C H A P T E R-II

LITERATURE REVIEW

In the semi-deserts of Kutch, the Jurassic rocks with the excellent outcrops have attracted many researchers since more than a century. Paleontologists were particularly attracted by rich invertebrate fauna and stratigraphers were fascinated by the well exposed condensed sections ranging from Bathonian to Holocene. In this chapter the author has attempted to present a brief review of the available literature on the Jurassic rocks of Kutch.

In the early eighteenth century, the earliest geological work from Kutch includes a description of devastating earthquake of 1819. **Skyes (1834)** prepared perhaps the first document of Kutch geology alongwith a short account on fossil collection of **Capt. W. Smee**. The changes in landforms and effect of the great earthquake find mention in the works of **Lyell (1835)** and **Wynne (1872)**.

The first paper on Geology of Kutch alongwith a map and a list of fossils was published by **Grant** as early as **1840**. The first comprehensive treatise on the geology of Kutch was made by **Wynne and Fedden (1872)**, following preliminary notes by **Blanford (1867), Wynne (1869) and Oldham (1869)**. Their pioneering work was published by **Wynne** (op.cit), in the memoir (vol.IX,1872) of the Geological survey of India. They mapped the area on 1"= 4 miles scale and for the first time gave a full stratigraphic classification from Jurassic to Tertiary. Their map is used as a base map for all the subsequent work. **Wynne** (op.cit) divided the Jurassic of Kutch into two series: "Lower Series" and "Upper Series" and mapped the area on that basis. He considered the former to be equivalent to the 'Inferior Oolite' of England. However, he wrongly included certain rocks of Cretaceous age in the younger 'Series'. **Wynne's** Memoir on Kutch does not give any concise description of the structure and tectonics of the region.

Stoliczka (1872) distinguished several divisions based on paleontological as well as physical and geological relations of the rocks. This has resulted in the establishment of four groups which **Stoliczka** named as Patcham, Chari, Katrol and Oomia Group in ascending order. Unfortunately, the sudden death of **Stoliczka** prevented him from presenting his data on the geology of Kutch.

Waagen (1873-76) made an extensive study of the Cephalopoda collection made by **Blanford, Wynne and others**. In collaboration with **Stoliczka(cited by Waagen, 1873), Waagen** subdivided the Kutch Jurassic into four series :

Series	Age
Umia series	Portlandian to Neocomian
Katrol series	Portlandian
Chari series	Oxfordian
Patcham series	Bathonian

He categorically stated that his subdivisions were not isochronous to those of European Jurassic.

Subsequently **Gregory (1893, 1900)** studied the echinoids and corals with the observation that the lower part of upper Patcham series, rich in corals (in Jumara dome), is correlatable with Bathonian and Callovian of Europe.

Spath (1927-33) subdivided the Chari Series into five divisions on the basis of ammonites. The divisions are : Dhosa Oolite Beds, Athleta Beds, Ancep Beds, Rehmanni Beds and Macrocephalus Beds in descending order. He further subdivided these into fourteen bio-stratigraphic subzones on the basis of ammonites. A good deal of **Spath's** Zonation Scheme depends upon **Blake's** systematic collection of macrofossils. **Blake** unfortunately had died before completion of the task, but his notes were used by Spath for detailed cephalopod zonation and global correlation.

Rajnath (1932, 1942), studied the Jumara Dome which is one of the best Jurassic section of Kutch and suggested few modifications over the previous classification of Jurassic rocks, based on his ammonites collections. This was essentially a revision of **Dr. Spath's** work. **Rajnath** subdivided Umia of **Waagen** into marine Umia and Ukra 'Beds' and non marine Bhuj 'Stage'/'Series'. **Rajnath's** contribution lay in emphasizing the Jurassic/Cretaceous boundary of Kutch at the base of Ukra ammonite bed. This distinctly pushes a sizable part of succession into the Lower Cretaceous comprising his Ukra beds and Bhuj series. **Rajnath's** work was the first attempt to study the stratigraphy of Kutch.

Agarwal (1957) studied the stratigraphy and Paleontology of Jhura Dome in North-Central Kutch and described 18 beds in Chari series on the basis of faunal assemblages. He suggested a new name, Habo series, for Chari series and subdivided it in three parts viz. Lower, Middle and Upper, ranging from Callovian to Oxfordian age. He included the lower Macrocephalus zone, considered as Bathonian by other workers, in Callovian.

Oil and Natural Gas Commission started the reconniatory work in Kutch in 1957. The systematic detailed / semidetailed mapping of both the Tertiary and Jurassic rocks of Kutch was started from the western end of Kutch Mainland since 1960.

Poddar (1959), while exploring the oil potential of the district, divided the Jurassic sequence into three basic divisions : Upper, Middle and Lower. **Pathak (1956)**, while exploring groundwater, published a detailed map.

Pascoe (1959) from all the available data compiled a stratigraphic classification which is more systematic with respect to the usage of stratigraphic terms like series, stages, substages and zones. He described each unit giving the lithological and paleontological characteristics, the latter, of course, predominated as most work was done on Paleontology.

Poddar (1964) adopted **Rajnath's** classification and his significant contribution was changing the status of the existing stratigraphic subdivisions. The four subdivisions described as 'Series' by **Rajnath (1934,1942) and Pascoe (1959)** were described as 'Formation' by **Poddar**. But such change of the status of stratigraphic units was not properly reasoned by him. **Mitra and Ghosh (1964)** carried out purely biostratigraphic work in Jhura dome (Jhurio Hill) area and produced a fairly accurate biostratigraphic map. They were first to realize the significance of environment and facies change in the shallow marine shelf deposits of Kutch.

Krishnan (1968) adopted the classification of **Rajnath (1932,1942)** with modifications of age according to **Arkell (1956)**. He, however, maintained the original four fold

classification and tried to streamline it by including **Rajnath's** Bhuj series as "Bhuj stage" within his Umia series.

Biswas (1971) proposed a litho-stratigraphic classification based on detailed mapping and systematic study of the stratigraphy covering all the outcropping areas in the basin. **Biswas (1977)** published the details of the classification with full descriptions of the designated holo-stratotypes and intrabasin correlation as required by the International Code of Stratigraphic classification (1972) for establishing a new classification. He introduced a new set of names to designate the rock stratigraphic divisions. They are Jhurio, Jumara, Jhuran and Bhuj in ascending order. This provided the basic framework for the study of the depositional model of the basin and its evolution **(Biswas, 1981)**. **Biswas (1986)**, proposed a chronostratigraphic classification of Mesozoic rock redefining the earlier classification of Waagen, Spath and Rajnath.

Bhalla and Abbas (1978) carried out detailed study of the foraminiferal fauna from Patcham, Chari, Katrol 'Series' of Kutch. The first two of these units are rich in foraminifera, while Katrol is found to be barren. They dated the fossiliferous series tentatively as Callovian to Oxfordian and discussed the paleoecology. They (1984) discussed the depositional environment of Jurassic rocks of Habo hills and divided the whole Jurassic of the Habo hills

into paleoecological units.

Krishna (1983) and Krishna et al. (1983) discussed the Mesozoic stratigraphy and suggested retention of old chrono-stratigraphic nomenclature for litho-stratigraphic units. They also discussed the depositional environment of the Jurassic / Cretaceous rocks.

Howard and Singh (1985) proposed a depositional model for these rocks based mainly on the studies of trace fossils.

Krishna (1984), Krishna and Westermann (1985), Krishna and Cariou (1986), Krishna et al.(1987) and Bardhan and Dutta (1987) attempted biostratigraphic zonation in Patcham and Chari Formations exclusively on ammonites.

Agarwal and Pandey (1985) made a detailed biostratigraphic study of the rocks of Gora Donger in Patcham island. They, on the basis of bivalves and cephalopods, attempted a biozonation of the beds and attempted a regional stratigraphic correlation.

Micropaleontological and palynological investigations were carried out by **Tewari(1957), Rao (1957), Agarwal and Singh (1960) Mathur et al.(1970), Mathur (1972), Lumbimova et al. (1960) Subbotina (1960), Guha (1976), Singh (1977,1979) Bhalla and Talib (1985), Mandwal and Singh (1989).**

Pandey and Dave (1993) studied the Mesozoic foraminifera of Western Kutch and proposed a biostratigraphic classification with description of standard foraminifera zones in the area. They provided detailed descriptions of the stages of the chronostratigraphic classification originally proposed by **Biswas (1986)** defining the time boundaries in the designated holo-stratotypes in accordance with the International guidelines (ISSC, 1976). Correlation of litho-, bio- and chrono-stratigraphic units were shown and thus, providing a complete framework of the stratigraphy of Kutch Mainland.

Sedimentological aspects of the Mesozoic rocks have so far been neglected except for **Biswas(1981,1991) Krishna et al.(1983) and Singh (1989).** Biswas and Krishna et al. dealt with all the Mesozoic formations in general based mainly on the megascopic studies. Singh studied only the topmost part of the Chari 'Formation'. Very little work was done on the sedimentology of the basin excepting descriptions of gross lithologies and their variations. Detailed work on carbonate rocks has not been done so far, particularly the microfacies, diagenesis and depositional history barring general descriptions of megascopic characteristics. The present work, therefore, dwells into the detailed sedimentological investigations of the Middle Jurassic carbonate sequences exposed in Jumara, Jhura and Habo domes.