Fresh water diatoms from Kua Tal, district Nainital, Kumaon Himalaya, Uttar Pradesh

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The present communication embodies the results of diatom analysis from lacustrine sediments of Kua Tal, district Naini Tal, Uttar Pradesh. The study reveals the predominance of Pennales which are represented by about one and a half dozen taxa. However, Centrales are infrequent and represented by two taxa only.

Key-words—Palynology, Diatoms, Pennales, Centrales, Kumaon Himalaya (India).

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सारांश

कुमायुँ हिमालय (उत्तर प्रदेश) में नैनीताल जनपद में स्थित कुआ ताल से अलवणी डाएँटम

आशा खण्डेलवाल एवं हरीपाल गुप्ता

नैनीताल जनपद (उत्तर प्रदेश) में कुआ ताल के सरोवरी अवसादों से उपलब्ध डाएँटम विश्लेषण के आँकड़े इस शोध-पत्र में प्रस्तुत किये गये हैं। इस अध्ययन से पिन्नेल्स की पूर्वबहुल्यता व्यक्त होती है जिनके कि इस समुच्चय में लगभग डेढ़ दर्जन वर्गक विद्यमान हैं। सॅन्ट्रेल्स अपेक्षाकृत लगातार नहीं मिलते तथा इनके केवल दो वर्गक विद्यमान हैं।

KUA TAL, remnant of an ancient lake, is situated about half a kilometer west of Bhim Tal on way to Naini Tal at an altitude of about 4,500′ between 79°40′ N longitude and 29°28′E latitude. Most of the peripheral area of Kua Tal has been dried up and brought under paddy cultivation leaving aside a shallow depresssion enabling to bore through about 0.75 m deep. As revealed by radiometric dates for other lake sediments in the basin, it is presumed that sediments of Kua Tal in question are not older than 400-500 yrs B.P.

In the Bhim Tal-Naukuchia Tal Basin it is a closed lake and has no outlet. According to Mathur (1955), the lakes in the basin originated due to differential earth movements. Wadia (1957) opined that lakes in Kumaon Himalaya are the result of landslides whereas, Raina (1965) advocated that they are of glacial origin.

Pollen analytical investigations have been carried out earlier in Naukuchia Tal (Vishnu-Mittre, Gupta & Robert, 1967), Naukuchia Tal and Bhim Tal (Gupta, 1973, 1977), Sat Tal (Gupta & Khandelwal, 1982) to reconstruct the palaeovegetation and palaeoenvironment. In addition to this, the occurrence of *Sphagnum papillosum* has also been recorded (Vishnu-Mittre & Gupta, 1971). Hitherto, no work on diatoms has been done. Obviously, this report is perhaps the first one to deal with the results of diatom analysis.

MATERIAL AND METHOD

Material from Kua Tal was procured by using Hiller's peat-auger with 50 cm long chamber. Samples from 0.75 m deep profile were collected in chronological sequence at an interval of 10 cm each. Only four samples, viz., 1, 3, 5 and 7 were subjected for diatom analysis.

The diatoms were extracted by boiling the matrix in concentrated H_2SO_4. The treated sample was washed with distilled water several times and permanent slides were made in Styrax. In order to

work out the diatom assemblage in each sample their relative abundance was calculated (Andrews, 1966). Each taxon is, thus, rated as follows:

Dominant—Numerous specimens in all fields of view.

Abundant—At least one specimen in all fields of view.

Common—At least one specimen in many fields of view.

Frequent—Several specimens on entire slide.

Rare—One or two specimens on entire slide.

SYSTEMATIC DESCRIPTION

All the four samples have yielded diatoms without much variation in number and diversity and hence their relative abundance has been considered collectively (Table 1).

Table 1—Showing relative distribution of diatom from Kua Tal, district Nainital

Diatom taxa	*Dominant*	*Abundant*	*Common*	*Frequent*	*Rare*
Caloneis silicula	–	–	–	–	+
Cocconeis placentula	–	+	–	–	–
Cyclotella meneghiniana	–	–	–	–	+
Cymbella aspera	+	–	–	–	–
Epithemia zebra	–	–	–	–	+
Eunotia pectinalis var. *neglecta*	–	–	–	+	–
Gomphonema acuminatum	–	–	+	–	–
G. constrictum var. *capitatum*	–	–	–	+	–
G. montanum var *acuminatum*	–	–	–	+	–
Gyrosigma acuminatum	–	–	+	–	–
Hantzschia amphioxys	–	–	–	+	–
Melosira sp.	–	–	–	+	–
Navicula cuspidata var. *ambigua*	–	+	–	–	–
N. graciloides	–	–	–	+	–
N. rhyncocephala var *amphiceros*	–	–	–	+	–
Neidium oblique-striatum var. *parallela*	–	+	–	–	–
Pinnularia sp.	–	+	–	–	–
Surirella ovata	–	–	+	–	–
Synedra ulna	+	–	–	–	–

Caloneis silicula (Ehr.) Cl.
Pl. 1, fig. 16

Valve 70-74 μm long, 13-15 μm broad, linear; margins slightly triundulate, distinctly tumid in the middle; ends broadly cuneate and slightly constricted, produced and rounded; raphe thin and straight; striae 9-10 in 10 μm, fine, slightly radial.

Cocconeis placentula Ehr.
Pl. 1, figs 9, 10

Valve 23-30 μm long, 15-20 μm broad, elliptical. Valve with raphe: raphe thin and straight, axial area very narrow; central area small roundish; striae 24-27 in 10 μm, finely punctate; marginal rim distinct. Valve with pseudo raphe: pseudoraphe narrow, linear; striae 23-25 in 10 μm, interrupted by several closely placed longitudinal, somewhat wavy hyaline bands.

Cyclotella meneghiniana Kütz.

Valve discoidal 11-19 in μm diameter; margin striated, striae wedge-shaped, 9-11 in 10 μm.

Cymbella aspera (Ehr.) Cl.
Pl. 1, figs 5, 6

Valve 35-60 μm long, 9-17 μm broad, asymmetrical; dorsal side strongly convex and ventral side slightly convex; ends constricted and produced rounded; raphe thick, eccentric; axial area very narrow; central area slightly widened; striae 10-12 in 10 μm, radial, distinctly punctate and somewhat closer at the ends.

Epithemia zebra (Ehr.) Kütz.

Valve 30-33 μm long, 10-12 μm broad, attenuate; slightly recurved at the ends; dorsal line arcuate; striae distinctly punctate, 9-10 in 10 μm.

Eunotia pectinalis (Kütz.) Rabh. var. *neglecta* Gandhi
Pl. 1, fig. 15

Valve 50-55 μm long, 9-10 μm broad, slightly curved with rounded ends; striae distinct, 11-12 in 10 μm.

Gomphonema acuminatum Ehr.
Pl. 1, fig. 7

Valve 50-67 μm long, 9-10 μm broad, wedge-shaped with broad head pole and strongly narrowed foot pole; striae punctate and radial transapically, 10-13 in 10 μm.

Gomphonema constrictum Ehr. var. *capitatum* (Ehr.) Grun. in van Heurck
Pl. 1, fig. 13

Valve 40-44 μm long, 10-13 μm broad; club-shaped with flat rounded head pole and more strongly narrowed foot pole, no transapical constriction; raphe thick and straight; striae fine, distinctly punctate and radial transapically, 11-12 in 10 μm.

Gomphonema montanum Schum. var. *acuminata* (Perag. M. & Hérib. in Hérib.) Mayer
Pl. 1, fig. 19

Valve 48-50 μm long, 16-18 μm broad; lanceolate, club-shaped with broad bluntly rounded

head pole and somewhat narrowed foot pole; striae distinctly punctate, 7-9 in 10 μm.

Gyrosigma acuminatum (Kütz.) Rabh
Pl. 1, fig. 2

Valve 90-100 μm long, 10-13 μm broad; S-shaped, lanceolate, gradually narrowed from the middle towards bluntly rounded apices; raphe correspondingly shaped; transverse and longitudinal striae faint.

Hantzschia amphioxys (Ehr.) Grun. in Cl & Grun.
Pl. 1, fig. 11

Valve 30-34 μm long, 7-9 μm broad; slightly arcuate, linear; dorsal side slightly convex, ventral side slightly concave with slight depression in the middle; ends constricted, bluntly rostrate to weakly capitate; keel eccentric, keel punctae coarse, two of the middle punctae widely set, 6-7 in 10 μm, striae distinct, 14-18 in 10 μm

Melosira sp.

Valve 25 μm long, 11 μm broad, cylindrical, generally found in girdle view.

Navicula cuspidata (Kütz.) Kütz. var. *ambigua* (Ehr.) Cl.
Pl. 1, fig. 17

Valve 85-98 μm long, 21-24 μm broad; elliptic-lanceolate with rostrate ends; raphe thin and straight; striae transverse, almost perpendicular to the middle line, 18-20 in 10 μm.

Navicula graciloides Mayer
Pl. 1, fig. 8

Valve 35-40 μm long, 8-10 μm broad, lanceolate; raphe thin and straight; striae 12-14 in 10 μm.

Navicula rhyncocephala Kütz. var. *amphiceros* (Kütz.) Grün. in Van Heurck
Pl. 1, fig. 12

Valve 45-55 μm long, 11-13 μm broad; broadly lanceolate with constricted, produced feebly capitate ends; raphe thin and straight; striae radial in the middle and convergent at the ends, 12-14 in 10 μm

Neidium oblique-striatum (A.S.) Cleve var. *parallela* Gonzalves & Gandhi
Pl. 1, fig. 14

Valve 55-75 μm long, 10-14 μm broad; linear-elliptical with constricted broadly produced subcuneate ends; raphe thin and straight, striae fine, 1-3 hyaline, longitudinal furrows near the margins, striae 22-26 in 10 μm.

Pinnularia gibba Ehr.
Pl. 1, figs 3, 4

Valve 60-75 μm long, 11-14 μm broad; linear, lanceolate with slight but uniformly convex sides and slightly swollen rounded ends; raphe thin and straight with central pore unilaterally bent and curved terminal fissures, axial area narrowly lanceolate, central area large rhomboidal reaching to the sides; striae radial in the middle and convergent at the ends, 11-12 in 10 μm

Surirella ovata Kütz.
Pl. 1, fig. 18

Valve 56-95 μm long, 18-30 μm broad, heteropolar, long, ovate with broadly rounded apex and grdually narrowed, well-marked cuneate base; costae 3-5 in 10 μm; striae indistinct.

Synedra ulna (Nitz.) Ehr.
Pl. 1, fig. 1

Valve 90-200 μm long, 5.7 μm broad, fragmental, slender, strongly constricted and produced rounded ends; striae strong and uniformly placed, 9-10 in 10 μm.

DISCUSSION AND CONCLUSION

The diatom analysis of lacustrine sediments from Kua Tal profile in Naini Tal District, Kumaon Himalaya, has revealed the overall dominance of Pennales both quantity-wise and quality-wise However, Centrales are insignificantly found and represented only by two taxa, viz., *Cyclotella* and *Melosira*. Nineteen types of diatoms have been studied. On the basis of their relative abundance in

PLATE 1 →

1. *Synedra ulna*. × 1000
2. *Gyrosigma acuminatum* × 850.
3, 4. *Pinnularia gibba*. × 850.
5, 6. *Cymbella aspera* × 1000.
7. *Gomphonema acuminatum* × 1000.
8. *Navicula graciloides*. × 1000.
9, 10. *Cocconeis placentula*. × 850.
11. *Hantzschia amphioxys* × 850.
12. *Navicula rhyncocephala* var. *amphiceros* × 1000.
13. *Gomphonema constrictum* var. *capitata*. × 1000
14. *Neidium oblique-striatum* var. *parallela*. × 1000.
15. *Eunotia pectinata* var. *neglecta* × 850.
16. *Caloneis silicula*. × 850.
17. *Navicula cuspidata* var. *ambigua*. × 850.
18. *Surirella ovata* × 1000.
19. *Gomphonema montanum* var. *acuminatum* × 1500.

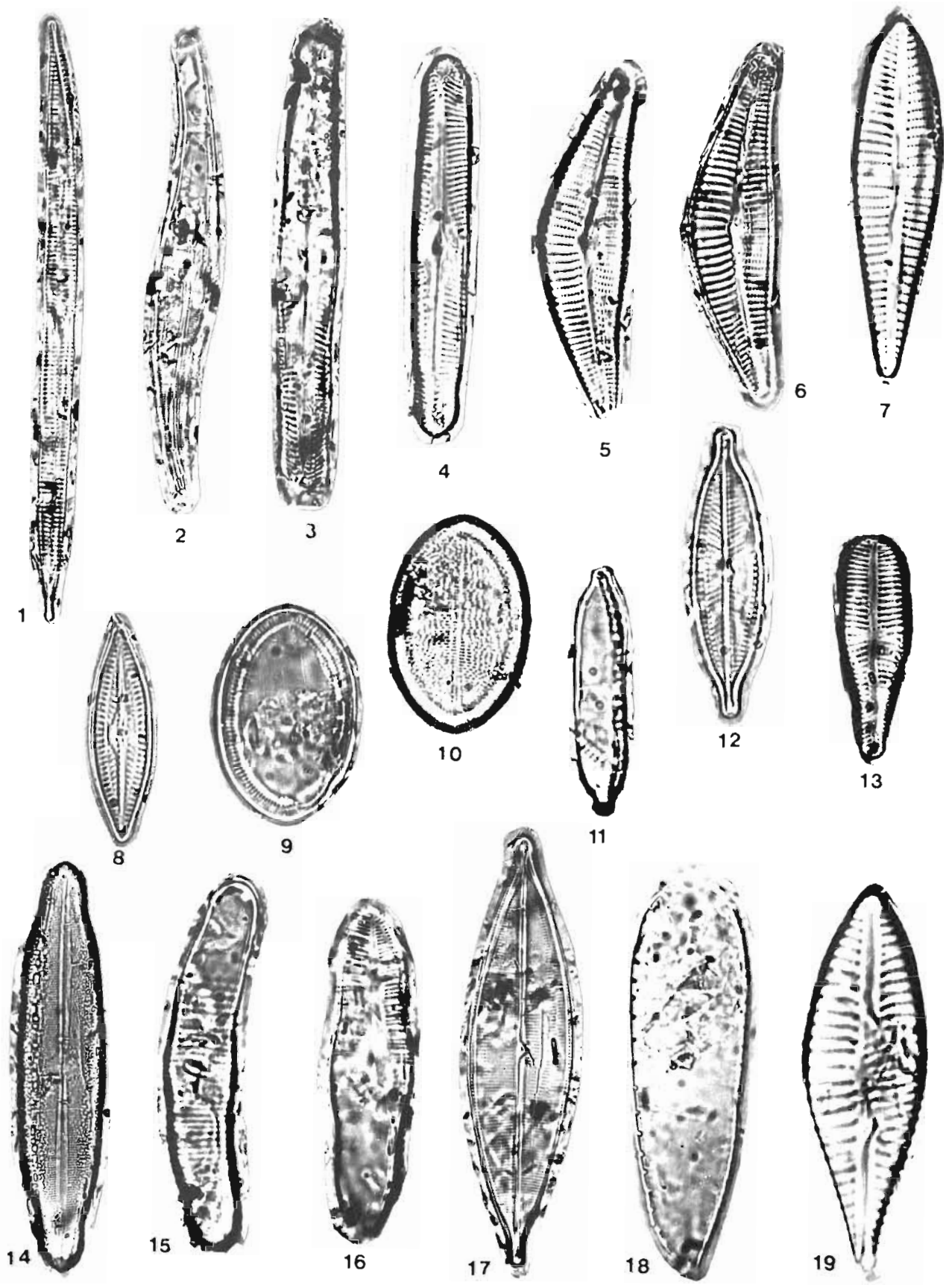

PLATE 1

the assemblage, five quantitative categories have been made to include in diatom taxa. Dominant taxa are *Cymbella aspera* and *Synedra ulna*; abundant taxa are *Cocconeis placentula*, *Navicula cuspidata* var. *ambigua*, *Neidium oblique-striatum* var. *parallela* and *Pinnularia* sp.; common taxa are *Gomphonema acuminatum*, *Gyrosigma acuminatum* and *Surirella ovata*, *Eunotia pectinalis* var *neglecta*, *Gomphonema constrictum* var *capitatum*, *Gomphonema montanum* var. *acuminatum*, *Hantzschia amphioxys*, *Melosira* sp., *Navicula graciloides* and *Navicula rhyncocephala* var *amphiceros* are frequent. The rare forms are *Caloneis silicula*, *Cyclotella meneghiniana* and *Epithemia zebra*.

The preservation of diatoms, irrespective of their type, is perfect and this may be accounted as due to the continual ponding environment during the course of their development. The diatom assemblage in the sediments is also suggestive of fresh water depositional environment.

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