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LEPIDOPTERIS OTTONIS (GOEPP.) SCHIMP. AND *PELTASPERMUM ROTULA* HARRIS FROM THE RHAETIAN OF POLAND

Lepidopteris ottonis (Goepp.) Schimp. i *Peltaspermum rotula* Harris z retyku Polski

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ABSTRACT. The specimens of the *Lepidopteris ottonis* (Goepp.) Schimp. were examined from Rhaetian of Poland. In Poland there are four localities of this seed fern: Śląsko-Krakowska (Silesia-Cracow) Upland, Rawicz region, Świętokrzyskie (Holy Cross) Mountains and the new site in Gradzanowo near Płońsk. The paper contains the description of leaves, seeds and fructification (*Peltaspermum rotula* Harris) of this fossil plants.

KEY WORDS: Upper Triassic, seed ferns, anatomy, morphology

INTRODUCTION

For the first time in Poland, leaves of Mesozoic seed fern *Lepidopteris ottonis* were found near Wieluń and Kluczbork (Śląsko-Krakowska Upland) in the middle of the 19th century. All the specimens of *L. ottonis* known from the territory of Poland were revised when a new location of that species was discovered near Płońsk in 1970. The specimens originated from region of Kluczbork (now stored in the Geological Museum of Wrocław University) were examined in detail again. This material, collected in the second half of the 19th century, was not covered by the earlier description of this territory (Goeppert 1846, Roemer 1870, Gothan 1909). The analysis of cuticle proved the previous identifications (with exception of two cases) so these specimens can be used as a comperative material for identification of a leaf from a new site.

Detailed examination of the material from the region of Kluczbork revealed, besides of leaves, fragment of cupulate disc (fructifications *Peltaspermum rotula* Harris) and a number of seeds previously known only from the Rhaetian of Greenland (Harris 1932).

The present paper gathers the information about specimens of *Lepidopteris ottonis* from the Polish sites including detailed description of cuticle, fructifications and seeds.

HISTORY OF INVESTIGATIONS

Lepidopteris ottonis (Goepp.) Schimper was first described from Poland from Wieluń and Kluczbork surroundings. In 1836 Goeppert described leaves from the Wieluń area under the name *Alethopteris ottonis* and in 1846 from the region of Kluczbork (Dobiercice, Maciejów, Biadacz)[1] under the name *Pecopteris ottonis* (Goeppert 1846). Some other specimens were also found near Kluczbork (Dobiercice, Gosław, Biadacz) and described under the names *Asplenites ottonis* (Roemer 1870) and *Lepidopteris ottonis* (Gothan 1909)[2]. In 1866 Roemer notified a site of *Pecopteris ottonis* in Mierzęcina near Kielce (The Świętokrzyskie Mountains). In 1891 other specimen from the Świętokrzyskie Mountains was described under the name *Lepidopteris ottonis* by Raciborski (1891) Makarewiczówna (1928) however proved, that it was the erroneous identification. In 1970 a new site of *L. ottonis* was found near Rawicz. It was described by Piwocki (1970), who also gave the first Poland description of cuticle of this species.

Germany is the other important region of occurrence of *L. ottonis*: Seinstedt near Brunschwik and Coburg over Danube. Schenk (1867) described leaves from that region as *Asplenites ottonis* and gave the first description of cuticle of this species. The genus name, *Lepidopteris*, created by Schimper (1869), is connected with characteristic scales-like protuberances on the main leave rachis.

Found for the first time in the Rhaetatian of Sweden (Scania) male reproduction organs *Antholitus zeilleri* (Nathorst 1908) were later connected with the leaves of *L. ottonis* by Antevs (1914). Subsequent papers deal with leaves from the Hör region (Antevs 1919) and from Scania (Johansson 1922, Lundblad 1950). The most complex descriptions of *Lepidopteris ottonis* could be found in Harris' paper (1932), dealing with the material from the East Greenland. Besides of careful examinations of morfology, the author gave details of cuticle. In the vicinity of leaves of *Lepidopteris ottonis* were found male reproductive organs *Antholitus zeilleri* Nath. and fructifications *Peltaspermum rotula* Harris as well. The latter, umbrella-shaped cupulate disc, were for the first time described in this material (Harris 1932). Seeds and pollen grains were also found there. Harris reconstructed the whole fructification and gave details of cuticle of cupulate disc and seeds. The stratigraphic investigations of Harris from Greenland need also attention. He correlated stratigraphic zones, each with its characteristic plants remains, with analogous zones distinguished by Nathorst in Scania and Central Europe (Harris 1937).

In 1970 Dobruskina (1970) described sites of *Lepidopteris ottonis* from Soviet Union (Ural, The Pechora Basin, The Donietsk Basin). She compared them chronologically

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[1] Poland was partitioned in the 19th century and a frontier existed between Wieluń (The Kingdom of Poland) and Kluczbork (Prussia). Therefore the site is described as "Wieluń ad Poloniae" in the first Goeppert's paper (1836) and the names of places are given in German spelling in the following papers dealing with material from Kluczbork area (Goeppert 1846, Roemer 1870, Gothan 1909) The actual Polish names are used in the present paper (Rospond 1951).

[2] None of those described specimens from regions of Wieluń and Kluczbork include the type-specimens of Goeppert are stored in the Geological Museum in Wrocław.

with an other site from China which let her to include them to the lower Keuper and to formulate hypotesis about the earlier appearance of *Lepidopteris ottonis* in the East Asia and its later expansion to the west.

MATERIALS AND METHODS

The specimens described in this paper were collected in three Polish localities: one of them in Gradzanowo near Płońsk, five in the region of Kluczbork (Śląsko-Krakowska Highland) and one in Mierzęcina (Świętokrzyskie Mountains). These materials except the specimen from Gradzanowo, had been determined by different synonims of the *Lepidopteris ottonis* species name:

1–*Asplenites ottonis* Schenk, *Pecopteris ottonis Goeppert*, Dobiercice (Wilmsdorf), det. 1866, No 3165p.

2–*Alethopteris ottonis* Goepp. Dobiercice (Wilmsdorf), leg. Janik 1847, No 3169p.

3–*Alethopteris ottonis* Goepp. Dobiercice (Wilmsdorf), leg. Roemer 1865, No 3166p.

4–*Pecopteris ottonis* Goepp. Gosław (Goslau) near Gorzów Śl., No 3164p.

5–*Asplenites ottonis* Schenk, Biadacz (Ludwigsdorf), det. Roemer 1863; *Pecopteris ottonis* Goepp. det. Rilag 1869, No 3167p.

6–*Pecopteris ottonis* Goepp. Mierzęcina near Kielce, leg. and det. Kosiński 1866, No 3168p. This specimen was mentioned by Roemer 1866. All these specimens belong to the Museum of the Geological Department of Wrocław University.

7–*Lepidopteris ottonis* (Goepp.) Schimp. Gradzanowo, leg. R. Dadlez 1970, collected in borehole Gradzanowo 1 near Płońsk (about 25 km away from Warszawa), belong to the W Szafer Institute of Botany, Polish Academy of Sciences, in Kraków No IB PAN PM S 942.

All the specimens are preserved partly in coalifield form, which made maceration possible (except one of them No 3166p), partly as impressions.

On one specimen from Dobiercice (No 3165p) there is impression of the cupulate disc – *Peltaspermum rotula* Harris, near the leaf, and several isolated seeds. Seeds are present near the other leaf from Dobiercice too (No 3169p). Some of them have well preserved coalifield cuticle.

The cuticle for preparation was oxidated in nitric acid and washed first in ammonia and then in destillated water. In order to obtain a clear appearance of veins, the oxidation in nitric acid lasted shorter time and the washing was in the 75% alcohol + sodium hydroxid mixture (Reymanówna 1970).

SYSTEMATIC DESCRIPTION

Leaf

GYMNOSPERMAE
Pteridospermopsida
Peltaspermales
Lepidopteris Schimper
Lepidopteris ottonis (Goeppert) Schimper

1836 *Alethopteris ottonis*, Goeppert, p. 303; Pl. 37, fig. 3, 4.
1846 *Pecopteris ottonis*, Goeppert, p. 144; Pl. 1, fig. 4–10.
1867 *Asplenites ottonis*, (Goeppert) Schenk, p. 53; Pl. 11.
1870 *Asplenites ottonis*, (Schenk) Roemer, p. 178; Pl. 13, fig. 1.

1876 *Lepidopteris ottonis*, (Goeppert) Nathorst, p. 29; Pl. 1, fig. 4a. Pl. 2, fig. 1.
1909 *Lepidopteris ottonis*, (Goeppert) Gothan, p. 2; fig. 1.
1914 *Lepidopteris ottonis*, (Goeppert) Antevs, p. 3; Pl. 1. figs 1–6; Pl. 2. figs 1–10.
1919 *Lepidopteris ottonis*, (Goeppert) Antevs, p. 24; Pl. 3, figs 2, 2a.
1922 *Lepidopteris ottonis*, (Goeppert) Johansson, p. 28; Pl. 1, figs 7–10; Pl. 6, fig. 3.
1926 *Lepidopteris ottonis*, Harris, p. 67; Fig 8.
1932 *Lepidopteris ottonis*, (Goeppert) Schimper, Harris, p. 58; Pl. 5, fig. 16; Pl. 6, figs 2, 10; Pl. 8, figs 8, 11, 15; Figs 27a–d.
1950 *Lepidopteris ottonis*, (Goeppert) Schimper, Lundblad, p. 30, Pl. 4, figs 6–7, 10; Pl. 5, figs 1, 11.
1970 *Lepidopteris ottonis*, (Goeppert) Schimper, Piwocki, p. 101; Pl. 1, figs 1, 2; Pl. 2, figs 3–5.

There are four specimens from the region of Kluczbork and one from Gradzanowo, which are similar and clearly belong to the same species. They are described together in the following. Two specimens (No 3167p, 3168p) showing differences, are mentioned in the discussion.

The leaf is bipinnate. The pinnae arise at angle of about 40–75° to the rachis, whose widths varies between 2–5 mm. The pinnule alternate, with entire or slightly dentate margin, their apex may be acute or rather obtuse, bases confluent. The length of pinnule varies from 5 to 25 mm and the width from 2 to 7 mm on the different specimens.

The venation is slightly distinguishable, rather shown by the macerated cuticle, pinnate. The veins arise to the midrib at angle 45–60° beginning from the base of pinnule and reaching to the margin. The midrib is straight and reach to the apex. All the specimen have the separate pinnules born on the rachis between pinnae ("Zwischenfiedern"). The surface of the rachis is covered with more or less distiguishable swellings, in two cases they are similar to scales (No 3165p, 3169p). The pinnules are of skin- type, the cuticle is very thick, dividing into two surfaces in maceration: upper – thicker and lower – thinner.

The cells of lamina, on both surfaces are large, polygonal, over the veins rectangular, the veins can be better seen on the thinner surface. The outlines are thick and straight, sometimes slightly sinuous. Almost every cell has a median papilla. It is usually great and markedly well cutinised, but it may be scarely marked too. The stomata are present on both surfaces, but a little more on the thin one. They are distributed between the veins and ocasionally over them.

The tipical stoma consists in 4–6 subsidiary cells, rather thicker cutinised than other ones of the lamina. They are often triangle and every of them has papilla on the tops, directed towards over the stomatal aperture. They may surrond it or, more or less, cover it. There are ocassionaly encircling cells surrounding the subsidiary cells. The guard cells are sunken, half – round shape, with extended poles. They are usually slightly cutinised, except the thick ventral walls.

There are some double stomata found in the material. In this case, one of the subsidiary cells is extended and has two papillae on two opposite ends, which belong to two separate stomata.

The cuticle of rachis and pinnae rachis is thicker than the cuticle of pinnules. The cells are polygonal, often rectangular. The outlines are straight and thick. The thicker surface shows some transversal thickenings being several dozen cells long. Papillae are present only on the thinner surface of pinnae rachis; on the thicker surface and on both

sides of the rachis they are absent. The stomata can be found on both of the rachis on the whole area, but their are more rarely distributed than on the pinnules.

On one of the examined specimens (No 3165p) there are some tubercles the function of which has been unknown till present and is to be studied. These tubercles are distributed along the whole rachis and on the bases of some pinnae rachis. They are carbonated, outside brown, inside yellow and spongy. They break away from the rachis very easily, because of thin bases. After maceration they show the cuticular structure. The cuticle is rather thin and spongy; each of them has thick cutinised ball inside. Apart from them, there are numerous opalescence drops there, which do not disperse in maceration. The size of tubercles is about 300–500 μm in diameter.

DISCUSSION AND COMPARISON

The described specimens were compared with the specimen from Sweden indetified by Lundblad in 1966 as *Lepidopteris ottonis* (Goepp.) Schimp. stored in the Władysław Szafer Institute of Botany, Polish Academy of Sciences in Kraków and the specimens from Rawicz described by Piwocki (1970), stored in the Museum of the Geological Institute in Warszawa. The morfology, as well as anatomy of cuticle, show that these specimens belong to the same species.

The material was also compared with the descriptions of Goeppert (1836, 1846), Schenk (1867), Roemer (1870), Antevs (1914), Johansson (1922), Harris (1926, 1932) and Lundblad (1950) corresponded with them well, except with two cases, which will be discussed at the end of this chapter.

The bodies from the rachis mentioned in the description need a special attention. Early papers of Goeppert (1846), Schenk (1867), Schimper (1869), Nathorst (1886) and following works of Gothan (1909) described and discussed the existence of structures, regarded as sori at the beginning. The above authors found these bodies in various positions: Goeppert (1846) described the round sori in a single row along the midrib of pinnule, Schenk (1867) – the elongated bodies along side veins, Nathorst (1886) – the round bodies close to periphery of leaflets. Nathorst macerated them, which brought him into conclusion about its epidermal origin. Antevs (1914) described tubercles on rachises and pinnae rachises and suggested their role in water secretion similar to hydatodae in temporary living plants. He also drew attention to holes in cuticle of the both sides of every part of examined leaves.

In the examined preparations from Kluczbork region and Gradzanowo can be found round partches. They were at first regarded as masses of mesophile which were not completely macerated; they were repertitively found in all the preparations, even from the Swedish material. They were typically spherical and had a structure similar to the bodies dissected from the main rachis, although they were much smaller (their diameters equaled 50–120 μm). If are there any connections of these round lumps and the bodies mentioned above it could be suggested that the lumps should be found on the every part of leaves, which agrees with Antevs observation. The presence of an opalescent content inside dissected bodies indicates however, that they are a kind of glands secreting rather

dense liquid then water, contrary to Antevs (1914) previous assumption.

The above leads to further conslusions; the holes in cuticle observed by Antevs could be caused by a separation of the lumps from the leaf surface, the thickenings in examined preparations – their basis remaining in the epidermis.

Unfortunately, because of small size of the preparations it was not possible to examine the arrangement of the bodies, with the exception of the rachis, where they could be seen with the naked eye.

The comparison of the material found near Kluczbork with the specimen from Gradzanowo revealed major differences in leaflets sizes. In the material from Kluczbork region they ranged 5–15 mm in lenght and 2–6 mm in width, in the specimen from Gradzanowo 12–25 mm and 5–7 mm respectively. The size ranges of the every specimen examined here and the materials known from the other publications are shown in the Table 1.

Table 1. The variation of leaflets sizes in different specimens of *Lepidopteris ottonis* (Goepp.) Schimp. The table contains data of measurements from the middle parts of leaves only (mm)

Specimens	max. length	mean length	min. length	mean width
L. ottonis – Gradzanowo No IB PAN PM S 942	25	20	12	5–7
L. ottonis – Johansson 1922, Pl. 6, fig. 3 Scania	19	15	11	4–6
Alethopteris ottonis Goeppert 1846, Pl. 1, the regiomn of Wieluń	17	15	12	3–5
A. ottonis – Dobiercice No 3169p	15	12	8	2.5–6
A. ottonis – Goeppert 1846, Pl. 1, fig. 7	14	12	10	2.5–4.5
L. ottonis – Scania coll. Lundblad, IB PAN No 42/20 (IB PAN, Kraków)	13	11	7	3–5
Pecopteris ottonis Gosław, No 3164p.	10	8	5	2–4
L. ottonis – Johansson 1922, Pl. 1, fig. 9 Scania	8	7	5	2–3
L. ottonis – Johansson 1922, Pl. 1, fig. 8 Scania	7	6	5	2–3
L. ottonis – Johansson 1922, Pl. 1, fig. 10 Scania	6	5	4	2–3
Asplenites ottonis – Dobiercice, No 3165p.	5	4.5	4	2–3

As the Table 1. shows, the mean length of the pinnule is gradually growing from the shortest in the specimen from Dobiercice (5 mm) to the longest from Gradzanowo (20 mm). According to Harris (1932) the differences in the size of segments may be caused by the

age of the living plant, or by the position of the leaves in the plant.

Even though the difference between the specimen from Gradzanowo and the other examined specimens is the length of the pinnules, the specimen from Gradzanowo can be included to *Lepidopteris ottonis* species and it is also supported by the data of the table.

In material there are two specimens which do not agree with the other ones and probably they are out of this species. The first of them of Biadacz (No 3167p) is extremaly small. The length of fragment of leaf, consisting in rachis and 6 pinnae is 4 cm and its breadth 3.5 cm. The length of pinnules is about 2.5–4 mm. The shape of this leaf is like L. ottonis and the "Zwichenfiderns" are present too. The cuticle is very thick and skin-like. The difference is in the cuticle structure. One of the surfaces (lower ?) is *L. ottonis* type, the second one (upper ?) is very uneven and bulging. Polygonal cells with the papillae can be only seen on small areas. The stomata are always more regular than in the other specimens *L. ottonis*, circular definitely separate from the other cells. The subsidiary cells are always small and triangle, with papilla directed over the stomatal aperture.

This specimen is only one showing such regular stomata. Those three differences cause, that this specimen can not be unambigously named *L. ottonis*. It is left in *Lepidopteris* sp. name.

The second specimen was collected in Mierzęcina near Kielce in Świętokrzyskie Mountains (No 3168p). It is consist in four carbonised separated fragments of pinnae rachis with pinnule. The pinnule are lanceolate, apex acute or slightly obtuse, margin entire, surface smooth. The length of pinnule is 12–16 mm and breadth 4–6 mm. Venation rather well distinguishable, pinnate. In maceration the cuticle completely dissolve in nitrid acid. It suggests, that this leaf may belong to ferns, as long as the latter have not such cuticle like gymnosperms and they are always destroyed by oxidative maceration (Harris 1932). Some morphological marks are similar like *L. ottonis*, but however the other, important marks are absent (the rachis is lacking), this specimen is undetermined.

This finding was comfirmed by recent stratygraphic examinations (see stratygraphical position).

The Fructification

Peltaspermum rotula Harris 1937, p. 34.

1886 unnamed, Nathorst, p. 113, Pl. 25, fig. 17
1950 *Peltaspermum rotula* Harris, Lundblad, p. 32; Pl. 4, figs 8–12; Pl. 5, fig. 2, figs 3–5, 8.

On the one of specimens from Dobiercice (No 3165p) there is an impression of fragment of fructification near the leaf. Its shape is circular, about 14 mm in diameter. This is about 1/3 lower surface of the cupulate disc showing the median place, (5 mm in diameter) the stalk had been broken down and, from the seven ribs, each of them being about 3 mm long. They are probably the seeds connection places between the ribs. (Harris 1932) The margin of disc is not preserved.

A similar stucture can be found in Nathorst (1886) description about flora from Bjuv, but Nathorst did not name it. In his interpretation it seemed to be fragment of stem unidentified plant. Harris recognised it as the fructification of *L. ottonis* after the examination of the material from Greenland. He made the reconstruction and the cuticular stucture The specimens of *Peltaspermum rotula* Harris with their cuticular structure are known from some localities in Sweden as well (Lundblad 1950).

The fragment from Dobiercice agrees with both of descriptions in size and morphological stucture. Moreover it is found near leaf and seeds on the same specimen.

Seeds

The several separate seeds are present on two specimens from Dobiercice (No 3165p, 3169p). They are ovate and become narrow toward the apex. One of them shows tipically curved micropyllar beak. In the other ones this beak is not visible. The length of them is 4–6 mm, width 3–4 mm. Some of them are covered by small fragments of cuticle. After maceration the cuticle differs into three types of membranes:

1. The thick cuticle, composed by polygonal cells with straight, rare slightly sinusoid cell-walls. Almost all of the cells have median papilla. Stomata are present, they resemble those of a leaf. This cuticle identifies with outer cuticle of the integument.
2. The thin cuticle with rectangular, strech cells, the cells-walls are straight. Stomata absent. This membran indetifies with inner cuticle of the integument.
3. The thick cuticle has no sign of cells. The whole surface is densely sculptured. It corresponds with megaspore membrane.

Harris (1932) was the first, who described the seeds of *L. ottonis* from Greenland. He found them together with leaves and fructifications and described their cuticular structure. He observed four types of membranes in his material:

1. outer cuticle of the integument
2. inner cuticle of the integument
3. cuticle of the nucellus
4. megaspore membrane

Material from Dobiercice in comparison with Harris' descriptions entirely agrees with them. In spite of bad preservation and a little quantity of the carbonised organic substance suitable to maceration, it was possible to prepare three of the four types of membranes mentioned by Harris. They are very small fragments but the structure of them is typical enough to establish the similarity of them to seeds from Greenland.

STRATIGRAPHICAL POSITION

Lepidopteris ottonis (Goepp.) Schimp. is a guide form for Rhaetian *Lepidopteris* Zone (Roemer 1870; Harris 1932, 1937). The age of that zone was not determined for a long time, because of difficulty in distinguishing the Rhaetian and the Lower Liassic strata. The first attempt was done by Nathorst, who divided the Rhaetian – Liassic section of Scania (The South Sweden) into 15 zones, naming them with plant species the

most frequent in each one. Further investigations showed however, that the narrow Nathorst's zones could not be applied to a wider territory, even in the South Sweden, so they are only of local importance. The further geological and paleobotanical investigations, especially comparisons of fossil flora from Greenland and Germany led to separation in Scania analogus zones: *Lepidopteris* (Rhaetian) and *Thaumatopteris* (Lower Liassic). These zones fitted the Greenland zones and were applied to the whole Central Europe (Harris 1937). It is admitted, that the Rhaetian is the latest, uppermost stage of the Triassic, and *Lepidopteris ottonis* appears in its uppermost *Lepidopteris* Zone.

The age of the specimens found in Dobiercice Beds near Kluczbork and Wieluń was determined as Rhaetian. Roemer (1870) was the first who compared the Keuper of Silesia and adjacent territories with the Keuper of Central Germany. He stated similarities of geological structure of the compared regions and accordance of occurrence of typical organic remains with the apparent domination of fossil flora in Silesia in the Dobiercice Beds (i.e. the Wilmsdorf Beds according to Roemer). The age of these strata was determined as Rhaetian on the basis of the presence of the characteristic species: *Asplenites ottonis* (=*Lepidopteris ottonis*), *Asplenites roesserti*, *Clathropteris münsteriana*, *Pterophyllum braunianum*, *P. münsteri*, *Calamites lehmanianus*.

The later investigations confirmed the Rhaetian age of the strata (Kopik 1970, Marcinkiewicz 1971) on the basis of correlation of the Gorzów Beds (where the Dobiercice Beds are included) with the Rhaetavicula contorta zone. The transgression of this zone, according to Harris, is closely connected with the appearance of the *Lepidopteris* flora, and its correlation with the Gorzów Beds proved, that the latter belong to the lowest part of this zone and therefore they are in the range of development of *Lepidopteris ottonis* flora.

The age of the specimen from Rawicz was determined also as Rhaetian, because it was found on the territory between the region of occurrence of the typical Gorzów and Wielichów Beds (Piwocki 1970).

The new Polish site of *Lepidopteris ottonis* – Gradzanowo near Płońsk also confirms the Rhaetian age of this specimen. The material originates from a borehole 2,125 m deep. The Triassic strata in the marginal depression occur at the depth of 1,500–2,000 m, which confirms the result obtained from borehole Płońsk 1 investigated by Stemulak (1957). That borehole reached the depth of 1934 m and the age of the deepest strata was determined as Liassic. It could be assumed that the Rhaetian strata lay deeper than 1984 m, as deep as about 2,000 m. This statement is highly probable because the analysis of boreholes from that region showed that formations of all the Triassic series are present on Polish Lowland. A wider extent, besides of the Lower and the Middle Buntsandstein, have the Rhaetian strata covering almost the whole Polish Lowland (Kopik 1973).

The Rhaetian age of the strata which contained the *L. ottonis* leaf in borehole Gradzanowo 1 is corroborated by the results of palynological analysis performed by Orłowska-Zwolińska (1983). The spore-pollen spectrum she found in these strata is characteristic of the Wielichów Beds which in Polish Lowland are the age equivalent of the upper horizons of the Gorzów Beds in the Śląsko-Krakowska Upland and according to the most recent data belong to the Rhaetian (Deczkowski 1963, Orłowska-Zwolińska 1985). The exclusion of the specimen from The Świętokrzyskie Mountains from the

species *Lepidopteris ottonis* is of high stratigraphic importance for this region, because the appearance of this species near Kielce would mean presence of the Late Rhaetian there. Exactly, the specimen from Mierzęcina has been mentioned as the proof that the Rhaetic beds were present in this area (Roemer 1866)[3]. The later examinations however proved, that the Rhaetian sediments were found in the Mesozoic cover of the core of the Świętokrzyskie Mountains, but they are significantly reduced, even totaly missing in some areas (Kopik 1973). Because of the low content of organic remains, especially flora, the discovery of the guide taxon would be of big importance. As that the specimen examined by Raciborski (1891), regarded by Makarewiczówna (1928) as unidentifiable, and Kosiński's specimen wich was reexamined lately, can not be included in the *Lepidopteris ottonis* species, the result of present examinations have been confirmed.

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STRESZCZENIE

Z retyckich warstw Wyżyny Śląsko-Krakowskiej od XIX w. znana jest paproć nasienna *Lepidopteris ottonis* (Goepp.) Schimp. po raz pierwszy opisana z tego terenu. Jest to gatunek przewodni dla najwyższego piętra retyku – poziomu *Lepidopteris*.

Przy okazji odkrycia nowego stanowiska *L. ottonis* w Gradzanowie k. Płońska została przeprowadzona rewizja innych polskich okazów tego gatunku, pochodzących z okolic Kluczborka (Wyżyna Śląsko-Krakowska), Rawicza i Gór Świętokrzyskich. Na jednym z okazów z Dobiercic (okolice Kluczborka) zaobserwowano struktury mające prawdopodobnie charakter gruczołów wydzielniczych, które w dalszym ciągu poddawane są badaniu. W sąsiedztwie liści z Dobiercic zostały znalezione również fragmenty owocowania *L. ottonis* – *Peltaspermum rotula* Harris oraz luźne nasiona przynależne do tego gatunku, znane dotychczas tylko z Grenlandii.

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[3] The information about this mention is found as the original label of this specimen.

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PLATES

Plate 1

Lepidopteris ottonis (Goepp.) Schimp. Gradzanowo (No IB PAN PM S 942)

1. Leaf
2. Lower cuticle of rachis (slide No. IB PAN PM S 943)
3. Lower cuticle of pinnule

Plate 1

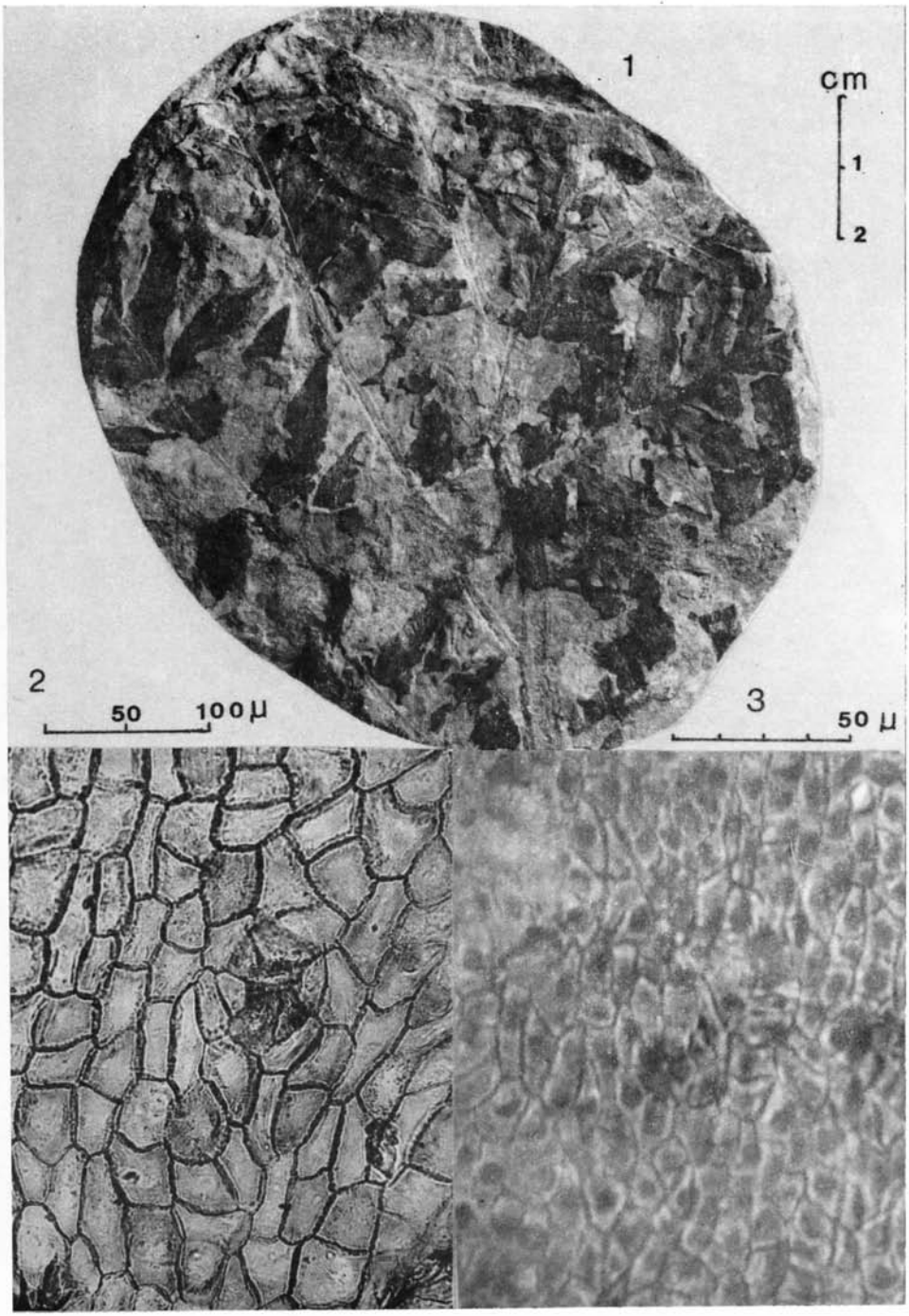

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Plate 2

Lepidopteris ottonis (Goepp.) Schimp. – Dobiercice (No 3169p)

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Plate 3

Lepidopteris ottonis (Goepp.) Schimp. – Gosław (No 3164p)

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Plate 4

Lepidopteris ottonis (Goepp.) Schimp. – Dobiercice (No 3165p)

1. Leaf
2. Rachis with tubercles
3. One of tubercles
4. Macerated tubercle (slide No IB PAN PM S 981).

Plate 4

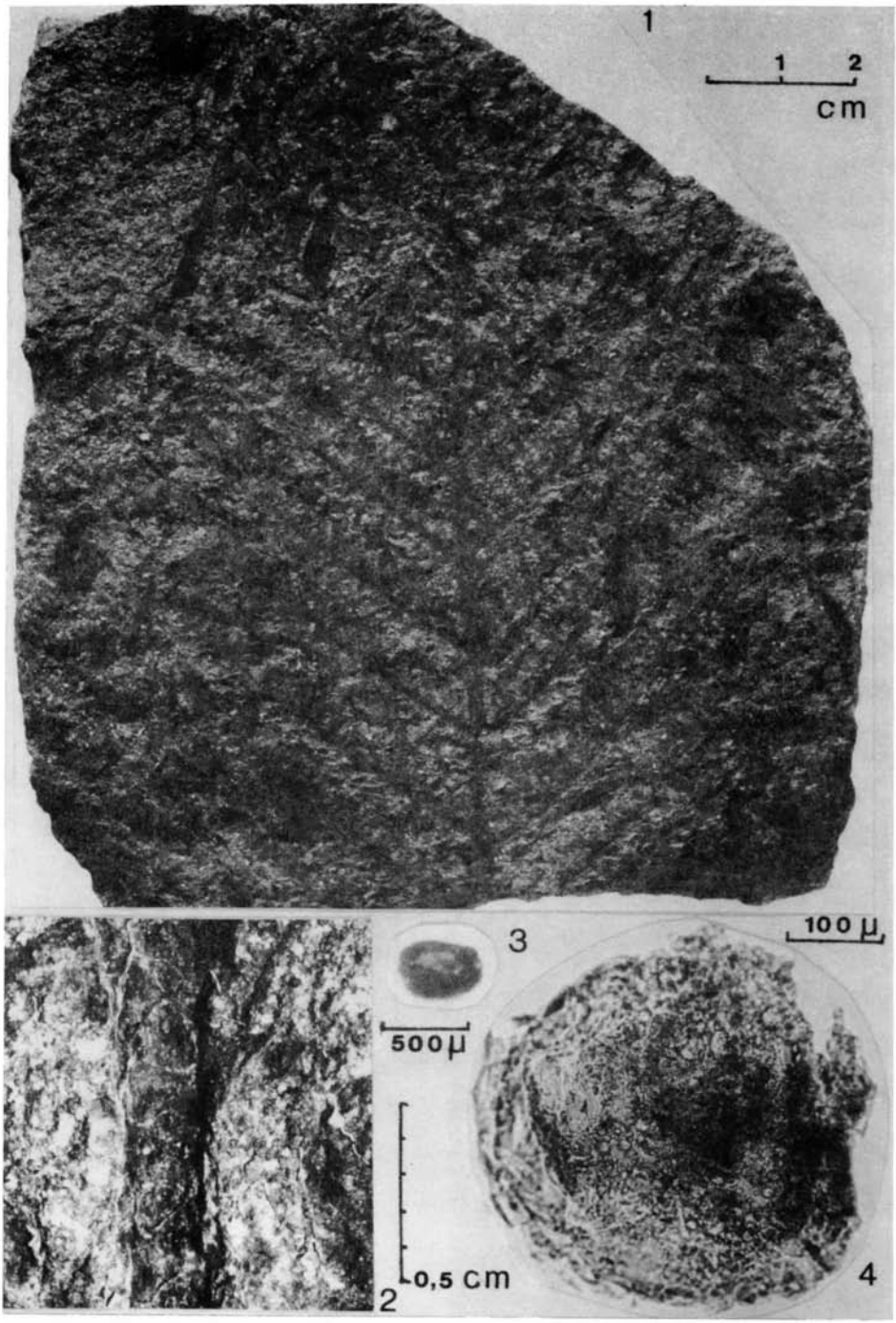

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Plate 5

Lepidopteris ottonis (Goepp.) Schimp.

1. Dobiercice (No 3166 p)
2. Dobiercice (No 3165 p), macerated tubercle (slide No IB PAN PM S 981
3. Opalescence drops inside tubercle (slide No IB PAN PM S 981)
4. Biadacz (No 3167 p)
5. Biadacz (No 3167 p) lower (?) cuticle (slide No IB PAN PM S 968)

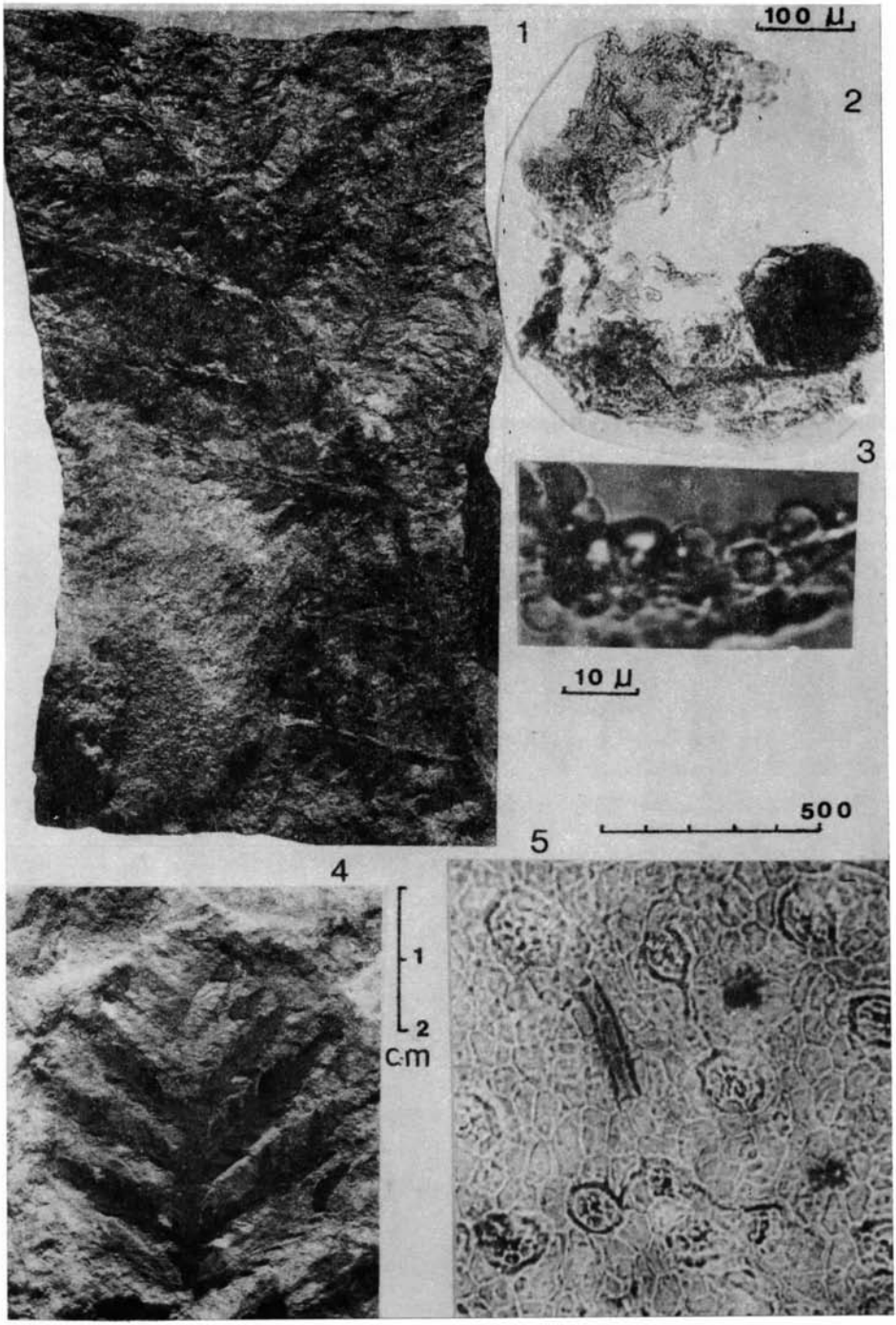

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Plate 6

Lepidopteris ottonis (Goepp.) Schimp.

1–3 Gradzanowo (No IB PAN PM S 942) fragments of cuticle showing the black lumps:

1. Upper cuticle of pinnule (slide No IB PAN PM S 944)
2. Lower pinnule of cuticle (slide No IB PAN PM S 946)
3. Lower cuticle of rachis (slide No IB PAN PM S 948)
4. Dobiercice No 3165p. Inpression of cupulate disc fragment

5–8. Seeds (5–7. No 3165p., 8. No 3169p.)

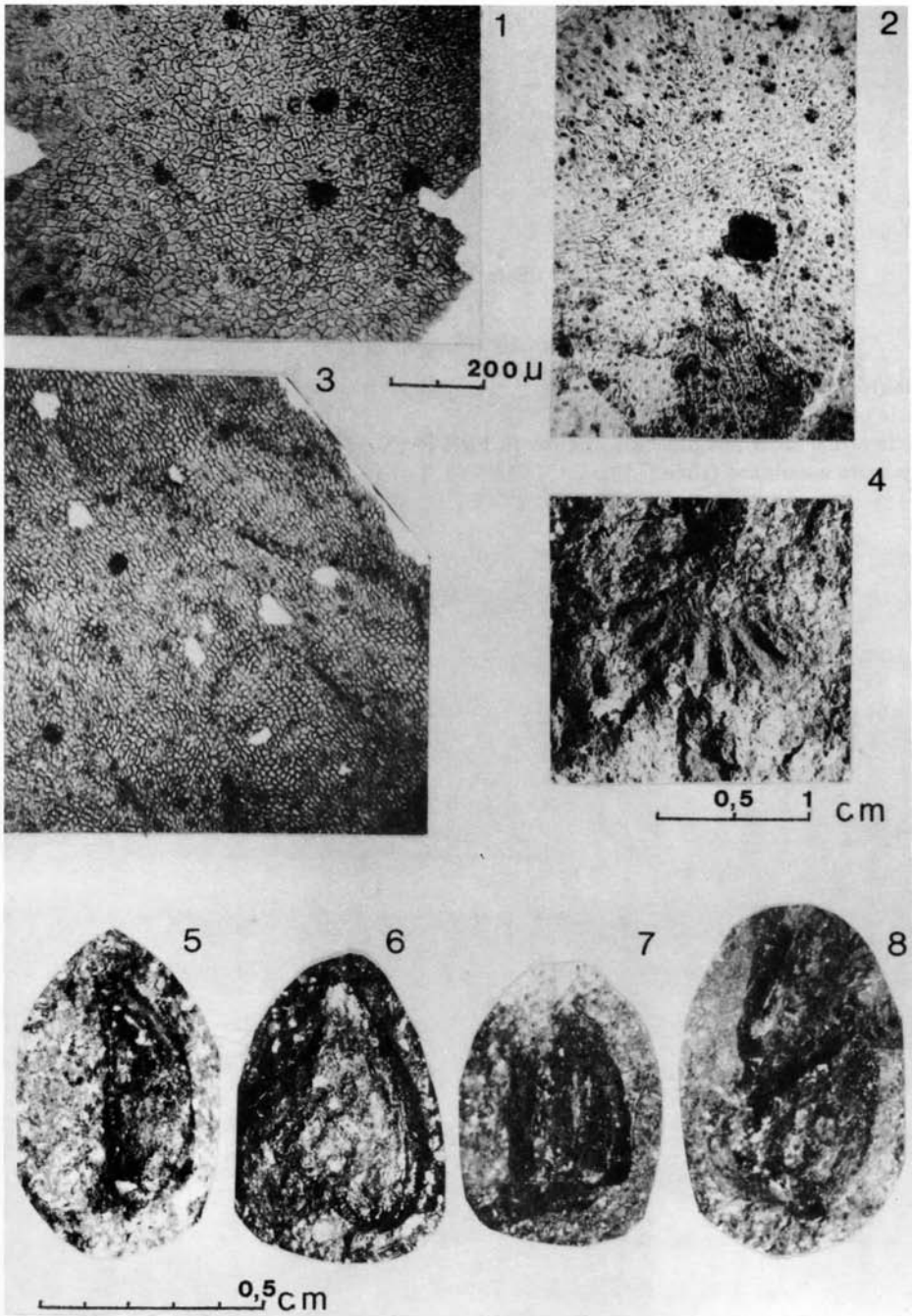

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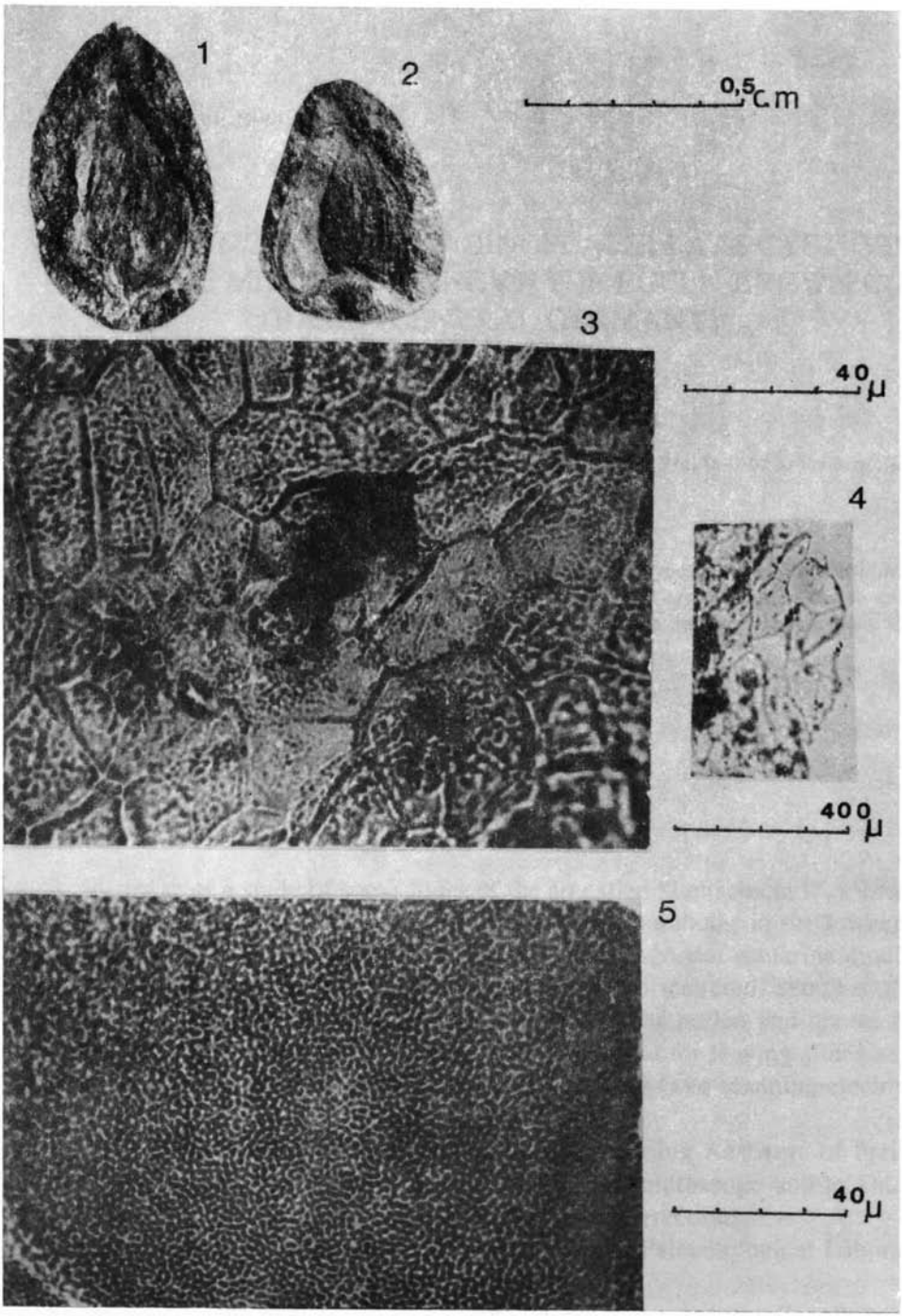
Plate 7

Lepidopteris ottonis (Goepp.) Schimp.

1–2. Seeds (No 3168p)
3. Cuticle of the outer integument (slide No IB PAN PM S 957)
4. Cuticle of the inner integument (slide No IB PAN PM S 974)
5. Megaspore membrane (slide No IB PAN PM S 973)

Plate 7



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