

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

- Fig. 1.1** Map of India and satellite imagery of Gujarat showing the location of Nal Sarovar and surrounding regions. 2
- Fig. 1.2** Geological map of Nal and surrounding regions. 5
- Fig. 1.3** Tectonic map of Nal and surrounding regions (Modified after Chandra and Chaudhary, 1969). 6

CHAPTER 2 GEOLOGICAL AND GEOMORPHOLOGICAL STUDIES

- Fig. 2.1** The sub-divisions of Quaternary sediments of Gujarat. 12
- Fig. 2.2** Composite Quaternary sediment profiles of river basins of Gujarat. (A) Narmada, (B) Mahi, (C) Sabarmati. (Redrawn from Chamyal and Merh, 1992). 14
- Fig. 2.3** Satellite imagery and interpretation showing deranged drainage pattern in older mud flats south of Nal Sarovar. 20
- Fig. 2.4** Satellite imagery and interpretation showing the location of palaeochannels (dashed lines), dunes (dots) and alluvial plains north of Nal Sarovar. 21
- Fig. 2.5** Satellite imagery and interpretation showing inland deltas, zone of terminating streams and older mud flats, south of Nal Sarovar. 22
- Fig. 2.6** A composite map showing the present day drainage pattern and location of palaeochannels in and around Nal region. 24
- Plate 1** Photograph of a small stream formed by silting of older channel. 26
- Plate 2** Photograph of cross bedding observed in inland delta region. 26

Fig. 2.7	A composite map showing deranged drainage pattern and zone of terminating streams below 20m contour in the Nal region. Above 40m contour only the major rivers are shown.	27
Fig. 2.8	Geomorphological map of Nal region.	29
Fig. 2.9	Plots of eustatic sea level change (Redrawn from Gillespie and Molnar, 1995).	32
Fig. 2.10	Map showing the location of bore hole sites and transects taken. Also shown are eastern and western margins of Cambay Graben. The approximate boundaries of the Nal region are shown by dotted lines.	34
Fig. 2.11	Lithological variation along the transects shown in Fig. 2.10.	35
Fig. 2.12.	Additional bore hole lithologs for sites shown in Fig. 2.10.	36
Fig. 2.13	Additional bore hole lithologs for sites shown in Fig. 2.10.	37
Fig. 2.14	Map showing the location of 54m long core and shallow trenches in Nal Sarovar.	39
Fig. 2.15	Lithology of the Nal Sarovar core.	40
Fig. 2.16	Lithology of shallow trenches showing the presence of shell layer in Nal Sarovar.	42
Plate 3	Field photograph of sediments from the shell layer, Horizon-1, taken during trenching.	43
Fig. 2.17	Variation of grain size with depth, Nal Sarovar core.	45
Fig. 2.18	Variation of total clay percentage and mineralogy with depth, Nal Sarovar core.	46
Fig. 2.19	E-W section along the Cambay Graben. (Drawn on basis of data given in Mathur et al, 1968).	51

CHAPTER 3 PALAEOCLIMATIC STUDIES

- Fig. 3.1** The extent of fossil aeolian features and isohyet contours in north western India (modified version largely redrawn from Chawla et al, 1992). Sites mentioned in text are indicated. 54
- Fig. 3.2** Plot of radiocarbon dates vs depth, Nal Sarovar core. 63
- Fig. 3.3** Age variation of %C, %N, C/N, $\delta^{13}\text{C}$, and % sand in sediment samples from Nal Sarovar core. 67
- Fig. 3.4** Palaeoclimatic interpretation of C/N and $\delta^{13}\text{C}$ variations in sediment samples from Nal Sarovar core. 69
- Fig. 3.5** A comparison of palaeoclimatic data from Didwana and Lunkaransar lakes in Rajasthan with Nal Sarovar. (a) Wasson et al, 1984; (b)&(c), Bryson and Swain, (1981). 72

CHAPTER 4 LUMINESCENCE DATING STUDIES

- Fig. 4.1(a)** Explanation of the basic process of TL induction using the band theory of solids (after Aitken, 1985). (i) Irradiation by ionising radiation results in the production of free charges some of which get trapped at various defects in the crystal. (ii) Energy 'E' is required for the detrapping of the charges. (iii) Stimulation by heating (or optically) can cause detrapping of these charges some of which recombine radiatively with the opposite charge at a recombination centre 'L' and emit light called as TL or OSL depending on type of stimulation. 77
- Fig. 4.1(b)** Schematic portrayal of simple types of defects such as negative ion vacancy, interstitial defect and impurities in an ionic crystal (after Aitken, 1974). 77
- Fig. 4.2** Comparative study of bleaching of quartz and feldspar (after Godfrey-Smith et al, 1988) showing faster bleaching of OSL signal; for OSL, 1% of initial signal was reached for

	quartz after 10 seconds of sun exposure whereas 9 min were required for a feldspar sample. For TL, exposure time of several hours was needed. Note reverse sensitivity of minerals to bleaching for OSL and TL.	80
Fig. 4.3	Schematic of methods used in estimation of equivalent dose for sediments. X-axis refers to laboratory dose (after Wintle and Proszynska, 1983).	81
Fig. 4.4	IRSL growth curve and age plateau for sample N-143. Also indicated are the mean values of ED and age.	90
Fig. 4.5	IRSL growth curve and age plateau for sample N-168. Also indicated are the mean values of ED and age.	91
Fig. 4.6	Variation of IRSL dates with depth in Nal Sarovar core. The open circles represent the anomalous dates (see text for discussion). The filled circles represent the dates used for interpolation.	93
Fig. 4.7	(a) Glow curves, (b) growth curves and (c) age plateau, for partial bleach dating (10 min sun exposure) of sample N-127.	95
Fig. 4.8	Result of anomalous fading test on a typical sample. The dashed lines show the TL of two aliquots immediately after irradiation of 44Gy. The continuous lines show the TL record of two other aliquots of the same sample similarly irradiated 3 months previously.	96

CHAPTER 5 SUMMARY, SYNTHESIS AND FUTURE PERSPECTIVES

Fig. 5.1	Schematic representation of the geography of the Nal and surrounding regions during the period (~125ka BP) of last major interglacial transgression (in Stage 1 of evolution of Nal region)	105
-----------------	---	-----

Fig. 5.2 Schematic representation of the geography of the Nal and surrounding regions during the period (~18ka BP) of last glacial maximum (LGM) regression (in Stage 2 of evolution of Nal region)	106
--	-----

Fig. 5.3 Schematic representation of the geography of the Nal and surrounding regions during the period (~5ka BP) of Holocene transgression (in Stage 3 of evolution of Nal region)	109
--	-----

APPENDIX D Experimental Procedures For $\delta^{13}\text{C}$ And C/N Analyses

Fig. D.1 Assembly line for extraction of Carbon dioxide and Nitrogen.	129
Fig. D.2 Calibration curve for determination of nitrogen.	130
Fig. D.3 Calibration curve for determination of carbon dioxide.	132