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LOWER TERTIARY CHAROPHYTA FROM THE NEMEGT BASIN,
GOBI DESERT

(Plates VII-XXVII)

Abstract. — Nineteen species assigned to nine genera of fossil oogonia of the Charophyta from the Paleogene deposits (White Beds) of the Nemegt Basin, Gobi Desert, are described and figured. Two new genera, *Gobichara* and *Nemegti-*
chara, and fifteen new species: *Nemegtichara prima*, *N. secunda*, *N. tertia*, *N. quarta*, *Mesochara terebrata*, *M. laminata*,
Grovesichara stepanovi, *G. kielani*, *Peckichara lefeldi*, *Croftiella grambasti*, *Gobichara deserta*, *G. nigra*, *G. rubra*, *G. alba*,
G. tenera are erected.

INTRODUCTION

The present paper is the second study on the fossil oogonia of the Charophyta from Mongolia. The first such study (KARCZEWSKA & ZIEMBIŃSKA-TWORZYDŁO, 1970) concerned the Upper Cretaceous Charophyta from the Nemegt Basin, while the present one contains a description of the Paleogene Charophyta from the same basin.

Lithological samples for geological studies were collected by Dr. J. LEFELD during the Polish-Mongolian Palaeontological Expedition (KIELAN-JAWOROWSKA & DOVCHIN, 1968/69). The samples which contained the oogonia of the Charophyta were turned over to the present writers for an investigation. The Charophyta from the deposits identified by GRADZIŃSKI *et al.* (1968/69) as of Paleocene age, are described in the present paper. The specimens come from Naran Bulak, Tsagan Khushu and Ulan Bulak where the deposits of this age are developed in the form of strongly calcareous mudstones, claystones and weakly-compact sandstones. Lithological data concerning these deposits are given by GRADZIŃSKI *et al.* (1968/69) in Text-figs. 10 and 12. Parts of geological profiles are shown by Szczechura (1971, Text-figs. 1—3), who also present the stratigraphic and geographic position of the samples in which the oogonia of the Charophyta occurred along with the valves of the Ostracoda.

Nine genera, including two new ones and 19 species, including 15 new ones, are described in the present paper. The collection is housed in the Palaeozoological Institute of the Polish Academy of Sciences, abbreviated as Z. Pal. The numbers of samples refer to the lithological collection of Dr. J. LEFELD, housed in the Institute of Geological Sciences of the Polish Academy of Sciences in Warsaw.

The authors are indebted to Professor Z. KIELAN-JAWOROWSKA, Director of the Palaeozoological Institute of the Polish Academy of Sciences in Warsaw, and to Dr. J. LEFELD of the Institute of Geological Sciences of the Polish Academy of Sciences, for the materials turned

over for study. Thanks are due to Professor M. KOSTYNIUK (Institute of Geology, Warsaw University) for his criticism of the manuscript, to Miss L. ŁUSCZEWSKA for taking the photographs, to Mrs. K. BUDZYŃSKA and Mrs. D. ŚLAWIK for making the drawings.

STRATIGRAPHY

The stratigraphic position of the Lower Tertiary deposits in the Nemegt Basin has not so far been accurately determined. On the basis of preliminary identifications of fossil mammals from these beds GRADZIŃSKI *et al.* (1968/69) refer to them as the Paleocene. SZALAY & McKENNA (1971) suggest that these beds are of the Upper Paleocene age. No new suggestions as to the stratigraphic position of the White Beds were obtained from the studies on the Ostracoda (Szczechura, 1971) which occurred in the same samples as the Charophyta.

Table 1

List of the known genera of the Charophyta occurring in the Paleogene of Mongolia and their stratigraphic ranges in Europe (according to GRAMBAST, 1962)

Genera	Age	CRETACEOUS		TERTIARY		
		Upper	Paleocene	Eocene	Oligocene	Miocene
<i>Mesochara</i>		—				
<i>Peckichara</i>		—	—	—	—
<i>Charites</i>				—	
<i>Gyrogona</i>				—	—	
<i>Grovesichara</i>				—	—	
<i>Grambastichara</i>				—	—	—
<i>Croftiella</i>				—	—	—

The table of the stratigraphic distribution of those genera of the Charophyta, which are known from Europe, and which occur in the deposits of the Nemegt Basin (Table 1), allows one to make certain conjectures concerning the age of these deposits. This assemblage of Charophyta forms indicates a part of the Lower Tertiary later than the Paleocene. Unfortunately, the lack of well described specimens of Charophyta from the adjoining countries (China, the Asian part of the U. S. S. R., etc.), does not allow a more accurate comparison with localities of the same age. In the Tertiary deposits of Mongolia, there occurs the genus *Peckichara* GRAMBAST, 1957, whose stratigraphic range in Europe reaches from the Upper Cretaceous to the Oligocene. In the Paris Basin two of its species are index fossils for the Paleocene (GRAMBAST, 1962). All other European genera found in the described material, that is, *Charites* HORN AF RANTZIEN, 1959, *Croftiella* HORN AF RANTZIEN, 1959, *Grovesichara* HORN AF RANTZIEN, 1959, *Grambastichara* HORN AF RANTZIEN, 1959 and *Gyrogona* LAMARCK, 1804, have their first occurrence in the Middle or Upper Eocene. The genus *Mesochara* GRAM-

BAST, 1962 (which in Europe, North America and Mongolia has hitherto been known only from the Upper Cretaceous), is a conservative element in the beds under study. The species of *Mesochara*, described from the Lower Tertiary beds, are different than the Cretaceous one. *Harrisichara* GRAMBAST, 1957, whose representatives have not been found in the material described, is a genus commonly occurring in the Eocene of the Paris Basin. Our samples contain the genus *Gobichara*, very similar morphologically to *Harrisichara* from which it differs only in the lack of the basal column. GRAMBAST (1957), the author of the genus *Harrisichara*, considers the presence of the column ("colonne") as a fundamental character of this genus. It is likely that the two genera are closely related. As follows from the facts cited above, the assemblage of Charophyta from the White Beds of the Nemegt Basin is more closely related to assemblages of Charophyta known from the Eocene of Europe rather than those from the Paleocene. Since most species occurring in the deposits of the White Beds are new ones (Table 2), it is not possible to base an unequivocal determination of the age of these deposits on the Charophyta. Consequently the approximate age of this series can be stated only as Paleogene.

Table 2

Stratigraphic occurrence of the Charophyta from the White Beds, Nemegt Basin

			Age	Formation	Samples Nos.*	Locality	<i>Nemegichara prima</i> n. gen., n. sp.	<i>Nemegichara secunda</i> n. gen., n. sp.	<i>Nemegichara terita</i> n. gen., n. sp.	<i>Nemegichara quarta</i> n. gen., n. sp.	<i>Gobichara deserti</i> n. gen., n. sp.	<i>Gobichara nigra</i> n. gen., n. sp.	<i>Gobichara tenera</i> n. gen., n. sp.	<i>Gobichara rubra</i> n. gen., n. sp.	<i>Gobichara alba</i> n. gen., n. sp.	<i>Peckichara lefeldii</i> n. sp.	<i>Grambastichara tornata</i> (R. & G.) H. AF RANTZEN	<i>Mesochara terebrata</i> n. sp.	<i>Mesochara laminata</i> n. sp.	<i>Mesochara</i> sp.	<i>Grovesichara kielani</i> n. sp.	<i>Grovesichara stapanovi</i> n. sp.	<i>Croftiella grammatis</i> n. sp.	<i>Gyrogona</i> sp.	<i>Charites minutissima</i> (MÄDLER) HORN AF RANTZEN
PALEOGENE WHITE BEDS	UB-1a	Ulan Bulak					+								+										
	NB-18	Naran Bulak					+	+																	
	NB-15	Naran Bulak					+	+																	
	NB-9	Naran Bulak					+	+																	
	NB	Naran Bulak					+	+	+																
	CE-3	Tsagan Khushu					+	+	+																
	CE-2	Tsagan Khushu					+	+	+																

* The numbers refer to the lithological samples collected by Dr. J. LEFELD and housed in the Institute of Geological Sciences, Polish Academy of Sciences, Warsaw.

SYSTEMATIC PART

The conventional taxonomy of the fossil oogonia of Charophyta in the present paper, is generally accepted as an artificial one. In the present writers' opinion, the application of natural taxonomy to the description of fossil gyrogonites of the Charophyta is impossible, since the taxonomy of the Recent Charophyta has mostly been based on the vegetative parts.

The terminology and abbreviations determining the shape and dimensions of the gyrogonites are the same as in KARCZEWSKA & ZIEMBIŃSKA-TWORZYDŁO (1970).

Genus **NEMEGTICHARA** nov.

Type species: *Nemegtichara prima* n. sp.

Derivation of the name: after the Nemegt Basin where specimens of this genus have been found.

Diagnosis. — Gyrogonites oblate spheroidal, prolate spheroidal, subprolate and prolate. In the apical part, cellular spirals very slightly calcified; in the apical periphery, a distinct depression is visible. Basal plug pentagonal, nearly twice as wide as high.

Description. — Gyrogonites varying in shape between oblate spheroidal and prolate (ISI 84—140), summit slightly protruding or rounded. Basal part mostly rounded. In lateral view, the number of convolutions from four to eight. In the apical part, cellular spirals considerably modified, in the apical periphery narrowed and depressed, towards summit gradually extending, in the apical center contacting each other at one point or along a short zigzag line. Basal pore wide, pentagonal, situated at the same level as the ends of spirals surrounding it. A slight calcification of cellular spirals in the apical part, where their thickness is twice smaller than on equator, is visible in longitudinal section. Two distinct calcification zones, varying in colour and texture, are visible in this section, the inner one fibrous in structure and dark-brown, the outer wider, crystalline and light-coloured. Basal plug closes a wide canal of the basal pore and is twice as wide as high.

Remarks. — *Nemegtichara* n. gen. is most closely related to the genus *Charites* HORN AF RANTZIEN, 1959, from which it differs in the presence of a furrow around the apical zone, in the thickness of spirals which is considerably smaller in the apical part than on equator, in an only slight extention of cellular spirals in the apical center and in the occurrence of specimens having convex cellular spirals. Four species of the genus *Nemegtichara* nov. have been erected, differing in the shape, size and number of convolutions. The variability in the shape of gyrogonites of various species of *Nemegtichara* n. gen. is illustrated by the diagram of the shape index (ISI), based on the 300 specimens examined (Text-fig. 1).

***Nemegtichara prima* n. gen., n. sp.**

(Pl. VII, Figs. 1, 3-4; Pl. VIII, Figs. 1-2, 5-6; Pl. IX, Figs. 2; Pl. XXIV, Figs. 1, 3-4; Text-fig. 2, 3)

Type specimen: Z.Pal.No.MgChar-II/D-2; Pl. VII, Fig. 3.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: *prima* — the first species of the genus *Nemegtichara* nov.

Diagnosis. — Gyrogonites middle-sized, subprolate, with slightly protruding summits and rounded bases; ranging in length from 400 to 600 μ and in width from 335 to 500 μ . Intercellular ridges wide and blunt, separated by wide and deep cellular furrows. Mostly six to seven spirals visible in lateral view. Basal plug thinner than wide. Equatorial angle about 20°.

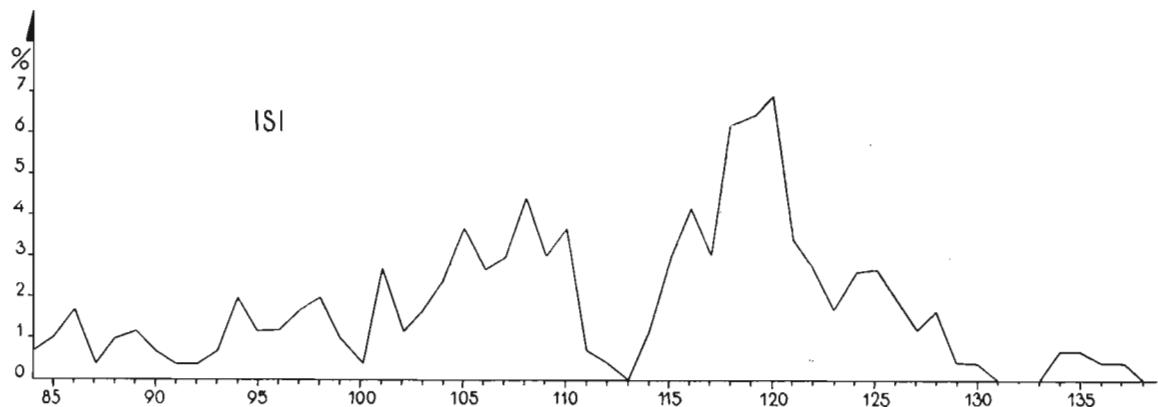


Fig. 1

The variability in the shape of gyrogonites of various species of *Nemegtichara* n. gen., for 300 specimens.

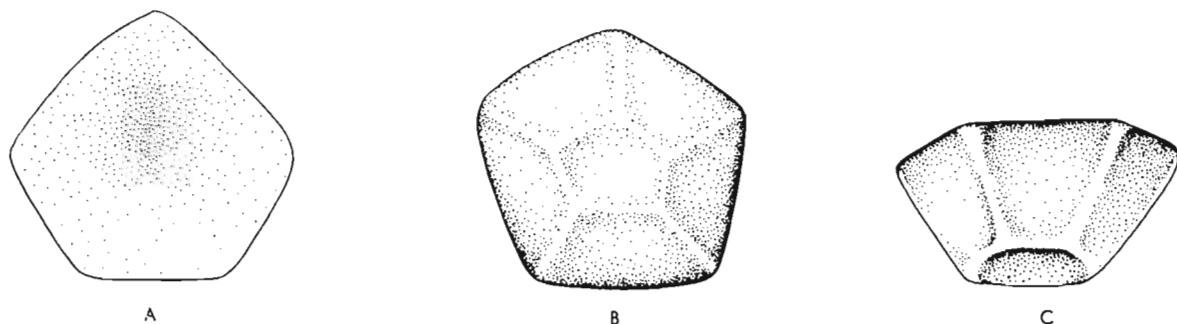


Fig. 2

Nemegtichara prima n. gen., n. sp.: the basal plug; a upper side, b lower side, c lateral view. Width of the basal plug — 112 µ.

Material. — A hundred and forty-nine well-preserved specimens and many fragmentary ones, from the Nemegt Basin; Naran Bulak, Tsagan Khushu and Ulan Bulak. Samples Nos.: CE-2, CE-3, NB, NB-9, NB-15, NB-18, UB-1a.

Measured gyrogonites of *Nemegtichara prima* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in µ	LED in µ	ISI	AND in µ	ANI	Numb. conv.	Width conv. at EA in µ
Hb-5	400	335	120	200	50	6	60
Md-1	435	350	124	225	52	7	55
Kd-9	470	390	120	220	47	5	70
Ma-10	500	425	118	250	50	6	75
Kh-3	500	430	116	240	48	6	75
Ld-4	500	440	114	250	50	6	70
Lh-5	525	440	119	235	45	8	70
Lc-6	525	425	124	275	52	7	75
Km-7	530	405	130	250	47	6	75
Lb-20	600	500	120	235	39	6	82
Range:	400—600	335—500	114—130	200—275	39—52	5—8	60—82

Description. — Gyrogonites middle-sized, subprolate (ISI 114—130) and ellipsoidal (ANI 39—57), with rounded or slightly protruding summits and rounded bases; ranging in length from 400 to 600 μ and in width from 335 to 500 μ . Five to eight spirals visible in lateral view. Intercellular spiral ridges wide and flat, separated from each other by wide and deep cellular furrows. Cellular spirals mostly concave, but there also occur specimens with convex spirals and several transitional forms between these two fundamental types of calcification. In the apical part, cellular spirals are strongly modified; in the peripheral part narrower and depressed, towards summit gradually protruding and in the apical center contacting each other at one point or along a short zigzag line. Basal area slightly rounded. Outer opening of the basal pore pentagonal, situated at the same level as the rounded ends of the surrounding spirals, so that no depression occurs around the basal pore. Equatorial angle about 20°.

Cellular spirals with two zones of calcification varying in texture and colour are visible in longitudinal section; the inner zone considerably thinner, yellow-brown in colour and fibrous in texture, outer very thick, light-coloured, crystalline. A very strong thinning of the spirals up to the half of their thickness on the equator is visible in the apical part. Basal plug well developed, twice as wide as high (Text. --- fig. 3) and closing a wide basal pore.

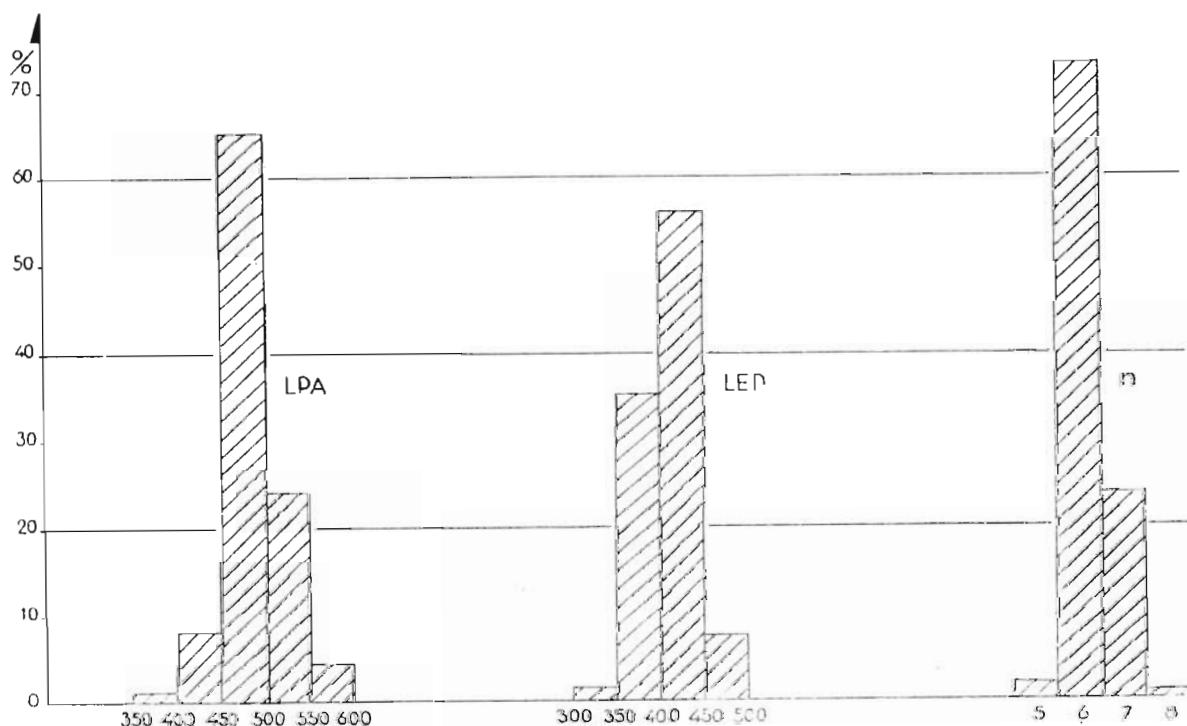


Fig. 3
Nemegtichara prima n. gen., n. sp.: the variability in the length (LPA), width (LED) and number of spirals (n), for 150 specimens.

Remarks. — *Nemegtichara prima* n. gen., n. sp. differs from the remaining species of this genus in shape, equatorial angle and size. *N. prima* n. sp. is most closely related to *Nemegtichara secunda* n. sp., from which it differs primarily in shape. The index of shape in *N. prima* n. sp. is contained within an interval of 114 to 130, the specimens most frequently

met with having an ISI of 118 to 120, while in *N. secunda* n. sp. these figures are 100 to 112 (mostly 105—110). The equatorial angle, which in *N. prima* n. sp. mostly amounts to about 20° and in *N. secunda* n. sp. to about 10°.

Distribution. — Gobi Desert, Nemegt Basin.

Nemegtichara secunda n. gen., n. sp.

(Pl. IX, Figs. 1, 3-4; Text-fig. 4)

Type specimen: Z.Pal.No.MgChar-II/D-25; Pl. IX, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Tsagan Khushu, Nemegt Basin, Gobi Desert.

Derivation of the name: the second species of the genus *Nemegtichara* nov.

Diagnosis. — Gyrogonites middle-sized, prolate-spheroidal (ISI 100—112), with rounded or slightly protruding summits and rounded bases; ranging in length from 340 to 520 μ and in width from 315 to 475 μ . Intercellular ridges wide and blunt, separated by wide and deep cellular furrows. Five to seven convolutions visible in lateral view. Equatorial angle about 10°. Basal plug thinner than wide.

Material. — Eighty-nine well preserved specimens and several fragments, from the Nemegt Basin; Naran Bulak, Tsagan Khushu. Samples Nos.: CE-2, CE-3, NB-, NB-9, NB-15, NB-18.

Measured gyrogonites of *Nemegtichara secunda* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Kn-17	340	315	108	112	33	6	50
Kn-2	375	350	107	180	48	5	50
Hb-10	395	395	100	195	49	6	65
Kk-13	410	375	108	185	45	6	57
Kn-12	415	380	109	190	46	7	70
Lf-13	415	385	108	260	63	7	75
Ld-7	475	430	110	200	46	6	65
Kl-5	475	457	104	230	53	5	80
Ma-12	500	445	112	235	48	6	65
Lb-8	520	475	110	225	42	7	70
Range:	340—520	315—475	100—112	112—195	33—63	5—7	50—80

Description. — Gyrogonites middle-sized, prolate-spheroidal (ISI 100—112), subobovoidal and ellipsoidal (ANI 33—67), with rounded and slightly protruding summits and rounded bases; ranging in length from 340 to 520 μ and in width from 315 to 475 μ . Five to seven cellular spirals visible in lateral view. Intercellular sutures straight and, on wide and flat ridges, separated from each other by wide and deep cellular furrows. In the apical part, cellular spirals modified, on the apical periphery hollowed, narrowed and forming a depression; towards summit they extend and, at the apical junction, join each other at one point or along a short, zigzag line. Basal area conspicuously rounded. In the basal part, cellular spirals are the same in thickness as on equator; their rounded ends surround the basal pore situated at the same level. Basal plug pentagonal twice as wide as high. Equatorial angle about 10°.

Cellular spirals with two calcification zones varying in texture and colour are visible in longitudinal section; the inner zone thin and darker, the outer very thick, light-coloured and crystalline in texture. A very strong thinning of spirals, reaching a half of their thickness on equator, occurs in the apical part.

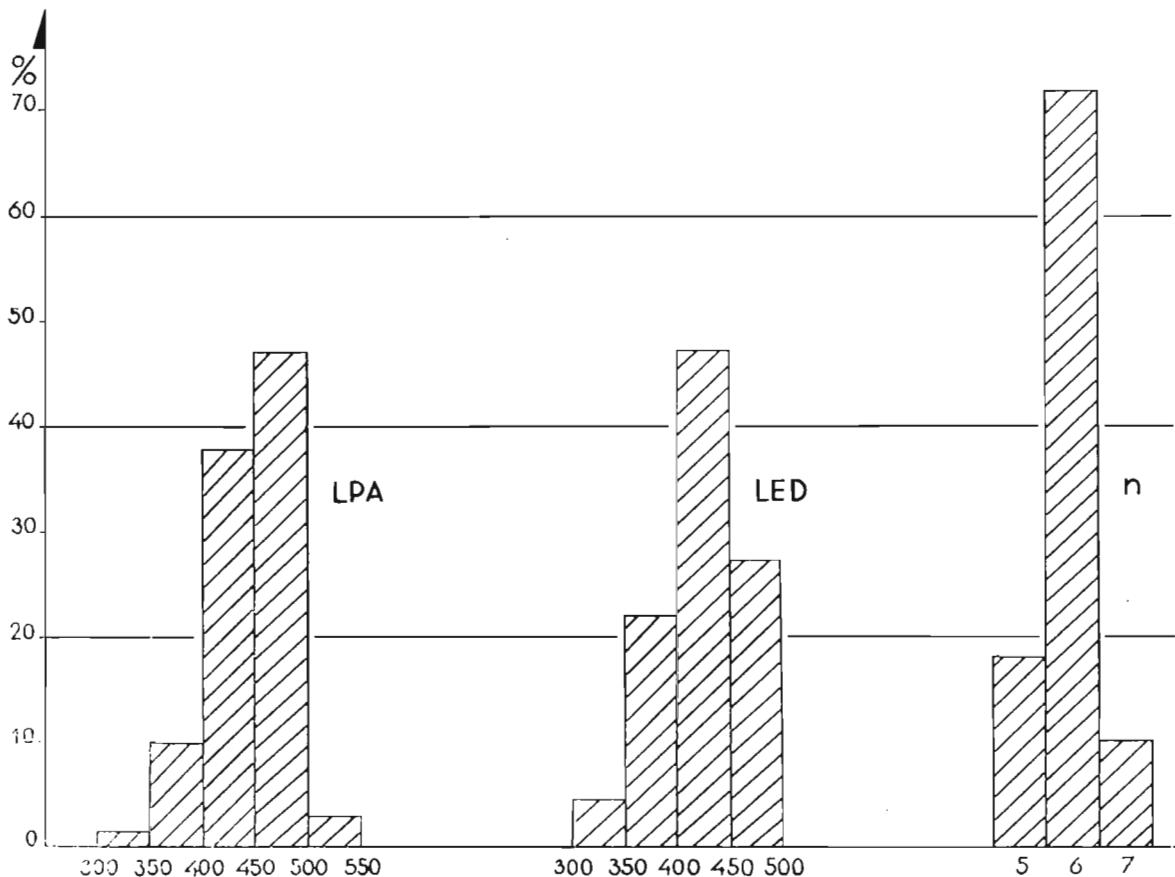


Fig. 4

Nemegtichara secunda n. gen., n. sp.: the variability in the length (LPA), width (LED) and number of spirals (n), for 90 specimens.

Remarks. — The gyrogonites of *Nemegtichara secunda* n. gen., n. sp. are most closely related to those of *N. prima* n. sp., from which they differ in a lower index of shape, and smaller equatorial angle.

Distribution. — Gobi Desert, Nemegt Basin.

Nemegtichara tertia n. gen., n. sp.

(Pl. X, Figs. 1-3; Text-fig. 5)

Type specimen: Z.Pal.No.MgChar-II/D-8; Pl. X, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: *tertia* — the third species of the genus *Nemegtichara* nov.

Diagnosis. — Gyrogonites small, suboblate and oblate spheroidal (ISI 75—99), with subtruncate summits and rounded bases; ranging in length from 250 to 452 μ and in width from 290 to 475 μ . Intercellular sutures straight and on broad and flat intercellular ridges,

separated by wide and deep cellular furrows. Five to seven convolutions visible in lateral view. Equatorial angle about 5°. Basal plug unknown.

Material. — Fifty-five well-preserved specimens and many fragments, from the Nemegt Basin: Naran Bulak, Tsagan Khushu. Samples Nos.: CE-3, NB-, NB-9.

Measured gyrogonites of *Nemegtichara tertia* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Lh-2	250	335	75	137	55	6	35
Kn-4	285	290	98	120	42	6	35
Lh-1	305	352	87	112	37	6	60
Lh-5	315	330	96	140	44	7	50
Lg-17	340	407	84	180	53	5	50
Lg-11	352	375	94	190	54	5	70
Kn-6	365	390	94	170	46	6	60
Le-12	425	475	89	212	52	6	50
Lf-20	447	452	99	227	51	6	52
Hb-8	452	470	97	190	42	5	75
Rang:	250—452	290—475	75—99	112—227	37—54	5—7	35—75

Description. — Gyrogonites small, oblate and oblate spheroidal (ISI 75—99), subovoidal and ellipsoidal (ANI 37—54), with slightly flattened summits and rounded bases; ranging in length from 250 to 452 μ and in width from 290 to 475 μ . Five to seven convolutions visible in lateral view. Cellular sutures straight and, on flattened and wide intercellular ridges, separated by deep and wide cellular furrows. On the apical periphery, cellular spirals slightly narrowed and considerably depressed, towards summit slightly extending and contacting each other at one point at the apical junction where they are conspicuously protruding. In the basal part, cellular spirals are the same in width as on equator, their rounded ends surrounding the basal pore situated at the same level. No crater occurs around the basal pore. Equatorial angle about 5°. Basal plug unknown.

Spirals with two calcification zones are visible in the longitudinal section; the inner zone is almost identical in thickness with the outer one, separated from the former by a distinct dark layer. In the apical part are two times thinner than on equator and composed of a single layer resembling in structure the outer calcification zone. All specimens are characterized by a very strong calcification of cellular spirals.

Remarks. — The gyrogonites of *Nemegtichara tertia* n. gen., n. sp. are most similar to those of *N. secunda* n. sp., from which they differ in a lower shape index, smaller size, strongly flattened summit and smaller equatorial angle. In longitudinal section, specimens of *N. tertia* n. sp. differ from *N. secunda* n. sp. in a higher degree of calcification and in a different correlation of the calcification zones of cellular spirals. In contradistinction to *N. secunda* n. sp., their inner zone is more strongly developed and its width is almost equal to that of outer zone.

Distribution. — Gobi Desert, Nemegt Basin.

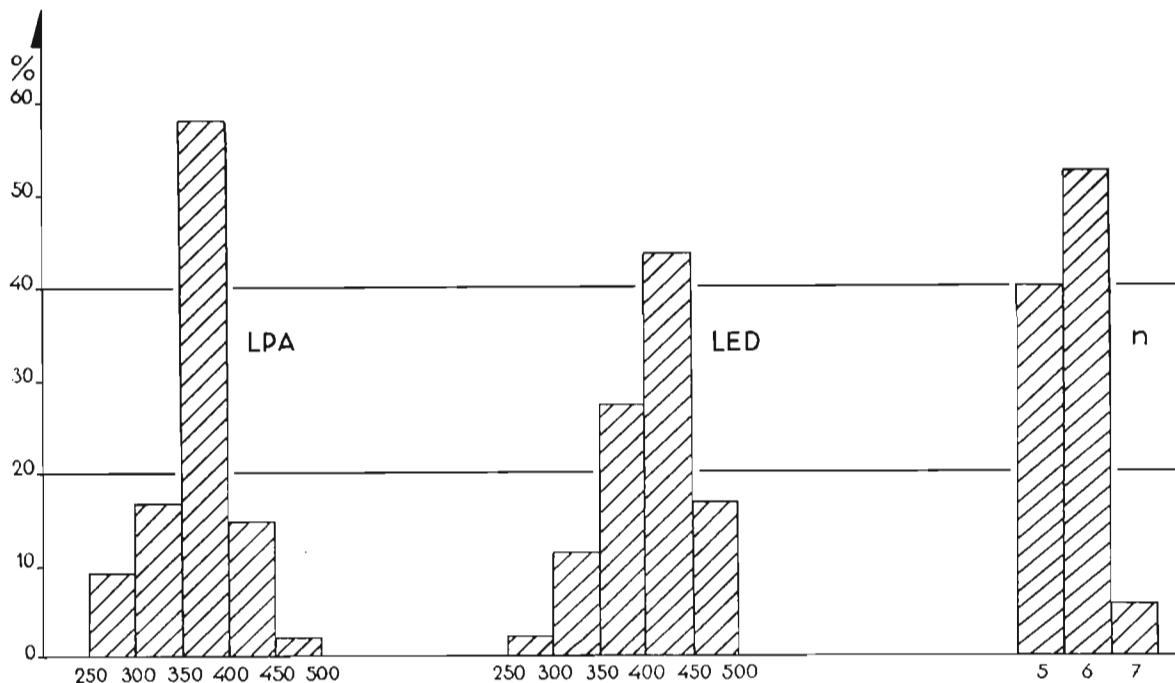


Fig. 5

Nemegtichara tertia n. gen., n. sp.: the variability in the length (LPA), width (LED) and number of spirals (n), for 50 specimens.

***Nemegtichara quarta* n. gen., n. sp.**

(Pl. VII, Fig. 2)

Type specimen: Z.Pal.No.MgChar-II/E-14: Pl. VII, Fig. 2.

Type horizon and locality: Paleogene (White Beds), Tsagan Khushu, Nemegt Basin, Gobi Desert.

Derivation of the name: *quarta* — the fourth species of the genus *Nemegtichara* nov.

Diagnosis. — Gyrogonites middle-sized, prolate (ISI 134—140), with slightly protruding summits and bases; ranging in length from 390 to 595 μ and in width from 290 to 445 μ . Intercellular ridges blunt, separated by wide and deep cellular furrows. Six to seven convolutions visible in lateral view. Equatorial angle about 25°. Basal plug unknown.

Material. — Seven well-preserved specimens, from the Nemegt Basin: Naran Bulak, Tsagan Khushu. Samples Nos.: CE-3, NB-9, NB-15.

Description. — Gyrogonites middle-sized, prolate (ISI 134—140) and ellipsoidal (ANI 45—55), with slightly protruding summits and bases; ranging in length from 390 to 595 μ and in width from 290 to 445 μ . Six to seven convolutions visible in lateral view. Intercellular sutures occur on not very wide, blunt ridges. Intercellular ridges separated by deep and wide furrows. Cellular spirals, narrowing on the apical periphery, form a slight depression; towards summit they extend and rise, meeting each other at one point at the apical junction. In the basal part, cellular spirals, the same in width as on equator, surround a pentagonal basal pore. The opening of the basal pore slightly depressed. Equatorial angle about 25°. Basal plug unknown.

Measured gyrogonites of *Nemegtichara quarta* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Mc-4	390	290	135	215	55	7	40
Mc-1	450	337	135	210	50	6	65
E-14	477	337	140	250	52	7	75
Ke-17	500	350	135	250	50	6	70
Kd-1	550	412	134	260	47	6	75
Lk-9	560	410	136	250	45	7	75
Lb-12	595	445	134	285	49	7	85
Range:	390—595	290—445	134—140	210—285	45—55	6—7	40—85

Remarks. — The gyrogonites of *Nemegtichara quarta* n. gen., n. sp. are most similar to those of *N. prima* n. sp., from which they differ in higher shape index.

Distribution. — Gobi Desert, Nemegt Basin.

Genus **GYROGONA** LAMARCK, 1804 ex Lmk, 1822 emend. GRAMBAST, 1956

Type species: *Gyrogona medicaginula* LAMARCK, 1804 ex Lmk, 1822, France, Oligocene.

Gyrogona sp.

(Pl. XXVI, Figs. 2-4)

Material. — Three incomplete specimens, from the Nemegt Basin: Naran Bulak. Samples Nos.: NB, NB-9.

Measured gyrogonites of *Gyrogona* sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
E-5	720	735	97	370	51	5	140
E-7	800	875	91	390	49	6	135

Description. — Gyrogonites large, oblate-spheroidal (ISI 91, 94) and ellipsoidal (ANI 49, 51), with a rounded summit and base; 720 and 800 μ long, 735 and 875 μ wide. Five and six convolutions are visible in lateral view. Spiral ridges narrow, low and slightly undulate. Inter-cellular sutures distinct. Cellular spirals wide (on equator 135 and 140 μ), flat or slightly concave, about 100 μ thick. In the apical part, cellular spirals slightly narrowed and contact each other at one point on the summit. Equatorial angle about 10°.

Remarks. — *Gyrogona* sp. from Mongolia are identical with the specimens described by HORN AF RANTZIEN (1959) as *Brevichara* sp. from „Oligocene” of France. Like HORN AF RANTZIEN the writers had not at their disposal a sufficient material for the specific determination of the specimens described.

Distribution. — Gobi Desert, Nemegt Basin.

Genus **CHARITES** HORN AF RANTZIEN, 1959

Type species: *Charites molassica* (STRAUB, 1952 emend. MÄDLER, 1955) HORN AF RANTZIEN, 1959; Germany, Oligocene-Miocene.

Charites minutissima (MÄDLER, 1955) HORN AF RANTZIEN, 1959
(Pl. XXIV, Figs. 1, 6; Text-fig. 6)

1955. *Tectochara minutissima* n. sp.: K. Mädler, Zur Taxonomic..., p. 292, Pl. 26, Figs. 1-6.

1959. *Charites minutissima* (MÄDLER) HORN AF RANTZIEN: H. Horn af Rantzen, Morphological types..., p. 64, Pl. 1, Figs. 8-12.

Material. — Seventeen well-preserved specimens, from the Nemegt Basin: Naran Bulak and Ulan Bulak. Samples Nos.: NB-9, UB-1a.

Measured gyrogonites of *Charites minutissima* (MÄDLER) HORN AF RANTZIEN

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
F-39	275	225	122	158	57	10	30
Mr-6	275	232	119	152	55	9	25
Mr-9	282	250	113	155	55	7	32
Mr-3	292	235	124	165	56	9	27
Mr-4	295	235	126	180	61	9	32
Lu-4	300	255	118	165	55	7	37
D-34	305	260	118	160	52	8	40
Mr-12	317	250	127	157	49	8	30
Mr-7	320	230	139	207	65	8	35
Mr-5	330	250	132	195	60	10	32
Range:	275—330	225—260	113—139	152—207	49—65	7—10	25—40

Description. — Gyrogonites very small, subprolate and prolate (ISI 113—139), ellipsoidal and subobovoidal (ANI 49—65), with slightly protruding summits and rounded bases; ranging in length from 275 to 330 μ and in width from 225 to 260 μ . Seven to ten convolutions visible in lateral view. Intercellular ridges high and narrow, separated by deep furrows. Cellular spirals slightly extending in the apical part and contacting each other at one point at the apical junction. In the basal part, cellular spirals the same in thickness as on equator, sharply terminating and surrounding the basal pore situated at the same level. The manner of arranging cellular spirals around the basal pore is illustrated in Text-fig. 6. Equatorial angle about 10°. Basal plug not preserved. Only one, poorly marked calcification zone, fine-crystalline in texture, is visible in longitudinal section. In apical junction cellular spirals are conspicuously elevated.

Remarks. — *Charites minutissima* (MÄDLER) HORN AF RANTZIEN, 1959, first described by MÄDLER in 1955 as *Tectochara minutissima*, was revised by HORN AF RANTZIEN in 1959. Specimens from MÄDLER'S collection were studied by HORN AF RANTZIEN, who illustrated their internal structure and, on its basis, assigned this species to the genus *Charites*. The specimens from the Nemegt Basin have features in conformity with the diagnosis of the species.

Distribution. — Southern Germany, Switzerland; Oligocene to Miocene. Gobi Desert, Nemegt Basin; Paleogene.

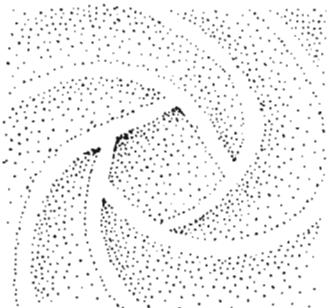


Fig. 6

Charites minutissima (MÄDLER) HORN AF RANTZIEN, 1959: the manner of cellular spirals around the basal pore. Width of the basal pore 35 μ .

Genus GROVESICHARA HORN AF RANTZIEN, 1959

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

Grovesichara stepanovi n. sp. (Pl. XXIV, Fig. 2; Pl. XXVI, Fig. 1)

Type specimen: Z.Pal.No.MgChar-II/D-17; Pl. XXVI, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: named in honour of Professor V. V. STEPANOV from the Museum of Odessa, U. S. S. R.

Diagnosis. — Gyrogonites subprolate, with rounded summits and slightly protruding bases, ranging in length from 522 to 635 μ and in width from 437 to 522 μ . Six to seven convolutions visible in lateral view. Cellular spirals not narrowed in the apical periphery and forming a deeply furrowed peripheral depressions. Basal pore with the outer opening lowered beneath the surfaces of the surrounding spirals. Basal plug thicker than wide.

Material. — Two well-preserved specimens, from the Nemegt Basin: Naran Bulak. Sample No.: NB-9.

Measured gyrogonites of *Grovesichara stepanovi* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
B-6	522	437	120	260	50	6	80
D-17	635	522	121	307	48	7	77

Description. — Gyrogonites middle-sized, subprolate (ISI 120, 121) and ellipsoidal (ANI 48, 50), with rounded summits and slightly protruding bases; 522 and 635 μ long, 437 and 522 μ wide. Six to seven convolutions visible in lateral view. Cellular spirals convex, wide (77 to 80 μ), separated by slightly depressed intercellular furrows. In the apical zone, the width of cellular spirals almost identical as on equator. On apical periphery, depressed cellular spirals

form a peripheral furrow, in apical center they are extended and thickened, contacting each other along a zigzag line and forming an indistinct rosette. Outer opening of the basal pore distinct, pentagonal, situated on the bottom of a depression formed by rounded and thickened ends of cellular spirals. Basal pore deep, closed by a basal plug which is higher than wide. Equatorial angle about 15°.

In longitudinal section, cellular spirals very thick (100 μ), without spiral canals and composed of two calcification zones, varying in texture and colour. Inner zone darker, occupying two-thirds of the thickness, distinctly fine-laminate in structure; outer zone thinner, lighter in colour and crystalline in texture. Basal plug pyramidal, also composed of two calcification zones, closing a deep basal canal.

Remarks. — The specimens of *Grovesichara stepanovi* n. sp. from Mongolia are most similar to those of *Grovesichara distorta* (REID & GRÖVES) HORN AF RANTZIEN, 1959, from which they differ in size and more strongly protruding basal part. The specimens from Mongolia do not exceed 635 μ , while those of *G. distorta* measure 900 to 1250 μ .

Distribution. — Gobi Desert, Nemegt Basin.

Grovesichara kielani n. sp.

(Pl. XXV, Figs. 1-2; Pl. XXVII, Fig. 5)

Type specimen: Z.Pal.No.MgChar-II/D-35; Pl. XXV, Fig. 2.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: named in honour of Professor Z. KIELAN-JAWOROWSKA, leader of the Polish-Mongolian Palaeontological Expeditions, Warsaw.

Diagnosis. — Gyronites prolate-spheroidal, broadly subprolate (ISI 109—122) and ellipsoidal (ANI 44—51), with rounded summits and bases; ranging in length from 487 to 550 μ and in width from 407 to 475 μ . Six convolutions visible in lateral view. Cellular spirals not narrowed in apical periphery, and join each other along a zigzag line in apical center. Basal pore indistinctly pentagonal, slightly beneath the surfaces of the surrounding spirals. Basal plug thicker than wide.

Material. — Ten well-preserved specimens, from the Nemegt Basin: Tsagan Khushu, Naran Bulak. Samples Nos.: CE-2, NB-18.

Measured gyronites of *Grovesichara kielani* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Mm-4	487	437	113	250	51	6	92
Mm-3	500	407	122	225	45	6	100
D-36	500	455	111	250	50	6	107
D-35	512	437	117	227	44	6	115
F-40	517	440	117	265	51	6	105
Mm-6	522	475	109	270	51	6	95
Mm-2	525	465	113	250	47	6	105
Mm-5	537	450	119	275	51	6	97
Mm-1	550	475	116	250	45	6	92
Range:	487—550	407—475	109—122	225—275	44—51	6	92—115

Description. — Gyrogonites middle-sized, prolate-spheroidal broadly subprolate (ISI 109—122) and ellipsoidal (ANI 44—51), with rounded summits and bases; ranging in length from 487 to 550 μ and in width from 407 to 475 μ . Six convolutions visible in lateral view. Cellular spirals flat or concave, very wide (91—115 μ), separated by distinct intercellular ridges; in the apical zone the same in width as on equator, in apical center joining each other along a short, zigzag line. Outer opening of the basal pore indistinctly pentagonal, slightly depressed in relation to the ends of the surrounding spirals. Equatorial angle about 10° or less.

In longitudinal section, cellular spirals thick (about 100 μ), composed of two calcification zones; the inner zone lighter in colour, fine-laminate in texture, occupying two-thirds of the thickness of a spiral, the outer one thinner, darker and crystalline in texture. Basal plug pyramidal, composed of two layers, higher than wide, closing the basal canal.

Remarks. — Specimens of the *Grovesichara kielani* n. sp. are most similar to those of *G. distorta* (REID & GROVES) HORN AF RANTZIEN, from which they differ only in much smaller dimensions and indistinctly developed peripheral depression in the apical part.

Distribution. — Gobi Desert, Nemegt Basin.

Genus PECKICHARA L. GRAMBAST, 1957

Type specimen: *Peckichara varians* L. GRAMBAST, 1957; France, Eocene.

Peckichara lefeldi n. sp.

(Pl. XIX, Figs. 2-3; Pl. XX, Figs. 1-2; Pl. XXI, Figs. 1-2; Pl. XXII, Fig. 2; Pl. XXVII, Figs. 1, 4; Text-fig. 7)

Type specimen: Z.Pal.No.MgChar-II/E-3; Pl. XXII, Fig. 2.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: named in honour of Doctor J. LEFELD (Institute of Geological Sciences of the Polish Academy of Sciences, Warsaw).

Diagnosis. — Gyrogonites middle-sized, subprolate (ISI 112—130), with broadly rounded summits and bases; ranging in length from 528 to 700 μ and in width from 435 to 585 μ . Six to nine convolutions visible in lateral view. Mature lime spirals with the tendency to surface ornamentation. In the apical periphery, spirals narrower and distinctly thinner than on the equator, forming an interrupted peripheral groove. In apical center, spirals thick and forming a low apical rosette. Basal pore situated in the bottom of a distinct pentagonal depression. Basal plug wider than thick.

Material. — Fifty-three well-preserved specimens and several fragments, from the Nemegt Basin: Naran Bulak, Tsagan Khushu and Samples Nos.: CE-2, CE-3, NB, NB-9, NB-15.

Description. — Gyrogonites middle-sized, prolate-spheroidal to subprolate (ISI 112—130), subovoidal and ellipsoidal (ANI 34—57), with widely rounded summits and bases; ranging in length from 528 to 700 μ and in width from 435 to 585 μ . Six to nine convolutions visible in lateral view. In mature specimens, a distinct tendency is observed to develop a variable ornamentation. Cellular spirals convex, flat or concave, 67 to 100 μ wide. In some specimens with concave spirals, very distinct secondary ridges occur which may be lower, equal to or higher than the intercellular ridges. In the apical periphery, spirals are distinctly thinner and narrower, forming a peripheral depression. In the apical center, extended and thickened

Measured gyrogonites of *Peckichara lefeldi* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Mu-12	528	435	121	285	54	7	67
Hj-2	620	490	126	307	50	7	80
Kae-17	630	515	122	215	34	8	77
D-39	630	517	122	360	57	8	67
Kae-5	640	575	112	295	46	7	87
Kae-10	650	500	130	310	48	7	80
Kae-4	660	555	119	330	50	6	100
Kae-14	670	585	114	260	39	7	82
D-37	677	565	120	335	50	9	92
Kae-3	700	580	120	290	41	7	95
Range:	528—700	435—585	112—130	215—360	34—57	6—9	67—100

spiral ends form a low rosette, very easily destroyed. The outer opening of the basal pore is situated on the bottom of a distinctly craterlike depression formed by the thickened ends of surrounding spirals. Equatorial angle about 15°.

In longitudinal section, cellular spirals are thick, composed of two calcification zones; the inner one being coarse-crystalline, the outer very fine-crystalline, trilaminar. Basal plug wider than high.

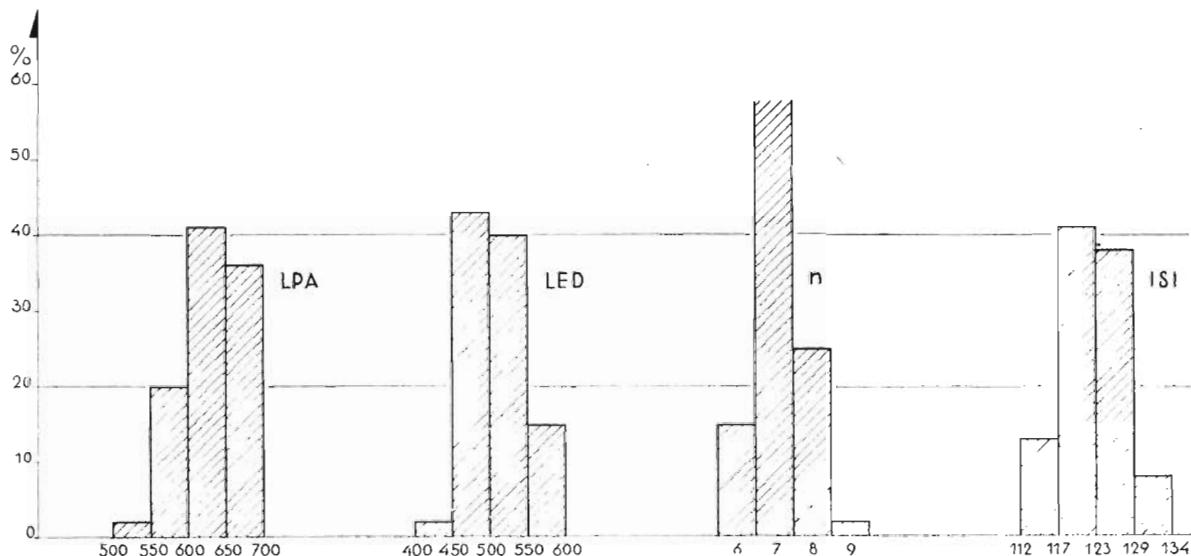


Fig. 7

Peckichara lefeldi n. sp.: the variability in the length (LPA), width (LED), number of spirals (n) and index shape (ISI), for 50 specimens.

Remarks. — The specimens of *Peckichara lefeldi* n. sp. are most similar to those of *P. coronata* (PECK & REKER, 1948) GRAMBAST, 1957, from which they differ in smaller dimensions and slightly more elongate shape.

Distribution. — Gobi Desert, Nemegt Basin.

Genus **GRAMBASTICHARA** HORN AF RANTZIEN, 1959

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

Grambastichara tornata (REID & GROVES, 1921) HORN AF RANTZIEN, 1959

(Pl. XXII, Fig. 1; Pl. XXVII, Fig. 2)

1921. *Chara tornata* REID & GROVES; C. Reid & J. Groves, The Charophyta..., p. 187, Pl. 5, Figs. 1-3.1955. *Tectochara tornata* (REID & GROVES) MÄDLER; K. Mädler, Zur Taxonomie..., p. 296, Pl. 26, Figs. 19-22.1959. *Grambastichara tornata* (REID & GROVES) HORN AF RANTZIEN; H. Horn af Rantzen, Morphological types..., p. 70, Pl. 4, Figs. 1-6.1961. *Chara tornata* REID & GROVES; Wang Shui, Tertiary Charophyta..., p. 199, Pl. 4, Figs. 19-25.

Material. — Seven well-preserved specimens and few fragments of gyrogonites, from the Nemegt Basin: Naran Bulak, Tsagan Khushu and Ulan Bulak. Samples Nos.: CE-3, NB-9, NB-15, NB-18, UB-1a.

Measured gyrogonites of *Grambastichara tornata* (REID & GROVES) HORN AF RANTZIEN

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Ms-1	550	430	128	260	47	9	70
Ko-1	557	420	132	285	51	9	67
Lk-3	635	450	141	312	49	10	75
Ml-4	640	475	134	270	42	9	70
E-4	665	482	136	325	49	9	80
Mn-1	675	500	134	325	48	10	75
Kaf-19	705	525	134	295	42	9	85
Range:	550—705	420—525	128—141	260—325	42—51	9—10	67—85

Description. — Gyrogonites middle-sized, subprolate and prolate (ISI 128—141), ellipsoidal and sometimes slightly subovoidal (ANI 42—51), with rounded or slightly protruding summits and conically narrowed bases which are, however, flattened in the center; ranging in length from 550 to 705 μ and in width from 420 to 525 μ . Nine to ten flat or convex convolutions are visible in lateral view. Intercellular ridges poorly developed, mostly lacking. Spirals width on equator, 67 to 85 μ . In the apical periphery, cellular spirals slightly narrowed and thinned, but not forming a distinct depression, in the apical center thick and distinctly extended, contacting each other at one point or along a short zigzag line. The outer opening of the basal pore situated on the bottom of a shallow depression formed by thickened ends of surrounding spirals. Equatorial angle about 15°.

In longitudinal section, cellular spirals are thick (about 70 μ) and composed of two calcification zones; the inner one narrower, coarse-crystalline and outer about three times as thick and fine-crystalline. Basal plug as thick as wide.

Remarks. — The specimens of *Grambastichara tornata* (REID & GROVES) HORN AF RANTZIEN from Mongolia are contained within the limits of variability of the species described from other areas.

Distribution. — England; Eocene. Switzerland; Oligocene. China (Chaidamu Basin); Tertiary. Gobi Desert, Nemegt Basin; Paleogene.

Genus **CROFTIELLA** HORN AF RANTZIEN, 1959

Type species: *Croftiella escheri* (ÜNGER, 1850) HORN AF RANTZIEN, 1959; Germany, Oligocene.

***Croftiella grambasti* n. sp.**

(Pl. XXIII, Figs. 1-2; Pl. XXIV, Fig. 5; Text-fig. 8)

Type specimen: Z.Pal.No.MgChar-II/E-8; Pl. XXIII, Fig. 1.

Type horizon and locality: Paleogene (White Beds). Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: named in honour of Professor L. GRAMBAST, Laboratoire de Paléobotanique et Évolution des Végétaux, Montpellier, France.

Diagnosis. — Gyrogonites prolate (ISI 143—159), with rounded summits and protruding bases; ranging in length from 690 to 750 μ and in width from 455 to 500 μ . Eight to ten convolutions visible in lateral view. In the apical periphery, cellular spirals distinctly narrower and thinner than on the equator. In the apical center, spirals forming a distinct apical rosette. Basal pore with outer opening at the same level as the surface of the surrounding spirals, or slightly lowered beneath them.

Material. — Four well-preserved specimens and several fragmentary gyrogonites, from the Nemegt Basin: Naran Bulak and Tsagan Khushu. Samples Nos.: CE-2, CE-3, NB-9, NB-15.

Measured gyrogonites of *Croftiella grambasti* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
E-9	690	455	152	325	47	10	70
Kaf-13	715	500	143	325	46	8	85
E-8	725	455	159	390	54	10	75
E-10	750	480	156	400	53	9	85
Range:	690—750	455—500	143—159	325—400	46—54	8—10	70—85

Description. — Gyrogonites middle-sized, prolate (ISI 143—159) and ellipsoidal (ANI 46—54), with rounded summits and protruding bases; ranging in length from 690 to 750 μ and in width from 455 to 500 μ . Eight to nine convolutions visible in lateral view. Mature specimens distinctly tend to develop ornamentation. Cellular spirals flat or concave, 70 to 85 μ wide. Very distinct secondary ridges, higher than intercellular ones occur in some specimens with concave spirals. Intercellular sutures distinct, slightly depressed. The system of sutures on specimens having secondary ridges is illustrated in Text-fig. 8. On the apical periphery, cellular spirals distinctly narrowed, slightly depressed and forming an indistinct peripheral depression. In the apical center, spirals ends strongly thickened and protruding, liable to destruction. The outer opening of the basal pore situated at the same level as the ends of surrounding spirals or slightly depressed. Basal plug unknown.

Remarks. — The specimens of *Croftiella grambasti* n. sp. are most similar to those of *Croftiella rochettiana* (HEER, 1854) HORN AF RANTZIEN, 1959, from which they differ in the

shape of basal part and tendency to form ornamentation. That two species also differ from each other in their stratigraphic range, *C. rochettiana* being known only from the Upper Miocene.

Distribution. — Gobi Desert, Nemegt Basin.

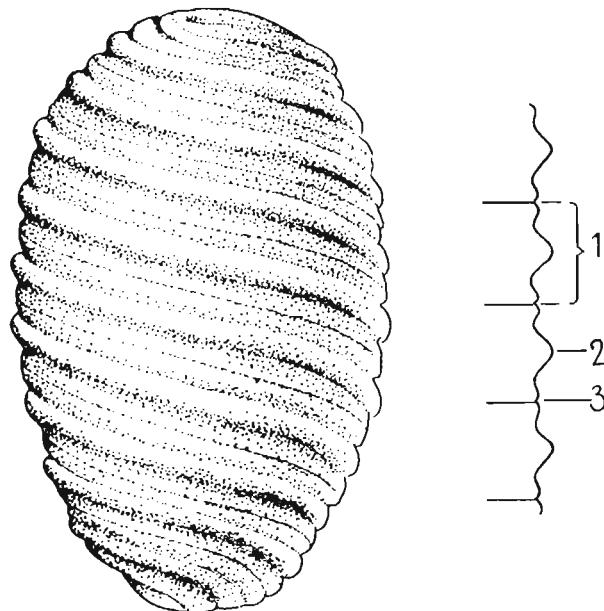


Fig. 8

Croftiella grambasti n. sp.: the system of sutures on specimen having secondary ridges; 1 cellular spiral, 2 secondary ridge, 3 intercellular suture. Length of the gyrogonite 725 μ .

Genus MESOCHARA GRAMBAST, 1962

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

Mesochara terebrata n. sp. (Pl. XI, Figs. 1, 3-4; Text-fig. 9)

Type specimen: Z.Pal.No.MgChar-II/D-16; Pl. XI, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *terebra* — a drill; after a drilllike shape of the gyrogonite.

Diagnosis. — Gyrogonites small, prolate, with pointed summits and bases; ranging in length from 350 to 462 μ and in width from 250 to 332 μ . Eight to eleven convolutions visible in lateral view. Spirals continuing up to the summit without changing their size and shape and meeting at a point. Basal pore with outer opening at the same level as the surfaces of the surrounding spirals. Basal plug thin.

Material. — Thirty-five well-preserved specimens, from the Nemegt Basin: Naran Bulak, Tsagan Khushu and Ulan Bulak. Samples Nos.: CE-3, NB-, NB-9, NB-15, UB-1a.

Measured gyrogonites of *Mesochara terebrata* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Lv-14	350	255	137	177	50	9	40
Ky-14	370	250	148	187	50	9	40
Lw-14	385	285	135	185	48	8	42
Lv-10	385	292	132	162	42	10	42
Kv-6	405	270	150	192	47	9	35
Lab-6	415	312	132	207	49	9	50
Mt-12	422	295	143	225	53	9	55
Mf-3	432	310	141	217	57	10	50
Laa-18	447	332	135	227	50	10	50
Kt-3	462	315	146	215	46	11	45
Rang:	350—462	250—332	132—150	162—227	42—57	8—11	35—55

Description. — Gyrogonites small, prolate (ISI 132—150) and ellipsoidal (ANI 42—57), with strongly protruding summits and bases; ranging in length from 350 to 462 μ and in width from 250 to 332 μ . Eight to eleven convolutions visible in lateral view. Cellular spirals concave, with secondary ridges. Intercellular ridges the same height or lower than secondary ridges. On the equator, spirals are 35 to 55 μ wide. Cellular spirals reaching the summit without any change in width, in the apical center they are strongly extended and contact each other at one point. Secondary ridges terminate in the apical periphery. Poorly developed tubercles are visible below the apical junction. The outer opening of the basal pore at the same level as the ends of the surrounding spirals. Equatorial angle about 10°.

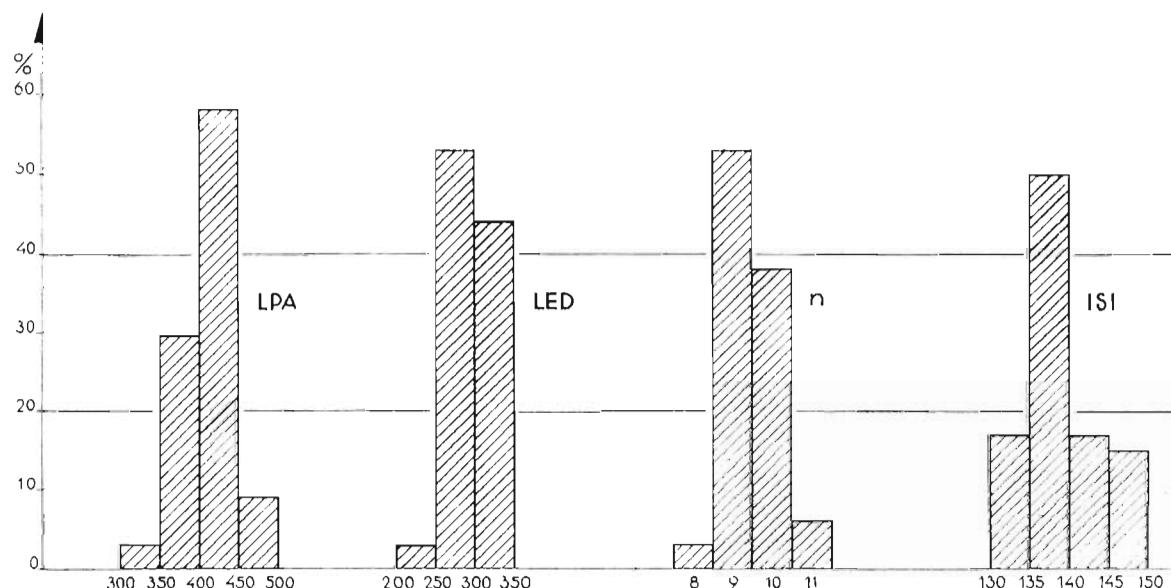


Fig. 9

Mesochara terebrata n. sp.: the variability in the length (LPA), width (LED), number of spirals (n) and index shape (ISI), for 35 specimens.

In the longitudinal section, cellular spirals are of an average thickness (about 35 μ), composed of two calcification zones; the inner one narrower, darker and amorphous in structure, the outer thicker, lighter in colour and composed of concentrically arranged small layers of calcium carbonate. In the apical part, cellular spirals slightly thinner. Basal plug thin, also composed of two zones.

Remarks. — The specimens of *Mesochara terebrata* n. sp. are most similar to those of *Mesochara mongolica* KARCZEWSKA & ZIEMBIŃSKA-TWORZYDŁO, 1970, from which they differ in a smaller protrusion of the summit, less sharp intercellular ridges and the tendency to develop ornamentation in the form of secondary ridges and tubercles in the apical part.

Distribution. — Gobi Desert, Nemegt Basin.

***Mesochara laminata* n. sp.**

(Pl. XII, Fig. 1; Pl. XXVII, Fig. 3)

Type specimen: Z.Pal.No.MgChar-II/E-1; Pl. XII, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *lamina* — *lamina*.

Diagnosis. — Gyrogonites small, subprolate, with pointed summits and protruding bases; ranging in length from 380 to 430 μ and in width from 317 to 330 μ . Eight convolutions visible in lateral view. Cellular spirals flat with secondary ridges wider and higher than intercellular ridges. Spirals continue on to the summit without changing their size. The ends of cellular spirals very strongly protruding, contacting each other at one point. Basal pore with outer opening at the same level as the surface of the surrounding spirals. Basal plug unknown.

Material. — Four well-preserved specimens, from the Nemegt Basin: Naran Bulak and Tsagan Khushu. Samples Nos.: CE-3, NB-, NB-9.

Measured gyrogonites of *Mesochara laminata* n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
E-1	380	317	120	200	53	8	45
Hk-2	422	325	130	187	44	8	40
Kz-4	425	330	129	237	54	8	45
C-13	430	325	132	220	51	8	45
Range:	380—430	317—330	120—132	187—237	44—54	8	40—45

Description. — Gyrogonites small, subprolate (ISI 120—132) and ellipsoidal (ANI 44—54), with strongly protruding summits and slightly elongate bases; ranging in length from 380 to 430 μ and in width from 317 to 330 μ . Eight convolutions visible in lateral view. Cellular spirals separated from each other by low and narrow intercellular ridges. The middle part of spirals is filled with very wide and high secondary ridges. On the equator, spirals are 40 to 45 μ wide. Cellular spirals reach the summit without changing their width. The ends of spirals strongly protruding and contacting each other at one point. The outer opening of the basal pore at the same level as the ends of surrounding spirals. Equatorial angle about 10°.

In longitudinal section, cellular spirals thick (about 46 μ) and composed of two cal-

cification zones; the inner one very thin, darker and fine-crystalline, the outer very thick, light-coloured and composed of many small layers of calcium carbonate. A distinct protrusion of the ends of spirals is visible in the apical center. Basal plug not preserved.

Remarks. — The specimens of *Mesochara laminata* n. sp. are most similar to those of *Mesochara terebrata* n. sp., from which they differ in shape (lower ISI) and less extended base.

Distribution. — Gobi Desert, Nemegt Basin.

***Mesochara* sp.**
(Pl. XI, Fig. 2)

Material. — Two well-preserved specimens, from Nemegt Basin, Naran Bulak. Sample No. NB-9.

Measured gyrogonites of *Mesochara* sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
F-28	455	285	160	225	50	9	45
E-17	510	315	162	260	51	9	50

Description. — Gyrogonites middle-sized, prolate (ISI 160, 162) and ellipsoidal (ANI 50 and 51), with strongly protruding summits and bases; 455 and 510 μ long and 285 and 315 μ wide. Nine convolutions visible in lateral view. Cellular spirals concave, with secondary ridges. Intercellular ridges with poorly visible sutures, somewhat higher and wider than the secondary ridges. On the equator spirals are 45 and 50 μ wide. In the apical part, spirals are strongly protruding, reaching the summit without changing their width and contacting each other at one point. Secondary ridges disappear on the apical periphery. Small tubercles are visible just below the summit. The outer opening of the basal pore at the same level as the ends of the surrounding spirals. Equatorial angle about 15°.

Remarks. — The specimens of *Mesochara* sp. are most similar to those of *Mesochara terebrata* n. sp., from which they differ in a more elongate shape, more protruding summits and bases and in larger equatorial angle.

Distribution. — Gobi Desert, Nemegt Basin.

Genus **GOBICHARA** nov.

Type species: *Gobichara deserta* n. sp.

Derivation of the name: after the Gobi Desert in which specimens of this genus were found.

Diagnosis. — Gyrogonites prolate-spheroidal, subprolate and prolate, with rounded summits and protruding bases. In the apical part, cellular spirals not modified. Most specimens are ornamented with secondary ridges and tubercles occurring in the apical part. In longitudinal section, two calcification zones; the inner one fine-crystalline, darker, the outer light-coloured, crystalline, with an indistinct lamination. Basal plug is composed of two zones, very thin.

Description. — Gyrogonites varying in shape from prolate-spheroidal to prolate (ISI 100—176), with rounded summits and protruding bases. Seven to twelve convolutions are visible in lateral view. Spirals reach the summit without changing their width or only slightly narrowing; in the apical center, they contact each other along a zigzag line. The outer opening of the basal pore at the same level as the thickened ridges of surrounding spirals. In most specimens, the ornamentation occurs in the form of secondary ridges sometimes higher and wider than the intercellular ridges. Secondary ridges disappear on the apical periphery. In many specimens, variously shaped tubercles occur in the apical parts of spirals.

In longitudinal section, two calcification zones are visible; the inner one darker, very thin, fine-crystalline and the outer light-coloured, thicker and with a poorly marked lamination. In the apical part, cellular spirals are the same in thickness or slightly thinner than on the equator. Basal plug thin, flat, composed of two zones, closing a wide, funnel-like canal of the basal pore.

Remarks. — *Gobichara* n. gen. is most similar to *Harrisichara* GRAMBAST, 1957, from which it differs only in the lack of a columnlike extension („colonne”) of the basal part, the presence of which is considered by GRAMBAST as a fundamental generic feature of *Harrisichara* (GRAMBAST, 1957).

***Gobichara deserta* n. gen., n. sp.**

(Pl. XV, Figs. 1-5; Pl. XVI, Figs. 1-6; Pl. XIX, Fig. 1; Text-fig. 10-11)

Type specimen: Z.Pal.No.MgChar-II/D-15; Pl. XV, Fig. 2.

Type horizon and locality: Paleogene (White Beds) Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *deserta* = desert.

Diagnosis. — Gyrogonites small, subprolate, with slightly rounded summits and protruding bases; ranging in length from 320 to 475 μ and in width from 250 to 355 μ . Seven to eleven convolutions visible in lateral view. In the apical part, cellular spirals are not modified. Ornamentation in the form of secondary ridges and comma-shaped tubercles occurring in the apical part. Basal plug very thin.

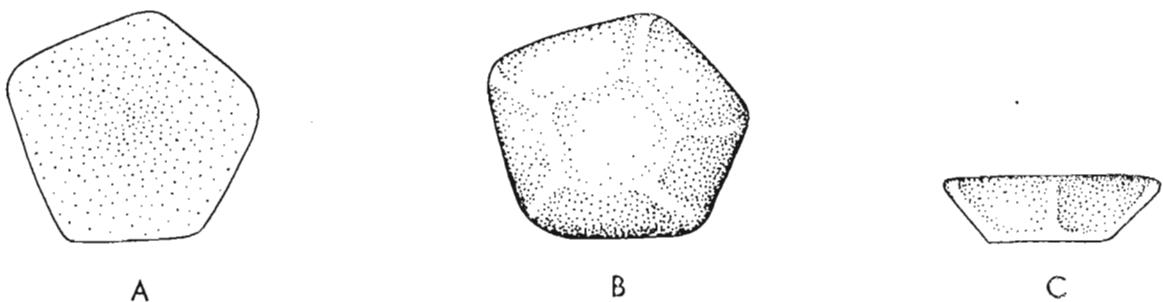


Fig. 10

Gobichara deserta n. gen., n. sp.: the basal plug; a upper side, b lower side, c lateral view. Width of the basal plug 65 μ .

Material. — More than 200 well-preserved specimens and several fragments, from the Nemegt Basin: Naran Bulak, Tsagan Khushu and Ulan Bulak. Samples Nos.: CE-2, CE-3, NB-, NB-9, NB-15, NB-18, UB-1a.

Measured gyrogonites of *Gobichara deserta* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Lp-7	320	250	128	167	52	8	35
Hd-12	335	260	129	157	47	9	35
Kab-10	345	277	129	167	48	7	32
Hd-9	345	287	120	167	49	9	45
He-7	382	320	119	180	47	9	42
Lad-3	412	305	135	195	47	10	32
Mo-2	415	317	131	180	43	11	37
Lac-3	420	315	131	182	41	10	40
Ku-13	430	332	129	195	44	9	55
Lz-1	475	355	130	225	48	9	50
Range:	320—475	250—355	119—135	157—225	41—52	7—11	32—55

Description. — Gyrogonites small, subprolate (ISI 119—135) and ellipsoidal (ANI 41—52), with slightly rounded summits and somewhat protruding bases; ranging in length from 320 to 475 μ and in width from 250 to 355 μ . Seven to eleven convolutions visible in lateral view. Cellular spirals are separated from each other by high intercellular ridges, have poorly visible sutures, reach the summit without changing their width and contact each other along a zigzag line. Secondary ridges, mostly narrower and lower than the intercellular ridges and less frequently equalling them, occur in the centres of cellular spirals. Secondary ridges have mostly a slightly undulate trace. The secondary ridges disappear on the apical periphery and comma-shaped tubercles appear in the apical center at slightly extended ends of cellular spirals. The outer opening of the basal pore at the same level as the thickened ridges of the surrounding spirals.

Two calcification zones are visible in longitudinal section, the inner one being very thin, fine-crystalline and outer light-coloured, thicker and slightly laminate. In the apical part, cellular

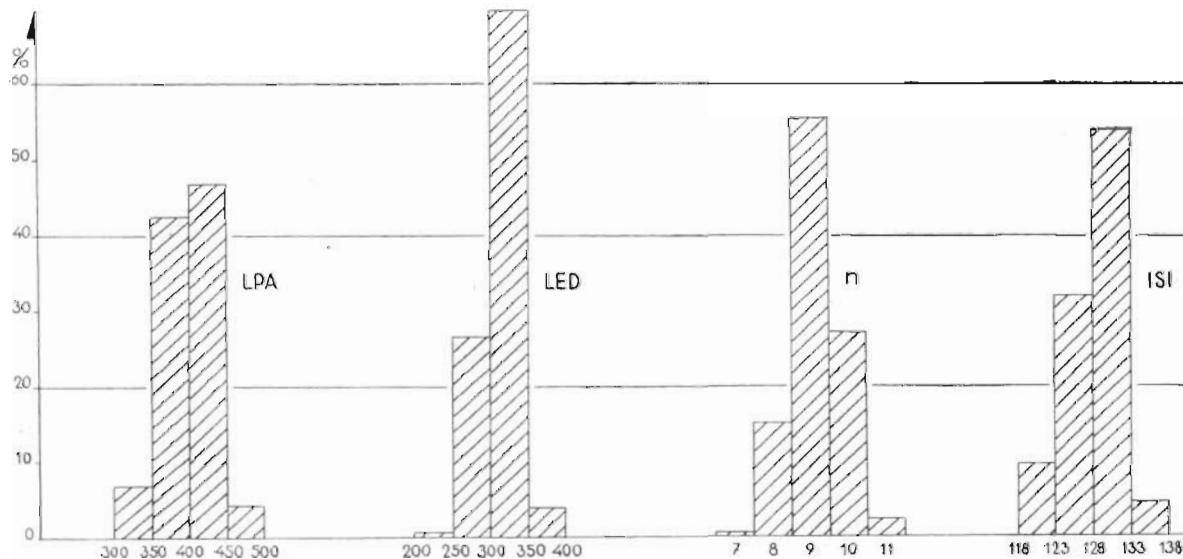


Fig. 11

Gobichara deserta n. gen., n. sp.: the variability in the length (LPA), width (LED), number of spirals and index shape (ISI), for 200 specimens.

spirals are of the same thickness as on the equator. Basal plug very thin, also composed of two zones. Equatorial angle about 8°.

Remarks. — *Gobichara deserta* n. sp. differ from all other species of this genus in the shape of gyrogonites, shape of the apical part, presence of comma-shaped tubercles and in an undulate trace of secondary ridges.

The specimens of *G. deserta* n. sp. are most similar to those of *Gobichara nigra* n. sp., from which they differ primarily in shape. The shape index (ISI) of *G. deserta* n. sp. is contained within an interval of 119 to 135, the most frequent specimens having ISI from 128 to 133, while the shape index of *G. nigra* n. sp. is contained within an interval of 131 to 149, the most frequent specimens having ISI from 135 to 140. The differences in the shape of these two species are illustrated by a diagram of the distribution of ISI (Text-fig. 12).

Other differences between these species concern the shape of tubercles in the apical part, the trace of secondary ridges and the size of equatorial angle.

Distribution. — Gobi Desert, Nemegt Basin.

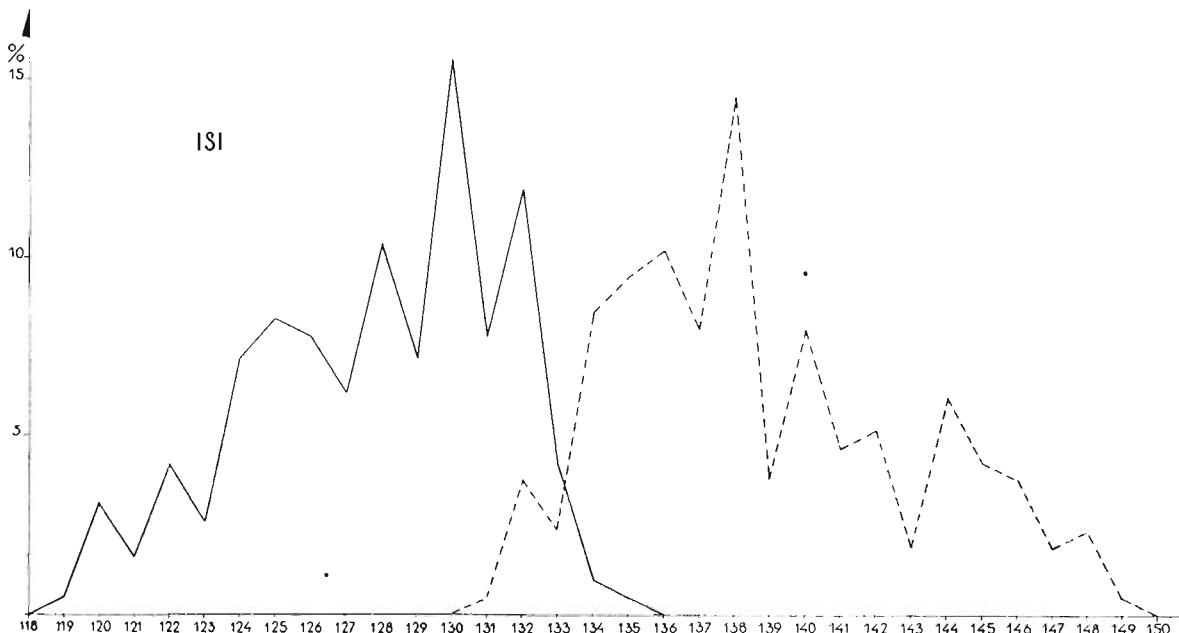


Fig. 12

The variability in the shape index of gyrogonites of *Gobichara deserta* n. gen., n. sp. — continuous line and *G. nigra* n. gen., n. sp. — broken line.

Gobichara nigra n. gen., n. sp.

(Pl. VIII, Figs. 3-4; Pl. XII, Figs. 2-5; Pl. XIII, Figs. 1-7; Pl. XIV, Figs. 2-4; Pl. XVIII, Fig. 4; Text-fig. 13)

Type specimen: Z.Pal.No.MgChar-II/D-4; Pl. XII, Fig. 2.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *niger* = black.

Diagnosis. — Gyrogonites small, prolate, with rounded summits and slightly elongated bases; ranging in length from 335 to 500 μ and in width from 227 to 365 μ . Seven to eleven convolutions visible in lateral view. In the apical part, cellular spirals are not modified and

the same in thickness and width as on the equator. In most specimens, ornamentation in the form of secondary ridges. Basal plug thin, closing a funnel-like canal of the basal pore.

Material. — More than 200 well-preserved specimens and several fragments, from the Nemegt Basin: Naran Bulak, Tsagan Khushu and Ulan Bulak. Samples Nos.: CE-2, CE-3, NB-, NB-9, NB-15, NB-18, UB-1a.

Measured gyrogonites of *Gobichara nigra* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Lv-17	335	242	138	155	46	10	32
Lw-19	340	227	145	167	49	9	40
Mt-13	420	282	149	175	42	10	42
Hi-14	440	325	135	267	60	9	45
Kt-7	440	300	146	172	39	10	45
Mt-5	452	345	131	207	49	10	45
Lab-4	462	332	140	210	46	11	32
F-1	467	342	136	210	45	7	60
D-22	480	365	132	235	49	8	50
Lz-2	500	360	138	245	49	9	52
Range:	335—550	227—365	131—149	155—267	39—60	7—11	32—60

Description. — Gyrogonites small, prolate (ISI 131—149), subovoidal and ellipsoidal (ANI 39—60), with rounded summits and slightly protruding bases; ranging in length from 335 to 500 μ and in width from 227 to 365 μ . Seven to eleven convolutions visible in lateral view. Cellular spirals reach the summit without changing their width, their inside being filled by secondary ridges which disappear in the apical periphery. Two morphological types, varying in the degree of calcification may be distinguished in the species under study. Type I is represented by gyrogonites in which secondary ridges are lower than or equalling the intercellular

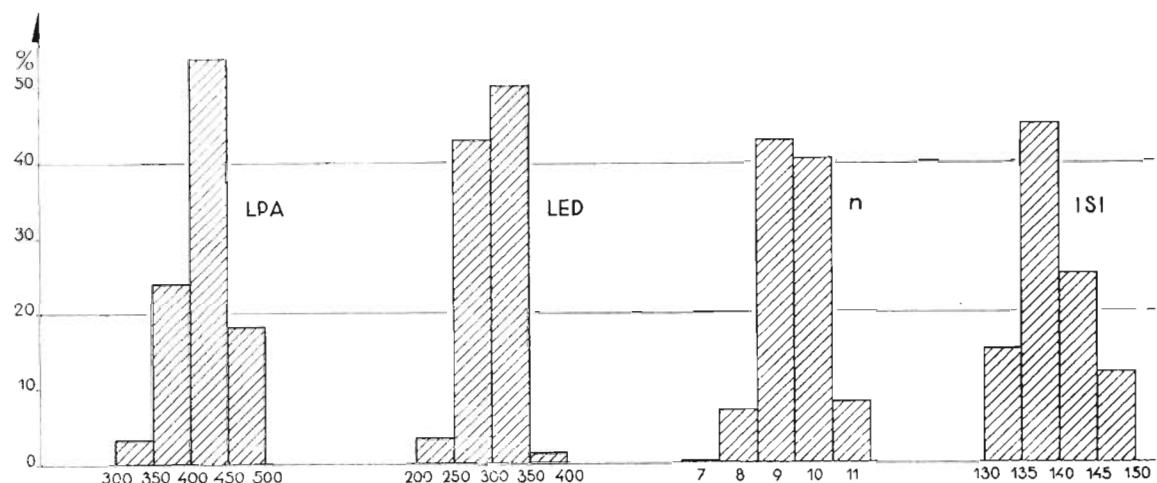


Fig. 13

Gobichara nigra n. gen., n. sp.: the variability in the length (LPA), width (LED), number of spirals (n) and index shape (ISI), for 200 specimens.

ridges and the apical part is devoid of tubercles (Pl. XII, Figs. 2—5). In type II, secondary ridges are much higher and wider than the intercellular ridges and large tubercles occur in their apical part (Pl. XIII, Figs. 1—7). In longitudinal section (Pl. XIII, Figs. 5—7), type II displays much thicker cellular spirals than those in type I (Pl. XII, Figs. 4—5). Several transitional forms occur between these two types. Specimens with concave cellular spirals, devoid of secondary ridges (Pl. XIV, Figs. 3—4) are rare. The outer opening of the basal pore situated at the same level as the thickened ridges of the surrounding spirals. Basal plug very thin, flat, monolaminate. Equatorial angle about 15°.

Remarks. — The specimens of *Gobichara nigra* n. gen., n. sp. are most similar to those of *Gobichara deserta* n. sp., from which they differ in the shape of gyrogonites (Text-fig. 12), trace of secondary ridges, shape of tubercles in the apical part and size of equatorial angle.

Distribution. — Gobi Desert, Nemegt Basin.

***Gobichara rubra* n. gen., n. sp.**

(Pl. XIV, Fig. 1; Pl. XVIII, Figs. 3, 5)

Type specimen: Z.Pal.No.MgChar-II/D-23; Pl. XIV, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Tsagan Khushu, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *rubra* = red.

Diagnosis. — Gyrogonites small, prolate (ISI 152—162), with rounded summits and strongly protruding bases; ranging in length from 375 to 500 μ and in width from 240 to 322 μ . Nine to twelve convolutions visible in lateral view. In the apical part, cellular spirals not modified, the same in thickness and width as on the equator. Ornamentation in the form of secondary ridges and tubercles in the apical part. Basal plug very thin and flat, closing a funnel-like canal of the basal pore.

Material. — Seventeen well-preserved specimens, from the Nemegt Basin: Naran Bulak, Tsagan Khushu. Samples Nos.: CE-2, CE-3, NB-, NB-9, NB-15.

Measured gyrogonites of *Gobichara rubra* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Hd-2	375	240	156	155	41	10	35
Hk-13	380	250	152	167	40	9	45
Hd-3	392	250	157	162	41	10	37
Hd-1	397	250	158	195	49	11	35
D-23	420	275	152	180	43	11	40
B-20	427	280	153	186	41	9	47
Kv-20	465	305	152	210	45	10	42
Kv-8	485	300	162	227	47	9	42
Kv-10	488	285	158	170	38	10	45
Hd-5	500	322	155	202	40	12	37
Range:	375—500	240—322	152—162	155—227	38—49	9—12	35—47

Description. — Gyrogonites small, prolate (ISI 152—162), subovoidal and ellipsoidal (ANI 38—49), with rounded summits and strongly protruding bases; ranging in length from 375 to 500 μ and in width from 240 to 322 μ . Nine to twelve convolutions visible in lateral

view. Cellular spirals reach the summit without changing their thickness and width. Ornamentation in the form of secondary ridges, equalling the intercellular ridges in width and height. The last-named ridges disappear on the periphery of a small apical area. Round tubercles are developed in the apical center. The outer opening of the basal pore small, at the same level as the ridges of surrounding spirals.

In longitudinal section, cellular spirals are thin, with two calcification zones, the inner one dark, very thin, fine-crystalline, the outer light-coloured, four times thicker and indistinctly laminate. Basal plug very thin, monolaminate. The canal of basal pore shaped like an elongate funnel (Pl. XVIII, Fig. 3). Equatorial angle about 15°.

Remarks. — The specimens of *Gobichara rubra* n. gen., n. sp. are most similar to those of *Gobichara nigra* n. sp., from which they differ in a more elongate shape, narrower apical area, more protruding basal part, as well as in narrower and thinner cellular spirals.

Distribution. — Gobi Desert, Nemegt Basin.

Gobichara tenera n. gen., n. sp.

(Pl. XVII, Figs. 1-6; Text-fig. 14)

Type specimen: Z.Pal.No.MgChar-II/D-9; Pl. XVII, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Naran Bulak, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *tenuer* = delicate.

Diagnosis. — Gyrogonites small, prolate-spheroidal and subprolate, with widely rounded summits and slightly protruding bases; ranging in length from 270 to 460 μ and in width from 250 to 387 μ . Seven to ten convolutions visible in lateral view. Ornamentation in the form of secondary ridges, marked by an undulate trace, and of tubercles in the apical part. Basal plug unknown.

Material. — About 100 well-preserved specimens, from the Nemegt Basin: Naran Bulak, Tsagan Khushu. Samples Nos.: CE-2, CE-3, NB-, NB-9, NB-15, NB-18.

Measured gyrogonites of *Gobichara tenera* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
Hk-1	270	250	108	107	40	8	25
Hk-9	300	250	120	137	46	10	25
Lo-5	330	307	107	125	38	7	40
Hg-3	332	332	100	145	44	9	40
F-11	365	325	112	212	58	9	40
Lo-8	375	312	120	125	32	8	40
Kac-3	375	305	123	165	44	7	37
Hk-15	382	312	123	187	49	10	40
Lm-8	435	375	116	200	46	8	50
Lm-1	460	387	118	220	48	9	50
Range:	270—460	250—387	100—123	107—220	32—58	7—10	25—50

Description. — Gyrogonites small, prolate-spheroidal and subprolate (ISI 100—123), subovoidal and ellipsoidal (ANI 32—58), with widely rounded summits and slightly protruding bases; ranging in length from 270 to 460 μ and in width from 250 to 387 μ . Seven to ten con-

volutions visible in lateral view. Intercellular ridges sharp, with very poorly visible sutures. In the apical part, cellular spirals not modified, the same in thickness and width as on the equator. Ornamentation in the form of narrow and undulate secondary ridges and small, irregular tubercles in the apical part. Secondary ridges disappear on the apical periphery. The opening of the basal pore at the same level as the ends of the surrounding spirals.

Two poorly visible calcification zones are visible in longitudinal section. Equatorial angle about 10°.

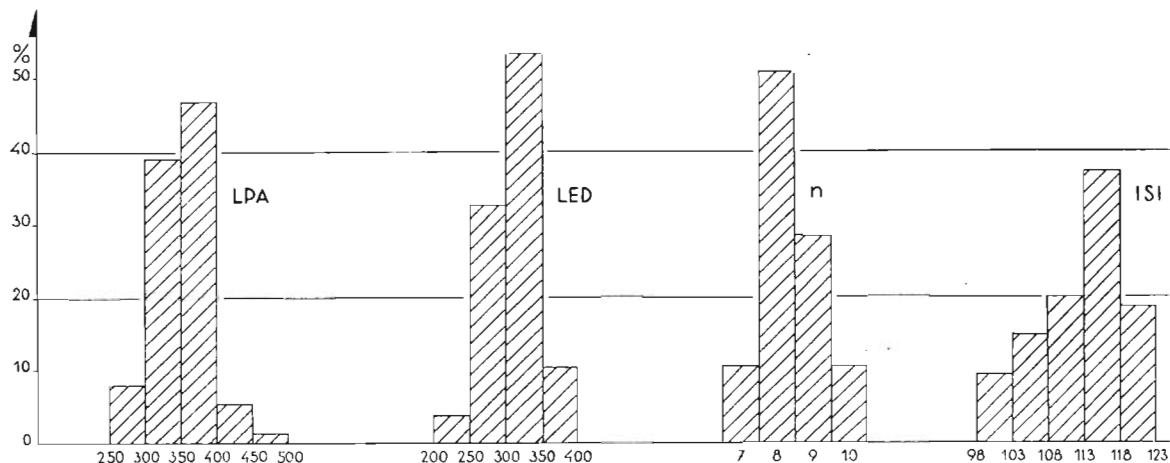


Fig. 14

Gobichara tenera n. gen., n. sp.: the variability in the length (LPA), width (LED), number of spirals (n) and index shape (ISI), for 80 specimens.

Remarks. — The specimens of *Gobichara tenera* n. gen., n. sp. are most similar to those of *Gobichara deserta* n. sp., from which they differ in the shape of gyrogonites and structure of intercellular ridges and tubercles in the apical part.

Distribution. — Gobi Desert, Nemegt Basin.

***Gobichara alba* n. gen., n. sp.**

(Pl. XVIII, Figs. 1-2)

Type specimen: Z.Pal.No.MgChar-II/E-16; Pl. XVIII, Fig. 1.

Type horizon and locality: Paleogene (White Beds), Tsagan Khushu, Nemegt Basin, Gobi Desert.

Derivation of the name: Lat. *alba* = white.

Diagnosis. — Gyrogonites small, prolate (ISI 170—176), with rounded summits and very strongly protruding bases; ranging in length from 380 to 440 μ and in width from 220 to 250 μ . Nine to ten convolutions visible in lateral view. Cellular spirals reach the summit without changing their width. Ornamentation in the form of secondary ridges. Basal plug unknown.

Material. — Three well-preserved specimens, from the Nemegt Basin: Naran Bulak, Tsagan Khushu, Ulan Bulak. Samples Nos.: CE-3, NB-15, UB-1a.

Description. — Gyrogonites small, very long (ISI 170—176), subovoidal and ellipsoidal (ANI 37—50), with rounded summits and strongly protruding bases; ranging in length from

Measured gyrogonites of *Gobichara alba* n. gen., n. sp.

Z.Pal.No. MgChar-II	LPA in μ	LED in μ	ISI	AND in μ	ANI	Numb. conv.	Width conv. at EA in μ
E-2	380	220	172	140	37	10	37
E-16	395	232	170	210	50	9	40
Mu-2	440	250	176	195	45	10	35

380 to 440 μ and in width from 220 to 250 μ . Nine to ten convolutions visible in lateral view. Cellular spirals reach the summit without changing their width and join each other along a short, zigzag line. Ornamentation in the form of secondary ridges, varying in height, but in all cases lower than the intercellular ridges. The opening of the basal pore at the same level as the ends of the surrounding spirals. Equatorial angle about 15°.

Remarks. — The specimens of *Gobichara alba* n. gen., n. sp. are most similar to those of *Gobichara rubra* n. sp., from which they differ in a more elongate shape and slightly more protruding base. The shape index in *G. alba* n. sp. is contained within limits of 170 to 176, while in *G. rubra* n. sp. it amounts from 152 to 162.

Distribution. — Gobi Desert, Nemegt Basin.

Department of Paleontology
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Warszawa, May 1971

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PLATES

J. KARCZEWSKA & M. ZIEMBÍŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE VII



1a



2a



3a



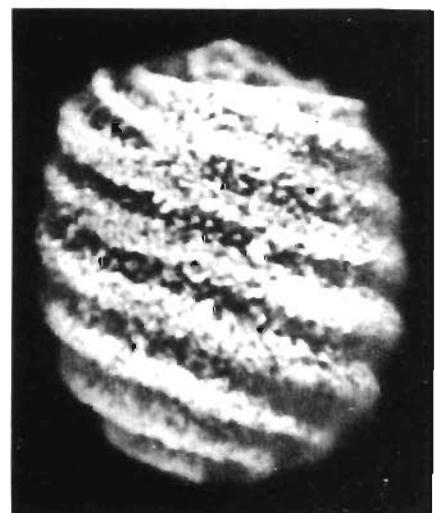
2b



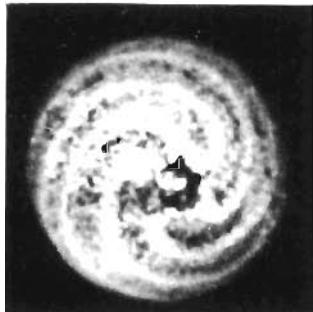
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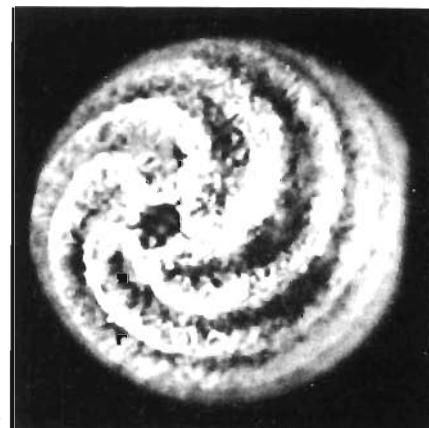
1b



3b



2c



3c

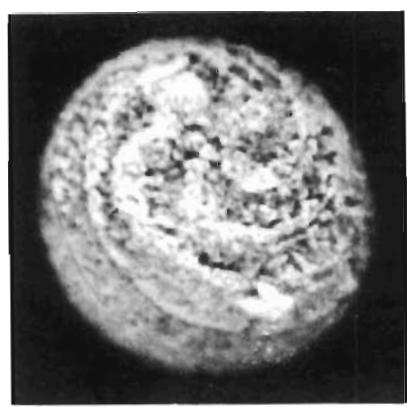
J. KARCZEWSKA & M. ZIEMBINSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE VIII

Page	54
<i>Nemegtichara prima</i> n. gen., n. sp.
Fig. 1. Naran Bulak (Z.Pal.No.MgChar-II/D-19): a basal view, b lateral view, c apical view; $\times 100$.	
Fig. 2. Tsagan Khushu (Z.Pal.No.MgChar-II/D-24): a apical view, b lateral view; $\times 100$.	
Fig. 5. Tsagan Khushu (Z.Pal.No.MgChar-II/D-27): lateral view; $\times 100$.	
Fig. 6. Tsagan Khushu (Z.Pal.No.MgChar-II/B-15): longitudinal section through gyrogonite; $\times 150$.	
<i>Gobichara nigra</i> n. gen., n. sp.
75	
Fig. 3. Naran Bulak (Z.Pal.No.MgChar-II/D-20): a basal view, b lateral view; $\times 100$.	
Fig. 4. Naran Bulak (Z.Pal.No.MgChar-II/D-21): apical view; $\times 100$.	

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

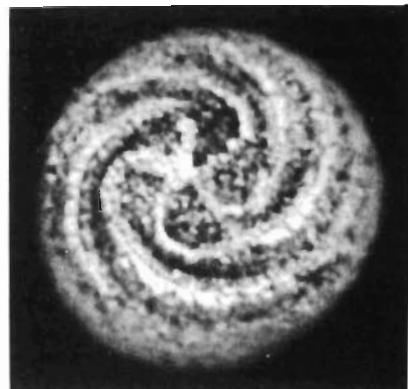
Photo: L. Luszczewska.



1a



2a



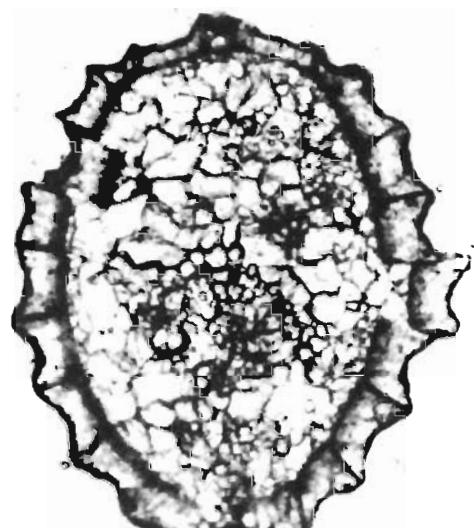
1c



2b

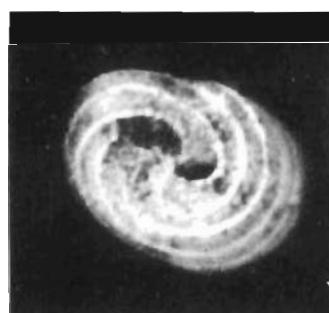


3a

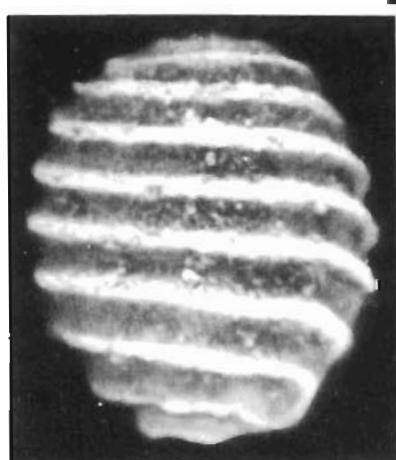


6

1b



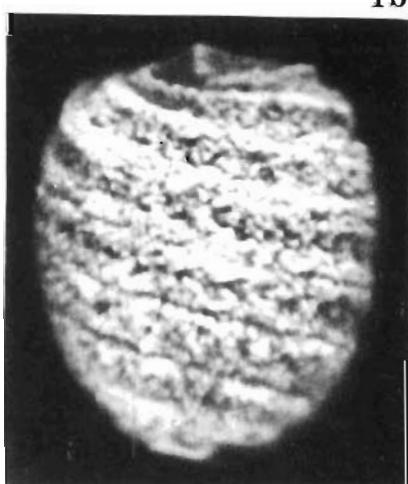
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5



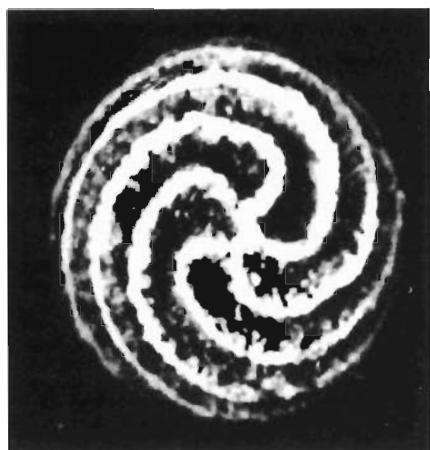
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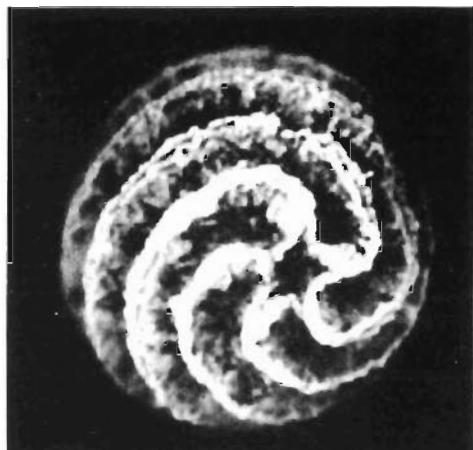
J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE IX

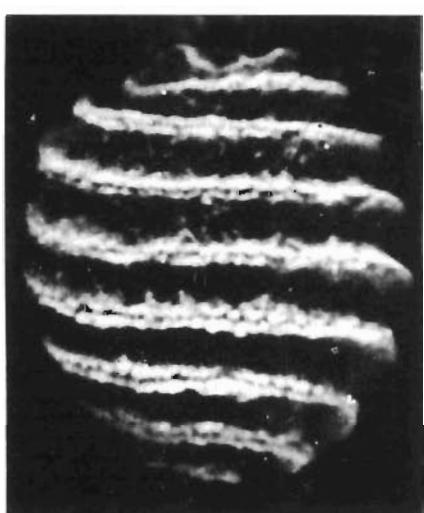
Photo: L. Luszczewska



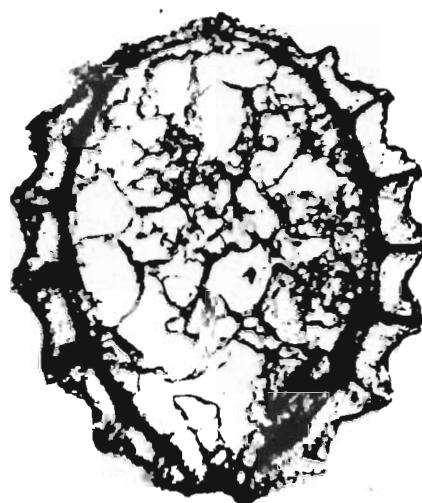
1a



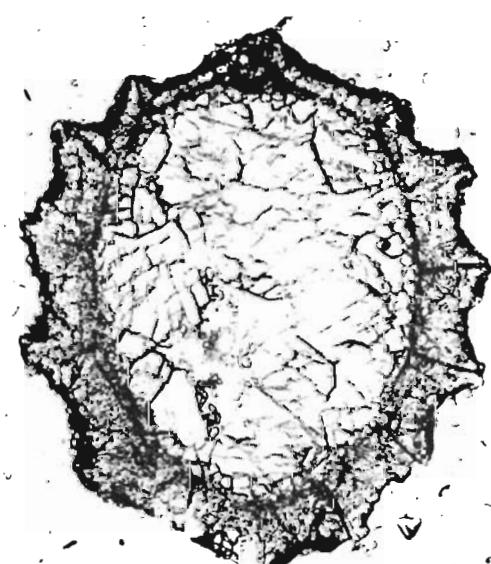
1c



1b



2



3



4

J. KARCZEWSKA & M. ZIEMBICKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE X

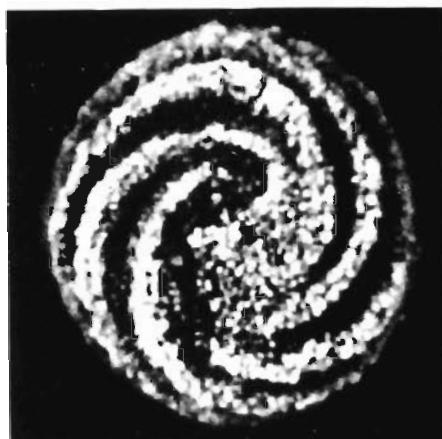
Fig. 1. Naran Bulak (Z.Pal.No.MgChar-II/D-8): *a* apical view, *b* lateral view, *c* basal view; $\times 100$. Type specimen.
 Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/E-15): *a* apical view, *b* lateral view; $\times 100$.

Nestling Peafowl Chicks Develop Monoclonal B cell Lines in White Pectoral Glands

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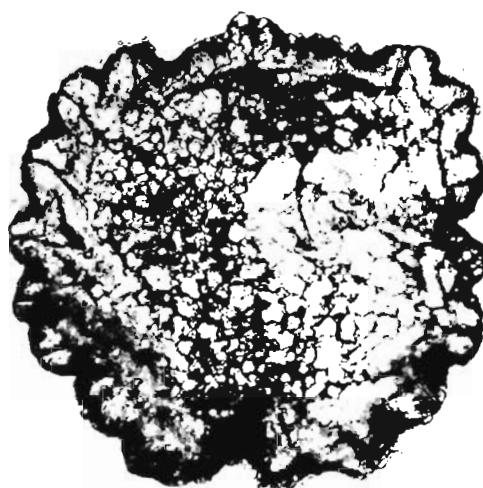
1a



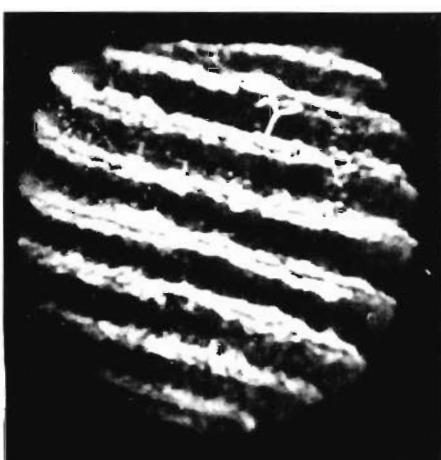
2a



1c



3



1b

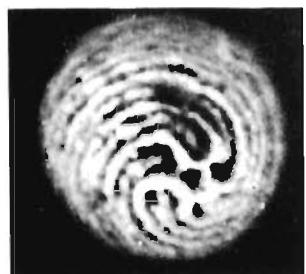


2b

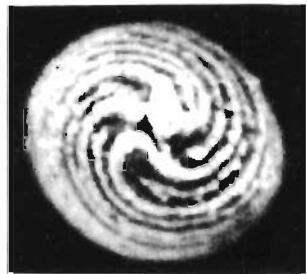
J. KARCZEWSKA & M. ZIEMBINSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XI

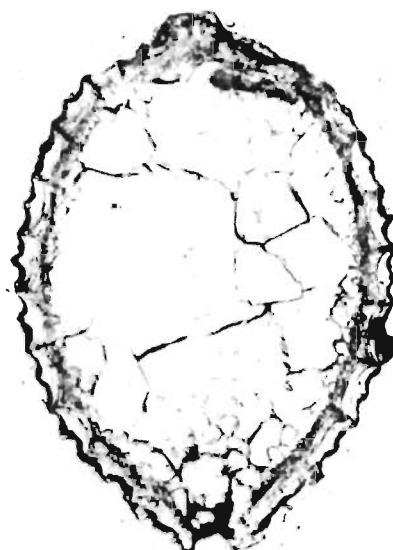
	Page
<i>Mesochara terebrata</i> n. sp.	69
Fig. 1. Naran Bulak (Z.Pal.No.MgChar-II/D-16): <i>a</i> basal view, <i>b</i> lateral view, <i>c</i> apical view; $\times 100$. Type specimen.	
Fig. 3. Tsagan Khushu (Z.Pal.No.MgChar-II/B-5): longitudinal section through gyrogonite; $\times 150$.	
Fig. 4. Tsagan Khushu (Z.Pal.No.MgChar-II/B-14): longitudinal section through gyrogonite; $\times 150$.	
<i>Mesochara</i> sp.	72
Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/E-17): <i>a</i> basal view, <i>b</i> lateral view, <i>c</i> apical view; $\times 100$.	



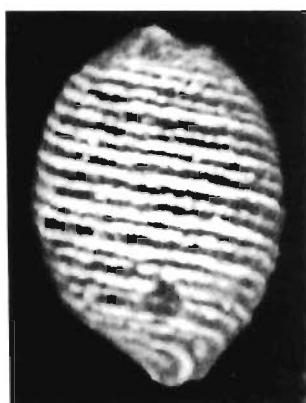
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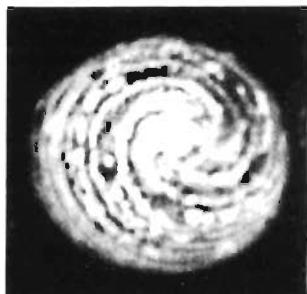
2a



3



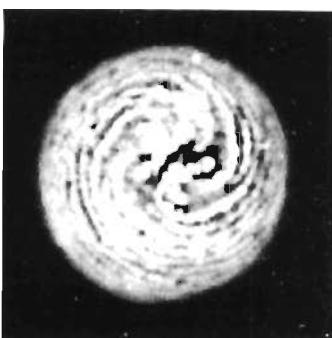
1b



2c



2b



1c



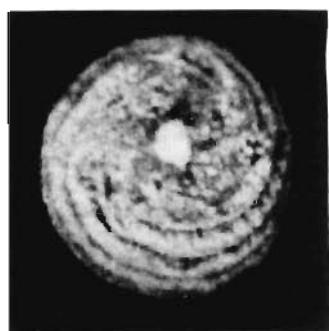
4

J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XII

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

Photo: L. Łuszczewska



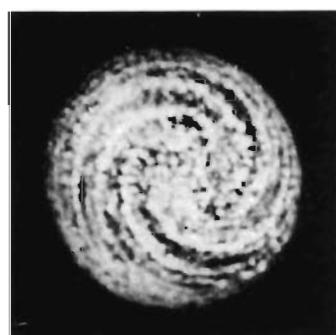
1a



1c



1b



2a



2c



4



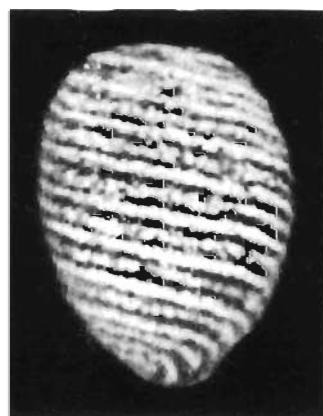
3a



3c



3b



2b



5

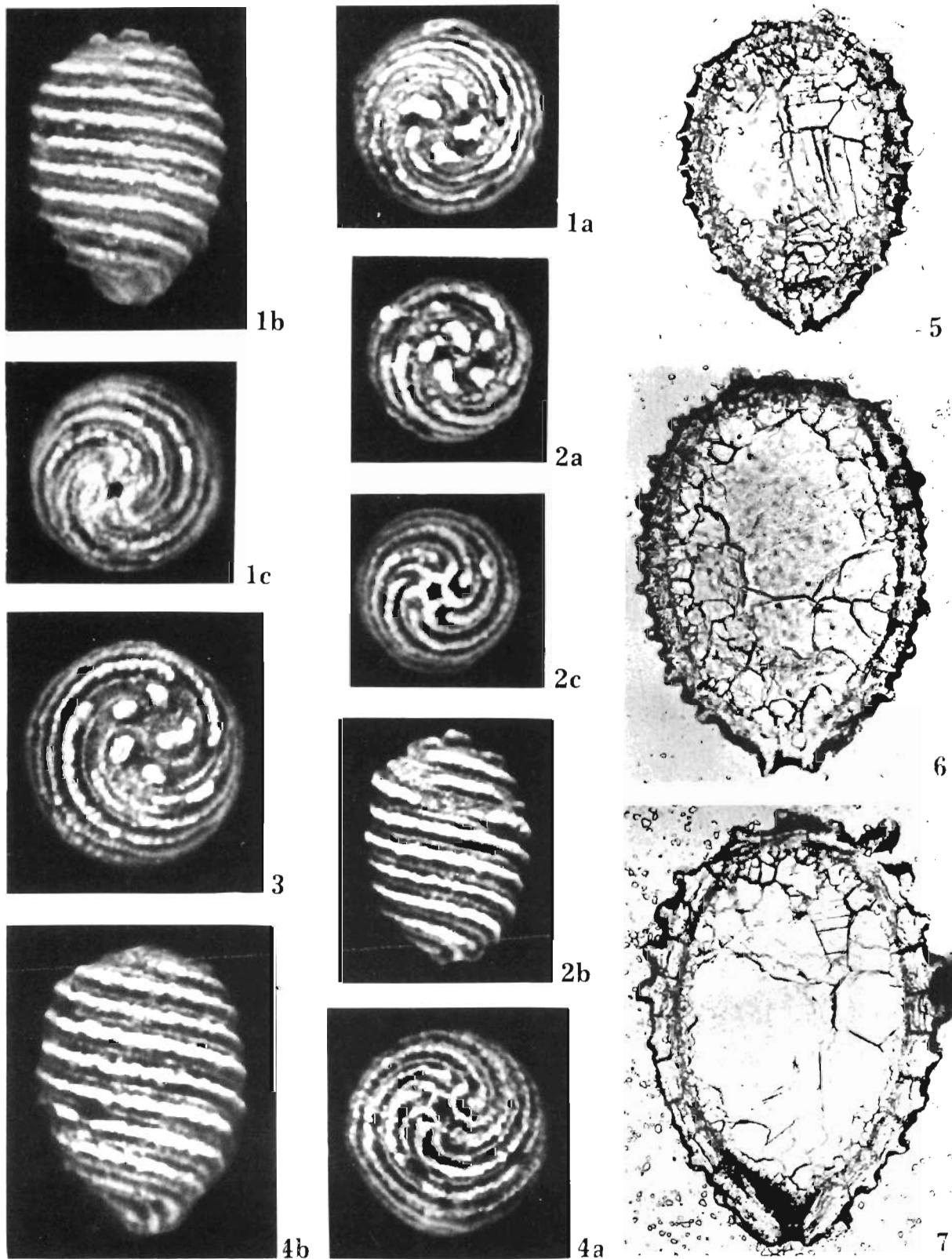
J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XIII

Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/D-33): <i>a</i> apical view, <i>b</i> lateral view, <i>c</i> basal view; $\times 100$. Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/D-32): <i>a</i> apical view, <i>b</i> lateral view, <i>c</i> basal view; $\times 100$. Fig. 3. Naran Bulak (Z.Pal.No.MgChar-II/D-1): apical view; $\times 100$. Fig. 4. Naran Bulak (Z.Pal.No.MgChar-II/D-18): <i>a</i> basal view, <i>b</i> lateral view; $\times 100$. Fig. 5. Tsagan Khushu (Z.Pal.No.MgChar-II/C-5): longitudinal section through gyrogonite; $\times 150$. Fig. 6. Tsagan Khushu (Z.Pal.No.MgChar-II/C-6): longitudinal section through gyrogonite; $\times 150$. Fig. 7. Naran Bulak (Z.Pal.No.MgChar-II/A-3): longitudinal section through gyrogonite; $\times 150$.	Page 75
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Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

Pionta: L. Luszczewska



J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XIV

Page

Gobichara rubra n. gen., n. sp.

77

Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/D-23): *a* apical view, *b* lateral view, *c* basal view; $\times 100$. Type specimen.

75

Fig. 2. Tsagan Khushu (Z.Pal.No.MgChar-II/D-29): *a* apical view, *b* lateral view, *c* basal view; $\times 100$.

Fig. 3. Tsagan Khushu (Z.Pal.No.MgChar-II/D-7): a basal view, b lateral view, c apical view; $\times 100$.

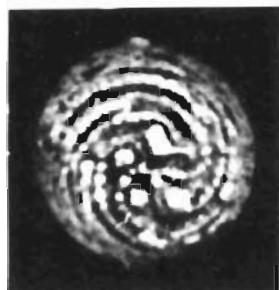
Fig. 4. Tsagan Khushu (Z.Pal.No.MgChar-II/C-3): longitudinal section through gyrogonite; $\times 150$.

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

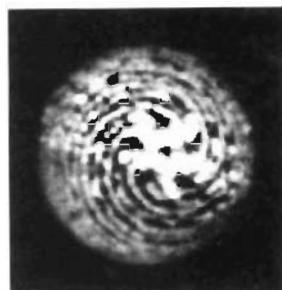
Photo: L. Luszczewska



1b



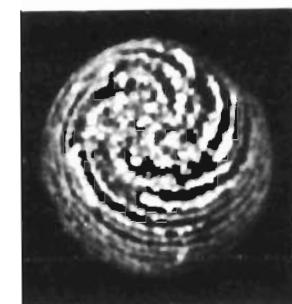
1a



1c



2b



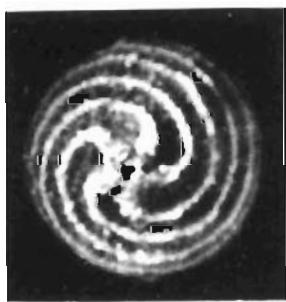
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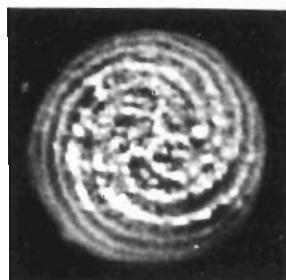
2c



3b



3a



3c



4

J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XV

Page	
73	<i>Gobichara deserta</i> n. gen., n. sp.
Fig. 1.	Naran Bulak (Z.Pal.No.MgChar-II/D-40): <i>a</i> basal view, <i>b</i> lateral view, <i>c</i> apical view; $\times 100$.
Fig. 2.	Naran Bulak (Z.Pal.No.MgChar-II/D-15): <i>a</i> apical view, <i>b</i> lateral view, <i>c</i> basal view; $\times 100$. Type specimen.
Fig. 3.	Naran Bulak (Z.Pal.No.MgChar-II/D-14): <i>a</i> apical view, <i>b</i> lateral view, <i>c</i> basal view; $\times 100$.
Fig. 4.	Naran Bulak (Z.Pal.No.MgChar-II/A-19): longitudinal section through gyrogonite; $\times 150$.
Fig. 5.	Naran Bulak (Z.Pal.No.MgChar-II/A-18): longitudinal section through gyrogonite; $\times 150$.

Nemegt Basin, Gobi Desert, Mongolia. Paleogene (White Beds)

Photo: L. Łuszczewska



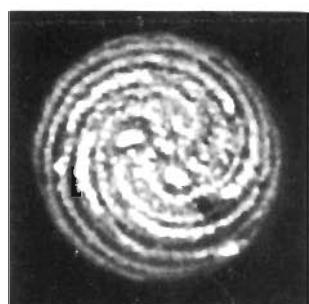
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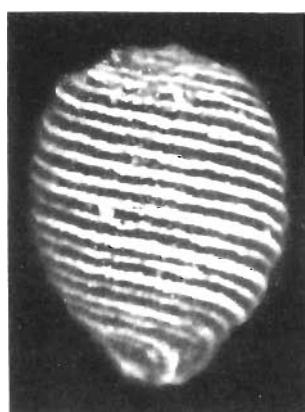
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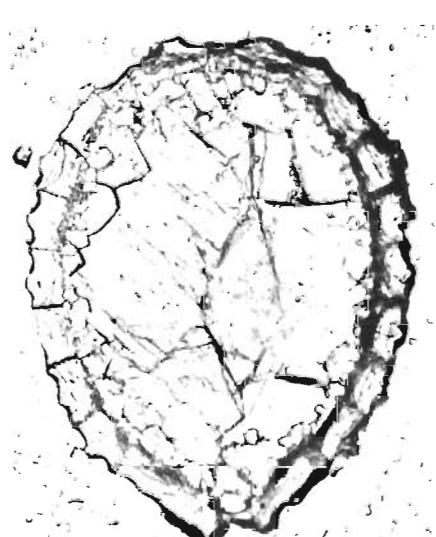
2c



1c



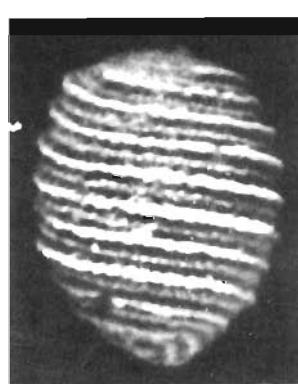
2b



4



3a



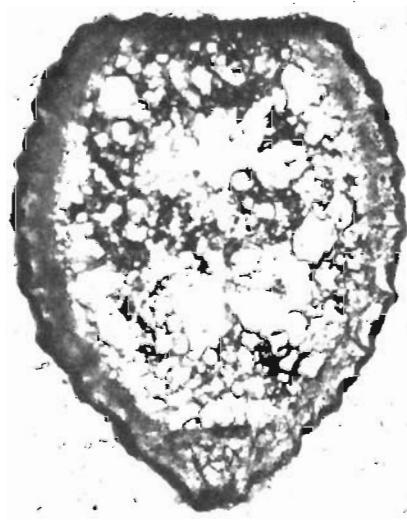
1b



3b



3c



5

J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XVI

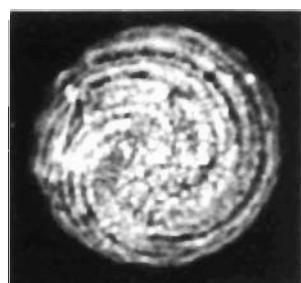
Page
73

Gobichara deserta n. gen., n. sp.

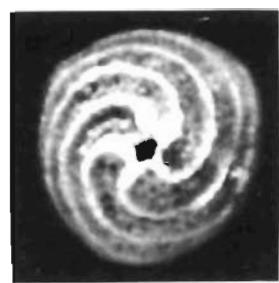
- Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/D-31): *a* apical view, *b* lateral view, *c* basal view; $\times 100$.
Fig. 2. Tsagan Khushu (Z.Pal.No.MgChar-II/D-30): *a* basal view, *b* lateral view, *c* apical view; $\times 100$.
Fig. 3. Tsagan Khushu (Z.Pal.No.MgChar-II/C-4): longitudinal section through gyrogonite; $\times 150$.
Fig. 4. Naran Bulak (Z.Pal.No.MgChar-II/C-12): longitudinal section through gyrogonite; $\times 150$.
Fig. 5. Naran Bulak (Z.Pal.No.MgChar-II/C-2): longitudinal section through gyrogonite; $\times 150$.
Fig. 6. Naran Bulak (Z.Pal.No.MgChar-II/A-15): longitudinal section through gyrogonite; $\times 150$.

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

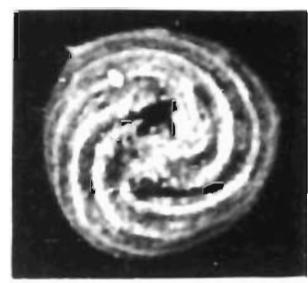
Photo: L. Luszczewska



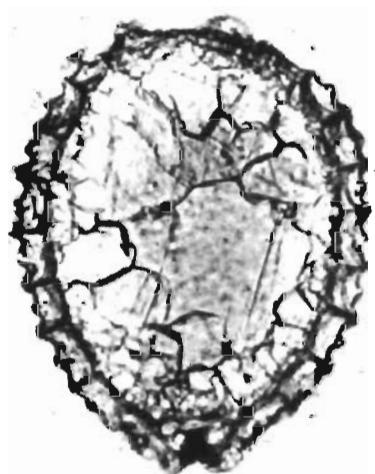
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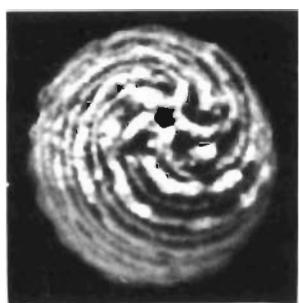
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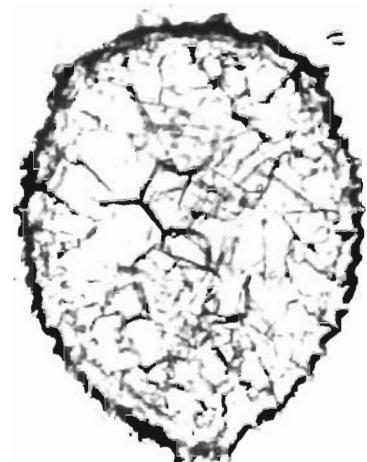
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3



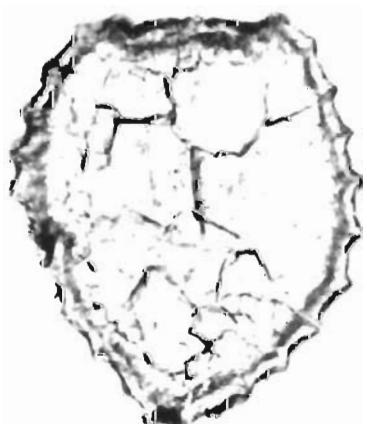
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4



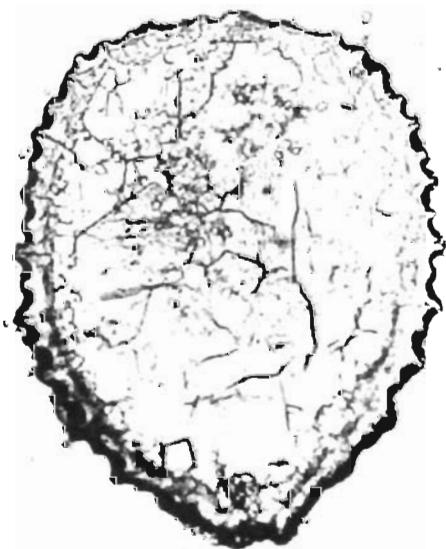
1b



5



2b



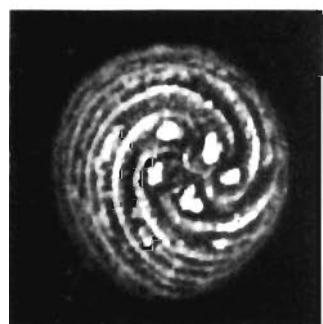
6

J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XVII

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

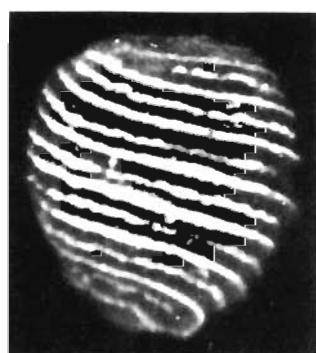
Photo: L. Luszczewska



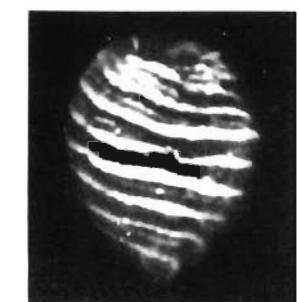
1a



2a



3b



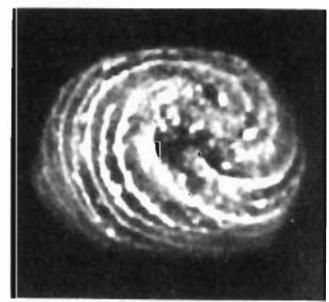
2b



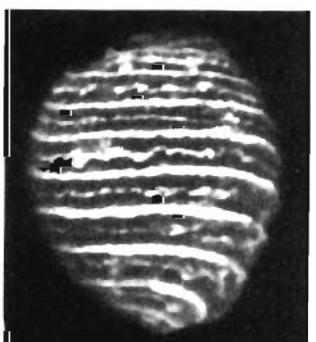
2c



1c



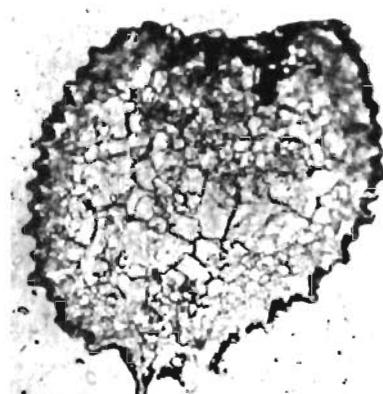
3a



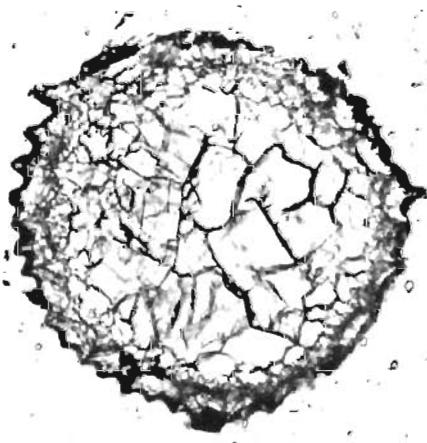
1b



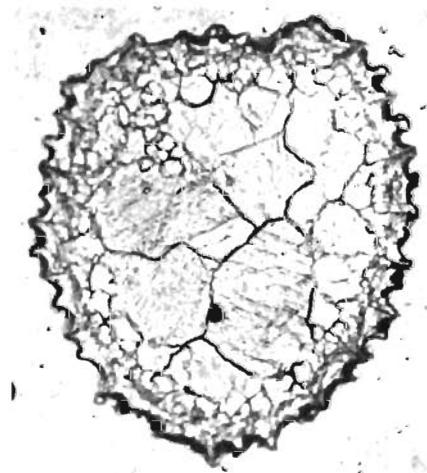
3c



4



5



6

J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XVIII

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

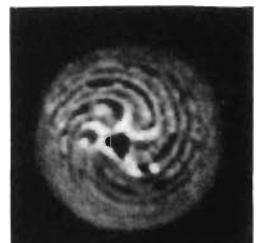
Photo: I. Fuszarewska



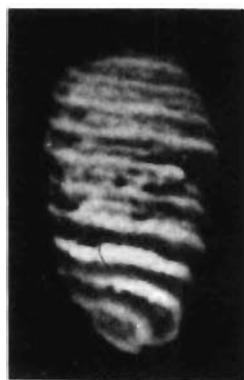
1b



1a



1c



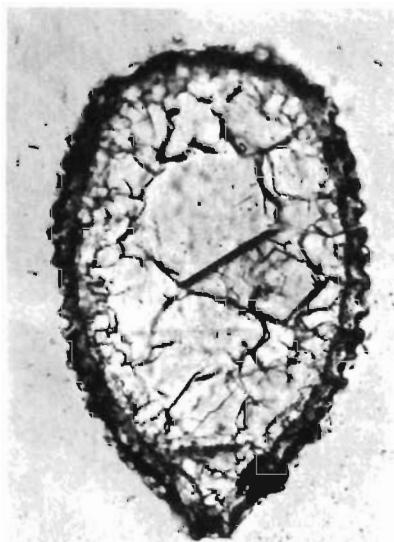
2b



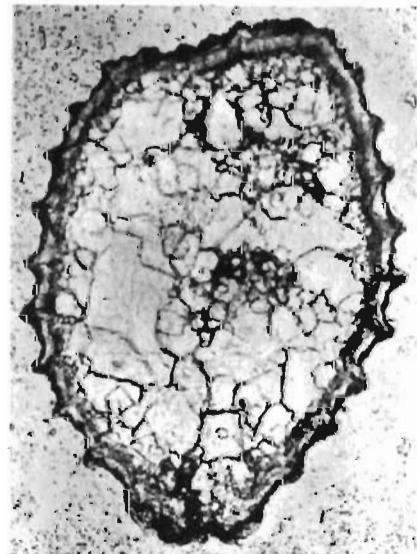
2a



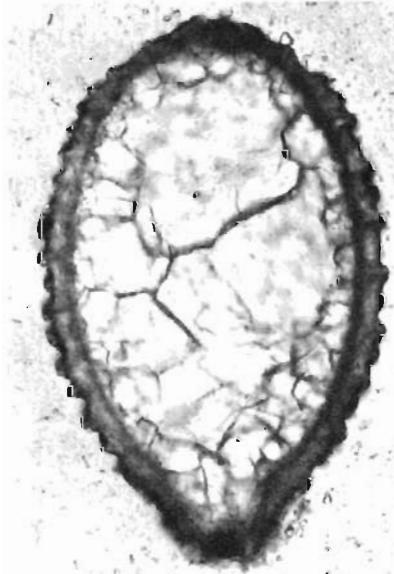
2c



3



4



5

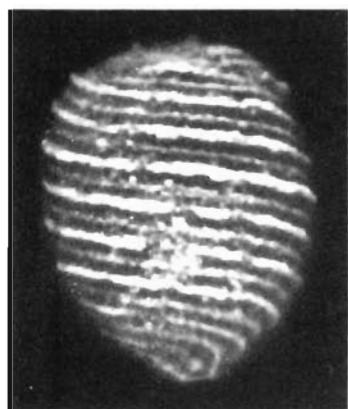
J. KARCZEWSKA & M. ZIEMBIAŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XIX

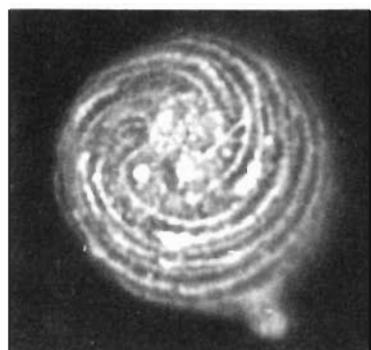
Nemegt Basin, Gobi Desert, Mongolia: Paleogene (White Beds)

All specimens $\times 100$

Photo: I. Łuszczewska



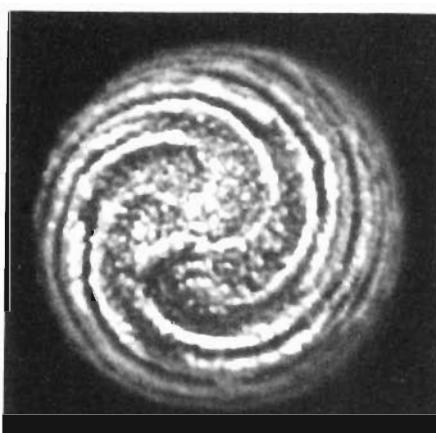
1b



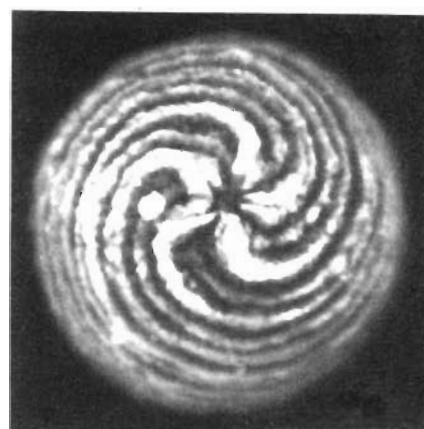
1a



1c



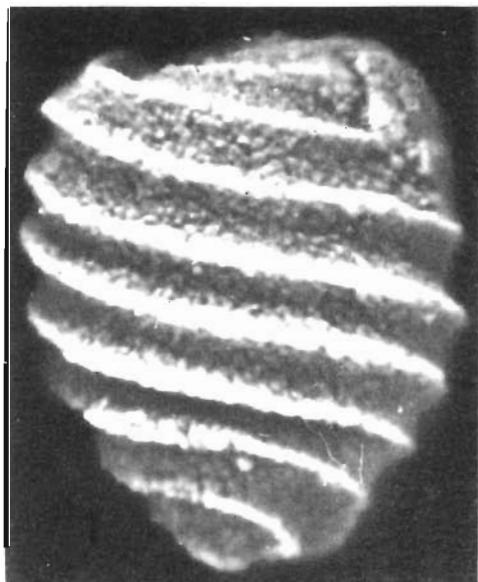
2a



2c



2b



3

J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XX

Page
65

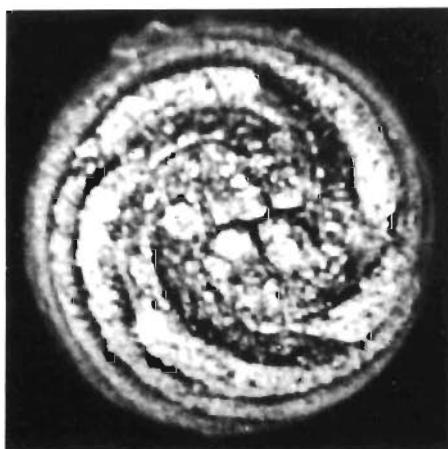
Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/D-39): *a* apical view, *b* lateral view, *c* basal view.

Fig. 2. Tsagan Khushu (Z.Pal.No.MgChar-II/E-12): *a* apical view, *b* lateral view, *c* basal view.

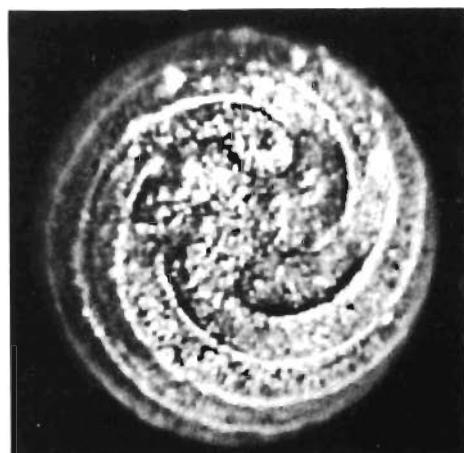
Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

All specimens $\times 100$

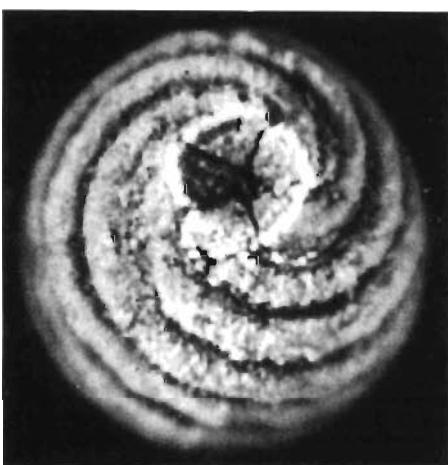
Photo: L. Luszczewska



1a



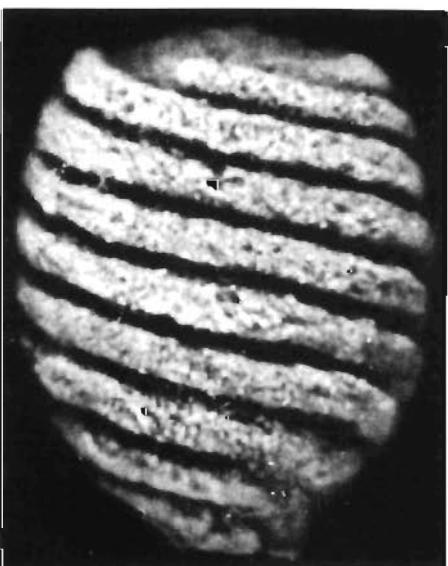
2a



1c



2c



1b



2b

J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

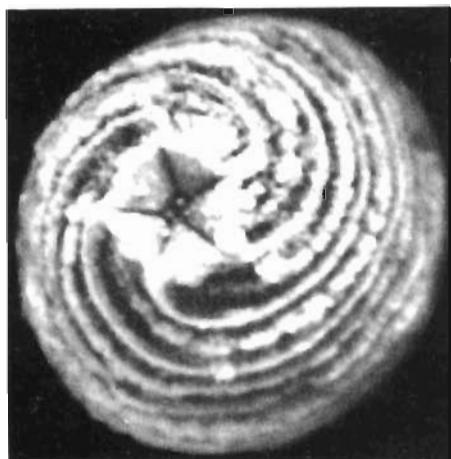
PLATE XXI

Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/D-38): *a* basal view, *b* lateral view, *c* apical view.

Nanout Basin, Gobi Desert, Mongolia; Paleogene (White Beds).

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Plants for Landscapes



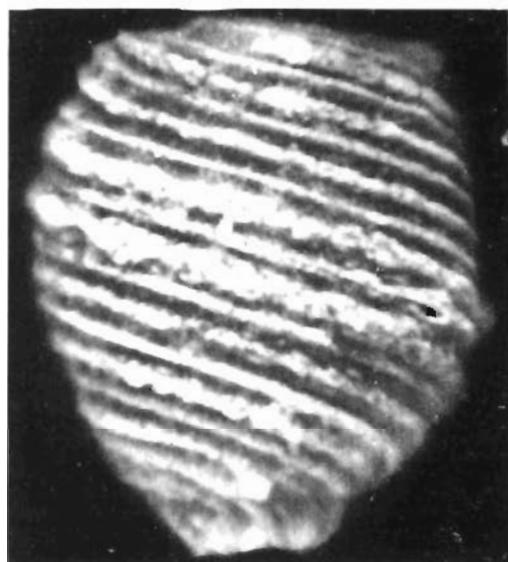
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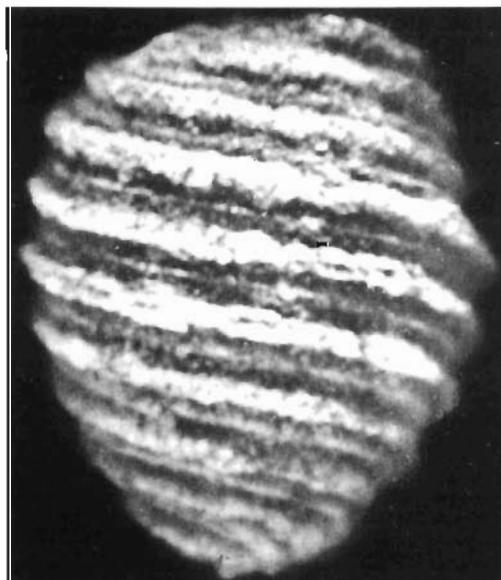
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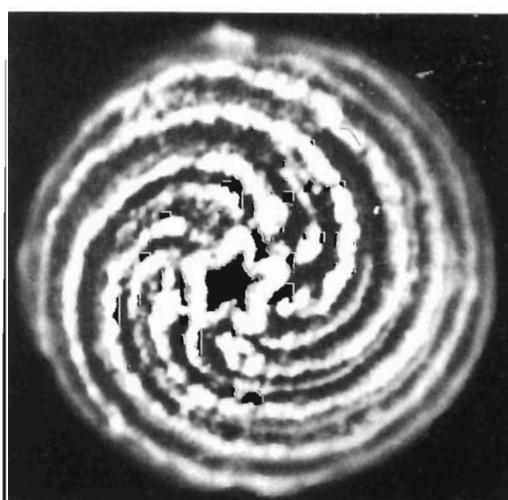
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2b



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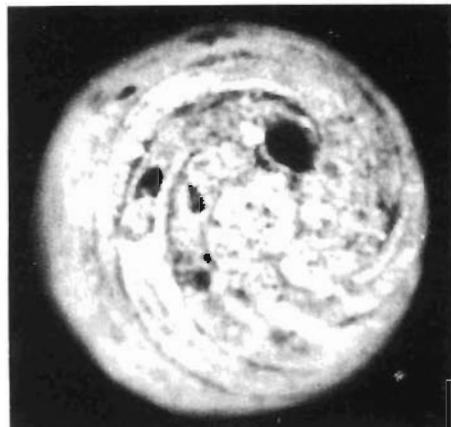
J. KARCZEWSKA & M. ZIEMBIŃSKA-TWORZYDŁO: LOWER TERTIARY CHAROPHYTA

PLATE XXII

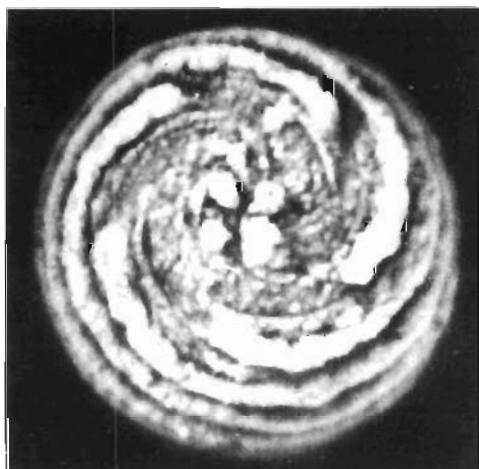
Photo: L. Luszczewska



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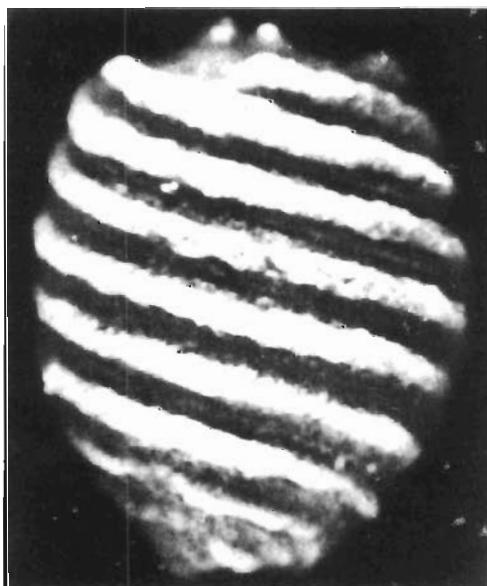
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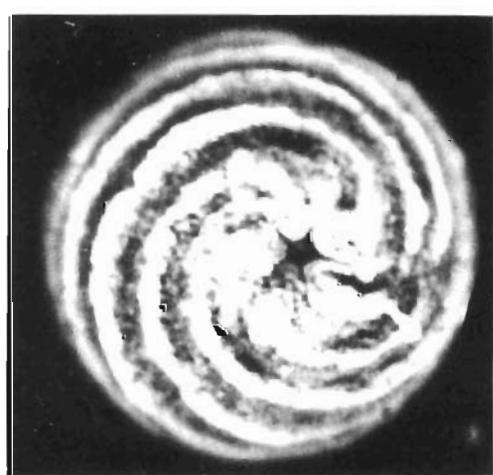
2a



1b



2b



2c

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PLATE XXIII

Page

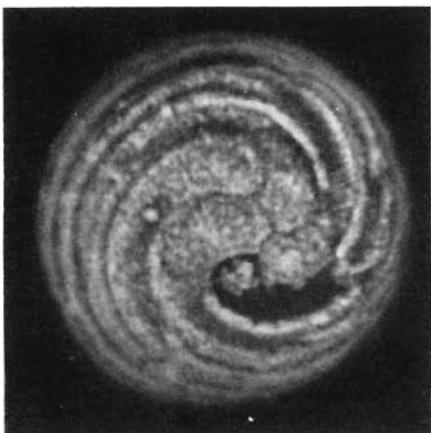
68

Fig. 1. Naran Bulak (Z.Pal.No.MgChar-JI/E-8): *a* apical view, *b* lateral view, *c* basal view. Type specimen.
 Fig. 2. Naran Bulak (Z.Pal.No.MgChar-JI/E-10): *a* apical view, *b* lateral view, *c* basal view.

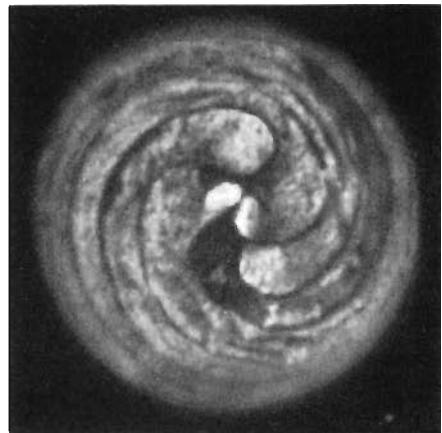
Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

All specimens ≤ 100

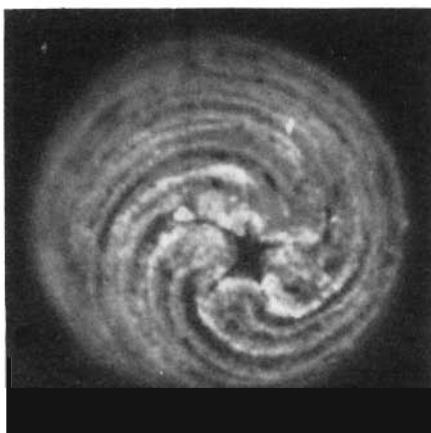
Photo: L. Luszczewska



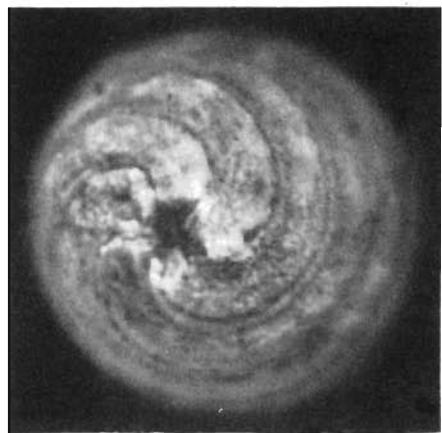
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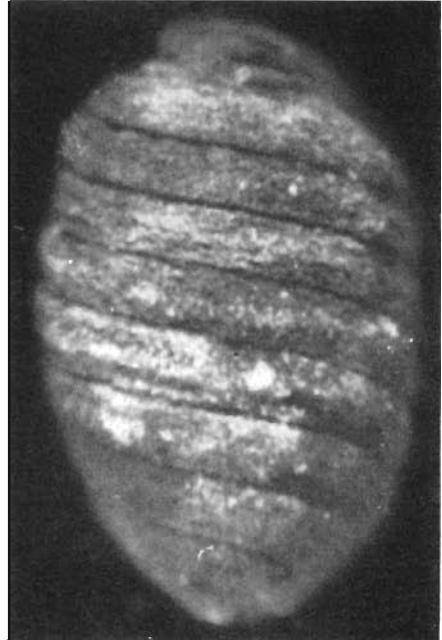
2a



1c



2c

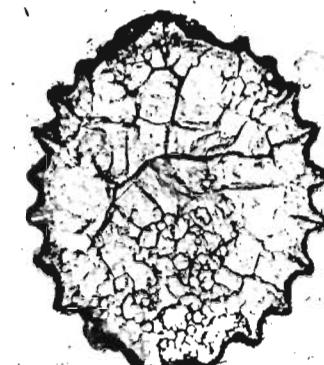


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PLATE XXIV

<i>Charites minutissima</i> (MÄDLER) HORN AF RANTZIEN	62
Fig. 1. Ulan Bulak (Z.Pal.No.MgChar-II/C-17): longitudinal section through gyrogonite; $\times 150$.	
Fig. 6. Ulan Bulak (Z.Pal.No.MgChar-II/D-34): <i>a</i> basal view, <i>b</i> lateral view, <i>c</i> apical view; $\times 100$.	
<i>Grovesichara stepanovi</i> n. sp.	63
Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/B-6): longitudinal section through gyrogonite; $\times 100$.	
<i>Nemegtichara prima</i> n. gen., n. sp.	54
Fig. 3. Naran Bulak (Z.Pal.No.MgChar-II/B-9): longitudinal section through gyrogonite; $\times 100$.	
Fig. 4. Tsagan Khushu (Z.Pal.No.MgChar-II/B-18): longitudinal section through gyrogonite; $\times 150$.	
<i>Croftiella grambasti</i> n. sp.	68
Fig. 5. Tsagan Khushu (Z.Pal.No.MgChar-II/E-9): <i>a</i> apical view, <i>b</i> lateral view, <i>c</i> basal view; $\times 100$.	
Nemegt Basin. Gobi Desert. Mongolia. Paleogene (White Beds)	

Photo: L. Luszczewska



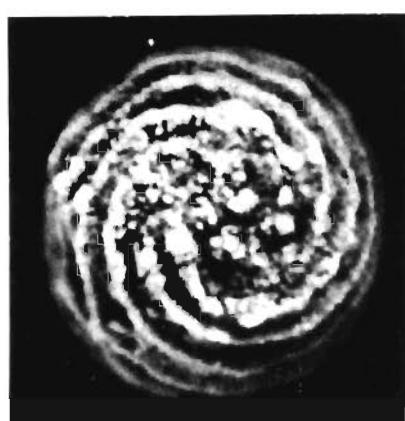
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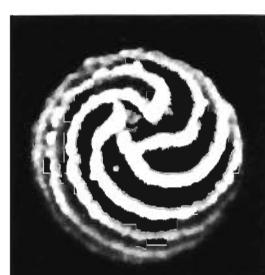
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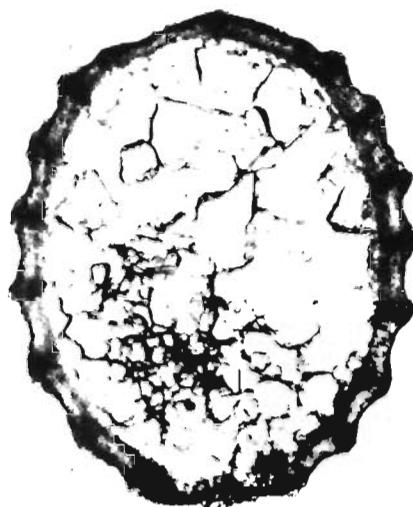
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5a



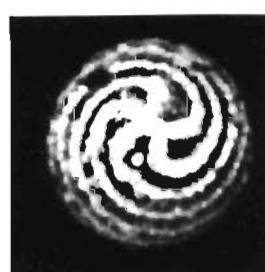
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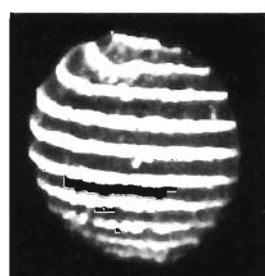
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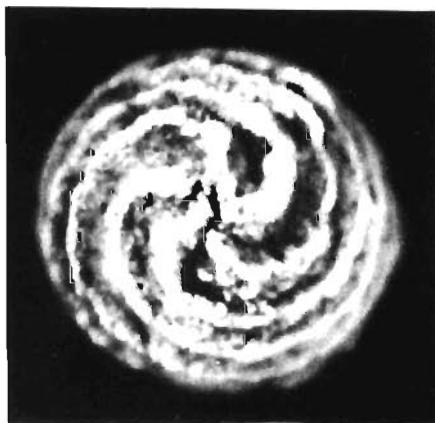
5b



6c



6b



5c

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PLATE XXV

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Fig. 1. Naran Bulak (Z.Pal.No.MgChar-II/D-36): *a* apical view, *b* lateral view, *c* basal view.

Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/D-35): *a* apical view, *b* lateral view, *c* basal view. Type specimen.

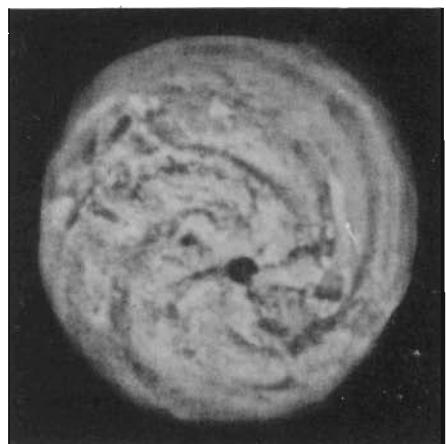
Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

All specimens $\times 100$

Photo: L. Łyszczeńska



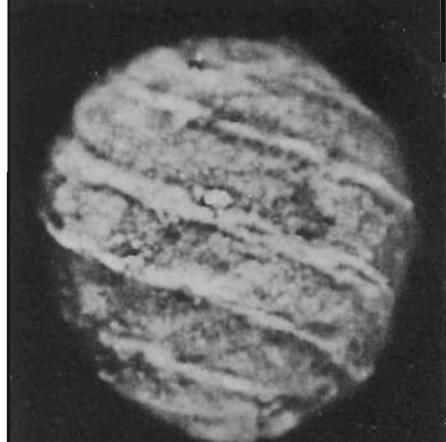
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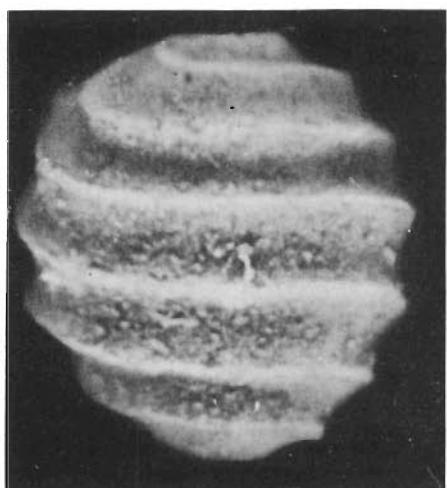
1c



2a



1b



2b



2c

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PLATE XXVI

	Page
<i>Grovesichara stepanovi</i> n. sp.	63

Fig. 1. Naran Bulak (Z.Pal.No.MgChar-II/D-17): *a* apical view, *b* lateral view, *c* basal view; $\times 100$. Type specimen.

<i>Gyrogona</i> sp.	61
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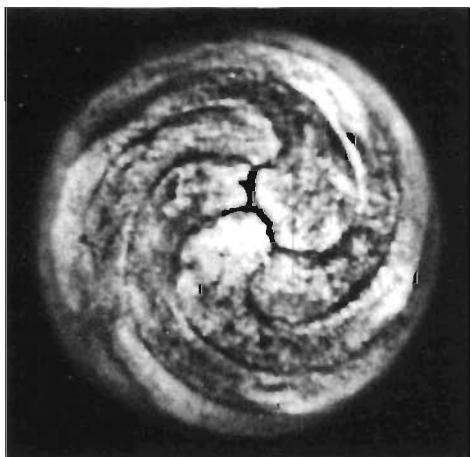
Fig. 2. Naran Bulak (Z.Pal.No.MgChar-II/E-7): lateral view; $\times 75$.

Fig. 3. Naran Bulak (Z.Pal.No.MgChar-II/E-6): apical view; $\times 75$.

Fig. 4. Naran Bulak (Z.Pal.No.MgChar-II/E-5): longitudinal section through gyrogonite; $\times 75$.

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

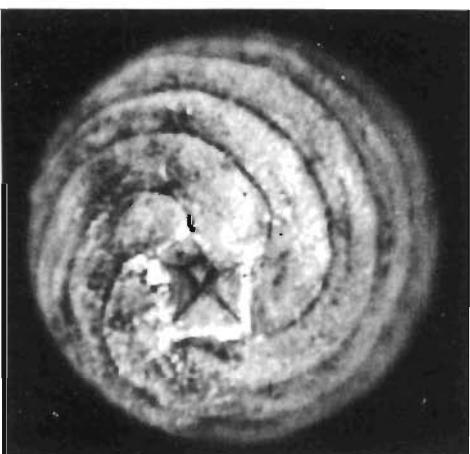
Photo: L. Łuszczewska



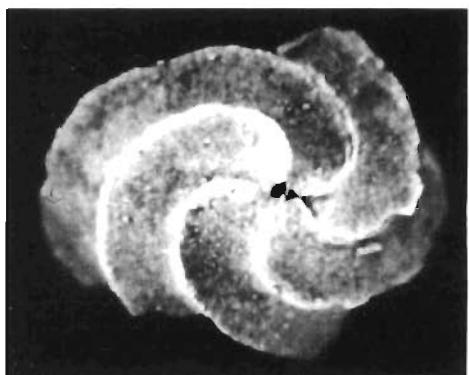
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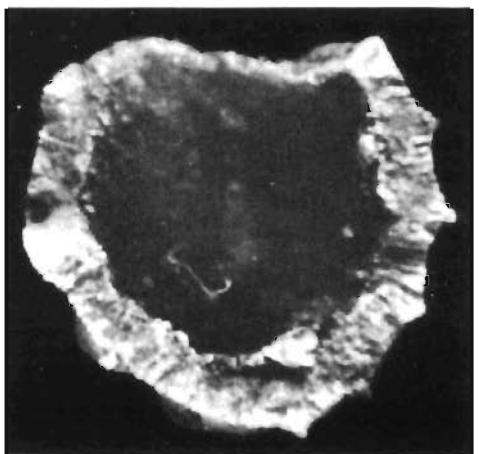
1c



3



1b



4

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PLATE XXVII

	Page
<i>Peckichara lefeldi</i> n. sp.	65
Fig. 1. Tsagan Khushu (Z.Pal.No.MgChar-II/C-10): longitudinal section through gyrogonite; $\times 100$.	
Fig. 4. Tsagan Khushu (Z.Pal.No.MgChar-II/C-9): longitudinal section through gyrogonite; $\times 100$.	
<i>Grambastichara tornata</i> (REID & GROVES) HORN AF RANTZIEN	67
Fig. 2. Tsagan Khushu (Z.Pal.No.MgChar-II/C-11): longitudinal section through gyrogonite; $\times 100$.	
<i>Mesochara laminata</i> n. sp.	71
Fig. 3. Naran Bulak (Z.Pal.No.MgChar-II/C-13): longitudinal section through gyrogonite; $\times 150$.	
<i>Grovesichara kielani</i> n. sp.	64
Fig. 5. Naran Bulak (Z.Pal.No.MgChar-II/C-8): longitudinal section through gyrogonite; $\times 150$.	

Nemegt Basin, Gobi Desert, Mongolia, Paleogene (White Beds)

Photo: L. Luszczewska

