

Figure 2. a, Variation in number of planktonic foraminifera in 1 g of dry sediments. b, Variation in number of *Orbulina universa* in 1 g of dry sediments. c, Variation in mean diameter of *Orbulina universa*.

0.63 mm. However, the minimum diameter was 0.225 mm (at st. no. 75–80 cm) and maximum diameter 1.19 mm (at st. no. 20–25 cm). The mean diameter curve shows three peaks, at 10, 25 and 40 cm, in the portion of the core deposited during the last interglacial. As discussed earlier^{1–3}, since mean diameter of *O. universa* is inversely proportional to salinity and directly proportional to temperature, it may be concluded that, during the Holocene, high temperature and low salinity conditions prevailed at about 8800, 5500 and 2200 yr BP and climatic fluctuations occurred. Since, in the Holocene, high temperature and low salinity conditions were coupled with rise in sea level due to melting of polar ice caps, it is further proposed that the above three dates may indicate episodes of marine transgression.

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ACKNOWLEDGEMENTS. I thank Dr B. N. Desai and Sri P. S. N. Murty for their keen interest in the study, and Sri R. R. Nair for critically reading the manuscript and suggesting many improvements.

3 June 1989

Fossil flowers from Kasauli Formation near Barog, Himachal Pradesh

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Well-preserved fossil flowers were found in the Kasauli Formation, which is part of the Lower Tertiary sedimentary sequence in the Himalayan region. These records are significant as fossil flowers are very rare in the Tertiaries of the Himalaya.

THE Dagshai and Kasauli formations represent part of the Lower Tertiary sedimentary sequence between the marine Subathu and freshwater molasse Siwalik Group. The Kasauli Formation represents well-established terrestrial conditions supported by the presence of unionids and fragmentary plant remains^{1–3}. Well-preserved fossil flowers, inflorescence and bud have been discovered in this formation and are recorded here. These were found in the greenish-grey siltstones exposed along the Kalka–Shimla road (Figure 1), 1.2 km NNW of Barog (30°53'53"N, 77°04'15"E; altitude 1725 m).

The Kasauli Formation in this section consists mainly of massive grey sandstones and greenish-grey silty shales and siltstones. In addition to the flowers, well-preserved dicot and monocot leaf impressions are also present in this formation and have been collected from several localities in this section. The discovery of flowers is significant as they are of rare occurrence and almost unknown from the Tertiaries of the Himalaya.

The fossil plants reported earlier from the Kasauli Formation include form genera *Poacites*, *Palmophyllum* and *Dicotylophyllum*^{4,5} and a single natural taxon *Sabal*

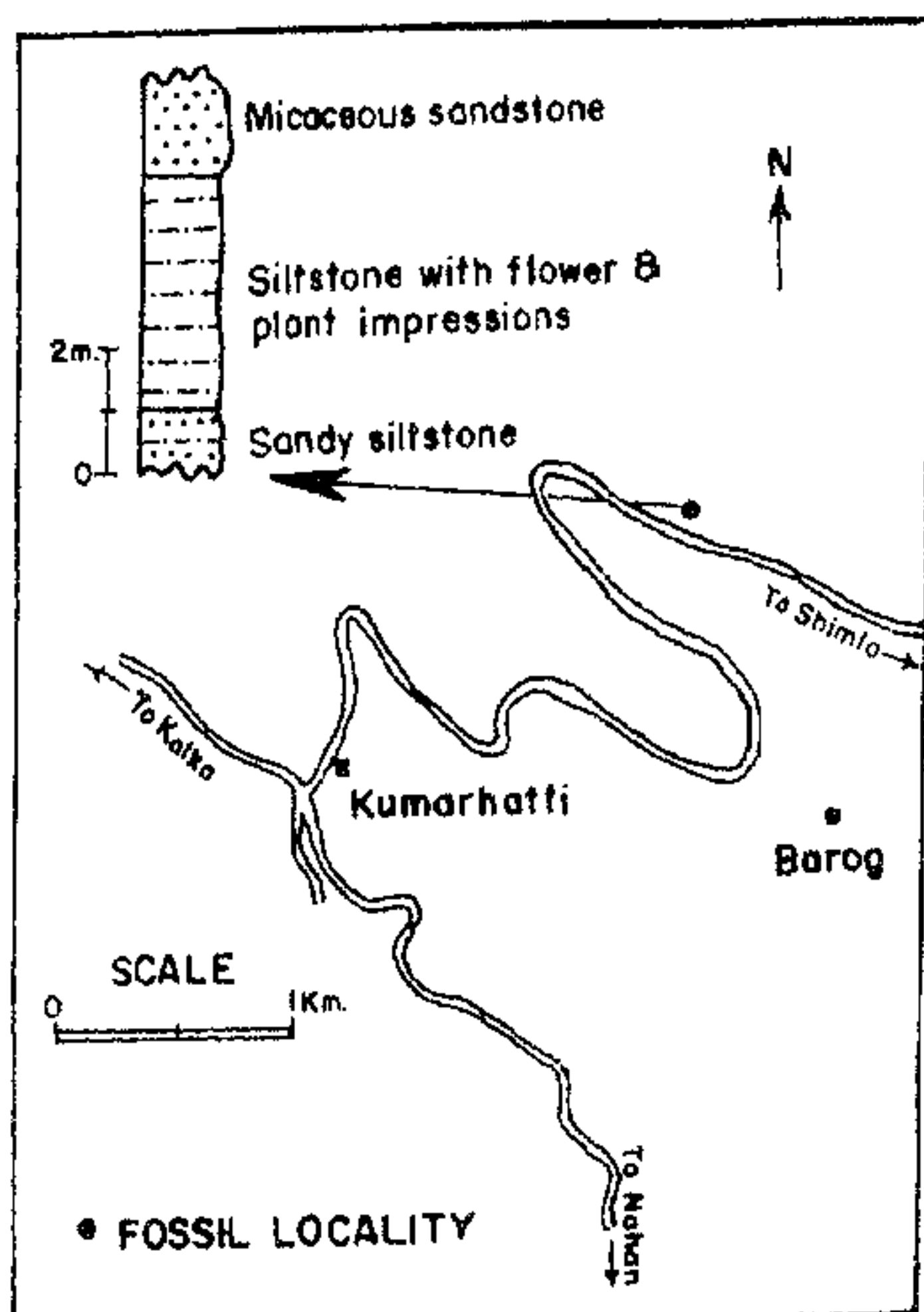


Figure 1. Map showing fossil locality.

major Heer.³ The systematic description of fossil flowers recorded here is based on Polunin and Stainton⁶ and comparisons are with the Icons at the National Botanical Research Institute, Lucknow.

Flower type I (Figure 2a)

Description: Flower simple, lacking reproductive parts owing to shedding/preservation, actinomorphic with seven free sepals and seven free petals in alternate arrangement; sepals less than half the length of petals, thin, lanceolate, acute with entire margin, visible maximum length 0.9 mm and width near proximal end 0.2 mm; petals spatulate, length of fully developed petal 2 mm; thalamus round with 1.3 mm diameter, nature not clear; maximum diameter of flower 4.8 mm.

Remarks: The fossil flower bears superficial resemblance in shape and size with *Hypericum japonicum* Thumb. ex Murray (family Guttiferae) but differs from the latter in having more sepals and petals. In number of petals and sepals it is comparable with flowers of family Theaceae but differs from the latter in size (smaller) and shape of petals.

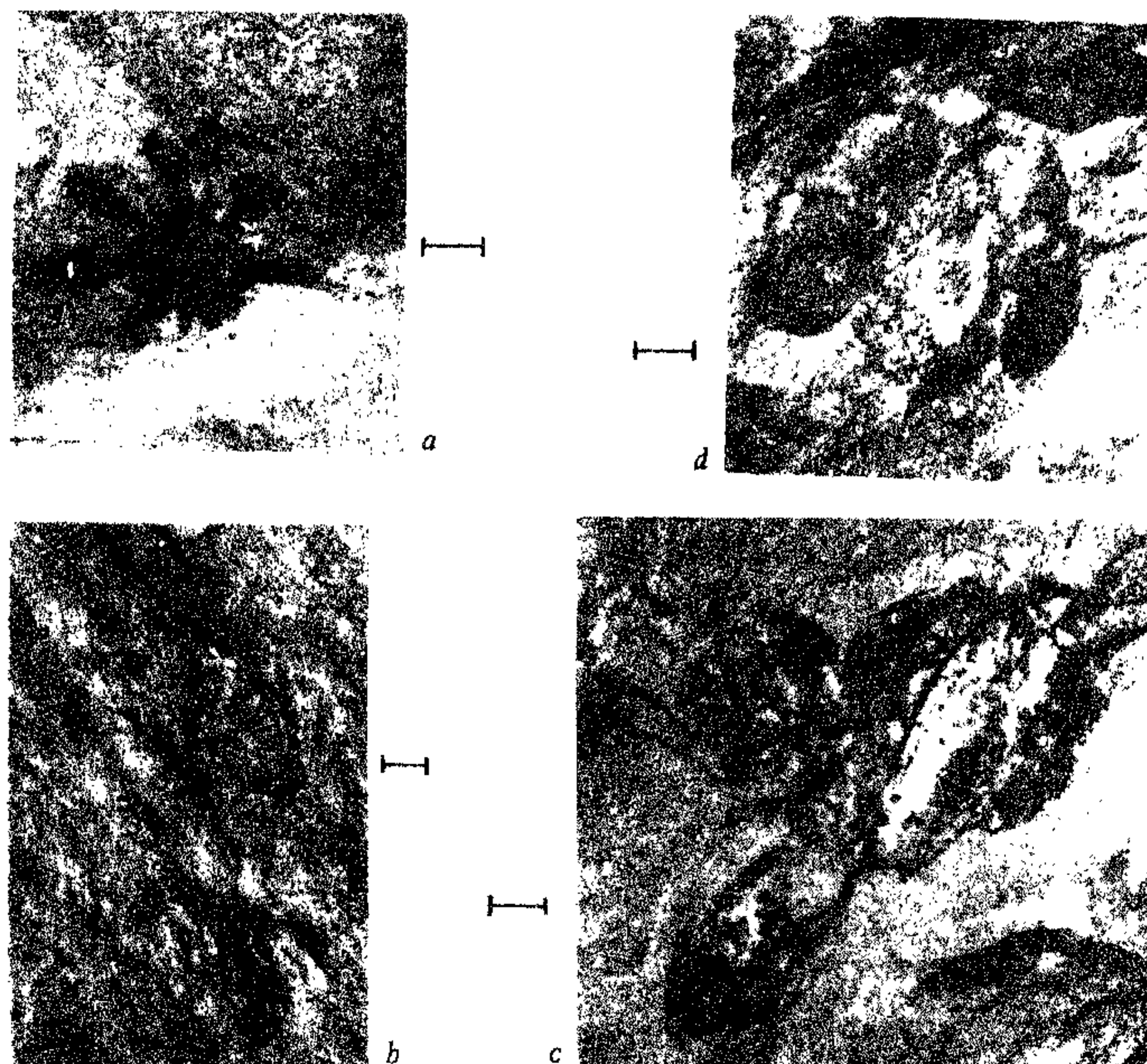


Figure 2. Fossil flowers from Kasauli Formation: a, flower type I; b, inflorescence; c, flower type II; d, bud (scale bar 1 mm).

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Flower type II (Figure 2c)

Description: Flower apparently regular with three preserved petals (could be four or five) which appear to be free, broad, bluntly rounded; maximum width of well-preserved petal 3 mm; preserved flower 1.1 cm across.

Remarks: The flower is incomplete to afford systematic placement but can be compared in overall appearance to members of family Rutaceae.

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Inflorescence (Figure 2b)

Description: One more or less complete inflorescence with its counterpart; sympodially growing cymose inflorescence having rounded branched cluster of tiny flowers; bracts small, alternate; structure of individual flowers not clear; flowers tiny, possibly having four petals; inflorescence 3.5 mm across.

Remarks: The inflorescence, though almost complete, is difficult to compare with any modern form, but its overall shape and four-petalled tiny flowers give the impression of an inflorescence of the Cruciferae.

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Bud (Figure 2d)

Description: A compact and undeveloped small flower bud with its counterpart apparently having bud scales/sepals opened; sepals/bud scales broad, bluntly rounded; undeveloped bud obtusely rounded apically; bud 5 mm across.

Remarks: Due to incomplete nature the bud could not be compared with any modern flower bud.

Repository No.: Geological Survey of India, Northern Region, NRP/1/811.

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ACKNOWLEDGEMENTS. We are deeply indebted to Shri H. M. Kapoor, Director, Palaeontology and Stratigraphy Division, Geological Survey of India, Northern Region, Lucknow, for guidance and keen interest in the work. Shri U. K. Dwivedi, J. T. A. (Geology), G. S. I., Northern Region, Lucknow, assisted in the field in collection of megaplants.

Alligatorine teeth from the Deccan Intertrappean beds near Rangapur, Andhra Pradesh, India: Further evidence of Laurasiatic elements

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Alligatorine teeth recovered from Intertrappean beds in the Deccan represent the first record of Indian alligatorines near the Cretaceous–Tertiary boundary level. The present record also suggests that there was a dispersal corridor for faunal exchange between the Laurasian and Gondwanian continents.

TEETH recovered from the Intertrappean locality near Rangapur, Rangareddi District, Andhra Pradesh (Figure 1), provide the first evidence of Indian alligatorine crocodiles near the Cretaceous–Tertiary boundary (KTB) level. The alligatorids are mainly of Eurasiatic distribution, and known from North America^{1–6}, Europe^{7,8} and China⁹. Their presence in India lends support to the hypothesis of a dispersal corridor between the Laurasian and Gondwanian continents.

The otolith assemblage and charophytic flora have already been described from the study area^{10,11}. The microvertebrates include fishes, amphibians, turtles, snakes, lizards, crocodiles and mammals. The teeth belong to order Crocodylia, suborder Eusuchia, family Crocodylidae and subfamily Alligatorinae.

The collection represents three morphological types belonging to the posterior and anterior part of the jaw. The posterior crushing teeth, characterized by small size (5.0 mm to 6.0 mm in width, and 2.0 mm to 3.0 mm in height), are typically button-shaped, have wrinkled low crowns sharply separated from the root (Figure 2d), are bluntly rounded, and do not appear striated. They are somewhat laterally compressed, showing the presence of weak carinae extending from apex to base (Figure 2e) and are laterally symmetrical and swollen at the gingival margin. The elliptical basal part seems trilobate (Figure 2a, b, d). These teeth exhibit similarities with the posterior teeth of *Hassiacosuchus kayi* known from the Lower Eocene of Wyoming (Mook, 1941, plate XXV and fig. 1)², isolated teeth of alligatorid recovered from the Upper Cretaceous of Austria and southern France (Buffetaut, 1980, fig. 6)⁷, and teeth of *Brachychampsia montana*, *Allognathosuchus* and *Asiatosuchus* described from the Late Cretaceous–Early Tertiary Formations of North America, Europe and China^{1–9}.

The second type of teeth (Figure 2e, f), subtriangular in shape, with pointed apices and carinae and with bilobate base, bear close resemblance with the median teeth of *Brachychampsia*, *Allognathosuchus* and *Asiato-*