

790 and  $830\text{ cm}^{-1}$  ( $\Delta^5$  bond in sterols) and  $810\text{ cm}^{-1}$  (H atom on trisubstituted double bond); NMR bands at  $\delta$  5.3 (*m*,  $\text{C}_6\text{-H}$ ); 0.66 (*s*, 3H,  $\text{C}_{18}$ ), 0.9 (*s*, 3H,  $\text{C}_{19}$ ); 1.59 (*d*, 6 Hz, 3H,  $\text{C}_{20}$ ); 5.1 (1H,  $J = 6\text{ Hz}$ , 9), 2.2 (1H, allylic,  $\text{C}_{25}$ ); 0.95 (*d*, 6H,  $>\text{C}=\text{CH}_2$ ), 3.4 ( $\text{C}_{3\alpha}$ , 1H, *m*), mass  $m/e$  412, ( $M^+$ ), 314 (base peak) and triplet at  $m/e$  299, 300 and 301 (indicative of  $\Delta^{24(28)}$  double bond). These are well in agreement with the data reported for fucosterol<sup>3</sup>, and hence it was characterized as fucosterol.

The mass spectrum of fucosterol also showed the presence of dihydrofucosterol ( $m^+ 414$ ). Fucosterol, a major sterol of *S. marginatum*, has been reported to be non-toxic and has the ability to reduce blood cholesterol level<sup>4</sup>. It has also been known to induce sexual reproduction in the *Ascomycetes* fungus, *Phytophthora cactorum*<sup>5</sup>. This steroid may become significantly important as a base material for the manufacture of sex hormones and for steroid synthesis<sup>6</sup>.

#### Compound C — 24-ketocholesterol:

IR bands at  $1710\text{ cm}^{-1}$  ( $>\text{C}=\text{O}$ ),  $m/e$  at 400, ( $m^+$ ), 43 (base peak), 382, 314, 271, 255, 213, 159, 145, 133, 119 and 107. Mass spectral data agreed with the data reported for 24-ketocholesterol<sup>7</sup>. It is possible that this steroid may be an artifact as reported by Knights<sup>8</sup>, since the sample was air-dried prior to extraction and is present in trace quantities.

This is the first report of the isolation of three steroidal constituents from *S. marginatum*.

The authors are grateful to Dr B. N. Desai, and Dr R. Sen Gupta for their keen interest in the work. Our thanks are due to Mr M. S. R. Murthy, RRL, Hyderabad, for GC data and Dr D. S. Bhakuni, CDRI, Lucknow, for spectral data. We also record our appreciation for the financial assistance under the Indo-US collaborative programme on "Bioactive Substances from the Indian Ocean".

23 September 1987; Revised 22 February 1988

1. Naqvi, S. W. A., Solimabi, W., Kamat, S. Y., Fernandes, L., Reddy, C. V. G., Bhakuni, D. S. and Dhawan, B. N., *Bot. Mar.*, 1980, 24, 51.
2. De Silva, S. M. S., Gamage, K. T. S., Savitri Kumar, N. and Balasubramanian, S., *Phytochemistry*, 1982, 21, 944.
3. Grunwald, C., *Annu. Rev. Plant Physiol.*, 1975, 26, 209.
4. Reimer, E., Topliff, J. and Wood, J. D., *Can. J. Biochem. Physiol.*, 1962, 40, 1401.
5. Knights, B. A. and Brooks, C. J., *Phytochemis-*

*try*, 1969, 8, 463.

6. Mautner, H. G., *Econ. Bot.*, 1954, 8, 174.
7. Safle, L. M., Wong, C. J. and Chandler, R. P., *J. Pharma Sci.*, 1974, 63, 464.
8. Knights, B. A., *Phytochemistry*, 1970, 9, 903.

### ICHOGENUS SKOLITHOS FROM GETHIA UNIT, DISTRICT NAINITAL, KUMAUN LESSER HIMALAYA

A. K. SHARMA and C. C. PANT

Department of Geology, Kumaun University, Nainital 263 002, India.

THE Nainital syncline comprises Nagthat–Blaini–Krol–Tal sedimentaries in an ascending order of succession. The rocks were studied as early as 1890 by Middlemiss. Subsequently, the geology of the area has been studied by many workers. However, the lithostratigraphic setting of the Nainital area is still controversial. The rocks around Gethia are extensively deformed as a result of multiplicity of faults and thrusts owing to its proximity with Main Boundary Thrust (figure 2), and stratigraphic position of the rocks is very ambiguous. It was Dhaundiyal who for the first time recognized a succession of a fossiliferous limestone and shales and grouped the rocks into what he named the Gethia horizon.

Exposed SE of Nainital around Gethia ( $29^{\circ}21'42''$ :  $79^{\circ}29'47''$ ) trending NW–SE and dipping  $25\text{--}35^{\circ}$  due NW (figures 1 and 2), the unit has been a matter

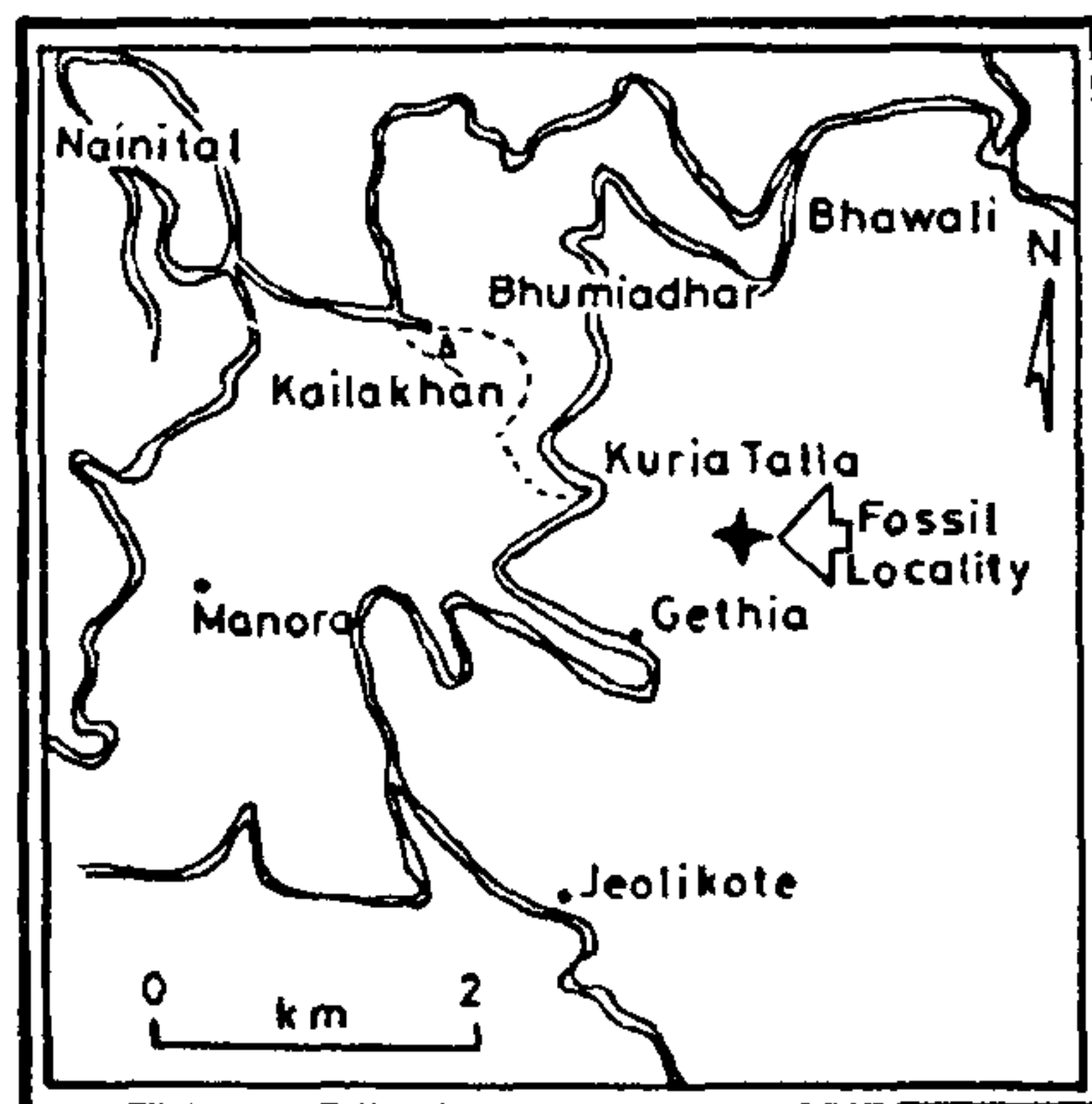


Figure 1. Location map of the fossil locality.

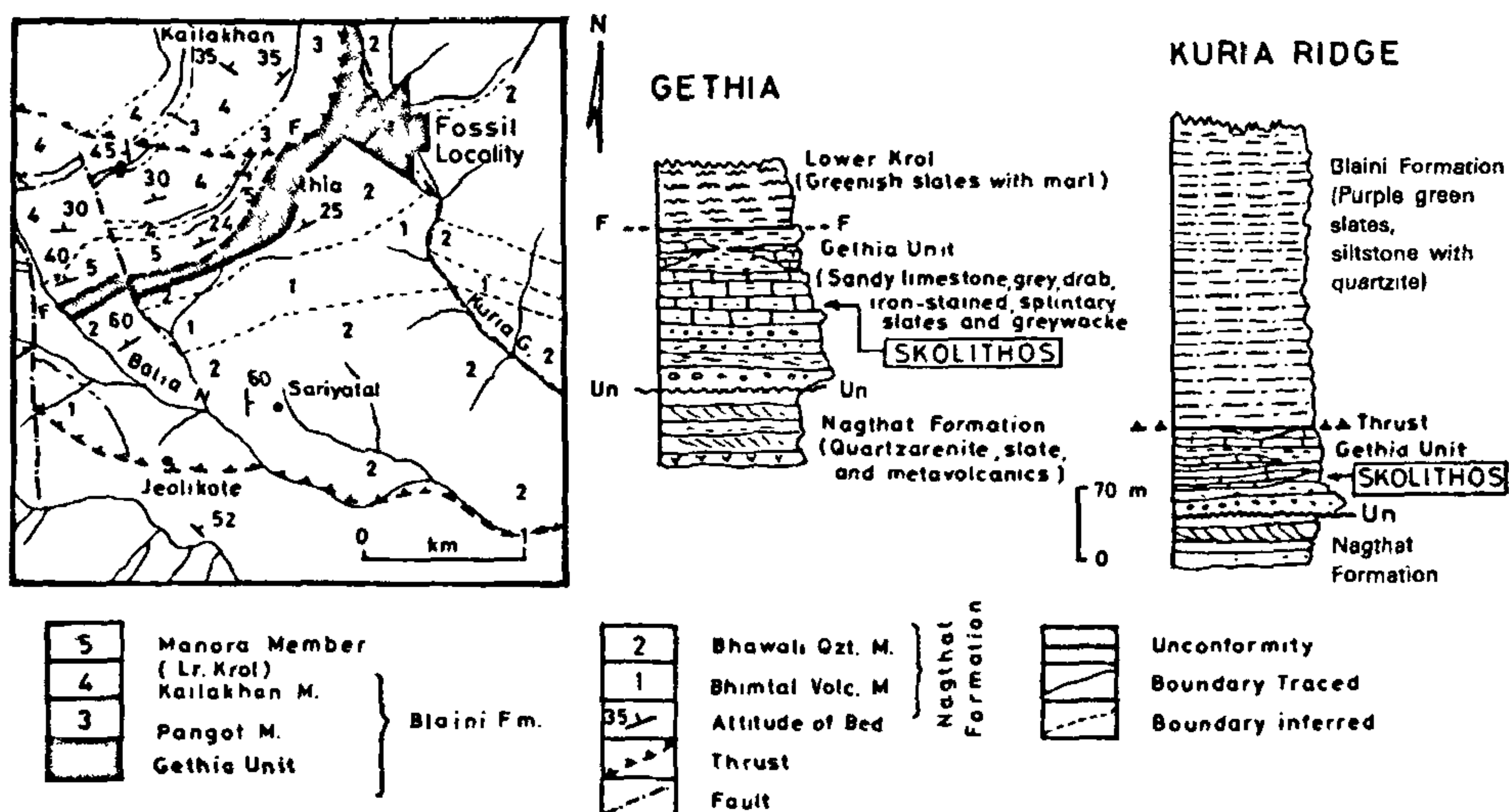


Figure 2. Geological map and lithologies of the Gethia area, Nainital District, Kumaun Lesser Himalaya.

of debate since the discovery of fragmentary shells and bivalves by Dhaundiyal<sup>1</sup> and Acharyya and Dhaundiyal<sup>2</sup> who, on the basis of splintery nature of shales, lithological similarities and fossil contents, assigned an Eocene age to the unit. Subsequently, Mathur and Sah<sup>3</sup> recorded an assemblage of bivalves, foraminifera and bryozoans — *Dybowskiella* sp., *Septopora* sp. and *Valvulinella* sp. of Carboni-

ferous to Lower Permian age for ferruginous shales of the Blaini (Gethia unit). Tewari<sup>4</sup>, and Tewari and Singh<sup>5</sup> recovered as assemblage of *Proto-retepora*, *Robustoschwagerina* and impression of *Productis* of Lower Permian age from the lower Blaini sediments at Gethia Sanatorium. However, Pande<sup>6</sup>, on the basis of fish tooth, conodonts, bryozoans (Fishuliporoidae), scolecodont fragments,

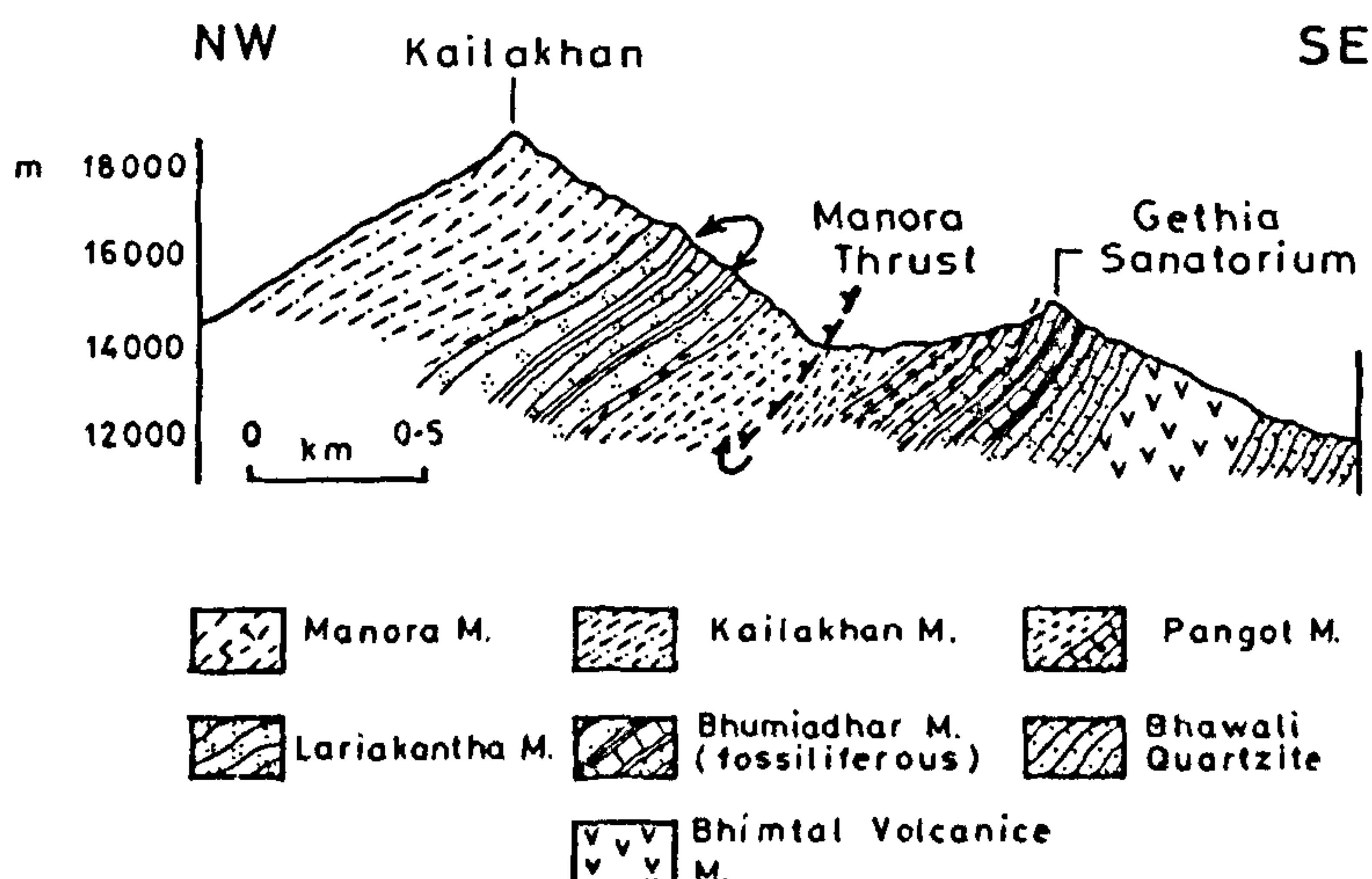
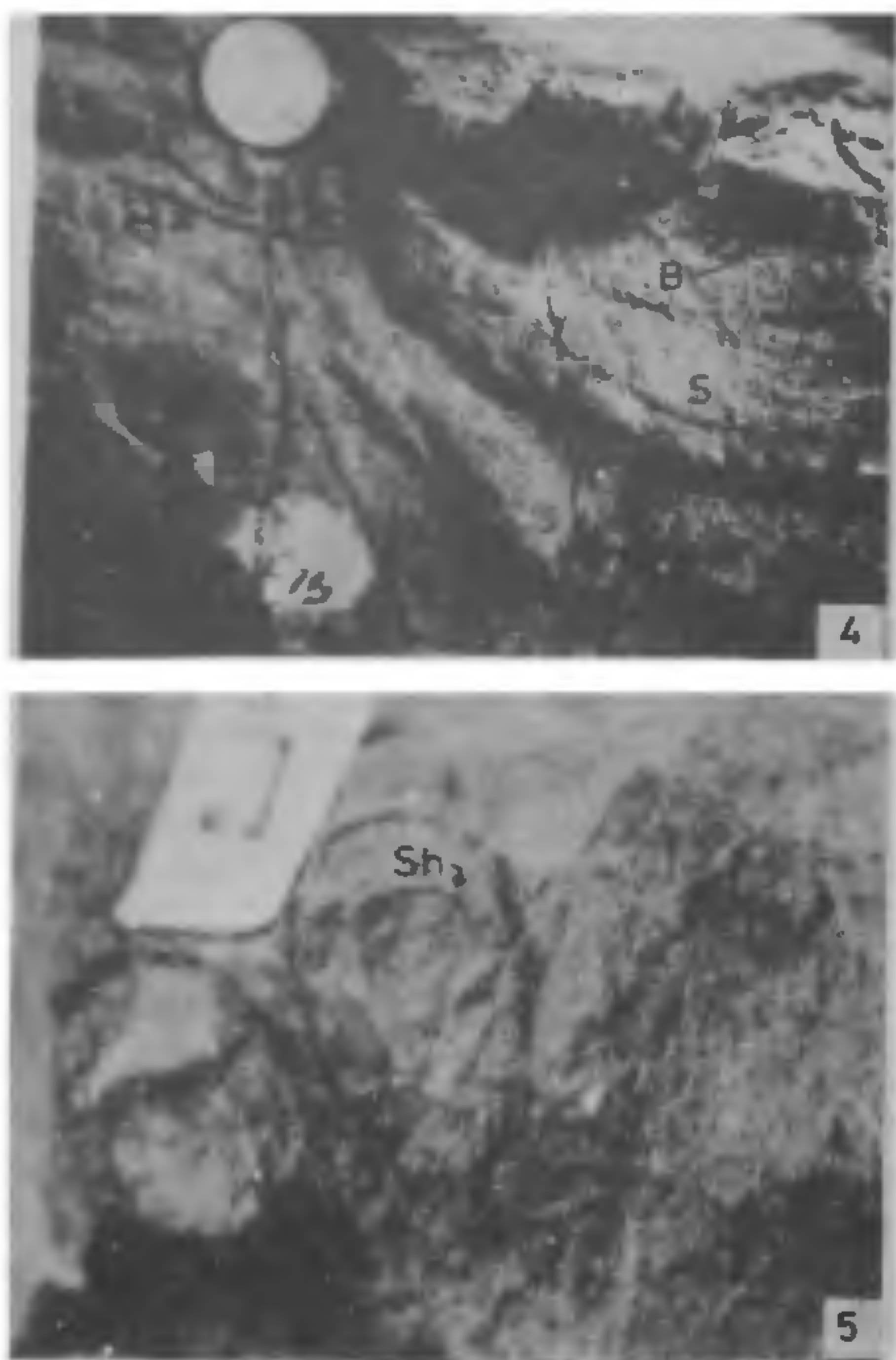


Figure 3. Geological cross section along Kailakhan-Gethia ridge.





Figures 4 and 5. 4. Field photograph of *Skolithos* showing distinct relief and parallelism of burrows, and 5. Unidentified large bivalve shells associated with sandy limestone in which *Skolithos* has been recorded.

foraminiferal moulds and echinoid spines, assigned Ordovician to Devonian date to the unit.

The detailed mapping reveal that the Gethia unit unconformably overlies the Nagthat quartzite and its upper limit is marked by greyish green slates with thin marly interbeds (Lower Krol) or purple and green slates (Blaini) with a tectonic contact (figures 2 and 3).

The Gethia unit is made of thinly laminated, highly splintery, greyish, greyish-green, drab, iron-stained slates with interbeds of sandy, coarse-grained limestone showing extensive facies variation.

The present note describes animal burrows from the Gethia unit for the first time.

The ichnogenera occur in the lower part of the Gethia unit (figure 2). The burrows, about 9.5 cm in length, are simple, unbranched and about 1.2 cm in diameter. In the upper level the burrows are deve-

loped almost at right angles to the bedding plane, becoming sub-horizontal in the lower part. They exhibit distinct relief and are inclined to the bedding. Locally the burrows occur parallel to each other (figure 4). In transverse section they are semi-circular to elliptical. The form is similar to ichnogenus *Skolithos*<sup>7-9</sup>. These are probably the dwelling burrows of suspension feeding organisms as also evidenced by associated invertebrates (figures 5).

The ichnogenera are helpful in deciphering the animal behaviour during the sedimentation. Besides the burrows, a large number of large shelly fossils are also associated with the burrowed sandy limestone. The overall lithological and petrographic character reveals that the sedimentation took place in a shallow, warm and coastal marine environment. This is further corroborated by the presence of the recorded ichnogenera.

The authors are grateful to Prof. K. S. Valdiya of Kumaun University; Prof. S. K. Tandon and Dr D. M. Banerjee of Delhi University for a critical perusal of the manuscript. Financial assistance from UGC and Department of Environment, New Delhi is thankfully acknowledged.

23 March 1988

1. Dhaundiyal J. N., *Him. Geol.*, 1978, 8, 1005.
2. Acharyya, S. K. and Dhaundiyal, J. N., *Geol. Surv. India News*, 1979, 10, 2.
3. Mathur, N. S. and Sah, S. C. D., *Him. Geol.*, 1978, 8, 1034.
4. Tewari, B. S., *Bull. Indian Geol. Soc.*, 1979, 12, 257.
5. Tewari, B. S. and Singh, R. Y., *Proc. IX Indian Coll. Micropal. Strat.*, 1981, p. 206.
6. Pande, M., *Curr. Sci.*, 1984, 53, 5, 263.
7. Frey, R. W., *Study of trace fossils*, Springer Verlag, New York, 1975, p. 13.
8. Collinson, J. D. and Thompson, D. B., *Sedimentary structure*, George Allen and Unwin, London, 1982, p. 156.
9. Singh, I. B. and Rai, B., *J. Palaentol. Soc. India*, 1983, 28, 67.

## OCCURRENCE OF AN AUTOCLASTIC VOLCANIC BRECCIA

V. J. S. LAMBA

1455, Narmada Road, Jabalpur 482 001, India.

THE present note records the occurrence of an autoclastic volcanic (intrusion) breccia from the Deccan Volcanic Province, for the first time.