CHAPTER - VIII

N E O T E C T O N I C A C T I V I T Y

GENERAL

The study of Landsat Imageries, aerial photographs, drainage pattern, landforms, seismic sections, data of Broach earthquake of the year 1970 and field observations, have provided positive evidences toward the occurrence of neotectonic activity in the study area. These observations by the present author, have further brought to light the fact that the adjoining area to the north viz. north of the Narmada river was comparatively less affected by neotectonism. The

tectonic movements that had affected the rocks are evidenced from the characteristics of the morphostructures. The topographic highs and lows, corresponding to structural features, are clearly reflected by the drainage pattern. The structural features formed due to neotectonism are indicative of tectonic activity in Quaternary times. These features are manifest as geomorphological anomalies and lineaments.

The neotectonic movements leave an imprint on morphologic expressions, which is of great help in the identification of the evolutionary phases of the area. Some of the important features are river rejuvenation, antecedent and entrenched drainage, raised and tilted terraces mappable on aerial photographs and Landsat Imageries. Some interesting features along the coastline pointing to periodic movement along the Narmada geofracture during the Quaternary period have recently been reported by Ganapathi et al (1983).

All the Cenozoic tectonisms including those of the Quaternary period, have been found to be related to differential uplifts and subsidences of fault bound blocks. Most of the major controlling faults have deep roots down to the Moho discontinuity as evidenced from the deep seismic sounding data (Kaila,1981), in the Narmada block (Fig.III.3).

It is obvious that the tectonic framework and depositional

history of the Tertiary and Quaternary rocks of western India, have been controlled by the northward drift of the India plate.

EVIDENCES OF NEOTECTONIC ACTIVITY

Landform analysis from Landsat Image of the study area indicates the presence of ENE-WSW trending lineaments and geomorphic features. The trend of these lineaments is more or less parallel with the trend of the gravity and magnetic anomaly contours (Agarwal,1983). Results of these studies along with a scrutiny of aerial photographs and field mapping suggest that the major lineaments are related to basement weakness zones, which by periodic reactivation are responsible for rock fracturing, vertical displacements and tonal anomalies. These lineaments extend beyond the study area to the ENE in the Deccan Trap exposed area, and the trend is similar as observed in the Tertiaries and Quaternaries of the study area(Fig.VIII.1).

An excellent evidence of the Late Cenozoic neotectonic activity in the study area is observed in the Narmada river paleo-bank feature marked by a lineament 30 km long, south of the present course of the Narmada river(Plate VIII.1). In the field this lineament is marked by an abandoned cliff along which the Narmada river was flowing with its left bank (Plate V.8.C). The straight part of the lineament suggests reactivation of a deep seated fault which dies out in the eastern part of the

Fig. VIII · 1

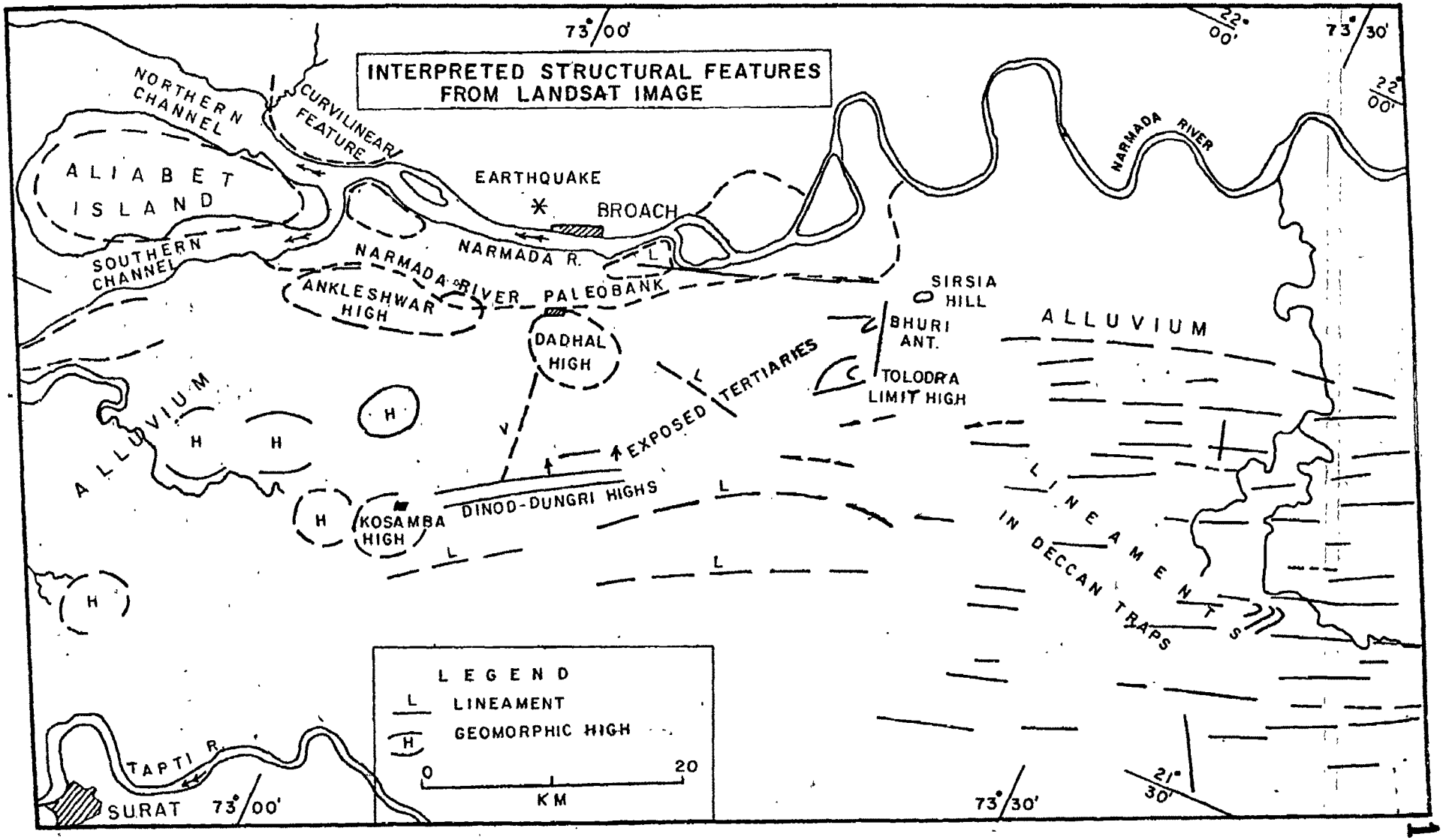
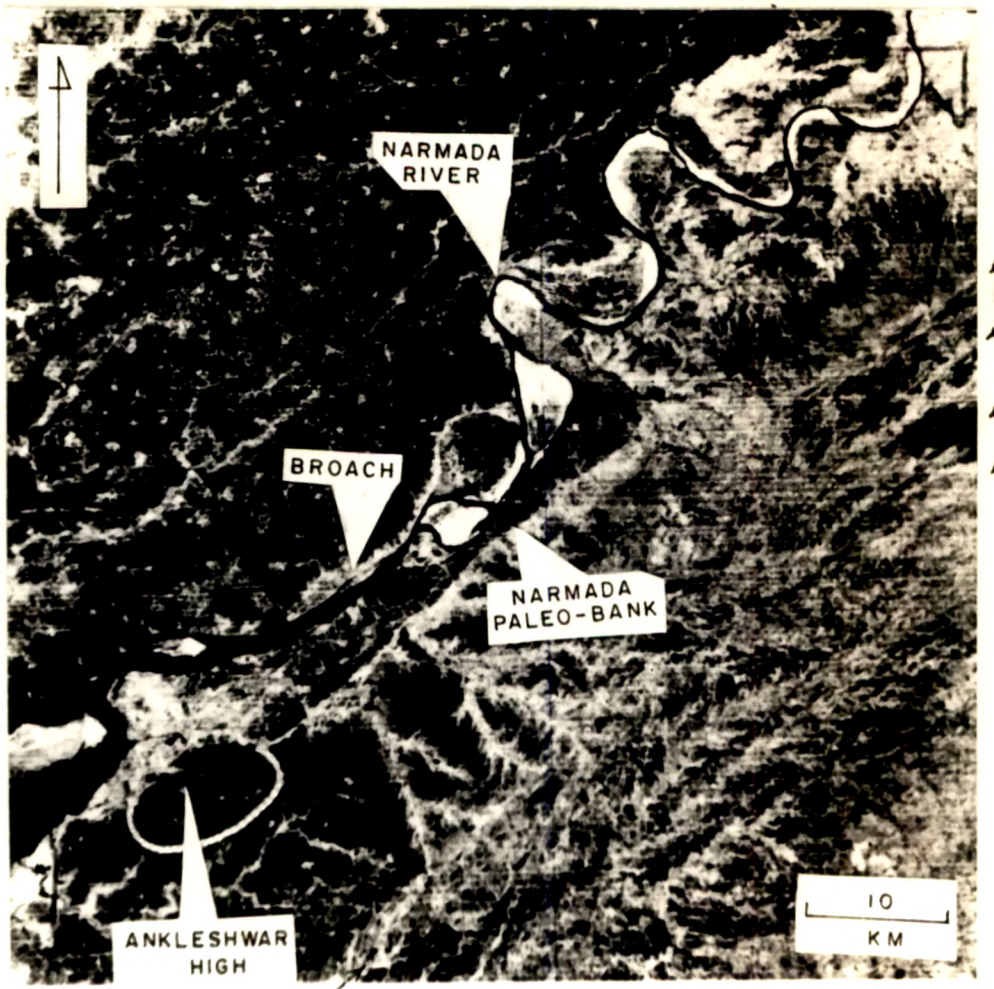

INTERPRETED STRUCTURAL FEATURES
FROM LANDSAT IMAGE
73°00'
22°00'
73°30'
NORTHERN CHANNEL
CURVILINEARY FEATURE
ALIABET ISLAND
EARTHQUAKE
BROACH
NARMADA RIVER
SOUTHERN CHANNEL
NARMADA R.
NARMADA RIVER PALEOBANK
ANKLESHWAR HIGH
DADHAL HIGH
SIRSIA HILL
BHURI ANT.
TOLODRA LIMIT HIGH
ALLUVIUM
EXPOSED TERTIARIES
DINOD-DUNGRI HIGHS
KOSAMBA HIGH
LINEAMENTS IN DECCAN TRAPS
TAPTI R.
SURAT
21°30'
LEGEND
L LINEAMENT
H GEOMORPHIC HIGH
0 20
KM

PLATE VIII-1

LANDSAT IMAGE SHOWING GEOMORPHIC FEATURES



Anklesvar high while the curvilinear part in the WSW suggests the circumventing of the left bank of the Narmada river when it was flowing close to the NNW dipping flank of the Anklesvar anticline.

A two-way-time seismic section, across the geomorphic features, representing the Anklesvar anticline and the Narmada river paleo-bank, shows that the southern part was uplifted and the northern down-faulted along a reverse fault (Fig.VI.2.A) hading SSE. In an earlier paper, the author has designated this as the Narmada reverse fault (Agarwal,1983). This fault affects only the eastern part of the Anklesvar anticline and seems to align itself with the trace of the Narmada river paleo-bank. This point to the reactivation of the fault during the Quaternary times thereby limiting the course of the left bank of the Narmada river. The area south of this feature is found to be structurally high, characterised by the presence of Anklesvar, Dadhaland Jhagadia anticlines (Fig.VI.2).

That the Narmada river migrated NNW-ward is evidenced from the consistent cutting of the right bank and the presence of cliffs all along the bank (Plate V.8.B). The northward migration of the river is attributed to the continued tilt of the Anklesvar-Jhagadia high trend toward north. Due to this tilt, of the two bifurcations of the Narmada river circumventing the Aliabet Island, the main channel is observed to be the

northern one on the Landsat Image (Plate VIII.1). This further suggests that in due course of time the southern channel may be abandoned and the river shall be flowing through the northern channel alone.

The Aliabet island is another significant geomorphic feature which seems to have taken its shape in Quaternary times. The ENE-WSW trend of the Aliabet island is similar to that of the Anklesvar anticline, and the southern channel of the Narmada river passes in between these two structural features (Plate VIII.1). The uplift along the Aliabet island was in all probability along two parallel faults bordering its northern and the southern limits, and trending ENE-WSW. The northerly tilt of the island similar to that of the Anklesvar block is reflected in the main flow of the Narmada river along the northern channel.

In the Kosamba area prominent ENE-WSW lineaments are observed on the Landsat Image (Plate VIII.1, Fig.VIII.1). From the ground truth they are represented by the Kosamba-Dinod and Dungri anticlinal highs. The water divide of the Narmada and the Kim river passes along this area forming a subtle geomorphic high. Reactivation along faults, bordering the southern boundaries of these highs in Quaternary sediments, has given rise to these features.

A number of streams, in the area between the Anklesvar and Jhagadia towns, flowing NW-ward from the water divide of Narmada and Kim river, cut across the Late Tertiary rocks, and the unconformably overlying Quaternary deposits. These streams have cut through the entire sequence of Quaternary and a few meters of Tertiary rocks thereby providing conclusive indications of neotectonic processes.

Recent neotectonic activity in the area is evidenced from the occurrence of 1970 earthquake of Broach (Fig.VIII.1). The earthquake was of an appreciable magnitude (5.4 CGS) causing considerable damage to the Broach town and nearby villages. According to Gupta (1972) the epicentre of the earthquake was about 6 km WNW of Broach town, and the earthquake was by the movements along some pre-existing fault in the Eocene sediments of the deepest part of the Cambay basin near Broach town. The alignment of the fault was interpreted to be N 92^{o}E on the basis of macroseismic evidences, mapped faults and the conspicuously straight course of the Narmada river in that region. Geological investigations and the analysis of both geological and geophysical data by the present author, typically and conclusively point to a release of compressive stresses through the Narmada reverse fault close to Broach town resulted in the earthquake.