

PART I : BACKGROUND

CHAPTER 1

I N T R O D U C T I O N

The Kutch peninsula which forms the northwestern part of the Gujarat State of India, has always posed challenging problems to geologists, and has been a place of attraction for many a stalwart for over a century.

The position of Kutch basin is unique in the geology of India, where a complete stratigraphic column ranging from middle Jurassic to Holocene has been developed, and even to-day this geological record is well preserved. The area offers variety of fascinating problems including those of facies and environment, structure, stratigraphy, and paleontology. Kutch is

known for its treasurehouse of fossils and has been an ever haunting place for paleontologists.

The author has spent a decade in various parts of Kutch in capacity of a geologist of the Oil and Natural Gas Commission, and has obtained a good perspective view of the geology of the entire area.

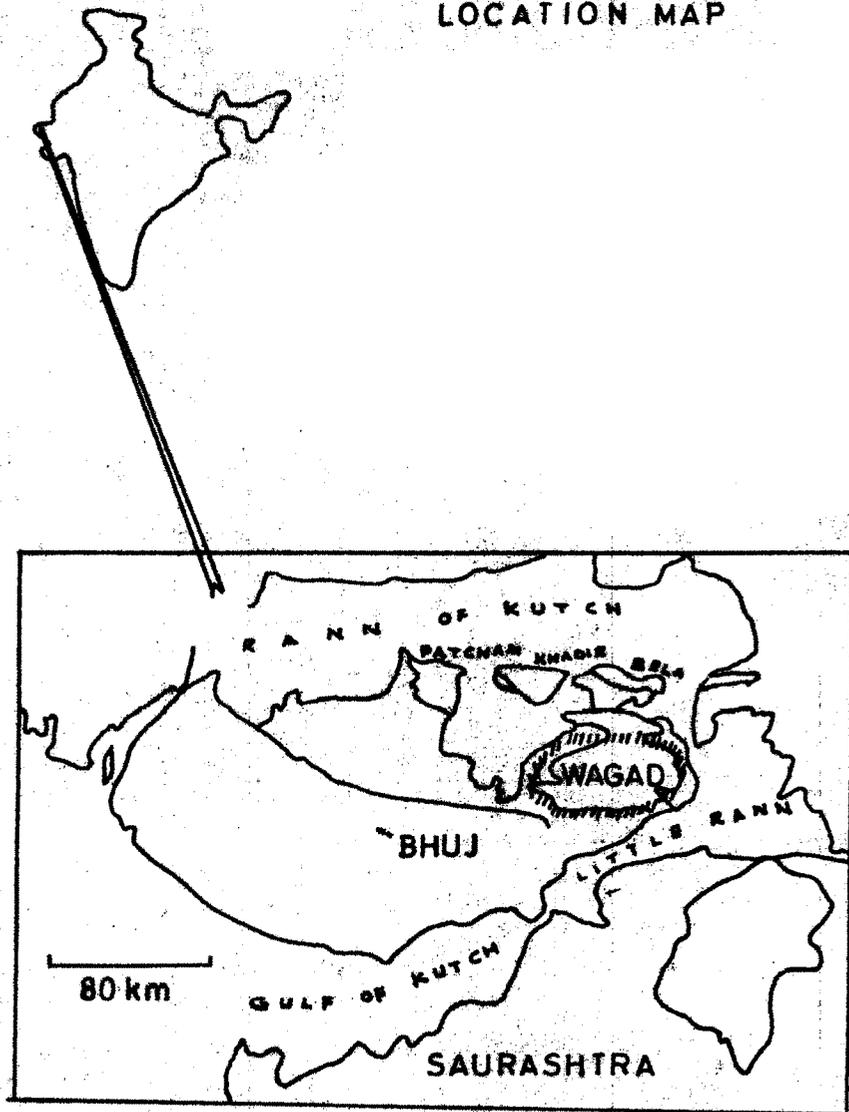
The author having worked in almost all parts of the Kutch, found that the Wagad hills comprise a unique assemblage of Mesozoic sediments, such that they illustrate all depositional and structural features of the entire Kutch basin within a nutshell. It was for this reason that he took up a detailed investigation of the Wagad hills, and this thesis contains a critical account of his observations and conclusions.

KUTCH IN GENERAL

Geographically, the Kutch territory forms the westernmost part of India (Fig. 1.1). It is bounded to N by Sind plains of Pakistan, to its E by plains of Gujarat Mainland and to its S and W by the Gulf of Kutch and the Arabian sea respectively. The most remarkable and unique feature of Kutch is the occurrence of a vast desolate terrain known as the Rann which occupies its northern and eastern parts forming more than half of the areal extent of the Kutch territory. Wadia, (1961,

Fig.1.1

LOCATION MAP



p. 399-400) has described the Rann of Kutch as saline, marshy plain scarcely above sea level, dry for one part of the year and covered by water for the other part. It was once an inlet of the Arabian sea but it has now been silted up by the enormous volume of detritus poured by the small rivers discharging into it from the E and NE. Wadia (1961, p.47-48) has supported the popular belief amongst the local people that the Rann was a navigable gulf of sea surrounded by coast towns within the historic past. The idea that the Rann was once a sea has been supported by many writers including Burnes (1839), Frere (1870), Lyell (1853), Sivewright (1907), Odham (1926), and lately by Platt (1962).

Wynne (1872) in his description of the Rann writes that 'its flat unbroken surface of dark silt baked by the sun and blistered by saline incursions is varied only by the mirage and great tracts of dazzlingly white salt or extensive but shallow flashes of concentrated brine; its intense silent desolation is oppressive and save by chance a slowly passing caravan of camels or some herd of wild asses, there is nothing beyond a few bleached skeletons of cattle, salt dried fish, or remains brought down by floods to maintain a distant and dismal connection between it and life, which is utterly unfit to support'.

The Rann is divisible into two parts termed as the Great Rann occupying the northern part and the Little Rann forming the eastern and south eastern part.

The entire Rann area is characterised by a chain of 'islands' comprising mainly the Pachham Island, the Khadir Island, the Bela Island, and the Chorar Island. The rocky area lying to the S of the Rann and the Island belt is termed as the Mainland. The Wagad hills occupy an isolated position S of the Island belt and to the ENE of the Mainland.

The Pachham, which is biggest of all the islands is marked by two great E-W trending hill ranges called the Kaladongar and the Goradongar ranges. The Kaladongar hill range which occurs to the N contains several high peaks including the Babia peak (1520') which is the highest among all the peaks of the Kutch region. The rest of islands comprise single hill ranges with roughly E-W axis.

The Mainland forms a continuous rocky terrain, and consists of broadly two subparallel E-W trending hill ranges with intervening low ground and a southern coastal plain. The two hill ranges called the Northern

Range and the Katrol Range coincide with the structural 'highs' of the area. It is seen that the topography of the entire region is structurally controlled.

Kutch experiences mainly arid to semi-arid climatic conditions. The annual rainfall is about 10-12 inches, spread over the entire monsoon months of June to September. The arid climate is characterised by extreme variations of temperature. The minimum temperatures falls even below the freezing point during winters while the same touches even 48°C during the summer months of April or May.

The meagre rainfall has resulted in a very poor natural vegetation. It is generally made up of only cactus, thorny shrubs and other semidesert flora. However, good agricultural products like wheat, cotton, vegetables, bajra etc. are grown in the irrigated areas.

The wild life of Kutch though not very rich, contains some of the rare species of both animals and birds. Common wild animals are deers, wild bears, 'nilgais' (blue bulls), hayenas, wolves and jackals. Kutch is known for the rare species of 'wild asses'. These animals can run at a speed of 40 to 60 miles per hour, and are reported from only two localities in the world - the Middle East and the Kutch. The eastern parts of Wagad hills and the Bela Island

almost fringes the southern part of Wagad. Rapar is the main town of Wagad and is served by a daily bus service from Bhuj. Besides, some of the interior villages are connected with Rapar by a bus service. However, common mode of transport is either camel or bullock cart.

SCOPE OF THE PRESENT INVESTIGATION

The present study is restricted to the Wagad hills which form the easternmost part of the Kutch. These hills occupy roughly the area between longitudes $70^{\circ}20'$ and $70^{\circ}55'$ E and latitudes $23^{\circ}20'$ and $23^{\circ}40'$ N.

The Wagad area comprises three main hill ranges which have been termed by the author as - the Southern Hill Range, the Kanthkot Hill Range, and the Northern Hill Range (Fig. 1.2). The southern and the Kanthkot ranges are roughly E-W trending, narrow linear in shape and correspond with the anticlinal and domal structures. The Vitrio peak (755') occurring in the central part is the highest of all the peaks of the Wagad.

Most of the drainage of the Wagad owes its origin to the Northern range. The entire area shows a radiating type of drainage ultimately disappearing

either in the Great Rann (to the N and W) or the Little Rann (to the E or S). Most of the rivers are only seasonal and drain during the wet monsoon months only. The sandstone members of the various formations occurring within the synclines or valleys are good water reservoirs.

The entire area measuring 500 sq miles (about 1,280 sq km) was investigated in detail by the author.

Geologically, the Wagad hills comprise Mesozoic sediments, and occur as an isolated block surrounded on all sides by the Rann and alluvium. The Mesozoic sediments which constitute about 90% of the areal extent of the Wagad hills are fringed by younger Tertiary sediments on all sides. The Wagad hills though areally occupy a small part and comprise comparatively a thin stratigraphic column, are comparable with the Mainland as far as stratigraphic divisions, environments of deposition and tectonic history, are concerned. As such the Wagad area represents a miniature or sandwiched geological record of the Kutch Mainland. Within a short distance of a few miles, the Wagad sediments show variety of environments. Besides, these sediments also show prolific development of sedimentary structures and structural complexities.

After a few reconnaissance traverses, the area was systematically mapped by the author on 1" = 1 mile scale toposheets. The various bands were continuously traced to decipher the structural configuration of the area (Fig. 1.4). The author further carried out stratigraphic thickness measurements of as many as twenty one representative sections (Fig. 1.3). The entire stratigraphic sequence has been classified by the author on the basis of mappability and lithologic variations. While the classifying, the criteria laid down in the code of stratigraphic nomenclature of the American Commission has been followed. Besides, a detailed paleocurrent study covering all formations was made throughout the area; and it included examination of bedding patterns, laminations, cross bedding, ripple marks, flute casts, sole marks etc. Over 300 samples representing important stratigraphic horizons were collected for sedimentological studies. Also, the structural complexities of the area were critically studied.

Based on different mappable attributes of the Wagad sediments, e.g. formation thicknesses, facies, scalar and vector properties, and structural patterns, the author's investigations have enabled him to work out the environments of deposition in space and time, and to construct the likely sedimentary model of the Wagad basin.