Chapter - 7

CHAPTER - VII

MEGA FOSSIL LOCALITIES AND DINOSAURIAN FOSSIL FINDS

VII.1. COLLECTION AND STUDY OF MEGAFOSSILS:

The mega fossils include the *dinosaurian* skeletal elements and ichnofossils at Anjar, Dayapar, Tharauda, Ratanpur, Pakhera, Patcham Island and the Fatehgarh areas. The *dinosaurian* and associated fauna and flora of study areas occur in rocks of varied geological ages, starting from Middle to Upper Jurassic to Palaeocene. These fossils have been preserved in different types of rocks deposited under varied environmental conditions, hence they show different modes of fossilisation and preservation. As a result, the treatment to each of them varies from place to place depending on the host rock in which they are enclosed. A brief account of their distribution in time and space and host rocks, is compiled in the Table-6.

VII.1.1. Dinosaurian Fossil Bones of Anjar and Patcham Island:

VII.1.1.1. Anjar Area:

In order to gain more details, fresh excavations and detail mapping were carried out by the author. A pit of about 8 m x 6 m was planned on the site where the *Dinosaurian* bones were found first. The excavation pit was located near a small nallah bank (Fig-4). It encountered black cotton soil, white marly fossiliferous limestone, banded chert, porcellanite, brown grey and black carbonaceous fossiliferous shale at depth. The pit was abandoned in the black fossiliferous shale after exposing the fossiliferous layer within the excavation pit.

The exposed fossils were thoroughly cleaned on the upper side. A detail plan of the excavation pit was prepared on 1:100 with the help of tape and compass by fixing reference points at 0.50 m grid along north-south and east-west reference lines (Fig-12). The fossils had not undergone replacement and were preserved within the impervious grey and black shale. They do not show calcification or silicification and hence they are very fragile and delicate in nature. They show much cracks and fractured nature. The fractured parts were joined with the help of favicol, acripol or araldite wherever possible, after cleaning and hardening the fossils, before subjecting to plastering. The fossils were first covered with thin cloth/paper on which frame work of bamboo sticks and clips were provided on the surface of fossil along length-width. The fossils were then covered with a cloth on which thick coating of plaster of Paris was applied to impart strength to the fossils during transportation. Thus, upper half side of the fossil specimen was covered with plaster of Paris. The remaining lower half was covered in the similar way and plastered. The lower half was not thoroughly cleaned before plastering as there was shortage of resins and favicol. The specimens were photographed in insitu position after exposing and cleaning and before plastering and before preparing detail plan (Fig-12; Plate-VI/1 & 2).

PLAN SHOWINGS DINOSAUR FOSSILS THE EXIAVATION PIT
SCALE

Fig. 12 Plan showing the excavation pit at Anjar, Kutch

Table-6: Brief Classification of Main Units:

Age	Formation	Units' Lithology	Fossils
Palaeocene to Upper Cretaceous	Anjar Formation (Kutch Deccan Traps)	Lava flows-5,6,7 with intertrappean bed between 6 & 7.	Major mega fossils are absent
		Flow 4	
		Intertrappean bed-3. Limestone, chert, shales, clays.	Dinosaurian bone fossils, plants
		Flow 3	
		Intertrappean bed-2. Porcellanites, clays, tuffs, agglomerates and shales.	Bone fossils, eggs, plants
		Flow 2	
		Intertrappean bed-1. Bentonite, clays, tuff, sand.	-
		Flow 1	-
Upper Cretaceous	Bhuj Formation Upper Member app.800-1000 m to	Variegated, friable, felspathic, sandstone, clays, ironstones.	Dinosaurian tracks, traces of Fatehgarh
Lower Cretaceous	Lower Member app. 500 m	Ironstones, shales, friable sandstones and intercalated sequence.	Dinosaurian tracks of Pakhera
Lower Cretaceous	Katrol Formation 350-400 m to	Calcareous sandstones, intercalated sequence of sandstone, shale and shale intercalations with siltstone.	Foot prints, foot tracks in upper unit at Tharauda
	Middle Member	Grey, gypseous shales.	-
	Lower Member	Intercalated sequence.	-
Upper Jurassic	Chari Formation 350-400 m app.	Dhosa Oolites and mainly limestones, shales, calcareous sandstones and Golden Oolite at base.	-
Upper Jurassic	Patcham Formation +350 m app.	Calcareous sandstone, intercalated sequence of sandstone and siltstone, calcareous sandstones and shales.	Petrified bone fossils- Nirwandh & Chapri Bet.
Middle Jurassic		Granite pebble conglomerate.	-

Plate VI/1 Photograph of the excavation pit in plan showing lay out of the exposed fossils in bone bed.

Plate VI/2 Section of dinosaur pit showing locations in plan from A to H for detail sections of study of lateral variation of units.

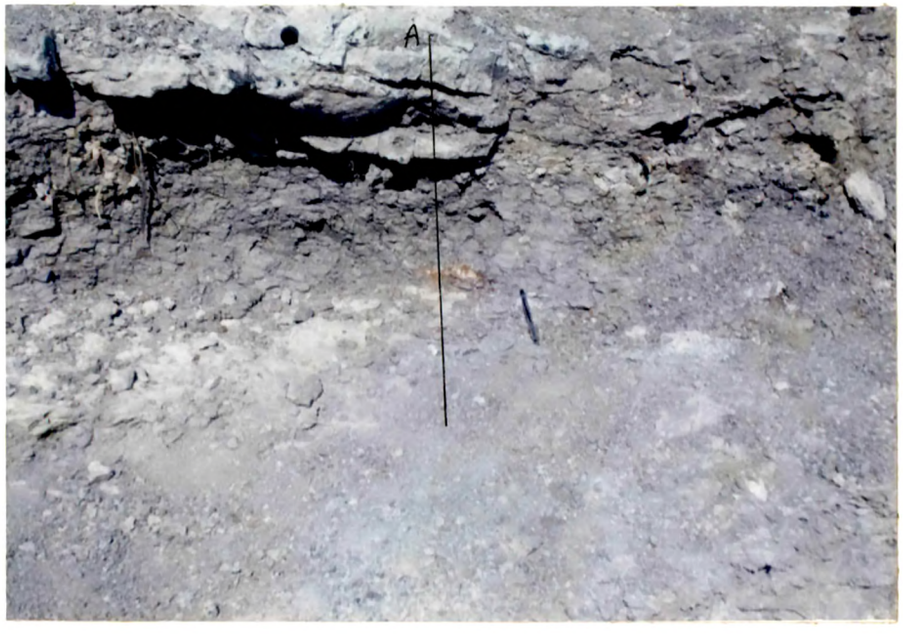

Plate VII Section of dinosaur pit showing detail sections for study of lateral variation of units at A, B, C and D.

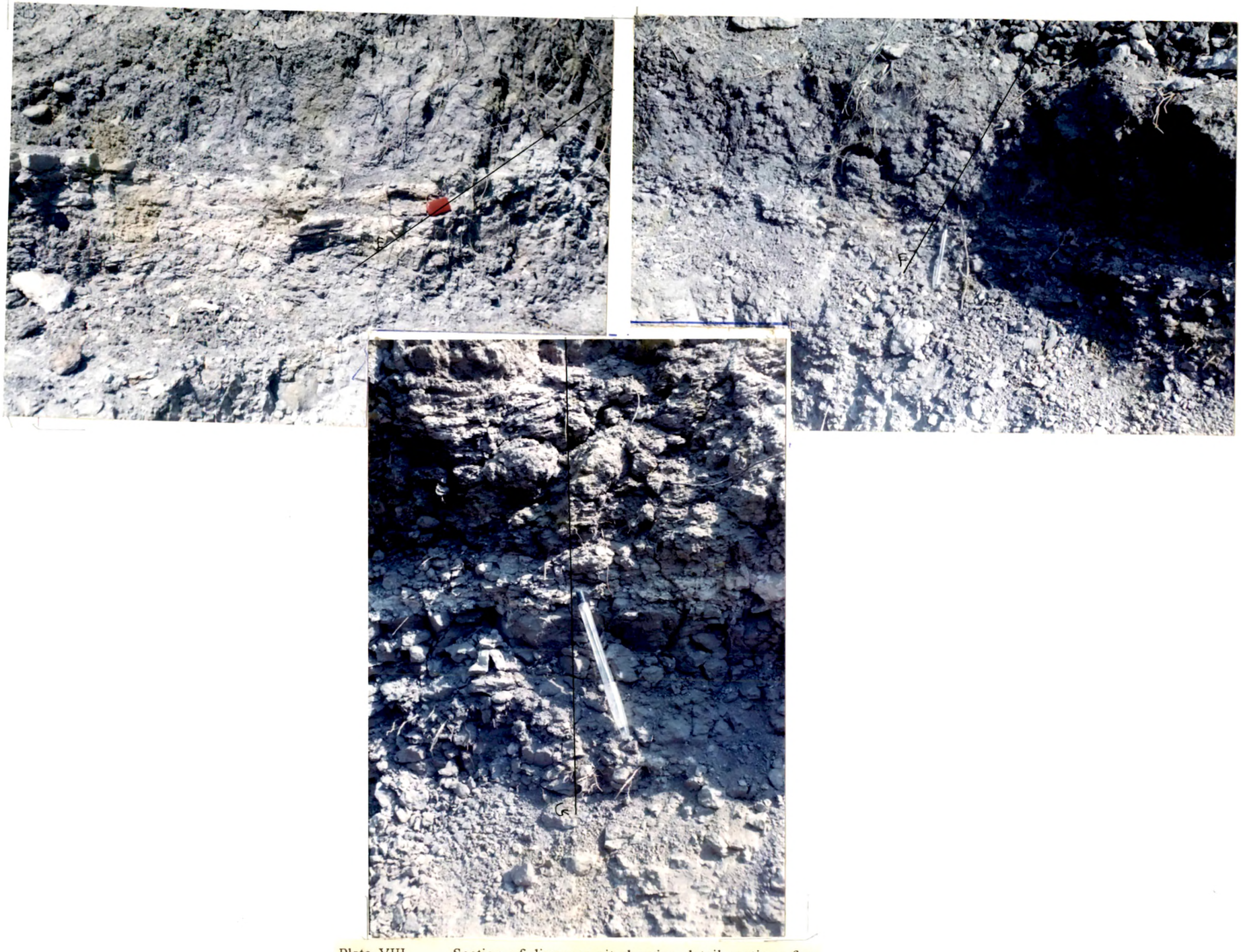

Plate VIII Section of dinosaur pit showing detail sections for study of lateral variation of units at E, F and G.

Plate IX Section of dinosaur pit showing detail sections for study of lateral variation of units at H and I.

Plate X/1 Close-up view of the lithological horizons. The chocolate coloured shale (1), bone bed (2) and the underlying black shale (3).

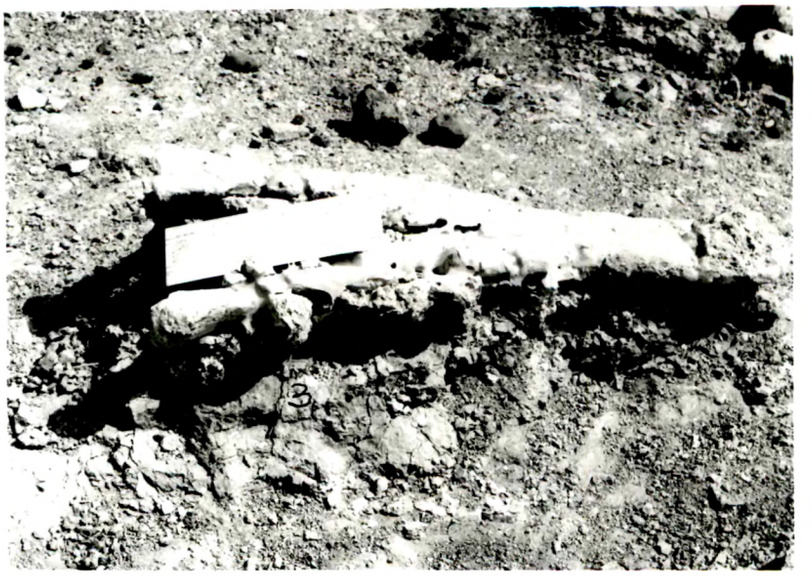

Plate X/2 Detail section of basal black shale and overlying chocolate coloured shale (2, 3).

VII.1.1.2. Transport of the plastered fossils:

The plastered fossils were thoroughly wrapped in paddy grass and tied properly to prevent any dislocation of the parts of fossils while in transport.

These fossils have not undergone any process of fossilisation, which would impart strength to them. As a result, they start losing moisture on exposure to atmosphere and develop cracks. To prevent damage to the bone fossils and for further hardening liquid acripol was applied to the cracks/fractures in the fossils.

VII.1.2. Dinosaurian Foot Tracks and Foot Prints at Fatehgarh:

The *dinosaurian* foot prints occur on the top of the bedding surface of the burrowed quartzitic sandstone of the Upper Member of Bhuj Formation (Plate-V/1,2). The foot prints comprise of different size groups. The foot prints occur as progressive in westerly southwesterly direction from east / northeast. These foot prints were first grouped into different shapes and photographed (Plate-V, Fig-13 & 14). Detailed sketches were prepared for different size and shape groups to show detail of morpho-metry and morphological features (sketches 1, 2 and 3). The details of claws, muscular scars, parts and digital impressions, angle of inclination of foot prints, rear and front sides etc., were determined and marked accordingly. After analysing different shape/size of groups, the foot prints were marked into *pes* and *manus*, right/left and the direction of progression was determined (Fig-14 and 15 B and D). These were used to determine and measure type of overlapping relationship of *pes* and *manus* types of coupling and gaits based on standard procedures and calculations (Searjant, 1979; Bird Lockely, et.al., 1990).

After determining the *pes* and *manus* and right and/or left foot prints, a possible reconstruction of foot tracks of different age groups were identified on the outcrop and numbered and photographed accordingly (Plate-III, IV, V). These were then mapped with the help of the tape and compass by fixing reference lines on 0.5 m grid along north-south and east-west reference lines. Thus, a detailed plan of the foot prints was prepared (Fig-15/B, D).

These measurements were used to calculate the speed of motion, hip height, possible weight and *pes/manus* structures of the trace maker based on the standard case histories and literature (Searjant, 1979; Lockely, et.al., 1990). Further, the detail plan of the foot prints was also used to study the social behavioural patterns and other important aspects related to the life cycles of the *dinosaurian* communities of different groups. The study of the *dinosaurian* foot prints at Fatehgarh has indicated that there were at least three age groups in the same herd. Some important information derived from their foot prints is used for ecological and environmental inferences.

VII.1.3. The Dinosaurian Foot Prints at Tharauda and Pakhera:

The *dinosaurian* foot prints at Tharauda occur on the top of bedding surface of the calcareous sandstone of the Katrol Formation and on the top of a baked ferruginous

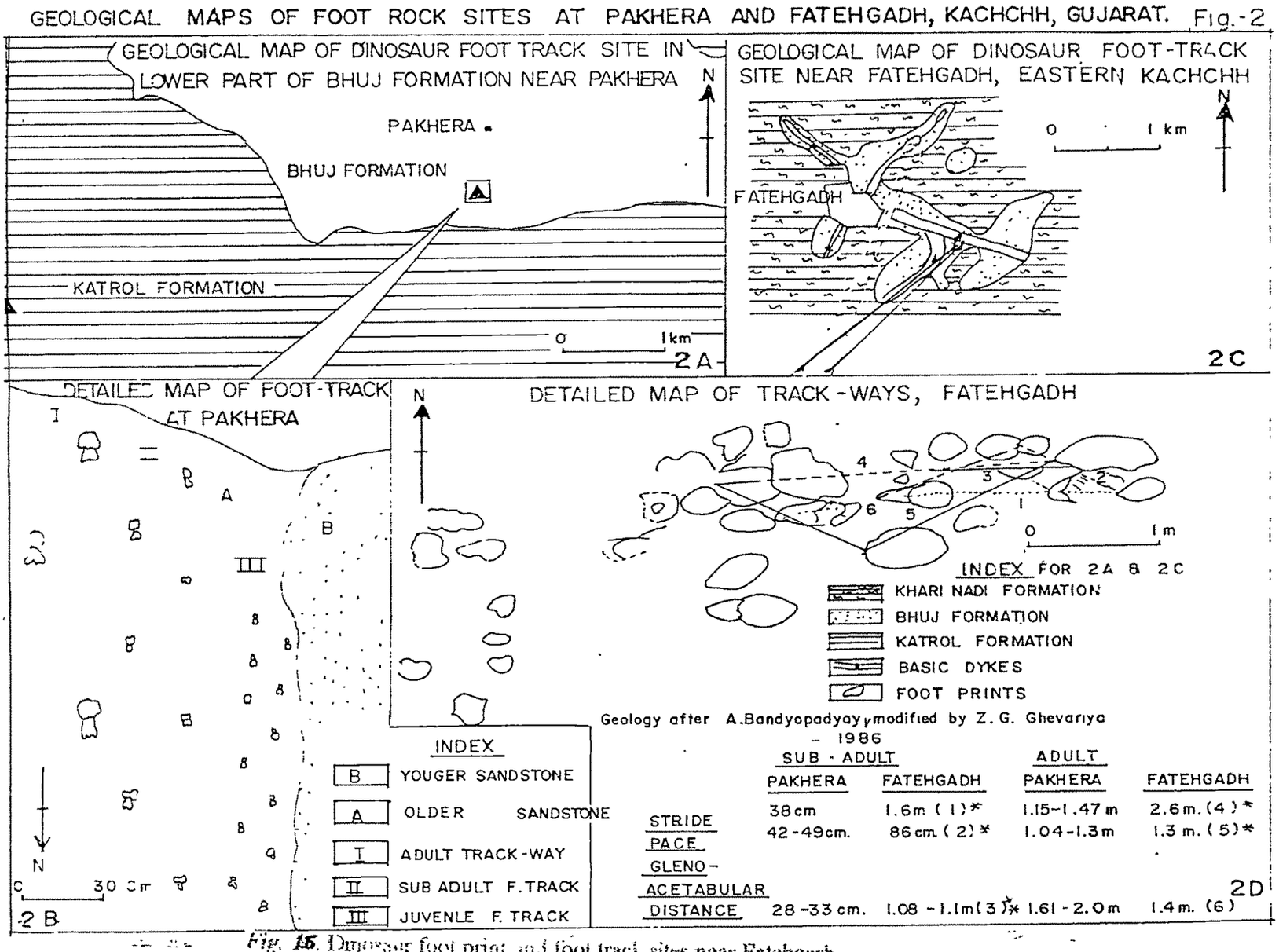

Fig. 15. Dinosaur foot print and foot track sites near Fatehgarh, Kutch.

sandstone of Lower Member of Bhuj Formation at Pakhera (Fig-10, 15 and 16).

These foot prints were also analysed marked in to left and right, and the direction of progression was determined in the similar way like that of Fatehgarh. The foot prints at Tharauda are of bipedal tridactyle type. They are of *Theropod* and *Ornithischian* types. The traceable foot tracks length is about 60 m. The *ornithischian* foot prints show progression in southwesterly direction, whereas *theropod* foot prints show progression in north-north-easterly direction (Fig-16).

These maps were used to calculate pace, angulation, gaits, stride and speed of locomotion and body height of the animals.

Similarly the detail study of the *quadruped dinosaurian* foot tracks at Pakhera was also carried out and the detail plan of the foot prints was prepared which was used for studies of important life habits of *dinosaurian* herds (Fig-15).

After preparing detail plans and maps of the foot prints, the plaster casts of the foot prints were prepared for each group type, based on morphology, shapes and size. For these plaster casts of different type groups, foot prints were first cleared thoroughly, then covered with tissue paper and then a paste of plaster of Paris was filled-in completely in the depressions of the foot prints depending on the morphological out line. These casts were removed from the foot prints on drying and kept in the museum after coating with varnish/resins

The *Dinosaurian* fossils at Dayapar are highly replaced beyond recognition and are highly fragmentary in nature.

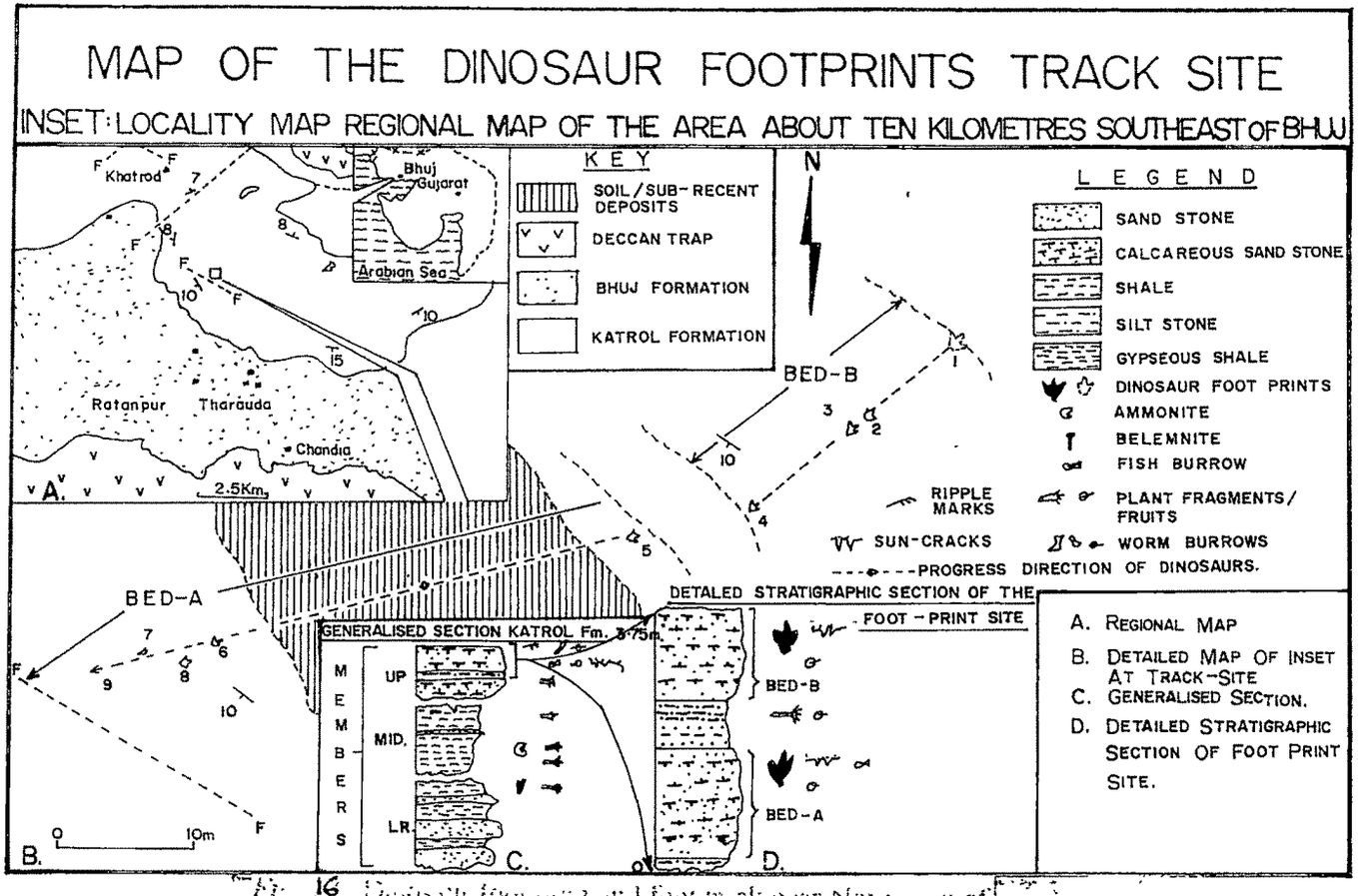

Fig. 16 Dinosaur footprint and foot track near Northeast of [illegible]