## Spatial and temporal variations of Os, Nd, Sr isotopes and redox sensitive elements in waters and sediments of the Arabian Sea and their implications

#### A THESIS

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by

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Under the Supervision of

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2012

# **DECLARATION**

I, Vineet Goswami, S/o Mr. Madan Goswami, resident of K-212, PRL residences, Navrangpura, Ahmedabad – 380009, hereby declare that the research work incorporated in the present thesis entitled "Spatial and temporal variations of Os, Nd, Sr isotopes and redox sensitive elements in waters and sediments of the Arabian Sea and their implications" is my own work and is original. This work (in part or in full) has not been submitted to any University for the award of a Degree or a Diploma. I have properly acknowledged the material collected from secondary sources wherever required.

I solely own the responsibility for the originality of the entire content.

Date:

(Vineet Goswami)

# CERTIFICATE

I feel great pleasure in certifying that the thesis entitled "Spatial and temporal variations of Os, Nd, Sr isotopes and redox sensitive elements in waters and sediments of the Arabian Sea and their implications" embodies a record of the results of investigations carried out by Vineet Goswami under my guidance.

He has completed the following requirements as per Ph.D. regulations of the University

(a) Course work as per the university rules

(b) Residential requirements of the university

(c) Presented his work in the departmental committee

(d) Published/accepted minimum of two research paper in a referred research journal.

I am satisfied with the analysis of data, interpretation of results and conclusions drawn.

I recommend the submission of thesis.

Date:

Name and designation of supervisor Sunil Kumar Singh, Associate Professor

Countersigned by Head of the Department Dedicated to Mommy, Papa, Ashu & Dimpy This thesis work was not possible without the help and support of many people. I would like to thank all of them for their help and cooperation.

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#### **ABSTRACT**

The prime focus of this thesis is application of spatio-temporal distributions and associated variations in the concentration and isotopic composition of selected trace elements to understand contemporary and paleo processes operating in the Arabian Sea and on the nearby continents. The study encompasses the ocean circulation, aeolian dust deposition, role of denitrification on distribution of redox sensitive elements, seawater <sup>187</sup>Os/<sup>188</sup>Os evolution, erosion-climate coupling and pattern of dispersal of sediments in the Arabian Sea. The study of Nd concentration and  $\varepsilon_{Nd}$  of waters of the Arabian Sea along with inverse model calculations suggest return of deeper water masses towards south in the eastern Arabian Sea along the western flange of Chagos-Laccadive ridge. Nd content in surface waters of the Arabian Sea show an enrichment due to aeolian dust flux, estimated to be 8  $\pm$  2 g m<sup>-2</sup> y<sup>-1</sup>. Further, the distributions of dissolved redox sensitive elements Re, U and Mo display conservative nature with no influence of suboxic/denitrifying layers of the Arabian Sea. Salinity seems to control their distribution in the Arabian Sea. The salinity-concentration link further supports that the distribution of these elements is governed by physical processes such as advection, mixing and evaporation. The temporal evolution of <sup>187</sup>Os/<sup>188</sup>Os in the Arabian seawater show significant variation on glacial-interglacial timescale. The <sup>187</sup>Os/<sup>188</sup>Os record of Arabian seawater shows deviation from the global ocean trend during the Last Glacial Maxima (LGM). This was due to anoxic/suboxic conditions deeper waters of the Arabian Sea because of reduced transport of North Atlantic Deep Water (NADW) into the Arabian Sea, resulting in its partial isolation from rest of the oceans during LGM. Results on Sr and Nd isotopic composition of sediments from north-eastern Arabian sea suggest the stablility in provenances of the sediments since last 40 ka whereas sediments from the southeastern Arabian Sea exhibit two major variation in proportions of sediment sources coinciding with two major climate change events; the LGM and the Holocene Intensified Monsoon Phase (IMP) resulting from the transport of sediments of the Bay of Bengal to the Arabian Sea during LGM and vice versa during IMP suggesting significant role of climate and ocean currents in erosion, dispersal and deposition of sediments in the Arabian Sea.

## CONTENTS

List o	of Tables	iv		
List o	List of Figuresvi			
Chapter 1	Introd 1.1 1.2 1.3	action1-11Introduction2Objectives of the thesis9Structure of the thesis9		
Chapter 2	Materi 2.1	als and Methods12-56Materials132.1.1Sediment Samples13		
	2.2	<ul> <li>2.1.2 Seawater Samples</li></ul>		
		<ul> <li>2.2.2 Re, U and Mo concentration measurement of seawater samples</li></ul>		
		<ul> <li>2.2.2.2 U and Mo concentration measurement of seawater samples</li></ul>		
		<ul><li>composition measurements in silicate fraction of sediments</li></ul>		
		<ul> <li>and hydrogenous leach of the sediments from the Arabian Sea44</li> <li>2.2.5 Re concentration measurement in bulk sediments from the Arabian Sea55</li> </ul>		
Chapter 3	Nd isot waters using i 3.1 3.2 3.3	copic composition and concentration of of the Arabian Sea: water mass analysisnverse model approach		

		<b>3.3.1.3</b> Contribution of different water	
		masses in the Arabian Sea71	
		<b>3.3.1.4</b> Excess Nd and its $\varepsilon_{Nd}$	
	3.4	Conclusions81	
Chapter 4	Dissolved redox sensitive elements, Re, U and Mo		
	in in	tense denitrification zone of the Arabian Sea83-108	
	4.1	Introduction84	
	4.2.	The Arabian Sea and its suboxic water column	
	4.3	Results89	
		4.3.1 General observations	
		<b>4.3.2</b> Re, U and Mo distributions <b>92</b>	
	4.4	Discussion100	
		<b>4.4.1</b> Re, U and Mo in the water column of the	
		Arabian Sea100	
		<b>4.4.2</b> Re, U and Mo in the Arabian Sea	
		Sediments106	
	4.5	Conclusions107	
~ -			
Chapter 5	Varia	ations in <sup>107</sup> Os/ <sup>108</sup> Os of the Arabian seawater	
	durii	ng past 30 ka109-125	
	5.1	Introduction	
	5.2	Results and discussion	
		5.2.1 Os concentration and its isotope	
		composition of bulk sediments	
		5.2.2 Re concentration of bulk sediments114	
		5.2.3 Os concentration and isotopic	
		composition of hydrogenous fraction of	
		core \$\$-3101G	
		<b>5.2.3.1</b> Os concentration variations in the	
		leachable fraction	
		01 SS-3101G118	
		<b>5.2.3.2</b> Temporal variation in $1870 - 1880 - 56$	
		US/ US of seawater	
	53	Conclusions 124	
	5.5	Conclusions	
Chanter 6	Tem	poral variations in $^{87}$ Sr/ $^{86}$ Sr and symin	
Chapter 0	sedin	nents of the south-eastern Arabian Sea:	
	Impa	of monsoon and surface water circulation	
	6.1	Introduction	
	6.2	Results	
	0.2	6.2.1 River sediments	
		6.2.2 Arabian Sea sediments	
	6.3	Discussion	
	0.0	<b>6.3.1</b> Core SS-3104G	
		<b>6.3.2</b> Core SS-3101G	
		<b>6.3.2.1</b> Provenance of sediments during	

Last Glacial Maximum (LGM).....141

		<b>6.3.2.2</b> Provenance of sediments during	
		Holocene Intensified Monsoon	
		Phase (IMP)	143
	6.4	Conclusions	145
Chapter 7	Sum	mary and future perspectives	147-153
	7.1	Nd and $\varepsilon_{Nd}$ of water from Arabian Sea:	
		quantification of water masses and estimation	
		of dust flux using inverse model approach	148
	7.2	Distribution of Re, U and Mo in the Arabian Sea.	149
	7.3	Temporal evolution of <sup>187</sup> Os/ <sup>188</sup> Os of seawater	
		from the Arabian Sea	150
	7.4	Temporal variation in ${}^{87}$ Sr/ ${}^{86}$ Sr and $\varepsilon_{Nd}$ of the	
		sediments of eastern Arabian Sea	151
	7.5	Future Perspectives	151
<b>References.</b>			154-171

List of publications	•••••••••••••••••••••	

## LIST OF TABLES

Table	Contents	Page
2.1	Details of the sediments cores	14
2.2	Calibrated <sup>14</sup> C ages of the sediments of cores	16
2.3	Location of sediment samples from west flowing rivers	18
2.4	Details of sampling for seawater in Arabian Sea	20
2.5	Various analytical techniques used in this thesis	22
2.6	Abundances of Nd isotopes in the sample and spike	27
2.7	Calibration of Nd Spike using Nd standard of known strength	27
2.8	Nd isotopic composition of GEOTRACES samples	30
2.9	Nd concentration measured in GEOTRACES samples	32
2.10	Nd isotopic composition of GEOTRACES standard	33
2.11	Replicate analysis for Nd concentration measurements	33
2.12	Replicate analysis for the Nd isotopic composition	34
2.13	Abundances of Re isotopes in the sample (natural) and spike	35
2.14	Calibration of Re spikes	35
2.15	Abundances of U isotopes in the sample (natural) and spike	30 26
2.10 2.17	Adundances of Mo isotopes in the sample (natural) and spike	30 27
2.17 2.18	Calibration of U and Mo spikes	38
2.10 2.10	Replicate analysis of L and Mo concentrations	
2.19	Measurement of Re. II and Mo in SAFe water sample	40 41
2.20	D line of Ke, C and Wo in SATE water sample	17
2.21	Replicate analysis of Sr, $Sr/Sr$ , Nd and $\varepsilon_{Nd}$ in sediments	43
2.22	Colibration of Os Spike	45
2.23	Calibration of Os Spike	45
2.24	Replicate analysis of Os and <sup>10</sup> /Os/ <sup>100</sup> Os in samples	52
2.25	Measurement of Os and <sup>18</sup> /Os/ <sup>188</sup> Os in USGS SCo-1 standard	53
2.26	Total procedural blank for Os analysis (bulk sediment analysis)	54
2.27	Total procedural blank for Os analysis (Hydrogenous leaching)	54
2.28	Blank of reagents used for hydrogenous Os leaching procedure	54
2.29	Replicate analysis of Re concentration in sediment samples	55
2.30	Measurement of Re concentration in USGS SCO-1 standard	56
2.51	I otal procedural blank for Ke measurements in bulk sediments	56
3.1	Salinity, pot. Temp., Nd and $\epsilon_{Nd}$ in profiles from Arabian Sea	62
3.2	A priori and a posterior values of the water mass end-members	69
3.3	Excess Nd and its $\varepsilon_{Nd}$ in the Arabian Sea waters	77

4.1	Re, U and Mo concentration in profiles from the Arabian Sea	94
4.2	Statistics of Re, U, Mo concentration with different DO levels	101
4.3	Re, U and Mo in Arabian Sea and other basins (at 35 salinity)	106
4.4	Enrichment of Re, U, Mo in Arabian Sea sediments over UCC	106
5.1	Os content and <sup>187</sup> Os/ <sup>188</sup> Os of bulk sediments from Arabian Sea	113
5.2	Re concentration in bulk sediments from the Arabian Sea	115
5.3	Os content of the leachable fraction and <sup>187</sup> Os/ <sup>188</sup> Os of seawater	117
6.1	Sr, Nd isotopic composition of river sediments	130
6.2	Sr, Nd content and isotopic composition of SS-3104G silicates	132
6.3	Sr, Nd content and isotopic composition of SS-3101G silicates	134
6.4	$^{87}\text{Sr}/^{86}\text{Sr}$ and $\epsilon_{Nd}$ of potential end members	138

## LIST OF FIGURES

Figure	Contents	Page
2.1	Scheme of sampling and initial processing of samples	14
2.2	Location of seawater and sediment cores used in this thesis	15
2.3	<sup>14</sup> C chronology of SS-3101G and SS-3104G	16
2.4	Location of river sediments used in this thesis	19
2.5	Research vessel, collection and processing of samples	21
2.6	Analytical techniques for measurement of various proxies	23
2.7	Setup for extraction of REEs using C18 cartridges	24
2.8	Extraction of REEs using C18 cartridges	25
2.9	Separation of Nd from REEs by the LN-C50-B resin	26
2.1	Measurement of <sup>143</sup> Nd/ <sup>144</sup> Nd of JNdi-1 on TIMS	28
2.11	Measurement of <sup>143</sup> Nd/ <sup>144</sup> Nd of JMC-321 on MC-ICP-MS	29
2.12	Nd isotopic composition of GEOTRACES samples	31
2.13	Measurement of "unknown" GEOTRACES standard	32
2.14	Measurement of <sup>87</sup> Sr/ <sup>86</sup> Sr of NBS-987 on TIMS	43
2.15	Measurement of <sup>87</sup> Sr/ <sup>86</sup> Sr of NBS-987 on MC-ICP-MS	44
2.16	Sediment samples in Carius tube before sealing	46
2.17	Bromine refluxing in the digestion vessel for Os extraction	49
2.18	Measurement of <sup>187</sup> Os/ <sup>188</sup> Os of standard on TIMS	52
3.1	Location of stations for Nd isotopic composition	59
3.2	Nd and $\varepsilon_{Nd}$ in vertical profiles from the Arabian Sea	64
3.3	Contour plots for distribution of various water masses	73-75
3.4	$Nd_{excess}$ and its corresponding $\epsilon_{Nd}$	80
4.1	Representative $\theta$ -S plots for two stations from Arabian Sea	90
4.2	Contour plots for temp, salinity, DO, nitrite, Re, U and Mo	91-93
4.3	Salinity, DO, nitrite, Re, U and Mo in Arabian Sea	97-100
4.4	Frequency distribution of Re, U and Mo concentrations	102
4.5	Re, U and Mo concentration versus salinity	105
5.1	Os and <sup>187</sup> Os/ <sup>188</sup> Os in Arabian Sea sediments with time	114
5.2	Re content in Arabian Sea sediments with time	116
5.3	Temporal variation of <sup>187</sup> Os/ <sup>188</sup> Os of Arabian seawater	118
5.4	Temporal variation in Re, Os content and organic carbon	119
5.5	<sup>187</sup> Os/ <sup>188</sup> Os of Arabian seawater with other oceanic basins	122
6.1	Location of two sediment cores analyzed	129

6.2	Sr-Nd isotope plot of contemporary river sediments	131
6.3	Temporal variation in ${}^{87}$ Sr/ ${}^{86}$ Sr and $\varepsilon_{Nd}$ of SS-3104G	135
6.4	Temporal variation in ${}^{87}$ Sr/ ${}^{86}$ Sr and $\varepsilon_{Nd}$ of SS-3101G	136
6.5	Sr-Nd isotopic plot of sediments from cores used in study	137
6.6	Surface currents in the Arabian Sea during monsoon	142