Chapter - 2

CHAPTER - II
THE REGION OF KUTCH

II.1. INTRODUCTION:

The region of Kutch is known since ancient vedic time, and is referred by various names as 'Marshy region of waste land' (Mallinath); 'Abhir' (Mahabharat), as 'Abir' or 'Abhir' (various Greek travellers). The region has unique importance in historical as well as in geographical sense. The name Kutch has been derived from its unique geographical characteristic shape and topographical features which resemble 'Tortoise'. The name 'Abhir' is also based on the local inhabitants - the Ahirs. The region of Kutch has unique geographical setup as the region has the rare geomorphic unit - the "Rann" - which is a dry as well as wet and at places also contains typical desert land forms. The greater Rann and little Rann of Kutch are two distinct entities and form Quaternary low lying marshy, subtropical, desertic regions. The region has also important archaeological and historical background and it forms a transitional cultural belt between Sindh, Rajasthan and Saurashtra.

II.2. GEOGRAPHICAL CONSIDERATIONS:

The Kutch region has a crescent shaped outline with arcuate sharp coast line on the south and southwestern part. Whereas the north, western and eastern and southeastern parts form the sinuous deeply cut creek and gulf of Kutch respectively. The depression of little Rann of Kutch which is a residual depression, drains to the gulf of Kutch and also get periodically flooded by sea water during high tides and during monsoons and in summer due to southwesternly stormy winds. The Rann of Kutch is covered by thick salt, silt and clay cover, and is devoid of vegetation and habitation, except for grass cover and xerophytic shrubs in slightly raised islands only. Kutch has total area of 44203 sq. km and is covering latitudes 22°44'11" to north latitude 24°41'05" and east longitude 68°09'46" to east longitude 71°54'47". It is bounded on north and northwest by Sindh, on north and northeast by Rajasthan, on west by Arabian sea, on east by Banaskantha and Patan districts, on southeast by Surendranagar, on south by Rajkot and gulf of Kutch and Arabian sea Fig. I.

The terrain of Kutch can be grouped from north to south in the following zones:

(i). Rann, (ii). The chain of islands bordering the greater Rann. (iii). The flat lands of Banni, (iv). The chains of hills ranging on the northern part of the mainland with intervening plains, (v). A chain of abruptly rising high hills with steeper northern face and gentler southern flanks, (vi). Southern coastal alluvial plains forming a convex outline.

The hills spread from the west to east with a narrowing belt from west to east. Dhinodhar, the 387 m high peak in the west and Patchaman Pir (Datratya) in the Patcham island form the important peaks of Kutch peninsula.

Kutch district has a coastline stretching for 352 km from Lakhapat to Shikarpur in east (Gulf of Kutch), with a number of creeks, islands and tidal channels. Numerous salt pans are located towards deeper interior parts of gulf of Kutch.

Kutch has a semi-arid type of climate of "steepe bush type". The steepe is the traditional belt bordering a real desert and separating it from a humid region beyond. The tropic of Cancer is passing through the northern part of Kutch. The area experiences extremely high temperature during the dry times and minimum temperature during night (showing maximum diurnal variations), which is typical of arid climatic zone. Winters are very cold and summers are scorchingly hot. Often hot gusts with dust laden storms are very common during summer months. Summer lasts from mid-March to mid-June. The average temperature during May is about 39°C-40°C, which some times goes as high as 47°C, and average minimum temperature is 9°C, which some times goes as low as 4°C. Monsoons prevails for a very short period. The rain fall is very meagre and erratic. The average rain fall is about 35 cm. Monsoons are active during June to September by northwest monsoons.

At times, weather phenomenon of thunder storms occur during monsoons time. These are generally formed in the interior parts, and in the Rann area/Banni.

The drainage starts from the higher ranges of the chains of Islands, and hill ranges of the mainland and drain to the south in the gulf of Kutch and to the west in the Arabian sea. The rivers draining to the north and to the south from Islands and central ridges of mainlands drain to Rann, Banni and to parts of the little Rann. The important rivers and streams include Kali, Godhatad, Dhudud, Nara, Kaiki, Rukmavati, Kankavati, etc., and these rivers drain to north except Rukmavati and Kankavati, which drain to the gulf and Arabian sea respectively. Kutch falls in the tropical semi-arid climatic zones of Cloppen, and receives very meagre and erratic rain fall. This little meagre rainfall does not support the variant growth of forest and grass land are common as in other tropical areas. The forest cover is very scanty and comprises of thorny bushes of *Acacia indica*, *Acacia arabica* (Babuls), Kher, Cactus and other xerophytic bushes common on the slopes of trap hills, on Jurassic hills, along stream courses, river reservoir basins and on the downstream side of the irrigation projects. A few thinly forest patches are found in the basaltic and Tertiary terrain of western and northwestern Kutch and in the Islands of Patcham, Khadir, Bela, Chorar and Wagad area. A few reserve forest areas with open mixed jungles are found in the central Kutch. The wild life is very scarce and common animals include nilgay, deer, black bucks, antelopes, wild bores, hyena, foxes, Jackals. The little Rann is known for the rare species of wild ass.

Kutch is economically very backward. Though as a large district, it is very thinly populated and has diverse but unique cultural heritage of Jats, Rabaris (Maldharis), Kanbis, Bania, Ayars (Yadava), Muslims, and Jains. The Hindu and Muslim communities are harmoniously living together. Some of the Hindu communities observe Muslim traditions

in the extreme northwestern parts and in Banni areas Cattle grazing and breeding and farming are the main occupation. The average literacy percentage is quite low in Islands, Banni, western and northwestern parts. The people are very hard working and lead a very hard and tough life. The area is in permanent grip of draught, for longer periods face acute scarcity for storage's drinking water in areas other than central and western part of mainland.

Narayan Sarovar, Koteshwar, Trivikamrai, Matanomadh are the important pilgrimage centres besides Bhadreshwar.

II.3. GEOMORPHOLOGICAL ASPECTS:

A fairly good account of the geomorphology and erosional surfaces has been given by Biswas (1974). He has visualised the "Kutch cycle" of erosion and has suggested four events of the erosional plains as 'Late Cretaceous/Early Tertiary (laterised surface), Mid Tertiary, Late Tertiary, and Early Quaternary surface'. These surfaces have been correlated with Palaeocene, Post Palaeocene, Post Miocene, and Early Quaternary. Poddar (1964) has indicated certain geological features and intrusive rocks to represent Upper Jurassic age in central Kutch on the basis of their relationship with rocks of Umia Series. The author, while carrying out the geological studies in parts of eastern, central and western Kutch and northern Islands has come across evidences of erosional surfaces of Upper Jurassic, Lower Cretaceous and post-Aptian times, besides more than one successive events of Lower Palaeocene and late Tertiary Eocene/Oligocene, Miocene erosional surfaces, besides other younger surfaces suggested by Biswas (1974).

The great Rann of Kutch forms the unique geomorphic terrain of Indian subcontinent. It consist of a low lying area covered by thick dry salt waste, blown silt, sand, low channels of few playas and shallow saline waste filled depressions. The flatness, low channels connected to the creek areas (Kori creek), extreme salinity and periodic annual inundation of sea water from west and north have rendered the greater Rann of Kutch desolate and barren. At few places the flat and low terrain of Rann is intervened by relatively higher, slightly elevated sand/silt covered bets or islands, which are generally covered by grass and xerophytic shrubs, and are visible from great distance. The greater Rann is bound on south by few, slightly elevated knolls and steeply rising steppes of Patcham, Khadir, Bela and Manvana Islands.

II.4. GENERAL GEOLOGY:

Geologically, the peninsula of Kutch occupies one of the most important and unique sedimentary basins of India. The stratigraphy of the Kutch region encompasses the rocks ranging in age from Jurassic to Recent, which are deposited in various environmental setups like marine, brackish, estuarine and continental. The important stratigraphic boundaries include Precambrian and Middle Jurassic, Upper Jurassic and Lower Cretaceous, Upper Cretaceous and Tertiary (supratrappean), supratrappean and Lower Eocene, Middle Eocene and Lower Oligocene, Miocene-Pliocene, Pliocene and Pleistocene and Pleistocene and Recent.

The oldest Mesozoic rocks are exposed as boulder granitic conglomerate in the Cheriya bet and Khadir, which are thought to be the oldest Mesozoic sediments. The actual contact of Precambrian basement and these rocks is said to be exposed in Meruda hills located in the greater Rann of Kutch, south of Nagarparkar (presently in Pakistan, Biswas, 1971, 1974). Same granite bouldery conglomerate horizon is recorded at many places in the northern foot hills of Patcham island, Bela and Maurana islands. These boulders are thought to represent the granite and syenites - supposed to be equivalents of the Erinpura Granites (Biswas, 1971). A total succession of Mesozoic rocks of the order of 2400 m is thought by him to have deposited in various parts of Kutch including the chain of discontinuous Islands.

The rocks are mainly clastics in nature and include gypseous shales, micaceous and felspathic, calcareous silty to gritty sandstones, siltstones, shales, clays with few bands of limestones of various nature. Few beds contain prolific fossils of *cephalopods, brachiopods, pelecypods, gastropods, bryozoa, corals, foraminifera,* varied microfaunal communities, Gondwana flora and logs, dinosaurs and other vertebrates and a rich assemblage of trace fossils. Numerous intrusive dykes, sills and few eruptive / intrusive centres and plugs of different ages are associated with these rocks at various localities.

The Cretaceous rocks are confined in the mainland and in the southern fringes of the Patcham, Khadir, Bela islands and in the Wagad mainland and Meruda islands. These rocks belong to Khadir, Patcham and partly to Wastava Formations. The rocks are exposed along the entire strike length from Bhachau in the east to near Lakhapat in the western extremity of the mainland. The Cretaceous rocks belong to uppermost part of Katrol and Bhuj Formations. The important rocks include varied medium to coarse gritty, felspathic, graded and current bedded sandstones, shales, variegated clays, with few coaly bands, and rhythmically deposited ironstone bands and few marly to calcareous bands in the middle part known as the Ukra beds. The rocks were deposited in estuarine, deltaic to fluvial channel regimes with few marine incursions in the upper part. The uppermost part of the Cretaceous sequence is dominantly volcano-sedimentary in nature and comprises alternations of olivine, alkaline and tholeiitic basaltic flows with intervening fossiliferous clastic sedimentary beds comprising sandstones, tuffaceous sands, gypseous clay, marl, limestone, banded chert, palaeosoil, mud and shales. At few places, thick trap pebble conglomerate beds and glauconitic sandstones and clays are also recorded (Fig-2). The intertrappean sedimentary beds have yielded dinosaurian and other fossils.

The Tertiary rocks are exposed along the western and southern parts of Kutch and along the areas bordering south of islands of Patcham, Khadir, Bela and Wagad high lands (Fig-1).

The Tertiary section of Kutch attains a thickness of about 1000 meters and overlies the rocks ranging from Jurassic in Patcham, Khadir, Bela and Wagad to Supratrappeans and older rock in the mainland of Kutch. These rocks comprise variegated to silty clays,

foraminiferal limestones, siltstones, gypseous and glauconitic clays and shales, micaceous sandstones. Very often these rocks are highly fossiliferous and contain *pelecypods, gasteropods, echinoides, bryozoans, corals, foraminifera, ostracoda* and many other varieties of microfossils, vertebrate remains, mammals and other reptiles, and a variety of trace fossils.

The soil types show a great variation depending on the parent bed rocks and include lateritic red, black cotton soil, alluvium, silt, sandy, marshy, saline, alkaline.and brown silty with salt encrustation (desertic) as noticed at various places in parts of Kutch. Sand dunes are common in the southern coastal plain, little Rann and southern edge of greater Rann.

II.5. SEISMICITY AND EARTHQUAKE RECORD:

Kutch formulates part of the seismically active region in western India (isoseismal zone V). It is possibly due to the intersection and interrelation of the major lineaments, which are periodically active. The region is greatly affected by moderately severe earthquakes on many occasions with intensity of +V on Richter scale, in past and in recent years during 1819, 1844, 1845, 1864, 1882, 1898, 1903, 1940 and 1956. The earthquakes of past have changed the course of Indus river to further westwards from its old course to greater Rann of Kutch by the creation of the major neotectonic feature - "The Allah Bund" - running for a distance of more than 50 km in NW-SE direction from near northwest of Khavda (in Patcham island). Devastation of Lakhpat, and further westward shifting of Arabian sea and continued emergence of land and Rann, demolition of Anjar town and other neotectonic features of the area, were due to such earthquakes and their related neotectonic attitudes.

II.6. IGNEOUS ACTIVITY:

The Mesozoic strata are extensively invaded by basic intrusions of different episodes. Various forms of intrusions comprising dykes, sills, plugs, ring dykes, laccoliths, stocks, drop, hook and en echelon shaped bodies of intrusions, flow conduits, feeder dykes, and central type of eruptive centres are recognised. Most of the intrusive are syntectonic, genetically related to the tectonism and are restricted within the flexure zones of Mesozoic rocks (Biswas, 1971). Certain plugs and stocks not related to the Mesozoics, are perhaps the centres of the early phase manifestation of Deccan Trap vulcanicity, which took place towards the end of the Tectonic cycle (Auden, 1949). The initial phase of igneous activity is marked by the alkaline intrusive plugs and a few eruptive centres, spread in chain of domes in Patcham, Bela, Mauvana, Kaya, Nara, Lakhapur and Ukra areas. The later stage of activity which marked the early part of trappean activity was also alkaline in nature. These alkali plugs were the source for the alkali flow sequences in certain parts of the Deccan basaltic sequence of Kutch in Bhachau, Anjar areas and central Kutch areas.

The igneous activity in the later phase was tholeiitic through discontinuous central cones as well as through repetitive, violent fissure eruptions and feeder fissures. These active periods of vulcanicity were interrupted intermittently by quiescent periods during which the fossiliferous intertrappean sedimentaries were deposited in small ponds, lagoons and lakes. The early phase of trappean activity was probably subaqueous in nature, which later turned subaerial through advent time and spread from 68.7±0.8 m.a. to 61.0±1.6 m.a. covering a reasonably longer period instead of conventionally thought 1.0 m.a.

The Cretaceous-Tertiary boundary transition section is thus, located within the volcanosedimentary sequence of Kutch. The sedimentation history of this transition is preserved in such intertrappean volcanosedimentary sections.

II.7. STRUCTURE AND TECTONICS:

Biswas and Deshpande (1975) Biswas (1980, 1982) and subsequently many workers from Geological Survey of India and many institutions made important contributions to study structures and tectonics. According to them, Kutch forms a pericratonic embayment bordering the Nagarparkar uplift on the north, Radhanpur-Barmer arch on the east and Kathiawar uplift on the south. The main structure include six major uplift zones running east-west including areas of mainland Kutch, Wagad block, Patcham, Khadir, Bela and Chorar islands. Few small uplifts also occur in the great and little Rann.

These uplifts (half cut domal structures) are surrounded by "residual depressions" of the great and little Ranns of Kutch. These plains are the basins between the uplifts in which the thick Tertiary sediments have been deposited, as part of residual depressions. The uplifts are further suggested to have been constituted by the quasi-vertical marginal faults located in the basement. All these major uplifts are bounded at least on one side, by a fault associated with flexure zone made up of chain of domes and anticlines of varying dimension and geometry, and on the other side by peripheral plains gently dipping into the surrounding residual depression.

It is important to note that the Mesozoic rocks are involved in the above structure. The low dipping Tertiary beds warp around the Mesozoic structures to form nose and embayments.

Sections in the study area at various places form part of some of the structures in mainland covering areas south of Katrol fault involving upper Cretaceous and the volcanosedimentaries. These structures form chain of short, discontinuous structures extending in east-west direction; and involve low dipping trap and associated intertrappean sedimentaries of the Upper Cretaceous and Lower Tertiary times.
