CHAPTER : II

PREVIOUS WORK

If one were to make an inventory of the previous work done on geo-environmental studies in and around Baroda, then the total workers and their contributions would not be more than three or four at the most. Since the present study has incorporated a lot of data from geology and archaeology, it would be worthwhile to make a brief mention of the earlier work done in each aspect, especially those which have been referred to in the present study.

For this purpose, the description of the previous work has been separated into three aspects viz. geology, archaeology and onvironment.

GEOLOGY :

The earliest known worker [Lush, 1836], described the reddish clay occurrence in Gundavie [now known as Gandevi, in S. Gujarat], which was then part of the erstwhile Baroda State.

Fulljames, [in Bruce Foote, 1898], while remarking on the geology of Baroda State, noticed a general depression to the south of Baroda city. He had also noticed the limestone occurrences about a mile SW of Wasna on the Heran river. This occurrence was then identified as a member of the Bagh beds.

Vampell [1839], stated a few facts about the geology of Baroda State without any specific observations.

Wynne [1868], made some passing remarks on the geological features occurring within Baroda State without being specific about any particular formation.

Blanford [1869] threw more light on the geology of the central parts of Baroda State and the surrounding country-side. This was accompanied by the first geological map of this region, in which observations on the distribution of the gneissic rocks, the Champaner beds, the Bagh beds and the Deccan Traps in the Waghodia and Sankheda talukas of the present Baroda district have been given. The relation between the different rock systems has been very clearly given and a masterly insight into the general structure of the country has been explicitly given. Wynne's [1868] observations have been incorporated in this report.

Elliot [1883], made a few remarks on the geology and topography of Baroda, but the observations made were not sufficient to get a clear picture of the geological setting.

During the years 1891-1898, Bruce Foote carried out the first systematic geological mapping of Baroda State. The economic mineral deposits were delineated and their value determined. In fact, so complete was this work, that it still holds true, especially the geological map. The geological succession as given by him is given below :

I	**The Archaean Rocks** : Granite with pegmatite veins of the Upper Sabarmati valley. Granites, gneisses and crystalline limestones of the Orsang and Unch valleys, Sankheda taluq. Instrusive rocks : Pegmatites, Quartz reefs, and Trapdykes.	Crystalline
II	**The Champaner System** : Quartzites forming the hills north of the Orsang river. Quartzites, limestones, calcareous schists, clay schists and slates in the valleys of the Heran and Aswan rivers.	Sub-metamorphic

III	**The Bagh Beds :** Songir conglomerates and sand-stones in Sankheda taluq, and conglomerates and limestones in Savli taluq.	Marine Cretaceous
IV	**The Deccan Trap [Cretaceous and Intertrappean rocks] :** Traps and Intertrappean rocks of the Mohar valley [Atarsuba]. Traps and Intertrappean rocks of the Mahi valley [Savli taluq]. Intertra-ppean rocks in the Vishwamitri. Traps in the Dev river. Traps in the valley of the Heran. Spurs of the Rajpipla hills north of the Tapti. Spurs of the Sahyadri range south of the Tapti. Dykes traversing the southern Trap area.	Cretaceous
V	**The Eocene [Nummulitic] System :** Clays, cement, stone, limestones, conglomerates and laterites, of the Kim and Tapti valleys. Laterites and sand-stones of the Sabarmati valley. Laterites of the Purna and Ambika valleys.	Tertiary
VI	**Recent :**	
	[A] Old Alluvia of the great rivers : Consoli-dated grits and ferruginous gravels of Sabarmati, Mahi and Tapti. Quaternary deposits.	Recent and Post-tertiary
	[B] Sub-aerial formations : Blown sands; soils; the great blown loam or "Loess formation"; fluviatile and marine alluvia.	

Apart from the detailed description of the above mentioned formations, he has also mentioned the ravine formation on the banks of the Mahi river. Mention has also been made of the 20-60 feet depth ranges of the

Vishwamitri, Deo and Dhadhar rivers.

Hobson [1923] made a geological survey of the western tracts of Chhota-udepur, and described the metamorphic rocks and intrusive granites.

Gupta and Mukherjee [1938], published an account of the geology of Gujarat and southern Rajputana, based on two periods of field-work with a hiatus of nearly twenty years. The geological succession as given by them is as follows :

		Recent and sub-recent soil	
Recent and Post-Tertiary		Kankar, calcareous conglomerate, laterite, etc.	
- - - - - - - - - - - -	Erosional Unconformity		- - - - - - - - - - - -
Eocene	Deccan Trap		
- - - - - - - - - - - -	Eruptive Unconformity		- - - - - - - - - - - -
Cretaceous	Infra-Trappeans	Bag beds, Lameta beds, Nimar sandstone, Ahmednagar sandstone	
- - - - - - - - - - - -	Erosional Unconformity		- - - - - - - - - - - -
Algonkian	Delhi system	Alwar quartzites	
- - - - - - - - - - - -	Erosional Unconformity		- - - - - - - - - - - -
		Composite gneisses, phyllites, slates, and schists with quartzitic intercalations	
Archaean	Aravalli System	Limestone	Intrusive quartz-veins, pegmatites, granite, epidiorites [amphibolites]
		Basal quartzite and conglomerate	
	- - - -	Erosional Unconformity	- - - - - - - - - - - -
	Pre-Aravallis	Banded gneissic complex	

This along with the earlier work done by Bruce Foote still remain the most standard geological references for the geology of Baroda district.

The first comprehensive study on the tectonics of the area was done by Mathur et al. [1968]. According to them the Cambay basin, in which the study area falls, was considered to be an intracratonic basin and could be divided into four tectonic blocks viz. [i] the Ahmedabad - Mehsana block [ii] the Cambay-Tarapur block, [iii] Jambusar-Broach block, and [iv] the Narmada block [Fig. 3]. The tectonic elements in each of the blocks were discussed in detail and the genetic explanation was given.

Chandra and Choudhary [1969], were the first to make a study of the stratigraphy of Cambay basin. The entire Paleogene and Neogene sedimentary section has been divided into fifteen mappable units, of which Deccan Trap and three Neogene formations are exposed and the rest are identifiable in the sub-surface.

Raju et al. [1971], studied the geological frame work of the Cambay basin and indicated that the three tectonic trends parallel to the Dharwar, Satpura and Aravalli lineaments determined the structural setting of the basin. They also suggested that Trap tectonics controlled the lithology of the overlying stratigraphic section.

Babu [1977], delineated the Quaternary geology of the Cambay basin based on study of aerial photographs. He identified areas consisting of black cotton soil, sandy loams, flood plain deposits, levees, swamps etc. The trends of the fluviatile and aeolian deposits were NE-SW, and those of the marine deposits NW-SE. The morpho-structural distribution was studied on the basis of tonal contrasts and drainage pattern. This indicated a NE-SW structural trend which was in conformity with the Aravalli grain. The landscape of the basin area and the youthful mantle failed to hide the dominant features of the underlying structural forms.

Bedi [1978], studied the geomorphology of the Mahi estuary. According

to him, the Mahi river encompasses a multicyclic polygenic compound landscape which has resulted due to the cumulative or individual effects of rejuvenations - both dynamic - eustatic and static. This involoved epeiro-variance, eustatic change in global or local palaeoclimatic and palaeohydrological oscillation which in turn used to induce anagenetic revivals and fluvial dynamic conditions. The three predominant domains or environs were recognised viz. [i] denudational domain operative in the hilly upland area, [ii] fluvial domain effective within the channel and flood plain of the Mahi river, and [iii] aeolian domain mainly covering the area west of the Mahi river. A detailed description of individual landforms and associated features is also given.

Biswas [1982], pointed out three craton margin embayed basins namely Kutch, Cambay and Narmada which were formed as grabens filled with clastic sediments. The Cambay basin was postulated to have been formed in the late-Cretaceous.

Gadekar et al. [1982], studied the LANDSAT satellite imagery of the lower reaches of Mahi river, which revealed some interesting geomorphic features. Interpretation of palaeo-channels of the Mahi river have been made by the identification of ox-bow lakes, point bars and island bars of streem meandering through flood plains. The study indicated the existence of at least four stages in the geomorphic evolution of the Mahi river. Progressive down-valley shifting of the river has been observed by them.

Nayak et al. [1982], studied the recent sediment distribution patterns of the Mahi river under active physiographic conditions. On the basis of the petrographical and grain-size studies, they found out that the present morphology of the Mahi river section is the manifestation of its bed-load material. The river shows mixed characteristic features of both mountainous and low-land river valley formation.

Raju et al. [1982], studied the lithological associations, sedimentary

structures and petrographic data of the northern Cambay basin and concluded that the sedimentary environment changed from shallow marine to littoral and then to deltaic marsh to fluviatile from Lower Eocene to Middle Eocene.

Ramanathan and Mukherjee [1982], studied the Quaternary lineaments around Baroda city with the help of aerial photographs and satellite imagery. From the rose diagram of these lineaments, they have concluded that the alignment of these lineaments coincided with the Satpura trend. They have analysed the implication of these lineaments on giant construction activities in Baroda city, particularly in the context of known reactivation of the Satpura trend during the Quaternary period, right up to the present day.

Rao and Talukdar [1982], while describing the petroleum geology of the Bombay high oil-field, discussed some structural aspects of the Cambay basin, observing that the Cambay basin appears to terminate south of the Narmada river. The structural grain of the basin is NNW-SSE [Dharwarian].

Biswas [1987], studied the western marginal basins of India viz. Cambay, Narmada and Kutch, giving regional tectonics, structure and their evolutionary history. According to him, the Cambay, along with the Kutch and Narmada basins, have been developed by rifting along the Pre-Cambrian tectonic trends as pericontinental basins. Their tectonic evolution is indicative of sequential reactivation of primordial faults.

Rao [1987], noticed that the northern Cambay basin which was totally covered by alluvium, was an intracratonic basin bounded on the east by the Pre-Cambrian shield of the Aravalli Orogeny Complex and by the Kathiawar uplift and Kutch embayment in the west and extending upto Bombay off-shore basin through the Gulf of Cambay. He also noticed three orogenic lineaments viz. Aravalli [NE-SW], Dharwarian [NW-SE] and Satpura [ENE-WSW]. He has studied the structural features of the Cambay basin by seismic and sub-surface geological methods. The prominent structural

features identified by him in the Cambay basin are the Mehsana horst and overlying Mehsana, Kadi, Sobhasan and Becharaji anticlines. He utilised several techniques to decipher the sedimentary environment of the Cambay basin.

Nayak et al. [1988], prepared a detailed geomorphic map of the Mahi estuary using stereo aerial photographs and LANDSAT TM satellite data. Various landforms like flood plains, terraces, cliffs, faults, etc. were delineated. They also studied the erosional and depositional phenomena in the Mahi estuary.

ARCHAEOLOGY :

There are numerous works related to regional archaeology and its bearing on the archaeology of Baroda, but only a few references are available on the archaeology of Baroda city and its surroundings. A brief review of only those works which have a direct relevence to the present study is given below.

Prinsep and Fleet [1883], defined the boundaries of ancient Vadapadraka [present Baroda], located to the east of the more important Ankotakka [present Akota], the then chief township. They identified that Akota was a modern village in comparison to the older Baroda on the basis of a copper plate found near present day Salatwada area of Baroda.

Burgess [1885], while digging the foundations for a new office block near present day Kothi, uncovered gold and silver coins. He mentioned that the "Juni Kothi" or "old fort" was probably the oldest building in the city [8th - 10th century A.D.].

Yazdam and Gyani [1944], published one article on the Navlakhi "Vav" or step-well, located in the Lakshmivilas Palace compound. According to them this step-well was bulit in the 14th century A.D.

Goetz et al. [1948], whilst digging the foundation trenches of the present medical college building extension of the hospital and the Central Jail, recovered a few sculptures and pieces of glazed pottery dating between 8th to 13th centuris A.D. This, according to them indicated the location of a small township on the right bank of the Vishwamitri river.

Mehta and Subbarao [1949-1953], made large-scale vertical excavations in different parts of Baroda with an aim to chalk out a continuous account of the origin and development of Baroda city, since the earliest times [at least 1000 B.C.].

Zeuner [1950], made an in-depth study on the Stone Age and Pleistocene chronology in Gujarat. In this classical study, he has interpreted a series of changes in climate, fluctuating between a wet forest and a dry arid type during the Pleistocene in Gujarat. It was during one of these wet episodes, that the Microlithic man came to settle on the low elevations found on either banks of the Mahi river. It maybe quite possible that this might have been the beginning of the development of Baroda.

Shah [1951], made one of the most important discoveries in Western India, when he unearthed Jain bronzes in Akota. This helped in the identification of Ankotakka with modern Akota.

ENVIRONMENT :

This apect of study for Baroda is very limited, with only 3 main works coming into the picture. But all these works have not taken into consideration all the aspects viz. geology, geomorphology, surface and sub-surface water, land-use, etc.

The earliest known work was done by Merh et al [1982], who described the geo-environmental controls of industrial pollution around Baroda. This work involved a critical appraisal of the [1] location and types of industries around Baroda, [2] meteorological and hydrological factors

controlling the water pollution, [3] laboratory experiments to isolate and identify the pollutants in water, soil and plants, and [4] attempt to suggest a strategy to fight the menace. After detailed studies the following points were highlighted by them :

[1] The high calcium, magnesium and sulphate levels appear to be related to the inherent character of the natural occurring water.

[2] The high nitrate, nitrite and phosphate levels relate to usage of fertilizers and mainly to pollution caused by indiscriminate effluent dumping.

[3] The manganese count can be related to the SW flowing streams coming from the Mn rich Champaner rocks of Panchamahals district.

[4] The high lead content appears to be related to motor vehicle exhaust pollution.

[5] High levels of mercury in some well waters can be due to indiscriminate effluent dumping and usage of pesticides.

[6] The high levels of zinc to the south of Baroda can be attributed to metal finishing industries.

Concluding, the workers have stated that there does not appear any alarming pollution through surface and sub-surface waters.

Patel et al [1986] worked on a research project on "Ambient air quality survey and effects of pollutants on human health and vegetation". They monitored the variation of SO_2, NO_x and suspended particulate matter and their combined effect on vegetation and human beings. They have noticed sporadic high levels of SO_2, NO_x and continuous high levels of suspended particulate matter. The vegetation survey has indicated the accumulation of pollutants in the plant tissues and soil. This may result

in decreased agricultural yield and deterioration of the sub-soil water quality.

Society for Clean Environment [SOCLEEN] [1988],in their project report on "Pollution of river Vishwamitri" have highlighted the level of pollution in the Vishwamitri river, mainly due to effluent and sewage dumping. They have suggested sewage treatment and the usage of this water for agricultural purposes. Effluents, could be diverted into the GIDC effluent channel.