CHAPTER - II

PREVIOUS WORK

The Quaternary sediments of Gujarat alluvial plains exposed in the cliffy banks of various rivers have been studied by archaeologists and geologists. The first description of Quaternary deposits of Gujarat alluvial plains was given by Blanford (1869) who studied the geology of Narmada and Tapti river valleys. He described the alluvial deposits in the cliff sections of these rivers. Foote (1898) in his book 'Geology of the Baroda State' described the alluvial successions of Sabarmati and Mahi rivers. He noted that the present day rivers were erosional rather than depositional.

Sankalia (1946) studied the archaeologic remains from the alluvial deposits of Sabarmati basin and fixed a lower palaeolithic age for the base of the exposed sequence on the basis of lower palaeolithic tools recovered from the basal gravels. Zeuner (1950, 1963) gave a detailed account of the exposed Quaternary deposits in a regional context. He studied the alluvial sediments of Narmada, Orsang, Mahi and Sabarmati in particular and noted their similarity. He envisaged the role of changing palaeoclimatic conditions in the deposition of the Quaternary continental sediments.

Wainwright (1964) described the Pleistocene deposits of the Lower Narmada valley and emphasised the role of sea level fluctuations in the deposition of these sediments. Allchin et al. (1978) described the aeolian deposits of NW India in archaeological context. Bedi and Vaidyanadhan (1982) investigated the geomorphology of the area around Lower Narmada valley. According to them the area has a polygenetic landscape which perhaps originated during Late Quaternary period. They emphasised the palaeohydrological and neotectonic activity in the morphogenesis of the landscape.

Ahmad (1986) emphasised the role played by Holocene tectonism. According to him the rivers changed their courses in response to epierogenic activity. He invoked uplift of 300 m during Late Quaternary. Bedi (1978) suggested that post-Mesozoic tectonic disposition has played an important role in the evolution of the multicyclic polygenetic landscape of Mahi basin.

Pant and Chamyal (1990) suggested the use of red soil as the marker horizon for stratigraphic studies in Gujarat alluvial plains. They studied the

Quaternary deposits of the Mahi basin and identified the role of tectonism in the deposition of these sediments and landscape evolution. They attributed the extensive ravine erosion to a slow tectonic uplift. According to them the base of the exposed Quaternary deposits is approximately 350 ka.

Merh (1992) considered the basal bluish mottled clays which form the base of the exposed Quaternary sediment succession all over the Gujarat alluvial plains, to be the euivalents of the miliolite deposits of Saurashtra and correlated with the Middle Pleistocene transgression. Of particular relevance is the work carried out by Chamyal and his collaborators (Pant and Chamyal, 1990; Chamyal and Merh, 1992; Merh and Chamyal, 1993; Chamyal and Merh, 1995; Chamyal et al, 1997). They have described the Quaternary sediments in the various river sections in the Sabarmati, Mahi and Narmada valleys. They found that the deposition in the Gujarat alluvial plains ceased with the deposition of aeolian deposition during the last glacial maximum.

The entire Quaternary geology of the Gujarat alluvial plains has been elaborately described for the first time by Merh and Chamyal (1987) (Table 2.1). They have provided the first detailed account of the lithostratigraphy, depositional environments, sedimentary facies and the sequence of paleoclimatic events. They found that the exposed sediments in the Narmada, Mahi and Sabarmati valleys are broadly comparable.

Sridhar et al. (1994; 1997) have proposed a 'super fluvial system' which deposited the Quaternary sediments in the northern alluvial plains. They assumed that the present day Rupen marks the palaeocourse of the Sabarmati and the

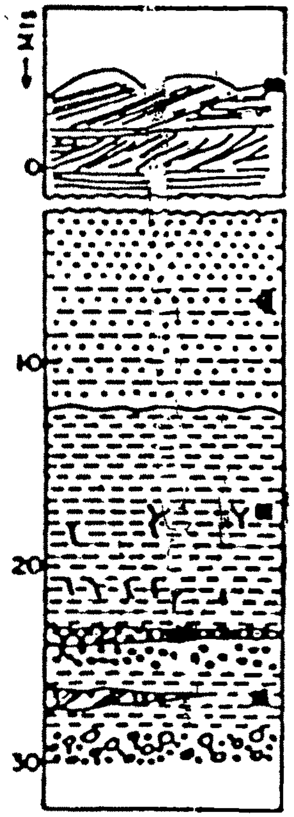
EVENTS	ENVIRONMENT	ENERGY CONDITIONS	LITHOLOGY	PEDOGENESIS	CLIMATE
Deposition of present day unconsolidated sand-sheets and dunes		Moderate to low	Sand and silt		Semi-arid to arid
Deposition of dunal sands	Aeolian environment	High velocity wind	Sand and silt		Arid
Period of non-deposition	Sub-aerial weathering			Stabilization and pedogenisation of silts Palaeosol formation and calcretization	Sub-humid to semi-arid
Sudden deposition of sediments of silt and fine sand	Aeolian environment	High velocity winds	Fine to medium grained silts and coarse sand		Arid
Deposition of third fluvial cycle	Fluvial environment	Reduced energy conditions. Deposition in the form of intermittent flash floods	Mud, coarse sand and lenses of gravel, chiefly composed of quartz grains feldspars and micas		Sub-humid to humid
Period of non deposition	Sub-aerial weathering			Pedogenetic changes including rubification of silts and development of calcrete nodules at the base	Sub-humid to semi-arid
Continuing deposition of second fluvial cycle Deposition of second fluvial cycle	Fluvial environment	Moderate to low energy conditions High to shallow energy conditions	Silts and sands Gravel comprising clasts of varying sizes of quartzite, rock fragments capped by mud		Humid
Period of non deposition	Weak sub-aerial weathering			Weak pedogenesis of the top part (mud)	Sub-humid to semi-arid
Deposition of first fluvial cycle	Fluvial environment	High to shallow energy conditions	Gravels comprising clasts of quartzite, granite, chert jasper and rock fragments overlain by mud		Humid
Period of non deposition	Sub-aerial weathering			Pedogenetic changes in basal clay	Semi-arid
Marine conditions (High sea)	Tidal environment	Low energy	Clay rich in illite, smectite, montmorillonite and silt comprising mainly quartz, feldspar and micas		Humid

Table 2.1 Synoptic view of the geological history of the alluvial plains (After Merh and Chamyal, 1997)

Shedhi marks the palaeocourse of Mahi river. Merh and Chamyal (1997) have indicated that the Orsang initially flowed through the present Dhadhar river before joining the Narmada. Sareen et al (1993) attributed the present N-S course of the Sabarmati to the neotectonic adjustment.

Tandon et al. (1997) described the Late Quaternary aggradational history of the Sabarmati basin and provided absolute dates to some of the key horizons (Table 2.2). They suggested that the present darinage adjustment is younger than 39 ka.

The earlier workers have emphasised mainly on the lithostratigraphic, sedimentological, and palaeoclimatic aspects of the exposed Quaternary sediments. However, Bedi (1978) and Bedi and Vaidyanadhan (1982) did point out the role of Late Quaternary neotectonic activity in the landscape evolution of Mahi and Lower Narmada valleys . No other data is available on the Quaternary tectonic evolution of the Gujarat alluvial plains barring the recent high resolution studies by the present author (Maurya et al.,1995, 1997a, 1997b, 1998) and Rachna et al. (1998) in the Lower Mahi basin. The present study is the first of its kind devoted solely to understand the role of Quaternary tectonics in the formation of Quaternary continental basins and the overall evolution of Gujarat alluvial plains.



STRATIGRAPHY: Formation	STRATIGRAPHY: Member	LITHOLOGY	ENUIRONMENTS	INFERRED PALAEOCLIMATE	TL DATES (ka)
Sabarmati	Aeolian	Reworked sand	Alluvial-plain	Semi-arid (seasonal)	2-5
	Fluvial	Silt, fine sand, river gravel			
Akhaj*		Fine sand	Stabilized dunes	Semi-arid (dry phase)	5.8
Mahesana	Sand	Medium to fine sand	Reworked sand (aeolian)		
	Heterolithic	Fine sand calche Silty clay	Sheet wash deposits	Semi-arid	39.0
Waghpur	Sand	Red sand (pedogenised and rhizoconcretionary)	Palaeosol (pedogenic reddening)	Semi-arid	58.0
	Conglomerate	Cemented gritty sand stone (secondary cementation) inter bedded with red sand	Low magnitude seasonal flood deposits	Semi-arid (wet phase)	≥300.0

* Not deposited at Hirpura

■ Location of Samples for Luminescence Dating.

Table 2.2 Stratigraphy, palaeoenvironmental and palaeoclimatic inferences with TL dates from Sabarmati succession (after Tandon et al., 1997)