U, Re, Mo and isotopic studies of Boron in water and sediments of the northern Indian Ocean: Implications to Contemporary and Paleo-Biogeochemical processes.

A Thesis

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by

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D E C L A R A T I O N

I, **Satinder Pal Singh**, S/o Mr. Tara Singh, resident of the family quarter, A-4, PRL residences, Navrangpura, Ahmedabad – 380009, hereby declare that the research work incorporated in the present thesis entitled **"*U, Re, Mo and isotopic studies of Boron in water and sediments of the northern Indian Ocean: Implications to Contemporary and Paleo-Biogeochemical processes*"** 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.

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I feel great pleasure in certifying that the thesis entitled "***U, Re, Mo and isotopic studies of Boron in water and sediments of the northern Indian Ocean: Implications to Contemporary and Paleo-Biogeochemical processes*****"** embodies a record of the results of investigations carried out by **Satinder Pal Singh** under my guidance.

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(d) Published/accepted minimum of one 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

Meenal, Mahin and the family

A C K N O W L E D G E M E N T S

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A B S T R A C T

This thesis deals with the spatio-temporal variations in abundances and isotope compositions of selected trace elements in the northern Indian Ocean to learn about their geochemistry, water mass structure and past oceanic chemistry. The U, Mo and Re abundances in surface waters of the Bay of Bengal (BoB) are controlled by fresh water supply from the Ganga–Brahmaputra (G–B) Rivers. Subsurface abundances of these elements are not affected by the prevailing suboxic conditions but show a salinity control suggestive of their conservative behavior. Further, water mass structure of the BoB, as constructed by inversion of Nd abundance, ε_{Nd} and hydrographic data, suggests that its less saline surface waters are composed primarily of G–B fresh water and Indonesian Throughflow surface waters, whereas the bottom waters are dominated by Antarctic Bottom Waters. The REEs content and ε_{Nd} in the bay hint at their significant supply by *in situ* release from G–B particles and from the margin sediments in the entire bay. The Nd contribution from G–B particulates, which characterizes the bay waters as less–radiogenic compared to rest of the Indian Ocean and the Pacific Ocean, diminishes in intermediate waters at about 1500 km away from mouth of the G–B River. Furthermore, a globally significant influx of dissolved Ba from the G–B river system to surface layer (top ~100 m) of the BoB is removed completely through the sinking particulate matter, about 95 % of which is regenerated in deep waters and at sediment–water interface. The temporal variations in $\delta^{11}B$ of G. Sacculifer are used to reconstruct the paleo-pH since last ~14 ka in surface waters of the Arabian Sea. The unrealistic pH, as low as ~7.1, in surface waters is due to a potential contamination by the detritus locked inside the forams.

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