Arctoa (2013) **22**: *83-92*

MOSSES FROM ROVNO AMBER (UKRAINE), 2

МХИ ИЗ РОВЕНСКОГО ЯНТАРЯ (УКРАИНА), 2

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Abstract

The new amber collections from Rovno expand the species and generic composition of its moss flora. *Calymperites ucrainicus* is described as a new form-genus and species; taxa of Calymperaceae were not previously reported in Eocene amber from Europe. Three species are the same as in Baltic amber, one is fossil *Hypnum palaeocircinale*, and two are comparable with extant *Trachycystis microphylla* (East Asia) and *Hypnodontopsis mexicana* (Mexico). One more specimen is compared with *Sematophyllites sp*. from Baltic amber, without more exact identification. One amber piece contains as much as 6 plants of *Hypnodontopsis mexicana* at different stages of development, representing its variation. The latter may challenge the species status of *H. pilifer* and *H. lingulata*, which may be assumed as merely a morphotypes of *Hypnodontopsis mexicana*.

Резюме

Новые коллекции ровненских янтарей существенно расширили данные о мхах ископаемой флоры эоценового возраста. *Calymperites ucrainicus* описан как новый формальный род и вид; ранее таксоны семейства Calymperaceae не были известны из эоценовых янтарей Европы. Три приводимых вида были известны из балтийского янтаря: один ископаемый вид *Hypnum palaeocircinale* и два отнесенных к современным видам *Trachycystis microphylla* (Восточная Азия) и *Hypnodontopsis mexicana* (Мексика). Еще один образец сравнивается с *Sematophyllites sp*. из балтийского янтаря, без более точного определения. В одном куске янтаря содержится 6 растений *Hypnodontopsis mexicana,* находящихся на разных стадиях развития и демонстрирующих варьирование этого вида. Это ставит под сомнение видовой статус *H. pilifer* и *H. lingulata*, которые, вероятно, правильнее считать морфотипами полиморфного *Hypnodontopsis mexicana*.

KEYWORDS: fossil, mosses, amber, Rovno region, Ukraine, Tertiary, Eocene

INTRODUCTION

After the first publication on mosses of Rovno amber in Ukraine (Ignatov & Perkovsky, 2011), additional moss specimens were accumulated. Some of them comprise species new to the Rovno amber, while others contribute more complete material and important details to variation of species already recorded in the Rovno amber.

Description of locality, discussion on Late Eocene age of Rovno amber collection and related items are given in Ignatov & Perkovsky (2011). All mentioned specimens are deposited in the Rovno amber collection of Schmalhausen Institute of Zoology in Kiev (SIZK).

Genus **Hypnum** Hedw. (extant, family Hypnaceae)

Description: Stem densely foliate. Leaves more or less falcate-secund, ovate-lanceolate to lanceolate, more or less long acuminate, margin entire to serrulate (see nonetheless comment below). Long single costa absent. Laminal cells elongate to linear, 6-10 μm wide, smooth.

Type species: *Hypnum cupressiforme* Hedw. This species is widespread in the world; however, the group of species traditionally classified in this genus is a difficult one, likely combining species that may need to be placed not only in more than one genus, but even in different families (cf. Ignatov *et al.*, 2007). Leaving these problems for discussion elsewhere, we, first of all, undertake here a comparison with the known Late Eocene material.

Frahm (2010) classified medium to small-sized fossil pleurocarpous mosses without costa and plus-minus falcate leaves into three genera: 1) *Hypnites,* characterized by relatively slightly falcate-secund leaves; 2) *Ctenidium* with strongly falcate-secund and distinctly serrulate leaves; 3) *Hypnum palaeocircinale* having strongly falcate leaves, while its margin in known specimens was not apparent enough to state if it is serrulate or entire.

The new moss specimen from Rovno can not be referred to *Hypnites*, as it has strongly falcate-secund leaves (see also discussion below), and at the same time its entire leaves preclude its placement in *Ctenidium*. Thus,

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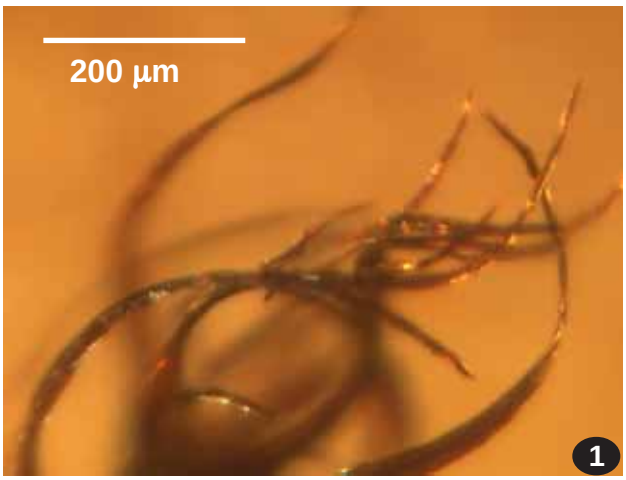
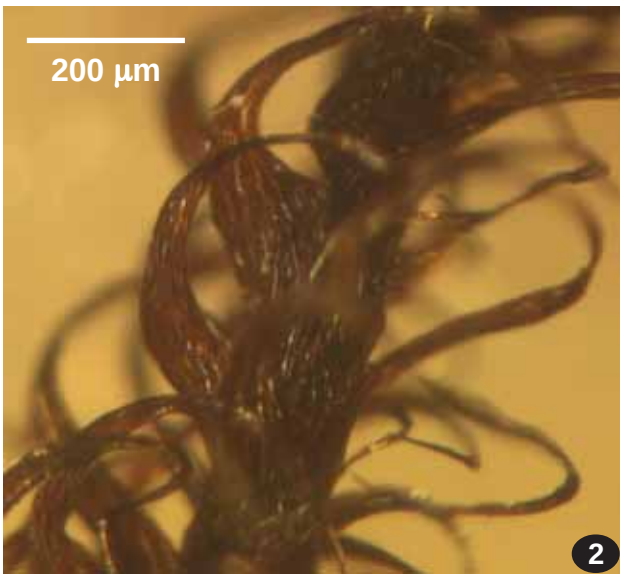
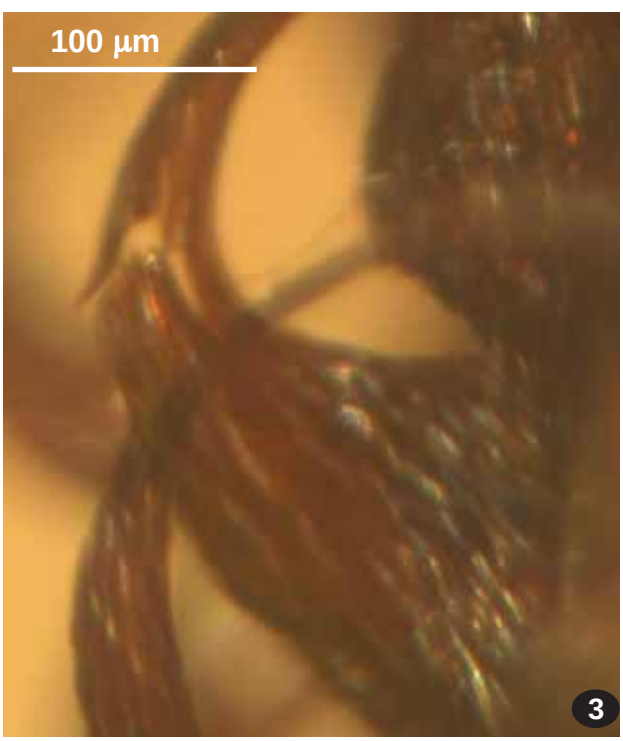






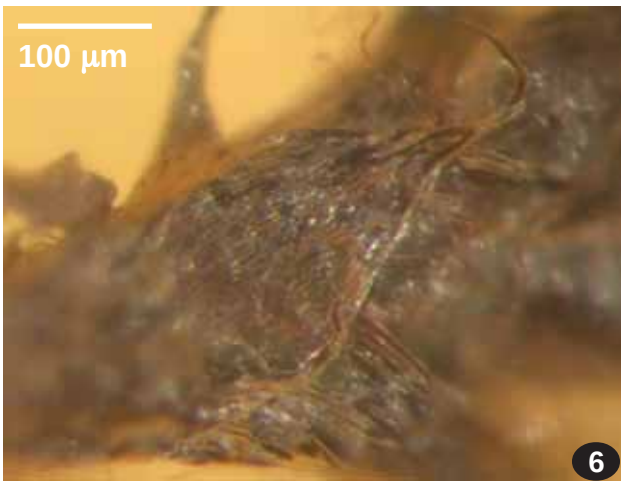
Figs. 1-4. *Hypnum palaeocircinale* J.-P. Frahm (from SIZK-K-27367): 1: leaves at shoot tip, showing entire leaf margins; 2, 4: habit; 3: leaf cell structure.

to avoid new names, we refer it to *Hypnum palaeocircinale*.

1. **Hypnum palaeocircinale** J.-P. Frahm [Late Eocene, Baltic amber]

Figs. 1-6

Shoots densely terete foliate, with ca. 20 leaves per 1 mm of subapical part of 2 mm long, where the stem is ca. 0.1 mm wide. Leaves spreading from base at 30–70°, strongly falcate, forming arches of (30°–)90°–180°(–270°), not clearly secund, but often somewhat twisted spirally around stem, 0.8-1.1×0.15-0.20 mm, at half length about



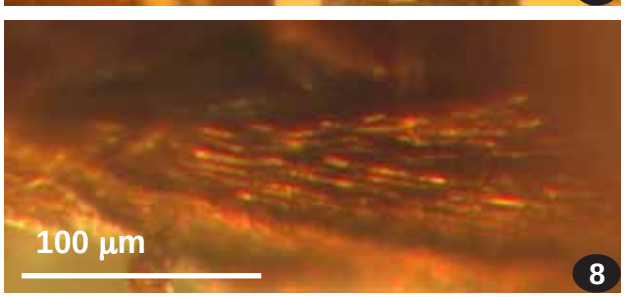
Figs. 5-6. *Hypnum* cf. *palaeocircinale* J.-P. Frahm (from SIZK-K-10053): 1: shoot tip; 2: leaf, showing narrow-celled areoaltion and recurved leaf acumen.

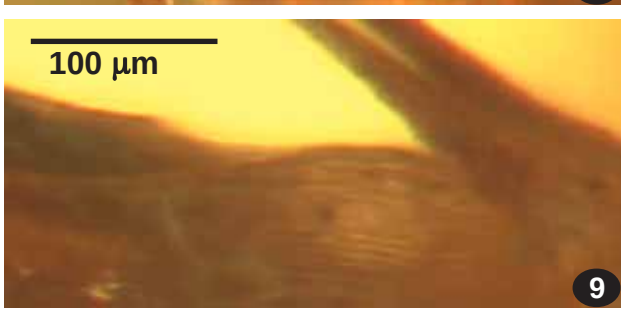
0.05 mm wide, from ovate-lanceolate basal part of ca. 200-250 µm long, gradually tapered to acumen; margin plane, entire; laminal cells linear, 7-9 µm wide.

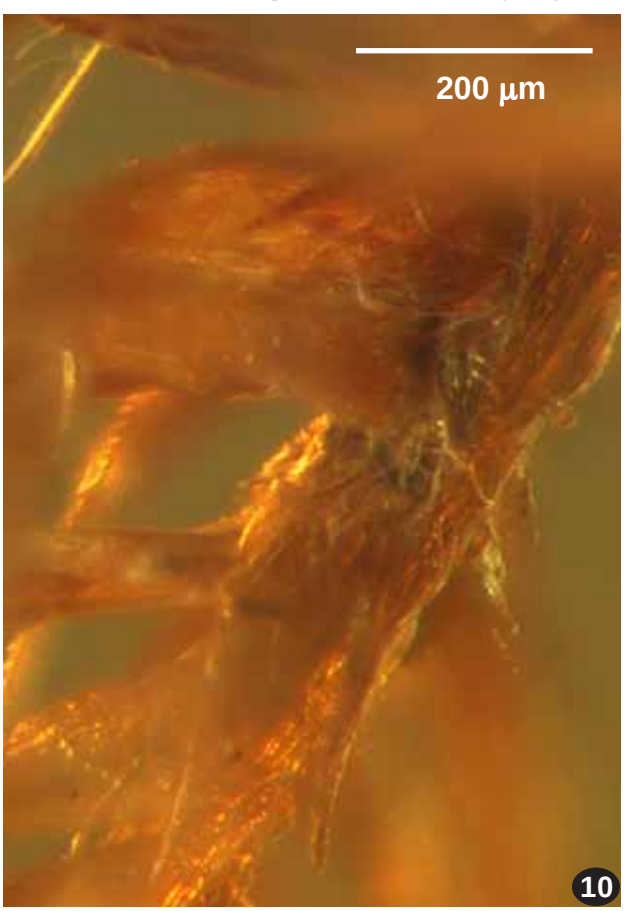
The above description is based on the specimen shown in Figs. 1-4. Another fragment of a shoot less than 1 mm long agrees with *Hypnum palaeocircinale* in lamina cell width and shape, plane leaf margin, overall leaf outlines, but differs in shorter, to 0.6 mm, less falcate to almost straight leaves, some leaves quite abruptly tapered from ovate base to more narrow acumen (Figs. 5-6).

Specimens examined: Klesov. Rovno amber. Late Eocene. SIZK-K-27367 (in amber piece of 0.45 g after primary treatment). Syninclusions: Diptera (Chironomidae, Chironominae, male), stellate hairs. SIZK-K-10053F.

Figs. 7-10. *Sematophyllites sp.* (from SIZK-K-10064). 7: habit; 8: leaf, showing narrow-celled areolation shortly above leaf middle; 9: prosenchimatous laminal cells in basal part of leaf; 10: shoot with leaves, leaf cells are seen at places, stem is covered by fungi weft.







Material: two specimens are found, one comprising a terminal part of shoot of 2 mm long, with ca. 40 leaves, while the second one is a small terminal part of shoot with ca. 20 small leaves, 1 mm long. The small leaf size was likely a result of unfavorable growth conditions, often leading to reduced size of plants, and especially of its shoot tips. Such specimens are usually difficult to interpret as young leaves often look different from leaves on the main part of stem.

Comparison: Frahm (2010) illustrated a slightly more regularly falcate leaves in collections of this species from Baltic amber (including the holotype), but otherwise plants are similar. The "prototype" of *H. palaeocircinale*, the extant North American species *Hypnum circinale* Hook., has usually larger leaves, up to 2.2 mm (Lawton, 1971), and also rather regularly falcate leaves.

Among Rovno collections, superficilally quite similar is *Ctenidium capillifolium* (Ignatov & Perkovsky, 2011), but that species has distinctly serrulate leaf margin, which is entire in both specimens referred here ot *H. palaeocircinale.*

Genus **Sematophyllites** J.-P. Frahm (form-genus, order Hypnales, family indefinite)

Systematics and nomenclature: It might be thought that the form-genus *Hypnites* would be most appropriate for specimens without revealing specific characters, but having lanceolate or ovate-lanceolate leaves without strong single costa, *i.e.* without costa or with short double costa, which cases in fossil materail is almost never possible to separate. However the usage of this name is problematic.

The genus *Hypnites* was described by Ettingshausen (1852) in time when the genus *Hypnum* included most of pleurocarpous species, classified nowadays in many genera and families. Both costate and ecostate mosses were placed in the genus *Hypnum* by many authors of the beginning and middle of the 19th century. In the original description of *Hypnites haeringianus* Ettingsh. it was the only representative of this genus, and therefore it is the type of the genus *Hypnites.* The original description, including illustrations, provides no information about costa, although indirect evidence on its presence is that Ettingshausen (1852) compared the plant with *Hypnum riparium* (*Leptodictyum riparium* (Hedw.) Warnst.). The picture shows stem with very distant patent leaves, similar to species of Amblystegiaceae or Calliergonaceae when they are growing submerged in mire hollows, and this similarity is an additional fact in favor of costa presence, as all species of such appearance in modern flora have costa. Schimper (1869) concluded that this species is the same as *Drepanocladus aduncus*, while Brotherus (1909) later published the combination *D. haeringianus* (Ettingsh.) Broth. So if consider this character of the costa presence important, then the name *Hypnites* should not be used for mosses with leaves without apparent single costa. Therefore we refer the following plant in the genus *Sematophyllites.*

Sematophyllites was described by Frahm with the type of *S. serratus*, indicating strongly toothed leaf margin. However, later he placed to this genus entire-leaved specimens, including *S. sp.* (Frahm, 2010), which is quite similar to one of the Rovno specimens (Figs. 7-10). It differs from *Hypnum* mainly in much loosely arranged, erect-spreading and more or less straight leaves.

2. **Sematophyllites** sp. [comparable with specimen Gröhn 2017, Late Eocene, Baltic amber, illustrated in Frahm, 2010, Fig. 117] Figs. 7-10

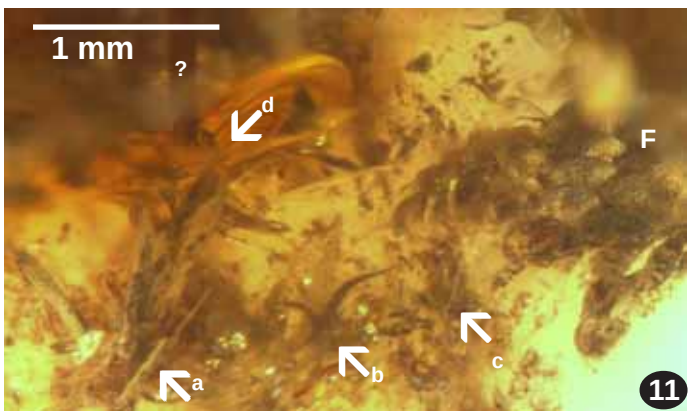
Description: Shoots terete foliate, with ca. 30 leaves per 2 mm in subapical part, with the stem ca. 0.1 mm wide. Leaves erect-spreading from base at 30–70°, almost straight to only slightly curved, 0.6-0.8×0.15-0.20 mm, at half length about 0.1 mm wide, from ovate-lanceolate basal part gradually tapered to lanceolate acumen; margin plane, entire; laminal cells linear, 5-7 μm wide.

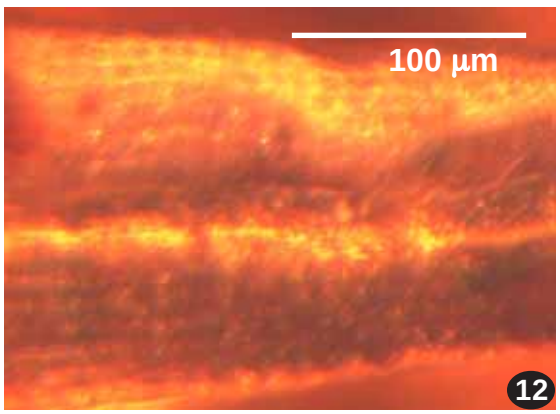
Specimen examined: Klesov. Rovno amber. Late Eocene. SIZK-K-10064 (in amber piece of 0.5 g after primary treatment).

Material: The only collection with 3 mm shoot is found, comprising a clear view of shoot foliage shortly below its tip, which itself is not possible to see. The middle part of the specimen is loosely covered by fungi weft (Fig. 10) and some filiform structures arising from the leaf (cf. Fig. 10, upper left corner), are also likely hyphae.

Comparison: *Sematophyllites* sp. lacks any highly specific character of any extant group and available features do not disagree with a number of families: Hypnaceae, Pylaisiaceae, Plagiotheciaceae, Sematophyllaceae, and some other smaller families of pleurocarpous mosses. *Sematophyllites subjulaceous* Ignatov & Perkovsky already known in Rovno has more rigid and concave-channeled leaves, resulting in a rather julaceous appearence, at least at places. In addition, its leaves are even smaller, 0.1 mm wide in creeping shoots (although considering the fact that many shoots are likely far from optimally developed, the size difference is of secondary importance). Frahm (2010)' pictures of *Aptichella sp*., *Hypnites subflagellaris, H. lanceolatus*, and some pleurocarpous mosses of indefinite position (Figs. 155, 157) do not differ considerably from this *Sematophyllites* sp.

Figs. 11-19. *Hypnodontopsis mexicana* (from SIZK-K-10055). 11 & 16: overall view of amber piece, the *H. mexicana* are arrowed, *Frullaria* sp. is marked as F; 12: lamina areolation, also showing papillose cells; 13-15: the same group of plants, at different angle, showing "capsule-like structure"; 17 & 19: the same plant at different angles, the maximally developed specimen, with upper leaves tapered in distal part into very narrow tubulose acumina; 18: small, likely young plants, some with rather obtuse apex.


1 mm
?
d
F
a
b
c
11


100 µm
12


0.5 mm
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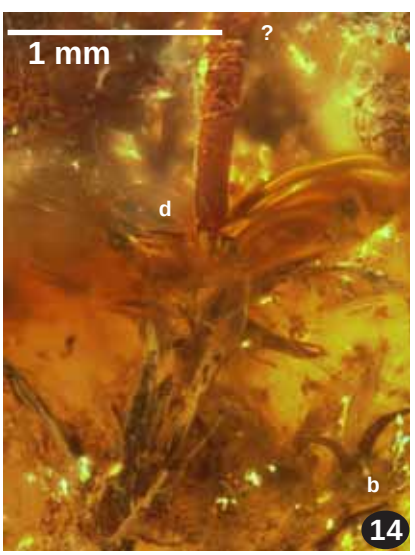
1 mm
?
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b
14


0.5 mm
?
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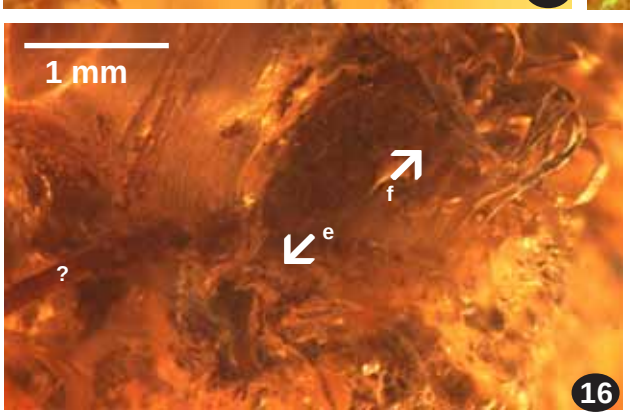
15


1 mm
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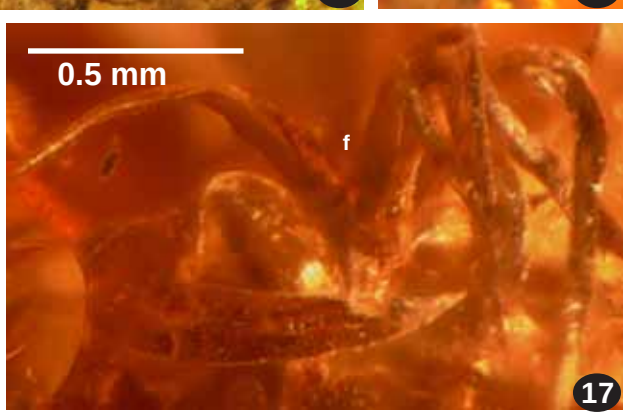
?
16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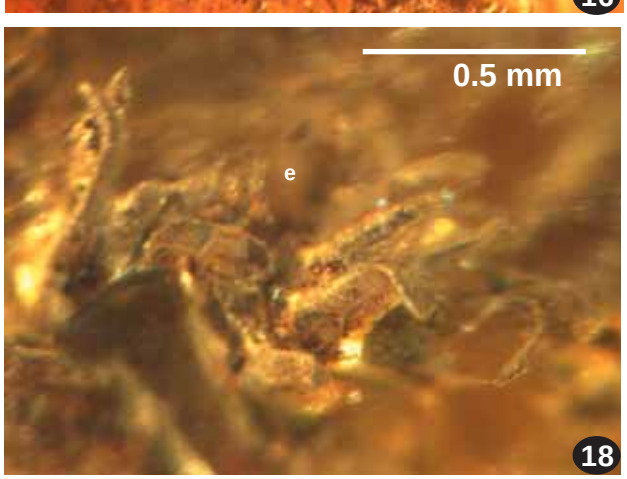
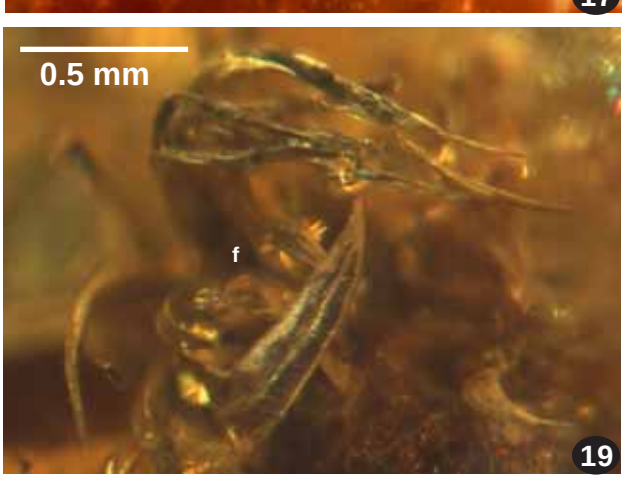
f
17


0.5 mm
e
18


0.5 mm
f
19

from Rovno, but detailed comparison can not be informative enough due to lack of "leading" structural details.

Genus **Hypnodontopsis** Z. Iwats. & Nog. (extant, family Rhachitechiaceae)

Two species of this genus were already found in Rovno amber (Ignatov & Perkovsky, 2011) and in Baltic amber as much as five species were recorded (Frahm, 2010). The collection found here may be quite valuable, as it represents a group of plants at different stages, allowing better understanding of infraspecific variation and polymorphism of heteroblastic leaf series.

3. **Hypnodontopsis mexicana** (Thér.) H. Rob. [extant, Mexico] Figs. 11-19

Description (based on current specimens): Stems shorter than 1 mm, densely foliate. Leaves strongly variable from proximally small, lingulate, obtuse, somewhat reflexed, next leaves narrowly elongate, acute to attenuate-apiculate, more or less straight, and upper leaves from lanceolate base tapered to long acumen, falcate; lower leaves 0.4×0.1 mm, middle leaves 0.8-1.2×0.1-0.2 mm and upper leaves ca. 2.0 mm long, in acumen 0.05-0.1 mm wide; margin entire, flat to slightly recurved, in acumen leaf channeled, with margins subincurved; costa strong, ending far below apex in lingulate leaves, near or within leaf apex in middle-sized leaves, and filling the acumen in upper leaves; in lower part of middle-sized leaves constituting ca. 1/5– 1/7 of leaf width, slightly projected on dorsal side of leaf, grooved on ventral side of leaf. Laminal cells more or less isodiametric, 8-10 μm, in longitudinal rows (6-8 on each side of costa), papillose with low rounded single papillae, in lower 1/6 part of leaf rectangular; cells at the dorsal side of costa similar to laminal cells.

Problematic structure ('? 'in Figs. 11, 14-16). Firm-tissued largely cylindric to distally somewhat clavate structure is situated in one of small-leaved plants. Its position is similar to seta of sporophyte, with very broad and long neck, like in modern *Ulota* species. It is 1.5 mm long, in the middle 0.2 mm in diameter, in distal (from leaves) part 0.3 mm; its distal end is broken off, at the place of broadening, ca. 1 mm from proximal end, a transverse folds occur. There is a temptation to refer this object to sporophyte, as its position and size agree with this interpretation. However, this structure is very rigid, lacking areolation details, which is commonly associated with neck; at proximal end a mark of crack is seen at higher magnification, so at least nothing like vaginula is observed at that area; leaves which are surrounding "seta" base are very small, while perichaetial leaves in most mosses are larger (or innermost perichaetial leaves can be smaller, but then outer perichaetial leaves are enlarged). Folding is also looking unnatural for sporophyte epidermis. Summing up, the discussed structure is not considered as a part of moss, until its structure is understood better.

Specimens examined: Klesov. Rovno amber. Late Eocene. SIZK-K-10055 (in fragment of transparent amber piece #2-1016, 48×31×29 mm, 18.5 g). Syninclusions: stellate hairs.

Material: There are at least 6 'plants' (one-two groups comprise 2-3 young gametophores), marked by letters 'a-f' in Figs. 11-19. The amber piece includes also several shoots of *Frullania* sp., which will be discussed elsewhere. As only a dorsal side of *Frullania* is seen, its identity is rather indefinite, because essential characters of amphigastria are unseen under opaque material.

Among *Hypnodontopsis* plants:

a: 5 leaves to 0.9-1.1 mm long; leaves erect, straight, acute; the leargest leaf has projection at apex, likely due to projecting costa; cell structure of lamina and dorsal side of costa is seen at places from dorsal leaf side of 3 leaves, papillose surface can be confirmed.

b: Two reflexed small leaves 0.4-0.5 mm long, gradually tapered to narrow acumen; they are dark, not allowing seeing cellular structure; larger straight leaf ca. 0.6 mm long is situated between them, having straight position; it is very pale, indicating that it was probably partly decomposed already at time of fossilization; laminal cell outlines are discernible in this larger leaf.

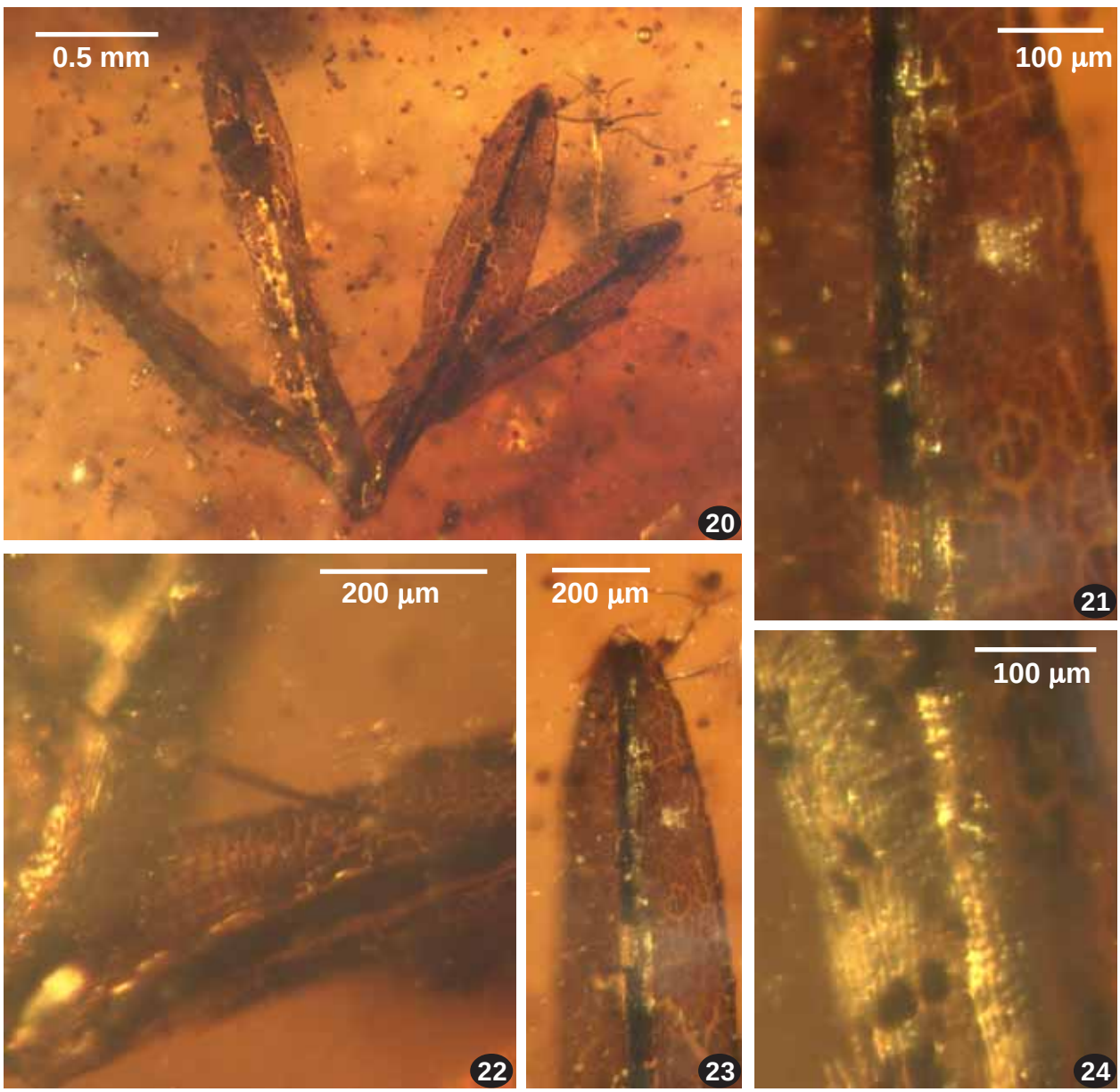
c: Obscurely seen few small leaves.

d: Rosette of three small acute leaves less than 0.5 mm long, somewhat similar to lowermost leaves of 'b'; their shape is so different from other leaves that, being found alone, they likely would be attributed to another species of genera; however, 'b' ensures that this variation is a characteristic of *Hypnodontopsis*; in between 'd' and 'a' there is probably one more plant but the light aberration precludes its clear view.

e: Group of very low plants, with leaves less than 0.5 mm long, acute to obtuse, reflexed shortly below apex; costa rather slender, disappearing shortly below apex; cell structure and papillose cell surface are apparent; plants in this group are seen from above, contrary to 'b', which may explain a certain difference in leaf shape; at a somewhat lateral view it looks acute (in 'b', partly in 'e'), while in view from above in 'e' its obtuse shape becomes apparent.

Obtuse-leaved *Hypnodontopsis* plants were described as a separate species *H. lingulatus* J.-P. Frahm, and our 'e' plants are very similar to it. Considering co-occurrence and variation in 'a-f' plants, we prefer to account them at the moment as an infraspecific variation, although the co-occurrence of several species can not be excluded.

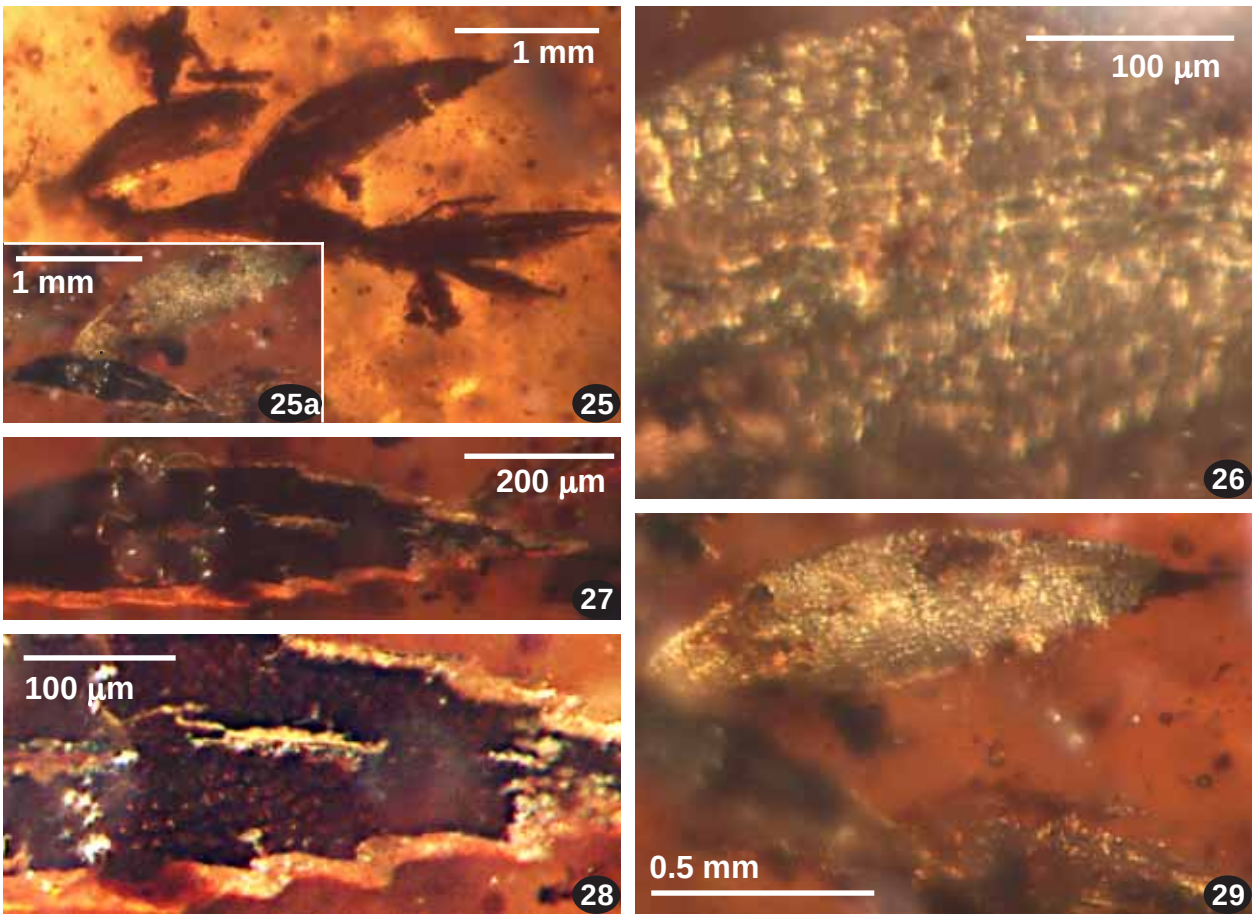
f: These are the largest plants in the group and their appearance is much contrasting with the others being more similar to *e.g. Dicranum viride* (Sull. & Lesq.) Lindb.; stem and basal part of shoot are not well seen, largest leaves are much longer than leaves in 'a' and 'b' plants, and are characterized by falcate tubulose acumens. However, one leaf in front of the group of five largest leaves is very similar to the middle-size leaves in 'a' and



Figs.20-24. *Calymperites ucrainicus* sp. nov. (from SIZK-K-27043FL1). 20: shoot fragment with four leaves; 21: dorsal side of leaf (closed up from 23), showing costa exserted on the dorsal leaf side; 22: leaf base, showing areolation of short rectangular cells; 23: upper half of leaf; 24: cells in midleaf showing areolation of dorsal costa and lamina.

'b'. One more leaf of the same structure is seen (although not clearly) slightly behind the largest leaf group, indicating that the middle-sized and the largest leaves are from the same shoot and comprising a heteroblastic series. Another reason for such evaluation is the variation which is seen in illustrations of different *Hypnodontopsis* species (Frahm, 2005; 2010: Fig. 54-74) and the description of this modern species in the "Flora of Mexico" (Sharp *et al*., 1994). Their upper leaves often have attenuate-tubulose acumens, and the Rovno specimen reported as *H. pilifer* J.-P. Frahm (Ignatov & Perkovsky, 2011) also may fall within the variation pf *H. mexicana* as it is accepted now.

Comparison: Previous Rovno collections referred to *H. mexicana* by Ignatov & Perkovsky (2011) were similar to plants 'a', and 'b', while plants from 'f' were treated by these authors as *H. pilifer* Frahm. Here we accept them as a single species, and such approach is in full congruence with the Klebs' description of *Dicranites casparyi* (= *Hypnodontopsis casparyi* (Klebs in Caspary) J.-P. Frahm. The illustration of this species in original description shows the whole range from small lingulate leaves through oblong to subulate ones. The specimens were referred to one species, in addition to a certain morphological similarity, also because of co-occurrence in amber. This picture has been reproduced and discussed by Frahm (2005), who however came to opposite conclusion that the collection and its illustration comprise the mixture of different species. In a way similar to *Orthotrichum* species that not rarely occur



Figs.25-29. *Trachycystis microphylla* (from SIZK-K-27043FL2): 25: habit; 26 & 29: areolation in middle part of largest leaf from ventral side; 27-28: dorsal view of the leaf (lower leaf in #25a), with areolation seen at places in #28.

together on tree trunks, the short and long-leaved species of *Hypnopdontopsis* grew nearby, but belonged to different species (Frahm, 2005). Therefore the short-leaved plants were placed in *H. mexicana*, while long-leaved were segregated as extinct *H. casparyi*. Our observations support the conclusion of Klebs (Caspary, 1907) rather than of Frahm (2005). However the further study is needed for the complete understanding the *Hypnodontopsis* variation.

Genus **Calymperites** gen. nov. [form-genus, order Dicranales s.l. (incl. Pottiaceae). family indefinite]

Description: Leaves erecto-patent, oblong-lingulate, obtusely acute; margin plane, subentire, unbordered; laminal cells quadrate to short rectangular, slightly bulging, not papillose; near leaf base rectangular.

Type species: **Calymperites ucrainicus** sp. nov.

Systematics and nomenclature: The specimen in Figs 20-24 comprises a relatively large moss, with four leaves up to 2.2. mm long and 0.35 mm wide, with moderately stout costa, quadrate to short rectangular laminal cells and rectangular basal cells, ca. 2-3:1. The latter character excludes the families Polytrichaceae and Timmiaceae, but there are still a lot of families, whose species are congruent with such a diagnosis: the Dicranaceae, Rhabdoweisiaceae, Rhachitheciaceae, Calymperaceae, Pottiaceae. The generic name addresses to *Calymperes*, as species of this genus are common epiphytes in tropical and subtropical regions, cells are not papillose but slightly bulging, basal cells are rather short rectangular at least in some species.

4. **Calymperites ucrainicus** sp. nov. Figs. 20-24.

Holotype: Klesov, Rovno amber. Late Eocene. SIZK-K-27043FL1 (in amber piece of 1.9 g after primary treatment). Syninclusions: *Trachycystis microphylla*, 12 Diptera (Psychodidae – 2, Phoridae – 6), Psocoptera (larva), 15 Collembola (Entomobryomorpha), 19 Acari (6 *Glaesacarus rhombeus* (Koch et Berendt), 3 Oribatei, 1 Erythraeidae). Figs. 20-24.

Description: Leaves densely arranged on stem, erecto-patent, forming angle with stem direction from 30 to 60°, straight, 1.7-2.3×0.30-0.35 mm, oblong-lingulate, slightly broader in upper half, obtusely acute; margin plane, subentire, unbordered; laminal cells quadrate to short rectangular, 10 µm wide; near leaf base rectangular, to 13-20×12-13 µm.

Specimen examined: Klesov. Rovno amber. Late Eocene. SIZK-K-27043FL1.

Material: The only collection has very short shoot fragment with 4 leaves, all seen from the dorsal side, which is obvious for three of them from arrangement, while the fourth, at the right in Fig. 20, has strongly exserted costa, which is characteristic for dorsal side (as it is in other leaves). Dark brown mud-like compound covers most of leaf surface; it is cracked into irregular polygons, but at places where it is fallen off, cell are readily visible (Figs. 21, 22, 24). The margin is not satisfactory studied; at places where areolation is seen better neither distinct serration, nor apparent limbidium are visible.

Comparison: *Calymperites* differs from *Hypnodontopsis* (cf. above) in larger and broader leaves. Although largest leaves of *Calymperites* are approaching in size to largest uppermost leaves of *H. mexicana*, these leaves in the latter species are narrowly acuminate and tubulose above, while lower leaves of *Hypnodontopsis* being more similar to *Calymperites* in shape are 2-4 times shorter.

Some *Atrichum* species from the Baltic amber have leaves only 2-3 mm long, and as only dorsal view is available here, this option should not be totally excluded. However the subentire margin (toothed in *Atrichum*) and more narrow leaves make this relation not particularly likely.

The considerable similarity to *Calymperites* in leaf shape is observed in *Rhabdoweissia* and *Oreoweisia*, but they are rare ground species, with low probability for fossilization in amber. At the same time Frahm & Newton (2005) reported as much as four *Calymperes* species from Dominican amber.

Genus **Trachycystis** Lindb. (extant, family Mniaceae)

The genus is represented in Baltic amber by three species (Frahm, 2001, 2004, 2010), some of them being represented by a number of collections. Extant species occur in East Asia, some being rather common there; plants are growing on soil, but *T. flagellaris* is a common epiphyte as well. We refer the Rovno specimen to the extant species, as there are no characters contradicting it.

5. **Trachycystis microphylla** (Dozy & Molk.) Lindb. [extant, East Asia] Figs. 25-29

Description: Shoots loosely arranged at distance ca. 0.5 mm from each other, erecto-patent, forming angle with stem from 30 to 45°, straight to slightly incurved, to 2.1×0.7 mm, elliptic to narrowly elliptic, gradually tapered to acute apex; margin plane, coarsely serrate in upper 1/3 of leaf, entire below, unbordered; laminal cells hexagonal, 13-17 μm in width and length. Cells above costa on ventral side are rectangular, 40×15 μm,

Specimen examined: Klesov, Rovno amber. Late Eocene. SIZK-K-27043FL2 (syninclusions: *Calymperites ucrainicus* and associated insect see under that species).

Material: The only shoot fragment has a large leaf, 2.1 mm long, seen from ventral side, and more appressed narrower leaf seen from dorsal side; base of the latter leaf is not clearly seen, but estimation of its length gives the smaller size, 1.7 mm long. Lower leaf lacks upper parts; uppermost leaves are strongly damaged.

Dark brown mud-like compound covers most of leaf dorsal sides, but fortunately the ventral side of the largest leaf (Figs. 26, 29) is clean and cellular structure is clearly visible. Although the margin is not perfectly seen, there is nothing indicating limbidium differentiation, at least size and shape of marginal cells look about the same with the other laminal cells (Fig. 28).

Comparison: The absence of limbidium formed by narrow elongate to linear cells differentiates *T. microphylla* from *T. flagellaris*, another common species in Baltic amber. The discussed Rovno specimen is much similar to the illustration of this species given by Frahm (2010: Figs. 44-47).

* * *

Among the five mosses reported in the present paper, the four are referred to the same or at least very closely related species that are found in Baltic amber. In our previous paper (Ignatov & Perkovsky, 2011), the five genera out of seven are also whose reported from the Baltic and Bitterfield amber collections. The similarity between moss flora of the latter and the Rovno amber mosses concerns also the species composition: for example, *Hypnodontopsis* was considered by Klebs (in Caspary, 1907) the most common moss in the Baltic amber. *Trachycystis* is also one of the genera described at the early time of amber inclusion study (as *Muscites hauchecornei* Casp. & G.A. Klebs, cf. Frahm, 2010), and subsequently found in many other collections. The latter genus highlights the similarity of East Asiatic extant and European Eocene flora, in addition to well known examples of hepatic *Nipponolejeunea* (Grolle, 1981), and gymnosperms like *Gingko* and *Metasequoia.*

ACKNOWLEDGEMENTS

We thank A. P. Vlaskin (SIZK) for preparation specimens for study, A.B. Ivanova for English correction. The work was partly supported by RFBR 13-04-01592.

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