

Contents

List of tables	iv
List of figures	vi
Chapter 1 Introduction	1
1.1 Introduction	2
1.2 Objectives of this thesis	6
1.3 The outline of the thesis	7
Chapter 2 Materials & Methods	8
A Materials	9
2.1 Stratigraphy and lithology of the area	9
(i) Outer belt sedimentary sequence	9
(a) Blaini	11
(b) Infra-Krol	11
(c) Krol	13
(d) Tal	13
(ii) Palaeontological records of ages of the various formations	14
(iii) Inner belt sedimentary sequence	17
(a) Deoban	17
(b) Mandhali	19
(iv) Intercorrelation between inner and outer belt sedimentaries	19
B Methods	22
2.2 Field sampling	23
(i) Black shales	23
(ii) Carbonates	25
(iii) River water	26

2.3	Powdering	26
2.4	Analytical Techniques	26
(i)	Re-Os measurement techniques	28
(a)	Re, Os standards, spikes and reagents	29
(b)	Os chemistry	31
(c)	Re Chemistry	34
(d)	Os and Re mass spectrometry	36
(e)	Procedural blanks	40
(f)	Precision and accuracy of Re and Os measurements	40
(ii)	Rb & Sr measurements	42
(iii)	O & C isotopes measurements	43
(iv)	Determination of elemental abundances	43
(a)	Sample preparation for elemental analysis	43
(b)	Atomic Absorption Spectrophotometry	44
(c)	Inductively Coupled Plasma-Atomic Emission Spectrophotometry	46
(d)	UV-visible Spectrophotometry	47
(e)	Inorganic, Organic carbon and nitrogen analysis	49
(f)	Anion measurements by ion chromatography	51
(v)	Mineralogical Studies	51
Chapter 3	Silicate and carbonate weathering in the Himalaya: Impact on major ion chemistry and $^{87}\text{Sr}/^{86}\text{Sr}$ of the Ganga Headwaters	52
3.1	Mineralogy, Chemical and Isotopic Compositions of the Precambrian carbonates	54
(i)	Mineralogy and Chemical Composition	54
(ii)	Oxygen and Carbon isotopes	64
(iii)	Sr isotope systematics	65

(iv)	Impact of carbonate weathering on $^{87}\text{Sr}/^{86}\text{Sr}$ of the Ganga-Ghaghara- Indus Headwaters	69
(v)	Sr contribution from Precambrian carbonates to the headwaters	70
3.2	Silicate and carbonate weathering in the Ganga-Ghaghara- Indus Basin	73
(i)	Major ion chemistry of the G-G-I source waters	73
(ii)	Silicate weathering: Contribution of cations to headwaters	85
(iii)	Carbonate (Ca+Mg) in the headwaters	89
(iv)	Sr and $^{87}\text{Sr}/^{86}\text{Sr}$ of Ganga, Ghaghara and the Indus source waters	92
3.3	Silicate and carbonate chemical weathering rates in the Ganga source water basins	102
Chapter 4	Re-Os isotope systematics in black shales from the Lesser Himalaya: Their chronology and role in $^{187}\text{Os}/^{186}\text{Os}$ evolution of seawater	105
4.1	Samples	108
4.2	Org. C, N, Re, Os concentrations and $^{187}\text{Os}/^{186}\text{Os}$	109
4.3	Lesser Himalayan black shale chronology	114
(i)	Outer belt black shales	116
(ii)	Inner belt samples	122
(iii)	Os isotopic ratio of Early Cambrian seawater	123
4.4	Os isotopes in the Himalayan black shales and $^{187}\text{Os}/^{186}\text{Os}$ evolution of seawater	125
Chapter 5	Summary & Conclusions	139
5.1	Chemical and Isotopic Studies of the Lesser Himalayan Carbonates	140
5.2	Re-Os Studies on Black shales of the Lesser Himalaya	142
5.3	Future Study	145
	References	147