Isotope geochemistry of black shales and Recent marine sediments

A THESIS

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by

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D E C L A R A T I O N

I, **Mr. Gyana Ranjan Tripathy**, S/o Mr. Uma Charan Tripathy, resident of A-4, PRL residences, Navrangpura, Ahmedabad – 380009, hereby declare that the research work incorporated in the present thesis entitled ***"Isotope geochemistry of black shales and Recent marine sediments"*** 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: (Gyana Ranjan Tripathy)

C E R T I F I C A T E

I feel great pleasure in certifying that the thesis entitled "**Isotope geochemistry of black shales and Recent Marine sediments**" by **Gyana Ranjan Tripathy** 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

My Parents,

Sri Uma Charan Tripathy & Smt. Monorama Tripathy

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ABSTRACT

The focus of this thesis is on the applications of radiogenic isotopes of Os, Sr and Nd to determine chronologies of key sedimentary deposits in India and temporal variations in provenances of sediments from the Bay of Bengal (BoB). Black shales from the Vindhyan, Lesser Himalaya (LH) and Aravalli were analyzed for ^{187}Re-^{187}Os systematics to constrain their depositional ages and to assess their potential to track atmospheric oxygen evolution during the Proterozoic to Early Cambrian. These studies have provided precise depositional ages for the Vindhyan (Kaimur) and outer belt of LH, in contrast samples from the Aravalli and inner belt of LH show "open system" behavior of Re-Os due to the post-depositional alterations. The ^{187}Re-^{187}Os isochron of black shales from the Upper Vindhyan yield an age of 1196±41 Ma with an initial ^{187}Os/^{188}Os of 0.74±0.27. The shales lying just above the Pc-C boundary of the outer LH provided a Re-Os age of 541±4 Ma, in excellent agreement with U-Pb ages for the Pc-C boundary reported from other locations. Results suggest more intense reducing condition during their deposition with higher supply of mantle like Os. The initial ^{187}Os/^{188}Os obtained in this study along with those available in literature on the Proterozoic ocean show consistent trend of atmospheric oxygen, attesting to the potential of ^{187}Os/^{188}Os as a suitable proxy for paleo-oxygen record.

The Sr-Nd isotopes of sediments from a piston core from the western BoB indicate that their dominant supply from the Himalaya and Peninsular India. Temporal variations in the Sr-Nd isotopes suggest source variability in the past with relatively reduced contribution from the Himalaya during LGM indicating a strong erosion-climate link. Lower erosion over the Himalaya is due to lower southwest monsoon intensity and higher snow cover over the Higher Himalaya during LGM.

Efforts to characterize the chemical erosion pattern of the Ganga basin and to apportion the sources of solutes, inverse modeling of available literature data on elemental and Sr isotopic composition of the Ganga headwaters was carried out. These results show that on average ~25% of major cations are from silicates and balance from carbonates. The chemical erosion rates of the basin bring out the importance of lithology in controlling the erosion pattern.

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