

SOME CHAROPHYTIC REMAINS FROM THE LOWER SIWALIK OF TANAKPUR, DISTRICT NAINI TAL

R. N. LAKHANPAL*, S. KAPOOR** & K. P. JAIN*

*Birbal Sahni Institute of Palaeobotany, Lucknow-226007

**A-6/1, Nirala Nagar, Lucknow 226007

ABSTRACT

The present paper deals with some fossil charophytic oogonia (gyrogonites) recovered from the Lower Siwalik beds (Miocene) at Purniagiri, near Tanakpur, District Naini Tal. The fossils have been described under three genera, viz., *Charites*, *Sphaerochara* and *Raskyaechara*, comprising five species of which *Charites siwalikus* and *Raskyaechara purniagiriensis* are new.

INTRODUCTION

THE Tanakpur area in the district of Naini Tal, U.P., adjoins the south-western territory of Nepal. The sedimentary sequence of the area has been correlated with the Lower Siwalik, possibly the Kamliak Stage, by Misra and Valdiya (1962) on the basis of lithology and mineralogy.

While surveying this area, one of us (Kapoor) made a small collection of charophytes from a road cutting on the southern side of the Purniagiri Hill. The fossils were recovered from a clay shale band overlain and underlain by fine grained sandstones. The clay shales are thinly laminated and greenish grey in colour. The matrix is fairly hard and compact.

The Purniagiri charophytic remains are the calcified portions of oogonia (gyrogonites). The vegetative parts, coronula and node cells, are not preserved. Their identification and classification are based chiefly on the features derived from lime shells. The scheme put forth by Horn af Rantzien (1956) for the morphological grouping of the Tertiary gyrogonites has been followed to describe and classify the present material.

Recently Rao (1974) has reviewed the Indian fossil charophytes including the recent publications of Bhatia and Mathur (1970) and Tewari and Sharma (1972), which deal with Upper Siwalik charophytes from Pinjore and Chandigarh respectively. The Upper Siwalik species are

assigned to Upper Pliocene — Lower Pleistocene age.

Abbreviations for measurements used in the text are as follows (after Horn af Rantzien, 1958, p. 51):

LPA = Length of the polar axis of the gyrogonite.

LED = Largest equatorial diameter of the gyrogonite.

AND = Distance from the apical pole to the LED as calculated along the polar axis.

EA = Equatorial axis.

ISI = Isopolarity index, i.e. $100 \times \text{LPA} / \text{LED}$.

ANI = Anisopolarity index, i.e. $100 \times \text{AND} / \text{LPA}$.

NR. CONV. = Number of convolutions visible in lateral aspect of the gyrogonites, including those partly visible at the poles.

AT EA WIDTH CONV. = Widths of the lime spirals (as measured between the intercellular sutures) at the equatorial axis of the gyrogonite.

BASAL PORE = Diameter of the outer (proximal) opening of the basal pore.

SYSTEMATIC DESCRIPTION

THE CHAROID TYPE

Genus — *Charites* Horn af Rantzien, 1958

Charites siwalikus sp. nov.

Pl. 1. figs. 1-5

Holotype — Pl. 1, fig. 1; Sl. no. 2820.

Type Locality — Purniagiri Hill, Tanakpur, Distt. Naini Tal, India.

Horizon — Lower Siwalik (Miocene).

Diagnosis — Lime shells prolate or subprolate (ISI 110-167), ellipsoidal; LPA

560-790 μm , LED 430-560 μm ; rounded both apically and basally. Lime spirals fine, sinistrally coiled, making two or almost two and a half turns around the oosporangium; convolutions 10-12 in lateral view, concave to flat; intercellular ridges sharp, 43-85 μm wide at equator. Equatorial angle 5-10°. Apical pole rounded, lime spirals narrowed in the apical periphery regaining width in the centre, line of junction somewhat zig-zag. Basal poles rounded, width and thickness of lime shells same as at EA. Tips of spiral ends rounded, overlapping each other, imbricate. Basal pore cone-shaped and not pentagonal (Table 1).

Comparison — *Charites siwalikus* sp. nov. can be compared in most of its morphological features with *Charites molassica* (Straub) Horn af Rantzien (1958) described from the Miocene of Germany and Oligocene of Switzerland. However, it differs in having imbricate type of basal spiral tip arrangement. This character separates the present species from all the known species of the genus *Charites*. *Chara zoberbieri* Fritsch (in Horn af Rantzien, 1954, pp. 27-28) described from the Pliocene of Germany has similar basal spiral tip arrangement

but differs in its small size and lesser number of convolutions. *Charites strobilocarpa* (Reid & Groves) Horn af Rantzien (1958) differs in having conically prolonged, much protruding basal pore and lesser and wider convolutions.

Charites molassica (Straub) Horn af Rantzien, 1958

Pl. 1, figs. 8-10

Remarks — About half a dozen oogonia belong to *C. molassica*. The measurements of a few well preserved specimens given in Table 2 indicate their identity with this species.

THE SPHAEROCHAROID TYPE

Genus — *Sphaerochara* (Mädler) Horn af Rantzien & Grambast, 1962

Sphaerochara rollei (Unger) Horn af Rantzien, 1954

Pl. 1, figs. 8-8a

Remarks — Unger (1858) described *Chara rollei* from the Miocene of Castle of Thal in the vicinity of Gratz, Steiermark, Austria.

TABLE 1 — MEASURED LIME SHELLS OF *CHARITES SIWALIKUS* SP. NOV.

Sl. No.	LPA μm	LED μm	ISI	Nr. Conv.	At EA Width Conv. μm	Basal Pore μm	Shape
1	680	460	148	11	50	—	Prolate
2	680	500	136	11	50	—	Prolate
3	560	460	121	10	68	—	Sub-prolate
4	715	560	128	12	60	51	Sub-prolate
5	680	510	133	10	57	—	Prolate
6	790	500	158	12	68	—	Sub-prolate
7	572	430	133	10	68	—	Prolate
8	715	545	131	12	57	—	Sub-prolate
9	572	500	114	12	50	—	Sub-prolate
Range	560-790	430-560	114-158	10-12	50-68	—	Prolate — Sub-prolate
M	645	561	137	11	56	—	Mostly prolate

TABLE 2 — MEASURED LIME SHELLS OF PRESENT MATERIAL OF *C. MOLASSICA*

Sl. No.	LPA μm	LED μm	ISI	Nr. Conv.	At EA Width Conv. μm	Basal Pore μm	Shape
1	715	486	147	12	57	—	Prolate
2	592	425	144	10	50	85	Prolate
3	572	400	143	12	43	—	Prolate

Later Horn af Rantzien (1954) transferred it to *Sphaerochara* but did not describe the species in detail. The following elaborate description is, therefore, suggested.

Elaborate Description — Gyrogonites white, glossy, prolate-spheroidal, ellipsoidal; LPA 630-840 μm , LED 680-760 μm ; enveloping cells five, sinistrally coiled, making one and a half turns around the oosporangium, convolutions 6-8 in lateral view, slightly convex, EA 85-119 μm broad, equatorial angle acute. Apical region rounded, enveloping cells turning towards the centre without any contraction or expansion; ends uniting along a short broken line. Basal region flat or slightly rounded, enveloping cells surround the small, rounded basal opening; diameter 68-102 μm at surface (Table 3).

THE ACLISTOCHAROID TYPE

Genus — *Raskyaechara* Horn af Rantzien, 1958

Raskyaechara purniagiriensis sp. nov.

Pl. 1, figs. 9-12

Holotype — Pl. 1, fig. 9; Sl. no. 2825.

Locality — Purniagiri Hill, Tanakpur, Distt. Naini Tal, India.

Horizon — Lower Siwalik (Miocene)

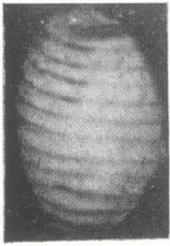
Diagnosis — Gyrogonites prolate-sphaeroidal or sub-prolate, LPA 765-850 μm , LED 680-730 μm . Enveloping cells five, sinistrally coiled, marking two to two and a half turns around the oosporangium; convolutions 10-12 in lateral view, convex, 68-72 μm wide at EA, separated from each

TABLE 3 — MEASURED LIME SHELLS OF *SPHAEROCHARA ROLLEI* (UNGER) HORN AF RANTZIEN (1954) BASED ON THE HOLOTYPE AND THE PRESENT MATERIAL

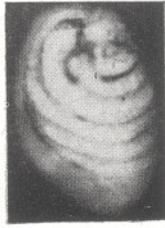
Sl. No.	LAP μm	LED μm	ISI	Nr. CONV.	At EA WIDTH CONV. μm	BASAL PORE μm	SHAPE
Holotype	840	760	110	7	—	—	Prolate-sphaeroidal
1	765	730	104	8	119	102	"
2	786	715	110	8	100	102	"
3	714	714	100	7	110	85	"
4	715	715	100	7	114	102	"
5	680	680	100	8	102	85	"
6	630	630	100	7	86	68	"
Range	630-840	630-760	100-110	7-8	86-119	68-119	"
M	740	698.6	104	7.5	102	80	"

TABLE 4 — MEASURED LIME SHELLS OF *RASKYAECHARA PURNIAGIRIENSIS* SP. NOV.

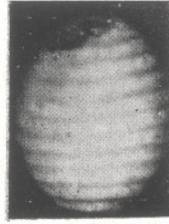
Sl. No.	LAP μm	LED μm	ISI	Nr. CONV.	At EA WIDTH CONV. μm	BASAL PORE μm	SHAPE
1	765	730	105	12	68	119	Prolate-spheroidal
2	850	765	111	12	72	170 × 102	"
3	786	672	117	11	86	115	Sub-prolate
4	765	680	113	10	68	163 × 102	Prolate-spheroidal
5	816	630	130	12	68	—	Sub-prolate
6	886	744	119	10	86	120	"
7	765-885	672-765	105-130	10-12	68-86	—	Mostly sub-prolate



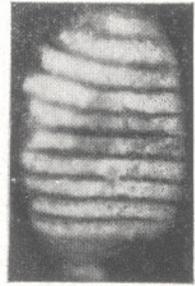
1



2



3



4



1a



1b



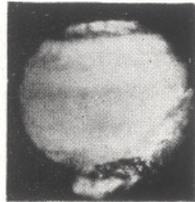
6a



5



8



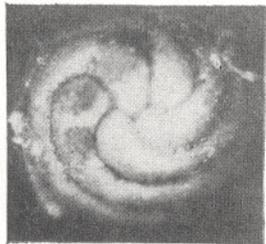
7



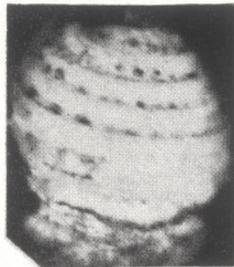
6



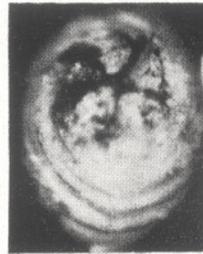
12



8a



10



11



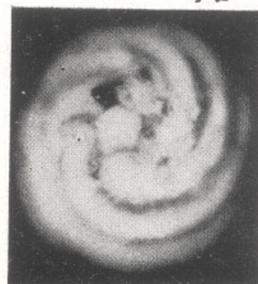
13



9



9a



9b

other by alternate, 20 μm broad thin calcified grooves, equatorial angle 5-10°. Apical pole rounded, lime spirals narrowed at the apical periphery becoming up to 60 μm , turning into the centre with distinct increase, becoming as wide as at the EA, meeting at a point without forming rosette. Basal poles rounded, width and thickness of lime spirals same as at EA. Basal pore outer op-

ening pentagonal, 115-170 μm wide. (Table 4)

Comparison — *Raskyaechara purniagirien-sis* sp. nov. closely resembles *R. grovesii* (Rasky) Horn af Rantzien (1958) but differs mainly in having narrower, thin calcified grooves and bigger basal outer opening.

Repository — The type material is housed at the Museum, Birbal Sahni Institute of Palaeobotany, Lucknow.

REFERENCES

- BHATIA, S. B. & MATHUR, A. K. (1970). First record of charophyta from Upper Siwaliks near Pinjore. *Bull. Indian geol. Assoc.* **3** (1&2): 27-28.
- HORN AF RANTZIEN, H. (1954). Revision of some Pliocene charophyte gyrogonites. *Bot. Notiser.* **107** (1): 1-33.
- IDEM (1956). Morphological terminology relating to female charophyte gametangia and fructifications. *Ibid.* **109** (2): 212-259.
- IDEM (1958). Morphological types and organ genera of Tertiary charophyte fructifications. Charophyte fructifications. *Stockh. Contr. Geol.* **4** (2): 45-197.
- MISRA, R. C. & VALDIYA, (1962). Petrology and sedimentation of Siwalik of the Tanakpur area, District Naini Tal, U.P. *Indian Mineralogist.* **2** (1): 7-35.
- RAO, A. R. (1974). Fossil charophytes. *Aspects and Appraisal of Indian Palaeobotany.*: 23-28.
- TEWARI, B. S. & SHARMA, S. P. (1972). Some fossil charophyta from Upper Siwalik near Chandigarh, India. *Bull. Indian geol. Assoc.* **5** (1&2): 1-2.
- ÜNGER, F. (1858). Ueber fossile pflanzen des Süßwasser-Kalkes und Quarzes. *Denkschr. K. Akad. Wiss. Wien.* **14**: 1-12.

EXPLANATION OF PLATE

1-5. *Charites siwalikus* sp. nov. 1, Convolution, seen in lateral view; 1a, same in apical view; 1b, same showing basal pentagonal pore; 2-4, different specimen in lateral view; 5, longitudinal section of calcified oogonia showing convolution thickness (Slide nos.: 2820, 2821 & 2822).

6-7. *Charites molassica* (Straub) Horn af Rantzien. 6, Convolution seen in lateral view; 6a, same showing basal pore; 7, another specimen in lateral view (Slide no. 2823).

8-8a. *Sphaerochara rollei* (Unger) Horn af Rantzien. 8, showing lateral convolutions and basal pore; 8a, same showing apical region (Slide no. 2824).

9-12. *Raskyaechara purniagirien-sis* sp. nov. 9, showing convolutions in lateral view; 9a, same in apical view; 9b, same showing basal outer pore; 10 & 12, other specimens in lateral view; 11, another specimen in apical view (Slide no.: 2825).

13. Magnified portion of the stage micrometer.