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Upper Llandoveryian and Lower Wenlockian acritarch assemblages from the Ledai-179 boring in Lithuania

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Silurian acritarchs of the Llandoveryian–Wenlockian boundary beds are investigated from the Ledai-179 well sequence in Lithuania. A Llandoveryian assemblage has been found in rocks of the Švenėionys Formation at a depth of 790.3 m. and 778.5 m. It represented by numerous specimens of the species *Cymatiosphaera helodarma*, *Domasia trispinoisa*, *D. elongata*, *Diexallophasis denticulata*, *Gorgonisphaeridium listeri*, *Oppilatala insolita*, *Solisphaeridium nanum* and others. The lowermost Wenlockian acritarch assemblage (depth of 771.0 and 758.2 m – Paprienis Formation) additionally includes *Cymbosphaeridium pilar*, *Eisenackidium carminae*, *Visbysphaera pirifera*, *Deunffia furcata*, *D. ramusculosa*, *Multiplacisphaeridium corallinum* and others. Both the Llandoveryian and Wenlockian associations differ taxonomically. The change of Silurian acritarch taxa in the sequences of Silurian deposits fixes a stratigraphically important boundary between the Llandoveryian and Wenlockian Series (and between the Telychian and Sheinwoodian Stages). Most of the investigated species usually occur in different geological regions, thus allowing a transregional telecorrelation of the Llandoveryian–Wenlockian boundary.

Key words: acritarchs, stratigraphy, Silurian, Llandoveryian, Wenlockian, Lithuania

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INTRODUCTION

The aim of this paper is to report the first results of palynological investigations of the Llandoveryian–Wenlockian transition beds in Lithuania. The object of our investigation was problematic microfossil acritarchs (Group *Acritarcha Evitt, 1963*), which are very important for the biostratigraphic subdivision and correlation, especially in the case when no characteristic faunal remains are found. We studied the sequence of the Ledai-179 boring, which is considered as a key-section of some local formations.

GEOLOGICAL SETTING, MATERIAL AND METHODS

Llandoveryian–Wenlockian transition beds were investigated in a sequence of the Ledai-179 borehole located in the central area of Lithuania, in the border zone of the Baltic Syncline (Fig. 1). This stratigraphic interval in the Ledai-179 sequence (Fig. 2) is charac-

terised mostly by carbonate deposits and belongs to the highest part of the Švenėionys Formation and the lowermost part of the younger Paprienis Formation. The Švenėionys Formation consists of blue-grey carbonatic marls with rare thin beds of mudstones. These rocks contain a rich conodont complex, which is referable to the *P. amorphognathoides* and *L. celloni* conodont zones and is correlated with the Telychian (Uppermost Llandoveryian) *O. spiralis* graptolite zone (Brazauskas, 1987; Paškevičius, 1994). The Paprienis Formation is composed by grey marls with thin interbeds of limestones and mudstones and characterised by conodonts of *K. raniliformis* Zone and is attributed to the Sheinwoodian (Lowermost Wenlockian) *C. murchisoni bohemicus* regional graptolite zone and *C. centrifugus* Standard graptolite zone (Brazauskas, 1983, 1986; Paškevičius, 1994 a, b).

Although these carbonate rocks lack palynomorphs, rare thin layers contain rich acritarch assemblages. Samples were collected and processed from the core material at a depth of 790.3–758.2 m (32.1



Fig. 1. Regional location of the Ledai-179 boring
1 pav. Ledø-179 graþinio geografinø padëtis

Chronostratigraphy			Biostratigraphy		Lithostratigraphy			
System	Series	Stage	Conodont zones	Depth, m	Column	Depth of samples investigated	Formation	
SILURIAN	WENLOCK	Shenwoodian	K. raniliformis	7547	[Lithostratigraphic column with alternating layers of gray marl with limestone interbeds (1) and blue-gray marl (2)]	7582	Papritenis	
				7768		7710		
				7872		7785		
				7925		7903		
	LLANDOVERY	Telychian	P. amorphognathoides	7991	[Lithostratigraphic column with alternating layers of gray marl with limestone interbeds (1) and blue-gray marl (2)]	[Lithostratigraphic column with alternating layers of gray marl with limestone interbeds (1) and blue-gray marl (2)]	[Lithostratigraphic column with alternating layers of gray marl with limestone interbeds (1) and blue-gray marl (2)]	Švenčionys
				7925				
				7872				
				7768				

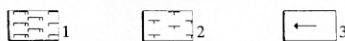


Fig. 2. Stratigraphic subdivision of the Llandovery–Wenlockian transition beds in the Ledai-179 boring (from Paškevičius, 1994 a, p. 80): 1 – gray marl with limestone interbeds, 2 – blue-gray marl, 3 – location of the samples investigated

2 pav. Llandovery ir venlokio ribos sluoksniø stratigrafinis suskirstymas (pagal Paðkevièiø, 1994a, p. 80): 1 – pilki mergeliai su kliniø tarp sluoksniais, 2 – melsvai pilki mergeliai, 3 – iðtirtø bandiniø padëtis pjûvyje

m). Two of them were 1.7 m and 13.5 m below the Llandoveryan–Wenlockian boundary (776 m) and two 3.8 m. and 18.6 m. above this level (Fig. 2).

These four samples were ground in manual way and macerated in concentrated fluorine (HF) and hydrochloric (HCl) acids. Dispersed organic material was washed and pressed out in a heavy liquid (KJ + CdJ) – 2.1 g/ml. All four samples contained numerous organic remains, which are concentrated in more than 100 palynological slides.

RESULTS AND CONCLUSIONS

In the course of works rich acritarch assemblages were established in the Llandoveryan–Wenlockian transition beds of Lithuania in the sequence of Ledai-179 borehole. Four samples of core material were studied as a whole from a depth interval of 790.3–758.2 m. Two of them were from upper part of the Švenčionys Formation attributed to the Telychian stage of the Llandoveryan Series, and the other two were from the lower part of the Papritenis Formation attributed to the Sheinwoodian Stage of the Wenlockian Series. In all cases the acritarch diversity was high, although they were found in variable abundance. Two different acritarch assemblages were identified (Table).

The first, or older, assemblage was recovered in the upper part of the Švenčionys Formation (depth 790.3 m and 778.5 m). Samples from the depth of 790.3 m (or 11.5 m below the top of the formation) are more representative. The predominant species here are:

Diexallophasis granulatispinosum (Downie 1963) Dorning 1981;

Domasia trispinosa Downie 1960, *D. elongata* Downie 1960,

Opillatala insolita (Cramer et Diez 1972) Dorning 1981;

Solisphaeridium nanum (Deflandre 1945) Turner 1984;

Micrhystridium stellatum Deflandre 1942;

Leiosphaeridia baltica (Eisenack 1968)

L. crassa (Naumova 1949) Jankauskas 1989.

Additionally rare specimens of the species are present:

Ammonidium microcladum (Downie, 1963) Dorning, 1981;

Baltisphaeridium aff. longispinosum (Eisenack 1931) Eisenack 1959

Gorgonisphaeridium listeri (Kirjanov 1978) emend. here;

Cymatiosphaera pentagonalis Kiryanov 1978, *C. subrotunda* Kirjanov 1978, *C. heloderma* Cramer et Diez 1972,

Deunffia monospinosa Downie 1960;

Table. Stratigraphic distribution of acritarchs (%) in the Llandoveryan–Wenlockian transition beds of the sequence Ledai-179

Lentelė. Akritarchų sudėties (procentais) stratigrafinis pasiskirstymas landoverio ir venlokio ribos sluoksniuose Ledø-179 grafinio pjūvyje

Acritarch species	Uppermost Llandoveryan (Švenėionys Fm.)		Lowermost Wenlockian (Paprienis Fm.)	
	790.3 m	778.5 m	771.0 m	758.2 m
<i>Ammonidium microcladum</i>	0.25	1.0	1.0	1.0
<i>Baltisphaeridium aff. longispinosum</i>	0.25	–	1.0	–
<i>Cymatiosphaera heloderma</i>	0.25	–	–	–
<i>C. pentagonalis</i>	0.25	–	2.0	–
<i>C. subrotunda</i>	0.50	–	–	–
<i>Deunffia monospinosa</i>	0.25	–	3.0	–
<i>ictyotidium eurydictyotum</i>	0.50	–	–	2.00
<i>Diexallophasis denticulata</i>	4.00	6.0	11.0	–
<i>D. sanbernensis</i>	0.75	–	–	–
<i>Domasia amphora</i>	0.50	–	–	11.00
<i>D. elongata</i>	11.00	10.0	14.0	10.50
<i>D. trispinosa</i>	13.00	28.0	15.0	–
<i>Dorsennidium mamillatum</i>	2.00	–	1.0	–
<i>D. rhomboidium</i>	0.50	2.0	4.0	2.0
<i>D. undosum</i>	1.00	–	–	–
<i>Gorgonisphaeridium listeri</i>	0.75	4.0	1.0	2.25
<i>Gorgonisphaeridium sp.</i>	0.75	1.0	–	–
<i>Leiofusa bernesga</i>	0.50	–	–	–
<i>L. filifera</i>	0.25	–	–	3.0
<i>Leiosphaeridia baltica</i>	3.00	9.0	1.0	1.0
<i>L. crassa</i>	3.25	3.0	1.0	0.50
<i>Lophosphaeridium rarum</i>	0.75	1.0	–	1.25
<i>Micrchystridium brevibradiatum</i>	0.25	–	–	–
<i>M. stellatum</i>	2.50	2.0	1.0	0.25
<i>M. vulgare</i>	0.50	2.0	–	0.50
<i>Multiplicisphaeridium arbusculiferum</i>	0.50	–	–	–
<i>Multiplicisphaeridium sp.</i>	0.25	–	–	–
<i>Onondagella ex gr. asymmetrica</i>	0.25	–	–	–
<i>Oppilatala insolita</i>	6.00	17.0	7.0	17.50
<i>Polygonium sp.</i>	0.50	11.0	1.0	0.50
<i>Pterospermella bernardinae</i>	0.25	–	1.0	0.50
<i>P. latimarginata</i>	0.50	–	–	–
<i>Solisphaeridium nanum</i>	37.50	2.0	13.0	30.0
<i>Tasmanites aff. medius</i>	0.50	–	–	–
<i>T. parvulus</i>	0.25	1.0	–	–
<i>Tylotopalla astrifera</i>	0.25	–	–	–
<i>T. tappanae</i>	0.25	2.0	–	–
<i>Veryhachium dovniei</i>	0.25	1.0	–	0.50
<i>V. europaeum</i>	0.25	–	–	–
<i>V. mucronatum</i>	0.50	1.0	–	0.25
<i>V. reductum</i>	0.25	4.0	–	1.50
<i>V. trispinosum</i>	0.25	–	–	–
<i>Visbysphaera meson</i>	0.25	–	–	–
<i>V. gotlandica</i>	0.25	–	1.0	–
<i>Cymatiosphaera aff. cubus</i>	–	–	1.0	0.75
<i>Cymbosphaeridium pilar</i>	–	–	4.0	1.00
<i>Deunffia brevispinosa</i>	–	–	–	0.25

Dictyodidium eurydictyotum (Eisenack 1938) Eisenack 1955;

Diexallophasis sanpetrensis (Cramer 1964) Dorning 1981

Domasia amphora Martin 1969;

Dorsennidium rhomboidium (Downie 1959); *D. undosum* Wic., Playf., Rol., 1999.

Gorgonisphaeridium sp.;

Leiofusa bernesgae Cramer 1964, *L. filifera* Downie 1959;

Lophosphaweridium rarum Timofeyev 1959;

Micrchystridium stellatum Deflandre 1945, *M. vulgare* Stoc., Will., 1962;

Multiplicisphaeridium arbusculiferum (Downie 1963);

Multisphaeridium sp.;

Polygonium sp.;

Pterospermella latimarginata Kirjanov 1978;

Tasmanites aff. medius (Eisenack 1931) Eisenack 1958, *T. parvulus* Kirjanov 1978;

Tylotopalla astrifera Kirjanov 1978, *T. tappanae* Kirjanov 1978;

Veryhachium trispinosum (Eisenack 1938) Deunff 1959; *V. dovniei* St., Will., 1962; *V. reductum* Deunff 1959; *V. europaeum* St., Will., 1963; *V. mucronatum* St., Will., 1962;

Visbysphaera meson (Eisenack 1955) Lister 1970, *V. dilatispinosa* (Downie 1963) Lister 1970.

The majority of these species were found in the second sample from the depth of 778.5 m (Table). Both samples collected from beds bear numerous conodonts of the *P. amorphognathoides* and *L. celloni* co-

<i>D. ramusculosa</i>	–	3.75		
<i>D. furcata</i>	1.0	2.00		
<i>Domasia intermedia</i>	1.0	0.50		
<i>D. bispinosa</i>	1.0	0.25		
<i>D. limaciforme</i>	1.0	0.50		
<i>Dictyotidium arctum</i>	1.0	–		
<i>Eisenackidium carminae</i>	1.0	–		
<i>Estiastra barbata</i>	1.0	0.25		
<i>Leofusa cylindrica</i>	1.0	0.25		
<i>Multiplicisphaeridium corallinum</i>	1.0	–		
<i>M. ramusculosum</i>	1.0	0.25		
<i>Polygonium polygonale</i>	1.0	1.0		
<i>Solisphaeridium</i> sp.	–	0.25		
<i>Tasmanites</i> aff. <i>martinssoni</i>	1.0	0.25		
<i>Veryhachium geometricum</i>	–	0.25		
<i>Visbysphaera pirifera</i>	2.0	–		
Others	3.50	2.0	2.0	2.50
In all specimens counted	400	100	100	400

Veryhachium sp.;
Visbysphaera pirifera
Eisenack 1954) Eisenack, Cramer et Diez 1973.

Both investigated acritarch assemblages exhibit close affinities with the corresponding assemblages in different areas of Europa (Wales, England and Ukraine). The first association of Lithuania is comparable with the first complex of Ukraine from the lower part of the Kitaigorodskaya Formation (Kirjanov, 1978) and the biostratigraphic zone **LL4** of

nodont zones and are correlated with the *O. spiralis* graptolite zone of the Baltic Region (Brazauskas, 1983, 1986; Brazauskas, Paškevičius, 1981). Besides, these strata are fully confidently correlated with the *M. crenulata* graptolite standard zone and belong to the upper part of the Telychian Stage (Paškevičius, 1994 b).

The second, **younger assemblage** was established in the lower part of the Paprienis Formation (samples from the depth of 771.0 m and 758.2 m). In these strata were found numerous conodonts of the *K. ranuliformis* zone, which is correlated with the *C. murchisoni bohemicus* – *S. antennularius* graptolite zones of the Baltic Region and the *C. centrifuges* – *C. rigidus* standard graptolite zones (Paškevičius, 1994 b).

Taxonomically richer is the sample from the depth of 758.2 m (18.6 m above the bottom of the formation). Here are recorded numerous species known in the older first association and many characteristic species, which appear above the bottom of the Paprienis Formation (Table). They are:

- Cymatiosphaera* aff. *cubus* Kirjanov 1978;
- Cymbosphaeridium pilar* (Cramer 1964) Lister 1970;
- Deunffia ramusculosa* Downie 1960, *D. brevispinosa* Downie 1960, *D. furcata* Downie 1960;
- Dictyotidium arctum* Kirjanov 1978;
- Domasia bispinosa* Downie 1960, *D. intermedia* Kirjanov 1978; *D. limaciforme* (Stockmans, Williere 1963) Cramer 1971;
- Eisenackidium carminae* Cramer 1964;
- Estiastra barbata* Downie 1963;
- Leofusa cylindrica* Kirjanov 1978;
- Multiplicisphaeridium corallinum* (Eisenack 1959);
- M. ramusculosum* (Martin 1966) Eisenack, Cramer, Diez 1973; *M.* sp.
- Polygonium polygonale* (Eisenack 1931) Eisenack, Cramer et Diez 1973;
- Solisphaeridium* sp.;
- Tasmanites* aff. *martinssonii* Eisenack 1958;

Shropshire (Dorning, 1981). The second Lithuanian association is correlated with the second complex of Ukraine and the zone **W1** of Shropshire. Thus, our investigations confirm that the boundary between the Švenčionys and the Paprienis Formations in Lithuania approximate to the Llandovery/Wenlockian boundary of the Standard (International) Stratigraphic Scale and prove that the first appearance of the acritarch species *Cymatiosphaera cubus*, *Cymbosphaeridium pilaris*, *Deunffia ramusculosa*, *D. furcata*, *Domasia intermedia*, *Onondagella asymmetrica*, *Tylotopalla astrifera*, *Visbysphaera pirifera* indicate the bottom of the Sheinwoodian Stage of the Wenlockian Series. Additionally, we can say that the beds with acritarch *Deunffia furcata* and *D. ramusculosa* form a biostratigraphic zone which is a coeval unit of the *K. ranuliformis* conodont zone and *C. centrifuges* – *M. riccartonensis* standard graptolite zones.

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Explanation of plates (black line – 10 μm), Plate 1

Fig. 1. *Gorgonisphaeridium listeri* (Kirjanov 1978):

prep. 16-3-3, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 2. *Cymatiosphaera heloderma* Cramer et Diez 1972:

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 3. *Dictyotidium eurydictyotum* Kirjanov 1978:

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 4. *Pterospermella latimarginata* Kirjanov 1978:

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 5. *Pterospermella bernardinae* Cramer 1964:

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 6. – *Tylotopalla astrifera* Kirjanov 1978:

prep. 16-4-5, well Ledai-179, depth 778.5 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 7. *Oppilatala insolita* (Cramer, Diez 1972) Dorning 1981:

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 8. *Dorsennidium rhomboidium* (Downie 1959):

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 9. *Diexallophasis denticulata* (Stockmans et Williere 1962):

prep. 16-3-6, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 10. *Veryhachium Europaeum* Stockmans et Williere 1960:

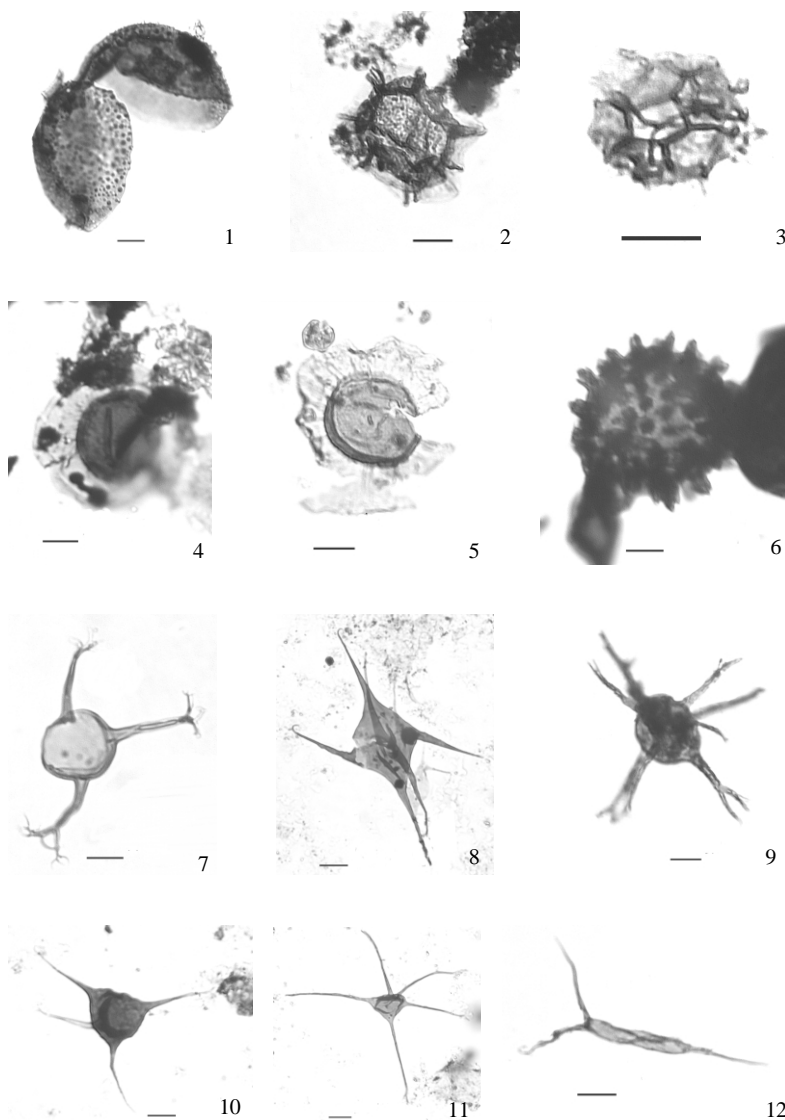
prep. 16-4-3, well Ledai-179, depth 778.5 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 11. *Veryhachium mucronatum* Stockmans et Williere 1962:

prep. 16-3-3, well Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania

Fig. 12. – *Domasia elongata* Downie 1960:

prep. 16-3-6, well. Ledai-179, depth 790.3 m. Ėvenėionys Formation, Telychian, Landoverly, Lower Silurian; Lithuania



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VIRĖUTINIO LANDOVERIO IR APATINIO VENLOKIO AKRITARCHŲ KOMPLEKSAI LEDŲ-179 GRĄPINIO PJŪVYJE (LIETUVA)

Santrauka

Autoriai ištyrė Lietuvos silūro akritarcho rūdinės sudėties pakitimus landoverio ir venlokio skyrių riboje, tam tikslui panaudojė kerno medžiagą iš Ledo-179 grąpinio. Jauniausiuose landoverio sluoksniuose, Ėvenėionių svitos uolienose (gylis 790,3 ir 778,5 m), rasti dvi rūdies akritarchai: *Cymatiosphaera heloderma*, *Domasia trispinosa*, *D. elongata*, *Deunffia mo-*

nospinosa, *Diexallophasis denticulata*, *Gorgonisphaeridium listeri*, *Oppilatala insolita*, *Solisphaeridium nanum* ir kiti. Seniausiuose venlokio sluoksniuose (gylis 771,0 m ir 758,2 m) dar nustatytos dvi rūdies *Cymatiosphaera cubus*, *Deunffia furcata*, *D. ramusculosa*, *Domasia intermedia*, *Eisenackidium carminae*, *Estiastra barbata*, *Tylotopalla tappanae*, *Visbysphaera mezon*, *V. pirifera* ir kitos. Išaiškinti esminiai akritarcho rūdinės sudėties pokyčiai landoverio ir venlokio riboje, Ledo-179 pjūvyje, paryškina dvi ribos biostratigrafinį pagrąstumą, o panašus akritarcho išsidėstymas kitose Europos dalies pjūviuose (Ukraina, Anglija) atveria naujas silūro nuogulų tarpregioninės koreliacijos galimybes.

Plate 2

Fig. 1. *Deunffia ramusculosa* Downie 1960:

prep. 16-7-17, well Ledai-179, depth 758.2 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 2. *Deunffia furcata* Downie 1960:

prep. 16-7-17, well Ledai-179, depth 758.2 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 3. *Domasia intermedia* Kirjanov 1978:

prep. 16-7-17, well Ledai-179, depth 758.2 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 4. *Domasia bispinosa* Downie 1960:

prep. 16-8-15, well Ledai-179, depth 771.0 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 5. *Dictyotidium arctum* Kirjanov 1978:

prep. 16-8-17, well Ledai-179, depth 771.0 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 6. *Estiastra barbata* Downie 1963:

prep. 16-8-15, well Ledai-179, depth 771.0 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 7. *Multiplicisphaeridium* sp.

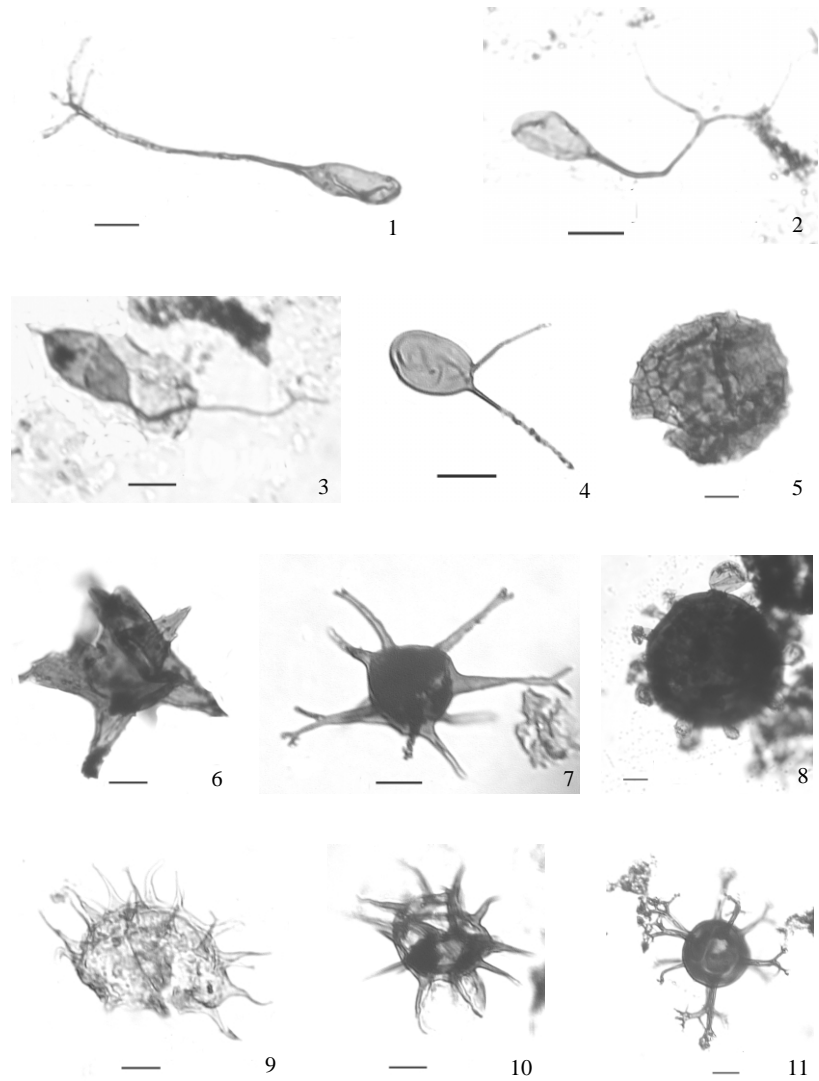
prep. 16-8-19, well Ledai-179, depth 771.0 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 9-10. *Solisphaeridium nanum* (Deflandre 1945) Turner 1984:

prep. 16-7-18, well Ledai-179, depth 758.2 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania

Fig. 11. *Multiplicisphaeridium ramusculosum* (Deflandre 1942) Eisenack, Cramer, Diez 1973:

prep. 16-8-15, well Ledai-179, depth 771.0 m. Paprienis Formation, Sheinwoodian, Wenlock, Lower Silurian; Lithuania



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КОМПЛЕКСЫ ВЕРХНЕЛАНДОВЕРИЙСКИХ И НИЖНЕВЕНЛОКСКИХ АКРИТАРХ В РАЗРЕЗЕ СКВ. ЛЯДАЙ-179 В ЛИТВЕ

Ðàçþì á

Ëçó÷áí èà ñèéóðèéñèéö àèðèòàðð á èáðí à ñèáàæí ù Ëýääé-179 ïíèàçàè çàèííí áðí óð ñí áí ó èò àèáíáí ñí ñòáà à íà áðáí èòá í èæí ááí ááððí àèáí áí ááðð è í èæí ááí ááí èí èà. Ááððí àèáí áí ááððèñèèà àèðèòàðð è ñòáí í áèáí ù á í áðàçòáð èáðí à íà àéóáéíá ïò 790,3 ï áí 778,5 ï. Ñòáàè í èò ïðáí àèááàðò *Solisphaeridium nanum*, *Domasia trispinosa*, *D. elongata*, *Diexallophasis denticulate*, *Oppilatala insolita*, ï áí áá ïííáí÷èñèáíí ù *Ammonidium microcladum*, *Pterospermella latimarginata*, *Dictyotidium eurydictyotum*, *Nymatiosphaera heloderma*, *Dor-*

senidium rhomboidium è áð. Æ ïðèíæáí èýò ï èæí ááí ááí èí èà (àéóá. 771,0 ï è 758,2 ï) ñòáí í áèáí ù àèðèòàððè *Cymbosphaeridium pilar*, *Deunffia furcata*, *D. ramusculosa*, *Domasia intermedia*, *Estiastra barbata*, *Visbysphaera meson*, *V. Pirifera*, *Dictyotidium arctum*, *Multiplicisphaeridium corallinum*, *M. ramusculosum* è áð. Ï í áí áí ù é ááðèáí ñòðáðèáðàòè÷áñèíáí ðáñí ðááàèáí èý àèðèòàðð ðáí áá áù è ïíèáí ×. Ááóí è (Downie, 1984) è Ë. Áíðí èí áí (Dorning, 1981) àèý ðàçðàçíá á Ááèèíáðèòáí è è Æ. Ëèðýííáùí (1978) àèý Óèðáèí ù. Ííáùá ááí í ùá ïí Ëèòáá ïðèááðò áí èüøóð áèí ñòðáðèáðàòè÷áñèóð ýðèí ñòù áðáí èòá èáí áí ááððè - ááí èí è ïíáðááðæáàðò áí çí í æí í ñòù í áæðáèí áèüí í é èí ððáèýòèè ñèéóðèéñèéö ïðèíæáí èé ïí ááí í ùí èññèááí ááí èý àèðèòàðð.