CHAPTER - I

INTRODUCTION

India is quite rich in Tertiary fossiliferous exposures. These are spread out in many parts of our country. The major exposures which have yielded rich mega fossil assmblages belong to Deccan Intertrappean series, the lower siwalik beds of Northern India, Tipam series of Eastern India, Cuddalore series of sourthern India , and Dupitila series of eastern India. These range in age from early Eocene to Miocene - Pliocene period. Apart from these Tertiary beds are found at Warkallai in Travancore, at Neyveli in South Arcot District, at Palana in Bikaner and at Dandot in West Punjab. These have yielded rich microfossil flora.

Study of these mega and microfossil exposures have yielded a valuable information which has thrown light on the past floras and past ecology of our country.

DECCAN INTERTRAPPEAN BEDS :

Amongst the Indian Tertiary exposures mentioned above earliest and the best preserved plants are found in the Deccan Intertrappean beds. The oldest Angiosperm fossils of our country are found in these beds. The vast peninsular region lying between the rivers Narmada and Cavery is traditionally referred to as Deccan. Since

the major rock type found in the Deccan is "Trap" the part is also known as Deccan Trap country.

Deccan plateau is the largest and the most pronounced plateau of India. Abutting against the Sahyadri on the West it extends from 22° N southwards of Tapti-Purna, limited on the east by Waiganga Pranhita - Godavari and including the Mysore plateau on the south. It covers an area of 7,00,000 sq.kms. Topographically the Deccan Plateau is subdivided into three broad sections, Maharashtra, Karnataka, and Telangana. The Maharashtra plateau is mainly formed of lava

GEOLOGY OF THE DECCAN INTERTRAPPEAN BEDS :

The Geology of the Deccan traps and their intercalated sedimentary beds has been discussed from time to time by geologists like Malcolmson (1837), Oldham (1871),Matley (1921), Holland (1926), Wadia (1957) and Krishnan (1960,1968).

In the Peninsula, the end of the Mesozoic era was characterised by the pouring out of extensive lava flows, which were erupted mostly through fissures and occupy a major portion of the Daccan plateau. The out bursts of lava continued over a long period of time and

resulted in the deposition of a sheet of lava thousands of feet in thickness, now called "Deccan trap". The thickness of the trap varies in different parts of the country from more than three kilometers near the cost of Bombay to only 60 feet in Belgaum.

The successive lava flows are commonly separated from one another by sedimentary beds which were formed under water and are known as the Intertrappeans. These beds are fossilferous and contain the remains of the ancient plants and animals.

The Deccan traps have been divided into upper, middle and lower groups depending upon the thickness of the trap, the nature of the intertrappean beds and the layers of the volcanic ash. Th upper traps are 450 meters thick, the middle traps are 1200 meters thick while the lower traps are only 150 meters thick.

The lower and upper traps contain fossiliferous intertrappean beds and are found in Maharashtra, Gujarath, Madhya Pradesh and parts of Karnataka like Gokak, Desur, Vicarabad etc.

AGE OF THE DECCAN INTERTRAPPEAN BEDS :

The age of Deccan Intertrappean series has been a controversial matter. The earlier geologists like Malcolmson (1837) and Hislop and Hunter (1855) suggested its age as early Tertiary. But later Banford (1867) and others suggested that it is late Cretaceous. However Oldham beleived them to be of Eocene age. The Cretaceous view was adopted later by Geological survey of India (Matley,1921, Holland 1926, Wadia 1926, Sahni 1934, and Sahni, Srivastava and Rao 1934,) for the first time suggested that the intertrappean plants had a strong Tertiary affinities. Since then much evidence has been put forth in support of Tertiary age by Sahni, his co-worker and others (Rao, 1936, 1950 ; Rao, Narayan Rao and Rao 1936 ; Narayan Rao and Rao 1937 ; Sahni 1937, 1938, 1941,1943 ; Sahni and Rode 1937 ; Sahni and Rao 1943 ; Mahabale 1950, 1953).

In 1938, Fermor suggested that the Deccan trap lava probably commenced at the very end of the Cretaceous period but were mainly erupted in the Lower Tertiary. Wadia (1957) suggested that from the external evidence it is quite apparent that the Deccan traps cannot be older than the Danian stage, of the

uppoermost Creataceous , while from the internal evidence of fossil fishes , palms and foraminifers they cannot be younger than Eocene. However Krishnan (1953,1968) opined that the Deccan Traps range from uppermost Cretaceous to earliest Eocene in Kathiawar, Gujrath and Kutch while in the rest of the area these are of Eocene age.

Lakhanpal (1973) and Chitaley (1974) think that Deccan trap range from uppoer Creataceous to Palaeocene in the age. Agarwal and Rama (1976) on the basis of Thorium dating technique have suggested that eruption of Deccan activity started in Gujarath and Kathiwar area in early Palaeocene and spread over almost the entire area. Basalts were laid in the middle of the Eocene (47 million years) in the North Eastern region near Chhindwara Amarakantak.

AGE OF DECCAN VOLCANICES :

Deccan Volcanism has been considered to be a Cretaceous Eocene event. This upper and lower age limits were fixed largely on the basis of stratigraphic and palaeontological data reviewed by Sastri (1981) and Chiplonkar (1986) Sastri (1981) has given the broad

time range of early Cretaceous to Eocene, Chiplonkar thought of upper Cretaceous to Palaeocene. Shivrudrappa (1981) on the basis of the studies of Charophytic remians in the intertrappean of Gurmatkal Karanataka has extended the upper age limit to Oligocene an age more cosistent with recent radiometric data. Wensink et al (1979)concluded that the Deccan volcanic activity lasted upto 5 million years at the most Mc lean (1985) put the period of errüption of Deccan basalts at only 0.58 to 1.86 million years.

DECCAN INTERTRAPPEAN EXPOSURES :

About 27 Intertrappean fossiliferous localities are now known (Map - I). These are scattered in a vast area of Deccan Plateau. Some well known localities are-

Bombay (Worli and Malbar Hills), Nagpur (Takali and Sitabardi hills, Mahurzari , Bharatwada) , Wardha, (Nawargaon, Margasur, Sindhivihira) , Jabalpure, Sagar (Khumaria and Barela), Mohgaonkalan, Keria, Seoni, Sitapur, Sausar,Samnapur and Parapani of M,P, Vicarabad of former Hyderabad state, Upperhatti, Desur (Belgaum District, Karnataka) , Rajahmundry (Dudukur, kateru of Andhra Pradesh), Kapurdi in Rajstan and Ghala and Anjor in Gujrath. Lamba et al (1988) have reported a new locality in Jabalpur district.

FLORA OF DECCAN INTERTRAPPEAN BEDS :

The investigations carried out on these localities have shown that the flora of Deccan Intertrappean beds is not quite homogeneous and consists of many ecological facies. For example, the flora of Mohgaonkalan was mainly an aquatic one along with which are preserved the neighbouring land plants (Lakhanpal 1968) . The small florule of Sausar also contains aquatic forms in which remians of Azolla intertrappea are abundant, besides numerous spores, fragments of Pteridophytes, fruiting characeae and some filamentous algae.

Nagpur-Bharatwada-Takali area consists mostly of land forms e.g. palms, Dicotyledonous woods, seeds, fruits and some conifers.

The fossil plants of Bombay are distinct from those of other localities likewise plant remains of Rajahmundry are remarkable for their aquatic charophytic and algal forms which thrive in brakish water. Further contributions made by Mahabale (1968) have added, Taxaceous and Podocarpaceous woods to this flora. From the above discussion it is clear that the intertrappean flora can be divided into small floras

like Nagpur - Chhindwara flora, Bambay-Malbar Worli flora etc. depending upon floristic composition and ecological facies as suggested by Lakhanpal (1968).

From this point of view it is necessary to make detailed study of plant fossils of as many intertrappean exposures as possible, to understand the floral variability and ecological amplitude of this large flora.

DECCAN INTERTRAPPEAN BEDS OF WARDHA DISTRICT :

With these aims in view the work of intertrappean exposures of Wardha district of Maharashtra was undertaken by Patil (1975), Shete (1979), Shenvi Prabhu(1985), Rao (1988), and continued by me. The main exposures investigated in detail in this work are found in Arvi Tehsil of Wardha district and are distributed between the forest villages Nawargaon, and Maragsur which covered a square area of 15 kms. These localities are rich in Dicotyledonous and Monocotyledonous woods.

Shukla (1941) first recorded a fossil palm Palmoxylon nawargaoensis and later on described one

more species of Palmoxylon P. sclerodermum Sahni from these beds (Shukla , 1946). Sahni (1964), also described a species of Palmoxylon, P. intertrappeum from the same area. The interest in the study of fossil plants of this region was revived after a gap of many years with the finding of fossil wood comparable with modern wood of Aristolochia by Kulkarni and Patil (1979). Later Prakash and Ambwani (1980) and Ambwani (1981) described two more species of Palmoxylon from these beds, one of which shows affinities with the moderen genus Livistona . Later on a fossil Borasoid palm root was described from Nawargaon by Ambwani (1981 a).

Similarly, Kulkarni and Patil (1977) and Shete and Kulkarni (1980), have also described two palm petioles Palmocaulon costapalmatum and P. hyphaenoidas. In addition a palm fruit Hyphaenocarpon indicun was described by Bande, Prakash and Ambawani (1982) and monocotyledonous rhizome Scirpusoxylom indicum was described by Shete (1986) are the recent additions to Nawargaon flora. Besides Aristolochioxylon prakashii described by Kulkarni and Patil (1979). The dicotyledonous plants so far described from these beds consists fossil woods comparable to the modern genus

Evodia, Amoora, Aeschynomene, Sonneratia, Ardisia, Heterophragma, Phyllanthus, Gmelina, of the families Rutaceae, Meliaceae, Papilionaceae, Sonneratiaceae, Myrsinaceae, Bignoniaceae, Euphorbiaceae and Verbenaceae respectively. (Shete and Kulkarni, 1982 ; Bande and Prakash , 1984 ; Bande, Prakash and Lalitha, 1986 ; and Bande 1986).

PHYSIOGRAPHY AND GEOLOGY OF WARDHA DISTRICT :

Physiography - The area is generally flat (970 feet R.L.) with hillocks rising to 1400-1500 feet elevations above main sea level.These hillocks are flat topped with gentle slopes as are typically found in other parts of the trap country. The main drainage in this part is by Bor river which flows north west to south west and its tributaries from north to south. The average rain fall is 121 cms per annum.

Geology - The area is covered with rocks of the Deccan Trap formation comprising massive basalts underlain by amygdaloidal and vasicular basalts with patches of tuff braccia. The basalts are generally fine to medium grained and dark gray in colour. The thickness of lava flow varies from 10 - 40 feet. The intertrappean beds

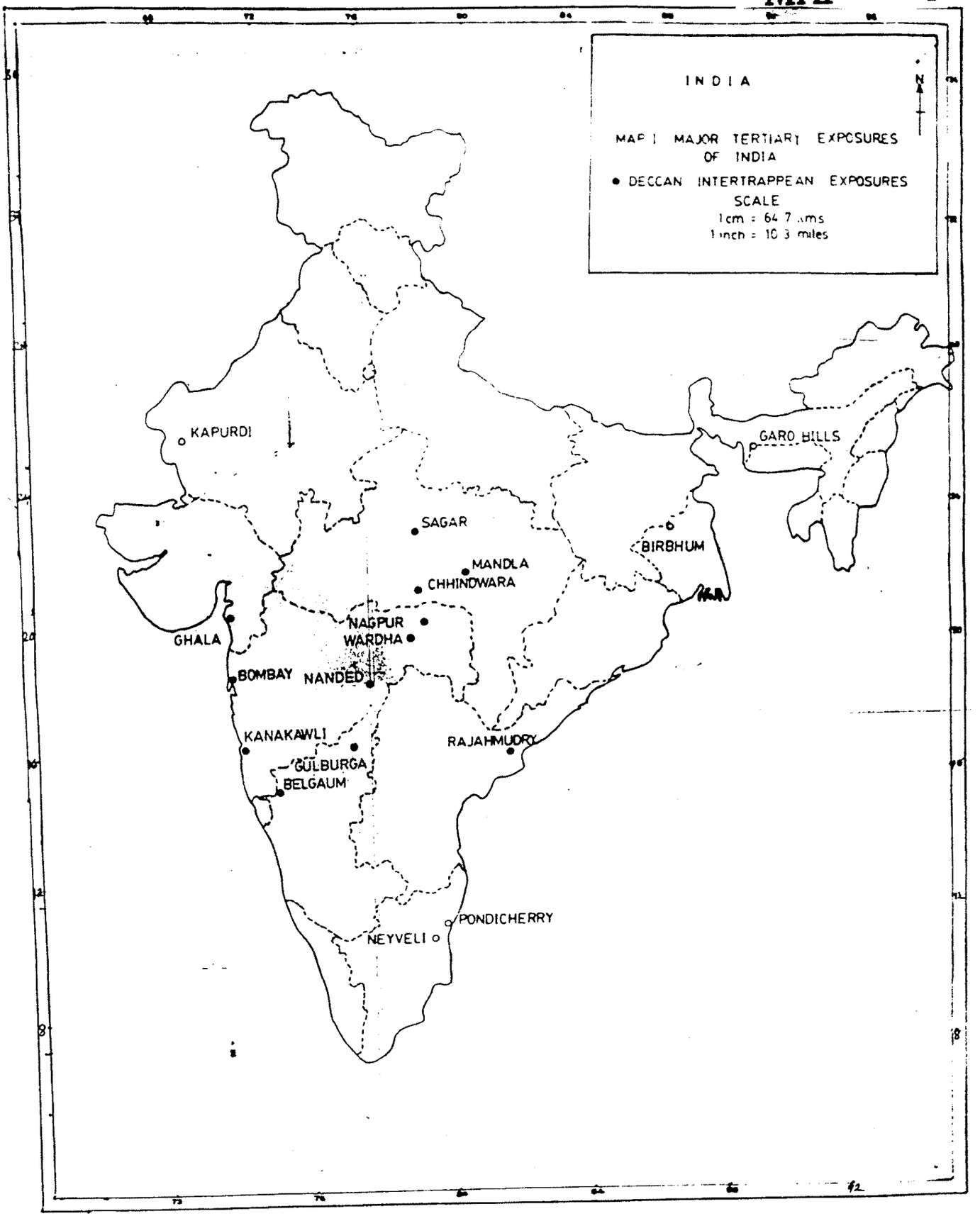
of yellowish to greenish yellow shales is found between massive basalts and amygadaloidal basalts. The intertrappean bed is 10 feet thick. It is horizontally disposed at some places.

The shales are fossiliferous. The main animal fossil being Physa. The general geological sequence of this area is as follows -

1. Amygdaloidal basalt
2. Massive basalt
3. Intertrappean shales
4. Amygdaloidal basalt
5. Massive basalt

The oldest rock formation exposed is the dark gray massive basalt followed by the brownish weathered amygdalodial basalt. This is overlain by yellowish brown to greenish gray Intertrappean bed of 10 - 16 feet thick. The intertrappean shale is overlain by massive basalt flow of 20 feet thick. This massive basalt is inturn succeded by greenish to dark gray amygdaloidal basalt which is exposed in the hillocks.

MAP - I


INDIA
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MAP I MAJOR TERTIARY EXPOSURES OF INDIA
• DECCAN INTERTRAPPEAN EXPOSURES
SCALE
1 cm = 64.7 kms
1 inch = 10.3 miles
KAPURDI
GARO HILLS
SAGAR
BIRBHUM
MANDLA
CHHINDWARA
NAGPUR
WARDHA
GHALA
BOMBAY
NANDED
KANAKAWLI
RAJAHMUDRY
GULBURGA
BELGAUM
PONDICHERRY
NEYVELI