

On several stratigraphically important species of sporomorphs occurring in the Keuper of Poland

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Abstract:

Seven species of sporomorphs are described occurring in large quantities in Keuper sediments of Western, Central and Southern Poland. Among these species three are new: *Triadispora keuperiana*, *Triadispora undulata* and *Eucommiidites sulechoviensis*; one species is a newly established combination of the species *Todisporites cinctus* (Mal.) nov. comb. The descriptions of the remaining three already given in foreign literature are supplemented by new observations made on the material investigated.

INTRODUCTION

Investigations of spores and pollen grains from Keuper sediments carried out by the Palaeobotanical Laboratory of the Geological Institute at Warsaw supplied some interesting paleobotanical material and led to the establishment of the palynological stratigraphy in the examined borings in the Foresudetic monocline, Mogilno trough, Silesian-Cracovian monocline and on the periphery of the Świętokrzyskie Mountains.

As base areas for investigation served the Foresudetic monocline and Mogilno trough since the development of Keuper sediments is undisturbed there.

Palynological studies demonstrated distinct differences in the microflora pattern resulting from changes in the horizontal ranges of the sporomorphs distinguished and still more from changes in their quantitative occurrence.

Four characteristic spore and pollen assemblages could be distinguished according to the established stratigraphic units for Polish epicontinental Keuper deposits (Szyperko-Sliwczyńska 1960) based on lithological differentiation.

The first spore and pollen assemblage is characteristic for Lower-Keuper, the second for the uppermost part of Lower Keuper that is bordering dolomite (Grenz-dolomit on the territory of Germany), and the lower gypsum series already belonging to the Upper Keuper (*sensu polonico*) the third assemblage is characteristic for the reed sandstone horizon and the fourth for the top part of the upper gypsum series. The latter is already a precursor of the Lower Rhaetian flora.

It is worth noting that a distinct change in the microflora occurs between the Lower and Upper Keuper (*sensu polonico*) below the bordering dolomite (Grentzdolomit). The bordering dolomite horizon assumed as the limit between the above named stratigraphic units exhibits already Upper Keuper microflora. This fact may be explained by the change of the temperate and moist climate in Lower Keuper to a dry and hot climate at the time of sedimentation of the lower gypsum series of the Upper Keuper.

In the Keuper deposits, beside sporomorphs occurring singly or in rather large numbers in the entire profile, some species dominate only in definite stratigraphic horizons. These species are important for palynological stratigraphy of the sediments studied, therefore several of them are here described.

The author wishes to express her grateful thanks to Professor J. Raniecka-Bobrowska, magister M. Rogalska and professor M. Kostyniuk for advice during the present work.

The aid of professor W. Klaus and doctor R.F.A. Clarke in the identification by correspondence of the sporomorphs of the genus *Triadispora* Klaus and the species *Conbaculatisporites longdonensis* is gratefully acknowledged.

METHODS

The spores and pollen grains here described were extracted mainly from grey claystone and mudstone sediments, by means of flotation. A heavy liquid (sp. wt. 2.1) prepared according to E. A. Doroganevskaya E. J. Shenfinkel and W. P.

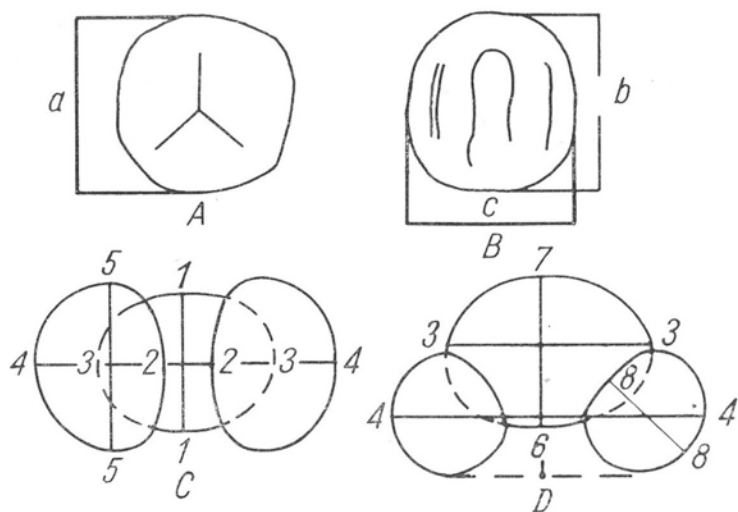


Fig. 1. Measurements of sporomorphs described

A — trilete spore; (*a*) spore diameter measured along arm of scar; *B* — Monosulcate pollen grains with two additional furrows; (*b*) length, (*c*) breadth; *C* — Disaccate pollen grains in polar view; 1-1: length of body, 3-3: breadth of body; 5-5: length of saccus, 2-4 breadth of saccus, 2-2: distance between lines of attachment of sacci, 4-4 overall breadth of pollen grain; *D* — Disaccate pollen grains in lateral view, 7-6: height of body, 8-8 height of saccus, 7-9 overall height of grain

Grichuk (1952) was used for flotation. The organic material thus obtained was subjected, when carbonified, to maceration with anhydrous HNO_3 (cf. Rogalska 1956).

Spores and pollen grains were identified and classified according to the system of R. Potonié (1956, 1958, 1966) for dispersed spores.

Spore and pollen grain measurements were performed according to the following scheme.

DESCRIPTIONS OF SPOROMORPHS

Anteturma: *Sporites* H. Potonié, 1893

Turma: *Triletes* (Reinsch, 1881) Potonié et Kremp, 1954

Subturma: *Azonotriletes* Lubert, 1935

Infraturma: *Laevigati* (Bennie et Kidston, 1886) R. Potonié, 1956

Genus: *Todisporites* Couper, 1958

Todisporites cinctus (Mal.) nov. comb.

(Plate I, figs 1—7)

1955? *Punctatisporites fissus* Lesch; G. Leschik Plate 2, fig. 14 p. 20

1964 *Neocalamitites punctata* Mal. em. Mal. var. *cincta* Mal.; W. S. Malyavkina, plate 24a, fig. 1, page 40;

1966 *Todisporites* sp. 2; E. Schulz, table 5c, no. 210;

1967 *Punctatisporites fissus*; Orłowska-Zwolińska, table 1.

Material: several hundred specimens.

Size: spore diameter 31–53 μ , generally ca. 40 μ .

Description: Spores with round contour and triradiate tetrad scar. Arms of scar straight, well visible, their length is $2/3$ of spore radius length. Exine thick, rigid, mostly not creased, sometimes slightly deformed owing to crushing. Exine thickness 1.6–3.5 μ most frequently 2.5 μ . Owing to the rigidity of exine, in case of mechanical injury of the specimen there appear radial cracks at the margin of the spore (Plate I, fig. 7). Exine surface smooth or punctate, on numerous specimens greatly corroded. When disposing of a large number of specimens of the species described, it is possible to follow the various stages of exine destruction. Besides intact specimens with a smooth surface (Plate I, figs. 1, 2) there are some partly (Plate I, figs 3, 4) or completely corroded (Plate I, figs 5, 6). The corroded surface shows a sinuously hatched minute pattern, so that specimens with a completely corroded surface apparently differ greatly from the holotype. The presence of specimens with a partly corroded and partly smooth surface is decisive for including all the specimens into one species. Corrosion was observed on *Todisporites cinctus* specimens in all the profiles examined both from the Foresudetic monocline and the periphery of the Świętokrzyskie Mountains. It is supposed that this fact is due either to the susceptibility of the specimens to physico-chemical destruction or to the action of bacteria.

Comparison and remarks: The spores as regards morphology greatly resemble the spore of *Neocalamitites punctata* Mal. var. *cincta* Mal. from the Lower Keuper of the north European part of the USSR (Malyavkina 1964, plate 24a, fig. 1). This author reports that the above mentioned spores are abundant in the U.S.S.R. in Lower and Middle Triassic and Lower Keuper sediments, they occur singly and seldom in the Upper Keuper, Rhaetian and Liassic.

Malyavkina found that the genus *Neocalamitites* is represented by numerous species of which she only described one — *Neocalamitites punctata*. Within this species she distinguished the variety *N. punctata* Mal. var. *cincta* Mal. differing by a sharply outlined rim (“okaymlynya”) which may be interpreted as the thickness of exine seen in the equatorial plane. The same author describes the exine surface of *N. punctata* spores as smooth, punctate or hatched. It is probable that the „hatched” surface of some of the specimens is a secondary symptom due to corrosion. The classification by Malyavkina (1964, p. 39) of the spores described to the genus *Neocalamitites* and the comparison of them to the specimen denoted *Calamites?* in Rogalska’s paper (1956, plate VII, fig. 6) does not seem convincing.

The spores described show a rather close similarity of the fossile spores of the fern *Todites* Seward. This is confirmed by the similarity to the spores macerated by Kopytova (1963) from the sporangia of *Todites szeiana* (P’an) Brick from Upper Triassic sediments in West Kazakstan.

It should, however, be noted that the spores here described show a similarity only to those specimens of *Todites szeiana* (P’an) Brick in which the verrucose perisporium was destroyed, and they differ by a thicker exine.

The spores here described resemble also the dispersed spores of *Todisporites minor* Coup. from the Middle Jura sediments in England (Couper 1958) and also the identically described spores from Keuper sediments in Austria (Bharadwaj and Singh 1964) The spores of *Todisporites cinctus* differ from the above named specimens of *Todisporites minor* by a thicker exine. Therefore they do not undergo “boat-like” crushing and preserve their rigid disk shape.

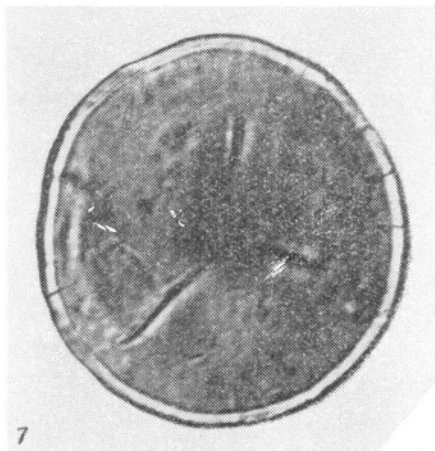
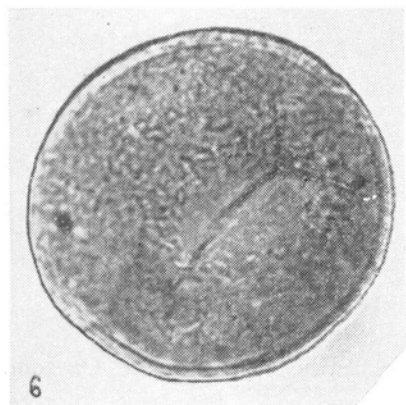
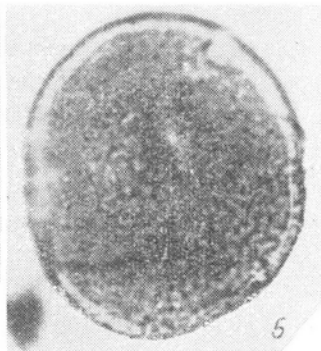
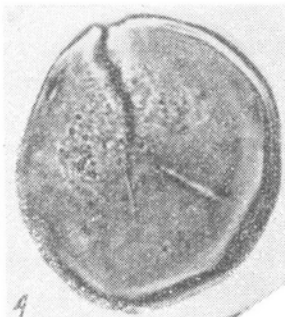
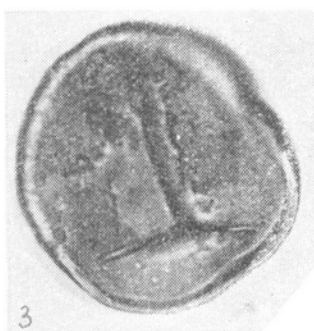
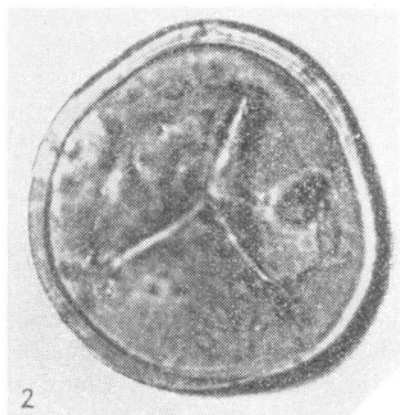
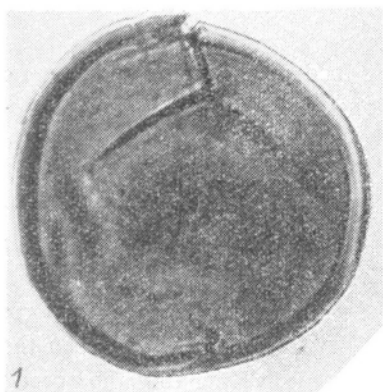
As regards the thickness of exine and the rigidity of the specimens associated with it, the spores described greatly resemble those of *Todisporites marginalis* Bharadwaj et Singh. They differ, however, from them by their smaller dimensions. Bharadwaj and Singh (1964) give as diagnostic trait of this species the radial cracks on the margin of the spore. This trait is probably secondary and due to mechanical pressure

Plate I

Todisporites cinctus (Mal.) nov. comb., $\times 1000$

- fig. 1. exine surface smooth; bore hole Wągrowiec, depth, 1 576.5 m
 fig. 2. exine surface smooth; bore hole Sulechów, depth 684.0 m
 figs 3, 4. exine surface partly corroded; bore hole Boża Wola depth 1 596.7–1 602.7 m
 fig. 5. exine surface completely corroded; bore hole Boża Wola depth 1 376.6–1 385.8 m
 fig. 6. exine surface corroded; bore hole Boża Wola, depth 1 596.7–1 602 m
 fig. 7. at edge of spore radiate cracks in exine; bore hole Sulechów, depth 684.0 m

Plate 1



as confirmed by the occurrence of irregular cracks on the specimens here described (Plate I, fig. 7).

Spores identified as *Todisporites* sp. B., are reported by Jain (1968) from Middle Triassic sediments of Argentina.

Diagnostic traits similar to those of the spores described are shown in the schematic drawing of a spore in the stratigraphic table of Schulz (1966), determined as *Todisporites* sp. 2, from sediments of the Lower Keuper and middle part of the Middle Keuper of Germany.

The spores here described also show a resemblance to those of *Punctatisporites fissus* Lesch. reported by G. Leschik (1955) from reed sandstone in Neuwelt near Basel.

Since the morphological characters agree with the diagnosis of dispersed spores of the genus *Todisporites* Coup., the author adopted for the spores described the genetic name *Todisporites* Coup. The specific name "fissus" defining the species *Punctatisporites fissus* Leschik is also accepted by Bharadwaj and Singh (1964) for the spores of *Todisporites fissus* characterised by larger dimensions, a granular exine surface and rather thin exine, it cannot therefore be used here for denoting the species described.

The characteristic thickness and rigidity of the exine in the spores examined distinguishes them from other already described species of the genus *Todisporites*. On the other hand, this trait seems to indicate a relationship with the specimen described by Malyavkina (1964, plate 21, fig. 1). The name of the variety "cineta" assigned by this author was adopted as the specific name for the specimens described, thus this large group of characteristic spores was raised to the rank of species.

Occurrence: The spores occur in masses in Lower Keuper sediments and singly in Upper Keuper and Rhaetian sediments (Książ, Sulechów, Wągrowiec, Solec, Gacki and Boża Wola bore holes).

Infraturma: *Apiculati* (Bennie et Kidston 1886) R. Potonié 1956

Subinfraturma: *Baculati* Dybova et Jachovicz 1957

Genus: *Conaculatisporites* Klaus 1960

Conbaculatisporites longdonensis Clarke 1965

Plate II, figs 1-4

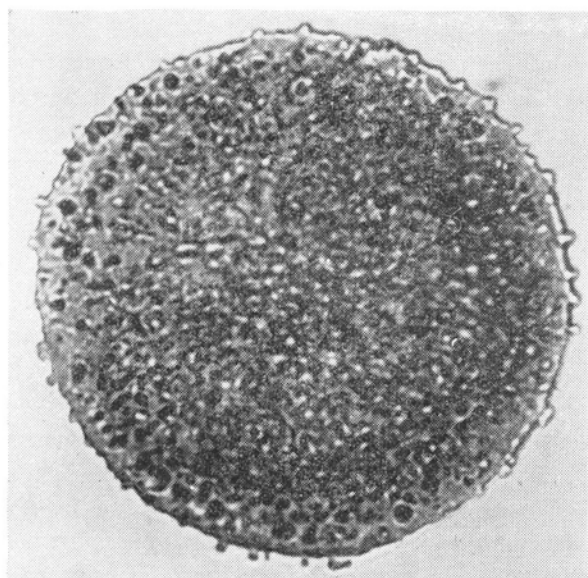
1965 *Conbaculatisporites longdonensis* Clarke; R.F.A. Clarke p. 229, plate 36, figs 1-3

1967 *Baculatisporites kajperianus* Orł.; T. Orłowska-Zwolińska plate 1, p. 48 — nomen nudum

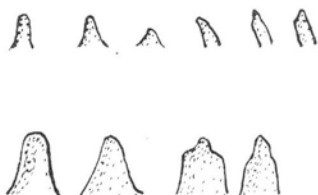
Material: about 160 well preserved specimens

Size: Specimen diameter 55-75 μ , most frequently ca. 65 μ .

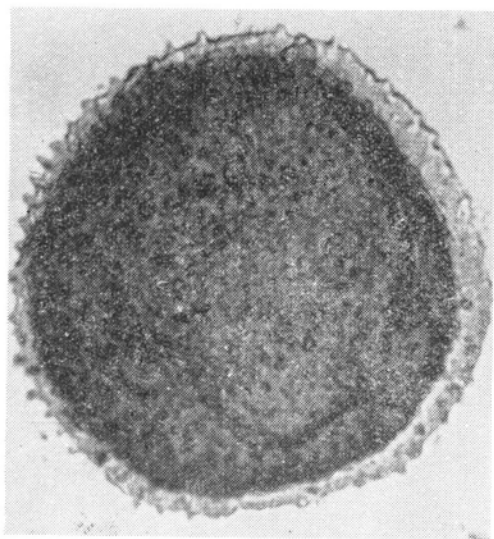
Description: spores with round outline, frequently greatly creased. On some few specimens a triradiate tetrad scar with short and wide open arms observed.



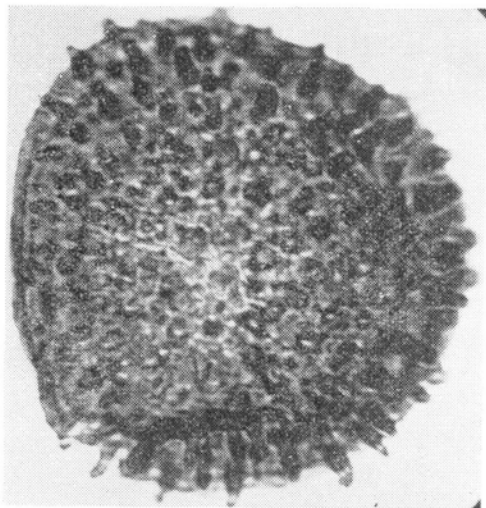
1



4



2



3

Conbaculatisporites longdonensis Clarke, 1965. $\times 1000$

fig. 1. bore hole Sulechów, depth 630.0 m fig. 2. bore hole Książ, depth 1 331.0–1336.0 m
 fig. 3. bore hole Woźniki (Zawiercie region) depth 137.0 m sculpture elements on distal side
 fig. 4. variability of sculpture elements in ca. 2000 enlargement

Exine surface covered with appendages of varying shape and size. Appendages either thin and short, ca. $1\ \mu$ long, or in other specimens larger, $1.5\text{--}3.5\ \mu$, and on the distal side reaching $7\ \mu$ in length. The shape of the appendages resembles cones, baculae, and sometimes bottles (Plate II, fig. 4). Exine of the spores is dark brown. Noteworthy is the lighter rim on the specimens as compared with the darker colour of exine in the central part, observed in the equatorial plane of many specimens (Plate II, fig. 2). There is, however, no distinct demarcation line between the two colours. The identical element of sculpture on uniformly coloured specimens and on those with a distinctly lighter rim excludes the possibility of existence of a perisporium. This fact may be explained as distinct differentiation between the sexine and the nexine.

Comparison: Specimens identified on the basis of morphological agreement of their characteristics with those of the species *C. longdonensis* Clarke, 1965 from the Upper Keuper of England.

Occurrence: The spores were found in large quantities in the uppermost part of the Lower Keuper within the bordering dolomite and in the lower gypsum series of the Upper Keuper in the profiles of Książ, Sulechów, Wągrowiec, in the region of Zawiercie and in the Lower Rhaetian in the Ośno profile.

Subturma: *Perinotrilites* Erdtman 1947

Genus: *Aulisporites* (Leschik 1955) Klaus 1960

Aulisporites astigosus (Leschik) Klaus 1960

Plate III, figs 1-5

1955 *Calamospora astigosus* Lesch.: G. Leschik p. 22, plate 2, fig. 17

1960 *Aulisporites astigosus* (Lesch.) Klaus: W. Klaus p. 119, plate 28, fig. 2, 3

Material: several hundred specimens.

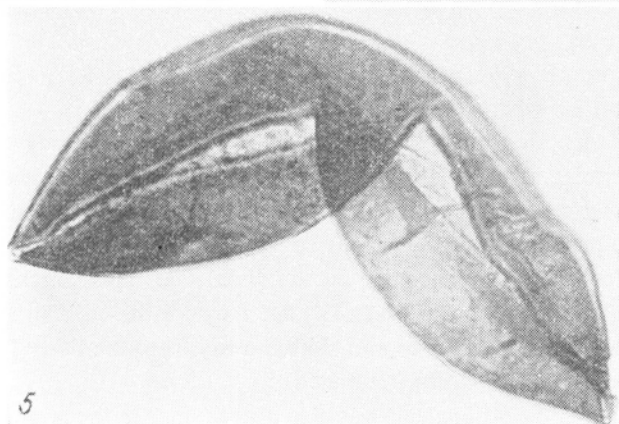
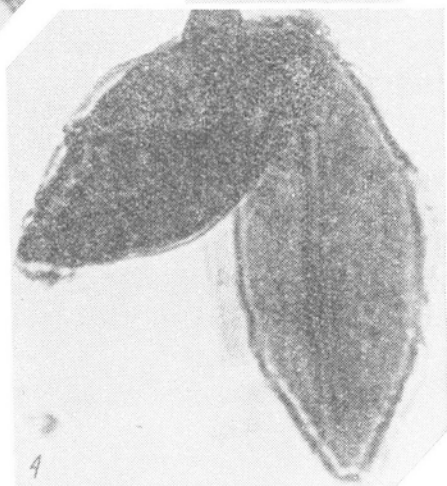
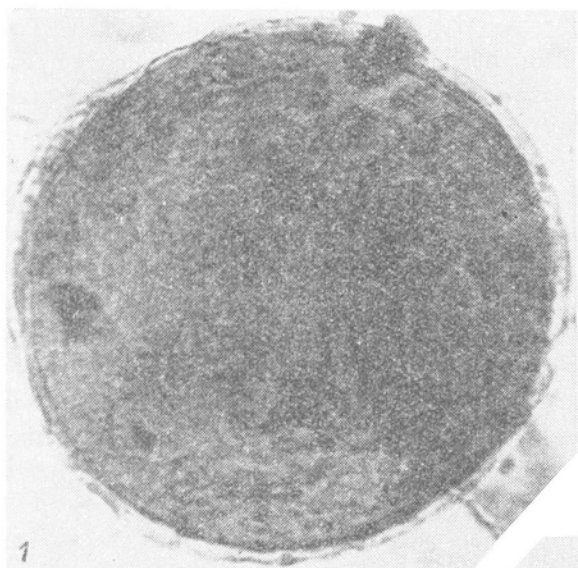
Size: specimen diameter $54\text{--}78\ \mu$.

Description: Spores with circular outline and triradiate tetrad scar, surrounded by a thin light perisporium. Exine dark brown, rather thick ($1.4\text{--}2.1\ \mu$), frequently greatly creased. Perisporium light, delicate, in equatorial plane forms a $2.0\text{--}4.0\ \mu$ wide rim. Perisporium smooth or punctate frequently partly or completely destroyed. Y scar small; length of arms $3.4\text{--}5\ \mu$. Around scar small contact areas lighter than

Plate III

Aulisporites astigosus (Leschik) Klaus 1960. $\times 100$

- fig. 1. specimen well preserved; bore hole Sulechów, depth 523.0 m
 fig. 2. one "half" of specimen with Y scar; bore hole Wągrowiec, depth 1726 m
 fig. 3. Y scar well visible; bore hole Boża Wola, depth 1212.7-1218.7 m
 fig. 4. cracked sporomorph with perisporium; bore hole Wieluń, depth 432.0 m
 fig. 5. specimen split into two "halves"; bore hole Boża Wola depth 1212.0-1218 m



remaining part of exine circumscribed by a distinct triangle or triangular — oval outline. The spores readily split into two parts which stretch characteristically (Plate III, figs 4, 5). After complete splitting of the spore and separation of the two parts, there appear in the same slide specimens morphologically resembling pollen grains of the type “*monosulcites*” (Plate III, fig. 2).

The presence of the characteristic Y scar and the colour and thickness of the exine indicate the common origin of all the here described forms and their appurtenance to the genus *Aulisporites astigosus*.

Comparison and remarks: The specimens described show a considerable resemblance to the spores of *Aulisporites astigosus* (Lesch) Klaus from the Alpine Keuper and to specimens of this species from reed sandstone in Neuwelt near Basel identified as *Calamospora astigosus* Lesch. The specimens of the above quoted authors have no perisporium. It is possible that it was destroyed as it is often seen in Polish Keuper sediments. Neither do these authors mention splitting of these sporomorphs into two parts. Mass occurrence of sporomorphs in the Polish material allowed to observe many unknown characters of this species.

Occurrence: Sporomorphs were found in Keuper sediments, they were particularly numerous in the reed sandstone horizon in the profiles of Sulechów, Książ, Wągrowiec. Boża Wola and in the region of Zawiercie.

Anteturma: *Pollenites* R. Potonié 1931

Turma: *Saccites* Erdtman 1947

Subturma: *Monosaccites* (Chitaley 1951) Potonié et Kremp 1954

Infraturma: *Triletesaccites* Leschik 1955

Genus: *Heliosaccus* Mädler 1964

Heliosaccus dimorphus Mädler 1964

Plate IV fig. 1

1964 *Heliosaccus dimorphus* Mädler: K. Mädler plate 1, figs 6, 7, p. 172

Material: 20 specimens

Size: specimens diameter 150–187 μ . Diameter of body 85–90 μ ; width of saccus on sporomorph periphery on the average ca. 40 μ .

Description: Sporomorph consists of round central body and surrounding saccus. No tetrad scar was noted. On surface numerous concentric folds. The sculpture of saccus minutely reticulate. Meshes of reticulum small narrow and radially arranged. It is probable that the saccus covers the body completely on the proximal side and is attached to it at the edge on the distal side. This conclusion results from observation of the specimen in Plate IV, fig. 1 where the edge of the saccus on the side of attachment is partly torn and shifted away from the body. The exine surface of the body free from the saccus is smooth.

Ready slipping off of the saccus was also noted, since in the preparation frequently only saccus was found without body.

Plate IV



cf. *Heliosaccus dimorphus* Mädler, 1964. $\times 750$
bore hole Sulechów, depth 634,0 m

Comparison and remarks: The characteristic traits of the species described, i.e. the large size of the specimens, the monosaccate structure of the grains and the exine sculpture give grounds to the assignment of the sporomorphs described to the species *Heliosaccus dimorphus* Mädlér known from the German Keuper sediments. On the specimens here described, however, the small tetrad scar found on the German specimens (Mädlér 1964 b) was absent.

Occurrence: The sporomorphs are frequently found only in the Lower Keuper sediments in the Sulechów, Książ, Wągrowiec and Solec profiles.

Subturma: *Disaccites* Cookson 1947

Infraturma: *Disaccitriletes* Leschik 1955

Genus: *Triadispora* Klaus 1964

Generotyp: *Triadispora plicata*: W. Klaus 1964, pl. 2. fig. 15

Triadispora undulata sp. nov.

Plate V, figs. 1-6

Holotypus: Plate V, figs 5, 6.

Locus typicus: Sulechów, depth 544.5 m, sample 19.

Stratum typicum: Upper Keuper — lower gypsum series.

Derivatio nominis: from the pronounced sculpture of the exine surface on the pollen grain body.

Material: 150 specimens.

Size: overall breadth of pollen grain 42.0—70.0 μ ; most frequently 54.0 μ

	breadth	28.9—44.0 μ mostly	34.0 μ
body	length	28.9—41.0 μ „	35.1 μ
	height	27.0—34.0 μ „	
	breadth	16.0—26.0 μ „	19.0 μ
saccus	length	30.0—43.0 μ	34.0 μ
	height		20.0 μ

Diagnosis: pollen grains disaccate with small tetrad scar on the body. Proximal body surface with pronounced sculpture. The sculpture elements have the shape of lobes. Distal surface smooth. Sacci have an indistinct reticulate sculpture. Sacci creased.

Plate V

Triadispora undulata sp. nov.

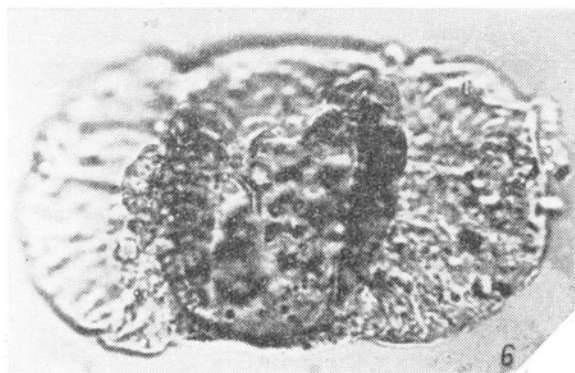
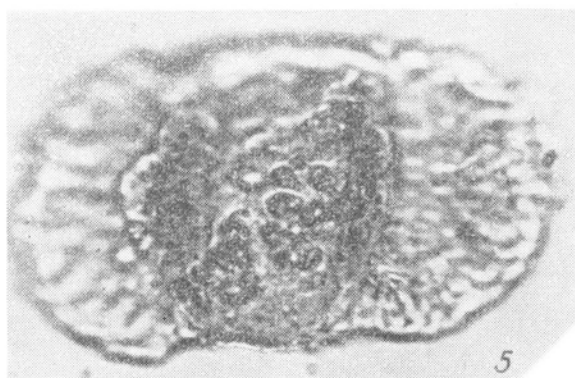
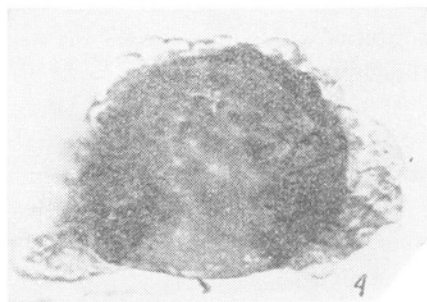
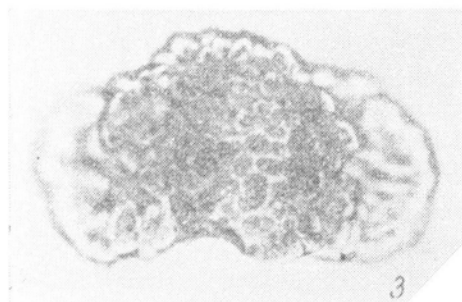
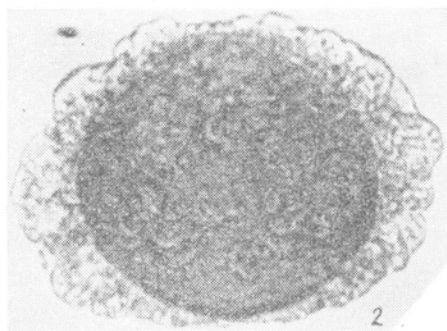
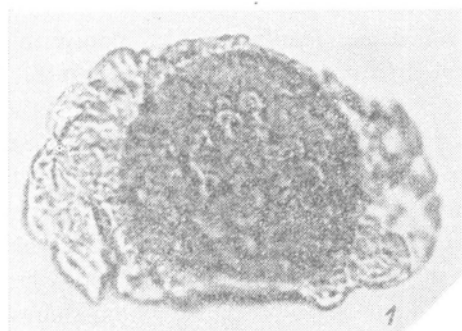
fig. 1. bore hole Sulechów, depth 544,0 m

fig. 2. bore hole Woźniki (Zawiercie region), depth 137.0 m

figs 3, 4. lateral view bore hole Wągrowiec, depth 1744,8 m

figs 5, 6 holotype, bore hole Sulechów, depth 544.5 m

Plate V



Description: body of grain round in outline up to slightly oval. Sacci of varying outline frequently semicircular, sometimes falciform, from poorly to well-demarcated from body, distinctly separated from one another on only distal side. Triradiate tetrad scar small, sharply outlined; length of its arms 3.5—5.6 μ .

Exine surface on proximal side of body with pronounced sculpture. Elements of sculpture wide at base (2.0—7.0 μ), rounded, densely and irregularly distributed give the impression of lobes. Exine morphology similar as in *Tsuga canadensis* grains. In lateral view the body outline wavy owing to the densely distributed sculpture elements (Plate V, fig. 3). Distal surface of body between the lines of attachment of the sacci smooth. Sacci covered with an indistinct small-mesh reticulum, thinwalled, sometimes creased, in the form of loose lobes. The variability of the grain shape concerns within this species the degree of separation of the sacci and the degree of sculpture on the body.

Comparison: The type of the structure of the grains corresponds to the diagnostic traits of the genus *Triadispora* Klaus 1964. The characteristic lobar exine sculpture distinguishes the specimens described from the species reported by W. Klaus.

Occurrence: The species *Triadispora undulata* identified in Poland for the first time occurs in large quantities in the upper most part of the Lower Keuper (bordering dolomite) and in the lower gypsum series of the Upper Keuper (Książ, Sulechów, Wągrowiec borings and profiles from the Zawiercie region).

Triadispora keuperiana sp. nov.

Plate VI, fig. 1–4

Holotypus: Plate VI, figs. 1, 2

Locus typicus: Sulechów, depth 630.0 m, sample 32

Stratum typicum: Uppermost part of Lower Keuper — bordering dolomite

Derivatio nominis: from the name of the stratigraphic stage

Material: 70 specimens.

Size: overall breadth of pollen grain 40.6–60.0 μ mostly 50.0 μ .

Plate VI

Figs 1–4. *Triadispora keuperiana* sp. nov. $\times 1000$

fig. 1, 2. holotype; fig. 1 — proximal surface sculptured; fig. 2 — distal surface smooth, bore hole Sulechów, depth 630,0 m

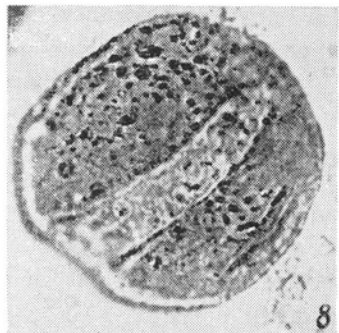
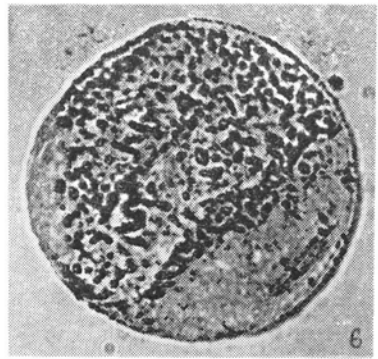
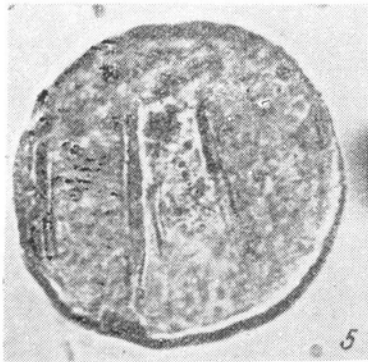
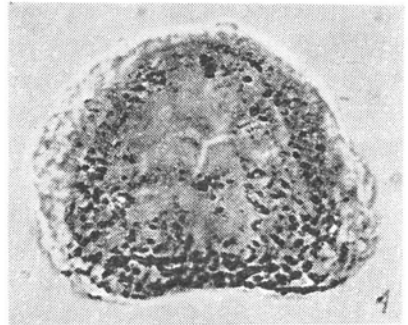
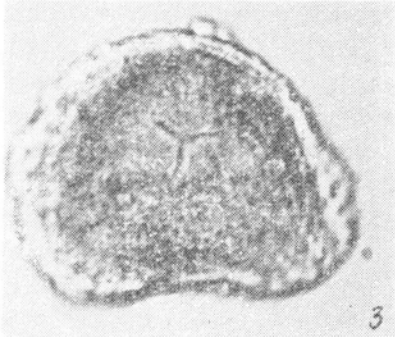
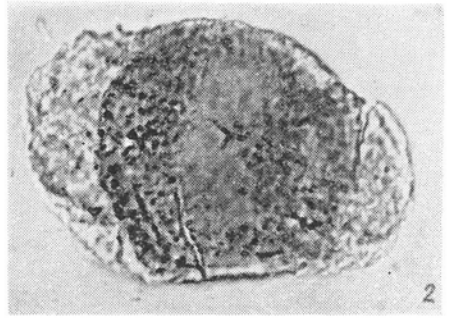
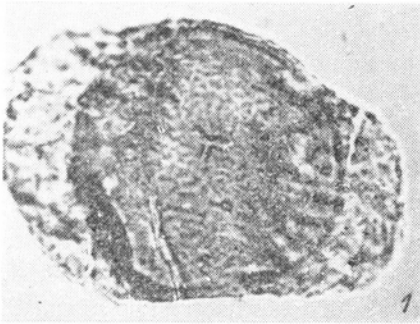
figs 3, 4: fig. 3 — proximal surface, fig. 4 — distal surface; bore hole Sulechów. depth 544.5 m

Figs 5–8. *Eucommiidites sulechoviensis* sp. nov. $\times 1000$

fig. 5. holotype; bore hole Sulechów, depth 630.0 m

fig. 6. bore hole Sulechów. depth 630.0 m

figs. 7, 8. bore hole Książ, depth 1308,2–1313.6 m



	breadth	31.0—36.0 μ	mostly	35.0 μ
body	length	29.0—34.0 μ	,,	34.0 μ
	height	28.0—35.0 μ	,,	
	breadth	18.0—22.0 μ	,,	18.0 μ
saccus	length	31.0—37.0 μ	,,	37.0 μ
	height	15.0—18.0 μ		

Diagnosis: pollen grains dissacate with small tetrad scar on body. Proximal surface with sculpture in the form of minute-mesh reticulum, distal surface smooth. Sculpture of sacci delicately reticulate.

Description: Body of grain mostly round in outline. Sacci semicircular, frequently falcate. Outline of sacci gradually passes into the outline of the whole pollen grain. Lines of attachment of sacci delicate, area between them rather distinct, light with smooth exine, ca. 13 μ wide. Body sculpture on proximal side in the form of minute narrow-mesh reticulum.

Comparison: Type of structure corresponds to the diagnosis of the genus *Tridiaspora* Klaus. The species *T. keuperiana* differs from those described in the literature by the streamline shape of the grains and the delicate but distinct sculpture on the proximal side of the body.

Occurrence: pollen grains found in large numbers in the uppermost part of the Lower Keuper — bordering dolomite and in the lower gypsum series of the Upper (Książ, Sulechów, Wągrowiec borings and profiles in the Zawiercie region).

Turma: *Plicates* (Naumova, 1937) R. Potonié 1960

Subturma: *Praecolpates* Potonié et Kremp 1954

Genus: *Eucommiidites* Erdtman 1948 emend. Couper 1958

Eucommiidites sulechoviensis sp. nov.

Plate VI, figs. 5–8

Holotypus: Plate. VI, fig. 5

Locus typicus: Sulechów depth 630,0, sample 32,

Stratum typicum: uppermost part of Lower Keuper — bordering dolomite

Derivatio nominis: from the locality Sulechów where the specimens were found for the first time.

Material: about 200 specimens.

Size: length of grain 30.6–47.8 μ , breadth of grain 30.6–40.0 μ

Diagnosis: Pollen grains outline circular or oval with one wide well developed furrow and two narrow ones frequently visible as delicate cracks in the membrane. Exine thin and delicate.

Description: pollen grains circular in outline, sometimes oval owing to the elongation of the polar axis. The characteristic trait are the three furrows. One is more distinct, light, strongly light-refracting, of length close to that of the polar

axis of the grain. Widely open, 2.0–6.8 μ wide. Furrow edges straight, smooth, sometimes surrounded by thin folds, ends usually wide open, sometimes rounded. The remaining two furrows short, often visible only as two light delicate cracks in the exine. Exine thin, ca 1 μ thick, delicate, light yellow with finely granular surface.

Comparison and remarks: the main features of the pollen grain structure agree with the diagnosis of the species *Eucommiidites troedssonii* Erdt, corrected by Couper (1958). The grains differ from those of the Jurassic species *Eucommiidites troedssonii* by their circular outline, thin exine and less pronounced furrows. From *E. granulatus* (Schulz, 1967) they also differ by their shape, exine thickness and differently developed furrows, and from *E. major* (Schulz, 1967) by much smaller measurements and a different outline of the main furrow.

The pollen grains have been preliminarily defined by the author as *Punctatosporites sulcatus* Orł. (T. Orłowska-Zwolińska, 1967, table 1, p. 48 — nomen nudum).

Occurrence: The specimens were sporadically found in the Lower Keuper, and in large amounts in the bordering dolomite and the lower gypsum series (Upper Keuper) (Sulechów, Książ, Wągrowiec, Boża Wola profiles and singly in the Lower Rhaetian in Foresudetic monocline borings).

REFERENCES

- Bharadwaj D. C., Singh H. P., 1964, An Upper Triassic miospore assemblage from the coals of Lunz Austria, *The Paleobotanist* 12 (1): 28–44.
- Clarke R. F. A., 1965, Keuper miospores from Worcestershire England, *Palaeontology* 8: (2): 294–321.
- Couper R. A., 1958, British Mesozoic microspores and pollen grains, *Palaeontographica Abt. B.* 103 (4–6): 75–179.
- Doroganevskaya E. A., Shenfinkel I. E., Grichuk V. P., 1952, Novaya tyazhelaya zhidkost dlya sporovo-pyltseвого analiza, *Izv. AN SSSR, ser. geogr.* 4: 73–74.
- Jain R. K., 1968, Middle Triassic pollen grains and spores from Minas de petroleo beds of the Cachenta Formation (Upper Gondwana) Argentina, *Palaeontographica Abt. B.*, 122 (1–3): 1–47.
- Klaus W., 1960, Sporen der Karnischen Stufe der ostalpinen Trias, *Geol. Jb. BA.* 5: 107–184.
- Klaus W., 1964, Zur sporenstratigraphischen Einstufung von gipsführenden Schichten in Bohrungen, *Erdöl- Z. Heft* 4: 3–13.
- Kopytova E. A., 1963, Spory paporotnika *Todites szeiana* (P'an) Brick iz otlozhenii Kuraylinskoi svity vierkhnego Triasa Zapadnogo Kazakhstana, *Trudy, VNIGNI*, vyp. 37.
- Leschik G., 1955, Die Keuperflora von Neuwelt bei Basel II. Die Iso- und Mikrosporen, *Schweizer. Paleont.* 72: 1–70.
- Mädler K., 1964, Bemerkenswerte Sporenformen aus dem Keuper und unteren Lias, *Fortschr. Geol. Rheinld. Westf.* 12 (3): 169–200.
- Malyavkina V. S., 1964, Spory i pyltса iz triasovykh otlozhenii Zapadno-Sibirskoi Nizmennosti, *Trudy VNIGRI*, vyp. 231.
- Orłowska-Zwolińska T., 1967, Mikroflorystyczne kryteria oceny wieku warstw z pogranicza triasu i jury na terenie Polski Pozakarpaciej, *Biul. Inst. Geol.* 203: 47–57.
- Potonié R., 1956, 1958, 1960, 1960, Synopsis der Gattungen der Sporae dispersae, Teil I–IV. *Beith. Geol. Jb. Heft* 23, 31, 39, 72.

- Rogalska M., 1956, Analiza sporowo-pyłkowa liasowych osadów obszaru Mroczków-Rozwady w powiecie Opoczyńskim, Biul. Inst. Geol. 104 1-89.:
- Schulz E., 1966, Erläuterungen zur Tabelle der Stratigraphischen Verbreitung der Sporen und Pollen vom Oberen Perm bis Untersten Lias, Abh. Zentr. Geol. Inst. Heft 8: 3-20.
- Schulz E., 1967, Sporenpaläontologische Untersuchungen rätoliassischer Schichten im Zentralteil des Germanischen Beckens. Paläontologische Abhandlungen, Abt. B., II, Heft 3: 427-633.
- Szyperko-Sliwczyńska A., 1960, O stratygrafii i rozwoju kajpru w Polsce, Kwart. geol. 12 (3): 701-710.

O kilku ważnych stratygraficznie gatunkach sporomorf z kajpru Polski

Streszczenie

Badania sporowo-pyłkowe osadów kajpru prowadzone w Pracowni Paleobotanicznej Instytutu Geologicznego w Warszawie dostarczyły ciekawego materiału paleobotanicznego oraz dały podstawę do ustalenia stratygrafii palinologicznej w zbadanych wierceniach.

Obszarem podstawowym dla prowadzonych badań była monoklina przedsudecka i niecka mogileńska ze względu na niezakłócony rozwój osadów kajpru.

Badania palinologiczne wykazały wyraźne zróżnicowanie w obrazie mikroflory kajpru będące wynikiem zmian w pionowych zasięgach wyróżnionych sporomorf oraz w większym stopniu zmian w ich ilościowym występowaniu. Duża zmienność w procentowym występowaniu gatunków w poszczególnych ogniwach kajpru spowodowana jest prawdopodobnie zachodzącymi podczas sedymentacji kajpru wyraźnymi zmianami klimatycznymi.

W mikroflorze kajpru wyróżniono cztery charakterystyczne zespoły spowo-pyłkowe:

- 1) zespół kajpru dolnego,
- 2) zespół dolomitu granicznego i serii gipsowej.dolnej,
- 3) zespół piaskowca trzcinastego,
- 4) zespół stropowej części serii gipsowej górnej.

Wyraźna zmiana mikroflory między kajprem dolnym i górnym następuje poniżej poziomu dolomitu granicznego.

W zbadanych osadach kajpru część gatunków występuje w dużych procentach tylko w określonych poziomach stratygraficznych. Spośród gatunków stratygraficznie ważnych dla zbadanych osadów opisano 7 gatunków. Trzy z nich są gatunkami nowymi: *Triadispora undulata*, *Triadispora keuperiana* i *Eucommiidites sulechoviensis*; jeden gatunek jest nowo utworzoną kombinacją gatunku: *Todisporites cinctus* (Mal.) nov. comb.; a trzy pozostałe opisane już w literaturze zagranicznej, zostały uzupełnione nowymi obserwacjami morfologicznymi.

Todisporites cinctus (Mal.) nov. comb.

tab. I, fig. 1-7)

Opis: Spory o zarysie okrągłym z trójramiennym znakiem tetradycznym. Ramiona znaku proste, ostro zarysowane o długości najczęściej 2/3 długości promienia spory. Egzyna sztywna przeważnie niepofałdowana, o grubości od 1,6 μ do 3,5 μ , najczęściej 2,5 μ . Powierzchnia egzyny gładka do lekko punktowanej ulega łatwo skorodowaniu częściowemu (tabl. I, fig. 3, 4) lub całkowitemu (tabl. I, fig. 5).

Triadispora undulata sp. nov.

(tab. V, fig. 1-6)

Diagnoza: Ziarna pyłku dwuworkowe z małym znakiem tetradycznym na korpusie. Powierzchnia proksymalnej strony korpusu mocno urzeźbiona w postaci płatowatych wyrostków, powierzchnia dystalnej strony gładka. Rzeźba worków w postaci drobnej siateczki. Worki pofałdowane.

Triadispora keuperiana sp. nov.

(tabl. VI, fig. 1-4)

Diagnoza: Ziarna pyłku dwuworkowe z małym znakiem tetradycznym na korpusie. Zarys ziarna opływowy. Powierzchnia proksymalnej strony korpusu urzeźbiona w postaci drobno oczkowej siateczki, powierzchnia dystalna gładka. Rzeźba worków w postaci delikatnej siateczki.

Eucommiidites sulechoviensis sp. nov.

(tabl. VI, fig. 5-8)

Diagnoza: Ziarna pyłku o zarysie kolistym lub owalnym z jedną szeroką, dobrze rozwiniętą bruzdą oraz z dwiema bruzdami wąskimi, często widocznymi jako delikatne pęknięcia błony. Egzyna cienka, delikatna.