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UPPER CRETACEOUS CHAROPHYTA FROM THE NEMEGT BASIN, GOBI DESERT

(Plates XXX—XXXIV)

Abstract. — Thirteen species, assigned to 10 genera of fructifications of Charophyta, from Upper Cretaceous sediments (Upper Nemegt Beds) of the Nemegt Basin, Gobi Desert, are described and illustrated. Seven new species: *Harrisichara cretacea*, *Maedlerisphaera pseudoulmensis*, *Mesochara mongolica*, *Saportanella nana*, *Tectochara altanulaensis*, *T. aurea* and *T. gobica* are erected.

INTRODUCTION

The results of studies on fructifications of Charophyta from the Upper Nemegt Beds of Nemegt Basin, Gobi Desert, are discussed in the present paper. On the basis of dinosaurs found in these beds, their age has been determined as the Upper Cretaceous, Campanian or Maastrichtian, zone of *Tarbosaurus bataar* (MALEYEV), *Saurolophus angustirostris* ROZHDESTVENSKY and *Dyoplosaurus giganteus* MALEYEV (see GRADZIŃSKI *et al.*, 1968/69, p. 37). Fossil Charophyta have not been known so far from the territory of the Gobi Desert. The present paper is the first work in this field.

In 1964 and 1965, during the Polish-Mongolian Palaeontological Expedition (see KIELAN-JAWOROWSKA & DOVCHIN, 1968/69), lithological samples were collected by Dr. R. GRADZIŃSKI, for sedimentological studies (GRADZIŃSKI, 1970). In the course of his laboratory work, many oogonia of Charophyta were found in some samples from Altan Ula IV and from Nemegt of the Nemegt Basin.

Geological data on the discussed sediments from the Nemegt Basin have been presented in detail by GRADZIŃSKI *et al.* (1968/69). The geological sections, which yielded the Charophyta described in the present paper, were given by GRADZIŃSKI *et al.* (*l. c.*, Figs. 3 and 5). In both these profiles, samples come from the Upper Nemegt Beds, but in the locality Nemegt these are the lowermost sediments of this formation, called Passage Series. Sediments from the locality Altan Ula IV are in vertical section about 100 m higher than the top of the Lower Nemegt Beds of the locality Nemegt. These two localities are about 50 km distant from each other. Without the observance of a horizontal scale, we present a schematic drawing (according to Dr. R. GRADZIŃSKI's sketch), which illustrates a mutual relation of beds in these two localities (Text-fig. 1). Since the sediments have not been sampled for the purposes of studies on fossil Charophyta, samples are not big and consequently the number of the specimens obtained is small, amounting altogether to about 150.

Ten genera and 12 species of Charophyta, including 7 new ones, have been identified. The collection is housed at the Palaeozoological Institute of the Polish Academy of Sciences (abbreviated as Z. Pal.), (see also KIELAN-JAWOROWSKA & DOVCHIN, 1968/69, p. 12).

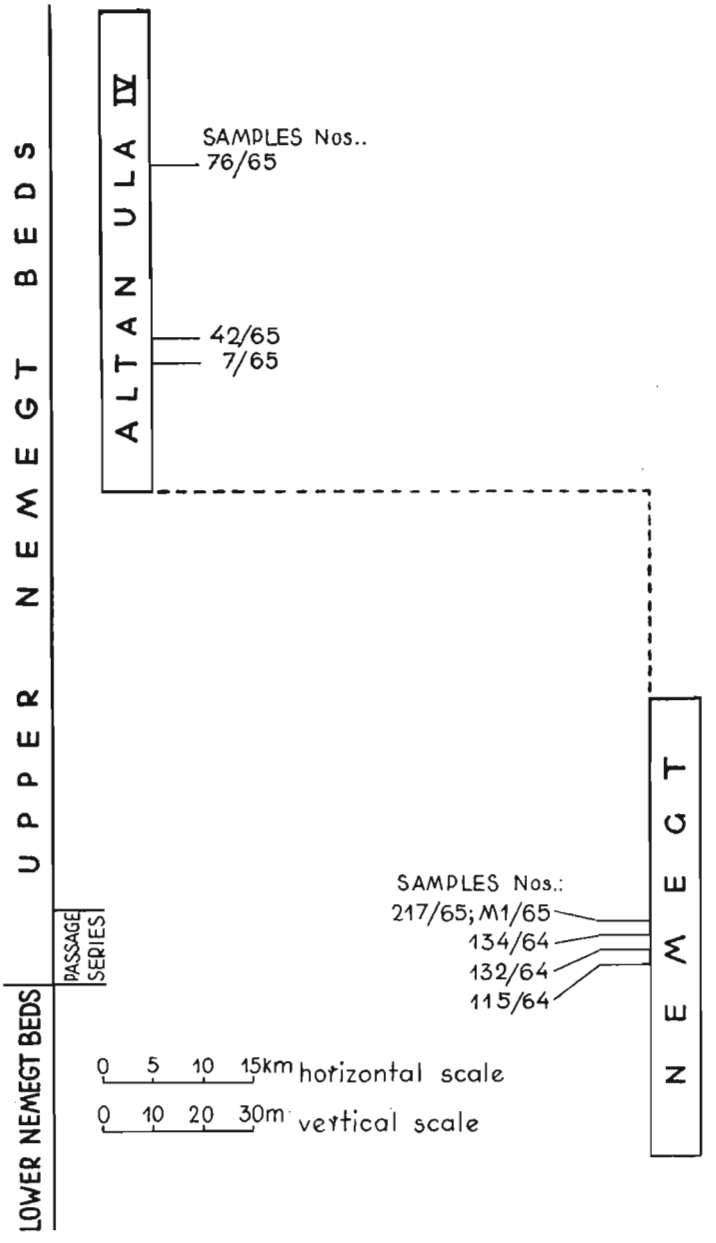


Fig. 1
Mutual relations of beds from localities Nemegt and Altan Ula IV (after GRADZIŃSKI, 1969).

The present writers would like to express their heartfelt thanks to Prof. Z. KIELAN-JAWOROWSKA, Director of the Palaeozoological Institute, Polish Academy of Sciences in Warsaw, and Dr. R. GRADZIŃSKI, from the Department of Geology of the Jagellonian University in Cracow, for making their collections available for elaboration, as well as to Prof. M. KOSTYNIUK, Head of the Palaeobotanical Laboratory, University of Warsaw, for many valuable remarks, comments and advice, given in the course of preparation of the present paper. The authors also feel indebted to Miss L. ŁUSZCZEWSKA for taking photographs, and to Mrs. D. SŁAWIK for making the drawings.

STRATIGRAPHY

In stratigraphical and palaeoecological studies of some continental sediments, when other index fossils are lacking, a considerable role is played by fructifications of fossil Charophyta. These fructifications, found in many, various sediments, mostly together with tests of Ostracoda, are best-known from the Jurassic and Tertiary deposits. On the other hand, Cretaceous, in particular the Upper Cretaceous, has so far supplied scanty material for the studies of such type. Fairly well-known are Charophyta from the Lower Cretaceous mostly from the territories of North America (PECK, 1957), Hungary (RASKY, 1945), Algeria (BAR & MAGNÉ, 1956), Syria (REY, 1952; BELLEN, 1948), Germany (SCHENK, 1871) and Great Britain (SEWARD, 1844).

Works devoted to the Upper Cretaceous Charophyta are only those by PECK & REKER (1947), KOCH & BLISSENBACH (1960) and GRAMBAST (1967), all of them concerning fructifications of Charophyta from Peru. In addition, a species *Atopochara multivolvis* PECK was described in 1957 by PECK from the Upper Cretaceous sediments of the southern part of the State of Utah, U. S. A. Furthermore, a new genus *Saportanella* was described by GRAMBAST (1962) from Maastrichtian of France.

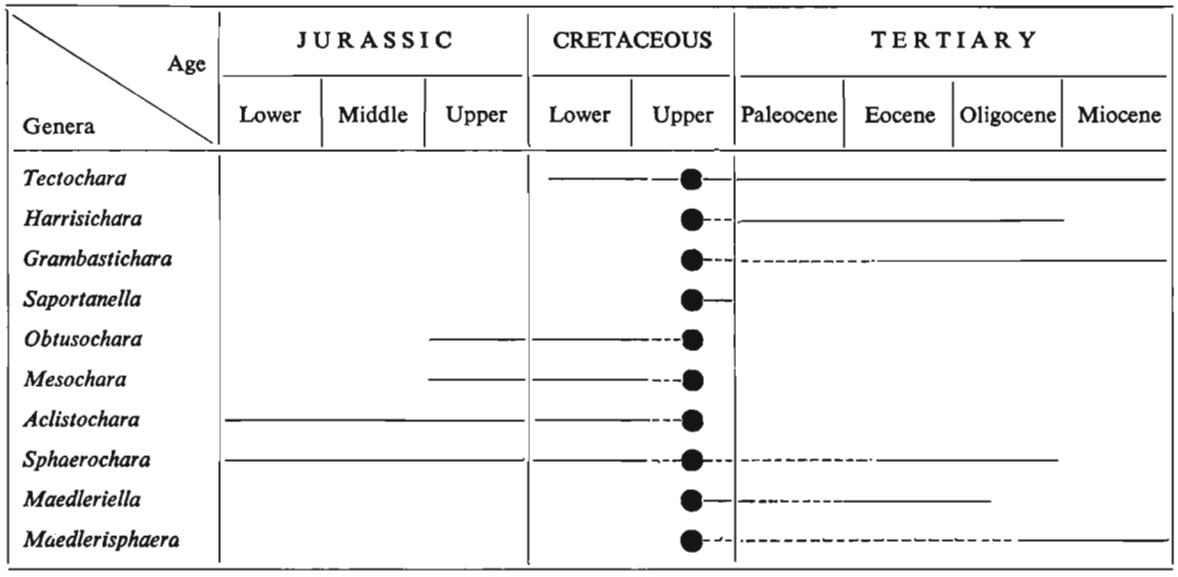
Among the genera and species of fructifications from the sediments of Gobi Desert, identified in the present paper, four species have already been known from PECK's and REKER's works. *Mesochara voluta* (PECK) and *Sphaerochara verticillata* (PECK) have been formed by PECK in the Jurassic sediments, Morrison formation and the Aptian sediments of North America. *Obtusochara madleri* PECK was known only from the Aptian sediments. The fourth of the previously known species *Maedleriella monilifera* (PECK & REKER), has been first described from the Eocene sediments of Peru (PECK & REKER, 1947) and hereafter from the boundary of the Cretaceous and Lower Tertiary sediments (KOCH & BLISSENBACH, 1960) also from Peru. The remaining seven species, described in the present paper, are new, but they belong to already known genera. On the basis of the stratigraphic range of these genera, we may only confirm the Upper Cretaceous age of the Upper Nemegt Beds, which was determined on the basis of dinosaurs. There are still no sufficient comparative data for a more detailed stratigraphic qualification of these sediments.

The stratigraphic range of the genera of Charophyta, found in the sediments from the Nemegt Basin, is presented in Table 1. The representatives have been found of three genera, whose occurrence in the Upper Cretaceous sediments was stated in other continents. There are: *Saportanella*, *Maedleriella* and *Tectochara*. The Upper Cretaceous age of these sediments is shown by the occurrence of *Saportanella nana* n. sp., assigned to the Upper Cretaceous genus *Saportanella* GRAMBAST and by the finding of *Maedleriella monilifera* (PECK & REKER), which is known from the Uppermost Cretaceous and Lower Tertiary.

The fact that no Charophyta of the family Clavatoraceae, whose fructifications are closed in additional utricles, have been found in the sediments under study, also throws a certain light on the age of these sediments. The fructifications of the Clavatoraceae are known from Triassic to the lower part of the Upper Cretaceous and make up a considerable percentage of Mesozoic Charophyta, described mostly from North America. The lack of such fructifications may testify to the Upper Cretaceous age of the sediments from Nemegt Basin, or to different ecological conditions predominating in this territory. The greatest number of the species described are those assigned to the genus *Tectochara*. These are: *T. gobica* n. sp., *T. altanulaensis* n. sp., and *T. aurea* n. sp. This is a relatively long-lived genus, represented by a considerable number of species. *Tectochara grambastorum* PECK, described by PECK (1957) from Aptian sediments of North America, is the oldest representive of this genus.

Table 1

Stratigraphic distribution of the Charophyta genera from the Upper Nemegt Beds (Upper Cretaceous)



Legend: ——— Stratigraphic range based on literature
------- Extend distribution
● Stratigraphic position of the genera from Mongolia

In the material under study the occurrence has been stated of a species of the genus *Sphaerochara*, whose representatives are known from the Triassic, Jurassic, Lower Crataceous and Tertiary deposits. Thus far, it has not been ever recorded in the Upper Cretaceous and therefore, our recognition of *Sphaerochara verticillata* in the Upper Cretaceous beds, fills a gap in the stratigraphic range of this genus. Of the genera known from Jurassic and Upper Cretaceous and whose representatives have never before been found in younger deposits, the following two have been found in the samples from the Nemegt Basin: *Obtusochara* (one species) and *Mesochara* (two species). Peculiar is the fact that both the species of the genus *Obtusochara* (*O. madleri* PECK) and one of the species of *Mesochara* (*M. voluta* (PECK)) are known from the Lower Cretaceous sediments of North America. On the basis of new findings, we may extend the stratigraphic range of these genera up to the Upper Cretaceous. *Harrisichara* and *Grambastichara*, two genera described so far only from the Tertiary deposits, have also been found in the Upper Cretaceous sediments of Nemegt Basin. GRAMBAST's (1959) supposition that the beginning of the stratigraphic distribution of this genus took place in the Upper Cretaceous, is thus confirmed.

HORN AF RANTZIEN (1959) in his considerations of a pre-Tertiary origin of Tertiary genera, maintains that some Jurassic and Lower Cretaceous Charophyta morphologically resemble *Grambastichara* and, therefore, he supposes that it might occur earlier than in the Lower Tertiary. *Maedlerisphaera* HORN AF RANTZIEN, 1959 is the last genus, whose representative is distinguished in Upper Nemegt Beds of the Nemegt Basin. The stratigraphic distribution of this genus was limited to the Upper Tertiary (Oligocene-Miocene). HORN AF RANTZIEN and GRAMBAST (1962) placed this genus under synonymy of *Sphaerochara* MÄDLER. In the opinion of the present writers, *Maedlerisphaera* HORN AF RANTZIEN is a valid genus. Morphologically and

Table 2

Stratigraphic occurrence of the Upper Cretaceous Charophyta from the Nemegt Basin, Gobi Desert

Age	Formation		Samples Nos. *	Locality	Lithology	*Tectochara gobica* n. sp.	*Harrisichara cretacea* n. sp.	*Tectochara altanulaensis* n. sp.	*Grambastichara* sp.	*Saportanella nana* n. sp.	*Obtusochara madleri* Peck	*Mesochara voluta* (Peck) nov. comb.	*Aclistochara* cf. *bransoni* Peck	*Sphaerochara verticillata* Peck	*Maedleriella monilifera* (Peck & Reker) Grambast	*Maedlerisphaera pseudoulmensis* n. sp.	*Mesochara mongolica* n. sp.	*Tectochara aurea* n. sp.
Upper Cretaceous	Upper Nemegt Beds		76/65	Altan Ula IV	Silty claystone, moderate reddish-brown	+											+	
			7/65	Altan Ula IV	Yellowish-gray silty claystone	+	+	+		+							+	+
			42/65	Altan Ula IV	Silty claystone, light reddish-brown											+		
		Passage Series	217/65	Nemegt	Silty claystone, light reddish-brown	+			+							+		
			M1/65	Nemegt	Silty claystone, moderate reddish-brown	+									+			
			134/64	Nemegt	Claystone, moderate reddish-brown	+	+	+		+	+	+	+	+				
			132/64	Nemegt	Claystone, moderate reddish-brown		+	+	+									
			115/64	Nemegt	Silty claystone, light reddish-brown	+												

* The numbers of samples refer to the lithological collection of Dr. R. GRADZIŃSKI, housed in the Department of Geology of the Jagellonian University in Cracow (see GRADZIŃSKI, 1970, p. 148).

anatomically it differs from the representatives of *Sphaerochara* to such an extent that these two genera cannot be regarded as congeneric. *Maedlerisphaera pseudoulmensis* n. sp., described on the basis of well preserved specimens, makes up an evidence of an appearance of this genus in the late Cretaceous.

The stratigraphic distribution of the species, described in the present paper, is presented in Table 2.

SYSTEMATIC PART

In the description of fructifications of Charophyta we have accepted the terminology used by PECK (1957) and HORN AF RANTZIEN (1959). To define the shape and size of gyrogonites we use the following abbreviations of HORN AF RANTZIEN:

LPA — length of the polar axis of the gyrogonite
LED — largest equatorial diameter of the gyrogonite
ISI — isopolarity index $\frac{LPA}{LED} \times 100$
AND — distance from the apical pole to the LED as calculated along the polar axis
ANI — anisopolarity index $\frac{AND}{LPA} \times 100$
EA — equatorial axis
Numb. conv. — number of convolutions in the lateral view
Width conv. at EA — width of the spirals at the equatorial axis
∅ basal pore — diameter of the outer opening of the basal pore

The shape terminology:

	ISI		ANI
prolate spheroidal	100—114	subovoidal	29—43
subprolate	114—133	ellipsoidal	43—57
prolate	133—200	subobovoidal	57—71

Genus **ACLISTOCHARA** PECK, 1937 emend. PECK, 1957

Type species: *Aclistochara bransoni* PECK, 1937; North America, Upper Jurassic.

Aclistochara cf. **bransoni** PECK

(Pl. XXX, Fig. 5)

1937. *Aclistochara bransoni* PECK; R. E. PECK, Morrison Charophyta..., p. 87, Pl. 14, Figs. 8-11.

Material. — One specimen with a destroyed summit.
Measured gyrogonite of *Aclistochara* cf. *bransoni* PECK:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ
116	395	342	115	207	53	8	50	55

Description. — Gyrogonite small, subprolate (ISI 115) and ellipsoidal (ANI 53), with a destroyed summit and rounded base. Intercellular ridges sharp and narrow, with tips flattened in the apical and basal periphery. Intercellular ridges separated by deep and relatively narrow cellular furrows. Eight concave convolutions visible in lateral view. Spirals in the apical periphery narrower than at the equator and with a comparatively distinct depression. Apical rosette absent, apical opening outlined by five slightly curved indentations. Basal opening conspicuously pentagonal in shape, situated at the same level as the protruding ends of the surrounding spirals. Equatorial angle about 15°.

Remarks. — Since, in our material, we have only one specimen of this species, it is impossible to determine its specific name. This specimen is very similar to *Aclistochara bransoni* PECK in morfological structure, but differs in stratigraphic position.

Distribution. — *Aclistochara bransoni* PECK — North America; Upper Jurassic, Morrison formation. *Aclistochara* cf. *bransoni* — Gobi Desert, Nemegt Basin, Nemegt; Upper Cretaceous (Upper Nemegt Beds). Sample No. 134/64.

Genus **GRAMBASTICHARA** HORN AF RANTZIEN, 1959

Type species: *Grambastichara tornata* (REID & GROVES, 1921) HORN AF RANTZIEN, 1959; England, Eocene.

Grambastichara sp.

(Pl. XXXII, Fig. 5; Text-fig. 2)

Material. — One well preserved specimen and one destroyed gyrogonite.
Measured gyrogonites of *Grambastichara* sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
148	517	330	156	250	48.5	10	70	50	187
138	500	300	166	—	—	8	62	40	—

Description. — Gyrogonites middle-sized, prolate (ISI 156—166) and ellipsoidal (ANI 48): with rounded summits, well developed apical rosettes and slightly protruding bases; ranging in length from 500 to 517 μ and in width from 300 to 330 μ. Eight to ten convolutions visible in lateral view. Spiral ridges flat or convex, separated by shallow and narrow intercellular furrows. Spirals gradually narrowed in the apical periphery, without depressions. Apical rosette comparatively low, with spiral tips widened and distinctly demarcated. Apical junction in the form of a very short line. Outer opening of the basal pore pentagonal and slightly lowered beneath the surrounding spirals. Equatorial angle about 20°.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt; Upper Cretaceous (Passage Series of Upper Nemegt Beds). Samples Nos. 132/64, 217/65.

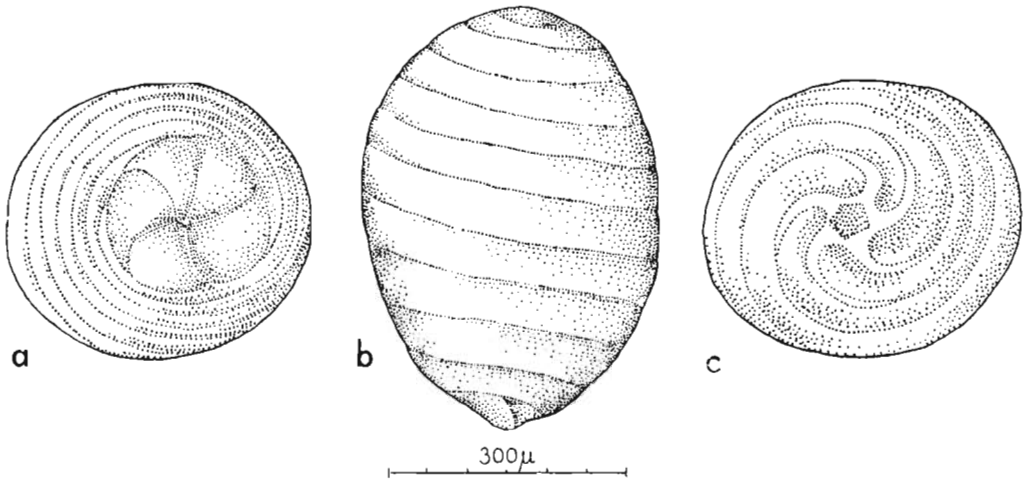


Fig. 2. *Grambastichara* sp.: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/148).

Genus **HARRISICHARA** GRAMBAST, 1957

Type species: *Harrisichara vasiformis* (REID & GROVES, 1921) GRAMBAST, 1957; England Eocene.

Harrisichara cretacea n. sp.

(Pl. XXXII, Fig. 4; Text-fig. 3)

Type specimen: Z. Pal. No. MgChar-I/134; Pl. XXXII, Fig. 4.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Nemegt, Nemegt Basin, Gobi Desert. Sample No. 132/64.

Derivation of the name: *cretacea* — found in Upper Cretaceous beds.

Diagnosis. — Gyrogonites subprolate, with pointed bases and subtruncate summits, ranging in length from 342 to 550 μ, and in width from 310 to 450 μ. Eight to nine convolutions visible in lateral view. Secondary ridges are developed along the centres of the cellular furrows. Basal opening irregulary pentagonal.

Material. — Seven well preserved specimens and a few fragments of gyrogonites.

Measured gyrogonites of *Harrisichara cretacea* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ
55	342	310	110	185	54	7	52.5	70
56	410	335	122	217	53	8	60	60
57	435	335	129	205	47	7	55	60
131	437	375	116	—	—	9	50	37.5
136	450	375	120	220	49	10	52.5	37.5
134	450	375	120	225	50	8	62.5	37.5
61	480	380	127	220	46	8	50	37.5
105	550	450	122	210	38	8	77.5	75
Range:	342—550	310—450	110—129	185—225	38—54	7—10	50—77.5	37.5—75

Description. — Gyrogonites medium sized, subprolate (ISI 110—129) with bases protruding in the form of a cone-shaped projection and summits broadly rounded to subtruncate. Ranging in length from 342 to 550 μ and in width from 310 to 450 μ. Seven to nine spirals visible in lateral view. Convolutions as a rule concave, with secondary ridges developed along the centres of the cellular furrows. Intercellular ridges more conspicuous than the secondary ones which are low and smooth. Spirals slightly narrowed in the apical periphery and together with intercellular ridges, forming an apical plate, comparatively distinct. Secondary ridges as a rule disappearing in the apical periphery and lacking in the apical centre. Apical junction in the form of a conspicuous zigzag line. Basal opening irregularly pentagonal. Outer opening of basal pore situated at the same level as the protruding ends of the surrounding spirals. Equatorial angle about 20°.

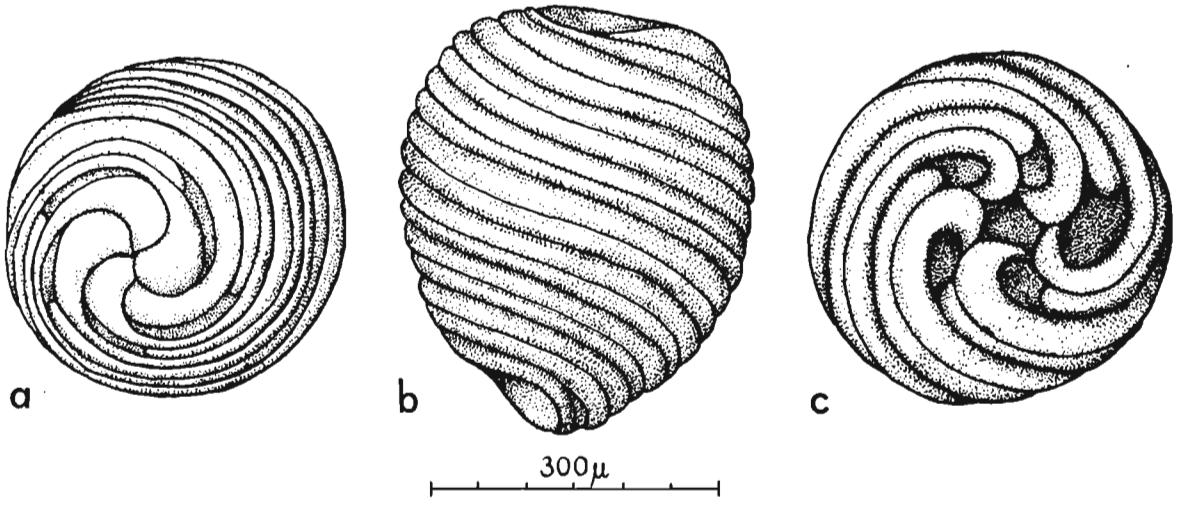


Fig. 3
Harrisichara cretacea n. sp.: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/134).

Remarks. — Gyrogonites of *Harrisichara cretacea* n. sp. are very similar to those of *H. bisulcata* (PECK & REKER), from which they differ in much smaller dimensions, a smallet number of convolutions and less protruding bases. *Harrisichara cretacea* n. sp. is the firsr species of the genus *Harrisichara* described from pre-Tertiary sediments.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt and Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples Nos. 7/65, 134/64, 132/64.

Genus **MAEDLERIELLA** GRAMBAST, 1957

Type species: *Maedleriella monilifera* (PECK & REKER, 1947) GRAMBAST, 1957; Peru, Eocene, Oligocene?

Maedleriella monilifera (PECK & REKER, 1957) GRAMBAST, 1957

(Pl. XXXIII, Fig. 4; Pl. XXXIV, Fig. 4)

1947. *Chara monilifera* PECK & REKER; R. E. PECK & C. C. REKER, Cretaceous..., p. 4, Figs. 12-18.
1962. *Maedleriella monilifera* (PECK & REKER); L. GRAMBAST, Classification..., p. 77.

Material. — Three specimens and one fragment of gyrogonite. Measured gyrogonites of *Maedleriella monilifera* (PECK & REKER):

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI
164	400	350	114	—	—
162	500	475	105	—	—
165	512	450	112	250	49

Description. — Gyrogonites middle-sized, prolate spheroidal (ISI 105—114) and ellipsoidal (ANI 49), with truncated summits and rounded bases; ranging in length from 400 to 512 μ and in width from 350 to 475 μ. Spiral ridges obscured by prominent more or less regularly arranged tubercles. In lateral view spirals invisible. Apical surface destroyed in all specimens. Base marked in all specimens by small, centrally situated tubercles.

Distribution. — Peru; upper part of Upper Cretaceous, Eocene-Oligocene. Gobi Desert: Nemegt Basin, Nemegt; Passage Series of Upper Nemegt Beds, Upper Cretaceous. Sample No. M 1/65.

Genus **MAEDLERISPHAERA** HORN AF RANTZIEN, 1959

Type species: *Maedlerisphaera ulmensis* (STRAUB, 1952) HORN AF RANTZIEN, 1959 Germany, Oligocene.

Maedlerisphaera pseudoulmensis n. sp.

(Pl. XXXII, Figs. 1—2; Pl. XXXIV, Fig. 3; Text-fig. 4)

Type specimen: Z. Pal. No. MgChar-I/151; Pl. XXXII, Fig. 1.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Altan Ula IV, Nemegt Basin, Gobi Desert. Sample No. 42/65.

Derivation of the name: *pseudoulmensis* — similar to *Maedlerisphaera ulmensis* (STRAUB) HORN AF RANTZIEN.

Diagnosis. — Gyrogonites middle-sized, subprolate to prolate, with rounded summits and slightly protruding bases; ranging in length from 400 to 500 μ and in width from 300

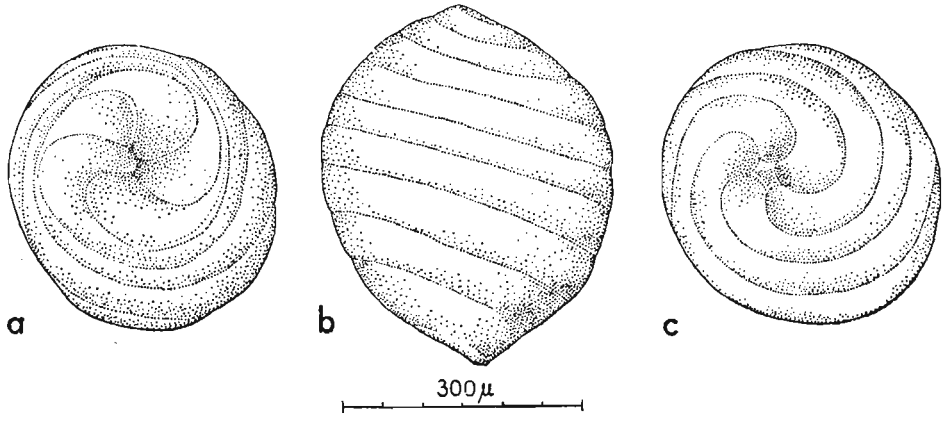


Fig. 4

Maedlerisphaera pseudoulmensis n. sp.: *a* apical view (Z. Pal. MgChar-I/151), *b* lateral view, *c* basal view (Z. Pal. MgChar-I/153).

to 375 μ. Eight or nine convolutions visible in lateral view. Spirals narrowed in the apical periphery, with indistinctly demarcated depressions, which form a low but discernible apical rosette. Basal opening pentagonal.

Material. — Eight well preserved specimens.

Measured gyrogonites of *Maedlerisphaera pseudoulmensis* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
155	400	300	133	200	50	9	42.5	32.5	—
151	400	307	130	200	50	9	47.5	37.5	182
153	417	310	152	202	48.5	9	47.5	35	192
154	417	320	150	212	51	8	42.5	37.5	185
157	417	350	119	217	52	8	47.5	50	182
152	425	305	141	205	48.5	9	47.5	35	195
156	437	342	127	237	54.5	9	50	—	190
141	500	375	133	225	45	9	50	42.5	195
Range:	400—500	300—375	119—150	200—237	45—54.5	8—9	42.5—50	32.5—50	182—195

Description. — Gyrogonites middle-sized, subprolate to prolate (ISI 119—150) and ellipsoidal (ANI 45—54), with somewhat rounded summits and slightly protruding bases; ranging in length from 400 to 500 μ, and in width from 300 to 375 μ. Eight or nine flat to convex convolutions visible in lateral view. Spirals in the apical periphery narrower than in the equator, with an indistinctly demarcated depression, forming a low but discernible apical rosette. Apical spirals contact each other in the centre of the summit along a short, irregular line. Basal opening distinctly pentagonal. Outer opening of basal pore situated at the same level as the surrounding spirals, so that a depression outside the basal pore is not developed. Outer basal opening 32.5 to 50 μ in width. The canal of basal pore occupied by a basal plug, somewhat thicker than wide.

Remarks. — *Maedlerisphaera pseudoulmensis* n. sp. is very similar to immature gyrogonites of *M. ulmensis* (STRAUB) HORN AF RANTZIEN described by MÄDLER (1955) from Upper Oligocene and Miocene of Southern Germany and Switzerland. Gyrogonites of *M. ulmensis* differ from our specimens in a more conically protruding apical rosette. Our specimens differ from mature gyrogonites of *M. ulmensis* (STRAUB) HORN AF RANTZIEN in smaller dimensions, smaller number of convolutions, strongly protruding bases and lack of ornamentation.

The genus *Sphaerochara* (MÄDLER, 1952 emend. HORN AF RANTZIEN, 1959) which, according to GRAMBAST & HORN AF RANTZIEN (1962), includes the genus *Maedlerisphaera* has not been adequately described. As it follows from HORN AF RANTZIEN'S (1959) emended diagnosis, the lack of rosette on apical pole is one of the characteristic features of *Sphaerochara*, whereas, according to HORN AF RANTZIEN (1959), a low, but strongly developed rosette is, among other features, typical of the gyrogonites of *Maedlerisphaera*. Our specimens of *Maedlerisphaera pseudoulmensis* n. sp. display features which precisely correspond to the diagnosis of the accurately defined genus *Maedlerisphaera* HORN AF RANTZIEN, so we assign them to this genus.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt and Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples Nos. 42/65, 217/65.

Genus **MESOCHARA** GRAMBAST, 1962

Type species: *Mesochara symmetrica* (PECK, 1957) GRAMBAST, 1962; North America, Aptian.

Mesochara mongolica n. sp.

(Pl. XXX, Fig. 1; Pl. XXXIV, Fig. 1; Text-fig. 5)

Type specimen: Z. Pal. No. MgChar-I/13; Pl. XXX, Fig. 1.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Altan Ula IV, Nemegt Basin, Gobi Desert. Sample No. 7/65.

Derivation of the name: *mongolica* — found in Mongolia.

Diagnosis. — Gyrogonites small, subprolate or prolate, with pointed summits and bases; ranging in length from 380 to 500 μ, and in width from 250 to 375 μ. Spiral ridges intercellular, narrow and sharp, separated by wide cellular furrows. Six to eleven spiral ridges visible in lateral view. Basal opening pentagonal.

Material. — Twenty two well preserved specimens and a few fragments of gyrogonites. Measured gyrogonites of *Mesochara mongolica* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ
60	380	305	124	220	58	7	50	47.5
24	387	295	131	200	51	6	55	55
90	400	250	160	180	45	10	45	47.5
29	400	315	127	155	39	9	45	35
25	410	285	143	185	45	7	75	—
6	425	300	142	210	49.5	11	50	50
30	445	345	129	220	49	8	55	65
13	490	325	150	225	46	9	60	30
82	500	327	152	237	47.5	10	55	62.5
87	500	375	133	262	52	10	55	57.5
Range:	380—500	250—375	124—160	155—262	39—58	6—11	45—75	30—65

Description. — Gyrogonites small, subprolate or prolate (ISI 124—160) and ellipsoidal (ANI 39—58), with pointed and strongly projecting summits and bases. Ranging in length from 380 to 500 μ, and in width from 250 to 375 μ. Six to eleven spiral ridges visible in lateral view. Spiral ridges intercellular, narrow and sharp, separated by wide cellular furrows. Spirals continue onto the summit, without changing their size, shape and degree of calcification, to meet in a point. Rosette not developed. Basal pole conically protruding. Tips of spirals rounded, of the same width as at the equator. Basal pore cone-shaped, outer opening conspicuously pentagonal. Equatorial angle about 15°. In the longitudinal section, spirals without spiral canals, with two zones of different texture and colour, the inner one being slightly thinner. Basal plug not preserved. Basal canal long and narrow.

Remarks. — Gyrogonites of *Mesochara mongolica* n. sp. are most similar to those of *M. voluta* (PECK) nov. comb., *M. symmetrica* (PECK) GRAMBAST, 1962, and to *Tolypella biacuta*

KOCH & BLISSENBACH, 1960. *M. mongolica* differs from *M. voluta* in larger dimensions, a greater number of convolutions and strongly protruding summits. As compared with *M. symmetrica*, gyrogonites of *M. mongolica* are somewhat smaller, have a greater number of convolutions and strongly pointed summits. Representatives of *M. mongolica* are very similar to *Tolypella biacuta* KOCH & BLISSENBACH from Upper Cretaceous of Peru. Since, KOCH and BLISSENBACH (1960,

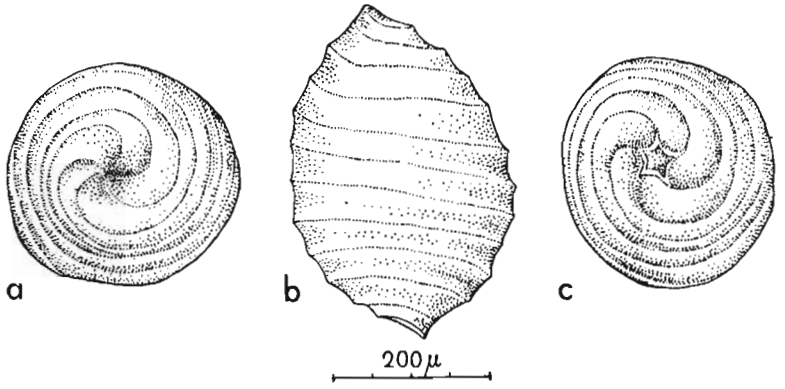


Fig. 5
Mesochara mongolica n. sp.: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/13).

p. 72, Pl. 1, Figs. 8*a-b*) have not described the apical structure and anatomy of the gyrogonites of *T. biacuta*, it is difficult to classify this species.

Distribution. — Gobi Desert, Nemegt Basin, Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples Nos. 7/65, 76/65.

Mesochara voluta (PECK) n. comb.

(Pl. XXX, Figs. 2-3; Text-fig. 6)

1937. *Chara voluta* PECK; R. E. PECK, Morrison Charophyta..., p. 85, Pl. 14, Figs. 16-19.
1941. *Chara voluta* PECK; R. E. PECK, Lower Cretaceous..., p. 289, Pl. 42, Figs. 12-14.
1957. *Praechara voluta* (PECK) PECK; R. E. PECK, North American..., p. 39, Pl. 7, Figs. 22-27.

Material. — Three well preserved specimens.
Measured gyrogonites of *Mesochara voluta* (PECK) n. comb.:

Z. Pal. No. MgChar-I	LPA in µ	LED in µ	ISI	AND in µ	ANI	Numb. conv.	Width conv. at EA in µ	∅ basal pore in µ
111	340	285	119	135	40	8	45	57.5
112	325	275	118	145	44.5	8	45	—
113	315	275	115	150	47	8	40	55

Description. — Gyrogonites small, subprolate (ISI 115—119) and ellipsoidal (ANI 40—47), with broadly rounded summits and pointed bases; ranging in length from 315 to 340 µ and in width from 275 to 285 µ. Eight spiral ridges visible in lateral view.

Spiral ridges intercellular, narrow and sharp, separated by fairly wide and deep cellular furrows. Cellular furrows about 45 μ wide. Spirals continue on to summit without changing their size and shape to join each other along a short, irregular line. Basal opening pentagonal in shape, situated at the same level as the protruding ends of surrounding spirals.

Remarks. — Within the genus *Praechara* HORN AF RANTZIEN, species without an opening on the apical pole of gyrogonites have been distinguished by GRAMBAST (1962, p. 78) who erected for them a new genus *Mesochara*. GRAMBAST clarius that all the species of the genus *Praechara*, described by PECK in 1957, should be included in the genus *Mesochara*.

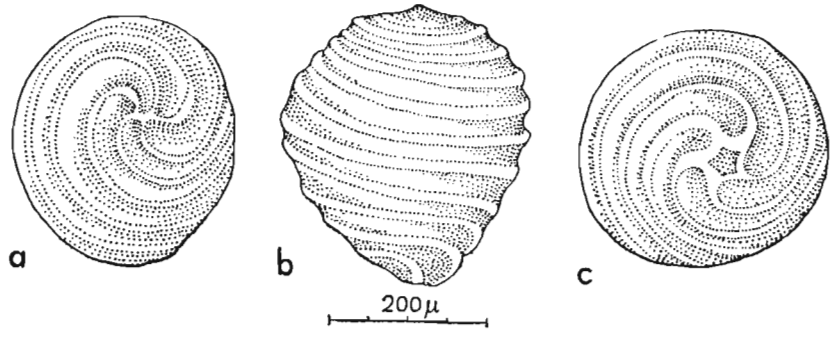


Fig. 6
Mesochara voluta (PECK) nov. comb.: *a* apical view (Z. Pal. MgChar-I/111), *b* lateral view, *c* basal view (Z. Pal. MgChar-I/113).

Distribution. — North America; Upper Jurassic, Morrison Formation, Lower Creta ceous, Aptian and the Bear River (Albian) Formation. Gobi Desert, Nemegt Basin; Uppe Nemegt Beds. Sample No. 134/64.

Genus **OBTUSOCHARA** MÄDLER, 1952

Type species: *Obtusochara* MÄDLER, 1952; Germany, Kimmeridgian.

Obtusochara madleri PECK, 1957

(Pl. XXXIII, Fig. 3; Text-fig. 7)

1957. *Obtusochara madleri* PECK; R. E. PECK, North American..., p. 38, Pl. 6, Figs. 5-8.

Material. — Two well preserved specimens.
Measured gyrogonites of *Obtusochara madleri* PECK:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ
114	275	205	134	130	47	7	30	35
115	280	215	130	145	52	8	40	45

Description. — Gyrogonites very small, subprolate to prolate (ISI 130 and 134) and ellipsoidal (ANI 47—52), with rounded bases and broadly rounded summits; ranging in length

between 275 and 280 μ, in width between 205 and 215 μ. Seven or eight convolutions visible in lateral view. Spiral ridges intercellular, sharp and narrow, separated by relatively wide and shallow cellular furrows. Spiral ridges join each other at a point in the apical centre. Central

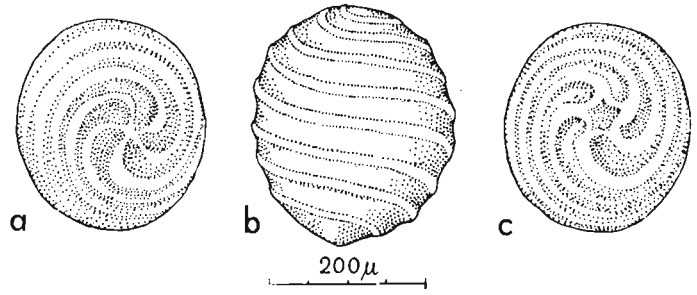


Fig. 7
Obtusochara madleri PECK: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/114).

part of summit occupied by five slightly swollen ends of spirals. Basal opening small, pentagonal. Tips of spirals rounded at the same level as the outer opening of basal pore.

Distribution. — North America (South Dakota); Aptian. Gobi Desert, Nemegt Basin, Nemegt; Passage Series of Upper Nemegt Beds, Upper Cretaceous. Sample No. 134/64.

Genus **SAPORTANELLA** GRAMBAST, 1962

Type species: *Saportanella maslovi* GRAMBAST, 1962; France, Upper Cretaceous.

Saportanella nana n. sp.

(Pl. XXXI, Figs. 1—4; Text-fig. 8)

Type specimen: Z. Pal. No. MgChar-I/124; Pl. XXXI, Fig. 1.
Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Altan Ula IV, Nemegt Basin, Gobi Desert. Sample No. 134/64.
Derivation of the name: Lat. *nanus* = dwarf; on account of its very small dimensions.

Diagnosis. — Gyrogonites very small, prolate spheroidal, with truncate summits and rounded bases. Ranging in length from 235 to 360 μ and in width from 225 to 345 μ. Spirals

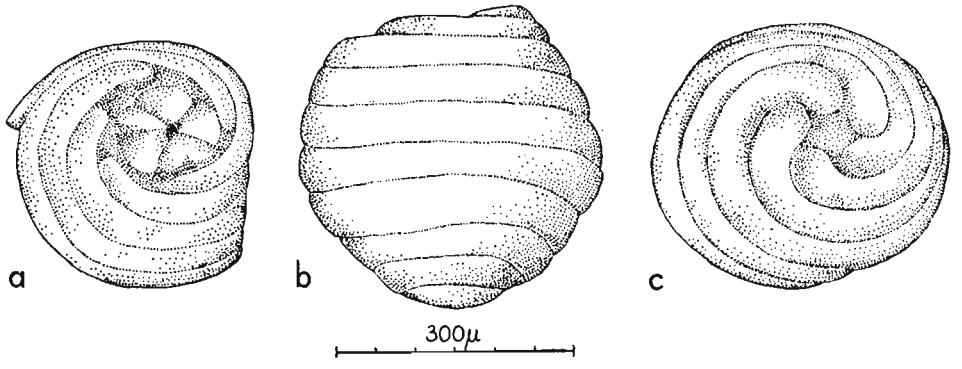


Fig. 8
Saportanella nana n. sp.: *a* apical view (Z. Pal. MgChar-I/126), *b* lateral view, *c* basal view (Z. Pal. MgChar-I/124)

slightly convex or concave, devoid of ornamentation. In specimens with concave spirals, intercellular ridges are relatively wide and blunt. Seven to eight spirals visible in lateral view. Basal opening pentagonal.

Material. — Ten well preserved specimens and a few fragments of gyrogonites.

Measured gyrogonites of *Saportanella nana* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
128	235	225	104	112	48	7	37.5	35	100
122	270	260	104	120	44.5	8	57.5	—	105
121	317	280	113	167	53	8	45	—	125
65	335	300	111	—	—	7	50	60	—
119	335	335	100	190	58	7	55	72.5	140
120	340	340	100	—	—	8	50	62.5	135
127	345	345	100	155	45	7	55	60	130
123	350	340	103	—	—	6	60	55	—
124	360	320	112	172	48	7	50	85	110
118	360	335	107	175	48.5	8	55	65	120
Range:	235—360	225—345	100—113	112—190	44.5—58	6—8	37.5—60	35—85	100—140

Description. — Gyrogonites very small, prolate spheroidal (ISI 100—113) and ellipsoidal to subobovoidal (ANI 44.5—58), with apical pole broadly rounded to truncate. Seven to eight spirals slightly convex, devoid of ornamentation, smooth, in the apical periphery slightly narrower and thinner than at the equator, ending truncately. In the apical centre spirals absent, replaced by five opercular cells, directly placed in relation to the surrounding spirals. Apical junction of cells form a distinct zigzag line. Bases rounded; spirals as a rule continue on to base without changing their size and shape, in some slightly widened around the basal pore. Basal opening distinctly pentagonal. Outer opening of basal pore situated at the same level as the surfaces of the surrounding spirals.

Remarks. — *Saportanella nana* n. sp. is very similar to *S. maslovi* GRAMBAST, 1962, from which it differs in much smaller dimensions.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt and Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples: Nos. 7/65, 134/64.

Genus **SPHAEROCHARA** MÄDLER, 1952 emend. HORN AF RANTZIEN & GRAMBAST, 1962

Type species: *Sphaerochara hirmeri* (RASKY) MÄDLER, 1952; Hungary, Upper Oligocene.

Sphaerochara verticillata (PECK, 1937) PECK, 1957

(Pl. XXXI, Fig. 5; Text-fig. 9)

1957. *Sphaerochara verticillata* (PECK); R. E. PECK, North American..., p. 36, Pl. 7, Figs. 1-12.

Material. — One well preserved specimen.

Measured gyrogonite of *Sphaerochara verticillata* (PECK):

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ
129	535	425	126	275	51	8	78	75

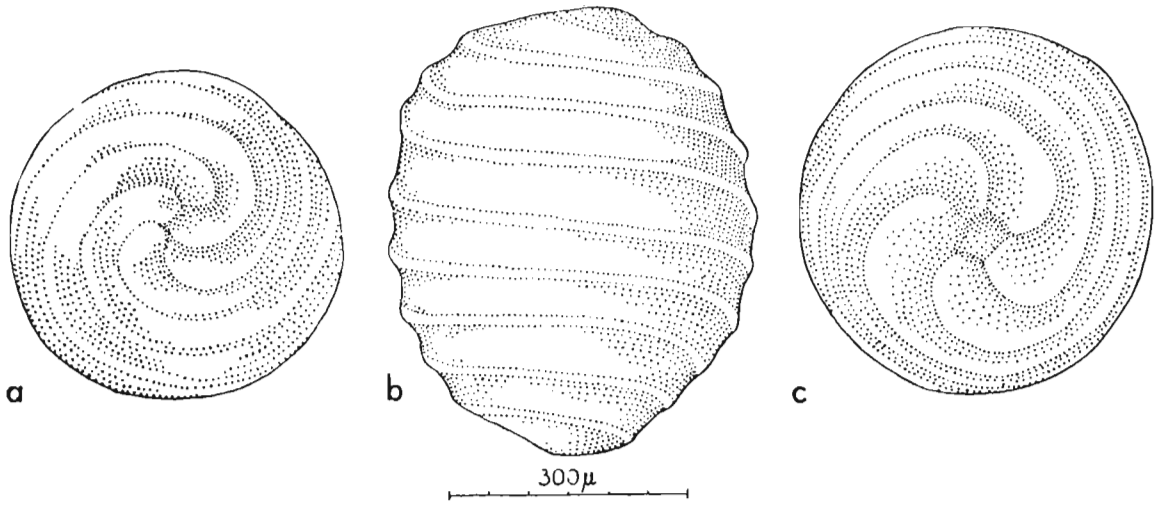


Fig. 9
Sphaerochara verticillata (PECK) PECK: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/129).

Description. — Gyrogonite middle-sized, subprolate (ISI 126) and ellipsoidal (ANI 51), with broadly rounded summit and rounded base. Gyrogonite 535 μ long and 425 μ wide. Eight slightly concave convolutions visible in lateral view. Intercellular ridges low and narrow, separated by wide, shallow cellular furrows. Spirals join each other in the apical centre along a short, irregular line. Outer opening of basal pore situated at the same level as the surfaces of the surrounding spirals. Basal opening irregular pentagonal. Equatorial angle about 5°.

Distribution. — North America; Upper Jurassic, Aptian. Gobi Desert, Nemegt Basin, Nemegt; Passage Series of Upper Nemegt Beds, Upper Cretaceous. Sample No. 134/64.

Genus TECTOCHARA L. & N. GRAMBAST, 1954

Type species: *Tectochara meriani* L. & N. GRAMBAST, 1954; Switzerland, Oligocene Miocene.

Tectochara gobica n. sp.

(Pl. XXXIII, Figs. 1-2; Pl. XXXIV, Fig. 5; Text-fig. 10)

Type specimen: Z. Pal. No. MgChar-I/143; Pl. XXXIII, Fig. 1.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Nemegt, Nemegt Basin, Gobi Desert. Sample No. 217/65.

Derivation of the name: *gobica* — found in the Gobi Desert.

Diagnosis. — Gyrogonites middle-sized, prolate spheroidal to subprolate, with distinct apical rosettes on subtruncate summits and broadly rounded bases; ranging in length from 427 to 610 μ and in width from 370 to 540 μ. Seven to nine concave convolutions visible in lateral

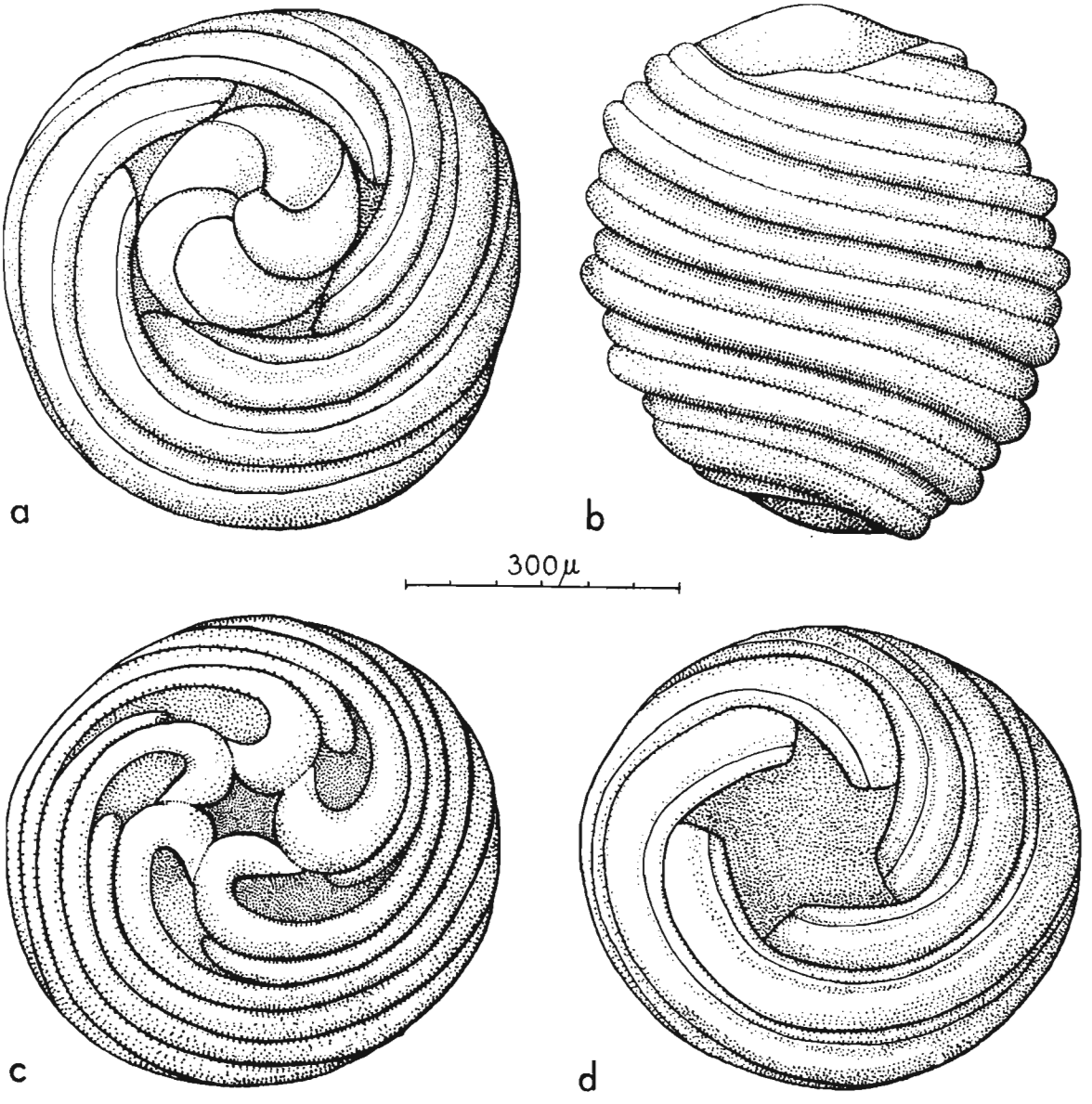


Fig. 10
Tectochara gobica n. sp.: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/143), *d* apical view (Z. Pal. MgChar-I/144).

view. Intercellular ridges thick and relatively high, separated by wide and deep cellular furrows with secondary ridges. Regularly pentagonal basal opening at the bottom of basal depressions.

Material. — Twelve well preserved specimens and seven fragments of gyrogonites. Measured gyrogonites of *Tectochara gobica* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
62	427	375	114	205	48	7	57.5	55	—
63	455	370	123	205	45	8	50	35	170
143	530	450	117	167	31	8	75	85	220
146	535	475	112	225	42	8	77.5	80	167
144	550	525	105	—	—	8	96	70	—
104	555	480	116	260	47	7	72.5	75	—
149	582	487	120	232	40	8	87.5	75	212.5
106	585	540	109	267	46	8	72.5	80	250
102	590	525	112	282	48	9	85	70	200
150	610	540	113	275	45	8	87	92.5	170
Range:	427—610	375—540	105—123	167—282	31—48	7—9	50—96	35—92.5	167—250

Description. — Gyrogonites middle-sized, prolate spheroidal to subprolate (ISI 105—120) and subovoidal to ellipsoidal (ANI 31—48), with subtruncate summits and broadly rounded bases; ranging in length from 427 to 610 μ and in width from 370 to 540 μ. Seven to nine concave convolutions visible in lateral view. Intercellular ridges thick and relatively high, separated by wide and deep cellular furrows with secondary ridges. Secondary ridges thinner and lower than intercellular ridges. In apical periphery spirals narrowed. Apical poles subtruncate with well developed apical rosettes consisting of rounded and distinct spiral lobes. Apical junction in the form of a short, apical line. When rosette is lacking, summit is open, but narrowing of spirals enables easy identification, since the outline of the opening has five curved indentations. Basal pole rounded, but truncate in basal centres. Spirals extend at the edge of basal depression; tips of spirals ending roundly. Outer opening of basal pore situated at the bottom of a funnel-shaped depression. Basal opening regularly pentagonal. Basal plug much wider than thick. Equatorial angle about 10°.

Remarks. — *Tectochara gobica* n. sp. is a distinctive species. It may be distinguished from all other recorded species of the *Tectochara* by strongly developed intercellular and secondary ridges. Our species is similar to *T. aurea* n. sp., described in the present paper but it differs from it in larger dimensions and differently developed intercellular and secondary ridges.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt and Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples Nos. 115/64, 134/64, 7/65, 76/65, M 1/65 and 217/65.

Tectochara altanulaensis n. sp.

(Pl. XXXII, Figs. 5—6; Pl. XXXIV, Fig. 2; Text-fig. 11)

Type specimen: Z. Pal. No. MgChar-I/80; Pl. XXXII, Fig. 6.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Altan Ula IV, Nemegt Basin, Gobi Desert. Sample No. 7/65.

Derivation of the name: *altanulaensis* — found in Altan Ula.

Diagnosis. — Gyrogonites small, subprolate to prolate, with apical rosettes on slightly rounded summits and protruding bases; ranging in length from 355 to 460 μ and in width

from 295 to 367 μ. Five to eight convolutions visible in lateral view. Spirals wide, flat or slightly convex, separated by shallow and narrow intercellular furrows. Basal opening distinctly pentagonal.

Material. — Seventeen well preserved specimens and seven fragments of gyrogonites. Measured gyrogonites of *Tectochara altanulaensis* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
76	355	302	120	145	48.5	7	55	60	—
33	390	335	116	220	56	6	65	60	135
32	400	320	125	162	40	5	80	75	160
72	412	335	123	197	48	7	65	57.5	112
75a	420	337	125	165	39.5	7	60	75	130
31	430	350	123	205	47	7	70	65	135
35	430	295	149	205	47	7	65	50	116
73	435	367	119	202	46.5	8	50	55	—
80	445	307	145	190	43	7	55	70	130
79	460	335	137	200	43.5	7	60	60	—
Range:	355—460	295—367	116—149	145—220	39.5—56	5—8	50—80	50—75	112—160

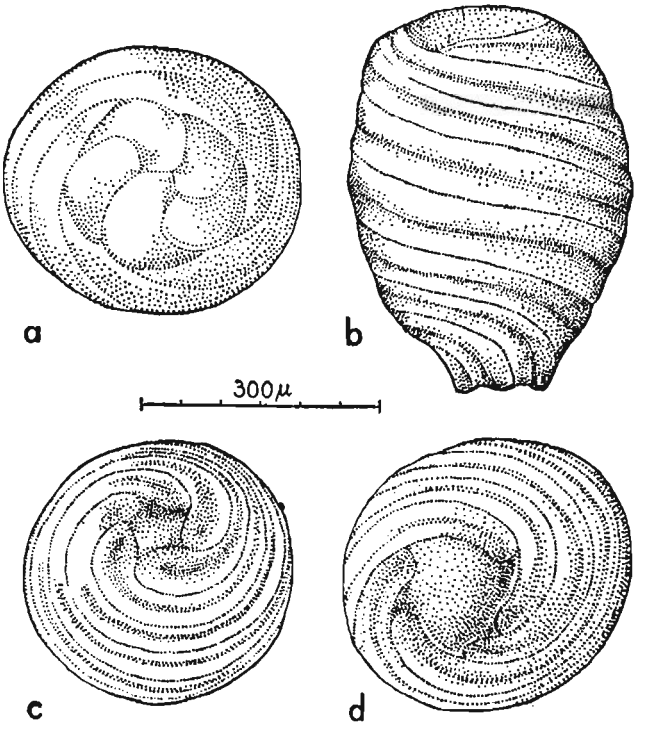


Fig. 11
Tectochara altanulaensis n. sp.: *a* apical view (Z. Pal. MgChar-I/79), *b* lateral view, *c* basal view (Z. Pal. MgChar-I/80), *d* apical view (Z. Pal. MgChar-I/78).

Description. — Gyrogonites small, subprolate to prolate (ISI 116—149) and subovoidal to ellipsoidal (ANI 39—56), with slightly rounded summits and protruding bases; ranging in length from 355 to 460 μ and in width from 295 to 367 μ. Five to eight convolutions visible in lateral view. Spirals flat or slightly convex, much wider than thick, separated by narrow but distinct intercellular furrows. Spirals slightly contracted in the apical periphery, forming an indistinct and shallow peripheral groove. Spirals in the apical centre with a low but distinct apical rosette in the form of a short, irregular line. When rosette is absent summit opening is outlined by five curved indentations. Basal pore with outer opening, slightly lowered beneath the surface of tips of surrounding spirals. Basal pore funnel shaped with outer opening conspicuously pentagonal. Basal plug not preserved. Equatorial angle about 20°.

Remarks. — *Tectochara altanulaensis* n. sp. is very similar to *T. ucayaliensis oblonga* KOCH & BLISSENBACH 1960, from which it differs in smaller dimensions and a smaller number of convolutions.

Distribution. — Gobi Desert, Nemegt Basin, Nemegt and Altan Ula IV; Upper Cretaceous (Upper Nemegt Beds). Samples: Nos. 7/65, 134/64, 132/64.

Tectochara aurea n. sp.

(Pl. XXX, Fig. 4; Text-fig. 12)

Type specimen: Z. Pal. No. MgChar-I/64; Pl. XXX, Fig. 4.

Type horizon and locality: Upper Cretaceous (Upper Nemegt Beds), Altan Ula IV, Nemegt Basin, Gobi Desert. Sample No. 7/65.

Derivation of the name: Lat. *aurea* = gold; on account of a golden colour of gyrogonites.

Diagnosis. — Gyrogonites small, prolate spheroidal to subprolate, with distinct apical rosettes on subtruncate summits and slightly protruding bases; ranging in length from 335 to 415 μ and in width from 300 to 385 μ. Seven to eight concave convolutions visible in lateral view. Intercellular ridges sharp and narrow, separated by very deep cellular furrows with secondary ridges. Secondary ridges identical in height and width with intercellular ridges. Basal opening pentagonal.

Material. — Five well preserved specimens and one fragment.

Measured gyrogonites of *Tectochara aurea* n. sp.:

Z. Pal. No. MgChar-I	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ	∅ basal pore in μ	∅ rosette in μ
59	335	300	112	190	56	7	60	60	135
54	375	327	114	160	43	7	70	47.5	185
64	375	330	114	170	44.5	7	45	37.5	160
52	400	325	123	180	45	8	55	55	162
53	415	385	108	200	48	7	60	87	185
Range:	335—415	300—385	108—123	160—200	43—56	7—8	45—70	37.5—87	135—185

Description. — Gyrogonites small, prolate spheroidal to subprolate (ISI 108—123) and ellipsoidal (ANI 43—56) with subtruncate summits and slightly protruding bases; ranging in

length from 335 to 415 μ, and in width from 300 to 385 μ. Seven to eight concave convolutions visible in lateral view. Intercellular ridges sharp and narrow, separated by very deep cellular furrows with secondary ridges. Secondary ridges identical in height and width with intercellula ridges. In the apical periphery spirals slightly narrower, forming a peripheral groove without a depression and in the apical centre forming a low but distinct rosette. The rosette formed by five extended tips of spirals which join each other along a zigzag line in the apical centre. Basal opening pentagonal. Outer opening of the basal pore situated at the same level as the protruding ends of surrounding spirals. Equatorial angle about 15°.

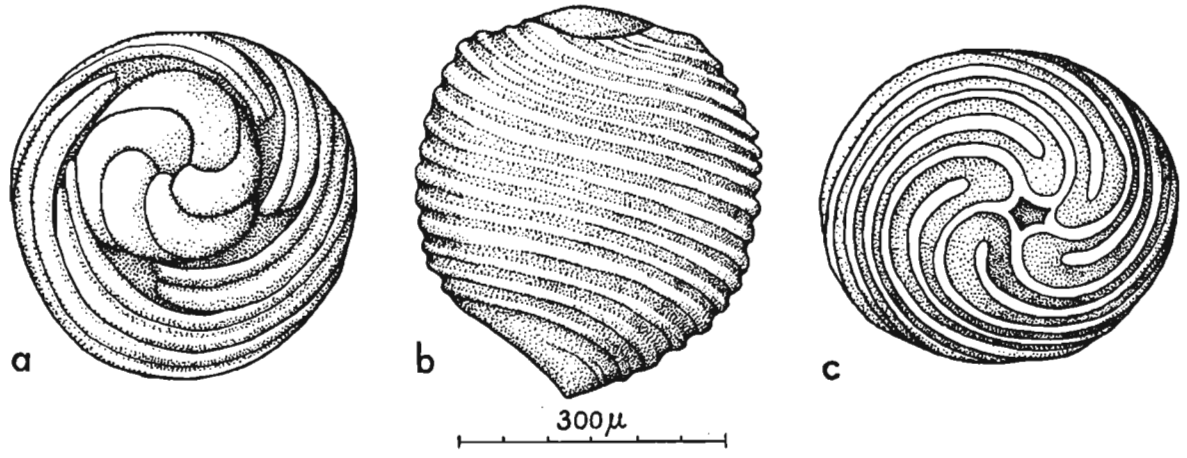


Fig. 12
Tectochara aurea n. sp.: *a* apical view, *b* lateral view, *c* basal view (Z. Pal. MgChar-I/64).

Remarks. — *Tectochara aurea* n. sp. is very similar to *Aclistochara polyspirata* MÄDLER, 1952. Our species differs from *A. polyspirata* in larger dimensions, a greater number of convolutions and a larger equatorial angle. *Tectochara aurea* n. sp. is known from Upper Cretaceous, *Achistochara polyspirata* from Kimmeridgian.

Department of Palaeobotany
of the Warsaw University
Warszawa, March 1968

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PLATES

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PLATE XXX

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Fig. 1. *Mesochara mongolica* n. sp. (Z. Pal. MgChar-I/13): *a* apical view, *b* lateral view, *c* basal view. Altan Ula IV. Type specimen 132
Fig. 2. *Mesochara voluta* (PECK) n. comb. (Z. Pal. MgChar-I/113): *a* lateral view, *b* basal view. Nemegt . . . 133
Fig. 3. *Mesochara voluta* (PECK) n. comb. (Z. Pal. MgChar-I/111): apical view. Nemegt 133
Fig. 4. *Tectochara aurea* n. sp. (Z. Pal. MgChar-I/64): *a* apical view, *b* lateral view, *c* basal view. Altan Ula IV. Type specimen 141
Fig. 5. *Aclistochara* cf. *bransoni* PECK (Z. Pal. MgChar-I/116): *a* lateral view, *b* apical view, *c* basal view. Nemegt 126

Nemegt Basin, Gobi Desert, Upper Cretaceous (Upper Nemegt Beds)
All specimens ×100

Photo: L. Łuszczewska

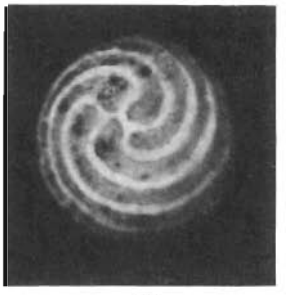
1a

1b

1c

2a

2b



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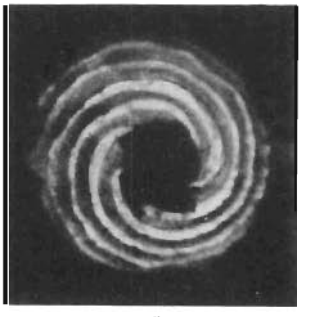
5a



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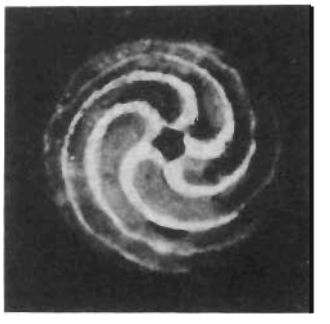

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PLATE XXXI

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Fig. 1. *Saportanella nana* n. sp. (Z. Pal. MgChar-I/124): *a* basal view, *b* lateral view. Nemegt. Type specimen 135
Fig. 2. *Saportanella nana* n. sp. (Z. Pal. MgChar-I/126): apical view. Nemegt 135
Fig. 3. *Saportanella nana* n. sp. (Z. Pal. MgChar-I/121): *a* basal view, *b* lateral view, *c* apical view. Nemegt 135
Fig. 4. *Saportanella nana* n. sp. (Z. Pal. MgChar-I/119): *a* basal view, *b* lateral view, *c* apical view. Nemegt 135
Fig. 5. *Sphaerochara verticillata* (Peck) (Z. Pal. MgChar-I/129): *a* basal view, *b* lateral view, *c* apical view. Nemegt 136

Nemegt Basin, Gobi Desert, Upper Cretaceous (Upper Nemegt Beds)
All specimens × 100

Photo: L. Luszczewska

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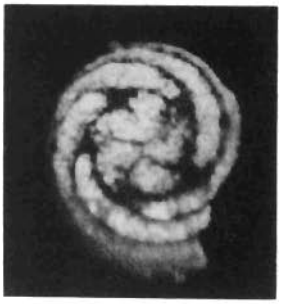
1b



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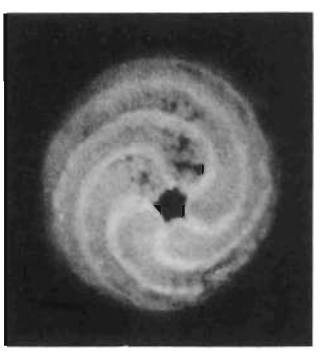

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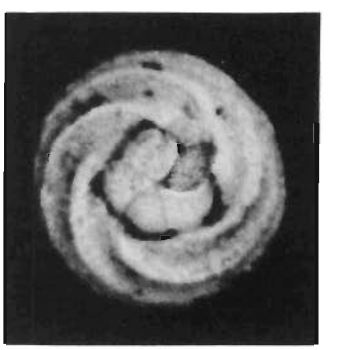

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PLATE XXXII

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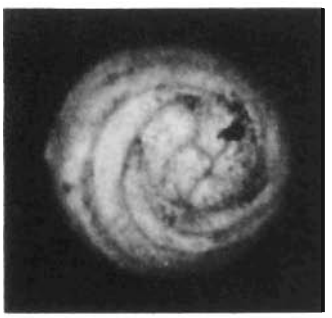
Fig. 1. *Maedlerisphaera pseudoulmensis* n. sp. (Z. Pal. MgChar-I/151): apical view. Altan Ula IV. Type specimen 130
Fig. 2. *Maedlerisphaera pseudoulmensis* n. sp. (Z. Pal. MgChar-I/153): *a* lateral view, *b* basal view. Altan Ula IV 130
Fig. 3. *Grambastichara* sp. (Z. Pal. MgChar-I/148): *a* lateral view, *b* apical view, *c* basal view. Nemegt 127
Fig. 4. *Harrisichara cretacea* n. sp. (Z. Pal. MgChar-I/134): *a* basal view, *b* lateral view, *c* apical view. Nemegt. Type specimen 128
Fig. 5. *Tectochara altanulaensis* n. sp. (Z. Pal. MgChar-I/79): apical view. Altan Ula IV 139
Fig. 6. *Tectochara altanulaensis* n. sp. (Z. Pal. MgChar-I/80): *a* basal view, *b* lateral view. Altan Ula IV. Type specimen 139

Nemegt Basin, Gobi Desert, Upper Cretaceous (Upper Nemegt Beds)
All specimens ×100

Photo: L. Łuszczewska



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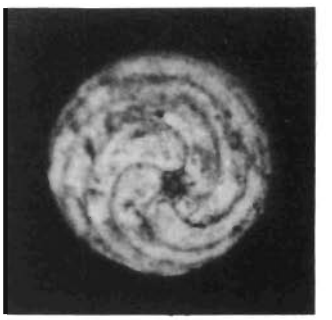

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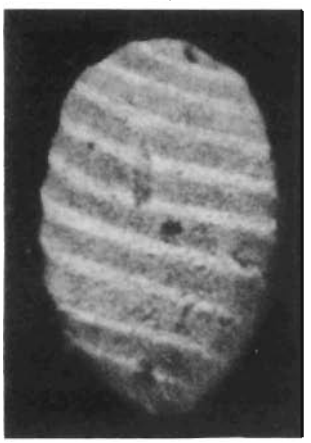

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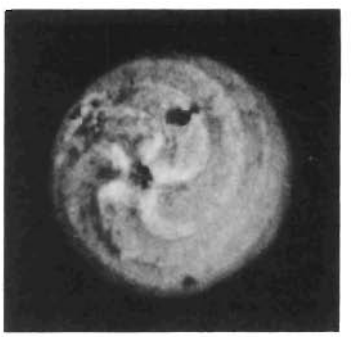

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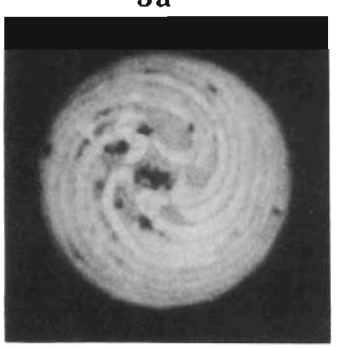

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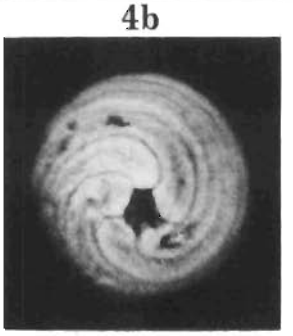

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J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: UPPER CRETACEOUS CHAROPHYTA

PLATE XXXIII

Page

Fig. 1. *Tectochara gobica* n. sp. (Z. Pal. MgChar-I/143): *a* apical view, *b* basal view, *c* lateral view. Nemegt. Type specimen 137

Fig. 2. *Tectochara gobica* n. sp. (Z. Pal. MgChar-I/144): apical view. Nemegt 137

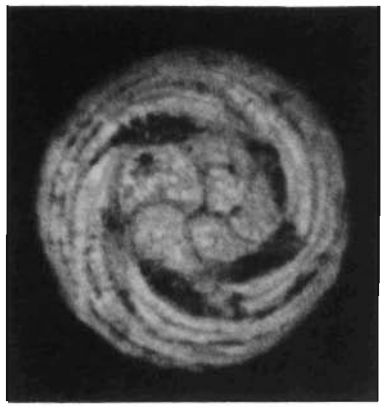
Fig. 3. *Obtusochara madleri* PECK (Z. Pal. MgChar-I/114): *a* apical view, *b* lateral view, *c* basal view. Nemegt 134

Fig. 4. *Maedleriella monilifera* (PECK & REKER). (Z. Pal. MgChar-I/162): *a* basal view, *b* apical view, *c* lateral view. Nemegt 129

Nemegt Basin, Gobi Desert, Upper Cretaceous (Upper Nemegt Beds)

All specimens ×100

Photo: L. Łuszczewska



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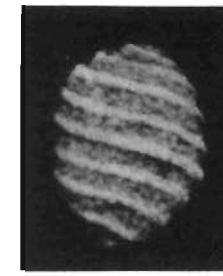

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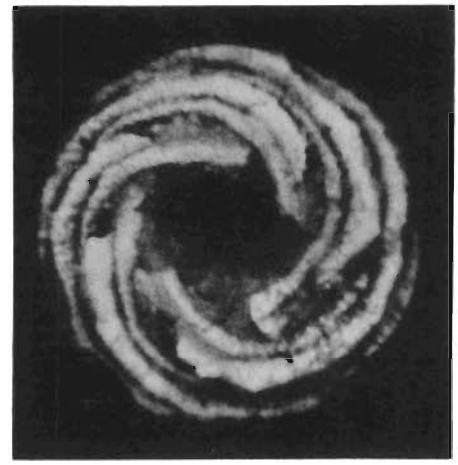

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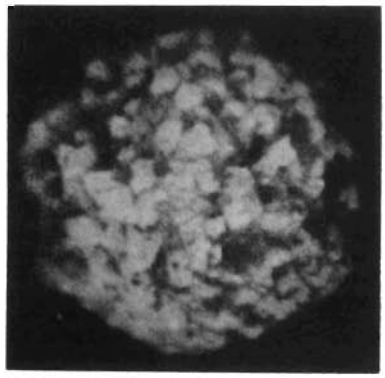

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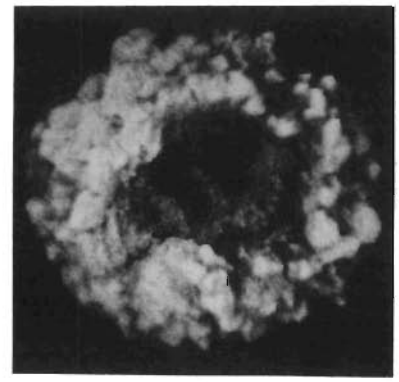

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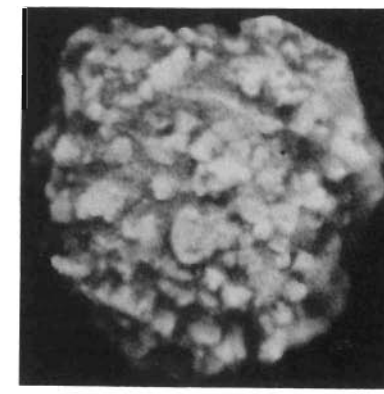

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J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: UPPER CRETACEOUS CHAROPHYTA

PLATE XXXIV

Page

Fig. 1. *Mesochara mongolica* n. sp. (Z. Pal. MgChar-I/87): longitudinal section through gyrogonite. Altan Ula IV 132

Fig. 2. *Tectochara altanulaensis* n. sp. (Z. Pal. MgChar-I/75a): longitudinal section through gyrogonite. Altan Ula IV 139

Fig. 3. *Maedlerisphaera pseudoulmensis* n. sp. (Z. Pal. MgChar-I/158): longitudinal section through gyrogonite. Altan Ula IV 130

Fig. 4. *Maedleriella monilifera* (PECK & REKER) (Z. Pal. MgChar-I/165): longitudinal section through gyrogonite. Nemegt 129

Fig. 5. *Tectochara gobica* n. sp. (Z. Pal. MgChar-I/94): longitudinal section through gyrogonite. Altan Ula IV 137

Nemegt Basin, Gobi Desert, Upper Cretaceous (Upper Nemegt Beds)

All specimens ×150

Photo: L. Luszczewska

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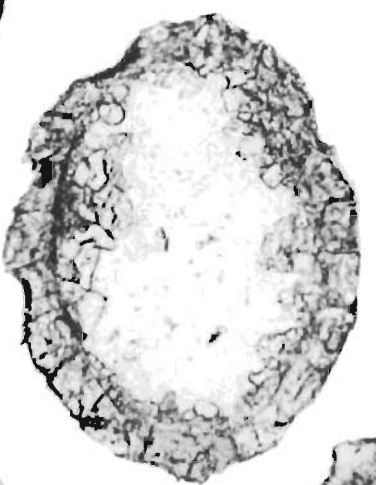

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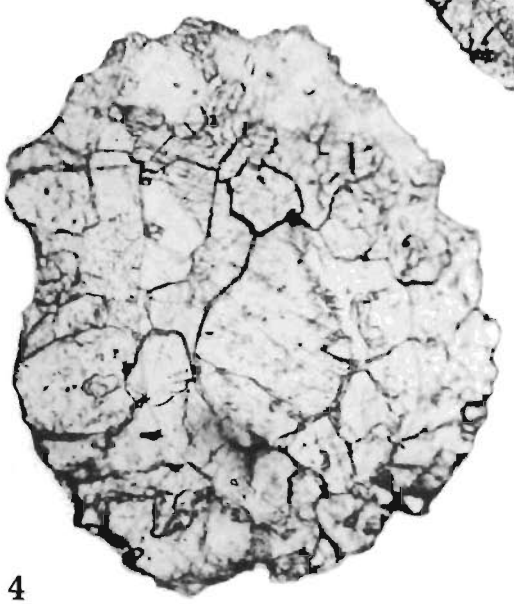

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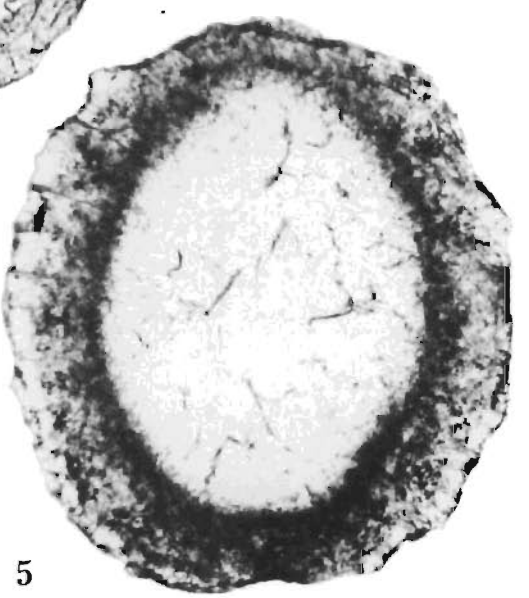

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