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PALAEONTOLOGY AND PALAEOECOLOGY OF THE INTERTRAPPEAN (CRETACEOUS-TERTIARY TRANSITION) BEDS OF THE PENINSULAR INDIA

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ABSTRACT

Several fossiliferous Intertrappean beds (Nagpur, Asifabad, Vikarabad, Nizamabad, Rajahmundry and Madhya Pradesh) of peninsular India yielding a high diversity of animals, especially lower microvertebrates, have been studied. The biotic and lithologic analyses of these Intertrappean beds indicate deposition in warm, subtropical, lowland coastal plain environments. Further, the presence of typical marine elements, such as algae, fishes and foraminifera suggest the presence of an epicontinental seaway across peninsular India during the Upper Cretaceous-Tertiary transition.

The palaeomagnetic data, in accordance with palaeontological and geochronological studies, indicate that the Intertrappean beds of peninsular India are of near Cretaceous- Tertiary boundary.

INTRODUCTION

In peninsular India, the Intertrappeans or its equivalent Takli Formation are considered Cretaceous-Tertiary transition sedimentary sequences which have a wide geographical distribution in Central, and Western India and are found in thin lens-shaped scattered patches having variable lithology in each locality. The Intertrappean beds of peninsular India are generally considered to have formed by sudden blocking of drainage system immediately after the eruption of Deccan Volcanics, resulting in the formation of small and large enclosed basins separated by interfluvial divides. Recently, these sedimentary sequences have claimed the attention of world geoscientists regarding their age (Cretaceous-Tertiary boundary problem), initiation and duration of Deccan lava eruption, palaeoenvironment and palaeoecology, because these beds have yielded a diversified microvertibrate fauna indicating coastal plain environment of deposition. The present paper discusses the extensive faunal analyses and their palaeoecological implications for these Intertrappean beds.

The palaeontological studies of the Intertrappean beds have been carried out since 1981 on some selected ossiferous localities in Central peninsular India (Nagpur, Asifabad, Nizamabad, Vikarabad and Rajahmundry areas, fig. 1). At Nagpur and Asifabad regions detailed work has been done by Rana (1984) and Prasad (1985). Hora (1938) has studied the Deothan and Kheri localities. The subsequent work on the above areas has been carried out by Sahni (1983, 1984a, b 1987, 1988); Sahni et al., (1982, 1984a, b, 1986, 1987); Sahni and Bajpai (1988); Rana (1988 1989); Rana and Sahni (1989); Bhatia and Rana (1984); Bhatia *et al.*(1989); Gayet *et al.*(1984); Prasad and Sahni (1987, 1988); Prasad (1989); Besse et al. (1986) and Courtillot et al. (1986). The above cited works suggest an age near the Cretaceous-Tertiary boundary. Efforts are going on to demarcate the pre-

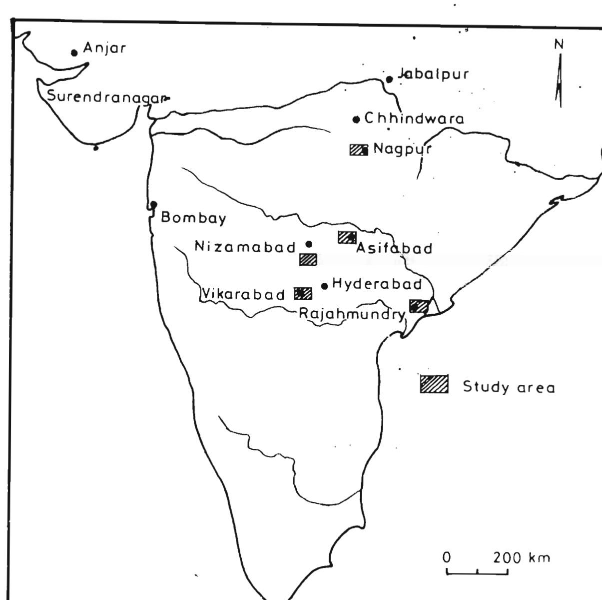


Fig. 1 Location map of the Intertrappean beds of Central peninsular India.

cise Cretaceous- Tertiary boundary in peninsular India on the basis of rare Earth elements (Iridium-Osmium anomalies), palaeontological, palaeomagnetic and geochronological studies of the Deccan Trap associated sedimentaries.

HISTORY OF PREVIOUS WORK

The geological and palaeontological studies of the Deccan basalt associated sedimentary beds of peninsular India initially were undertaken mainly by the military surveys by the east Indian company in the mid-ninteenth century. The association of the "Collectors", who were mainly professional soldiers or army surveyors, with interested laymen in science such as Hislop, Greatly helped the advancement of knowledge of the Central Indian Mesozoic-Early Tertiary Geology.

The pioneer palaeontological work on Intertrappean beds were carried out by Coulthard (1829) who reported monocot and dicot wood from the neighbourhood of Sagar. Malcolmson (1933) described *Unio deccanensis*, *Physa prensepii*, *Paludina deccanensis* and *Melania qudrilineata* from the Chikni and Highanghat localities situated about 90 km north west of Nagpur. Later, work on geology and molluscan fauna has been undertaken by Hislop and Hunter (1855), Hislop (1860) Blanford (1867, 1872a, b), Oldham (1871), Crookshank (1936), Natarajan et. al. (1981) and Prasad (1986).

Work on the ostracod fauna was initially carried out by Jones (1860) who reported five species of *Cypris* from the Nagpur Intertrappean beds. The detailed study on ostracod fauna from the Intertrappean beds of Katharu, Rajahmundry has been done by Bhalla (1965, 1979, 1982) and Jain (1978). Recently, Bhatia and Rana (1984) described five species of ostracodes from the Takli Formation, -Nagpur and Prasad (1986) reported same species from the Intertrappean beds of Asifabad, Andhra Pradesh. Murray (1860) described some insect remains from the Nagpur and Govindan (1981) and Narayan Rao and Rao (1937a) reported radiolarians and foraminifera from the Intertrappean beds of Narsapur and Rajahmundry, Andhra Pradesh.

Extensive palaeobotanical studies have been done on the Intertrappean beds of peninsular India starting from the 19th century and the first report was by Coulthard (1829) from the Sagar, Malcolmson (1837) from Jabalpur and Buist (1851) and Carter (1852) from Bombay. Later, the main contributions to the knowledge of the Intertrappean plant fossils were made by Hislop and Hunter (1855); Sahni (1931, 1941, 1943a, b, 1946); Sahni and Narayan Rao (1943); Sahni and Rao (1943); Sahni et. al. (1934); Sahni and Rode (1937); Sahni and Surange (1944, 1953); Narayan Rao and Rao (1937b, 1940); Narayan Rao et. al. (1938); Rao (1957); Rao and Narayan Rao (1939); Rode (1933a, b, 1943a,b, 1935, 1936); Pia et. al. (1937a, b); Prakash (1954, 1955, 1956a, b, 1957, 1958a, b, 1959a, b, 1960a, b); Prakash and Srivastava (1959); Prakash and Ambwani (1980); Lakhanpal (1956); Mahabale (1950a, b, 1953); Mahadevan and Sharma (1948); Shallom (1958, 1959); Shukla (1938, 1939, 1944a, b, 1948, 1950); Shukla and Chitaley (1948); Surange and Prakash (1953); Trivedi (1956); Verma (1950, 1956a, b); Dwivedi (1956, 1959); Chitaley (1949, 1950a, b, 1951a, b, 1954, 1956, 1958); Gupta (1956); Trivedi and Ambwani (1971); Shivarudrappa (1972a, b, 1977, 1978); Bhatia and Mannikeri (1976); Bhatia and Rana (1984) and Bhatia *et al.* (1989).

Vertebrate palaeontological studies were also initiated from the Intertrappean beds of peninsular India by Hislop and Hunter (1855) who recovered bone fragments, isolated teeth and scale fragments from the Takli, Nagpur. Blanford (1967) reported *Rana pusilla*, reptilian and tortoise remains from the Intertrappean beds of Worli Hill Bombay. Lydekker (1890) reported a tooth of *Massospondylus rawesi* from Takli, Nagpur. Hora (1938) described fossil fish scales from the Intertrappean beds of Deothan and Kheri, Madhya Pradesh and assigned them up to family level. Chiplonkar (1940) reported *Indobatrachus trivialis* and Verma (1965) *I. malabaricus* from the Intertrappean beds of Bombay. Bhalla (1974) reported *Eotrigonodon jonesi* from the Intertappean beds of Rajahmundry. The work on Intertrappean beds of Sundernagar District, Gurajat has been carried out by Borkar (1973a, b, 1975, 1984) who reported well preserved remains of fishes. The extensive work on microvertebrate palaeontology has been started on the Intertappean beds of Central peninsular India by collaboration between the vertebrate palaeontology laboratories of Panjab University, Chandigarh, University of Montpellier and University of Paris VI, France since 1981 and work has been published on multidisciplinary aspects of vertebrate palaeontology by Sahni (1983, 1984a, b, 1987, 1988); Sahni et. al. (1982, 1984, 1986, 1987) Gayet et. al. (1984); Rana (1988, 1989) Rana and Sahni (1989); Rana and Kumar (1989); Prasad and Sahni (1987, 1988); Prasad (1987, 1989) and Sahni and Bajpai (1988).

STRATIGRAPHIC COLUMNS

Geologic and stratigraphic columns (fig. 2) ranging from 1.2m to 5.0m thick were measured from six Intertrappean localities in Maharashtra and Andhra Pradesh where the microvertebrate were recovered.

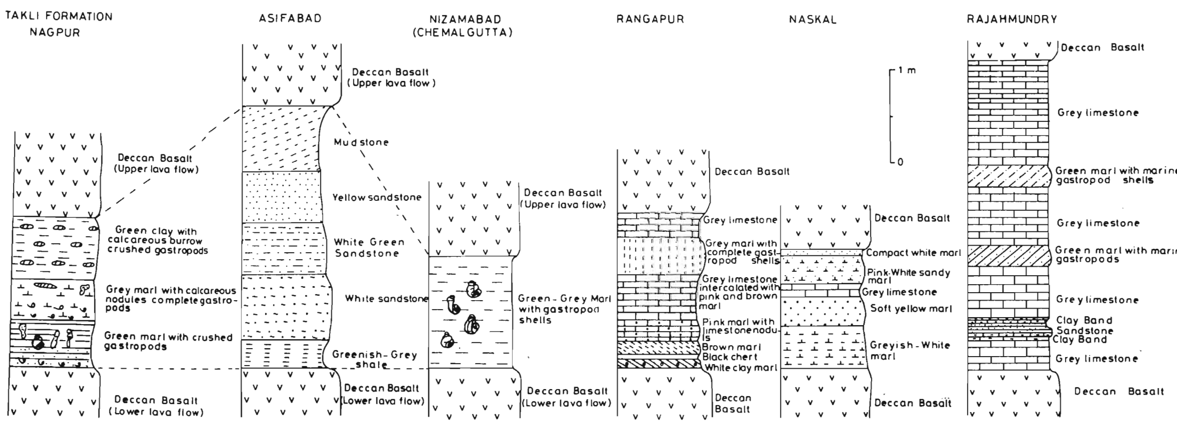


Fig. 2. Stratigraphic columns of the Intertrappean beds of peninsular India (Nagpur, Asifabad, Nizamabad, Rangapur, Naskal and Rajahmundry.

Nagpur: The Nagpur ossiferous locality is situated 4km northeast of Nagpur Railway station. The section attains a thickness of about 20m. A massive basalt (Flow 1) underlies the Takli Formation which is 1.60m thick measured along quarry (fig. 2). The basement unit of the Takli Formation is green marl with broken gastropods followed successively by green-grey sandy hard marl with hard calcareous limestone nodules and green and grey pebbly marl with thin band of light pink marl at the top. The top of the Takli Formation is covered by weathered Deccan basalt. The fossil content is given in table 1.

Asifabad: The Asifabad fossiliferous locality is situated 5 km south of village Ada, near Asifabad. Weathered basalt is observed at the base of the section which is 2.20m thick. The basement unit of the Intertrappean beds is greenish grey, friable shale (0.25m) which is embedded with limestone nodules and poorly preserved molluscan shells. The green-grey shale bed is followed by calcareous, gritty white sandstone (0.75m), whitish green sandstone (0.60m), soft fine grained pale yellow sandstone (0.60m) and yellow mudstone at the top in ascending order (fig. 2). All the units of the Intertrappean beds are fossiliferous and have yielded abundant microvertebrates (table 1). The top of the section is occupied by loose soil (10m). The weathered upper lava flow is exposed high in the hill.

Nizamabad: The Nizamabad Intertrappean beds are exposed around a 30km radius of Kammareddi city. The ossiferous locality is situated 7.5 km northeast of Kammareddi city at Chimalgutt Hill. The intertrappean bed is found between lava Flow 2 and Flow 3 (according to Natarajan et. al., 1981) and attains 1.20m thickness (fig. 2). It consists of green and grey friable marl having abundant complete and fragmentary mollusc shells. The base of the Intertrappean bed is massive Deccan basalt and not well exposed and the top basalt is weathered. The fossils recovered are listed in table 1.

Rangapur: The Rangapur ossiferous Intertrappean horizon is situated 1 km southwest of Rangapur village and found between lava Flow 4 and Flow 5 (according to Dutt, 1975) and attains 1.59 m thickness. The basement unit is white marl with limestone nodules (13 cm) which is successively overlain by black chert (0.05m), black-brown friable marl (0.15 m), grey limestone (0.02 m), black marl (0.02 m), grey limestone (0.04 m), grey marl (0.02 m), pink marl (0.08 m), grey limestone with nodules (0.52 m), white-grey marl (0.40 m), black clay band (0.02 m) and grey limestone, (0.14 m, fig. 2). The microvertebrates were recovered from the white marl, black-brown and grey marl beds.

Naskal: The Naskal ossiferous horizon is exposed 2 km northeast of Naskal village and occurs between Deccan lava Flow 3 and Flow 4 (according to Dutt, 1975), attaining 1.30m thickness. The basement unit of the Intertrappean bed is greenish white marl (0.45 m) followed by soft yellow marl (0.30 m), pinkish grey shelly limestone (0.15 m), pink white sandy marl (0.30 m) and white marl in ascending order (Prasad and

Sahni, 1988). The microvertebrates were mainly recovered from the pinkish marl bed.

Rajahmundry: The Rajahmundry ossiferous Intertrappean bed is situated at Linga Kanda area about 1km southeast if Duddukuru village near Rajahmundry. The basement unit of the Intertrappean bed is limestone (0.30 m) followed by a clay band (0.03 m), sandstone (0.12m), limestone (0.45 m), grey marl with fragmentary mollusc shells (0.20 m) limestone (0.58 cm), grey marl with mollusc shells (0. 20 m) and limestone (1.12 m). The microfossils were recovered from both the grey marl beds.

VERTEBRATE FAUNA

The vertebrate fauna recovered and identified from the Intertrappean beds of central peninsular India is listed here. The fragmentary bones, dental elements, isolated otoliths and reworked nature of the specimens precludes further identification. The classification followed in the paper is from Romer (1966) and Greenwood et. al. (1966).

Class Chondrichthyes
Order Selachii
Family Orthacodontidae
Orthacodus longidens AGASSIZ, 1843
Order Batoidea
Family Rajidae
Raja sp.
Family Dasyatidae
Coupatezia woutersi CAPPETTA, 1982
? *Dasyatis* sp.
Rhombodus cf. *R. levis* CAPETTA & CASE, 1975
Rhombodus sp.
Family Myliobatidae
Igdabatis sigmodon CAPPETTA, 1972
Class Osteichthyes
Order Semionotiformes
Family Semionotidae
Lepidotes sp.
Family Lepisosteidae
Lepisosteus indicus WOODWARD, 1908
"*Lepisosteidarum*" sp.
Order Pycnodontiformes
Family Pycnodontidae
Pycnodus lametae WOODWARD, 1908
Pycnodus cf. *P. praecursor* DARTEVELLE & CASIER, 1949
Pycnodus sp.
Order Elopiformes
Family Elopidae
"*Elopidarum*" elongatus RANA & SAHNI, 1989
Order Anguilliformes
Family Muraenidae
Emouraena cf. *E. sagittidens* CASIER, 1967
Order Clupeiformes
Family Clupeidae
"*Clupeidarum*" *valdiyai* RANA & SAHNI, 1989
"*Clupeidarum*" sp. (cf. *Clupea*)
"*Clupeidarum*" sp.
Order Osteoglossiformes
Family Osteoglossidae
Osteoglossum deccanensis (nov. comb.) RANA, 1988
Scleropages Intertrappus (nov. comb.) RANA, 1988
Family Notopteridae
Notopterus nolfi (nov. comb.) RANA, 1988
Order Salmoniformes
"*Salmoniformorum*" *rectangulus* RANA, 1988
Family Enchodontidae
Apateodus striatus WOODWARD, 1901
Enchodus ferox LEIDY, 1855
Enchodus sp.
Order Cypriniformes
Family Cyprinidae
Cyprinidae gen. *et.* sp. *indet.*
Order *Siluriformes*
Family *Ariidae*
"*Ariidarum*" sp.
Order Perciformes
Family Chandidae (Centropomidae)
"*Chandidarum*" *cappettai* RANA & SAHNI, 1989
Family Serranidae
Dapalis sp.
"*Serranidarum*" jaegeri RANA & SAHNI, 1989
"*Serranidarum*" taklinensis RANA & SAHNI, 1989
"*Serranidarum*" nagpurensis RANA & SAHNI, 1989
"*Serranidarum*" sp. RANA, 1988
Family Apogonidae
"*Apogonidarum*" *ovatus* RANA, 1988
Family Indet Indet.
"*Percoideorum*" *Ellipticus* RANA, 1988
"*Percoideorum*" rangapurensis RANA, 1988
"*Percoideorum*" sp. 1. RANA, 1988
"*Percoideorum*" sp. 2. RANA, 1988
Family Sparidae
Chrysophrys sp.
Family Nandidae
Nanfidae gen. *et.* sp. *indet.*
Family Sphyraenidae
Sphyraenae sp.
Family Labridae

	Palaeolabrus sp.
Order	Tetraodontiformes
Family	Trigonodontidae
	Stephanodus lybicus DAMES, 1883
	Stephanodus sp.
Family	Eotrigonodontidae
	Eotrigondon indicus LYDEKKER, 1886
	Eotrigonodon jonesi WHITE, 1934
	Eotrigondon wardhanensis JAIN & SAHNI, 1983
	Eotrigondon sp.
	Indotrigonodon ovatus JAIN & SAHNI, 1983
Family	Ostracontidae
	Ostracion sp.
Class	Amphibia
Order	Anura
Family	Pelobatidae
	Pelobatidae gen. *et.* sp. *indet.*
Class	Reptilia
Order	Chelonia
Family	Pelomedusidea
	Pelomedusidae gen. *et.* sp. *indet.*
Order	Squamata
Infraorder	Scincomorpha
	Family gen. *et.* sp. *indet.*
Family	Anguidae
	Anguidae gen. *et.* sp. *indet.*
Family	Boidae
	Boidae gen. *et.* sp. *indet.*
Order	Crocodilia
Family	Crocodylidae
	? *Brachychampsa* sp.
	Crocodylus sp.
Order	Saurischia
Family	Coelurosauridae
	? Coelurosaurian *indet.*
Family	Megalosauridae
	Megalosauridae gen. *et.* sp. *indet.*
	Sauropod *indet.*
Class	Mammalia
Order	Symmetrodonta
	Family gen. *et* sp. *indet.*
Order	*Creodonta*
Family	*Palaeoryctidae*
	Deccanolestes hislopi PRASAD & SAHNI, 1988

SYSTEMATIC PALAENTOLOGY OF LOWER MICROVERTEBRATES

The systematic palaeontology of the lower microvertebrates recovered from the investigated Intertrappean beds of Central peninsular India has already been described by Hora (1938), Gayet *et. al.* (1984), Rana (1988, 1989), Rana and Sahni (1989), Prasad (1989) and Prasad and Sahni (1987, 1988). Therefore, the systematic palaeontology is not included in this paper but some minor taxonomic revision has been done.

Gayet *et. al.* (1984, fig. 2h), Prasad (1989, plate 1, fig. 17) and Prasad and Sahni (1987, plate 3, figs. 1-3) have described *Belonostomus* species on the basis of scale fragments. Detailed morphological and comparative analyses indicate that these are not scale fragments of *Belonostomus* but fringing fulcra fragments of caudal skeleton elements of fish. These fringing fulcra are fixed to the proximal part of hypural and probably belong to the genus *Lepisosteus* as figured and illustrated by Nybelin (1977) and Wiley (1976). Similarly, *Phareodus* and *Musperia* have been identified on the basis of scale fragments. Rana (1988) has described two species of Osteoglossidae, "*Osteoglossidarum*" *deccanensis* and "*O*". *intertrappus*, on the basis of isolated otoliths and these resemble the otoliths of Recent *Osteoglossum* and *Scleropages* respectively. The detailed morphological and comparative analyses of Indian osteoglossids with the Recent genera, Rana and Kumar (1989) have revised the taxonomy and assigned two genera and species: *Osteoglossum deccanensis* and *Scleropages intertrappus*. Rana (1988) and Rana and Sahni (1989) have assigned many new species of fishes on the basis of otoliths without definite generic assignments. Further study of otoliths such as "*Clupeidarum*" sp. and "*Apogonidarum*" *ovatus* known from the Intertrappean beds of Rangapur indicate they probably belong to the general *Clupea* and *Apogon* respectively.

Some invertebrates have also been collected and include gastropods (*Natica* sp., *Paludina normalis, Physa princepii, Limnea sublata* etc.) and ostracodes (*Paracypretta jonesi, Mongolianella hislopi, Metacypris strangulata, Candoniella* sp. and *Cyprois* sp.).

Palaeobotanical studies were not extensive and are concentrated on charophytes including *Platychara perlata, P. raoi, P. sahnii, Microchara sausari, M. vestita, Peckichara varians* and *Negmatichara grambasti*, detailed in Bhatia and Rana (1984) and Bhatia *et al.* (1989).

DISCUSSION AND CONCLUSION

The lower microvertebrates from the Intertrappean beds of central peninsular India resemble the Late Cretaceous-Early Tertiary assemblages reported from North America: Estes (1964), Fowler

Table 1. Comparison of the microvertebrate faunas from the Intertrappean localities of the peninsulasr India and their palaeoenvironmental and climatic characters.

VERTEBRATES	INTERTRAPPEAN LOCALITY							HABITAT										
								PALAEOENVIRONMENT								CLIMATE		
	DEOTHAN/KHERI	NAGPUR	ASIFABAD	NIZAMABAD	RANGAPUR	NASKAL	RAJAMUNDRY	FRESH-WATER	LACUSTRINE	BRACKISH-WATER	ESTUARINE	SHALLOW-WATER	DEEP-WATER	AMPHIBIOUS	TERRESTRIAL	TROPICAL	SUB-TROPICAL	TEMPERATE
Selachii indet.	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	
Orthacodus longidens	-	-	X	-	-	-	-	-	-	-	-	X	X	-	-	X	X	X
Raja sp.	-	-	X	-	-	-	-	-	-	-	-	X	X	-	-	X	X	X
Coupatezia woutersi	-	-	X	-	-	-	-	-	-	-	-	X	X	-	-	X	X	X
Dasyatis sp.	-	X	-	-	X	X	-	-	-	X	X	X	X	-	-	X	X	-
Rhombodus cf.*R. levis*	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	X	X	X
Rhombodus sp. *levis*	-	-	X	-	X	X	-	-	-	-	X	-	-	-	-	X	X	X
Igdabatis sigmodon	-	X	X	-	X	X	-	-	-	X	X	X	-	-	-	X	X	-
Lepidotes sp.	-	X	X	-	-	-	-	X	X	X	-	-	-	-	-	-	X	X
Lepisosteus indicus	X	X	X	-	X	X	-	X	X	X	-	-	-	-	-	-	X	X
Pycnodus lametae	-	X	X	-	X	-	-	-	-	X	X	X	-	-	-	X	X	X
Pycnodus cf. *P. praecursor*	-	-	X	-	-	-	X	-	-	X	X	X	-	-	-	X	X	X
Pycnodus sp.	-	-	X	X	-	-	X	-	-	X	X	X	-	-	-	X	X	X
"Elopidarum" elongatus	-	X	-	X	-	-	-	-	X	X	X	X	-	-	-	X	-	X
Eomuraena cf. *E. sagittidens*	-	-	X	-	-	-	-	-	-	-	X	X	-	-	-	X	-	X
"Clupeidarum" valdiyai	-	X	-	-	-	-	-	-	-	-	X	X	X	-	-	X	-	X
"Clupeidarum" sp. (*Clupea*)	-	X	-	-	X	X	-	X	-	-	X	X	-	-	-	X	-	X
"Clupeidarum" sp.	-	X	-	X	X	X	-	X	-	-	X	X	X	-	-	X	-	X
Clupeidae	X	X	-	X	X	X	-	X	-	-	X	X	X	-	-	X	-	X
Osteoglossum deccanensis	X	X	X	X	X	X	-	X	X	-	-	-	-	-	-	X	-	X
Scleropages intertrappus	-	-	-	-	X	X	-	X	X	-	-	-	-	-	-	X	-	X
Notopterus nolfi	-	-	-	X	X	X	-	X	X	-	-	-	-	-	-	X	-	X
"Salmoniformorum" rectangulus	-	-	-	-	X	X	-	X	-	-	-	-	-	-	-	?	?	?
Apateodus sp.	-	X	X	X	X	X	-	-	-	-	-	X	X	-	-	X	-	X
Enchodus ferox	-	X	X	X	X	X	-	-	-	-	-	X	X	-	-	X	-	X
Enchodus sp.	-	X	X	X	X	X	-	-	-	-	-	X	X	-	-	X	-	-
Cyprinidae	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	X	X
"Ariidarum" sp. (*Arius*)	-	X	-	X	X	X	-	-	-	-	X	X	-	-	-	X	X	X
"Chandidasrum" cappettai	-	X	-	-	-	-	-	-	-	X	X	X	-	-	-	X	X	-
Serranidae	X	X	-	X	X	X	-	X	-	-	X	X	X	-	-	X	X	X
"Serranidarum" jaeqeri	-	X	-	-	-	-	-	X	-	-	X	X	X	-	-	X	X	X
"Serranidasrum" taklinensis	-	X	-	-	-	-	-	X	-	-	X	X	X	-	-	X	X	X
"Serranidarum" nagpurensis	-	X	-	-	-	-	-	X	-	-	X	X	X	-	-	X	X	X
"Serranidarum" sp.	-	-	-	-	X	X	-	X	-	-	X	X	X	-	-	X	X	X
Dapalis sp.	-	-	-	-	X	X	-	X	-	-	X	X	X	-	-	X	X	X
"Apogonidasrum" ovatus (*Apogon*)	-	-	-	-	X	X	-	X	-	-	X	X	X	-	-	X	X	X
Paleolabrus sp.	-	X	X	-	-	-	-	-	-	-	-	X	X	-	-	X	X	X
"Percoideorum ellipticus"	-	-	-	-	X	X	-	-	-	?	?	?	?	?	?	?	?	?
"P." rangapurensis	-	-	-	-	X	X	-	-	-	?	?	?	?	?	?	?	?	?
"Percoideorum" indet.	-	X	-	X	X	X	-	-	-	?	?	?	?	-	-	?	?	?
"Percoideorum" indet. 2	-	X	-	X	X	X	-	-	-	-	?	?	?	-	-	?	?	?
Chrysophrys sp.	-	-	-	-	-	-	X	-	-	-	-	X	X	-	-	X	-	X
Nandidae	X	-	-	-	-	-	-	X	X	X	-	-	-	-	-	X	-	-
Sphyraena sp.	-	X	-	-	-	-	-	-	-	-	-	X	-	-	-	X	X	X
Stephanodus lybicus	-	X	X	-	X	X	-	-	-	-	-	X	X	-	-	X	X	X
Spephanodus sp.	-	-	X	-	-	-	X	-	-	-	-	X	-	-	-	X	X	X
Eotrigonodon jonesi	-	-	X	-	-	-	X	-	-	-	-	X	X	-	-	X	X	X

Table 1 (Contd.)

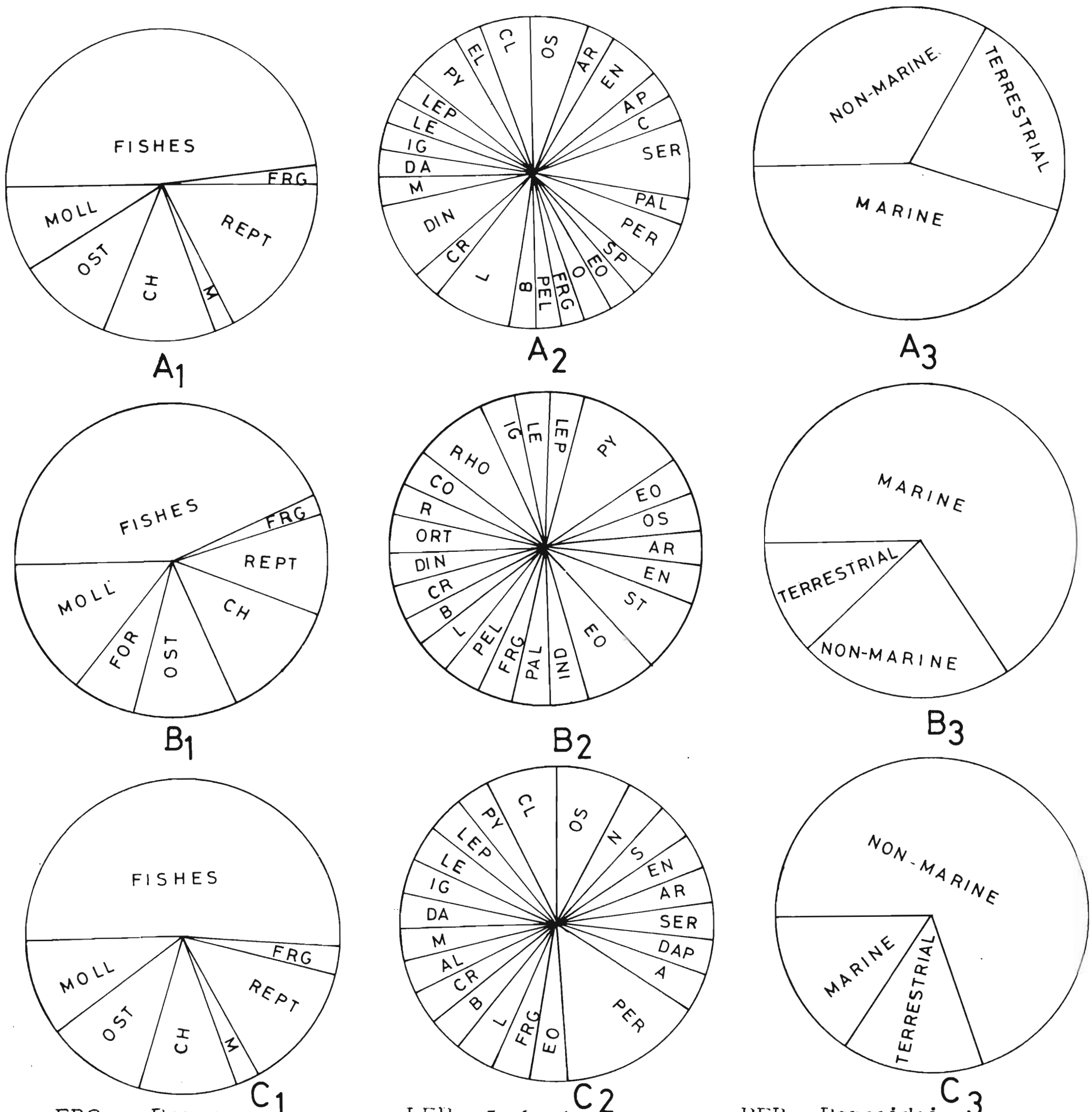
VERTEBRATES	INTERTRAPPEAN LOCALITY							HABITAT										
								PALAEOENVIRONMENT								CLIMATE		
	DEOTHAN/KHERI	NAGPUR	ASIFABAD	NIZAMABAD	RANGAPUR	NASKAL	RAJAMUNDRY	FRESH-WATER	LACUSTRINE	BRACKISH-WATER	ESTUARINE	SHALLOW-WATER	DEEP-WATER	AMPHIBIOUS	TERRESTRIAL	TROPICAL	SUB-TROPICAL	TEMPERATE
Eotrigonodon indicus	–	–	X	–	–	–	–	–	–	–	–	X	X	–	–	X	X	X
Eotrigonodon wardhaensis	–	–	X	–	–	–	–	–	–	–	–	X	X	–	–	X	X	X
Eotrigonodon sp.	–	–	–	X	X	X	–	–	–	–	–	X	X	–	–	X	X	X
Indotrigonodon ovastus	–	–	X	–	–	–	–	–	–	–	–	X	X	–	–	X	X	X
Ostracion sp.	–	X	–	–	–	–	–	–	–	–	–	X	X	–	–	X	–	–
Pelobatidae	–	X	X	–	X	X	–	–	–	–	–	–	–	X	–	X	X	–
Pelomedusidae	–	X	X	–	X	X	–	X	–	–	–	–	–	–	–	X	–	–
Scincomorpha	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	–
Anguidae	–	X	X	X	X	X	–	–	–	–	–	–	–	–	X	X	–	–
Boidae	–	X	X	–	X	X	–	–	–	–	–	–	–	–	X	X	X	X
Crocodilus sp.	–	X	X	X	X	X	–	X	–	–	–	–	–	–	–	X	–	X
? *Brachychampsa* sp.	–	–	–	–	X	X	–	X	X	–	X	–	–	–	–	X	X	X
Saurischia indet.	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	–
Celurosauridae	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	X	X	–
Magalosauridae	–	X	X	–	–	–	–	–	–	–	–	–	–	–	X	X	X	–
Symmetrodont indet.	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	?	?	?
Deccanolestes hislopi	–	–	–	–	?	X	–	–	–	–	–	–	–	–	X	?	?	?

(1911), Breithaupt (1982), Carpenter and Lindsey (1980), Sahni (1972), Russell (1974) and Carpenter (1979); South America: Muizon *et., al.* (1983); Africa: Arambourg (1952), Cappetta (1972), Flynn *et al.* (1987); Europe: Buffetaut (1980) and South east Asia: (Sanders (1934), Hills (1934, 1943). In India some vertebrates have affinities with those known from the Subathu Formation (Eocene), Himachal Pradesh and Kalakot, J & K reported by Kumar and Loyal (1987) and Eocene beds of Rajasthan described by Jolly and Loyal (1985). Some elements are common to those described from Baluchistan (Sahni, 1980 and Gayet, 1987) and the infratrappean beds (Lameta Formation) of peninsular India (Woodward, 1908, Jain and Sahni, 1983). Although fishes as a rule are not good for biostratigraphic correlation due to their long temporal ranges, the unique nature of the Intertrappean taxa make them important.

The faunal list of the lower microvertebrates and their palaeoenvironment representation are shown in table 1. Tables 2 and 3 compare genera and generic diversity of the five Intertrappean localities. Work on the Nizamabad locality is preliminary (work in progress). The fauna represented by fishes, amphibians, turtles, lizards, snakes, crocodiles and mammals comprising 43 genera and 59 species. Fig. 3 depicts the relative abundance of the individual genera and marine, non-marine and terrestrial diversity of the total vertebrates from the three Intertrappean localities.

Six genera of Chondrichthians have been recovered from the Deccan Trap associated sedimentary beds of peninsular India and comprise 6.25% (Nagpur), 23.05% (Asifabad) and 7.40% (Rangapur and Naskal) of the total vertebrate fauna. These represent five families of littoral, benthonic and neritic environment with warm, tropical and subtropical climate comparable to modern analogues of chondrichthians. The absence of typical Rajiformes, *Myledaphus* and *Ischyriza*, from the Intertrappean beds (which represent common coastal fauna during the end of Cretaceous), may indicate more restricted paludal environments with fluvial connections to the epicontinental sea in central peninsular India during Cretaceous-Tertiary transition time.

The bony fishes represent 64% (Nagpur), 57.70% (Asifabad), 82% (Nizamabad), 70.40% (Rangapur) and 66.70% (Naskal) of the total vertebrate fauna (table 3). These comprise: 16 genera and 19 species, Nagpur; 10 genera and 15 species, Asifabad; 8 genera and



FRG	Frogs	LEP	***Lepisosteus* sp.**	PER	Percoidei
REPT	Peptiles	PY	***Pycnodus* sp.**	SP	***Sphyraena* sp.**
CH	Charophytes	EL	Elopidae	PAL	***Palealabrus* sp.**
OST	Ostracodes	CL	Clupeidae	ST	***Stephanodus* sp.**
FOR	Foraminifers	OS	Osteoglossidae	EO	***Eotrigonodus* sp.**
MOLL	Molluscs	N	Notopteridae	IND	***Indotrigonodon* sp.**
M	Mammals	S	Salmoniformes	O	***Ostracion* sp.**
ORT	***Orthacodus* sp.**	A	Apogonidae	PEL	Pelomedusidae
R	***Raja* sp.**	DAP	***Dapalis* sp.**	L	Lacertilia
CO	***Coupatezia* sp.**	AP	***Apatheodus* sp.**	B	Boidae
DA	***Dasyatis* sp.**	EN	***Enchodus* sp.**	CR	***Crocodilus* sp.**
RHO	***Rhombodus* sp.**	AR	Ariidae	AL	Alligators
IG	***Igabatis* sp.**	C	Chandidae	DIN	Dinosaurs
LE	***Lepidotes* sp.**	SER	Serranidae		

8 species, Nizamabad; 15 genera and 20 species, Rangapur and 14 genera and 19 species, Naskal. The total bony fishes from the Intertrappean beds of central peninsular India represent 23 genera and 41 species. Some species of bony fishes have been assigned "*Percoideorum*" sp. on the basis of otoliths and their precise palaeontological interpretation is not possible.

In the Intertrappean fauna, five families of bony fishes represent freshwater (primary, secondary and peripheral) fishes include Lepisosteidae, Osteoglossidae, Notopteridae, Cyprinidae and Nandidae (table 1). The modern Lepisosteidae or gars are confined to North America freshwater and brackish water except for an endemic species in Cuba. Gars live in brackish water and salt water along the coast of Gulf of Mexico showing that gars are secondary freshwater fishes. The modern gars are active predators of small fishes and crustaceans (carnivorous). Fossil Lepisosteidae are known from the Upper Cretaceous of North America, South America, Europe and India and the Lower Cretaceous of Africa (Suttkus, 1963; Wiley, 1976; Estes, 1964; Breithaupt, 1982 ; Muizonde *et al.* 1983 and Gayet *et. al.* 1984) and are considered to have originated in Africa and migrated to Europe and India and from Europe to North America on the basis of the oldest fossil records. Wiley (1976) also suggests that the presence of Lepisosteidae remains in both the Laurasian and Gondwanian supercontinents indicates that they existed in Pangaea approximately 125 My ago. The Cyprinidae and Nandidae are primary freshwater fishes. The modern representative of these families are found in all continents except that Cyprinidae are not found in South America and Australia and the Nandidae are absent in North America and Europe. The report of these families in the Intertrappean beds indicates freshwater conditions of deposition.

The Osteoglossidae are represented in the collection by otoliths, scales and dental elements and are represented by two genera and species: *Osteoglossum deccanensis* and *Scleropages intertrappus*. These genera presently found in South America and Banka, Borneo, Malaya, Sumatra and Thailand respectively. The modern genera of the family Osteoglossidae occur in all southern continents except the Indian subcontinent in tropical freshwater environments. The fossil records and their palaeogeographical implication are already described by Rana (1988). The freshwater environment of deposition is also indicated by the presence of notopterid fossils in the Intertrappean beds. Fossil Notopteridae are only known from the Eocene beds of Sumatra and Intertrappen beds of India (Sanders, 1934 and Rana, 1988). The occurrence of Osteoglossomorpha in Central peninsular India indicate an allochthonous fauna. A freshwater environment is also indicated by the presence of extinct genus *Lepidotes*. It has a wide geographical distribution from the Triassic to Upper Cretaceous of North America, South America, Europe, Asia and Africa.

The other bony fishes from the Central peninsular Intertrappean beds indicate marine water and are represented by Pycnodontidae, Elopidae, Clupediae, Muraenidae, Enchodontidae, Ariidae, Chandidae, Serranidae, Apogonidae, Labridae, Eotrigonodontidae and Ostracionidae. The fossil records and modern analogues (which are not extinct) of these families have a worldwide marine distribution in tropical, subtropical, temperate, warm and cold climatic conditions. Some of them are also represented in coastal, brackish water and even intrude into freshwater environments. The occurrence of these marine fishes suggests two possibilities; either there was proximity to the sea or there was a marine transgression and regression in Central peninsular India during the end of Cretaceous time. The fish fauna in the present collection indicates that bottomfeeders were probably not a significant part of the fauna and may simply represent allochthonous taxa. On the other hand the high percentage of bony fishes indicate that these represent autochthonous elements of the fauna.

A family (Palobatidae) of frog is represented in the Intertrappean collection, indicating freshwater environment of deposition as most modern anurans are inhabitants of such conditions. It is difficult to establish an ecological interpretation for the Late Cretaceous pelobatid frogs. The fragmentary nature of the bones and their low diversity of the pelobatid frogs in the fauna are probably a result of allochthonous transport of material in the shallow water paludal environment. A freshwater environment of deposition is also indicated by the presence of pelomedusid turtles in the Intertrappean fauna.

The lacertilians are represented by at least two genera (table 1 and 3) indicating carnivore feeding niche (fig. 4) of this community. The terrestrial and semiaquatic predators (lizards and snakes) are represented by fragmentary and waterworn elements in the collection indicating an allochthonous part of the fauna. Comparison of the fossil lizards with their modern relatives can best be made at order and famil-

Table 2. Number of genera in the Intertrappean beds of Nagpur, Asifabad, Nizamabad, Rangapur and Naskal

Vertebrates	Nagpur	Asifabad	Nizamabad	Rangapur	Naskal
Elasmobranchii					
Selachii	0	1	0	0	0
Batoidea	2	5	0	2	2
Holostei	3	3	1	2	1
Teleostei	13	7	8	13	13
Total Fishes	**18**	**16**	**9**	**171**	**16**
Amphibians					
Anura	1	1	0	**1**	1
Total Amphibians	**1**	**1**	**0**	**1**	**1**
Reptiles					
Turtles	1	1	0	1	1
Lacertilia	2	1	1	1	1
Snakes	1	1	0	1	1
Crocodiles	1	1	1	2	2
Dinosaurs	3	1	0	0	0
Total Reptiles	**8**	**5**	**2**	**5**	**5**
Mammals	1	0	0	0	1
Total Genera	**28**	**22**	**11**	**23**	**23**

ial level. Thus the ecological implications of this part of the fauna can only be described as diverse, possibly ranging from borrowing terrestrial to semiaquatic forms which are active either by day or night, as are modern teiid lizard. Thus it can be suggested that the lacertilians from the Intertrappeans generally represent the river bank microterrestrial carnivores of warm, lowland tropical to subtropical habitates. It is difficult to make a comparison of the ecological roles of modern and ancient lizards because many of these niches are subsequently occupied by the diversification of snakes.

Table 3. Relative abundance of major group of microvertebrates in the five Intertrappean localities of Central peninsular India

Vertebrates	Nagpur	Asifabad	Nizamabad	Rangapur	Naskal
Elasmobranchii					
Selachii	0	03.85	0	0	0
Batoidea	6.25	19.20	0.00	7.40	7.40
Holostei					
Semionotiformes	6.25	7.70	0.00	3.70	3.70
Pycnodontiformes	3.125	11.55	9.00	3.70	0.00
Teleostei					
Elopiformes	3.125	0.00	9.00	0.00	0.00
Anguilliformes	0.00	3.85	0.00	0.00	0.00
Clupeiformes	6.250	0.00	0.00	7.40	7.40
Osteoglossiformes	6.250	5.85	18.50	11.10	11.10
Salmoniformes	6.250	7.70	9.00	11.10	11.10
Siluriformes	3.125	0.00	9.00	3.70	3.70
Perciformes	18.750	3.85	18.50	26.00	26.00
Tetraodontiformes	9.375	19.20	9.00	3.70	3.70
Amphibians	3.125	3.85	0.00	3.70	3.70
Reptiles					
Turtles	3.125	0.00	0.00	3.70	3.70
Boiid snakes	3.125	3.85	0.00	.370	3.70
Lacertilia	6.25	3.85	9.00	3.70	3.70
Crocodiles	3.125	5.85	9.00	7.40	7.40
Dinosaurs	9.375	3.85	0.00	0.00	0.00
Mammals	3.125	0.00	0.00	0.00	3.70
Total Percent	**100%**	**100%**	**100%**	**100%**	**100%**

In the collection, two genera of crocodiles have been recovered; *Crocodylus* sp. and Alligatorinae of *Brachychampsa*. These are represented by isolated teeth and the percentage at each locality is shown in table 3. The alligator teeth have close affinities to the *Brachychampsa* known from the Upper Cretaceous of North America described by Sahni (1972), Carpenter (1979), Carpenter and Lindsey (1980), Breithaupt (1982), the Upper Cretaceous of China (Young, 1964) and Upper Cretaceous alligator teeth from Europe reported by Buffetaut (1980) who considered the Cretaceous alligators were primarily turtle and mollusc eaters because they had a broad snout and short bulbous teeth, like modern alligators which feed on turtles (Neill, 1971). The modern alligator is primarily freshwater and generally found in lagoons and shallow lakes rather than streams. The presence of alligators (*Brachychampsa*) in the Intertrappean beds indicates that there were many small shallow lakes in Central peninsular India connected with rivers during the end of Cretaceous and the deposition was probably lagoonal. Modern crocodiles are coastal, estuarian, lagoonal reverine and also tolerate salt water. They are less tolerant of cold than alligators. At the end of the Cretaceous, there was a world wide sudden fall of temperture (Buffetaut, 1979) and prob-

	AQUATIC AND SEMI-AQUATIC COMMUNITY				TERRESTRIAL COMMUNITY	
CARNIVORES			Notopteridae	1		
	Orthacodus sp.	1	*Enchodus*	1	Boidae	1
	Coupatezia sp.	1	*Apatheodus*	1	Coelurosaurian	1
	Raja sp.	1	Ariidae	1	Megalosauridae	1
	Dasyatis sp.	1	Chandidae	1	Symmetrodonta	1
	Rhombodus sp.	2	Serranidae	5	Eutherian	1
	Igdabatis sp.	1	Apogonidiae	1	Scincomorpha	1
	Lepidotes sp.	1	Percoidae	6	Anguidae	2
	Lepisosteus sp.	1	Labridae	1		
	Pycnodus sp.	3	Tetradontidae	5		
	Elopidae	1	Pelobatidae	1		
	Osteoglossidae	2	Crocodilidae	2		
OMNIVORES	Clupeidae	3				
	Pelomedusidae	1				
HERBIVORES	Ostracodes	5			Sauropod	1
	Gastropods	6				
	Foraminifers	3				

Fig. 4. Vertebrate communities present at Nagpur, Asifabad, Rangapur and Naskal.

ably many species of alligators became extinct.

The terrestrial community is also indicated by very small isolated teeth and thin egg shell fragments of theropod and sauropod dinosaurs, carnivorous and omnivorous respectively. (fig. 4). Remains of sauropod dinosaurs are generally found in estuarine and marine deposits and also commonly in swamps. The allochthonous nature of most of the terrestrial fauna in the Intertrappean localities of Central peninsular India indicates that these teeth and egg shell fragments were probably transported to the site of deposition. This conclusion is further supported by the recent find of mammals in the Intertrappean beds.

The invertebrate fossil assemblage, such as gastropods and ostracodes indicates fairly shallow lacustrine environment of deposition with slight current.

Palaeobotanical studies indicate seashore conditions on the basis of fossil similar to modern *Cocos, Nypa, Sonneratia* etc. This evidence is supported by finding the marine alga *Lyssonnetia* from the Mohgaonkalan. Palaeobotanical studies also indicate a uniform humid and tropical climate, whereas the charohpytes represent fluvio-lacustrine deposition.

The biotas from the Intertrappeans of Central peninsular India thus represent both a terrestrial allochthonous and an aquatic autochthonous fauna. The latter contributes most of the diversities and indicates thanatocoenose assemblage. The assemblage consists of chondrichthians, holosteans, teleosts, amphibians, turtles, lizards, snakes, crocodiles, dinosaurs and mammals, similar to that found in the terminal Cretaceous fossil record. The occurrence of marine elements indicate either the presence of an arm of Tethys sea (epicontinental sea) or a marine transgression along the Narmada and Godavary rivers to Central India during the Cretaceous-Tertiary transition time. The marine, brackish water, freshwater and terrestrial elements from the Intertrappeans may also indicate paludal environment of deposition with the fluvial connection with an epicontinental sea in the Central peninsular India at that time.

REFERENCES

ARAMBOURG, C. 1952. Les vertébrés fossiles des gisements de phosphates (Maroc-Algérie-Tunisie). *Service geologique Maroc Notes* et *Mémories*. **92**: 1-372.

BANDE, M.B. 1973. A petrified dicotyledonous wood from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Botanique*, **4** (1): 41-48.

BANDE, M.B. 1974. Two fossil wood from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Geophytology*. **4**(2): 189-195.

BANDE, M.B. & KHATRI, S.K. 1980. Some more fossil wood from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. *Paleontogr*. B, **173**(4-6): 147-165.

BANDE, M.B. & PRAKASH, U. 1980. Four new fossil dicotyledonous wood from the Deccan Intertrappean beds near Shahpura, Mandla District, Madhya Pradesh. *Geophytology*. **10** (2): 268-271.

BANDE, M.B. PRAKASH, U. & BONDE, S.D. 1981. Occurrence of *Peyssonnelia* and *Distichoplax* in the Deccan Intertrappean beds of Mohgaonkalan with remarks on age of Chhindwara traps and palaeogeography of the region. *Geophytology*. **11**(2): 182-188.

BESSE, J., BUFFETAUT, E., CAPPETTA, H., COURTILLOT, V., JAEGER, J.J., MONTIGNY, R., RANA, R.S., SAHNI, A., VANSAMME, D & VIANEY-LIAUD, M. 1986. The Deccan Trapps (India) and Cretaceous-Tertiary boundary events. *Lect. notes Earth Sci.* (ed.O. Walliser), **8:** 365-370.

BHALLA, S.N. 1965. A note on the ostracoda from the Intertrappean beds near Pangadi, Andhra Pradesh. *Ann. Geol. Dept. Aligarh Mus. Univ.*,**1**: 57.

BHALLA, S.N. 1974. On the occurrence of *Eotrigonodon* in the Eocene of Rajahmundry, Andhra Pradesh. *Jour. Geol. Soc. India*. **15**(3): 335-337.

BHALLA, S.N. 1979. A new ostracoda species from Lower Eocene Intertrappean beds of Andhra Pradesh. *Indian Geol. Assoc. Bull.* **12**(2): 145-149.

BHALLA, S.N. 1982. A new Early Eocene Cythruid ostracoda species from India. *Proc. Nat, Sci. Acad.* **48**(6): 545-549.

BHATIA, S.B. & MANNIKERI, M.S. 1976. Some charophyta from the Deccan Intertrappean beds near Nagpur Central India. *Geophytology*. **6**(1): 75-81.

BHATIA, S.B. & RANA, R.S. 1984. Palaeogeogreaphic implications of the charophyta and ostracoda of the Intertrappean beds of peninsular India. *Mém*. geol. Soc. France, N.S. **147**: 29-35.

BHATIA, S.B., REVELIN, J. & RANA, R.S. 1989. Charophyta from the Deccan Inter-trappean beds near Rangapur, Andhra Pradesh, India *Geophytology*. (in press).

BLANFORD, W.T. 1867. Trap and Intertrappean beds of Western and Central India. *Mem. G.S.I.*, **6**(2): 137-162.

BLANFORD, W.T. 1872a. Description of the Geology of Nagpur and its neighbourhood. *Mem. G.S.I.*, **9**(2): 295-330.

BLANFORD, W.T. 1872b. Sketch of the Geology of Bombay Presidency. *Rec. G.S.I.* **5**: 82-102.

BORKAR, V.D. 1973b. Fossil fishes from the Intertrappean beds of Sundernagar District, Saurashtra. *Proc. Indian Acad. Sci.*, **78** (4) ser. B. : 181-193.

BORKAR, V.D. 1975. New fossil fish scales from the Intertrappean bed of Bamanbor, Sundernagar District, Gujarat State. *Biovigyanam*. (2): 161-166.

BORKAR, V.D. 1984. *Palaeopristolepis chiplonkari*, a new fossil fish from the Intertrappean bed Bamanbor, Sundernagar District, Gujarat. *Biovigyanam*. **10**: 65-67.

BREITHAUPT, B.H. 1982. Palaoentology and palaeocology of the Lance Formation (Maestrichtian), east flank of Rock Springs Uplift, Sweetwater County, Wyoming. *Contb. Geol. Univ, Wyoming*. **21**(2) : 123-151.

BUFFETAUT, E. 1979. The evolution of the crocodilians. *Scientific Amm.*, **2411**(4): 130-144.

BUFFETAUT, E. 1980. Crocodilians from the continental Upper Cretaceousof Europe: New finds and interpretations. *Mesoz-*

oic *Verteb. Life*. **1**: 5-14.

BUIST, G. 1851. Geology of the Island of Bombay. *Trans. Bombay Geogr. Soc.* **10:** 167.

CAPPETTA, H. 1972. Les poissons Crétacés et Tertiaries de Bassin de Iullemmeden (République du Niger). *Palaeovertebrata,***5**(5): 179-251.

CARPENTER, K. 1979. Vertebrate fauna of the Laramie Formation (Maestrichtian), Weld County, Colorado. *Contrb. Geol. Univ. Wyoming.* **17**: 87-49.

CARPENTER, K. & LINDSEY, D. 1980. The dentary of *Brachychampsa montana* Gilmore (Alligatorinae), Crocodylidae), a late Cretaceous turtle-eating alligator. *Jour. Palaeont.,* **54**: 1213-1217.

CARTER, H.J. 1852. Geology of the Island of Bombay. *Jour. Bombay Bran. Roy. Asiat. Soc.* **4**: 161.

CHIPLONKAR, G.W. 1940. A new species of fossil frog from the Intertrappean beds of Worli Hill Bombay. *Jour. Bombay Nat. Hist. Soc.,* **41**(4): 799-804.

CHITALEY, S.D. 1949. On a new species of *Dadoxylon, D. eceonum* sp. nov. from the District of Chhindwara, C.P. India. *Jour. Indian Bot. Soc.* **28**(4): 227-237.

CHITALEY, S.D. 1950a. Microflora of the Deccan Intertrappean Chert. *Jour. Indian Bot. Soc.* **29**(1): 30.

CHITALEY, S.D. 1950b. Fossil flower from the Mohgaonkalan bed of Chhindwara, C.P., India. *Sci. & Cult.* **15**: 446-447.

CHITALEY, S.D. 1951a. Fossil microflora from the Mohgaonkalan bed of Madhya Pradesh, India. *Proc. Nat. Inst. Sci. India.* **17**(5): 373-383.

CHITALEY, S.D. 1951b. Further report on the fossil microflora from the Mohgaonkala beds of Madhya Pradesh, India. *Proc. 38th Indian Sci. Congr.* 159.

CHITALEY, S.D. 1954. On a fructification from the Intertrappean flora of Madhya Pradesh, India. *Palaeobot.,* **3**: 9-17.

CHITALEY, S.D. 1956. On the fructification of *Tricoccites trigonum,* Rode from the Deccan Intertrappean series of India. *Palaeobot.***5**(2): 56-63.

CHITALEY, S.D. 1958. Seed of *Viracarpon hexaspermum,* Sahnik from the Intertrappean beds of Mohgaonkalan, India. *Jour. Indian Bot. Soc.,* **37**(3): 408-411.

COULTHARD, S. 1829. The Trap formation of the Sagar District, and those district westward of it, as far as Bhopalpur, on the back of river Newas, in Omatwara. *Asiat. Resear.* **18** : 47.

COURTILLOT, V., BESSE, J., VANDAMME, D., MONTIGNY, R., JAEGER, J.J. & CAPPETTA, H. 1986. Deccan flood basalt at the Cretaceous/Tertiary boundary? *Earth Planetary Sci. Letters.* **80**: 361-374.

CROOKSHANK, H. 1936. The geology of the northern slopes of the Satpuras between the Morand and Sher rivers. *Rec. G.S.I.,* **66**: 1-171.

DUTT, N.V.B.S. 1975. Deccan traps of the western part of Hyderabad District, Andhra Pradesh. *Rec. G.S.I.,* **114**: 125-141.

DWIVEDI, J.N. 1956. On a new secimen of *Enigmocarpon parijai* Sahni : *Jour. Palaeont. Soc. India.* **1** (1): 163-171.

DWIVEDI, J.N. 1956. Fossil thallophytes from Mohgaonkalan locality, Chhindwara District, M.P. *Curr. Sci.,* **28**(7): 285-286.

ESTES, R. 1964. Fossil vertebrate from Late Cretaceous Lance Formation, Eastern Wyoming. *Univ. California Pub. Geol. Sci.,* **49**: 1-180.

FLYNN, L.J., BRILLANCEAU, A., BRUNET, M., COPPENS, YVES., DEJAX, J., DUPERON-LAUDOUENEIX, M., EKODECK, G., FLANAGAN, K.M., HEINTS, E., HELL, J., JACOBS, L.L., PILBEAM, D.R., SEN, S. & DJALLO, S. 1987. Vertebrate fossils from Cameroon, West Africa., *Jour. Vert. Palaeont.* **7**(4): 469-471.

FOWLER, H.W. 1911. A description of fossil fish remains of the Cretaceous, Eocene and Miocene Formations of New Jersey. *Bull. Geol. Surv, New Jersey.,* **4**: 1-191.

GAYET, M. 1987. Lower vertebrate from the Early Middle Eocene Kuldana Formation of Kohat (Pakistan): Holostei and Teleostei., *Cont. Mus. Palaeont. Univ. Michigan.* **27**: 151-167.

GAYET, M., RAGE, J. & RANA, R.S. 1984. Nouvelles ichthyofaune et herpétofaune de Gitti Khadan, ke plus anciengisement connu du Deccan (Crétacé-Paléocène) á microvértébrés. Implications paléobiogéographiques. *Mém. Soc. géol. France, N.S.* **147** : 55-65.

GOVINDAN, A. 1981. Foraminifera from the Infra and Intertrappean sub-surface sediments of Narsapur Well-1 and age of the Deccan Trap Flows. *Proc. IX Indian Coll. Micropalaeont. Strat.* 81-93.

GREENWOOD, P.H., ROSEN, D.E., WETTZMAN, S.H.& MYERS, S.H. 1966. Phyletic studies of teleostean fishes with provisional classification of living forms. *Bull. Amm. Mus. Nat. Hist. New York.,* **131**: 341-445.

GUPTA, K.M. 1956. Fossil plants from the Deccan Intertrappean series 1. A bryophytic type of sporogonium. *Sci. & Cult.* **21**: 540-541.

HILLS, E.S. 1934. Tertiary frewshwater fish from southern Queensland. *Mem. Queen. Mus. Brisbane,* **10**: 157-173.

HILLS, E.S. 1943. Tertiary freshwater fishes and crocodilian remains from Gladstons and Duringa, Queensland. *Mem. Queensl. Mus. Brisbane,* **12**: 96-100.

HISLOP, 2. 1860. On the Tertiary deosits, associated with trap rock in theh east India with descrition of fossil shells. *Quart. Jour. Geol. Soc. London.* **16.**: 154-189.

HISLOP, S & HUNTER, R. 1855. On the geology and fossil of the neighbourhood of Nagpur, Central India, *Quart, Jour. Geol. Soc. London,* **11**: 345-383.

HORA, S.L. 1938. Fossil fish scales from the Intertrappaen of Deothan and Kheri. *Rec. G.S.I.,* **73**: 267-297.

JAIN. S. P. 1978. Ostracodes des "Inter-trappean (Eocene Inférieur) de Kathéru Rajahmundry, Cote-est de l'Inde. *rev. Micropalént.* **21**(2): 51-58.

JAIN, S.L. & SAHNI, A. 1983 Some Upper Cretaceous vertebrates from Central India and their palaeogeographic implication. *Indian Assoc. Palyn. Lucknow.* 66-83.

JOLLY, A. & LOYAL, R.S. 1985. Record of microvertebrates from the Middle Eocene March Stage of Sri Kolayat-Ji, Rajasthan. *Bull. Geol. Min. Met. Soc. India,* **52**: 374-384.

JONES, T. 1860. A note on fossil Cypridae, in Hislop, S. 1860, *Quar. Jour. Geol. Soc. London.* **16**: 154-189.

KUMAR, K. & LOYAL, R.S. 1987. Eocene ichchyofauna from the Subathu Formation, North western Himalaya, India. *Jour Palaeont. Soc. India.* **32**: 60-64.

LAKHANPAL, R.N. 1956. *Palmoxylon surangei,* a new species of petrified palm from the Deccan intertrappean series. *Palaeobot.* **4**: 15-21.

LYDEKKER, R. 1890, Note on certain vertebrate remains from the Nagpur District. II part of the chelonian plastron from Pisdura. *Rec. G.S.I.* **23**: 22-23.

MAHABALE, T.S. 1950a. Some new fossil plants from the Deccan Intertrappean series. *Palaeobot. India, VII. Jour. Indian Bot. Soc.,* **29**(1): 31-33.

MAHABALE, T.S. 1950b. A species of fossil Salvinia from the Deccan Intertrappean series, India. *Nature,* **165**: 410-411.

MAHABALE, T.S. 1953. Occurrence of *Sparganium* in the Deccan intertrappean of Madhbya Pradesh, India. *Proc. Nat. Inst. Sci. India.* **19**(5): 623-629.

MAHADEVAN, C. & SHARMA, S.R. 1948. Deccan Intertrappean Series (Vikarabad, Hyderabad State) - Charophyta from the Deccan. *VI. Jour. Indian Bot. Soc.* **26**(4): 260.

MALCOMSON, J.G. 1833. In Hislop, S. and Hunter, R. 1855 *Quart. Jour. Geol. Soc. London* **11**: 345-383.

MALCOLMSON, J.G. 1837. On the fossils of the eastern portion of the great basaltic district of India. *Trans. Geol. Soc. London.* **5**: 537.

DE MUIZON, C., GAYET, M., LAVENU, A., MARSHALL, L.G., SIGE, B. & VILLAROEL. C. 1983. Late Cretaceous vertebrate, including mammals from Tiupampa, southcentral Bolivia. *Geobois,* **16**(6): 747-753.

MURRAY, A. 1860. The fossil insect, in Hislop, s. (1860). *Quart. Jour. Geol. Soc. London.* **16**: 154-189.

NARAYAN RAO, S.R. & RAO, K.S. 1937a. Some foraminifera from the hintertrappean beds near Rajahmundry. *Rec. Geol. Surv. India.,* **71**(4): 389-396.

NARAYAN RAO, S.R. & RAO, K.S. 1937b. *Holosporella* cf. *H. samienis* Pia from the Rajahmundry limestone. *Rec. G.S.I.,* **71**(4): 397-400.

NARAYAN RAO, S.R. & RAO, K.S. 1940. More algae from the Intertrappeans. *Proc. 27th Indian Sci, Congr.,* **3**: 118-119.

NARAYAN RAO, S.R. & RAO, K.S. & PIA, J. 1938. Calcareous algae from the Intertrappean beds near Rajahmundry. *Curr. Sci.* **6**(8): 376-377.

NATARAJAN, V., SARVOTHAMAN, H.K., NANDA, J.K. & RAJAGOPALAN NAIR, S. 1981. A note on the Intertrappean stratigraphy of Gandhari, Kamareddi and Ramayampet areas, Nizamabad and Medak District, Andhra Pradesh *Rec. G.S.I.* **114**: 19-23.

NIELL,W.T. 1971. The last of the ruling reptiles. Alligators, crocodiles and their kin. *New York, Columbia Univ. Press.*: 1-486.

NYBELIN. O, 1977. The polyural skeleton of *Lepisosteus* and certain other Actinopterygians. *Zoologica Scripta.* **6**: 233-244.

OLDHAM, T. 1871. Sketch of the Geölogy of Central Provinces. *Rec. G.S.I.,* **4**(3): 69-81.

PIA, J., NARAYAN RAO, S.R.and RAO, K.S. 1937a. Dasycladaceen aus zwischenlägen des Deccantrapps bei Rajahmundry in Sudindien. *Anz. Akad. Wiss. Wien.* **4**: 185-188.

PIA, J., NARAYAN RAO, S.R.and RAO, K.S. 1937b. Dasycladaceen aus Zwischenlagn des Dekkantrapps bei Rajahmundry in Sudindien. *Anz. Akad. Wiss. Wien. Mathem. Naturw. Kl.* **146**(5&6): 227-236.

PRAKASH, U. 1954. *Palmocarpon mohgaoense* sp. nov., a palm frit from the Deccan Inertrappean series, India. *Palaeobot.,* **3**: 91-96.

PRAKASH, U. 1955. On the structure and affinities of *Sahnipushpum glandulosum* sp. nov. from the Deccan Intertrappean series, India. *Palaeobot.* **4**: 91-100.

PRAKASH, U. 1956a. Studies in the Deccan Intertrappean flora. 1. On a petrified ovuliferous cone from Mohgoan chert in the Deccan. *Palaeobot.* **5**(2): 91-94.

PRAKASH, U. 1956b. Studies in the Deccan Intertrappean flora 2. further observation on *Dryoxylon mohgaoense* Rode. *Palaeobot.* **5**(2): 104-108.

PRAKASH, U. 1957. Studies in the Deccan Intertrappean flora. 3. On the new species of fossil wood of Euphorbiacee from the Intertrappean beds of Madhya Pradesh. *Palaeobot.* **6**(2): 77-81.

PRAKASH, U. 1958a. Studies in the Deccan Intertrappean flora. 4. Two fossil woods from Madhya Pradesh *Palaeobot.* **7**(1): 12-20.

PRAKASH, U. 1958b. Studies in the Deccan Intertrappean flora. 5. Two palm woods from Mohgaon Kalan. *Palaeobot.* **7**(2):

PRAKASH, U. 1959a. Studies in the Deccan Intertrappean flora. 6 Two fossil woods from Bharatwada and Mohgaon Kalan. *Palaeobot.* **8**(1):

PRAKASH, U. 1959b. Studies in the Deccan Intertrappean flora. 7. *Mohagaonstrobus sahnii* a new megastrobilus from Mohgaon chert. *Palaeobot.* **9**(1): 20-21.

PRAKASH, U. 1960. On two palm fruits from the Deccan Intertrappean beds of Madhya Pradesh. *Curr. Sci.,* **28** (11): 446-448.

PRAKASH, U. & AMBWANI, K. 1980. A petrified *Livistona*- like palm stem, *Palmoxylon livistonides* sp. nov. from the Deccan Intertrappean beds of India. *Palaeobot.* **26** (3) 297-306.

PRAKASH, U. & SRIVASTAVA, S.K. 1959. On the occurrence of a new species of *Spiroxylon, S. intertrappean* from district Dhar in Madhya Pradesh. *Curr. Sci.*

PRASAD, G.V.R. 1985. Microvertebrates and associated microfossils from the sedimentaries associated with Deccan traps of the Asifabad, Adilabad District, Andhra Pradesh. *Unpüb. Ph. D. Thesis P. U. Chandigarh,* 1-320.

PRASAD, G.V.R. 1986. Microfossil assemblage from the Intertrappean beds of Asifabad, Adilabad District, Andhra Pradesh. *Resh. Bull. P.U. Chandigarh.* **37** (3&4): 65-77.

PRASAD, G.V.R. 1987. Fossils fish remains from the Intertrappean beds of Duddukuru, Andhra Pradesh. *Bull. Indian Geol. Assoc.,* **20**(2): 33-39.

PRASAD, G.V.R. 1989. Vertebrate fauna from the Infra-and Intertrappean beds of Andhra Pradesh: Age implication. *Jour. Geol. Soc. India.* **34**: 161-173.

PRASAD, G.V.R. & SAHNI, A. 1987. Coastal-plain microvertebrate assemblage from the terminal Crëtaceous of Asifabad, peninsular India. *Jour. Paleont. Soc. India.* **32**: 5-19.

PRASAD, G.V.R. & SAHNI, A. 1988. First Cretaceous mammal from India. Nature. **332**: 638-640.

RANA, R.S. 1984. Microvertebrate palaeontology and biostratigraphy of the Infra and Intertrappean beds of Nagpur, Maharashtra. *Ph. D. thesis, P.U. Chandigarh.* 1-234.

RANA, R.S. 1988. Freshwater fish otoliths from the Deccan trap associated sedimentary (Cretaceous-Tertiary transition) beds of Rangapur, Hyderabad District, Andhra Pradesh, India, *Geobios.* **21**(4): 465-493.

RANA, R.S. 1989. Alligatorinae teeth from Rangapur Intertrappean beds of Andhra Pradesh, India. *Curr. Sci.* (in press).

RANA, R.S. & KUMAR, K. 1989. Late Cretaceous-Early Tertiary fish assemblages from peninsular India and Himalayan regions: Comments on phylogeny and palaeogeography. *Cret. Event. State. Corr. Indian Nonmarine Strata.* (in press).

RANA, R.S. & SAHNI, A. 1989. Fish otoliths from the Takli Formation (Intertrappeans), Nagpur, Maharashtra, India. *Jour. Geosci.* (in press).

RAO, A.R. 1957. Contribution to our knowledge of the Deccan Intertrappean Flora. *Palaeobot.* **6**(1): 19-21.

RAO, K.S. & NARAYAN RAO, S.R. 1939. The fossil charophyta of the Deccan Intertrappean near Rajahmundry (India). *Mem. G.S.I.,* **29**(2): 1-14.

RODE, K.P. 1933a. A note on fossil angiospermous fruits from the Deccan Intertrappean beds of Central Province. *Curr. Sci.,* **2**(5): 171-172.

RODE, K.P. 1933b. Silicified palm from the Deccan Intertrappean beds. I-II. *Quart. Jour. Geol. Min. Met. Soc. India.* **5** (2&3):

75-88.

RODE, K.P. 1934a. A note on the petrified palm from the Mohgaon Kalan, District Chhindwaram C.P. *Proc*, 21 *Indian Sci. Congr.*, **3**: 349.

RODE, K.P. 1934Bb. On *Rhizopalmoxylon penchiensis* sp. nov., a fossil palm root from Mohgaon Kalan, District Chhindwara, C.P. Chhindwara, C.P. *Proc. Indian Sci. Congr.* **3**: 349-350.

RODE, K.P. 1935. On a dicotyledonous leaf impression: *Phyllites mohgaoensis* sp. nov. from the Deccan Intertrappean bed of Chhindwara District, C.P., *Prov. 22nd India Sci. Congr.* **4** 209.

ROMER, A.S. 1966. Vertebrate Palaeontology, 3rd *edition Univ. Chicago press London.* 468 pp.

RUSSELL, L.S. 1974. Fauna and correlation of the Rivenscrage Formation (Palaeocene) of Southwestern Saskatchewan. *Life Sci. Cont. Royal Ontorio Mus. Nat.* **102**: 1-52.

SAHNI, A. 1972. The vertebrate fauna of the Judith River Forama tion, Montana. *Amm. Mus. Nat. Hist. Bull.*, **147**: 321-421.

SAHNI, A. 1980. Eocene vertebrate fauna from the Salt Range (Pakistan), Kashmir and Simla Himalaya and China. *Him. Geol Sem. W.I.H. Geol. Dehradun.*

SAHNI, A. 1983. Upper Cretaceous palaeobiogeography of the peninsular India, and Cretaceous-Palaeocene transition. *Cretaceous India*, 128-140.

SAHNI, A. 1984a. Cretaceous-Palaeocene terrestirial fauna of India. Lack of endemism drifting of the Indian Plate. *Science*, **226**: 441-443.

SAHNI, A. 1984b. Upper Cretaceous- Early Palaeobiogeography of India based an terrestrial vertebrate fauna. *Mém. Soc. géol. France, N.S,.* **147**: 125-137.

SAHNI, A. 1987. Faunal assemblage, correlation and palaeoecology of Late Cretaceous non-marine sequences of peninsular India. *I GCP 216 Symp. China* (in press).

SAHNI, A. 1988. Cretaceous-Tertiary boundary events: Mas extinction, Iridium enrichment and Deccan Volcanism. *Curr. Sci.*, **57**(10): 513-519.

SAHNI, A. & BAJPAI, S. 1988. Createaceous-Tertiary boundary events: the fossil vertebrate, palaeomagnetic and radiometric evidence from peninsular India. *Jour. Geol. Soc. India.* **32**: 382-396.

SAHNI, A., JAEGER, J.J. RANA, R.S. & PRASAD, G.V.R. 1986 Takli Formation and coeval Deccan Intertrappeans: Are they Cretaceous or Palaeocene. *B.S.I.P. Symp.* 1986, 28-33.

SAHNI, A., KUMAR, K., HARTENBERGER, J.L., JAEGER, J.J. RAGE, J.C., SUDRE, J. & VIANEY-LIAUD, M. 1982. Microvertébrés nouveaux des Trapps du Deccan (Inde): misc en évidence d'une voice de communicatio terrestre probable entre la Laurasia et L'Inde à la limite Crétacé-Tertiaire. *Bull. Soc.* géol. France. **24**: 1093-1099.

SAHNI, A. RANA, R.S & PRASAD, G.V.R. 1984a. SEM studies of thinegg shell fragments from the Intertrappeans (Createous-Tertiary transition) at Nagpur and Asifabad, peninsular India. *Jour. Palaeont. Soc. India.* **29**: 26-33.

SAHNI, A., RANA, R.S., KUMAR, K. & LOYAL, R.S 1984b. Stratigraphic nomenclature for the Infra and Intertrappean beds of Nagpur. *Jour. Geosci.*, **5**(1): 55-58.

SAHNI, A. RANA, R.S & PRASAD, G.V.R. 1987. New evidence for palaeobiogeographic Intercontinental Gondwana relationships based on Late Cretaceous- Earliest Palaeocene coastal fauna from the peninsular India. *Amm. Geophy. Union.* 207-218.

SAHNI, B. 1931. Revision of Indian fossil plants: pt. 2-Coniferales (b. petrifactions). *Mem. G.S.I., Pal. Indica, N.S.*, **11**: 51-124.

SAHNI, B. 1941. Indian silicified plants I. *Azolla intertrappea* Sah and H.S. Rao. *Proc. Indian. Acad. Sci.*, **14**(6): 489-501.

SAHNI, B. 1943a. *Enigmocarpon parijai*, a silicified fruit from the Deccan, with review of the fossil history of the Lythraceae. *Proc. Indian Acad, Sci.* **17**: 59-96.

SAHNI, B. 1943b. A new species of petrified palm stem, *palmoxylon sclerodermum* sp. nov., from the Deccan intertrappean series. *Jour. Indian Bot. Sec.* **2**: 209-224.

SAHNI, B. 1946. A silicified Cocos-like palm stem, *Palmoxylon (Cocos) sundaram* from the Deccan Intertrappean beds. *Jour. Indian Bot. Soc.* **25**: 361-374.

SAHNI, B. & NARAYAN, RAO, S.R. 1943. On *Chara sausari* sp. nov., a *Chara* (sensu stricto) from the Intertrappean chart at Sausar in the Deccan. *Proc. Nat. Acad. Sci. India.* **13**(3): 215-223.

SAHNI, B. & RAO, H.S. 1943. A silicified plant from the Intertrappean chert round Sausar in Deccan . *Proc. Nat. Acad. Sci. India.* **13**(1): 36-75.

SAHNI, B. & RODE, K.P. 1937. Fossil plants from the Intertrappean beds of Mohgaon Kalan, in the Deccan, with a sketch of the geology of Chhindawara District. *Proc. Nat. Acad. Sci. India.* **7**(3): 165-174.

SAHNI, B., SRIVASTAVA, B.P. & RAO, H.S. 1934. The silicified flora of the Deccan Intertrappean series. *Proc. 21st. Indian Sci. Congr.* **1-4**: 25-28.

SAHNI, B. & SURANGE, K.R. 1944. A silicified member of the Cyclanthaceae from the Tertiary of the Deccan. *Nature*, **154**: 114-115.

SAHNI, B. & SURANGE, K.R. 1944. A silicified member of the of *Cyclanthodendron Sahnii* (Rode), Sahni and Surage from the Deccan Intertrappean series.

SANDERS, M. 1934. Die fossilen fishe der Alt tertiaren Susswasserblagerungen aus Mittel-Sumatra. *Verh. Geol. Mijnbouw. Genootsch. Nederl. Kol. Geol. Ser. Amesterdam.* **11**: 1-144.

SHALLOM, L.J. 1958. A fossil dicotyledonous wood from the Deccan Intertrappean beds of Mahurjhari. *Jour. Indian Bot. Soc.* **37**(4): 492-498.

SHALLOM, L.J. 1959. *Simaribaceoxylon mahurjhari* gen. et. sp. nov., a new fossil wood from the Deccan Intertrappean beds of Mahurzari. *Curr. Sci.*, **28**(4): 168-169.

SHIVARUDRAPPA, T.V. 1972a. On the occurrence of charophytic remains from the Intertrappean of Gurmatkal, Gulbarga District, Mysore State. *Curr. Sci.* **41**(2): 21-23.

SHIVARUDRAPPA, T.V. 1972b. On *Gyrogonites medicaginula* and *Chara wrighti* from the Intertrappean of Gurmatkal, Gulbarga District, Masore State. *Proc. IInd. Coll. Micropal. Strat. Lucknow.* 115-119.

SHIVARUDRAPPA, T.V. 1977. Discovery of fossil reproductive organ of *Chara* from the Intertrappean of Gurmatkal, Gulbarge District, Karnataka State. *Jour. Mysore Univ.* **B27**: 104-110.

SHIVARUDRAPPA, T.V. 1978. First record of Nitellites from the Lower Tertiary Intertrappean sediments of Gurmatkal, Gulbarga District, Karnataka State, *Abst.* VII *Indian Coll. Micropal. Strat. Madras.* 33-34.

SHUKLA, V.B. 1938. On a new species of *Dadoxylon, D. deccani* sp. nov., from the Deccan Intertrappean series. *Jour. Indian Bot. Soc.*, **17** (5&6): 355-367.

SHUKLA, V.B. 1939. On *Palmoxylon kamalam* Rode, from the Deccan Intertrappean series with special importance of ground-tissue in the classification of palm. *Rec. G.S.I.*, **74** (4): 492-503.

SHUKLA, V.B. 1944a. On *Sahnianthus*, a new genus of petrified flowers from the Intertrappean beds at Mohgaon Kalan in Deccan and its relation with the fruit *Enigmocarpon parijai* Sahni from the same locality. *Proc. Nat. Acad. Sci. India.* **14** (1&2): 1-39.

SHUKLA, V.B. 1944b. *Dadoxylon resinosum* sp. nov., from the Chhindwara District of the Central Province. *Jour. Indian Bot. Soc.,* **23**(3): 83-90.

SHUKLA, V.B. 1948. A new angiosperm flower of gymnospermous ovule from Mohgaon Kalan: Palaeobotany in India-Vi. *Jour. Indian Bot. Soc.*, **26**(4): 259.

SHUKLA, V.B. 1950. *Shanipushpam* gen. nov., and other plants remains from the Deccan Intertrappaean; Palaeobotany in India-VII. *Jour. Indian Bot. Soc.* **29**(1): 29.

SHUKLA, V.B. & CHITALEY, S.D. 1948. Microflora of Mohgaon chert: Palaeobotany in India-VI. *Jour. India Bot. Soc.* (4): 259.

SURANGE, K.R. & PRAKASH, U. 1953. *Palmocarpon mohgaoense* sp. nov., a fruit from Deccan Intertrappean series. *Pro. 40th Indian Sci. Congr.*, : 108-109.

SUTTKUS, R.D. 1963. Order Lepisostei., *Mem. Sears. Found. Marine Res.* **1**: 61-68.

TRIVEDI, T. 1956. Fossil dicotylesonous leaf impression from the Intertrappean beds of Bharatwada, Nagpur District. *Jour. Palaeobot. Soc. India,* **1** (1): 186-188.

TRIVEDI, B.S. & AMBWANI, K. 1971. Occurrence of *Hibiscoxylon intertrappeum* sp. nov. from the Deccan Intertrappean series of Manurzari near Nagpur, India. *Curr. Sci.*, **4**(7): 167-168.

VERMA, J.K. 1950. A fossil dicot wood from the Intertrappean chert of Mohgaon Kalan: Palaeobotany in India-VII. *Jour. Indian Bot. Soc.* **29**(1): 301.

VERMA, J.K. 1956a. On a new petrified flower, *Sahnipushpam shuklai* sp. nov., from the Intertrappean beds of mohgaon Kalan in the Deccan. *Jour. Palaeont. soc. India.*, **1** (1): 131-141.

VERMA, J.K. 1956b. A petrified monocotylydenous inflorescence from the Deccan Intertrappean beds, Chhindwara, M.P. *Jour. Bombay Nat, Hist. Soc.*, **53**(3): 505.

VERMA, K.K. 1965. Note on new species of fossil frog from the Intertrappean beds of Malabar Hill, Bombay. *Curr. Sci.*, **34**(6): 182-183.

WILEY, E.O. 1976. The phylogeny and biogeography of fossil and Recent gars (Actinopterygii-Lepisosteidae). *Univ. Kansa. Pub. Ms. Nat. Hist. Miscell. Pub.* **64**: 1-111.

WOODWARD, A.S. 1908. On some fish remains from the Lameta beds at Dongargaon, Central Province. *Mem. G.S.I., Pal. Indica, N.S.*, *3*(3): 186.

YOUNG, C. 1964. New fossil crocodiles from China. *Vert. Palsiat.*, **8**: 189-210.