $5.323 \pm 0.818 \mu\text{g/g}$ untuk U, dan di TR 2 adalah $8.380 \pm 2.080 \mu\text{g/g}$ untuk Co, $8.066 \pm 2.141 \mu\text{g/g}$ untuk Cu, $18.856 \pm 5.577 \mu\text{g/g}$ untuk Pb dan $4.407 \pm 0.852 \mu\text{g/g}$ untuk U. Purata kepekatan organik karbon adalah $1.818 \pm 0.643 \%$ untuk TR 1, dan $1.084 \pm 0.108 \%$ untuk TR 2. Melalui kaedah $^{230}\text{Th}_{\text{excess}}$, kadar sedimentasi yang diperolehi untuk kawasan kajian TR 1 adalah 2.59 mm/y dan 2.03 mm/y untuk TR 2. Usia sedimen pada kedalaman 30 sm untuk TR 1 adalah 115.955 tahun dan 147.580s tahun untuk TR 2. Faktor pengkayaan dan normalisasi digunakan untuk mengetahui tahap pencemaran dan asal usul sedimen di kawasan kajian dan ia menunjukkan bahawa semua elemen geokimia yang dikaji adalah dari sumber semulajadi. Pekali hubung-kait digunakan untuk melihat hubungan di antara logam dan organik karbon. Di dalam kajian ini, hubungan logam dan karbon organik adalah sederhana baik dan kurang baik.