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The History of the Genus *Pseudotorellia* Florin (Pseudotorelliaceae, Ginkgoales)

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Abstract—The Mesozoic history of the genus *Pseudotorellia* is considered. Two new species, *P. semyonica* sp. nov. and *P. transbaikalica* sp. nov. are described from the Lower Cretaceous of Transbaikalia.

INTRODUCTION

The leaf genus *Pseudotorellia* was established by Florin (1936) with two species *P. nordenskioldii* (Nath.) Florin from the Lower Cretaceous of Spitzbergen and *P. ephela* (Harris) Florin from the Lower Jurassic of Greenland. Subsequently 16 more species were described from the Triassic, Jurassic and Cretaceous of Europe and northern Asia. Detailed studies of the morphology and cuticular structures by Lundblad (1957, 1968) and Krassilov (1972), who erected the family Pseudotorelliaceae, have led to the conclusion that the epidermal characters are most important for the taxonomy of *Pseudotorellia*. A study of large leaf samples showed that morphological characters, such as the dimensions, shapes of the apices, density of veins, etc. might vary in respect to environmental conditions, while the epidermal characters appeared relatively constant. For instance, two species, *P. ensiformis* (Heer) Dolud. and *P. amgustifolia* Dolud. from the Upper Jurassic deposits of the Bureya Basin (Vakhrameev and Doludenko, 1961) turned out to be variants of polymorphic leaf shapes linked by transitional forms. Their epidermal characters, in particular the details of the upper epidermis structures, are nearly identical (Krassilov, 1972).

In all species of *Pseudotorellia* the leaf morphology is rather uniform: they are entire, flat, oblanceolate, elongate or linear, sessile. Each leaf is supplied by two vascular bundles that fork near the base, then forming a system of parallel veins extending to the apex.

The analysis of the stratigraphic and geographic ranges, as well as the taphonomy of the leaf remains show that *Pseudotorellia* reached a peak in diversity in northern Eurasia. The regional numbers of species are as follows: Europe—4, Greenland-1, North Siberia—3, South Siberia—3, Far East—2, Transbaikalia—3, China-2, Kazakhstan and Central Asia—7 species (Table 1).

Thus, during the Mesozoic, *Pseudotorellia* was widespread in northern Eurasia, comprising Greenland, northern and central Europe, Siberia, the Far East, China, Central Asia and Kazakhstan, with maximal diversity in the latter region. The earliest occurrences of the genus were recorded from the Upper Triassic (Rhaetian) of Sweden (Lundblad, 1957), the latest—from the Upper Cretaceous of northeastern Asia (Samylina, 1988). It must be noted that *Pseudotorellia* was listed from a great number of localities but only the described forms with cuticles are considered here (Table 2).

Most localities are confined to coal-bearing deposits, suggesting that *Pseudotorellia* inhabited swampy wetlands. Coal accumulation is controlled by such variables as precipitation, temperature, relief, tectonic structures, etc. Any of these could promote or hinder the deposition of coal measures. Thus, a constant correlation of *Pseudotorellia* with coal deposition indicates a constant environment that might be reflected in the relative constancy of the leaf morphology.

Notably, the Early Albian *P. kharanorica* Bugd. was found by bulk maceration of coals from the industrial Kharanor Quarry in the Chita Region (Bugdaeva, 1995). It was found that 90–95% of Kharanor coal consisted of compressed *Pseudotorellia* leaves, the rest were formed by the conifer shoots *Pagiophyllum* Heer. This find was the first evidence of *Pseudotorellia* as a coal-building plant. The coal-building assemblage might also include some ferns and conifers. Evidence of this is the occurrence of *Cladophlebis* Brongniart pinnules and *Pagiophyllum* shoots in association with *Pseudotorellia* in the ash layer from the upper part of the industrial coal seam of the Kharanor Quarry. In the older, Neocomian to Aptian deposits of Transbaikalia, *Pseudotorellia* was also found as a permanent component of fossil plant assemblages from the coal-bearing facies of peaty flood plains and lake banks. Yet in these deposits *Pseudotorellia* is never dominant, but occurs as a common or sometimes rare element.

The Mesozoic localities of *Pseudotorellia* were shown on paleoclimatic maps with the temperature and precipitation patterns for the Late Triassic, Early to Middle Jurassic, Late Jurassic, Neocomian to Aptian, Albian and Late Cretaceous (Sinitsyn, 1980). It was found that *Psudotorellia* was confined to the areas with a mean annual precipitation range of 1200–2000 mm/year, with the exception of the Neocomian–Aptian of Transbaikalia with an assumed annual sum of 800–1200 mm/year (Fig. 1). Notably, in the latter region, the Early Cretaceous plants were mostly preserved in the peaty flood-plain facies, often as coal-building material. The precipitation might actually have been higher or perhaps there was a larger water-collecting area.

The first appearences of *Pseudotorellia* correlate with an increase of precipitation in the Late Triassic (Rhaetian) in mid-to high latitudes of the Northern Hemisphere after the relatively arid Early to Middle Triassic epoch. The Late Triassic vegetation was relatively uniform, with minor variation between the regional localities. The mid-Mesozoic humid stage lasted from the Late Triassic to Middle Jurassic. Many coal-bearing localities were formed during this stage. No less than 12 *Pseudotorellia* species are confined to the mid-Mesozoic humid stage.

Arid conditions became widespread again in the Late Jurassic (Vakhrameev, 1962; Vakhrameev and Doludenko, 1976 and elsewhere). A humid climate persisted in eastern Asia alone. In particular, the coal-bearing Talynjan Formation was deposited in the Bureya Basin. A single Late Jurassic species *Pseudotorellia angustifolia* came from these deposits.

The diversity of *Pseudotorellia* increased during the Early Cretaceous humid stage (Manum *et al.*, 1991). In the Late Cretaceous coal deposition ceased everywhere except the Far-Eastern Region where the Arkagalian Formation was deposited. *Pseudotorellia postuma* Samyl. came from this formation.

Thus, the alternation of the Mesozoic humid and arid epochs correlates directly with the diversity peaks and lows of *Pseudotorellia* species, whereas the arid conditions in the Late Jurassic led to the near extinction of such specialized forms. However, the genus recovered in the Early Cretaceous, reaching the second peak of diversity. Interestingly, a similar evolution of diversity is observed in the genus *Czekanowskia* Heer (Samylina and Kirichkova, 1991), the geologically oldest species of which appearing in the Late Triassic, with the last appearances in the Late Cretaceous (Fig. 2). Like *Pseudotorellia*, the genus *Czekanowskia* reached a peak in diversity in the Mid-Jurassic, followed by a decrease in the Late Jurassic. However, in the Early Cretaceous there was a burst of *Pseudotorellia* alone, while *Czekanowskia* was represented by a nearly equal number of Late Jurassic and Early Cretaceous species, with a decline to the end of the Early Cretaceous epoch. Later, in the Late Cretaceous, both genera gradually disappear.

A distinction in the pattern of the evolution of diversity between *Pseudotorellia* and *Czekanowskia* might have been related to their different ecological niches. *Pseudotorellia* might belong to a stable climax community, whereas *Czekanowskia* often played the role of a pioneer plant and active colonizer of newly formed habitats (Krassilov, 1972; Bugdaeva, 1983). Supposedly, in the Late Triassic to mid-Jurassic *Pseudotorellia* developed as a coherent element of the plant communities, that is in the direction of increaed sustainability of vegetation systems. The mid- to Late Jurassic and Albian crises are reflected in the lower diversity of both these typical Mesozoic genera. Occasional finds of *Pseudotorellia* and *Czekanowskia* in the Late Cretaceous and their scanty numerical representation in the fossil plant communities of this age reflect a gradual decline of both genera to the end of the Mesozoic.

Table 1. Geographic distribution of *Pseudotorellia* species

Region	*Pseudotorellia* species
Europe	*minuta*
	grojecensis
	heeri
	nordenskioldii
Greenland	*ephela*
North Siberia	*emarginata*
	tjukansis
	postuma
South Siberia	*paradoxa*
	longifolia
	angustifolia
Transbaikalia	*semyonica*
	transbaikalica
	kharanorica
Far East	*angustifolia*
	longifolia
China	*hunanensis*
	longilancifolia
Middle Asia and Kazakhstan	*angrenica*
	costata
	ephela
	mamillata
	nordenskioldii
	orlovskajae
	vachrameevii

Most researchers assign *Pseudotorellia* to Ginkgoales. Zhou (1991) includes the family Pseudotorelliacea Krassilov (1972) to the latter order as a transitional form between the Karkeniaceae and Ginkgoaceae, but considers the name Umaltolepidaceae as more appropriate, since it is based on reproductive structures. Meyen (1987) recognized a single family Ginkgoaceae that comprised *Pseudotorellia*. Samylina (1986) suggested, that the stomatal structures of *Pseudotorellia*

Table 2. Stratigraphic distribution of *Pseudotorellia* species

	T_3	J_1	J_2	J_3	K 1nc–apt	K 1alb	K_2
1. *minuta*	■						
2. *ephela*		■					
3. *grojecensis*		■					
4. *hunanensis*		■					
5. *longifolia*		■	■	▒	■		
6. *nordenskioldii*		■	▒	▒	■		
7. *paradoxa*		■	■				
8. *angrenica*		■	■				
9. *longilancifolia*		■	■				
10. *costata*			■				
11. *mamillata*			■				
12. *orlivskajae*			■				
13. *vachrameevii*			■				
14. *angustifolia*				■			
15. *emarginata*					■		
16. *semyonica*					■		
17. *transbaikalica*					■		
18. *kharanorica*						■	
19. *tjukansis*						■	
20. *postuma*							■

differed from those of *Ginkgo* L., *Baiera* C.F.W. Broun, *Eretmophyllum* Thomas and *Leptotoma* Kirichk. et Samyl. to the extent of excluding this genus from the family Ginkgoaceae thus supporting Pseudotorelliaceae as a distinct family. However, some authors hold a quite different view of the taxonomic position of *Pseudotorellia*. Kirichkova (in *Fitostratigrafiya i flora*, 1985) assigned *Pseudotorellia tjukansis* Kirichk. to Pinopsida *incertae sedis* rather than to Ginkgoales. Li *et al.* (1988) consider the taxonomic position of this genus as uncertain.

Two new species of *Pseudotorellia* from the Lower Cretaceous of Transbaikalia are described below. One of these came from the locality Semyon in central Transbaikalia that also contains *Thallites* sp., *Muscites ingodensis* Srebr., *Muscites* sp., *Equisetum* sp., *Coniopteris* cf. *setacea* Vachr., *Coniopteris* sp., *Onychiopsis* sp., *Cladophlebidium dahuricum* Pryn., *Neozamites verchojanensis* Vachr., *Otozamites lacustris* Krassil., *Baikalophyllum lobatum* Bugd., *Vitimia doludenkoae* Vachr., *Ctenis* sp., *Ginkgoites* ex gr. *huttonii* (Stern.) Black, *Baiera* sp., *Czekanowskia bugdaevae* Samyl., *Leptostrobus* sp., *Phoenicopsis* ex gr. *angustifolia* Heer, *Brachyphyllum* sp., *Elatocladus* sp., *Nageiopsis transbaikalica* Srebr., *Pityophyllum* ex gr. *solmsii* Sew., *P.* ex gr. *nordenskioldii* (Heer) Nath., *Pseudolarix* sp., *Pityospermum stenopteron* Pryn., *P. turgense* Pryn., *P. witimii* (Reis) Pryn., *Schizolepis kryshtofovichii* Pryn., and *Baisia hirsuta* Krassil. (Srebrodolskaya, 1980, 1983a, 1983b; Bugdaeva, 1984). The second species was found in coal seam VI of the Bukachacha coal field in eastern Transbaikalia. In 1985 geologists of the Biostratigraphic Department, Chita Geological Survey, guided by S.M. Sinitsa, collected the following in the latter locality: *Vitimia doludenkoae*, *Ginkgo paradiantoides* Samyl., *Sphenobaiera* (?) *czekanowskiana* (Heer) Florin, *Swedenborgia* sp., *Czekanowskia ninae* Kirichk. et Samyl., *Elatocladus* sp., *Pagiophyllum* sp., *Pityophyllum* ex gr. *nordenskioldii*, *Carpolithes* sp.

SYSTEMATIC PALEONTOLOGY

Genus *Pseudotorellia* Florin, 1936

Pseudotorellia semyonica Bugdaeva, sp. nov.

Pl. 5, figs. 1–11

E t y m o l o g y. From the locality Semyon Creek.

H o l o t y p e. Institute of Biology and Pedology DVO RAN, no. 3B 325/6979, left bank of Semyon Creek, White Mountain outcrop, Central Transbaikalia; Semyon Sequence, Lower Cretaceous.

D i a g n o s i s. Leaves oblanceolate, 4.5–5 mm broad, about 20 mm long, base constricted, slightly curved, apex rounded or notched. Petiole short, about 5 mm long, 1 mm thick. Veins 6–8, adaxially indistinct. Leaf hypostomatic. Stomata in indistinct files. Subsidiary cells with small hemispherical papilla. Cell walls slightly curved, with nodular thickenings.

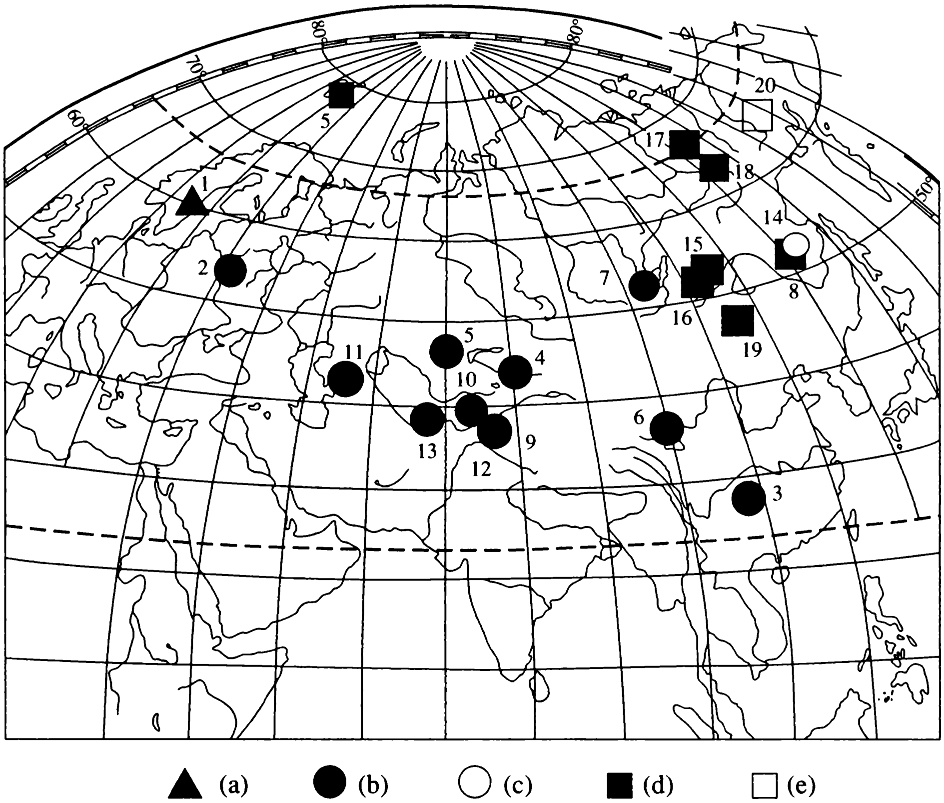


Fig. 1. Map of *Pseudotorellia* localities: (1) *minuta*, (2) *grojecensis*, (3) *hunanensis*, (4) *ephela*, (5) *nordenskioldii*, (6) *longilancifolia*, (7) *paradoxa*, (8) *longifolia*, (9) *angrenica*, (10) *orlovskajae*, (11) *costata*, (12) *mamillata*, (13) *vachrameevii*, (14) *angustifolia*, (15) *transbaikalica*, (16) *semyonica*, (17) *emarginata*, (18) *tjukansis*, (19) *haranorica*, (20) *postuma*. Legend: (a) Triassic, (b) Early–Middle Jurassic, (c) Late Jurassic, (d) Early Cretaceous, (e) Late Cretaceous.

D e s c r i p t i o n (Fig. 4). The length of leaf blades vary from 19 mm to 33 mm, average 22–25 mm, width 4–7 mm, mostly 4.5–5 mm. The petiole is short, about 0.5 mm, 1 mm thick. The venation is typical for *Pseudotorellia*: two veins enter the leaf base, fork in the lower third of the leaf blade, then run parallel to the margins.

The upper cuticle is thin, not showing the venation pattern. the upper epidermal cells are 20–28 × 150–195 μm, elongate with oblique rounded or acute ends, occasionally with concave or convex transverse walls. The anticlinal cell walls are uneven, irregularly thickened. Occasional transverse walls are more strongly cutinized. Trichomes are lacking, but some cells show an ill-defined median ridge.

The lower cuticle is likewise thin, showing stomatal and stomata-free zones. The stomata are longitudinally orientated, well spaced within the stomatal zones, arranged in irregular files. The guard cells are sunken, surrounded by five to six subsidiary cells. The stomatal aperture is protected by 2–5 papillae, the latter are small, rounded. The stomata are about 65 × 86 μm.

The anticlinal cell walls are unevenly thickened, with cuticular nodes. Occasional transverse walls are more strongly cutinized. The cell shapes are elongate-rectangular, rarely wedge-shaped or rhomboid, with rounded corners. The cell dimensions are about 16–33 × 17–125 μm.

The intercostal cells are relatively narrow, elongate-rectanguloid, often wedge-shaped, occasionally spin-

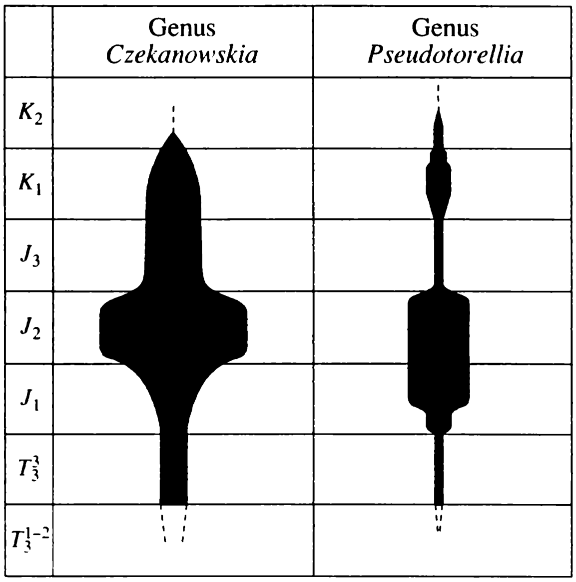


Fig. 2. Species diversity of *Czekanowskia* and *Pseudotorellia* during the Mesozoic.

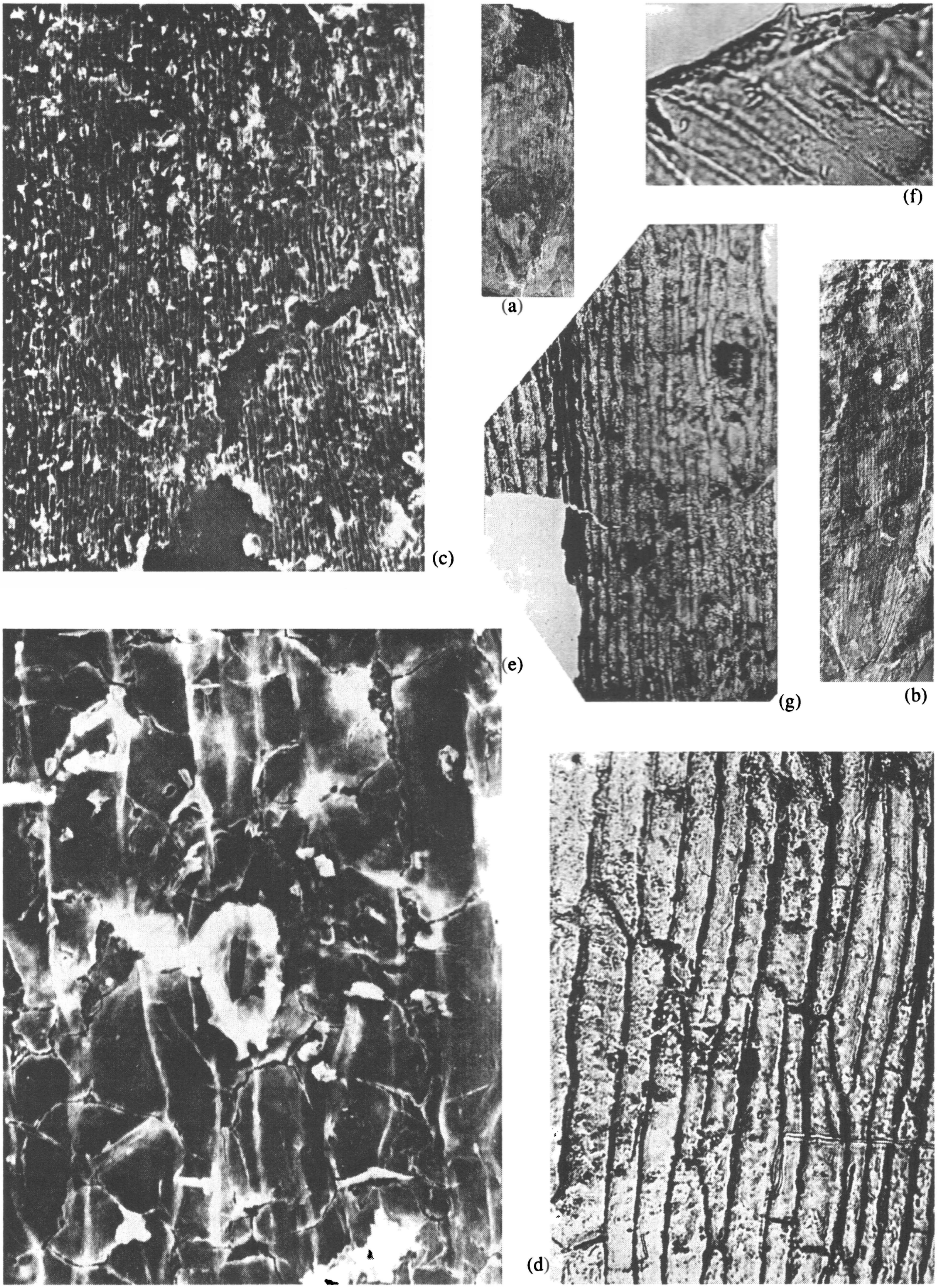

(a)
(b)
(c)
(d)
(e)
(f)
(g)

Fig. 3. *Pseudotorellia transbaikalica* sp. nov., (a) leaf, holotype no. 3BB VI-1, ×2; (b) leaf, specimen no. 3BB VI-2; (c) lower epidermis, SEM, ×500; (d) upper epidermis, ×340; (e) stoma, SEM, ×50; (f) papilla on periclinal wall of the epidermal cell, ×340; (g) lower epidermis with stoma and a fragment of the upper epidermis divided by the cutinized leaf margin, ×150.

del-shaped, dimensions 66–200 × 11–16 μm. Trichomes are lacking except on the median ridge.

Comparison. Papillate stomata are typical for such species as *Pseudotorellia angrenica* Gomolitzky, *P. costata* Kirichk., *P. ephela, P. hunanensis, P. mamillata* Loseva, *P. minuta* Lundblad, *P. orlovskajae* Dolud. et Samyl., *P. postuma, P. tjukansis* and *P. vachrameevii* Gomolitzky. However, in all the above listed species, except *P. orlovskajae* and *P. mamillata*, both upper and lower epidermal cells bear distinct median ridges that are characteristic of the genus. In the Transbaikalian species the median ridges are inconspicuous except in the marginal zones where they are expressed as indistinct cuticular thickenings on the periclinal walls.

In addition, in *P. angrenica* from the Middle Jurassic of Uzbekistan and Kyrgyzstan the leaves are longer

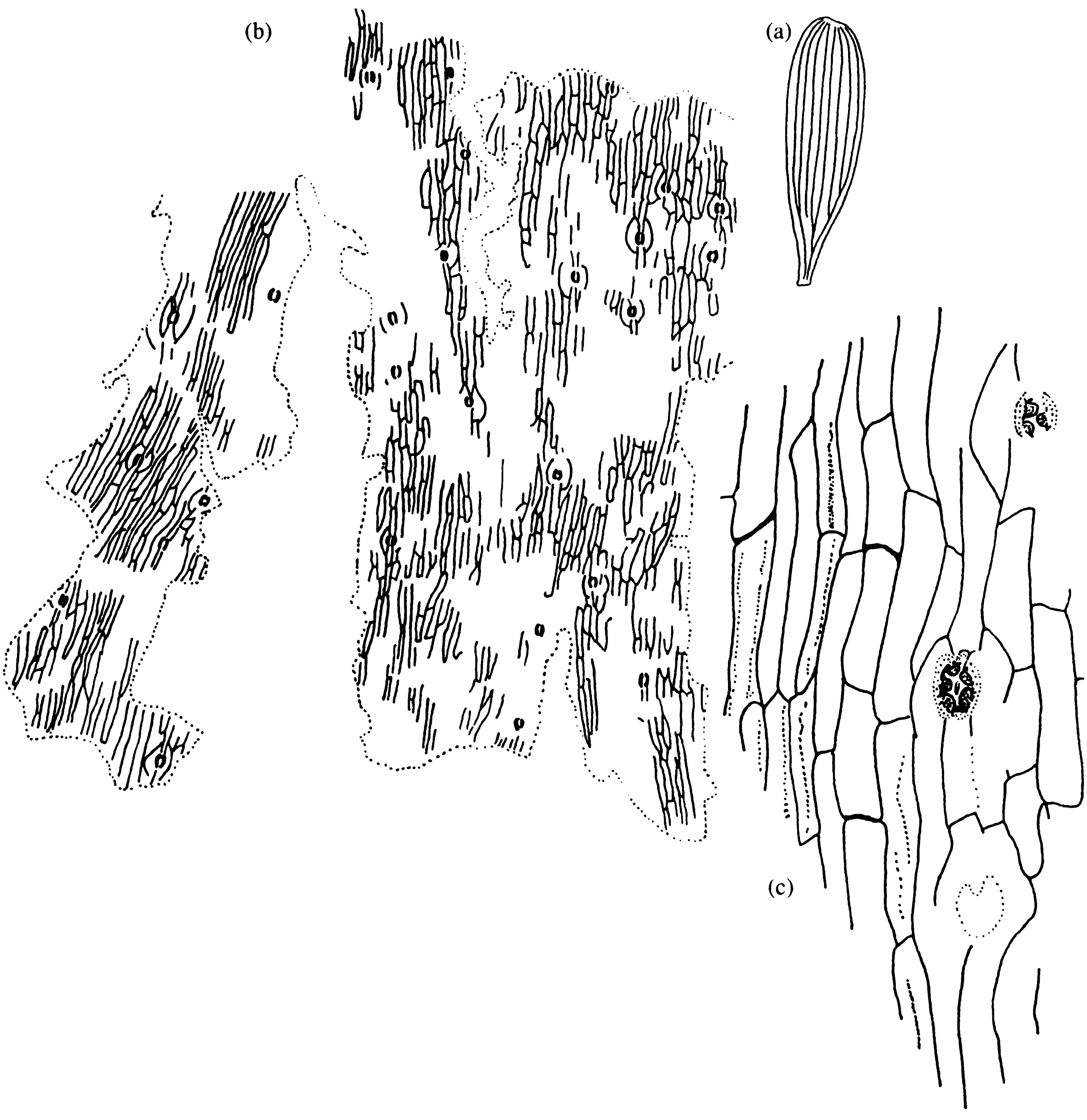


Fig. 4. *Poseudotorellia semyonica* sp. nov.: (a) leaf, holotype no. 3B 325/6979, ×2; (b) lower epidermis, ×50; (c) line drawing from Pl. 5, fig. 6, ×220.

and narrower, with fewer (4–5) veins, the leaves are amphistomatic (Gomolitzky and Khudajberdyev, 1981; Burakova, 1984) rather than hypostomatic as in *P. semyonica*. The epidermal cells of *P. angrenica* bear cuticular warts that are occasionally confluent, forming taeniate ridges.

In *P. costata* from the Bajocian and Bathian of northern Emba, the Fore-Caspian Depression, the leaves are comparatively small (18–28 mm long, 3–4 mm wide), with four distinct parallel veins. In distinction from the Transbaikalian species, the epidermal cells of *P. costata* are elongate or broadly polygonal, and constricted (Baranova *et al.*, 1975).

Leaves of *P. ephela* from the Early Jurassic of eastern Greenland (Harris, 1935) are larger than in *P. semyonica*, with ridged subsidiary cells. The stomata are scattered and the stomatal papillae are not uniformly developed.

P. hunanensis from the Early Jurassic of southwestern Hunan Province has curved leaves with acute apices. There are large (20 μm) papillae on both upper and lower epidermal cells. This species also differs from *P. semyonica* in that the stomata are irregularly scattered or form short files of 2–3 occasionally contiguous stomata (Zhou, 1983).

In *P. mamillata* from the Middle Jurassic of northern Fergana, the leaves are long (more than 60 mm), with 8–10 veins in the middle part and with thin intermediate veins that are totally lacking in the Transbaikalian species. Also, in the Ferganian species the upper epidermal cells are elongate-rectangular with median constrictions. The cell walls are typically straight, occasionally microsinuate. Each cell bears a central trichome (Vassilevskaya *et al.*, 1972).

In *P. minuta* from the Late Triassic of Sweden (Lundblad, 1957) the leaves are quite narrow, 2 mm wide, with four veins. The epidermal cells bear not only cuticular ridges, but occasionally, papillae that are totally lacking in *P. semyonica*.

P. orlovskajae from the Middle Jurassic of South Kazakhstan (Doludenko and Samylina, 1992) has longer leaves, with the stomata of the lower epidermis arranged in distinct bands two or three stomata wide. The subsidiary cells bear large papillae overhanging the aperture, whereas in *P. semyonica* the stomatal papillae are small and rounded.

In the Late Cretaceous *P. postuma* from the Arkagalian Formation of the Kolyma Basin (Samylina, 1988), the leaves are relatively large, typically linear, with two parallel ridges on the larger epidermal cells. In distinction from *P. semyonica*, the Kolymian species has cylindrical or clavate, rather than hemispherical, papillae.

The leaves of *P. tjukansis* from the Albian Khatyrykian Formation of the Lena Basin (*Fitostratigrafiya i flora*, 1985) are up to 10 mm wide, with 11–13 veins. They differ from the new species also in the stomatal structures and in having a median longitudinal ridge on the leaf blades.

Leaves of *P. vachrameevii* from the Jurassic of the Hissar Range (Gomolitzky, 1965) are narrow linear, with the stomata arranged in regular files wihin stomatal zones, whereas in the Transbaikalian species the stomatal files are irregular. The Hissarian species also differs in stomatal structures.

R e m a r k s. In addition to the Semyon Creek locality, a dispersed cuticle with stomata protected by papillae was obtained by bulk maceration of marls from bed 31, Baisa locality in the upper reaches of the Vitim River. The leaf shape and stomatal arrangements remained unknown, but the stomatal structures are identical to those of the type material of *P. semyonica* sp. nov.

M a t e r i a l. Eight complete and 19 fragmentary specimens.

***Pseudotorellia transbaikalica* Bugdaeva, sp. nov.**

E t y m o l o g y. From Transbaikalia.

H o l o t y p e. Institute of Biology and Pedology, DVO RAN, no. 3BB VI-1; roof of the coal seam VI, Bukachacha coal field, eastern Transbaikalia; Lower Cretaceous.

D i a g n o s i s. Leaf oblanceolate, slightly curved, up to 40 mm long, 8 mm broad. Veins poorly defined, about 14 per maximal breadth of leaf blade. Leaf hypostomatic. Epidermal cells elongate, irregular-rectanguloid to triangular or fusiform, with a well defined longitudinal crest. Cells of lower epidermis with a single or several confluent periclinal papillae. Stomata in indistinct files. Subsidiary cells with small hemispherical papillae. Cell walls slightly curved, with nodular thickenings.

D e s c r i p t i o n (Figs. 3, 5). The leaves are oblanceolate, tapering to the base, occasionally slightly curved. The apices are not preserved. Incomplete length of a better preserved specimen 35 mm, complete length probably 40 mm. Maximal width 8 mm. The veins diverge basally from the marginal vein, then extend parallel to the margins, indistinct, about 14 in the upper part of the leaf blade.

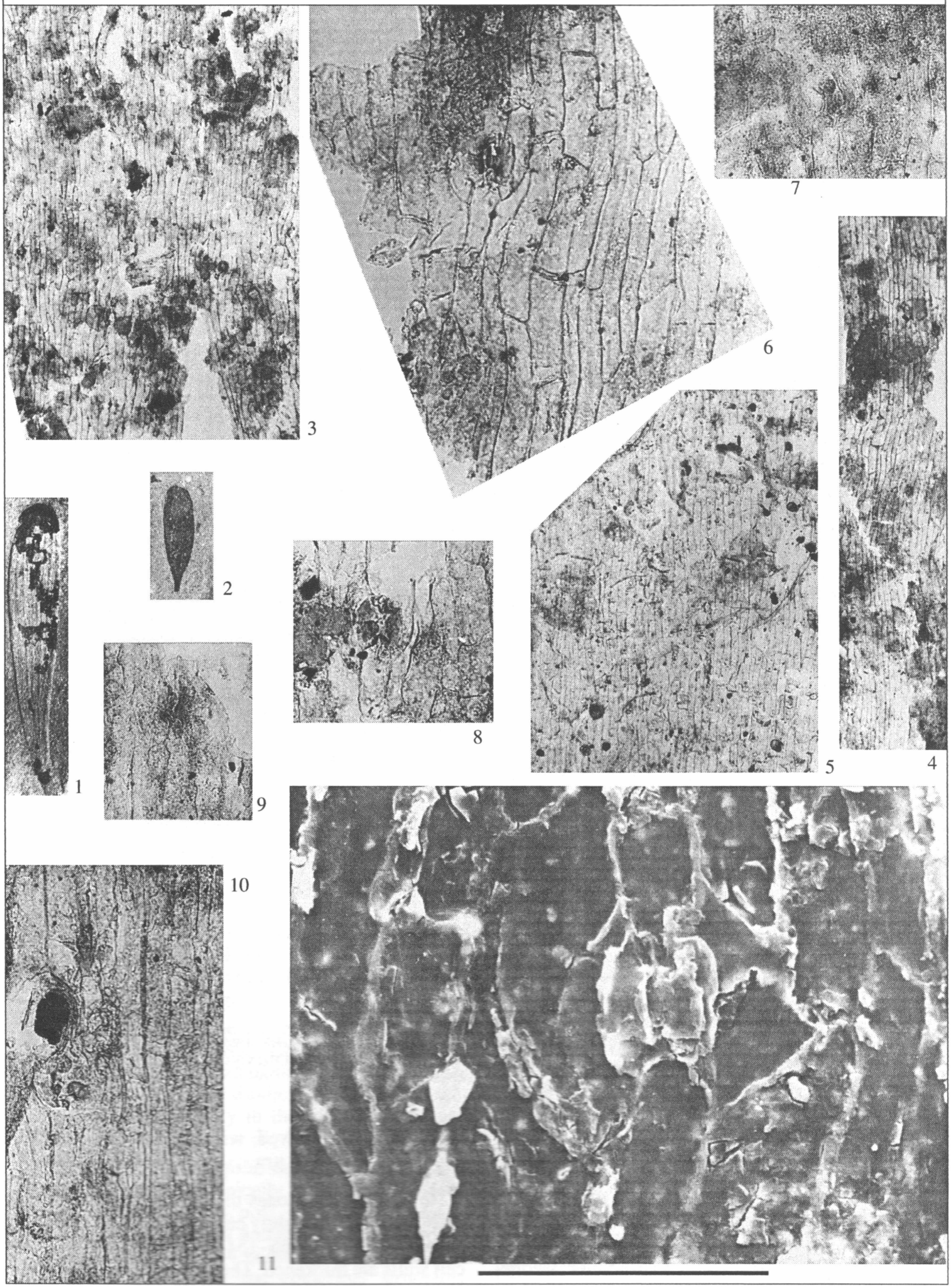
The cuticle is poorly preserved, showing a few epidermal features. The upper epidermal cells are elon-

→

E x p l a n a t i o n o f P l a t e 5

Figs. 1–11. *Pseudotorellia semyonica* sp. nov.: (1) leaf, specimen no. 3B 325/3249, ×2; (2) leaf, holotype no. 3B 325/6979, ×1; (3, 4) lower epidermis, ×55; (5) upper epidermis, ×55; (6) stoma and adjacent cuticle, notice the thickened transverse walls, ×220; (7–10) papillate stomata, ×220; (11) stoma, SEM, scale bar 100 μm.

Plate 5



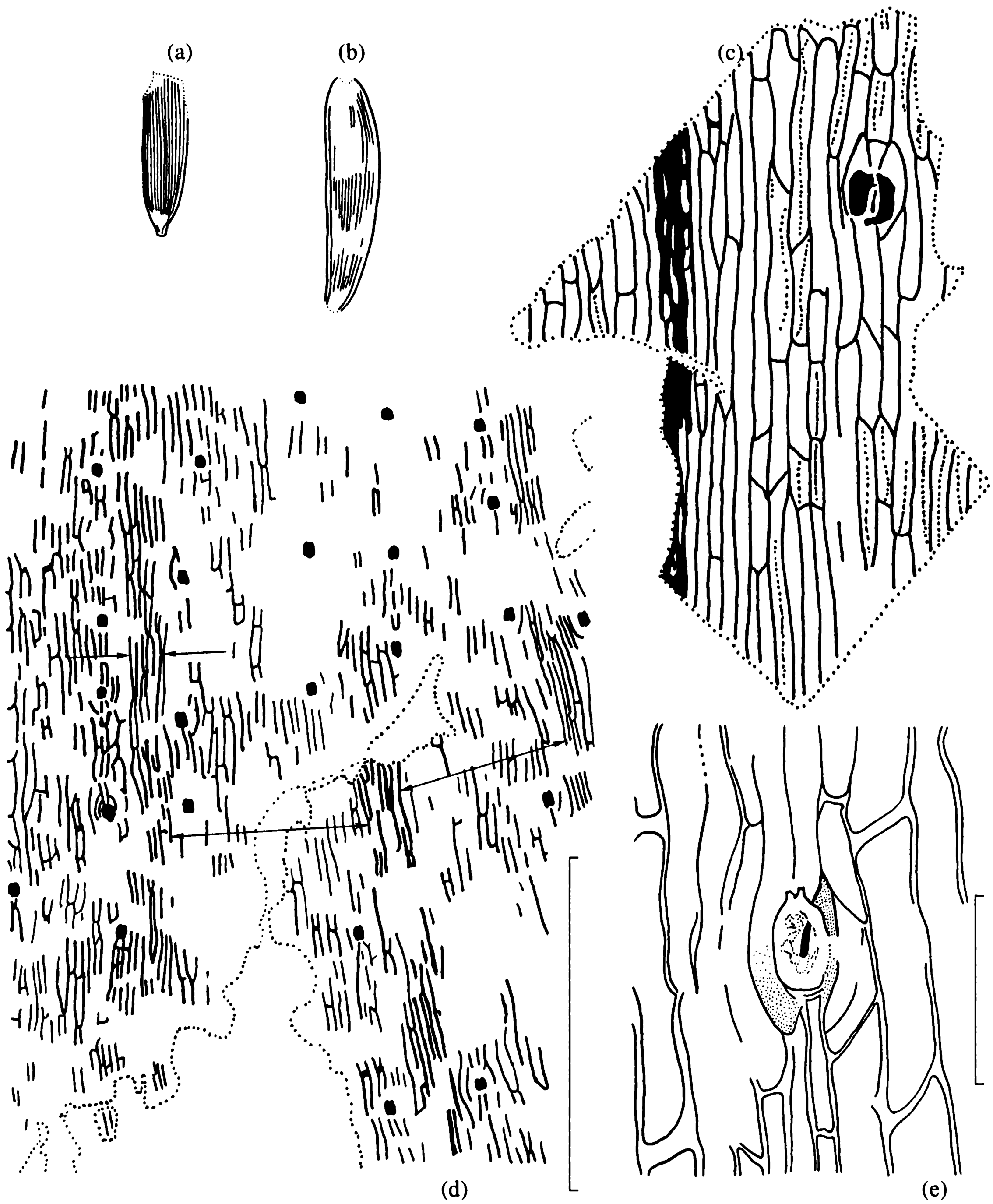


Fig. 5. *Pseudotorellia transbaikalica* sp. nov.: (a) leaf, holotype no. 3BB VI–1, ×1; (b) leaf, specimen no. 3BB, VI–2, ×1; (c) line drawing from Fig. 3, g, ×150; (d) line drawing from Fig. 3, c, short arrows mark the width of the costal zone, long arrows mark the width of the intercostal zone, scale bar 1000 µm; (e) stoma, scale bar 100 µm.

gate, irregularly rectangular to triangular or spindel-shaped, with rounded corners. Almost all the epidermal cells bear a median cuticular ridge.

The lower cuticle is divided into stomatal and stomata-free zones. Cells of the latter are relatively narrow, elongate-rectangular, spindel-shaped or wedge-shaped, slightly curved, with rounded corners, about 11–16 × 2–192–308 µm.

In the stomatal zones the epidermal cells are elongate-rectangular, slightly curved, with rounded or acute corners, about 16 × 66–154 µm. Occasional transverse cell walls are thickened. The median ridge is more conspicuous in the cells of stomata-free zones. Occasional cells show a periclinal papilla or a few confluent warts.

The stomata have 4–5 subsidiary cells, two of which are in the polar position. Dimensions of the stomata are about 40×40 µm.

Comparison. The stomata of the Bukachachian species lack papillae which is the feature shared with *Pseudotorellia nordenskioldii* from the Wealden of Spitsbergen and the Jurassic of Kazakhstan, *P. grojecensis* Reyman. from the Jurassic of Poland, *P. paradoxa* Dolud. from the Lower to Middle Jurassic of the Irkutsk Basin, *P. angustifolia* from the Upper Jurassic Talynjan Formation and the lower part of the Lower Cretaceous Urgalian Formation of the Bureya Basin (typically, but with occasional papillate cells) and from the Jurassic Tcheremkhovian Formation of the Ust-Baley locality, *P. longifolia* Dolud. from the Lower Cretaceous Solonian Subformation, the Urgalian Formation of the Bureya Basin and from the Lower to Middle Jurassic of the Irkutsk Basin, *P. longilancifolia* from the Lower to Middle Jurassic of the Qaidam Depression, China, *P. emarginata* Vassilevsk. from the Aptian Silyapian Formation of the Indigirka River, and *P. kharanorica* from the Lower Albian of eastern Transbaikalia. However, in *P. nordenskioldii* (Florin, 1936; Orlovskaya, 1962) the epidermal cell walls are sinuous and the stomatal structures are different from those of the Transbaikalian species. In *P. grojecensis* (Reymanowna, 1963) the epidermal cells are shorter, sometimes constricted, while the venation is not reflected in the upper epidermal structure. The upper epidermal cells show striations that were not observed in the Transbaikalian species. In *P. paradoxa* (Doludenko and Rasskazova, 1972) the leaves are narrower (4–5 mm) than in our species, the veins are fewer (about 10), the cell walls are sinuous, the venation is not reflected in the upper epidermal structure, the cuticular ridges of the periclinal cell walls are lacking.

In *P. longifolia* the leaves are longer and narrower than in the new species. They are linear-lanceolate, with fewer (5–8) veins. The stomata are irregularly scattered within the stomatal bands. The epidermal cells are comparatively short and broad. The micrographs of cuticular structures (Vachrameev and Doludenko, 1961; Doludenko and Rasskazova, 1972) show indistinct median ridges.

In *P. longilancifolia* the leaves are long, narrow, spear-shaped, with denser veins (25–18 in the broadest part of leaf) than in *P. transbaikalica* sp. nov. The epidermal structures are fairly similar to those of *P. longifolia* (above) differing only in the more distinct and broader stomatal bands (Li *et al.*, 1988).

The leaves of *P. angustifolia* vary in both shape and dimensions, but they are typically longer and narrower than in *P. transbaikalica* sp. nov., with fewer veins (4–6 in the narrow-leaved form, and about 10 in the broad-leaved form compared to 14 in our species). There are also some distinctions in the epidermal structures (Vakhrameev and Doludenko, 1961; Doludenko and Rasskazova, 1972; Krassilov, 1972).

P. emarginata (Samylina, 1993) differs from the Transbaikalian species in their obovate, nearly ovate leaf shapes with broadly rounded apices and wedge-shaped bases. The epidermal cell walls are straight or slightly sinuous in the lower epidermis, sinuous in the upper epidermis.

P. kharanorica from the Lower Cretaceous of the Turgino-Kharanorian Depression, eastern Transbaikalia differs from the new species in the narrower leaves with a median ridge and with acute, often curved apices. In these leaves the venation is inconspicuous. The stomata are irregularly scattered, with T-shaped polar thickenings (Bugdaeva, 1995).

Material. Two almost complete leaves and abundant fragmentary leaf remains.

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