CHAPTER - IV

M E T H O D O L O G Y

GENERAL

The author has approached the various problems involved in the present investigation in four ways; firstly he has mapped the area with the aid of air-photos and ground checking, mapped the field relationship of different formations and traced their lateral continuity, and collected samples; secondly he examined the samples in detail for faunal contents; thirdly he carried out sedimentological studies of samples from the arenaceous lithounits; and fourthly studied the Landsat Image, air-photos and topographical maps

of the area of study and adjoining areas for mapping structural features, faults, lineaments, geomorphic features, drainage pattern and neo-tectonics coupled with field mapping.

To delineate structural features and associated faults, a detailed study of air-photos of the entire area of study and field mapping was carried out. Various trends on air-photos were traced and their structural and lithological control were identified by ground checking. Geological map thus prepared (Fig.IV.1) indicates considerable variation in lithological and structural details which were not mapped earlier. Detailed geological mapping was thus carried out on air-photos with ground control. Representative samples were collected from various exposed lithounits.

It has been clearly emphasized by the present author that his investigations were aimed at establishing all possible connections between the surface and sub-surface Tertiaries, and thereby prepare an integrated picture of the Cenozoic history of the Cambay basin rocks. To achieve his objectives, he had to evolve a methodology wherein considerable emphasis was placed on the field mapping of Tertiary outcrops as well as Quaternary deposits. The landform studies, together with evaluation of drainage characteristics also were carried out with a view to establish the continuity of tectonic

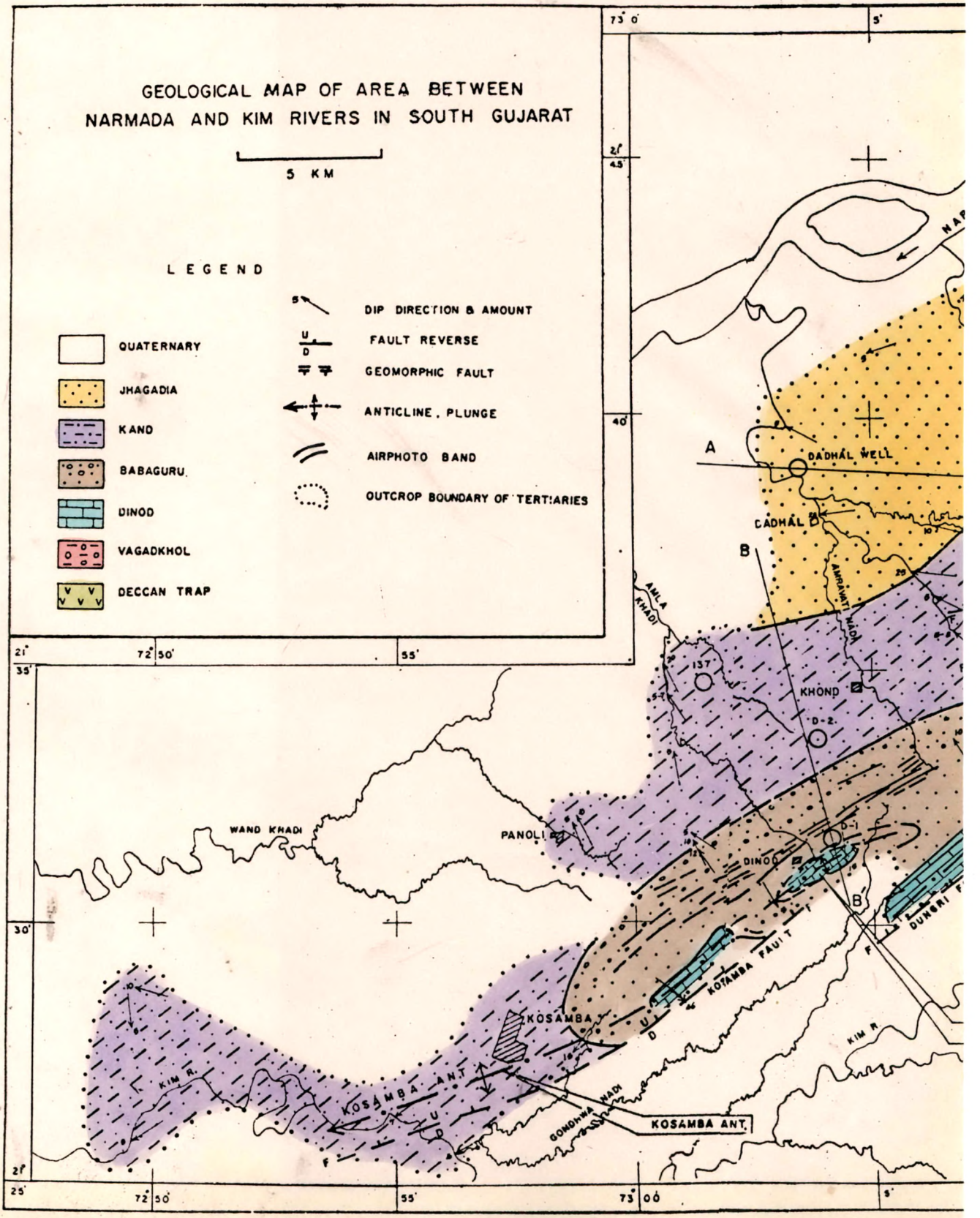
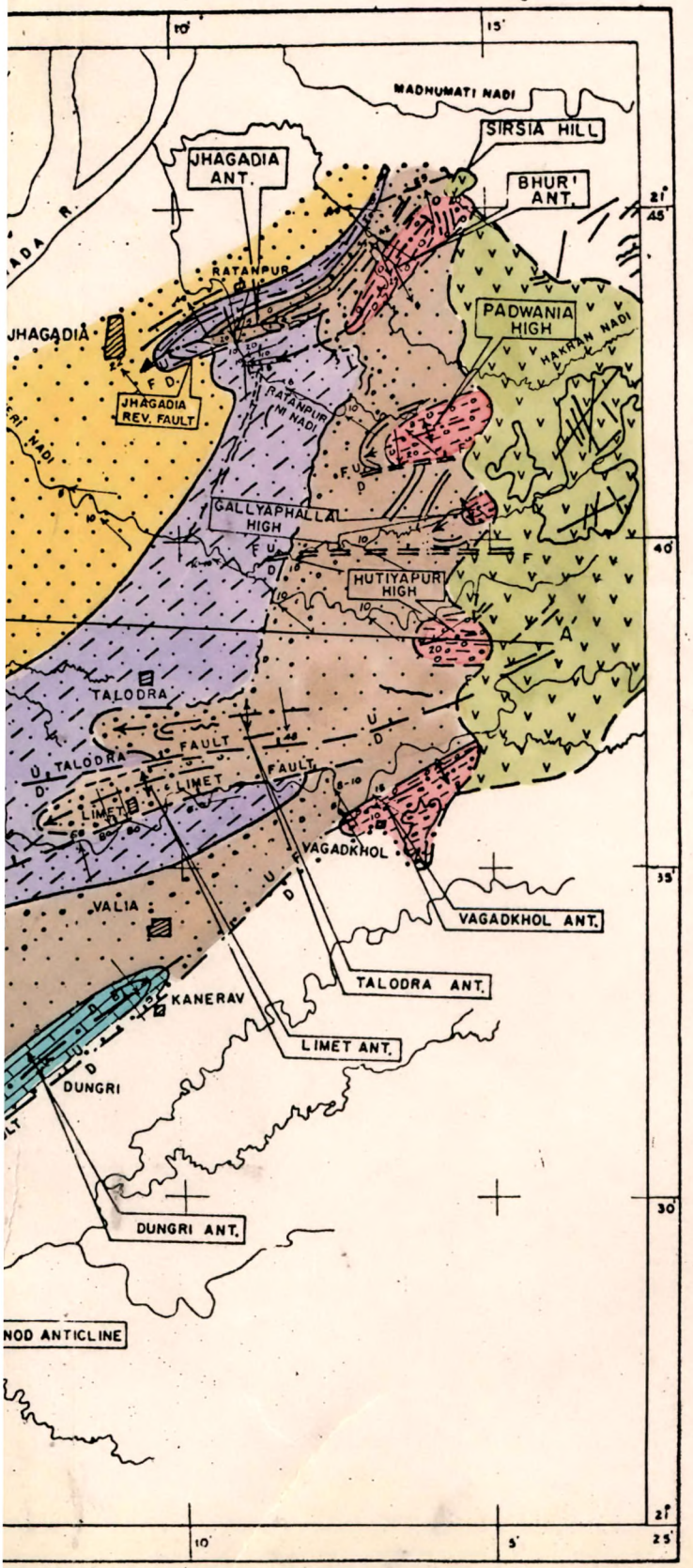

GEOLOGICAL MAP OF AREA BETWEEN
NARMADA AND KIM RIVERS IN SOUTH GUJARAT
5 KM
LEGEND
QUATERNARY
JHAGADIA
KAND
BABAGURU
DINOD
VAGADKHOL
DECCAN TRAP
DIP DIRECTION & AMOUNT
FAULT REVERSE
GEOMORPHIC FAULT
ANTICLINE, PLUNGE
AIRPHOTO BAND
OUTCROP BOUNDARY OF TERTIARIES
73° 0'
5'
21° 45'
40'
A
DADHAL WELL
DADHAL D
B
AMRAVATI NADI
AMLA KHADI
137
KHOND
D-2
D-1
WAND KHADI
PANOLI
DINOD
B'
DUNGRI F
KOSAMBA FAULT
KOSAMBA
KOSAMBA ANT.
KIM R.
GONDHWA NADI
KOSAMBA ANT.
KIM R.
21° 35'
72° 50'
55'
30'
21° 25'
72° 50'
55'
73° 00'
5'

Fig IV · 1


MADHUMATI NADI
SIRSIA HILL
JHAGADIA ANT.
BHUR' ANT.
RATANPUR
JHAGADIA
PADWANIA HIGH
HAKRAN NADI
JHAGADIA REV. FAULT
RATANPUR NADI
GALLYAPHALLA HIGH
HUTIYAPUR HIGH
TALODRA
FAULT
LIMET
VAGADKHOL
VALIA
VAGADKHOL ANT.
TALODRA ANT.
KANERAV
LIMET ANT.
DUNGRI
DUNGRI ANT.
NOD ANTICLINE
10'
15'
21° 45'
40'
35'
30'
21° 25'
10'
5'

processes through Tertiary into Quaternary. The field studies had to be appropriately supported by a variety of laboratory investigations of the samples collected. The available subsurface information, when interpreted in the light of the results obtained by the present author, has enabled him to arrive at conclusions which throw new light on the Tertiary sequence, and also explain quite a few unexplained aspects.

The field work by the author was carried out during the winter months of 1981, 1982 and 1983. He carried out the geological mapping of the exposed Tertiary and Quaternary sequences between the Narmada river to the north and the Kim river to the south bounded by longitude $72^{\circ}45'$ E to $73^{\circ}17'$ East and Latitude $21^{\circ}23'$ North to $21^{\circ}45'$ North, included in topographical sheet Nos. 46 C-14 & 15 and G-1,2 and 3 (Fig.I.1). The geological mapping compresed study of the air-photos of scale 1:25,000 followed by ground checking and tracing of various litho-units along the strike in the field. Thus, a fairly accurate map on a scale of 1:25,000 could be prepared. The various geological, geomorphological features, faults, folds, sample position, dips and strike of beds, important topographic features and location of field photographs have been shown in the map (Fig.IV.2).

SEDIMENTOLOGICAL INVESTIGATIONS

The samples of sandstones and conglomerates collected from

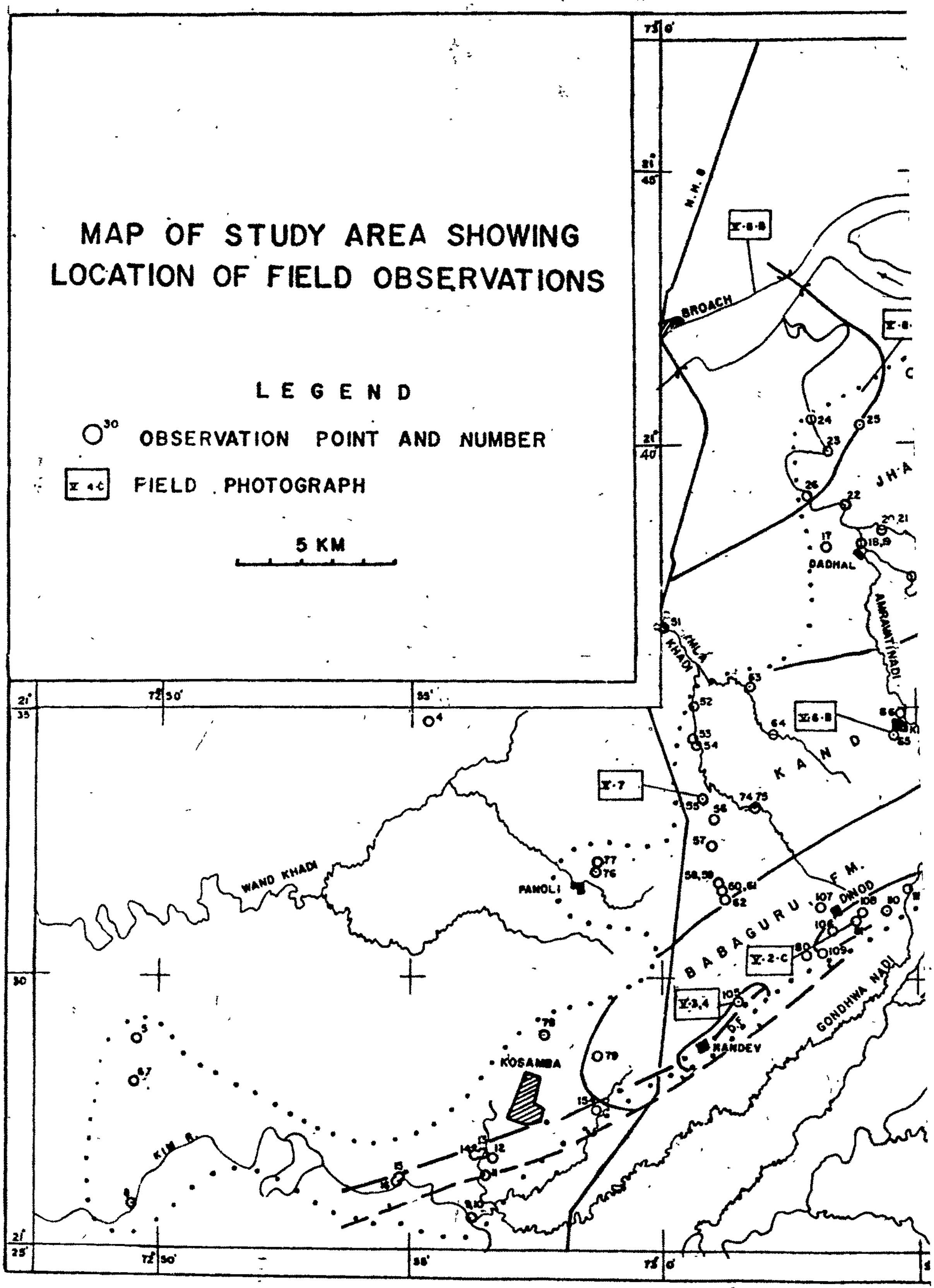
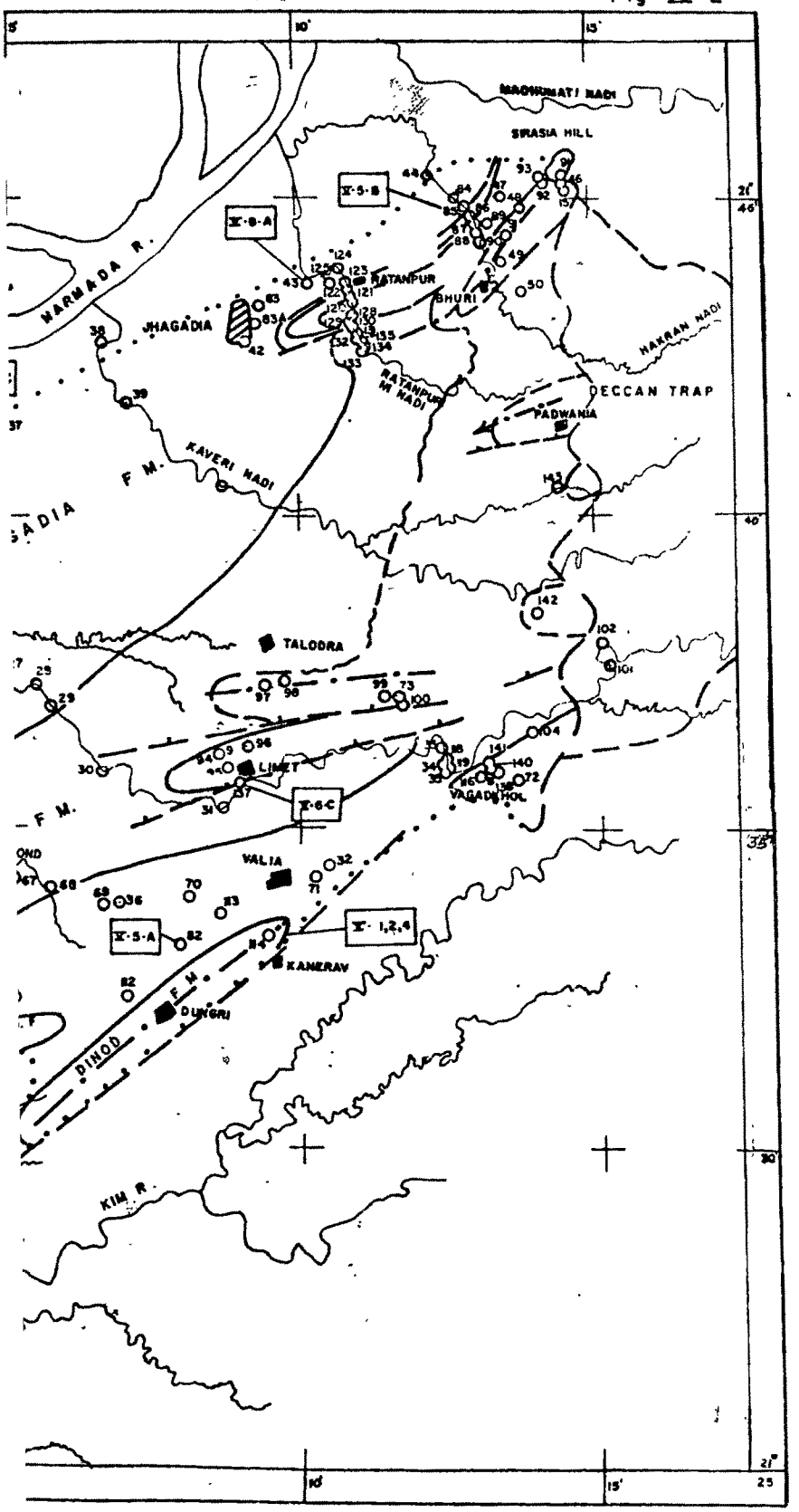

MAP OF STUDY AREA SHOWING
LOCATION OF FIELD OBSERVATIONS
LEGEND
OBSERVATION POINT AND NUMBER
FIELD PHOTOGRAPH
5 KM
BROACH
DADHAL
AMRAVATI NADI
KAND
PANOLI
WAND KHADI
BABAGURU F.M.
DHOD
GONDHWA NADI
KOSAMBA
RANDEV
KIM R.

Fig IV·2


MADHUMATI NADI
SIRASIA HILL
NARMADA R.
JHAGADIA
RATANPUR
BHURI
HARSAN NADI
DECCAN TRAP
PADWANIA
RATANPUR NADI
F M.
KAVERI NADI
TALODRA
LIMET
VAGADKHOL
VALIA
KAMRAV
DUNGRI
DIHOD
KIM R.

various lithounits of all the formations were studied for their mineralogical composition. The treatment of the samples consisted of distintegration or breaking down of the samples into two or more suitable fractions. The samples were first soaked in water for about 24 hours. In the case of samples having calcareous cement treatment was given with a cold dilute hydrochloric acid of about 10 percent concentration. The treated samples were thoroughly washed with water to remove acid completely. The samples were then crushed. Precautions were taken while crushing the samples so as not to break the individual grains. After crushing the samples were again washed and dried. Two fractions of plus 120 and plus 230 mesh (American Society for Testing Material - ASTM) were selected for the study of heavy minerals as well as light mineral fraction. The samples were seived by using a set of 4 sieves of 100,120,200 and 230 mesh. The selected fractions were then subjected to separation of heavy and light minerals using bromoform (tribrom-methane, $CH Br_3$) of specific gravity 2.89 as the separating medium. The heavy and the light crops thus separated were drawn off, and collected on separate filter papers, and subsequently washed with acetone to remove the bromoform completely. These separates were then dried and mounted on glass slides with canada balsam for microscopic examination.

The heavy minerals were examined under a microscope with a view to know the source rocks and provinances of the desired sediments. The light fractions were studied so as to know the

mineralogical composition of the rock and about the sedimentary processes and depositional environment that affected their sedimentation.

TECHNIQUE OF FAUNAL STUDY

SAMPLE TREATMENT

The samples collected from the limestones and coquina beds exposed in the area of study near Nandev, Dinod and Dungri villages as well as the limestones and marl samples from the Kand formation were analysed for their faunal contents. A total of 20 samples were processed and examined. Nearly all the samples consisted of hard and compact limestones, and yielded a rich assemblage of foraminifera which have been identified for age determination.

In order to process the samples, the techniques of Cushman (1959) and Jones (1956) were used. The methods employed for the extraction of fossils from the rock samples consisted of treating and boiling of the samples for disintegration, washing and drying, and finally sorting and mounting.

The soft friable samples were soaked in water and two table spoons of soda ash was added, kept overnight and then boiled for two to three hours. The moderately hard samples

were lightly hammered to obtain small pieces and then were soaked in a 15 percent hydrogen peroxide solution for about 24 hours. The cleaning process included washing, drying and using of 3 standard ASTM sieves of 40, 80 and 150/200 mesh. Care was taken to keep the sieves clean and dipped in Methyl blue solution to colour the left over material of the sieve to avoid contamination.

The washed residue was transferred in enamelled bowls and kept in an oven for drying at a temperature of about 40°C for nearly an hour. The picked specimens of fauna were placed in cardboard slides. The specimens were fixed in the chambers of the slide by glue and a drop of dilute phenol solution was added to prevent fungal growth and decomposition. A few thin sections of limestone samples and individual fossils were prepared for the following studies:

1) Oriented thin sections of individual fossils for internal morphological study, and
2) General rock sections for petrographic study.

The larger foraminifera were cut along axial and equatorial planes for internal morphological studies. A few thin sections of the hard limestone were also prepared for petrographic studies to know the mineralogical composition, grain size, sorting, shape of the grains and contacts between the grains.