Yellow fever threat?

In the wake of dengue and dengue hemorrhagic fever (DHF) epidemic in Delhi and neighbouring states, there is a heightened concern among the public health experts of the possible outbreak of yellow fever in the Indian subcontinent. This lurking fear emerges from the global experience in the emergence and re-emergence of atleast 30 infectious diseases[1]. Yellow fever virus belongs to flavivirus group, and other members of this group have already entered India and gradually assumed epidemic proportions as exemplified by the appearance of DHF in Calcutta in 1963 and Japanese encephalitis (JE) in North Arcot Dist., Tamil Nadu in 1958. These diseases moved from east towards west, and have now occupied vast territories throughout India, thus raising an alarm of the possible future scenario of communicable diseases and exposing the public health preparedness and monitoring capabilities. Other examples are the re-emergence of once-decimated diseases like kala-azar and malaria, the recent epidemic of plague, and emergence of drug-resistant parasites, vector resistance, and ecological succession of vectors with better adaptations. Tropical climate and environmental degradation makes India a hot bed of new infections and, therefore, warning signals for yellow fever are already there. Vector control which was so successful in the control of communicable diseases has unfortunately taken a back seat. The entomological component in most public health programmes in the endemic countries is the weakest and often nonexistent, whereas vector control still remains the most effective and rational approach to vector-borne disease control. Endemic countries will do well by giving entomology its due place in the public health programmes. What makes India vulnerable to yellow fever are an unprecedented increase in *Aedes aegypti* populations due to urbanization, industrialization, water storage practices, rural water supply and population migration. *Aedes aegypti* 'type form' and var. '*queenslandensis*' are sympatric[2] and both are potential vectors as demonstrated by transmission studies[3]. Similarly *Ae. albopictus* is susceptible to yellow fever virus[4]. *Ae. aegypti*, breeds in containers, rain water collections and invades new territories through used tyres and solid waste dumps and finally diffuses through piped water supply and then proliferates, whereas *Ae. albopictus* is sylvatic and native to India. This mosquito invades peripheral wooded areas and gardens in urban areas. Indian are susceptible to yellow fever as they lack antibodies[3]. Virus invasion is a possibility through the large volume of traffic from yellow fever endemic countries in Africa and South America. Although yellow fever has not moved to any other continent, there is a geographical spread from west coast to east coast of Africa, south of Sahara. There is, therefore, a possibility that large-scale population movement, ecological upheavals, population explosion and developments for better living may break these barriers. Furthermore, quarantine health checks and special sanitation measures introduced under the International Health Regulations[5] to prevent yellow fever entry through air and sea ports into India are not functional. Once the virus enters India either through infected humans or the vector, it can spread through the local vectors. Indian monkeys, viz. *Macaca mulatta mulatta* and *Macaca radiata* are susceptible to yellow fever virus and *Ae. albopictus* can maintain a zoonotic cycle and become a lasting source of infection. To prevent this from happening, quarantine health checks and *Aedes* control measures should be applied rigidly and introduced at all ports of entry in the Indian sub-continent. A surveillance system should be developed to monitor vector populations and the antibody profile in the indigenous populations. Municipal and building bye laws should be adapted and implemented uniformly throughout the country to control vector breeding on sustainable basis. Solid waste disposal should be managed professionally. Emergency strategic planning and adequate stocks of vaccines and drugs should be at hand to fight the accidental entry of new diseases such as the yellow fever.

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Occurrence of a 'fossil' crocodilian vertebra from Hassan District, Karnataka State – A preliminary report

The fossils were recovered accidentally during levelling operation by a bulldozer prior to the agricultural activities in Mosale Hosahalli village, Hassan Taluk and District (Figure 1). This was brought to our notice by one of our students of the same area who also helped us in collecting the samples.

From our observation about the material, it is unlikely that the material was originally in the present place and that it was found *in situ*. It might have been

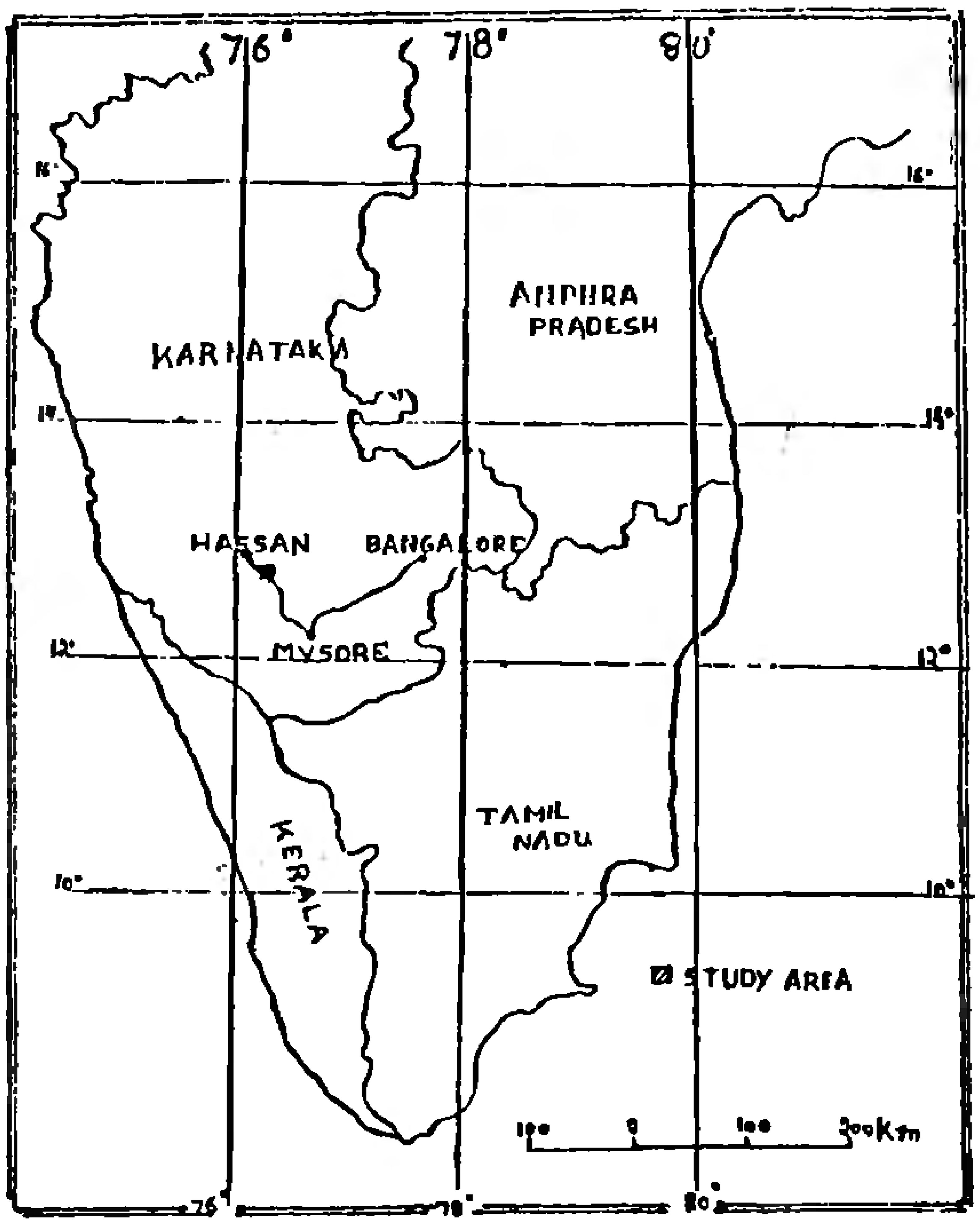

Figure 1. Location map of Mosale Hosahalli.

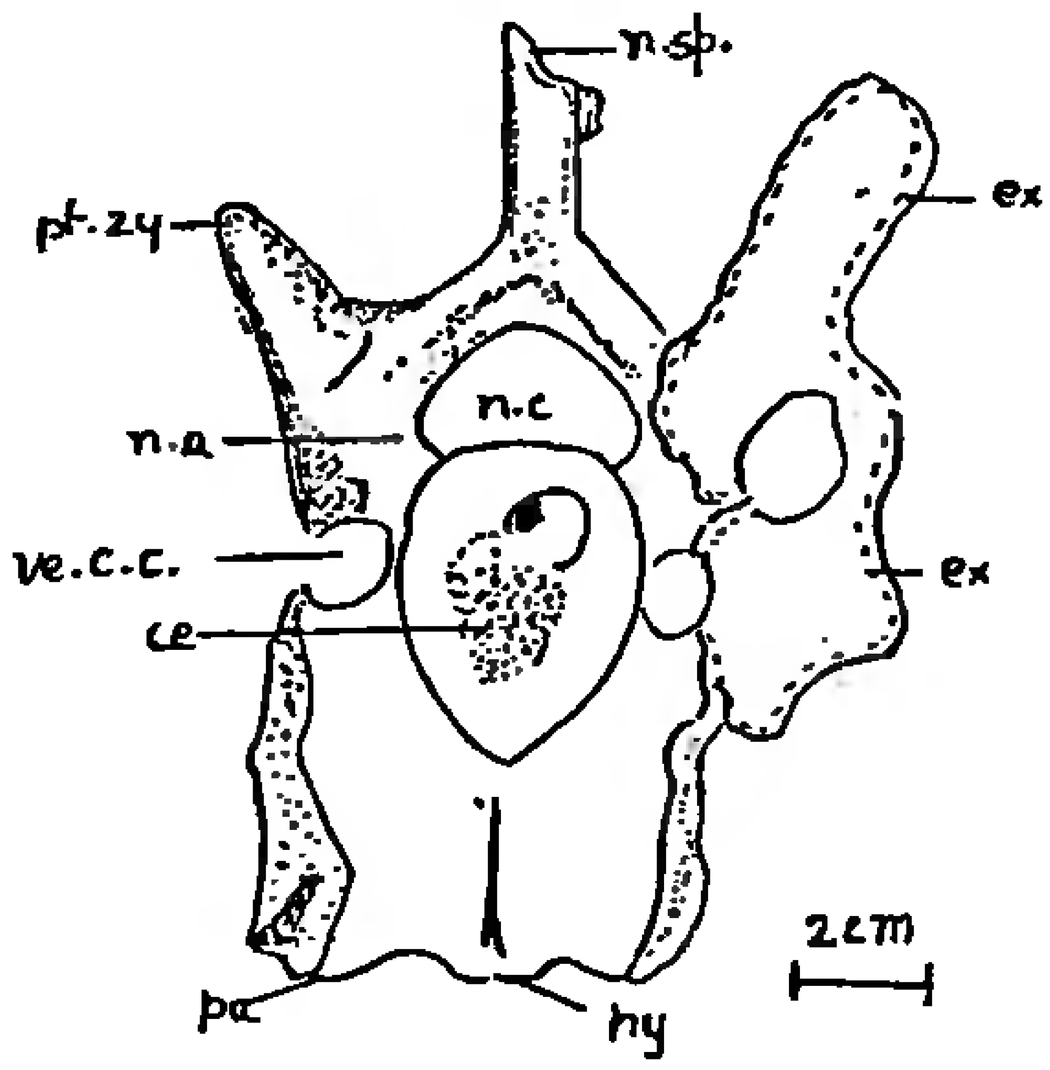

Figure 4. Posterior view of vertebra. ce, centrum; ex, extraneous part; hy, hypapophysis; n.a., neural arch; n.c., neural canal; n.sp, neural spine; pa, parapophysis; pt.zy, post zygapophysis; ve.c.c., vertebrocostal canal.

Figure 5. Left lateral view of vertebra.

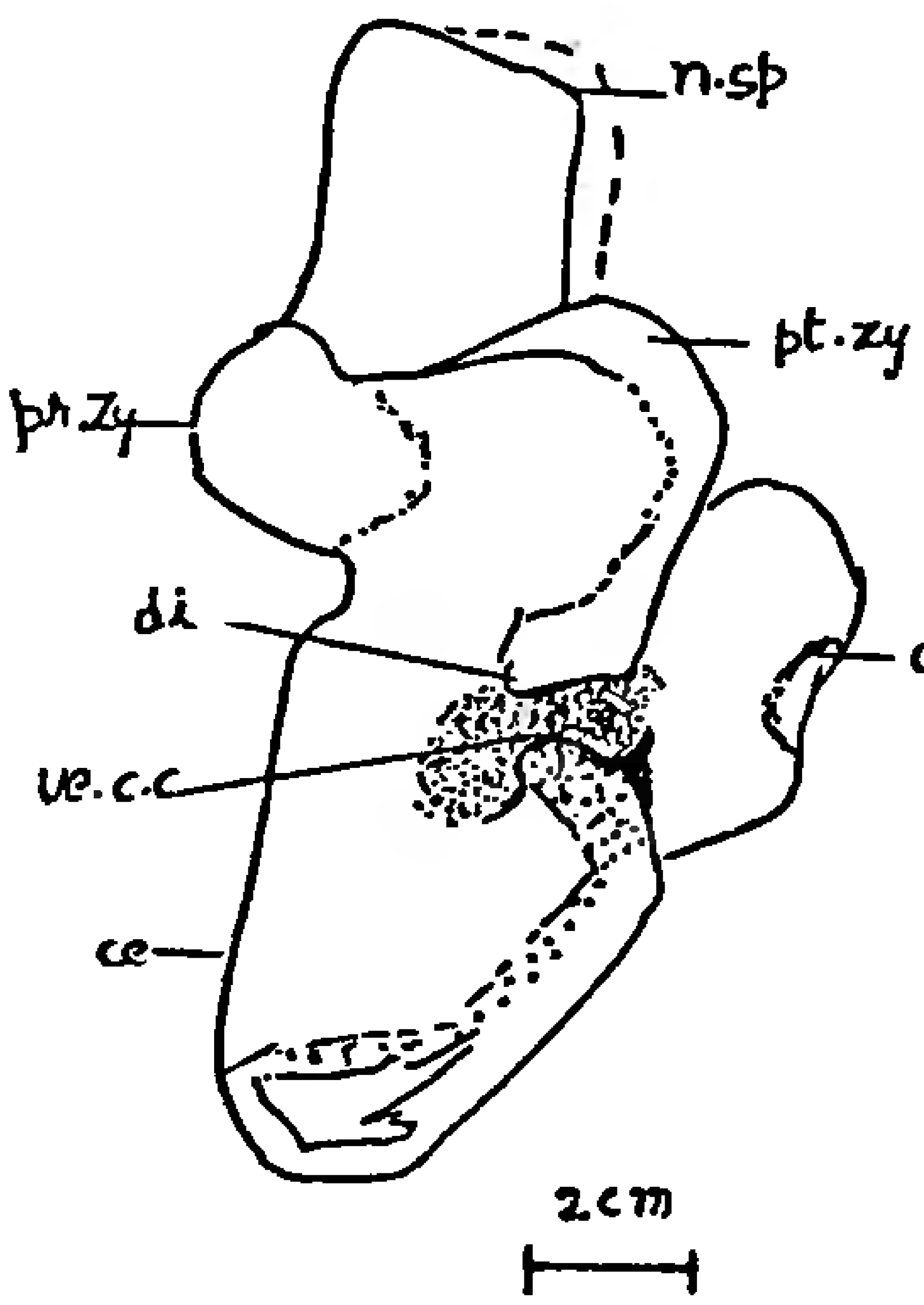

Figure 2. Left lateral view of vertebra. ce, centrum; di, diapophysis; n. sp, neural spine; pr. zy, pre zygapophysis; pt.zy, post zygapophysis; ve.c.c., vertebrocostal canal.

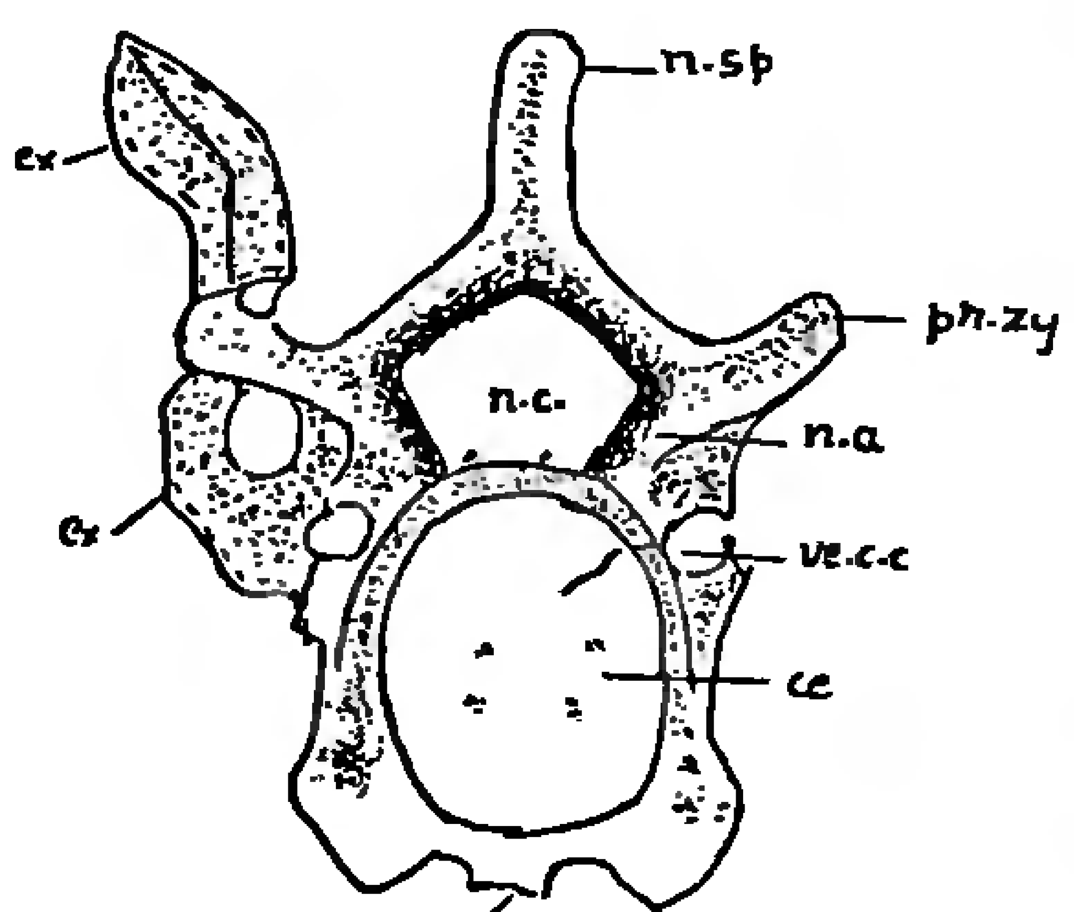

Figure 3. Anterior view of vertebra. ce, centrum; ex, extraneous part; hy, hypapophysis; n.a., neural arch; n.c., neural canal; n.sp., neural spine, pa, parapophysis; pr.zy, pre zygapophysis, ve.c.c., vertebrocostal canal.

carried by water currents to the place from where it was collected.

The country rock of the area is peninsular gneiss enclosing schistose rocks of Bababudan group, Dharwar Supergroup spanning an age of 2600 to 3000 m.y. in the Archean[1]. These rocks are highly metamorphosed and are commonly devoid of any fossil remains[1,2]. This brief geological account covers a general study of the entire Bababudan group as a whole which also includes Mosale Hosahalli from where the collection of our material was made. The soil of the area is grey in colour and contains clay and mica particles. Kankar nodules are abundant below this mantle of soil.

The vertebra measures a length of 9 cm, height of 14 cm and width (in the region of zygapophyses) of 9 cm. The material is cement grey in colour and weighs about 670 g, which is quite heavy when compared to the modern crocodilian vertebra, which is pale yellow in colour and relatively lighter also.

Figure 6. Anterior view of vertebra.

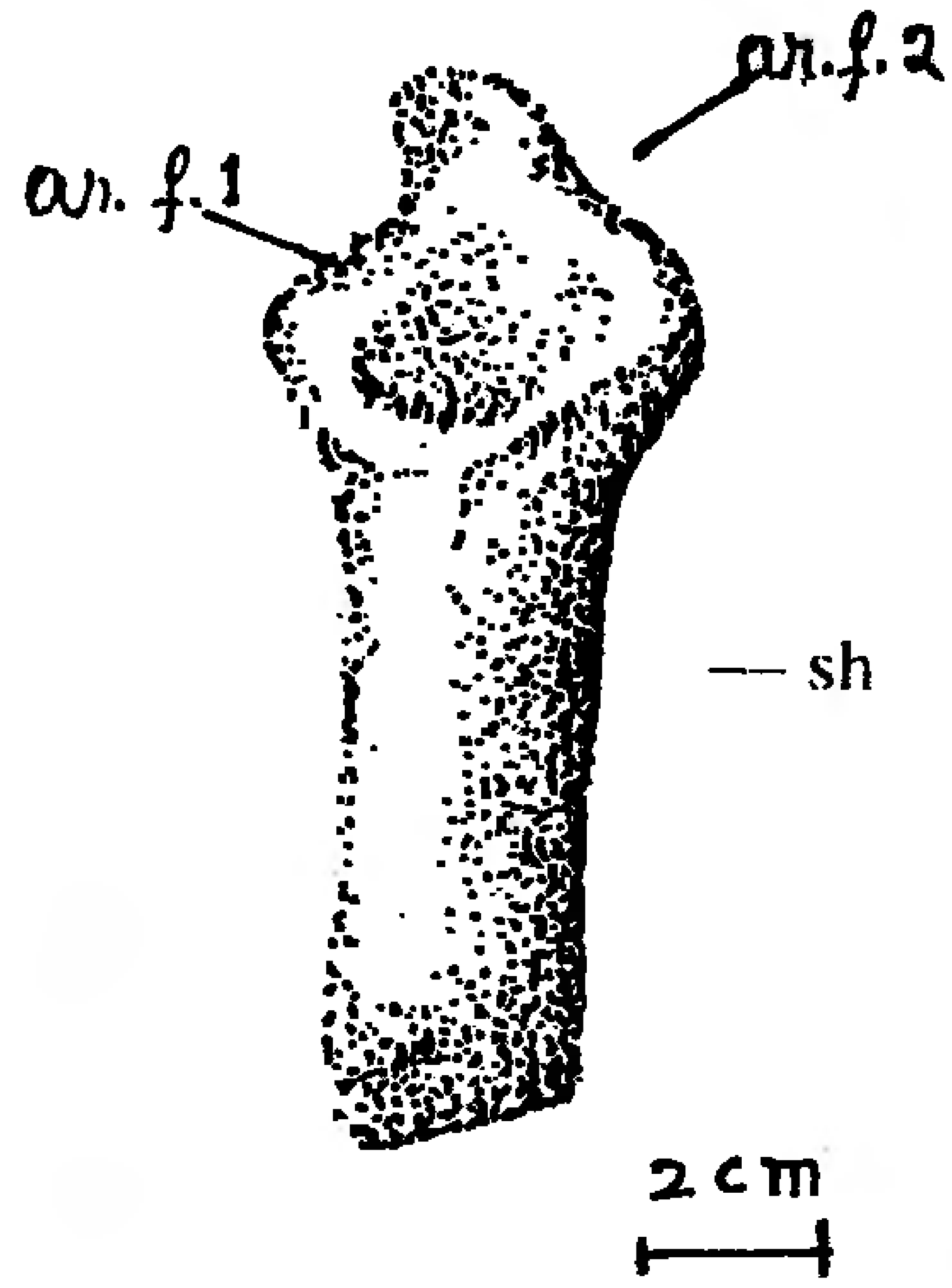

Figure 8. Dorsal view of fibula. ar.f.1, facet for articulation with astragalus; ar.f.2, facet for articulation with calcaneum; sh., shaft.

Figure 10. Dorsal view of fibula.

Figure 7. Posterior view of vertebra.

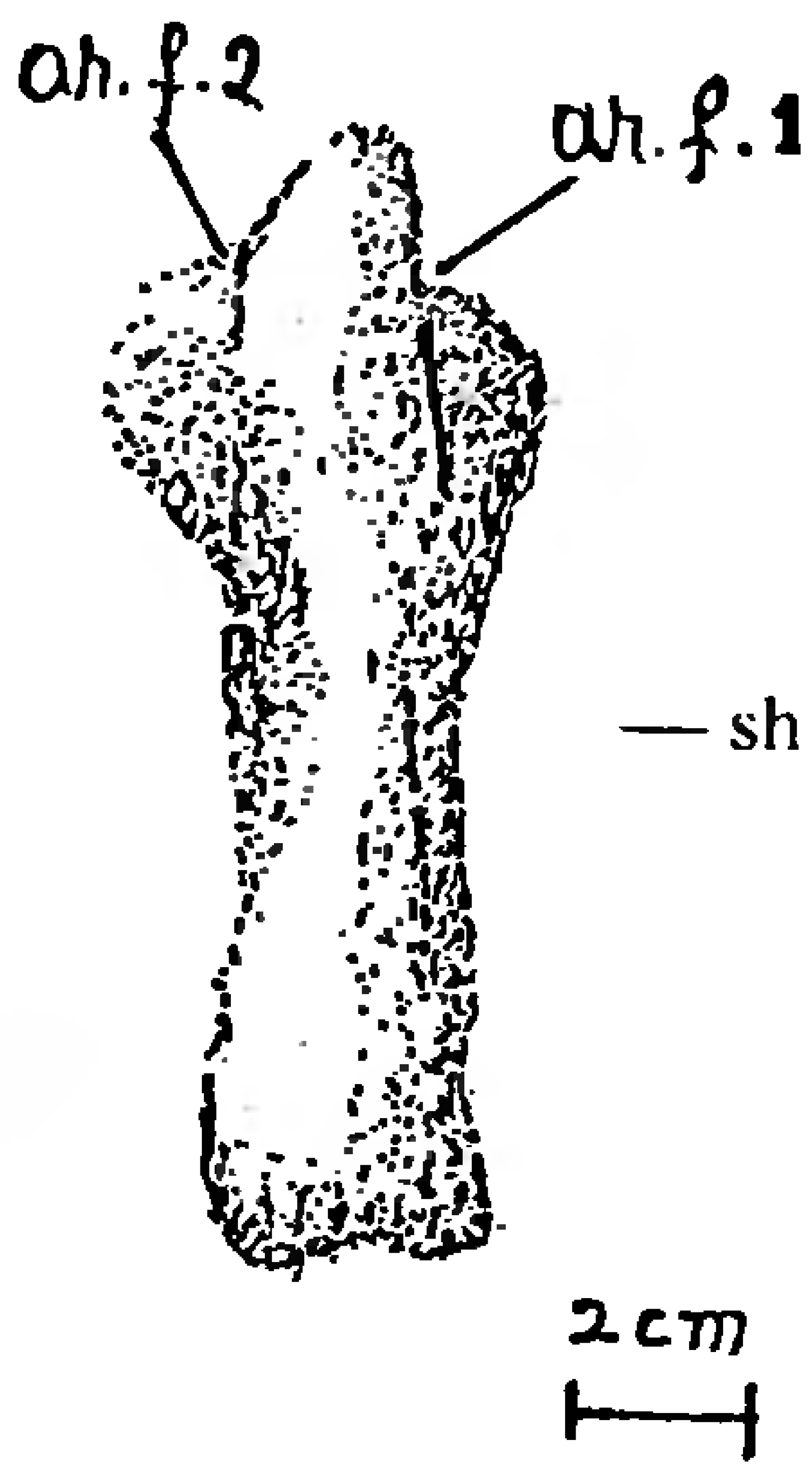

Figure 9. Ventral view of fibula. ar.f.1, facet for articulation with astragalus; ar.f.2, facet for articulation with calcaneum; sh, shaft.

Figure 11. Ventral view of fibula.

The vertebra shows the centrum, neural arch and accessory structures. The centrum is procoelous, being broad and low anteriorly and narrow and high posteriorly. Dorsolaterally it bears a pair of vertebrocostal canals for the passage vertebral arteries. The diapophyses have been partly preserved. Feeble traces of hypapophysis and parapophyses are also seen.

The neural spine arises as a dorsal median vertical ridge from the neural arch. The zygapophyses extend as lateral flattened horizontal processes from the sides of the neural arch. The pre- and post-zygapophysis have broad and shallow articulating facets[3] (Figures 2–7).

In view of the above details regarding the fossil vertebra, the same has been identified as a cervical vertebra of the order, Crocodilia. However, there is an extraneous part attached to the zygapophyses on the right side of the vertebra, whose identity and presence are not clear.

From the above description, it is clear that our material is distinctly different from the corresponding modern crocodilian vertebra.

In the fibula the length of the shaft measures 12 cm and its diameter is 3 cm. The articulating surface of the distal end has a diameter of 5.5 cm. The material is cement grey in colour and weighs 250 g which is quite heavy when compared to the corresponding fragment of modern crocodilian fibula.

The fossil bone shows a thick shaft and a terminal expanded portion showing a central shallow depression and articulating surfaces. It also shows a conical process posteriorly.

The above remains are probably the distal part of fibula of the order Crocodilia. Probably the proximal two-thirds of the bone is wanting[4].

The fibula articulates with the tarsus at its distal end. In the living crocodile, there are two proximal tarsal elements articulating with tibia and fibula. These are the astragalus and calcaneum. Fibula articulates with the astragalus at its inner articulating surface and with the calcaneum at its outer articulating surface at the region of bony projection (Figures 8–11).

From the study of the crocodilian 'fossil' vertebra and fibula, it seems that a very small area of sedimentary fossiliferous rocks is lying over the non-fossiliferous schistose rocks which cover most of the area.

This is the first report of the occurrence of crocodilian 'fossil' skeletal remains from this place which incidentally gets the name Mosale Hosahalli. The term Mosale in Kannada means a crocodile. Perhaps, because of occurrence of crocodiles in this place in the distant past in a large body of water, probably a river, the village might have obtained its current name, Mosale Hosahalli.

There are reports of similar 'fossils' being found in the late Pleistocene gravel beds of peninsular Indian rivers (Ashok Sahni, pers. commun. 1995).

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Agnostid trilobites from the Cambrian Sequence of Zanskar and their stratigraphic significance

The Zanskar area forms a vast mountainous region between the great Himalayan range in the south-west and Indus Valley in the north-east and occupies the southern part of Zanskar region lying between lat. 30°00–33°08'N and long. 77°15' to 77°25'E (Figure 1). Srikantia *et al.*[1] have given a detailed geological map of the Zanskar region. Gaetani *et al.*[2] also discussed the significant stratigraphy and sedimentology of the Zanskar. Dungrakoti *et al.*[3] also recorded trilobites from Zanskar Valley and assigned an upper Cambrian – Orodovician age. Whittington[4] described some trilobites from Kurgiakh section of the area. Nanda and Singh[5] worked on the sedimentology[1] of the area. Since Zanskar Basin shows continuity with the Spiti Basin, the lithostratigraphic nomenclature adopted here is identical to the one adopted for Spiti Basin. A complete succession of Palaeozoic–Mesozoic rocks is exposed along the right bank of Zanskar river in the Lingti valley (Figure 1). Rocks of Cambrian to Permian age exposed in the Valley are rich in fossils. The sequence in the southwestern part of Zanskar is represented by Giambal, Haimanta and Kanawar groups. In Kurgiakh valley the rock formations found at the base belong to the Batal Formation and Kunzam La Formation of Haimanta Group, consisting of greyish or greenish micaceous schists which attain a huge thickness. The upper Kunzam La Formation according to Hayden[6] corresponds to the Parahio 'series' of Spiti from where Middle Cambrian trilobites have been recorded. The Haimanta group of the Zanskar is overlain by the Kanawar Group which is divided into three formations, namely Lipak, Po and Ganmachidam formations. Kanawar Group directly overlaps the Thango Formation in most of the Zanskar Basin.

The fossiliferous Cambrian sequence in this valley has a faulted contact with Gumbranjan Granite. A diversified trilobite fauna was collected from this sequence. The fauna signifies a Middle Cambrian age. The lowermost bed of this sequence consists of a laminated micaceous shale chiefly attaining a great thickness and is devoid of fossils. Gaetani *et al.*[2] grouped this shale under Phe Formation of Precambrian to Early Cambrian age.

The trilobite fauna obtained from this area include the following taxa.