CHAPTER - I

INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The objective of the present study is to identify the different lithofacies of Jurassic sediments, exposed in Jaisalmer Basin and to understand their depositional environment, sedimentary dynamics, sedimentation pattern, diagenetic history, and to assess the effect of diagenesis on pore geometry of Reservoir facies. An attempt has also been made to establish the lithofacies variation in selected sub-surface sections with the exposed sections in the area.

Field and laboratory investigations of the Jurassic sediments of Jaisalmer basin were carried out along the following lines :

1. Examination of the various lithounits comprising the Jurassic sediments and their regional distribution, detailed sampling of exposed sections through a series of systematic traverses, recording of sedimentary structures and preparation of geological maps based on field data.

2. Textural studies of the clastic sediments to delineate sedimentary dynamics and depositional environments.

3. Heavy mineral study of clastic sediments to understand the nature of provenance and tectonic episodes.

4. XRD studies for the identification of clay and carbonate minerals, leading to the understanding of the nature of reservoir matrix and diagenesis in the rocks.

5. Geochemistry of major and trace elements in different formations

in order to interpret the nature of matrix and depostional environment.

6. Petrographic studies and classification of clastic sediments to delineate the framework i.e., grain, cement and matrix relationship, leading to a better understanding of the depositional environment and diagenesis.

7. Microfacies studies of the carbonate sediments to know their depositional setting and energy condition.

8. Surface morphological studies of the detrital grains, matrix and cements by Scanning Electron Microscopy (SEM) to understand the diagenesis and pore geometry of the reservoir facies.

9. Integration of the various data of sedimentological investigations revealing the depositional environment and sedimentation pattern.

LOCATION

The thesis encompasses a detailed account of the geological investigations of Jurassic sediments in the Jaisalmer basin, Western Rajasthan. The area of investigation lies between N. Latitudes 26° 30' to 27° 12' and E. Longitudes 70° 45' to 71° 45' occupying an area of approximately 3870 sq km. (Fig. I.1) The exposed section of Jurassic sediments comprises of, in ascending order, Lathi, Jaisalmer, Baisakhi and Bhadasar formations, further overlain by Cretaceous - Eocene sediments.

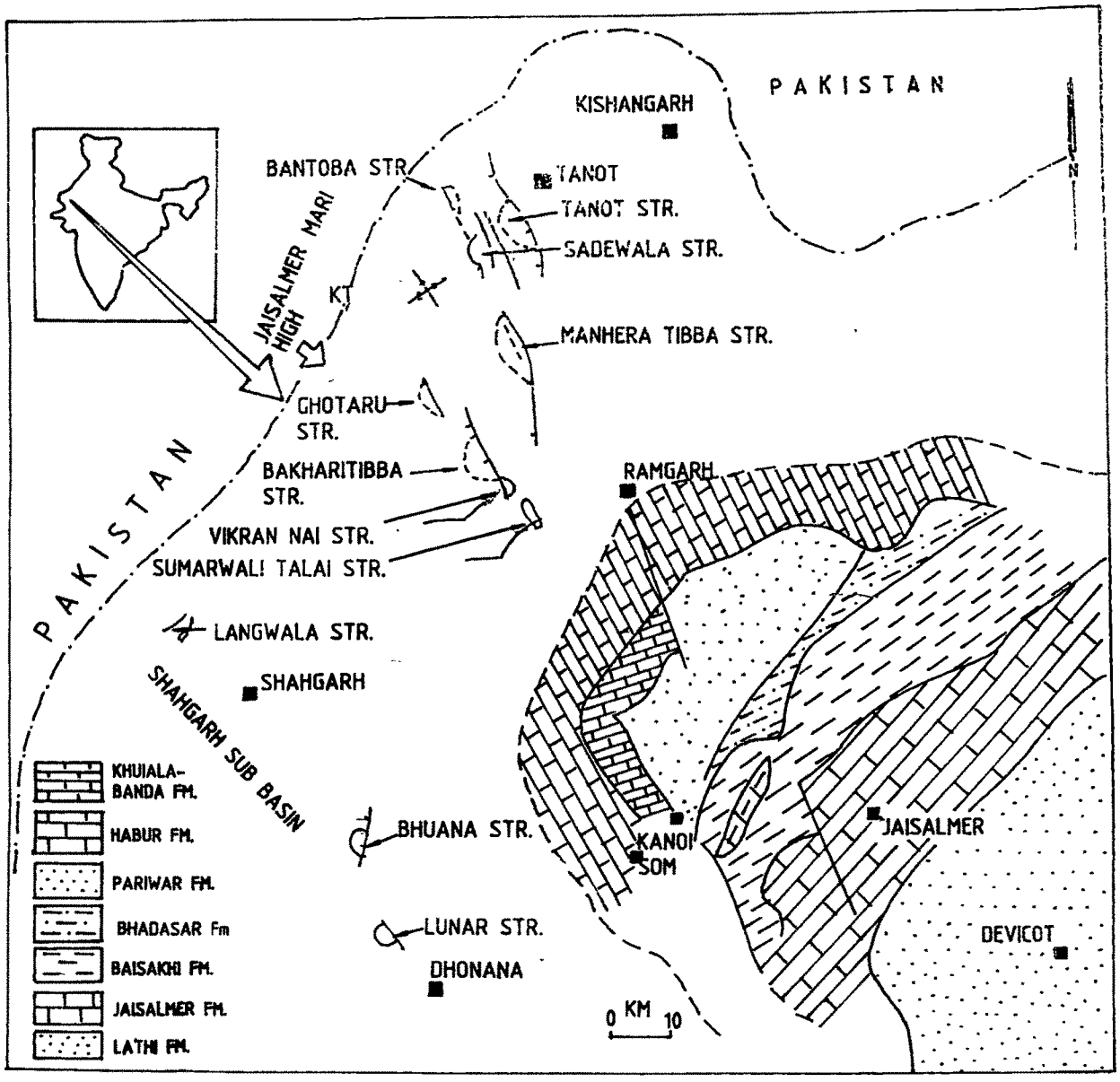


FIG.I.1 : LOCATION MAP AND REGIONAL GEOGICAL SETTING OF JAISALMER BASIN

The unexposed Baisakhi and Bhadasar formations are undifferentiated due to a lack of marked change in lithoassociation and hence have been clubbed together as Baisakhi-Bhadasar Formation.

TOPOGRAPHY

The area under investigation is almost a flat terrain, except in some parts where almost parallel cuestas have been noted. The average elevation of the area ranges from 235m to 335m. The highest point has been observed in the southwest of Jaisalmer, which slopes to the west at an average value of less than 8° .

The topography of the area appears to be controlled mainly by its geology. Cuestas alternating with flat plains are the prominent features in the area. The basal calcareous sandstones and the upper part of Jaisalmer Formation being predominently limestones, form persistant, long cuestas, extending upto 20km in a northeast-southwest direction, following the average strike direction of the beds. The Lathi, Baisakhi and Bhadasar formations being dominantly fine grained clastic and shaly sequences are found exposed as low scarps.

A major part of the area is covered by wind blown sands usually arranged in the form of linear dunes, which are more or less parallel to each other (plate I.1). The setting of dunes usually follow NNE-SSW and NE-SW directions and appear to have been controlled by prevailing wind direction. These dunes continued to change their positions depending on the direction of the wind.

PLATE-I.1

A. Topographical relief of Jaisalmer Basin, Locality : NW of Jaisalmer.

B. Sand dunes covering western part of Jaisalmer Basin, Locality : Som village.

DRAINAGE PATTERN

The drainage pattern existing in the area is characteristic of an arid-zone climate and is mostly dominated by small streams and nalas, the most important ones being Masurdi Nadi and Kakhi Nadi. The Masurdi Nadi situated in the south-western part of Jaisalmer, flows northwards initially, abruptly changing its flow towards the west, possibly due to subtle lineaments. Similarly the Kakhi Nadi situated in the north of Masurdi Nadi flows almost towards the north initially. Some tributaries of these streams flow either parallel or almost perpendicular to the main streams. It appears that the flow directions of these two main streams follow the NNE-SSE fault trends occuring in the area.

Jaisalmer town, the main reference point in the area is situated on a plateau which is oriented along a ENE-WSW direction. Towards the south, there is a man made tank, into which a few small streams are flowing. In the northern part of the area, a combination of dendritic and northerly flowing parallel drainage is well evident. The trend of the drainage is almost perpendicular to the strike of the formations. The southern part of the area is also characterised by a combination of dendritic and sub-parallel drainage which is seen flowing normal to the strike of the cuestas and the formation boundaries. Due to high elevated areas around Jaisalmer, the streams in the northern and southern parts are flowing in opposite directions, which may be due to the attitude of the formations and the presence of structures like faults and cuestas in the area. In the northeastern part of the area where the

sediments belonging to Baisakhi Formation are outcropping, a typical local centripetal drainage pattern has been observed, which could be due to the shaly nature of the sediments.

Seasonal streams are common, which remain dry throughout the year execpt during the rainy seasons. The drainage is mainly of interior type with streams losing themselves within the sands and small lakes. As such due to the internal drainage of the arid-zone, there is no development of any major river system.

CLIMATE AND VEGETATION

The climate is typically arid, with an average temperature range between 1°-2°C during the winter months, and 45°-50°C during the summer. Even the diurnal variation in temperature is high, which is a characteristic feature for any desert area. The rainfall is meagre, less than 12cm per annum and precipitation is spread over a short period, usually during July and August. Occasional short drizzles during the winter are however common. The water-table in the area is usually at a depth of 35-70m below the ground level. After the monsoon, local accumulations of water in some perched permeable beds are trapped by shallow, inclined wells called 'Bheris'.

The area is a part of the Great Indian Desert known as 'The Thar' and is sparsely vegetated. Except in baghs (irrigated orchards), where mango, pomegranates, lime and occasional drumstick trees are grown, there are very few trees and rare vegetation, which is mainly of

xerophytic type. Prosopis Spicigera, Acacia arabica and Acacia Senegal are the common trees species. The commonest shrubs are the species of Acacia, Calatropis and Euphorbia. The dry climate, sandy soil and heavy biotic interference is responsible for the undershrub stage of vegetation which is a common feature in the area, and represented by Calligonum, Polygonoides, Crotolaria, bushi etc, (puri et. al., 1959).

DIMENSION STONES

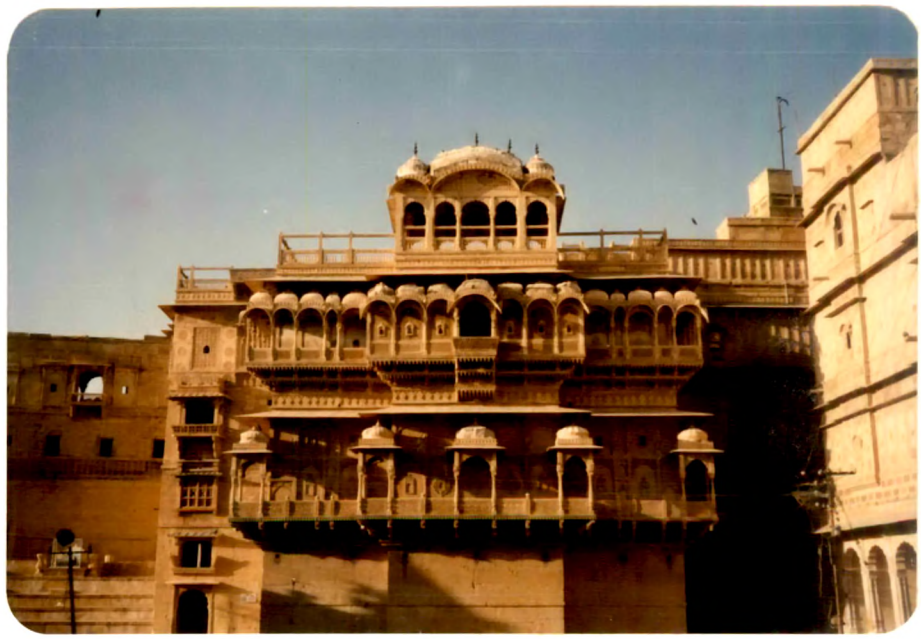
Yellow coloured limestone is the most important economic dimension stone in the area and is quarried around Jaisalmer town. The argillaceous nature of these limestones make them extremely amenable for carving and delicate lattice work (Plate - 1·2), as seen in Jaisalmer Palace (cover plate). Gypsum is quarried at Sri Mohangarh and Kuldhar villages by the Department of Geology and Mines, Rajasthan.

COMMUNICATION AND TRANSPORT

Jaisalmer, the biggest town in the area is connected by National Highway No.15 with Bikaner and Barmer. Rajasthan State High links it with Jodhpur and Barmer Part of the National Highway now extends upto Tanot, about 100km northwest of Jaisalmer. Besides these metalled roads, several partially metalled gravelled roads connect villages with the main towns. Jaisalmer is also the main railway station for the metre-gauge branch line connecting it with Pokharan, Phalodi and Jodhpur. Rajasthan State Roadways buses ply regularly between Jaisalmer, Jodhpur, Pokharan, Bikaner, Barmer, Srimohangarh, Ramgarh etc. Jaisalmer and Ramgarh has a post and telegraph office, the former having a telephone exchange as well.

PLATE-I.2

A. Architectural panorama of golden city of Jaisalmer showing economic importance of yellow calcareous sandstone and sandy Limestone of Jaisalmer Formation; (salimsingh JI-KI-haweli, Jaisalmer).



B. Architectural panorama of golden city of Jaisalmer showing details arches and carvings; (Gaj place Jaisalmer).