CHAPTER 8

REGIONAL TECTONIC FRAMEWORK

TECTONIC POSITION OF THE KUTCH BASIN

The Kutch basin is bordered to its N by the alluvial plains of the Indus valley, to its E by the Gujarat plains which form the cratonic shield area of the Indian peninsula. To the S lies the Gulf of Kutch and the Saurashtra uplift. The northern plains form a part of the Lower Indus basin (Williams, 1959, p.1).

The Kutch basin opens out to the W and it is presumed that thicker sediments lie concealed underneath the Arabian sea. The Kutch-Saurashtra

area has been termed as a shelf zone of the Indian platform which is bordered to its E by areas of Aravalli and Delhi folding (Eremenko et al., 1969, fig. 1). The eastern alluvial plains of Gujarat and Rajasthan are marked by a gravity high called 'Radhanpur-Barmer high' (Biswas and Deshpande, 1970, fig. 2). The northern plains of the Lower Indus basin which just border the Kutch basin form a foreland zone of the Baluchistan geosyncline (Ahmed, 1969, fig. 9). However, the occurrence of the basal granite conglomerate beds of the Khadir Island and the syenite of the Meruda hill of Kutch and Nagarparkar of Pakistan indicate that the sedimentary sequence of the north eastern part of the Kutch basin is quite thin and that the oldest exposed Bathonian sediments directly overlie the Precambrian basement rocks (Biswas and Deshpande, 1968, p.6).

Kutch, thus forms a pericratonic basin which experienced active sedimentation during the Mesozoic and the Cenozoic eras. Lately, Biswas (1971, p.229) has called Kutch as a pericratonic embayment. The sedimentary column ranges from Bathonian to Holocene and forms a wedge shaped body with thinner ends towards N and E.

REGIONAL STRUCTURE

In relation to the above description, it is pertinent to review the regional structural pattern to understand the position of Kutch.

The Delhi and the Aravalli rocks of the northern parts of Rajasthan show a regional NE-SW strike. The foliation strikes of the Aravalli rocks often show WSW-ENE trends in Sirohi-Palanpur area (Patel, 1971, p.43). The original Aravalli fold trend in this area is E-W, and it is later superimposed by Delhi folding which show NE-SW trends (Patel, 1971, p.44). It is interesting to note that around Kapasia, a swarm of narrow E-W trending dykes are reported by Coulson (1933), Heron and Ghosh (1938) and Patel (1971). Coulson (1933) has grouped these dykes as belonging to post-Malani age and has genetically related them to E-W faults. Heron and Ghosh (1938) have considered them to be post Erinpura granite and of a pre-Malani mafic suite. The geological map of this area shows that the intrusion of the Abu massiff which has been regarded as belonging to the Erinpura granite intrusive phase, has taken place along the junction of the Aravallis and the Delhis. Patel (1971, p.200) has said

that the emplacement of granite took place along the Delhi-Aravalli contact during the orogenic upheaval that folded and lifted up the Delhis, resting over the metamorphosed Aravallis. Thus it appears that these NE-SW and E-W strikes form a fundamental fracture trends of this Precambrian basement. Further, N of Himmatnagar the NE-SW strike of the Delhi rocks shows a swing towards ENE while the Aravalli strike swings towards S. It is quite likely, that in Abu-Himmatnagar area, there is a bifurcation of the Precambrian trends. One trend having a swing from WSW-ENE to E-W continues westward and perhaps forms the basement of the Kutch basin, while the other appears to have N-S trend and acts as the basement for the Cambay basin, further south. Biswas (1971, p. 231) has also postulated the extension of Delhi strike in the Kutch basin and has said that recent gravity and magnetic studies reveal this continuation through the subsurface region of the Cambay basin.

It is obvious from the regional E-W trend of the Kutch rocks, that the entire structural style of the Kutch basin has been controlled by this Precambrian

basement lineaments. The present author thinks that there is a very marked and continuous change in the Precambrian strike from Mt. Abu to the western part of the Kutch. The strike swings from almost NE-SW at Mt. Abu to as much as WNW-ESE in the western half of the Kutch Mainland. The eastern Kutch (the Mainland and the Wagad) shows the intermediate variations. It may be mentioned here that all the faults, major as well as minor, encountered in the eastern Wagd show NE-SW maxima while these occurring in western Wagad show WNW-ENE maxima (Fig. 9,2). All the areas of Kutch, including the Mainland, the Island belt, the Wagad and the Nagarparkar, the structural trends show a marked influence of the basement grain.

SIGNIFICANCE OF VARIOUS FOLD AND FAULT STRUCTURES

The Kutch basin is marked by six major uplifts viz. the Mainland, Pachham, Khadir, Bela, Chorar, and the Wagad while the remaining areas are occupied by the residual depressions of the Great and the Little Rann and the Banni basin (Biswas and Deshpande, 1970, fig.2). Except the Wagad uplift, all the others are bounded by high angled fault to their N. The Wagad uplift is an

exception in the sense, that it is bounded by a high angled normal fault to its S. It is apparent that the various uplifts have taken place along the linear vertical fault planes which in turn represent the fundamental fracture or weak zones of the Precambrian basement.

The dominant structural style of the area is of block faulting similar to the one described by Prucha, Graham and Nickelsen (1965, p.969) in the Wyoming province. Such faults which have been produced by vertical uplift of the rigid basement blocks usually show high angled normal and vertical natures, but locally they also exhibit high angle reverse movement. These faults have been termed as 'upthrusts' by several writers (viz. Green, 1900; Link, 1930; Bengtson, 1956; cfs. Prucha, Graham and Nickelsen, 1965), and they are typical dislocations along which the relative movement changes from 'normal' to 'reverse' type. Prucha et al. (1965, p.970) have very lucidly explained this phenomenon; and have shown that "the nature of the upthrust fault exposed i.e. vertical, high angle normal or high angle reverse is a function of the level of observation relative to the corresponding structural segment of the

and Hodgson (1965, p.943) has discussed similar phenomenon from the Colorado plateau and the Wyoming.

It is thus obvious that the various uplifts are the result of differential vertical movement of the discrete fault blocks of the basement. The anticlines, synclines, and other fold structures present are adjustments resulting from such movements coupled with regional crustal warping.