

# List of Figures

1.1	Seasonal Migration of ITCZ . . . . .	2
1.2	Schematic of fractionation of $^{13}C$ in soil. . . . .	6
1.3	Rayleigh isotopic distillation curve . . . . .	8
1.4	Temperature- $\delta^{18}O$ relationship in precipitation . . . . .	9
1.5	Relation between rainfall and its $\delta^{18}O$ . . . . .	10
1.6	Schematic representation of a convective cloud system . . . . .	11
1.7	$\delta^{18}O$ variation with altitude . . . . .	12
1.8	Continental effect . . . . .	12
2.1	Conceptual model explaining the formation of speleothems in a karstic cave . . . . .	17
2.2	A schematic diagram of the role of different pathways involved in speleothem formation . . . . .	21
2.3	Factors controlling $\delta^{13}C$ of speleothem . . . . .	24
2.4	Map of the India showing the locations of the caves explored for paleoclimate studies . . . . .	32
2.5	Overview of the Dandak cave . . . . .	33
2.6	Cross sectional view of Kotumsar cave . . . . .	34
2.7	Cross sectional view of the Belum cave . . . . .	35
2.8	A schematic explaining Upwelling in the coast of Oman . . . . .	36
2.9	Location of core SK-234-60 from Andaman Sea . . . . .	38

3.1	Dramet cutting machine at PRL . . . . .	42
3.2	New Wave Research Micro Mill at PRL . . . . .	43
3.3	Polished cross sectional view of the Dan-I stalagmite . . . . .	45
3.4	Polished and schematic cross sectional view of the Dandak-II stalagmite . . . . .	46
3.5	Polished cross sectional view of the Kotumsar cave speleothem . . . . .	47
3.6	Schematic cross section of KOT-I stalagmite . . . . .	48
3.7	Polished cross-section of Kailash stalagmite . . . . .	49
3.8	Polished cross-section of Belum stalagmite . . . . .	50
3.9	Sketch of a mass spectrometer . . . . .	52
3.10	Working principle of quadrupole . . . . .	54
3.11	Thermo Fisher Delta-V Plus IRMS . . . . .	54
3.12	Kiel-carbonate device and Thermo Fisher MAT-253 IRMS . . . . .	55
3.13	Working principle of Kiel carbonate . . . . .	57
3.14	Thermo-scientific Quadrupole-Inductively Coupled Plasma mass spectrometer . . . . .	62
3.15	Typical calibration curves for different trace elements generated on ICP-MS . . . . .	63
3.16	The benzene synthesis glass line at PRL . . . . .	67
3.17	Schematic representation showing wet and dry combustion setup for radiocarbon dating . . . . .	71
3.18	Schematic diagram showing acetylene and benzene synthesis setup . . . . .	72
3.19	Formation of Uranyl compound in water . . . . .	74
3.20	Rosholt and Osmond type plots used to determine for initial activities of $^{230}\text{Th}$ and $^{234}\text{U}$ in the sample . . . . .	75
3.21	Schematic of the Monte Carlo simulation for age model . . . . .	78
4.1	Climatological monthly rainfall over Dandak cave . . . . .	82

---

4.2	Plane polarized light and cross polarized light images of Dan -I stalagmite . . . . .	82
4.3	Age model of Dan-I stalagmite . . . . .	83
4.4	$\delta^{18}O$ and $\delta^{13}C$ profiles of the Dan-I stalagmite . . . . .	87
4.5	Trace element variations in the Dan -I stalagmite . . . . .	88
4.6	Age model reconstructed for Dan - II stalagmite . . . . .	89
4.7	$\delta^{18}O$ and $\delta^{13}C$ profiles of Dan-II stalagmite . . . . .	90
4.8	Sketch of the Dandak-II stalagmite, showing sampling the sampling sites for Hendy's test and U-Th ages . . . . .	91
4.9	Age model for the Kotumsar stalagmite . . . . .	93
4.10	Hendy's test results of Kotumsar stalagmite . . . . .	93
4.11	$\delta^{18}O$ and $\delta^{13}C$ timeseries of KOT-I stalagmite . . . . .	94
4.12	Monsoon rainfall reconstructed from Ulvi speleothem and Param-bikulam teak cellulose . . . . .	95
4.13	Locations of marine and terrestrial proxies . . . . .	97
4.14	$\delta^{18}O$ variations of planktic foraminifera from six different cores from the eastern Arabian Sea . . . . .	98
4.15	Combined Holocene monsoon record based on $\delta^{18}O$ of KOT-I, Dandak-I and II stalagmites . . . . .	100
4.16	Comparison between Dandak- II stalagmite, GRIP ice core record and Qunf cave . . . . .	102
4.17	Interproxy comparison between present study and ISM records . . . . .	106
4.18	Charcoal layers preserved in sediments of the Kotumsar cave and the Dandak cave . . . . .	107
4.19	The comparison between $\delta^{18}O$ time series of Jhumar speleothem, Dandak speleothem, and the present study . . . . .	109
5.1	Locations of different terrestrial records from the core monsoon region of India . . . . .	116

5.2	Age model of the Kailash stalagmite . . . . .	119
5.3	$\delta^{18}O$ and $\delta^{13}C$ timeseries of the Kailash cave stalagmite . . . . .	120
5.4	Climatological monthly rainfall over the Belum cave . . . . .	122
5.5	Three day back trajectory at the Belum cave . . . . .	122
5.6	Correlation coefficient between model simulated JJAS average rainfall $\delta^{18}O$ at the Belum cave and over surrounding grids . . . . .	123
5.7	Plane polarized light and cross polarized light images of a thin section of the Belum stalagmite . . . . .	124
5.8	Age model of the Belum stalagmite . . . . .	128
5.9	$\delta^{18}O$ profile of the Belum cave stalagmite . . . . .	129
5.10	Comparison between the $\delta^{18}O$ profile of the Belum stalagmite and trace element ratios . . . . .	130
5.11	Interproxy comparisons of the $\delta^{18}O$ profiles of Sanbao, Xiabailong cave stalagmites with the Belum stalagmite . . . . .	132
5.13	Locations of different cores raised from the Arabian Sea and the Bay of Bengal . . . . .	136
5.14	Comparison between Andaman Sea sediment core $\delta^{18}O$ record of the present study with sediment cores from the Bay of Bengal and the Arabian sea . . . . .	138