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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D E C L A R A T I O N

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)

C E R T I F I C A T E

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

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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 $^{187}Os/^{188}Os$ evolution, erosion-climate coupling and pattern of dispersal of sediments in the Arabian Sea. The study of Nd concentration and ε_{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 ± 2 g m^{-2} y^{-1}. 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 $^{187}Os/^{188}Os$ in the Arabian seawater show significant variation on glacial-interglacial timescale. The $^{187}Os/^{188}Os$ 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 south-eastern 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.

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