Jabalpur Formation and opined its Oolitic dating. Bose and Sukhdev[7] recorded two Lower Cretaceous index form genera, viz., *Weichselia* and *Onychiopsis* from this formation (Jabalpur Series, *sensu stricto*) exposed at Bansa (Madhya Pradesh). Bose and Sukhdev[8] also reported *Onychiopsis paradoxus* from the same horizon exposed at Sehora in Madhya Pradesh. This Lower Cretaceous dating has also been supported by palynological studies[9]. Contrary to this, Bharadwaj *et al*[10] deduced an Upper Jurassic age after a statistical analysis of the Jabalpur mioflora.

Similarly, the age of Lameta Formation like Jabalpur Formation is also disputable. Medlicott[11] correlated the Lameta rocks with the Bagh Formation in the Lower Narmada Valley and assigned them Cretaceous age. Matley[6] commented further that the Lameta Group is probably Albian or Cenomanian or both and the lowest Deccan Traps are possibly no younger than middle Cretaceous.

The detailed field and laboratory investigations carried out during the recent years (1983–87) indicate that the Jabalpur mioflora comprises a varied assemblage of gymnosperms (90%) followed by pteridophytes (9%) and bryophytes (1%). The stratigraphically significant index palynotaxa in the assemblage, viz., *Aequitriradites triangulatus*, *Contignisporites dettmanii*, *C. cooksonii*, *Crybelosporites* sp. cf. *C. stylosus*, *Coptospora mesozoica*, *Coptospora pallida*, *Callialasporites trilobatus*, *Schizosporis rugulatus* and *Podosporites tripakshii* point out its deposition at the dawn of Cretaceous Period (Tithonian to Neocomian). The occurrence of Wealden plants, such as, *Weichselia* and *Onychiopsis* in Bansa and the latter in Sehora areas of the formation (Jabalpur Series, *sensu stricto* Bose and Sukhdev[7,8]) further provide a testimony to this fact.

The palynological assemblage of the Lameta Formation has been recorded for the first time from its type area. The assemblage consists of angiosperms (35%), phytoplankton (24%), gymnosperms (21%), pteridophytes (18%) and bryophytes and acritarchs (2%). It includes typical Maestrichtian association such as, *Ariadnaesporites punctatus*, *Leptolepidites verrucatus*, *Proxapertites crassimurus*, *Palmidites maximus*, *Liliacidites microreticulatus*. *Aquilapollenites indicus*, *A. bengalensis*, *Aquilapollenities andamanensis*, *Scollardia conferta*, *Dinogymnium* sp., *Gonyaulacysta* sp. etc. In view of above assemblage it seems that the deposition of Lameta Formation took place near the end of Mesozoic Era (Maestrichtian). The Danian dating of the Deccan trap from Jabalpur area is an additional evidence in this regard[12]. The abundance of phytoplankton in the population further indicates the deposition of the Lameta Formation under the marginal marine environment probably in backshore condition, whereas, the complete absence of phytoplankton in the underlying Jabalpur Formation is perhaps due to its non-marine nature. Some of the significant palynotaxa of Jabalpur and Lameta Formations are illustrated in figure 1. The details of the present study are being published separately.

4 June 1987; Revised 11 April 1988

1. Sastry, M. V. A. *et al.*, *Geol. Surv. India Misc. Publ.*, 1977, **36**, 43.
2. Oldham, T., *Rec. Geol. Surv. India*, 1871, **4**, 3, 69.
3. Crookshank, H., *Mem. Geol. Surv. India*, 1936, **66**, 2, 173.
4. Medlicott, J. G., *Mem. Geol. Surv. India*, 1860, **2**, 199.
5. Oldham, R. D., *Geology of India*, 2nd edn, Govt. of India Publn., Calcutta, 1893.
6. Matley, C. A., *Rec. Geol. Surv. India*, 1921, **53**, 142.
7. Bose, M. N. and Sukhdev, *Nature* (*London*), 1959, **183**, 130.
8. Bose, M. N. and Sukhdev, *Palaeobotanist*, 1959, **8**, 1&2, 57.
9. Singh, H. P., *Palaeobotanist*, 1966, **15**, 87.
10. Bharadwaj, D. C., Kumar, P. and Singh, H. P., *Palaeobotanist*, 1972, **19**, 3, 225.
11. Medlicott, H. B., *Rec. Geol. Surv. India*, 1872, **5**, 4, 115.
12. Khanna, V. K., Pillai, C. S. and Shivani, S. K., *Bull. Indian Geol. Assoc.*, 1983, **16**, 2, 181.

## FOSSIL CRAB FROM MIZORAM

R. P. TIWARI and P. P. SATSANGI*
*Department of Geology, Pachhunga University College, NEHU, Aizawl 796 001, India*
** Mira Cottage, Nongrimbah, Shillong 793 003, India.*

DURING field work in parts of Mizoram, the specimen of a fossil crab was found *in situ* in the silty sandstone of the Upper Bhuban Formation (approximately Lower Miocene in age) and was found exposed along the road section at a locality 3 km of the Lunglei Jail on the Lunglei-Vanhe road (figure 1). Associated with this were other fossils

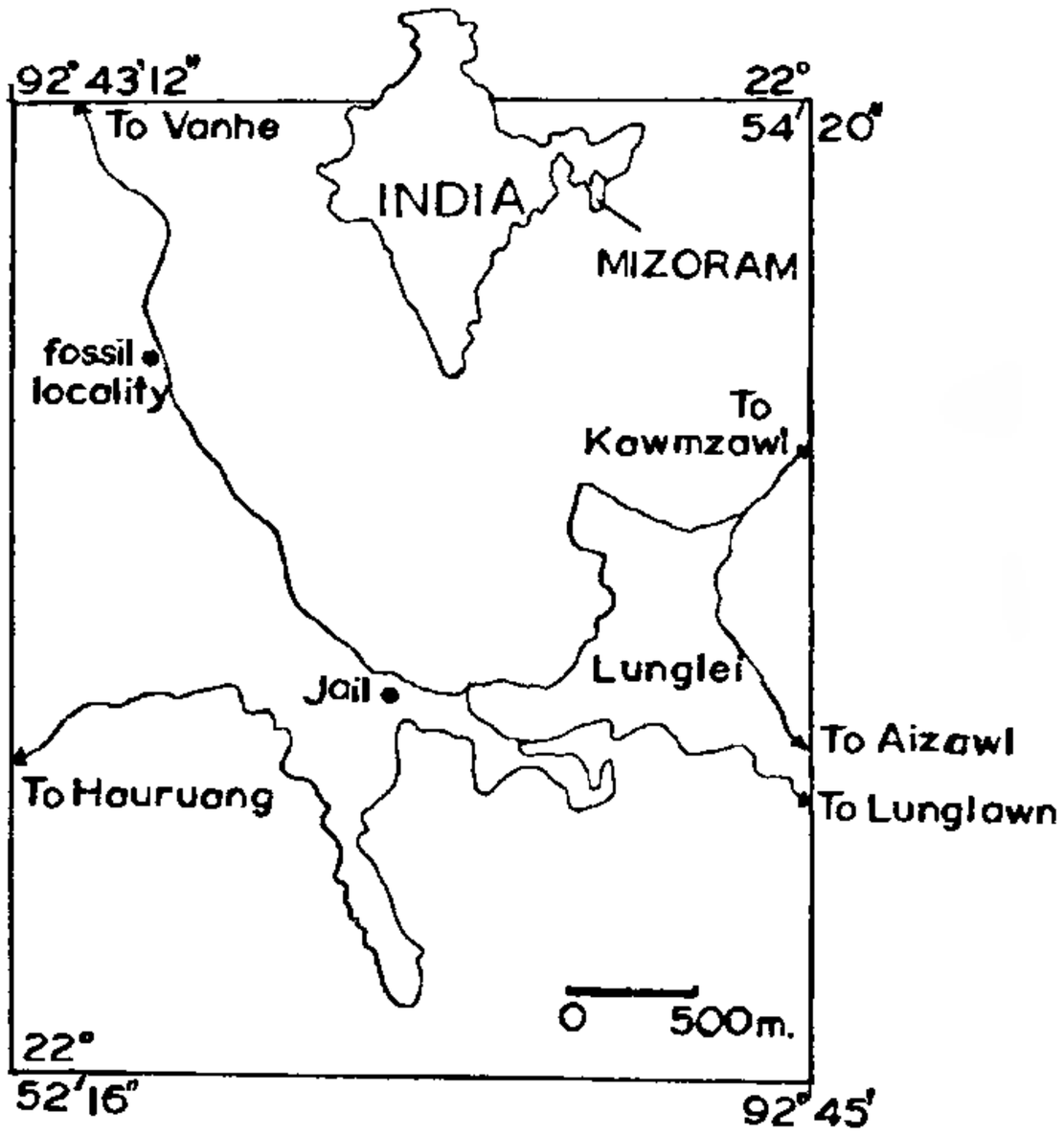


**Figure 1.** Location of fossil crab.

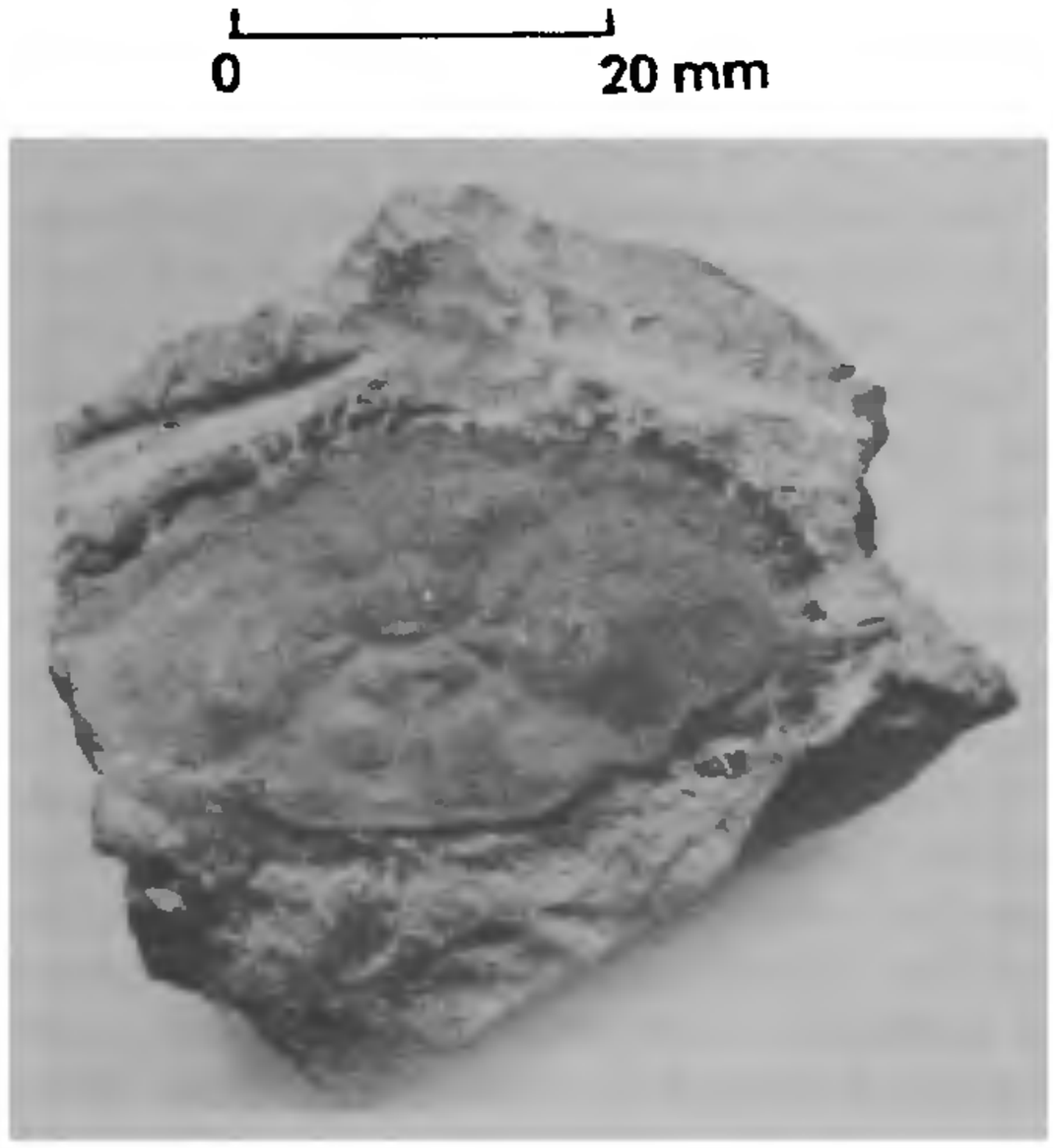


**Figure 3.** *Portunus* sp.

comprising mainly of pelecypods, gastropods and a few echinoids. This is the first report of Portunid crab from Mizoram and a brief description is given below:

Superfamily – Portunoidea
Family – Portunidae Refinesque, 1815
Genus – *Portunus* Weber, 1795; *Portunus* sp.; figures 2 and 3.

The material comprised a single specimen of a well-preserved crab with nearly complete carapace. The carapace was transversely ovate, the width (40 mm) almost double the length (19 mm). The surface of the carapace was covered with fine granules. The orbitofrontal margin was slightly rounded with four small depressed spines and occupied about two-fifths of the carapace width. The orbits were large, ovate and directed forwards. The anterolateral borders were almost semicircular and lined with seven even-sized spines which continued from the orbit and ended at the antero-lateral angle where a prominent lateral spine was present. The thinly ridged posterolateral borders were slightly concave, sinous and converged rapidly to join the straight posterior margin which was about as wide as the orbitofrontal border. The epibranchial ridge was feebly developed near the lateral spine but became prominent anterior to the mesobranchial lobe, around which it took a broad curve terminating near the groove posterior to the gastric lobe. The cervical groove was shallow forming a U-shaped curve in crossing the mid-line between the gastric and the cardiac lobes.

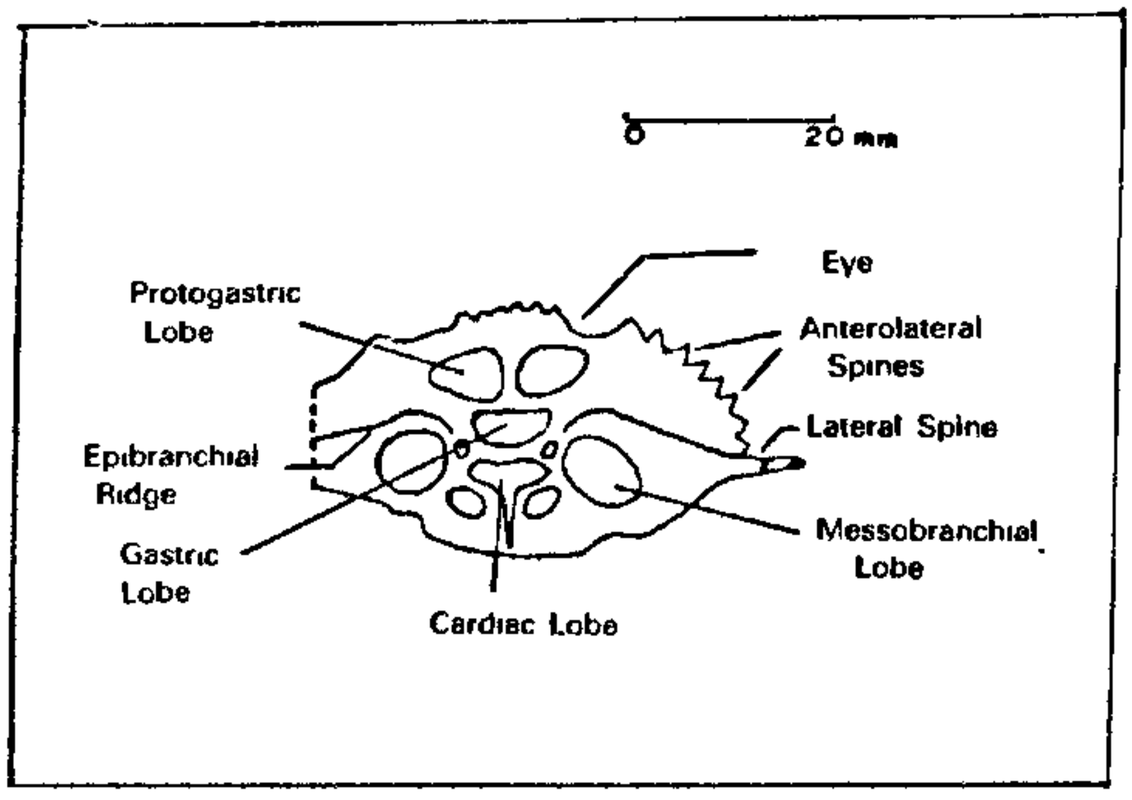


**Figure 2.** *Portunus* sp., Dorsal view.

The regions were well-defined. The meso and meta gastric lobes were confluent and formed a median shield-like elevated platform with a thin ridge at the posterior margin. The anterior process of the mesogastric extended forward and ended up at the base of the small and ovate epigastric lobes. The protogastric lobes were large and ovate with a transverse ridge across the middle of the lobes. The cardiac region was tumid and shaped like an elongated pentagon with a median furrow separating the two ovate cardiac lobes. The intestinal region was

narrow extending round the metabranchial lobe to join the base of the cardiac. The mesobranchial lobe was prominently developed and marked the highest elevation on the carapace.

The specimen has been deposited at the Department of Geology, Pachhunga University College, North-Eastern Hill University, Aizawl (no. 1).

Comparing with the known fossil Portunid crabs from the Indian Sub-continent, the specimen shows closer similarity to the *Portunus* (*Neptunus*) *arabicus* Woodword[1] (referred to as *Chrysbdis* by Glaessner[2]) described from Mekran coast, Baluchistan from a horizon doubtfully referred to Pliocene.

*Portunus* has a geological age range from Eocene to Recent. Most of the records of Portunid crabs from the Indian Sub-continent are from Miocene, excepting *Neptunus arabicus* whose exact horizon is still doubtful and *Neptunus sijuensis* reported from Eocene of Garo Hills, Meghalaya[3]. The extant *Portunes pelagicus* is a free swimming crab inhabiting the warm and temperate seas.

This work is a part of Ph.D. Dissertation of one of the authors (RPT). The authors thank G. S. Jaggi for help during the field work.

4 September 1987, Revised 4 March 1988

1. Woodword, H., *Geol. Mag.*, 1905, **2**, 305.
2. Glaessner, M. F., *Ann. Mag. Nat. Hist.*, 1933, ser. 10, **12**, 1.
3. Satsangi, P. P. and Parida, K., *J. Geol. Soc. India*, 1980, **21**, 305.

## INDUCTION OF ROOTING IN CLADODE CUTTINGS OF *CASUARINA EQUISETIFOLIA*

K. GURUMURTI and H. C. S. BHANDARI
*Plant Physiology Branch, Forest Research Institute, Dehra Dun 248 006, India.*

CASUARINA EQUISETIFOLIA L. has proven its capacity to establish itself in poor sites, particularly in the east coast of India. It can withstand stresses such as soil acidity, salinity, water stress (both flooding and drought), high temperature and high wind velocity[1]. Viable seed production in *C. equisetifolia* is good. Pollination is by wind and hence hybridization and genetic variation in progeny propagated by seed is obvious. Often, within a population there are individual trees that perform better than the others under acidic and saline conditions. Vegetative propagation would be the method of choice for large and rapid multiplication of such trees. This method can reduce the variation in the population and improve the yield. This paper presents the result obtained on rooting cladodes of *C. equisetifolia*. The cladode in *Casuarina* is a green, segmented modified branchlet. The extremely reduced leaves are barely visible and occur in whorls at the nodes of the cladodes. Tender cladodes (5–7 cm) without heel from the side shoots of 15-month-old *Casuarina* plants were excised in October, surface-sterilized by dip treatment in 0.1% Emision solution (mercuric chloride), and divided into three groups of 12 cladodes each. One group was used as control and the other two were treated with the rooting hormone indolebutyric acid (IBA) at 2000 and 4000 ppm. The hormone mixture was prepared by mixing 20 and 40 mg of crystalline hormone, for 2000 and 4000 ppm respectively, with 10 g of talcum powder in a rotary shaker. Control consisted of talcum powder without the hormone. The cut end of the cladode was dip-smeared with hormone mixture or talcum powder up to a length of one cm from the cut end. The treated cladodes were planted in 48 h-presoaked vermiculite in plastic trays and placed in a mist chamber. During the first 15 days, misting was given for 6 sec every 20 min during the day (9.00 a.m. to 7.00 p.m.) and every 50 min during the night (7.00 p.m. to 9.00 a.m.). After 15 days, when callus formation was observed in the cut ends of the cladodes, misting frequency was changed to once every 40 min during the days; misting frequency during the night was not changed. Root initiation was observed 20 days after planting. Rooting data were recorded 40 days after planting by carefully removing the cladode cuttings from the vermiculite and washing the roots under a water spray. For each group, the number of cladodes that rooted, number of roots per rooted cladode and average root length were recorded (table 1). The control cladodes failed to root. In the IBA 2000 group 2 out of 12 cladodes rooted, with 3 roots per

**Table 1** *Rooting of cladode cuttings of Casuarina equisetifolia*

| Treatment | Cladodes planted | Cladodes rooted | Roots per rooted cladode | Average root length |
|---|---|---|---|---|
| Control | 12 | 0 | 0 | 0 |
| IBA 2000 | 12 | 2 | 3.5 ± 0.1 | 1.0 ± 0 |
| IBA 4000 | 12 | 12 | 13.8 ± 2.9 | 6.5 ± 0.7 |