

List of Figures

| | | |
|------|--|----|
| 2.1 | Simplified geological map of the Lesser Himalaya | 10 |
| 2.2 | Lithostratigraphy of the outer Lesser Himalaya | 12 |
| 2.3 | Lithostratigraphy of the inner Lesser Himalaya | 18 |
| 2.4 | Inter-correlation between the inner and outer belts based on lithological considerations suggested by West (1939) and Valdiya (1995) | 20 |
| 2.5 | Inter-correlation between the inner and outer belts based on fossil records suggested by Mehr (1977), Stocklin (1980) and Shanker et al. (1993) | 20 |
| 2.6 | Flow diagram for Os chemistry | 32 |
| 2.7 | Flow diagram for the Re chemistry | 35 |
| 2.8 | Typical mass spectrum obtained from NTIMS for Os derived from black shales and Os standard | 38 |
| 2.9 | Comparison of ICP-AES measurements of various elements with reported values for different USGS standards. | 46 |
| 2.10 | Comparison of concentration of various elements in black shales measured by ICP-AES and AAS | 47 |
| 2.11 | Comparison of Sr in carbonates measured by TIMS and ICP-AES | 48 |
| 3.1 | Precambrian carbonate exposures in the Lesser Himalaya and the sampling locations | 55 |
| 3.2 | (a) Micrite ground mass is cut with veins filled with secondary calcites or quartz and (b) vein filled with calcite and quartz cutting the microspar ground mass | 59 |
| 3.3 | Secondary silica and calcite filled fractures | 60 |
| 3.4 | Thin section showing schistosity | 60 |
| 3.5 | X-ray diffraction spectrum | 61 |
| 3.6 | Histograms of leachable fractions of Ca, Mn, Sr and Al | 62 |
| 3.7 | Scatter diagram of Sr/Ca vs Mn in the carbonates analysed. | 63 |

| | | |
|------|---|-----|
| 3.8 | Covariation plot of $\delta^{13}\text{C}$ vs Sr | 64 |
| 3.9 | Histogram showing the comparison of $^{87}\text{Sr}/^{86}\text{Sr}$ and Sr/Ca in the G-G-I source waters and Precambrian carbonates | 70 |
| 3.10 | Carbonate Sr component in the G-G-I source waters | 71 |
| 3.11 | The contribution of Na and (Na+K) to the G-G-I source waters via silicate weathering | 79 |
| 3.12 | Frequency distribution of Ca/Na and Mg/Na abundances in granites and gneisses of the Higher and Lesser Himalaya | 81 |
| 3.13 | Silicate Ca and (Ca+Mg) in the headwaters of G-G-I source waters | 84 |
| 3.14 | $(\Sigma\text{Cat})_s$ in the headwaters of G-G-I system | 88 |
| 3.15 | Frequency distribution of molar fraction of evaporite Ca in the source waters | 90 |
| 3.16 | Comparison of $^{87}\text{Sr}/^{86}\text{Sr}$ and Sr/Ca in G-G-I source waters, silicates and Precambrian carbonates | 93 |
| 3.17 | Variation of measured $^{87}\text{Sr}/^{86}\text{Sr}$ in G-G-I source waters with their calculated $(\Sigma\text{Cat})_s$. | 96 |
| 3.18 | Scatter plot of silicate Sr (Sr_s) vs carbonate Sr (Sr_c) | 97 |
| 3.19 | The sum of silicate and carbonate Sr contribution to the budget of the G-G-I source waters. | 100 |
| 3.20 | Plot of $^{87}\text{Sr}/^{86}\text{Sr}$ vs Ca/Sr of G-G-I headwaters | 101 |
| 4.1 | Black shale occurrences in the Lesser Himalaya | 107 |
| 4.2 | Histograms of Re, Os concentrations and $^{187}\text{Os}/^{186}\text{Os}$ of black shales analysed in this study | 112 |
| 4.3 | Covariations of ^{192}Os and Re with organic carbon and nitrogen | 113 |
| 4.4 | Sample position on lithostratigraphical column collected from Maldeota and Durmala mines | 117 |
| 4.5 | Isochron plot for Maldeota black shales | 118 |
| 4.6 | Isochron plot for Durmala black shales | 118 |

| | | |
|------|---|-----|
| 4.7 | Isochron plot for both Maldeota and Durmala black shales | 119 |
| 4.8 | Correlation of different units of Tal formation, Lesser Himalaya with Siberian and Chinese sections | 121 |
| 4.9 | Inner belt black shale isochron | 122 |
| 4.10 | Different sources of Os to the oceans | 126 |
| 4.11 | $^{187}\text{Os}/^{186}\text{Os}$ evolution of seawater during the last 25 Ma | 130 |
| 4.12 | Rate of change of $^{187}\text{Os}/^{186}\text{Os}$ in ocean | 131 |
| 4.13 | Temporal variations in total Os and ^{186}Os flux required from global rivers to reproduce the observed $^{187}\text{Os}/^{186}\text{Os}$ of seawater | 133 |
| 4.14 | Osmium flux required from HTP rivers if all the observed changes in oceanic $^{187}\text{Os}/^{186}\text{Os}$ resulting from Os supply from the HTP rivers | 134 |
| 4.15 | Changes required in riverine (global) $^{187}\text{Os}/^{186}\text{Os}$ to reproduce the observed changes in seawater $^{187}\text{Os}/^{186}\text{Os}$ during past ~16 Ma. | 136 |
| 4.16 | Required variations in $^{187}\text{Os}/^{186}\text{Os}$ of HTP rivers if they account for the entire increase in seawater $^{187}\text{Os}/^{186}\text{Os}$ | 137 |