

Thus, the precise analysis of the ^{13}C resonances of the folic acids has led to the confirmation of the structure proposed earlier¹ for these compounds. The proton coupled spectrum however revealed that the ^{13}C resonances reported earlier, based on theoretical consideration and off-resonance decoupling for the three methine carbons of the phenyl ring were to be revised as 115.6 replacing 120.3 which replaces 131.7 and the latter 115.6.

We thank Aldrich Chemical Company, Inc., Wisconsin, U.S.A. for the ^{13}C NMR spectrum of β -phenyl lactic acid, and UGC, New Delhi for financial assistance.

16 October 1986

1. Gunasegaran, R. and Nair, A. G. R., *Indian J. Chem.* 1983, B22, 606.
2. Gaunasegaran, R. and Nair, A. G. R., *Indian J. Chem.*, 1985, B24, 1084.
3. Chopin, J. (personal communication.)
4. Markham, K.R. and Chari, V.M., In: *The flavonoids, Advances in research*, (eds) J.B. Harbone, and T.J. Mabry, Chapman and Hall, London, p. 23.
5. Werli, F. W. and Wirthlin, T., *Interpretation of C-13 NMR spectra*, Heyden, London, 1976, p. 259.

DYROSAURID CROCODILE (MESOSUCHIA) FROM THE INFRATRAPPEAN BEDS OF VIKARABAD, HYDERABAD DISTRICT, ANDHRA PRADESH

RAJENDRA SINGH RANA

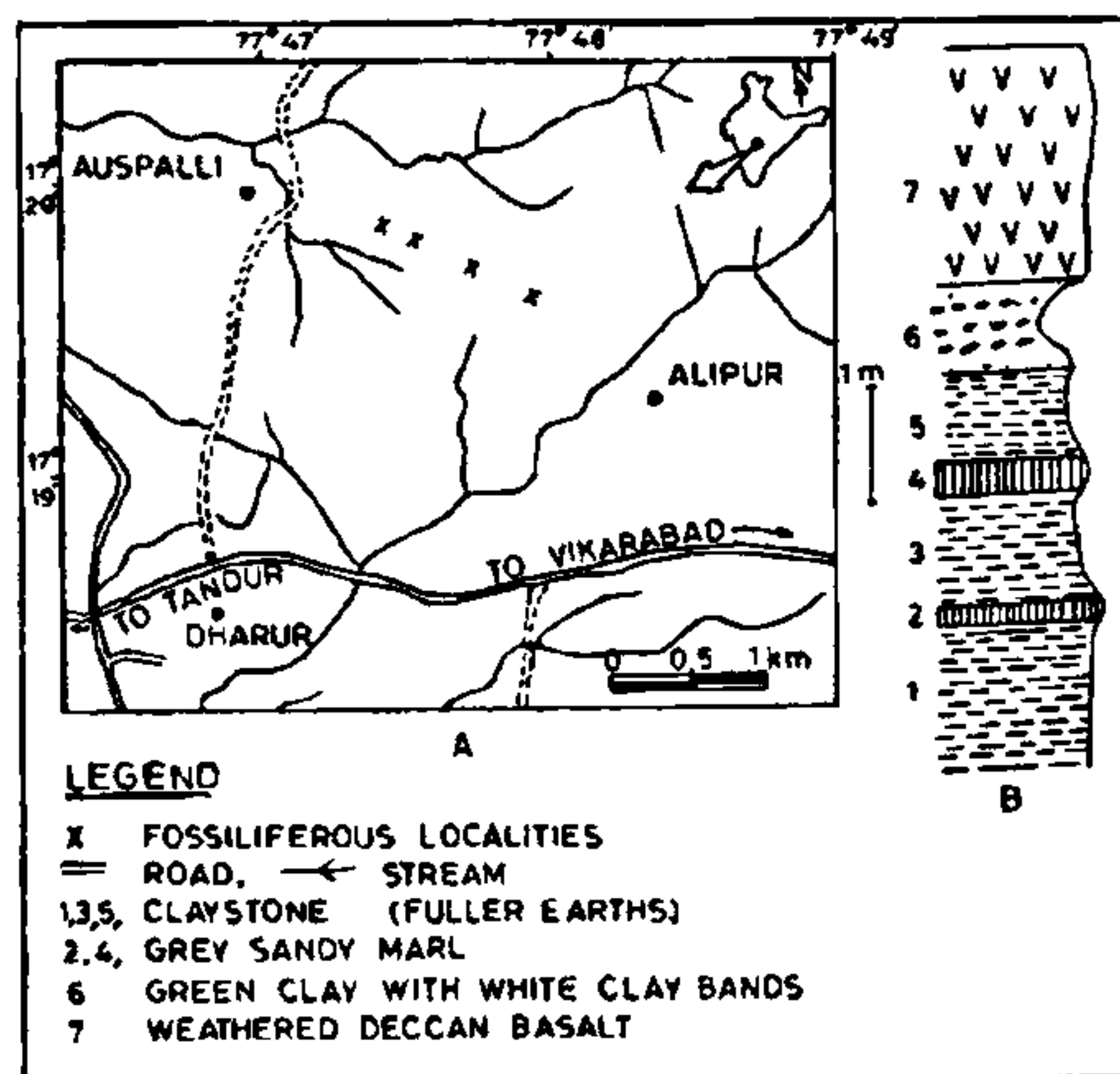
Centre of Advanced Study in Geology, Punjab University, Chandigarh 160 014, India.

Present address: University Paris VI, Laboratoire de Paléontologie des Vertébrés et Paléontologie Humaine, 4, Place Jussieu, 75252, Paris Cédex 05, France.

GEOLOGICAL and palaeontological investigations of the Infra and Intertrappean beds of the western part of Hyderabad District (near Vikarabad) during February, 1986 suggest that the Infratrappean beds yield fossil vertebrates. Though the Intertrappeans of the area were shown to be fossiliferous¹, there was no previous report of Infratrappean (Lameta Formation) fossils. The Infratrappean beds exposed in patches in a wide region, rest directly above the Archaean rocks (granites, gneisses, schists and quartzites) and in turn are overlain by the Deccan basalt.

The ossiferous Infratrappean locality (figure 1A) is situated 1 km south of Auspalli village ($17^{\circ}20' 77^{\circ}47'$) and 1.5 km west of Alipur ($17^{\circ}19' 77^{\circ}48'$). A 5.93 m thick section was measured at a quarry near Auspalli where the base is not exposed (figure 1B). The basal unit is greenish grey and fine grained, soft clayey stone (Fuller's earth) and is followed by alternating claystone and greenish grey calcareous sandy marl with abundant recrystallized calcite. The uppermost unit is a green friable clay with thin white bands. The top of the section is covered by basalt weathered to a reddish or greenish colour.

The faunal assemblage from the Infratrappean (Lameta Formation) horizon is represented by *Lepisosteus* fish scales, dyrosaurid amphicoelous crocodile vertebra and teeth and abundant turtle carapace and plastron fragments. The amphicoelous vertebra is assigned to the family Dyrosauridae (Suborder-Mesosuchia) and is the first report from India. Till now dyrosaurids were known from *Cardita beaumonti* beds (Maestrichtian-Danian) of Sind Baluchistan^{2,3}, Kala Chitta area (Eocene) of Pakistan³⁻⁵, Pondaung Formation (Priabonian) of Burma^{3,6}, the Maestrichtian of Brazil^{5,7}, Maestrichtian to Danian of New Jersey, USA⁹ and Maestrichtian to Lutetian sequences of northern and western Africa^{3,5}.



Figures 1A-B. A. Location map, showing fossiliferous localities. B. Stratigraphic section near Auspalli.

Order	Crocodylia	GMELIN, 1788.
Suborder	Mesosuchia	HUXLEY, 1875.
Family	Dyrosauridae	DE STEFANO, 1903.

The amphicoelous vertebra is cylindrical in shape, partially broken, 3.3 cm long and has a strong concave centrum which is slightly deep and compressed (figure 2A). The anterior side of the vertebra is represented by subrectangular outline and closely resembles those described by Buffetaut¹⁰. In the ventral view, there is a prominent hypapophysis (ventral keel) which is more pronounced and broader towards the anterior side (figure 2B). In dorsal view, the transverse process and neurocentral suture are also prominent but zygapophyses are broken. The position of parapophysis in the present vertebra indicates that the specimen represents the posterior cervical vertebra¹⁰. The present amphicoelous vertebra can be compared with similar specimens from Kala Chitta, Pakistan described and illustrated by Buffetaut⁴ (1978, figures 3a-c) which show close resemblance in shape, size and other morphological characters.

The Infratrappean (Lameta Formation) beds are generally assigned a Turonian-Maestrichtian age on

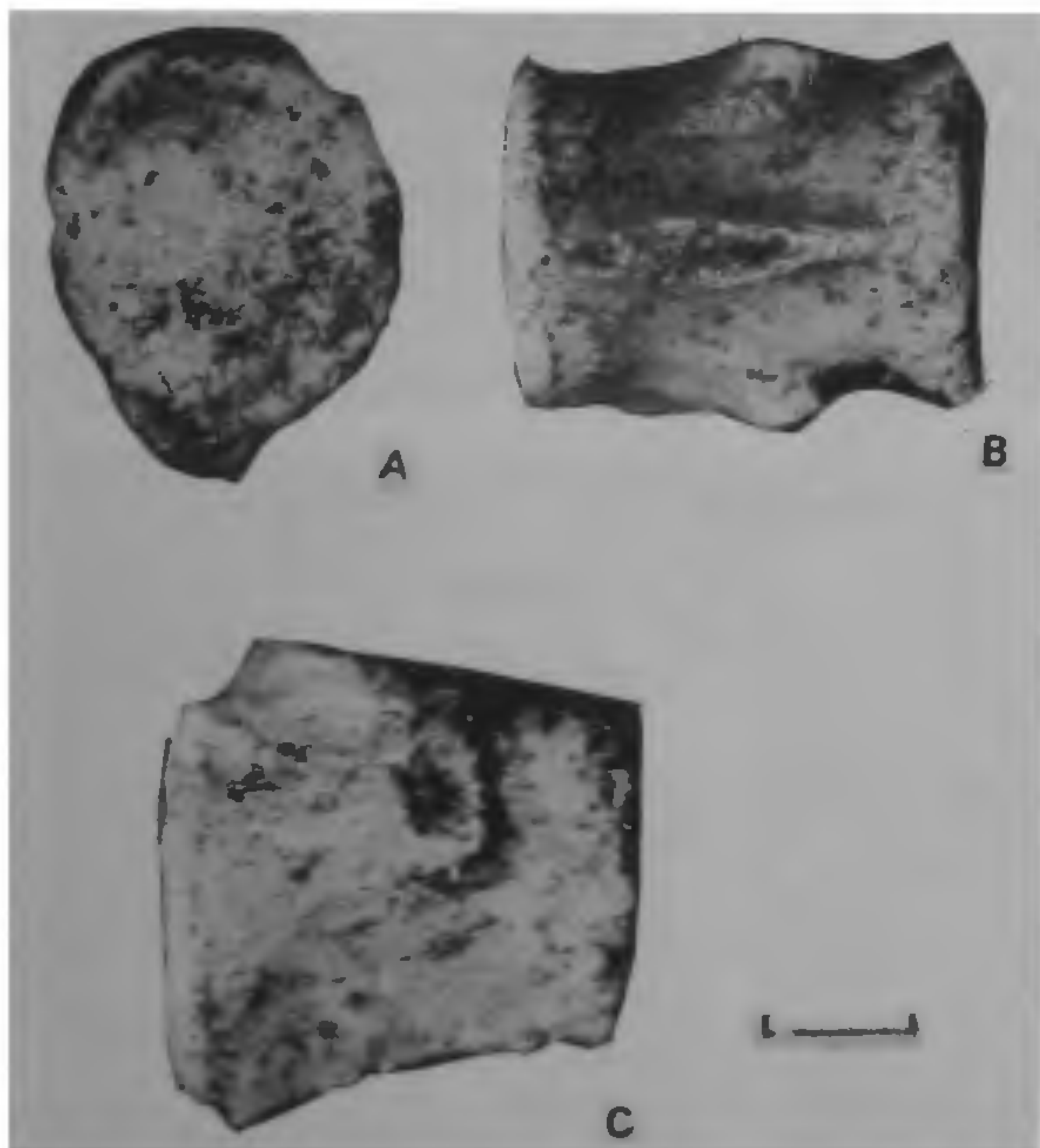
the basis of dinosaur assemblages¹¹⁻¹³. However, the presently documented temporal range of dyrosaurid is from Maestrichtian to the Priabonian and suggests that the Infratrappean beds of the area are of Maestrichtian age. The *C. beaumonti* beds indicate a terminal Cretaceous or Danian age on the basis of marine invertebrates. This is consistent with the data of the dyrosaurid and associated vertebrates from Vikarabad.

Although dyrosaurids from the Upper Cretaceous of North and South America, Africa and *C. beaumonti* beds of the Indian Subcontinent represent littoral marine environment, the finds from the Eocene of Pakistan and Pondaung Formation, Burma indicate a freshwater environment. At Vikarabad, the present indications are that the fauna is predominantly freshwater, though marine influxes are not uncommon. This coastal environment supports Buffetaut's views³, that the adult dyrosaurid spent most of their time in littoral marine water but laid their eggs inland near stream bank. In general, the primitive dyrosaurids are marine while those from the Eocene of the eastern Tethyan region are freshwater. The associated faunal assemblages in the Vikarabad Infratrappean such as *Lepisosteus* and turtle fragments also indicate a freshwater environment of deposition.

The author thanks Profs. A. Sahni, Chandigarh; E. Buffetaut and J. J. Jaeger, Paris, for valuable suggestions and UGC, New Delhi for financial assistance.

23 April 1986; Revised 24 November 1986

1. Dutt, N. V. B. S., *Rec. Geol. Soc. India*, 1975, **114**, 126.
2. Lydekker, R., *Palaeont. Indica*, 1879, **4**, 11.
3. Buffetaut, E., *C. R. Acad. Sci. Paris*, 1977, **D285**, 869.
4. Buffetaut, E., *N. Jb. Geol. Palaeont. Abh.*, 1978, **156**, 262.
5. Buffetaut, E., *C. R. Acad. Sci. Paris*, 1976, **D283**, 487.
6. Buffetaut, E., *N. Jb. Geol. Palaeont. Mh.*, 1978, **5**, 273.
7. Cope, E. D., *Trans. Am. Philos. Soc.*, 1869, **14**, 252.
8. Owen, R. O., *Q. J. Geol. Soc. London*, 1849, **5**, 380.
9. David, C. P., *NJ, MUS. Trenton*, 1986, **4**.
10. Buffetaut, E., *Geobios*, 1976, **9**, 143.



Figures 2A-C. Dyrosaurid cervical vertebra. **A.** Anterior view of centrum, **B.** Ventral view and **C.** Lateral view.

11. Huene, F. Von and Matley, C. A., *Palaeont Indica, N.S.*, 1933, 21, 1.
12. Chatterjee, S., *Palaeont. J.*, 1978, 52, 570.
13. Colbert, E. H., *Indian J. Earth Sci.*, 1984, 11, 25.

OCCURRENCE OF FOSSIL REMAINS IN WARKALLI SEDIMENTS (TYPE AREA), SOUTHERN KERALA, AND ITS STRATIGRAPHIC SIGNIFICANCE

C. P. RAJENDRAN

Centre for Earth Science Studies, Trivandrum 695 031, India.

THE sedimentary section at Varkala (Warkalli, $8^{\circ}44' : 76^{\circ}43'$) located to the south of Quilon (figure 1a) is considered to be the type area of Tertiary sediments¹ in Kerala. This section which

consists of sandstones, variegated clays with lignitic bands, is considered to be a littoral facies partially overlapping the underlying Quilon Limestone². Palynological studies conducted on the carbonaceous sediments at the base of Warkalli sediments^{3,4} have indicated an Early Miocene age. An Early Miocene age has also been assigned to the Quilon Limestone⁵, located at Padappakara (figure 1a) on the basis of foraminiferal studies. This obviously indicates that the deposition of limestone and lignite is more or less coeval which occurred in two different types of environments. A slightly younger age (Mio-Pliocene) has been tentatively assigned² to the top-most Warkalli sediments as these sediments are barren of plant and animal fossils.

During the course of palaeontological studies of the Tertiary sediments of the area, milky white grains resembling fossil tests (figure 2) have been observed in a borehole at Thachankonam, behind the Varkala cliffs (figures 1a&b). Similar silicified fossil fragments have also been observed in the Varkala cliff sediments (figure 2). The silicified

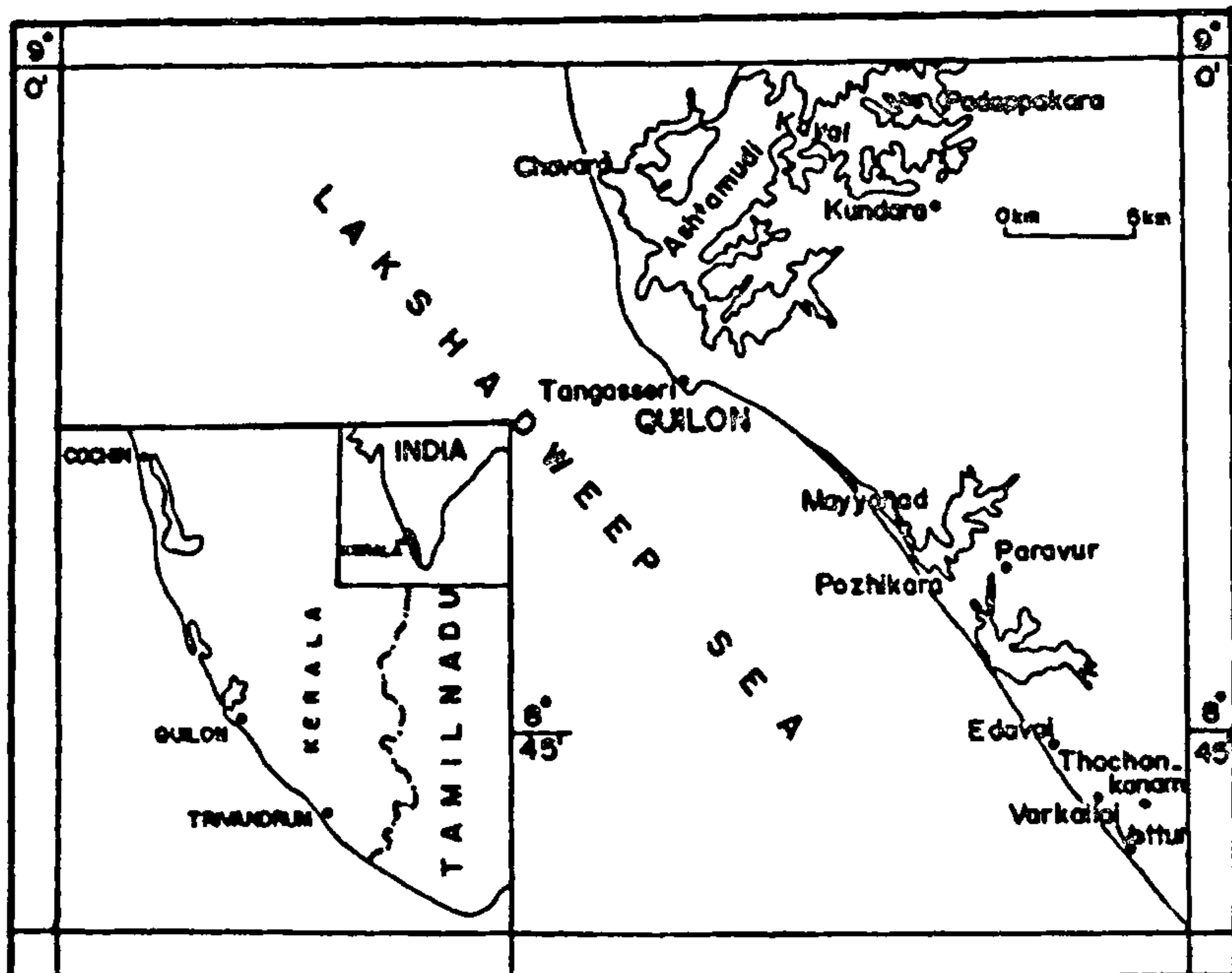


Figure 1a. Location map.