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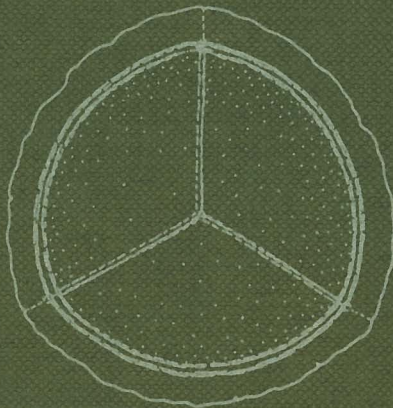
A Lower Carboniferous microflora from the Ørslev No. 1 borehole, island of Falster, Denmark

BY

Finn Bertelsen

DANSK SAMMENDRAG

*En nedre karbon mikroflora fra boringen
Ørslev nr. 1, Falster, Danmark*



I kommission hos C. A. Reitzels Forlag. København 1972

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ABSTRACT

A miospore assemblage comprising 80 species is recorded from Lower Carboniferous strata in the Ørslev No. 1 borehole, island of Falster, Denmark. 45 spore types are referred to known species and 6 are proposed as new. The remaining forms are described with open nomenclature.

The present knowledge of the Lower Carboniferous microfloras and their distribution within NW. Europe is briefly summarized. It is shown, that the Ørslev assemblage has a composition very close to that of the *Lycospora pusilla* (Pu) Zone assemblages from Scotland and northern England. Outside NW. Europe it shows affinities to spore assemblages described from eastern Canada and the south-west areas of the Soviet Union. The stratigraphical implications of these correlations are discussed. By means of indirect correlations the spore containing beds are referred to the Belgian Upper Tournaisian or Lower Viséan.

РЕЗЮМЕ

В настоящей работе дается краткое обобщение современных знаний о микрофлоре нижнего карбона и ее распространении в Северо-Западной Европе.

Основное внимание уделено комплексу миоспор, обнаруженному буровой скважиной Øрслев № 1 на острове Фальстер (Дания). Комплекс состоит из 80 видов, из которых 45 относятся к известным спорным типам, а 6 являются новыми. Остальные формы описаны в открытой номенклатуре.

Состав øрслевского комплекса очень близок к комплексу зоны *Lycospora pusilla* (Pu). Шотландии и Северной Англии. Вне Северо-Западной Европы он имеет сходство со спорными комплексами Восточной Канады и юго-западных районов Советского Союза. Дается разбор стратиграфической сопричастности этих сопоставлений. Путем косвенных сопоставлений предполагается, что отложения, содержащие данный комплекс миоспор, по возрасту относятся к верхнему турне или нижнему визе Бельгии.

INTRODUCTION

In Denmark deposits of Carboniferous age were recorded with certainty for the first time in the Ørslev No. 1 borehole (D.G.U. file No. 238.502). Text-fig. 1 shows the location of the borehole on the island of Falster in the southern part of the country. The boring, made by the Danish Underground Consortium (D.U.C.) reached its final depth, 8440' (2573 m) in January 1968.

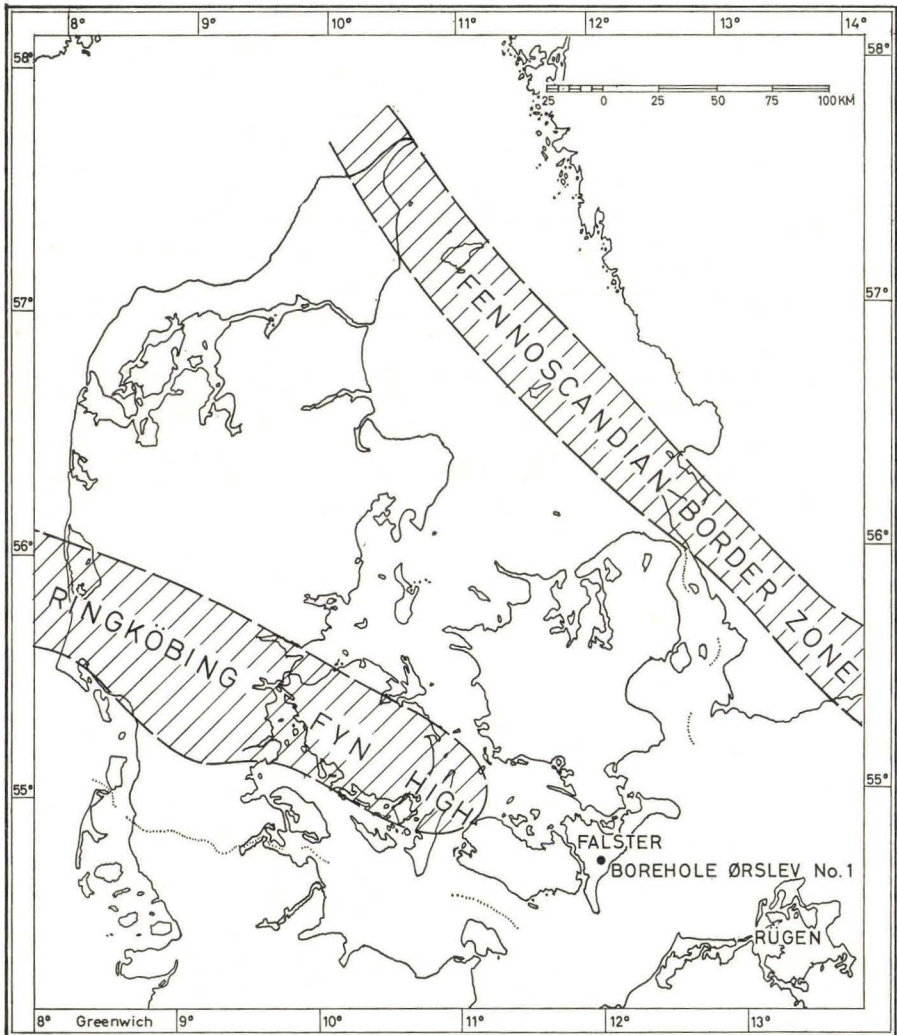
Below a series of Upper Permian (Zechstein) evaporites, 750' (229 m) of reddish shales, siltstones and sandstones, tentatively assigned to the Upper Carboniferous or Lower Permian (Rotliegendes) were recorded. These in turn are underlain, between 6740' (2051 m) and the base of the bore at 8440' (2573 m), by a series of alternating grey and black claystones (shales), marlstones and limestones, generally containing a rich benthonic fauna of brachiopods, corals, crinoids, foraminifera and ostracods.

These latter beds have been described in two recently published papers by CHRISTENSEN (1971) and MICHELSEN (1971). Two cores only, from between 6850'–6898' (2088–2103 m, Core No. 1) and 7686'–7746' (2343–2361 m, Core No. 2) (cf. text-fig. 2), were recovered and their lithology and fossil content described by CHRISTENSEN, who previously in 1968 (unpublished report) had shown these beds to be of Lower Carboniferous age. Following a comparison with the Lower Carboniferous section on the Island of Rügen (D.D.R.) and its fauna he suggested (1971, p. 21), that the Tournaisian was present in the lowermost part of the Ørslev No. 1 bore, and that the upper part of the section, including Core No. 2 was of Viséan age.

MICHELSSEN, briefly described and subdivided the lithology of the entire proved Carboniferous section. He made a detailed analysis of the benthonic foraminiferal faunas and subdivided the section into four faunizones. He showed that the faunas were comparable with the foraminiferal faunas known from the Lower Carboniferous type area in Belgium and also with those from Rügen. He correlated the Ørslev section with the Lower Viséan (V_1) and possibly (the uppermost part) with the lower part of the Middle Viséan (V_2) too.

The results of miospore analysis of samples from different levels of the proved Carboniferous section are described in this paper. In addition, short descriptions of other organic-walled microfossils are given. These include scolecodonts, hystrichosphaeres and algae? of the *Tasmanites* type. Their presence in the deposits may prove to be a valuable contribution to the interpretation of the depositional environment.

All depths are given in English feet (sample depths not corrected) and meters (corrected depths based on Schlumberger logs) below the Kelly Bushing (KB).



Text-fig. 1: Map showing the location of the Ørslev No. 1 borehole.

MATERIALS AND METHODS

The samples.

A general lithological description of the Lower Carboniferous section in the Ørslev No. 1 borehole is given by MICHELSEN (1971). The abbreviated description and the lithological column of text-fig. 2 is taken from this paper. The location of the two cored intervals is shown and also the horizons from which samples have been studied.

The majority of the samples were taken from Core No. 2 (7686'–7746'), at intervals of approximately 3', throughout the core. Not all the samples taken were prepared, since no marked differences in the spore counts from various levels in the core were observed. The spore assemblages are richest and best preserved in the lowest part of the core.

Spores have been recovered from cuttings of dark grey clay- and marlstones isolated from samples taken in the interval between the two cored sections. The dark claystone of the sample between 7270' and 7280' appears to originate in the claystone intercalation (7260–7274', 2213–2217 m) in the limestone beds between 2209 and 2220 m (cf. text-fig. 2) based on the interpretations of the Schlumberger logs. Two other samples are derived from levels just below the upper limestone beds from which Core No. 1 was taken (cf. text-fig. 2). They are contaminated by cavings of the limestone and the overlying red-coloured beds. Contamination by grey-coloured cavings from the Mesozoic strata may almost certainly be excluded as the last casing is set at 5994' in the top of the red series. As preparations of claystones from these red beds, possibly of Upper Carboniferous or Lower Permian age do not contain spores, it is deduced that the sparse spore assemblages found in the samples, below Core No. 1, represent the youngest part of the Lower Carboniferous in the Ørslev No. 1 borehole.

No spores were obtained from samples taken from Core No. 1 (6850'–6898'). This core is composed of dolomitic limestones.

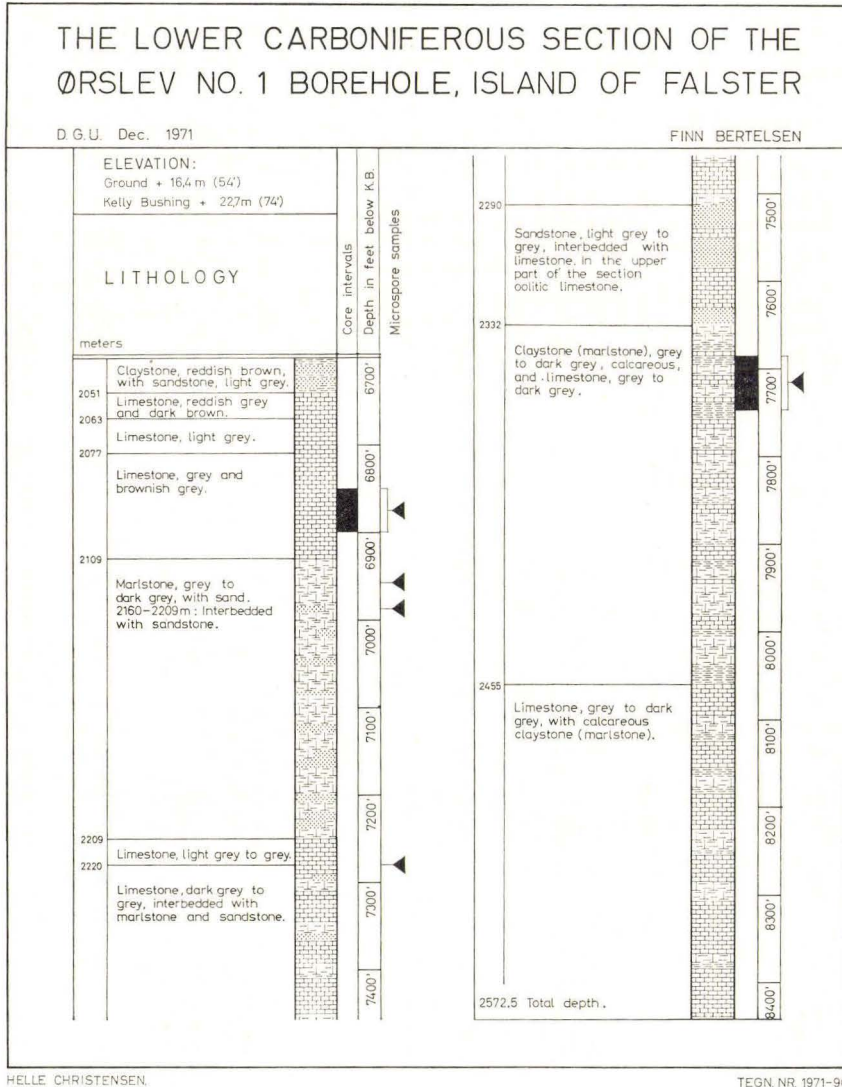
No samples were studied below Core No. 2 since in this interval it is not possible to locate the cuttings with the necessary precision.

Sample preparation.

As the sample material is rather uniform in composition, consisting of dark, black-grey shales, claystones and marlstones, the same procedure has been followed for all the samples prepared.

After careful cleaning, about 5 gm. of the sample is crushed between two sheets of thick, plastic foil by a hammer. The fraction below 1 mm is transferred

to a 200 cc polyethylen beaker and immersed in 20% HCl for 24 hours to remove the carbonates. The sample is then washed by centrifuging with distilled water and transferred to a platinum crucible. The silicates are removed by boiling for one hour in 40% HF. The HF solution is decanted after centrifuging



Text-fig. 2.

in a polyethylen centrifuge tube. Heavy-soluble fluorine compounds are dissolved by several treatments with hot, concentrated HCl, involving centrifuging and decanting. After washing with distilled water, the sample is treated for a few minutes with SCHULZE's solution, mainly to remove pyrite. A final wash with

1% NH_4Cl after washing with distilled water, removes oxidized organic matter.

The residue, now chemically cleaned, is washed on a stainless steel sieve (Dürener Metalltuch, PZ Gewebe, 14 μ mesh) as described by STREEL (1965) and KAISER (1970), transferred to a glass centrifuge tube and washed with distilled water, alcohol and finally benzene. The residue now enriched in spores and free from colloidal particles, is stored in silicone oil (AK 2000). The advantages of this embedding medium are discussed by ANDERSEN (1960). A few samples are stored in glycerine and in some cases glycolgel has been used as imbedding medium. At least three strew slides are made of each sample and the cover slips are sealed with paraffin wax. In addition several hundred single-grain slides have been made

Mounting technique used for scanning electron microscopy.

The spores are isolated from a strew mount of the residue in silicone oil using a "single-hair" brush. Specimens are selected under an optical microscope using transmitted light ($\times 250$ – $\times 400$ magnification). Later they are picked out under a binocular stereomicroscope ($\times 12.5$ – $\times 50$ magnification) and washed in benzene in a watch glass to remove all traces of silicone oil. The low viscosity of glycerine compared with silicone oil makes the former less suitable as a temporary mounting medium.

The cleaned spores are secured to a circular cover-slip either by means of Araldite (a two-component epoxy glue) or "nose-fat". In the first method the adhesive is emulsified in alcohol and a small drop of the emulsion placed on the cover-slip. It is allowed to evaporate so that the residue is spread as a film-like layer over the cover-slip. The amount of emulsion used should be carefully limited in order that the thickness of the Araldite film is not so great that it covers the specimens. If the second and easier method is used it is only necessary to touch the cover-slip lightly with the tip of one's nose, to produce sufficient adhesive and then add a drop of alcohol to form the emulsion.

To attach the cover-slip to the specimen holder and also prevent charging phenomena, conductive silver paint (Dotite paint) is introduced between them. Finally the specimens are coated with either gold or preferably carbon/gold in the high vacuum evaporator.

Storage of preparations and technical data.

Coordinates of the single-grain and strew slides refer to Leitz Laborlux microscope No. 66 42 25 of the Department of Subsurface Geology, Geological Survey of Denmark. Strew slides are marked with PM, single-grain slides with SM. SH refers to specimen holders used for S.E.M. Transmitted light photography was carried out using a Leitz Orthomat mounted on a Leitz Ortholux microscope, with Ilford FP 4, 35 mm film and a "panchogrün" filter. The scanning micrographs were taken on a Cambridge Stereoscan Mk. IIa

(Inst. Hist. Geol. Palaeont., University of Copenhagen) and a Jeol JSM-SI (D.G.U.).

Preparations and holotypes are stored in the type collection of the Department of Subsurface Geology, Geological Survey of Denmark, Copenhagen. Paratypes of the new species proposed in this paper are also stored in the collection of the Department of Geology, University of Sheffield, Great Britain.

STRATIGRAPHICAL INVESTIGATION

Composition of the microflora.

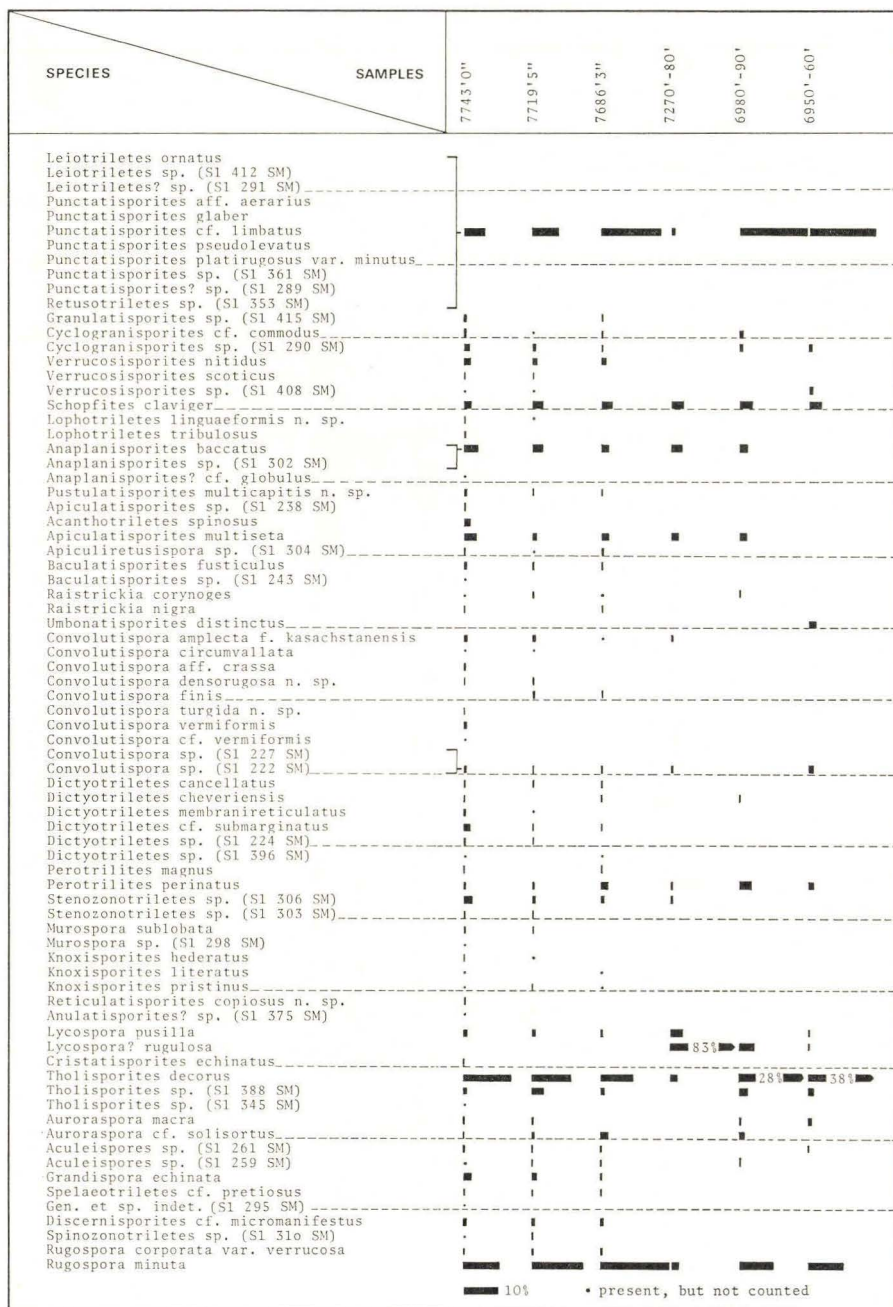
The composition of the microflora studied is diagrammatically shown in text-fig. 3. Of the 80 species described or figured, 77 are listed in the diagram. 45 forms are referred to known species, while 6 are proposed as new. The remaining forms are described with open nomenclature. In addition to the 80 species mentioned, some forms referable to the genus *Calamospora* occur in the samples studied. These forms are not described, but they are included in the totals of the *Laevigati* in text-fig. 3.

The counts of the core samples are based on 400 to 700 grains from each sample divided on two slides to reduce errors of mixing. The counts of the ditch samples are based on 200 specimens from each sample due to the scantiness of material. Species not recorded in the counted slides, but present in the sample are marked with a point in the diagram.

The uniformity of the assemblages from the core is demonstrated in the diagram. For this reason these assemblages will be treated as one assemblage. The microflora generally is richest in number of specimens and best preserved in the lower part of the core. It is dominated by two species, *Rugospora minuta* NEVES and IOANNIDES (in press) and *Tholisporites decorus* BHARADWAJ and VENKATACHALA, associated with *Schopfites claviger* SULLIVAN, *Anaplani-sporites baccatus* (HOFFMEISTER, STAPLIN and MALLOY) SMITH and BUTTERWORTH and *Apiculiretusispora multiseta* (LUBER) BUTTERWORTH and SPINNER, the latter three being common. The frequency of the remaining forms is commonly less than 1%. Stratigraphically important is the occurrence of *Lycospora pusilla* (IBRAHIM) SOMERS (in press) in the core samples.

The assemblage from the ditch sample 7270'–80' (cf. text-fig. 2) is characterized by an abundant occurrence of *Lycospora? rugulosa* BUTTERWORTH and SPINNER (83%), in association with *S. claviger*, *A. baccatus*, *A. multiseta*, *L. pusilla* and *R. minuta*, all being common (2–4%). The spores of this assemblage are well preserved and the amount of cuticula pieces and fragments in the sample is rather high compared with that of the core samples.

The assemblages of the two uppermost ditch samples, 6980'–90' and 6950'–60', resemble those of the core, but the state of preservation is rather bad. The number of species recorded is lower, but the characteristic species are the same. The fact, that many of the rare species of the core are not recovered is partly due to the limited material available from the ditch samples of which



Text-fig. 3: Composition of the microflora. Note: unidentified *Calamospora* spp. are included in the totals of the *Laevigati*.

only a minor part consists of cuttings of dark claystone and shale, the major part being cuttings and cavings of limestone from the superjacent beds. The species, *Umbonatisporites distinctus* CLAYTON, is the only new form introduced into the microflora in these samples.

In the stratigraphical analysis the microflora of the entire section studied is regarded as one assemblage, although the incoming of *L. ? rugulosa* in the ditch samples marks a change. The main reason has been the close resemblance between the assemblages of the core and the uppermost ditch samples. Also, the diverging sample, 7270'–80', is rich in cuticula fragments, but contains no scolecodonts, and it seems to represent an (par)autochthone, strongly locally influenced microflora, buried in limnic environments. Previous records of *L. ? rugulosa* (BUTTERWORTH and SPINNER 1967, MARSHALL and WILLIAMS 1970, NEVES and WILLIAMS 1970) seem to prove that this species is especially abundant in coals.

The other samples contain scolecodonts and (Hystrichophyta), which points at a deposition in the littoral zone, as the scolecodonts are regarded as maxillae of polychaete worms, Errantida, of which modern forms inhabit the coastal zone. The shells of the macrofossils frequently washed together in thin layers and the occurrence of few well preserved plants may also be interpreted as indicating shallow water conditions (CHRISTENSEN 1971). Finally the absence of Archæodiscidae in the foraminiferal faunas may be due to the facies developed (MICHELSEN 1971, p. 25). The record of conodonts in the core (CHRISTENSEN 1971, p. 13) is doubted by the present author. The specimens seem to be fragments of scolecodonts.

The spore assemblages deposited in this type of environment, approximately represent the average flora of a relatively large area of vegetation, since a mixing and an equalizing will take place during the transport and sedimentation. From a stratigraphical point of view such assemblages are more valuable than those of a coal swamp or related facies. For this reason no special attention has been paid to the ditch sample 7270'–80'.

The majority of the forms identified with existing species are found to have a stratigraphical range confined to the Lower Carboniferous, while a few extend down into the Upper Devonian or up into the Upper Carboniferous. For a more precise correlation the assemblage is compared with the Lower Carboniferous microfloras described from the neighbouring regions of the North European area of sedimentation.

Previous research on Lower Carboniferous microfloras in NW. Europe.

Text-fig. 4 shows the areas of localities in north-western Europe from which Lower Carboniferous miospore assemblages have been described.

Miospore assemblages from the Devonian-Carboniferous transition beds have been described in detail from southern Eire by DOLBY (1970), from south-

western England by SULLIVAN (1964b), NEVES and DOLBY (1967), DOLBY (1970), DOLBY and NEVES (1970), UTING and NEVES (1970), from North-West France by COMBAZ and STREEL (1970) and from the Ardenne-Rhine Basin by STREEL (1966, 1968, 1969 and 1970) and PAPROTH and STREEL (1970). The assemblages described are all older than Middle Tournaisian (Tn₂) (incl.).

In the above mentioned areas, which include the type areas of the Lower Carboniferous chronostratigraphical units Avonian, Tournaisian and Viséan and the type locality of the base of the Carboniferous System (Hönnethal), the spore-containing beds are overlain by thick sequences of limestones. This precludes the erection of a palynological zonation of the younger Lower Carboniferous strata in these areas. Only one microflora of Viséan age has been published from the region encompassed by the above mentioned papers (SULLIVAN 1964a).

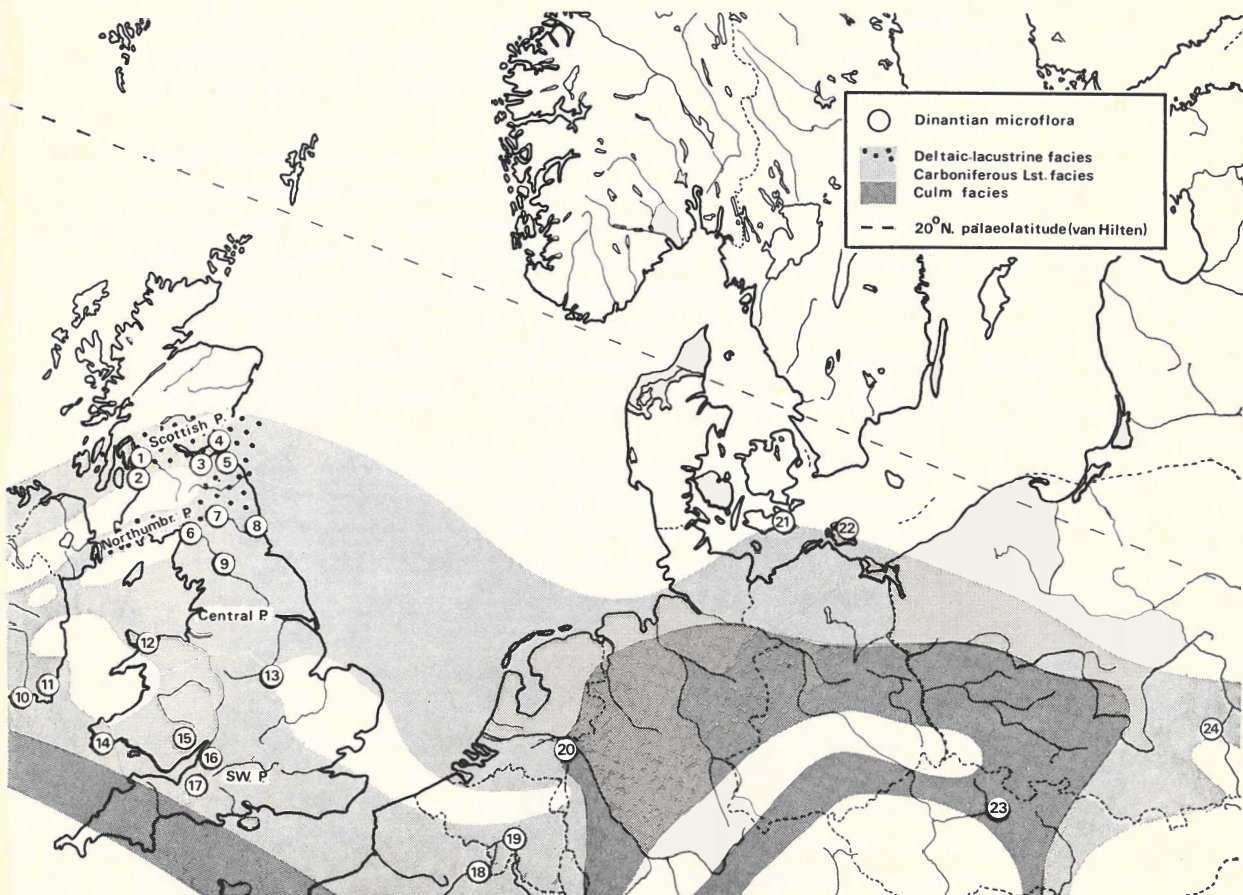
It follows from this that chronostratigraphical datings of younger Lower Carboniferous microfloras from other areas, especially those derived from non-marine deposits, will only be the results of one or more indirect correlations, the value of which in many cases may be doubted.

Thick Lower Carboniferous sequences in a non-Carboniferous Limestone facies are present in the Northumbrian and Scottish Provinces of Great Britain (cf. GEORGE 1969). Brackish, limnic, deltaic and lacustrine deposits are the main components of these provinces. Marine horizons are scarce, except in the uppermost beds of both Provinces and in the basal part of sequence in the south-western part of the Northumbrian Province. In these areas the establishment of a coral-brachiopod zonation has proved difficult. On the other hand the region offers the possibility of a study of the development and change of miospore assemblages throughout a large proportion of the Lower Carboniferous.

Miospore assemblages have been described from several localities in the Midland Valley of Scotland (LOVE 1960, SULLIVAN and MARSHALL 1966, SULLIVAN 1968, NEVILLE 1968, CLAYTON 1971 and NEVES and IOANNIDES in press), the latter from the Spilmersford borehole, East Lothian, being the most complete profile so far documented. Descriptions of microfloras from the Northumbrian Province are given by BUTTERWORTH and SPINNER (1967), SMITH and BUTTERWORTH (1967), NEVES and WILLIAMS (1970) and MARSHALL and WILLIAMS (1970). The microfloras from this province are less well known than those of the Scottish Province.

Miospores from the Central Province of Great Britain have been described by HIBBERT and LACEY (1969), LLEWELLYN, BACKHOUSE and HOSKIN (1969), MORTIMER, CHALONER and LLEWELLYN (1970) and JOHNSON and MARSHALL (1971). The assemblage described by HIBBERT and LACEY from North Wales is of Viséan age (S₂ or D₁), whereas all the other assemblages are considered to be of Tournaisian age.

Apart from the records from the Ardenne-Rhine Basin there are few palyno-



Text-fig. 4: Map showing the areas of localities in North-West Europe, from which Dinantian miospore assemblages have been recorded. The lithofacies of the Lower Viséan is shown as background (after GEORGE 1969 and PAPROTH 1969). The approximate course of the 20°N. palaeolatitude is drawn after a map in SULLIVAN (1967).

1) SULLIVAN and MARSHALL 1966, 2) SULLIVAN 1968, 3) LOVE 1960, NEVES and IOANNIDES in press, 4) NEVILLE 1968, 5) CLAYTON 1971, 6) MARSHALL and WILLIAMS 1970, 7) BUTTERWORTH and SPINNER 1967, NEVES and WILLIAMS 1970, 8) SMITH and BUTTERWORTH 1967, 9) JOHNSON and MARSHALL 1971, 10), 11), 14) DOLBY 1970, 12) HIBBERT and LACEY 1969, 13) LLEWELLYN, BACKHOUSE and HOSKIN 1969, MORTIMER, CHALONER and LLEWELLYN 1970, 15) SULLIVAN 1964a, 1964b, 16) UTTING and NEVES 1970, 17) DOLBY and NEVES 1970, NEVES and DOLBY 1967, 18–20) STREEL 1966–1970, PAPROTH and STREEL 1970, 21) Ørslev, 22) Rügen, 23) KALIBOVA 1971, 24) JACHOWICZ 1967.

logical descriptions of Lower Carboniferous deposits from the north European mainland. DOUBINGER and RAUSCHER (1966) have described a microflora of Upper Viséan age from "Les Vosges" in eastern France. The beds were previously dated on the basis of brachiopods.

KALIBOVA (1971) has described a Lower Carboniferous microflora from the Tb-1 borehole, Bohemia, Czechoslovakia. A comprehensive description of the microfloras from the Zaręby Beds, Swietokrzyskie (Holy Cross) Mts., south-eastern Poland is given by JACHOWICZ (1967 and 1970). These beds were originally dated as Tournaisian by ZAKOWA (1962). Upper Viséan assemblages have also been described by JACHOWICZ (1970) a.o. from various areas of southern Poland. The microfloras from the Lower Carboniferous of the island of Rügen, D.D.R., are presently being studied according to KNÜPFER and WEYER (1967).

From the above discussion it is evident that the equivalents of the Ørslev miospore assemblage, dated indirectly by means of foraminifera as being of Lower Viséan age are probably present in the Scottish Province. This is the only area in North-West Europe so far known, where the composition and development of the microflora can be followed continuously through the major part of the Lower Carboniferous. A direct correlation with Belgium is precluded, as it is only possible to follow the development of the microflora through the lowest part of the Lower Carboniferous because of the presence of a limestone facies in the overlying beds. Assemblages from the Tn₂ substage are the youngest hitherto recorded in Belgium. In the Swiety Krzyz area of Poland a break in the sequences of assemblages seems to occur close to the Tournaisian/Viséan boundary, and therefore this area is also precluded from the comparative stratigraphical analysis.

Correlation with Scotland and northern England.

The Ørslev assemblage is directly comparable to those of the *Lycospora pusilla* (Pu) Zone described by NEVES and IOANNIDES (in press) from the Spilmersford borehole, East Lothian, Scotland. The zone is differentiated from the underlying *Schopfites claviger-Auroraspora macra* (CM) Zone by the first appearance of *L. pusilla* (IBRAHIM) SOMERS (in press), a species present, but only in small numbers in the Ørslev assemblage. The zone is characterized by the presence of *L. pusilla* in association with several species also recorded in the Ørslev assemblage: *Verrucosisporites nitidus* (NAUMOVA) PLAYFORD, *Schopfites claviger* SULLIVAN, *Baculatisporites fusticulus* SULLIVAN, *Raistrickia corynoges* SULLIVAN, *Knoxisporites literatus* (WALTZ) PLAYFORD and *Auroraspora macra* SULLIVAN.

Tholisporites decorus BHARADWAJ and VENKATACHALA, *Dictyotriletes cancellatus* (WALTZ) POTONIÉ and KREMP and *Anaplanisporites baccatus* (HOFFMEISTER, STAPLIN and MALLOY) SMITH and BUTTERWORTH of which the first- and last-mentioned species are common in the Ørslev assemblage are also

recorded in this zone and also from the zones immediately above and below in the Spilmersford borehole.

Vallatisporites ciliaris (LUBER) SULLIVAN and *Knoxisporites stephanophorus* LOVE are species initiating the transition to the overlying *Perotrilites tessellatus*-*Schulzospora campyloptera* (TC) Zone (NEVES, GUEINN, CLAYTON, IOANNIDES and NEVILLE in press). Neither of these or any other forms occurring for the first time in the TC Zone are found in the samples studied. The appearance of *Lycospora? rugulosa* BUTTERWORTH and SPINNER in the ditch samples from the upper part of the section studied indicates that the upper assemblage may be correlated with the middle part of the Pu Zone, since the oldest of the published records of this species seems to be that of BUTTERWORTH and SPINNER (1967) from the Cambeck Beds of North-West England, where it occurs associated with a species of the uppermost part of the Pu Zone (*V. ciliaris*). The Cambeck Beds (C₂ age) is correlated with the Lower Viséan (DAY 1970).

As the results of the work of NEVES and IOANNIDES on the Spilmersford borehole are not yet published it is difficult to compare them in detail with the Ørslev assemblage. CLAYTON (1971), from the Cockburnspath area of South-East Scotland published a description of an assemblage which would appear to be slightly older than the assemblage of Core No. 2. Apart from the absence of *Lycospora* spp., which according to CLAYTON (1971, p. 597) occur only 30 ft above the youngest sample described by him in the Birnieknowes borehole, the assemblages are very similar. Species recorded by CLAYTON are shown in text-fig. 5. Those marked with an asterisk also occur in the Ørslev assemblage.

The assemblages described by BUTTERWORTH and SPINNER (1967) (cf. text-fig. 5) from the Cambeck Beds (C₂) and the older Bewcastle Beds (C₁, cf. DAY 1970) of North-West England are correlated with the upper part of the Pu Zone based on the occurrence of *V. ciliaris* (NEVES, GUEINN, CLAYTON, IOANNIDES and NEVILLE in press). These assemblages are restricted in the number of species they contain and are best compared with the assemblage of the ditch sample 7270'-7280'. They do not have the same pronounced similarity to the assemblage of Core No. 2 as do those from Cockburnspath. However they are the only assemblages so far published from the Pu Zone in the two northern provinces.

The Pu Zone is considered to be more or less equivalent to the coral-brachiopod zone C₁ (NEVES, GUEINN, CLAYTON, IOANNIDES and NEVILLE in press). New studies of the foraminiferal faunas in the South-West Province of Great Britain suggested that the *Caninia* Oolite should be correlated with the Lower Viséan of Belgium (V_{1a} or probably V_{1b}) (cf. CONIL and GEORGE 1971). The upper part of the Lower *Caninia* Zone (C₁) including the *Caninia* Oolite is therefore referable to the Lower Viséan of Belgium and not as previously to the Tournaisian. Deposits characterized by Pu Zone assemblages may therefore be indirectly referred to the Upper Tournaisian-Lower Viséan of Belgium.

COCKBURNSPATH
ASSEMBLAGE
(CLAYTON 1971)

- * *Anaplanisporites baccatus*
- Auroraspora balteola*
- * *Auroraspora macra*
- *? *Auroraspora solisortus*
- * *Baculatisporites fusticulus*
- * *Convolutispora circumvallata*
- C. flexuosa* f. *major*
- *? *C. cf. mellita*
- * *Corbulispora cancellata*
- Crassispora trychera*
- Cristatisporites bellus*
- *? *Cyclogranisporites commodus*
- Discernisporites crenelatus*
- *? *D. micromanifestus*
- Knoxisporites cinctus*
- * *K. literatus*
- K. literatus* var. *triangularis*
- Lophozonotriletes bellus*
- L. sp. A.*
- Microreticulatisporites hortonensis*
- * *Perotrilites magnus*
- * *Perotrilites perinatus*
- Propriisporites undosus*
- Pulvinispora scolecophora*
- * *Raistrickia corynoges*
- Retusotriletes incohatus*
- *? *Rugospora* cf. *corporata*
- * *Schopfites claviger*
- S. cf. claviger*
- * *Spelaeotriletes* cf. *pretiosus*
- Spinozonotriletes uncatus*
- * *Tholisporites* cf. *decorus*
- * *Umbonatisporites distinctus*
- * *Verrucosisporites nitidus*
- * *V. scoticus*
- V. variotuberculatus*

CAMBECK BEDS
ASSEMBLAGE
(BUTTERWORTH and SPINNER 1967)

- Retusotriletes incohatus*
- * *Cyclogranisporites commodus*
- * *Anaplanisporites baccatus*
- * *Apiculiretusispora multiseta*
- Convolutispora planimuricata*
- Dictyotriletes pseudopalliatum*
- *? *Endosporites micromanifestus*
- Velosporites echinatus*
- Lycospora noctuina*
- * *Lycospora rugulosa*
- Lycospora tenebricosa*
- Vallatisporites ciliaris*

BEWCASTLE BEDS
ASSEMBLAGE
(BUTTERWORTH and SPINNER 1967)

- Retusotriletes incohatus*
- * *Apiculiretusispora multiseta*
- Raistrickia ponderosa*
- Convolutispora* cf. *finis*
- Knoxisporites literatus*
- *? *Endosporites micromanifestus*
- Lycospora noctuina*
- Vallatisporites ciliaris*
- * *Perotrilites perinatus*

Note: *Laevigati* are excluded from the species lists.

* = species recorded in the Ørslev assemblage.

The Cockburnspath assemblage represent 13 samples, the Bewcastle Beds assemblage and the Cambeck Beds assemblage only 1 sample each.

Text-fig. 5: Miospore assemblages from Scotland and North-West England comparable with the Ørslev assemblage.

Correlation with Lower Carboniferous microfloras outside NW. Europe.

U.S.S.R.

The comparison with the Lower Carboniferous miospore assemblages described from various parts of the Soviet Union is for linguistic reasons only superficial. Only a small part of the Russian literature has been available and the value of the comparisons made below is therefore debatable.

A comparison has been made with the spore assemblages described by KEDO (1963, 1966) from the Pripyat depression, an area north-west of Kiev, White Russia. The Ørslev assemblage is perhaps, best compared with those of the Bobrikov 2 "complex".

This is characterized by the first occurrence of *L. pusilla*. *Apiculiretusispora multiseta* (LUBER) BUTTERWORTH and SPINNER and *Acanthotriletes dominans* KEDO =? *Acanthotriletes spinosus* (NAUMOVA) ISCHENKO, both common in the Ørslev assemblage, are characteristic members of the Bobrikov 1 and Bobrikov 2 assemblages (cf. KEDO 1966, pl. XII).

Although the Pripyat depression may be presumed to have been located at the same palaeolatitude as Ørslev and the Midland Valley of Scotland, the assemblages from it do not bear much resemblance to those from the latter two areas. This is in contrast to the similarity between the Scottish and Danish assemblages. The Bobrikov horizon is referred by PAPROTH (1969, p. 289, table VII) to the Viséan, V_{1b} of Belgium and to C₁^d of the Donetz Basin.

Comparisons with the Donetz Basin are based on the range charts of ISCHENKO (1956). Only a few species recorded in the Donetz assemblages are present in that from Ørslev.

Convolutispora amplecta f. *kasachstanensis* (LUBER) JACHOWICZ, *Dictyotriletes cancellatus*, *Knoxisporites hederatus* (ISCHENKO) PLAYFORD and *Knoxisporites literatus* have a vertical range comprising C₁ⁱ and C₁^{a-e}. *Punctatisporites platirugosus* (WALTZ) SULLIVAN var. *minutus* WALTZ, *Punctatisporites glaber* (NAUMOVA) PLAYFORD, *A. spinosus* and *L. pusilla* do not occur in strata older than C₁^a. *Leiotriletes ornatus* ISCHENKO is restricted to deposits younger than C₁^f. *Lophotriletes* aff. *grumosus* NAUMOVA =? *Verrucosisporites nitidus* (NAUMOVA) PLAYFORD is not recorded in deposits younger than C₁^d.

On the basis of these ranges the Ørslev assemblage can be correlated with the C₁^{a-e} interval of the Donetz Basin. This is approximately equal to the Lower Viséan of Belgium, as the overlying subzone C₁^f₁ can be correlated with some certainty with V_{2b} in Belgium and C₁^c can be correlated with Tn_{2b-2c} (AISENBERG, BRAZHNIKOVA and VDOVENKO 1971). The interval between these two horizons is difficult to correlate with Belgium since the two areas had different facies developed at this time.

Several of the species used in the above correlation have proved to have a greater vertical range in the Donetz Basin than quoted above (ISCHENKO 1958). This does not alter the general correlation.

Canada.

A spore assemblage figured by BARSS (1967, pl. 5–6) has many points of resemblance with the Ørslev assemblage. Of note are the numerous illustrations of cavate or “perinate” spores. Some of the forms illustrated as *Secarisporites?* spp. are probably identical with *Rugospora minuta* NEVES and IOANNIDES (in press), the dominating species of the Ørslev assemblage.

The assemblage was obtained from a horizon within the Windsor Group of eastern Canada and stated by BARSS to be of Viséan age. The precise level within the group is unknown. The general correlation of the Windsor Group to the European standard zonation is still not clear. PLAYFORD (1963b) mentions that the lower part of the Windsor Group on the basis of a marine fauna is taken to be of Early Viséan age. NEVES and BELT (1970) state that the Windsor Group is of Middle to Late Viséan age. The assemblage figured by BARSS is different from that recorded from the upper part of the Windsor Group by NEVES and BELT, which contains a microflora comparable with that of Late Viséan age in Scotland. The age of the assemblage figured by BARSS is probably of Early or Middle Viséan age.

Spore assemblages from the underlying Horton Group have been described by HACQUEBARD (1957), PLAYFORD (1963b) and VARMA (1969). The microflora of the uppermost formation of the Horton Group, the Cheverie Formation, is comparable to that of the *Schopfites claviger-Auroraspora macra* (CM) Zone in Scotland and several species of the Ørslev assemblage occur in these strata. The older assemblages of the Undifferentiated Horton Group may be compared with those described from the Lower Limestone Shales of Burrington Combe (DOLBY and NEVES 1970) and Forest of Dean (SULLIVAN 1964b), having several diagnostic species in common.

The Lower Carboniferous miospore assemblages from north-western Canada described by HACQUEBARD and BARSS (1957) and PLAYFORD and BARSS (1963) were assigned by SULLIVAN (1965) to his *Monilospora* suite, representative of a northern floral province, along with those described from Spitsbergen by HUGHES and PLAYFORD (1961), BHARADWAJ and VENKATACHALA (1961) and PLAYFORD (1962–1963a). Comparison with these assemblages is not made here.

Conclusions.

The miospore assemblage from the Ørslev borehole is comparable to those described from eastern Canada (Lower part of the Windsor Group and the underlying Cheverie Formation of the Horton Group), Scotland (Pu Zone of the Calciferous Sandstone Measures), northern England (Bewcastle Beds and Cambeck Beds) and the Soviet Union (Bobrikov 2 horizon of the Pripyat depression, White Russia and the C₁^v stage of the Donetz Basin).

The greatest similarity exists between those from Scotland, northern England, eastern Canada and Ørslev. This is interpreted as a consequence of the former

closer position of these areas. It seems to prove that the spore producing plant community growing along the southern edge of the former "Old Red Continent" was uniform over long distances. Palaeomagnetic measurements and the facies developed (reefs etc.) show the climate to have been tropical. Semi-arid environments seem to have been necessary for the formation of the Cementstone facies in Canada and Scotland (BELT *et al.* 1967, NEVES and BELT 1970) and may also have existed within the Danish area.

The assemblages which are considered comparable to that of the Ørslev borehole have all been indirectly assigned to the Upper Tournaisian or Lower Viséan as defined in Belgium. Thus the Ørslev assemblage is indirectly correlated with the Belgium type area and this supports the conclusions of MICHELSEN (1971), who referred the Lower Carboniferous section of the borehole to the Lower and Middle? Viséan and CHRISTENSEN (1971), who referred the section to the Tournaisian? and Viséan.

SYSTEMATIC PALYNOLOGY

Notes to the descriptions. The systematic classification of the miospores is traditionally based on the artificial morphographic taxonomic system of POTONIÉ (1956–1970). The descriptive terminology recommended by the C.I.M.P. (GREBE 1971) has been followed as far as possible.

The Hystrichophyta have been classified in accordance with the system established by MÄDLER (1963).

MIOSPORES

Anteturma Sporites H. POTONIÉ 1893

Turma Triletes REINSCH 1881

Subturma Azonotriletes WALTZ 1935

Infraturma Laevigati (BENNIE and KIDSTON) POTONIÉ 1956

Genus *Leiotriletes* (NAUMOVA) POTONIÉ and KREMP 1954

***Leiotriletes ornatus* ISCHENKO**

Pl. I, figs. 1–2.

1956 *Leiotriletes ornatus* ISCHENKO, p. 22; pl. 2, figs. 18–21.

1960 Spore type 1 of LOVE, p. 122; pl. 2, fig. 9 and text-fig. 12.

1962 *Leiotriletes ornatus* ISHCHENKO – PLAYFORD, p. 575; pl. 78, figs. 7, 8.

1966 *Leiotriletes ornatus* ISH. – DOUBINGER and RAUSCHER, p. 364; pl. 1, fig. 4, 5.

1967 *Leiotriletes ornatus* ISCHENKO – JACHOWICZ, p. 17; pl. 3, fig. 9.

1967 *Leiotriletes ornatus* ISCHENKO – FELIX and BURBRIDGE, p. 354; pl. 53, fig. 3.

1970 *Leiotriletes ornatus* ISHCHENKO – KAISER, p. 83; pl. 16, fig. 7.

Description. Miospores trilete, acavate. Diameter 38–50 μ (5 specimens). Amb convexly triangular with broadly rounded apices. Suturae labrate, straight, distinct, almost equal to spore radius. Labra low, smooth, distinct, individually 4 μ in width. Borders of labra straight. Exine laevigate, 2–2.5 μ thick, rarely folded.

Stratigraphical range. Up. Devonian to L. Namurian.

Geographical distribution.

Europe: Scotland (LOVE 1960), England (SULLIVAN 1964b, DOLBY and NEVES 1970, UTTING and NEVES 1970), France (DOUBINGER and RAUSCHER 1966), Belgium-Germany (cf. STREEL 1970), Poland (JACHOWICZ 1967).

U.S.S.R.: ISCHENKO (1956, 1958).

Arctic region: Spitsbergen (PLAYFORD 1962), Bear Island (KAISER 1970).

North America: U.S.A. (FELIX and BURBRIDGE 1967).

Leiotriletes sp. (SI 412 SM)

Pl. I, fig. 9.

Description. Miospores trilete, acavate. Diameter 75 μ (only one specimen was satisfactorily preserved). Amb convexly triangular. Apices rounded. Suturæ labrate, straight, distinct, equal to spore radius. Labra 3–4 μ high, narrow. Exine laevigate, 1 μ thick, "fragile".

Remarks. This spore type has been recorded in several samples, but the specimens are more or less destroyed due to the "fragile" nature of the exine.

Leiotriletes? sp. (SI 291 SM)

Pl. I, fig. 3.

Description. Miospores trilete, acavate?. Diameter 34–61 μ , mean 46 μ (10 specimens). Amb convexly triangular. Apices rounded. Suturæ labrate, straight to sinuous, almost equal to spore radius. Labra raised, 3–4 μ high, narrow. Exine finely infrapunctate, 1 μ thick.

Remarks. *Leiotriletes tumidus* BUTTERWORTH and WILLIAMS 1958, p. 359, has some resemblance to the above described spore type. *L. tumidus* has a laevigate structureless exine and is acavate. *L.? sp.* (SI 291 SM) is possibly camerate. The infrapunctation of the exine prevents its observation, but colour differences may indicate the presence of a separated intexine.

Genus *Calamospora* SCHOPF, WILSON and BENTALL 1944**Calamospora spp.**

Remarks. *Calamospora* spp. occur frequently in the preparations. As they commonly are heavily folded and non-measurable a description is omitted.

Genus *Punctatisporites* (IBRAHIM) POTONIÉ and KREMP 1954**Punctatisporites aff. aerarius BUTTERWORTH and WILLIAMS 1958**

Pl. II, fig. 5.

Description. Miospores trilete, acavate. Diameter 55–76 μ (5 specimens). Amb circular. Suturæ labrate, straight, distinct, 0.3–0.5 radius of spore. Labra 2–3 μ high, membraneous. Exine laevigate, 2.5–4 μ thick, only rarely folded.

Remarks. The above described specimens have shorter suturæ than stated for the species by BUTTERWORTH and WILLIAMS (1958, p. 360; pl. 1, figs. 10–11.): "rays slightly longer than half radius". Otherwise they are identical. The spores described by KAISER as *P. aerarius* (1970, p. 85; pl. 16, fig. 12) have suturæ being 2/3 radius of spore. They may perhaps better be identified with *P. planus* HACQUEBARD 1957. *P. aerarius* has previously been recorded from the Viséan

and Namurian of Scotland (BUTTERWORTH and WILLIAMS 1958, LOVE 1960, SULLIVAN and MARSHALL 1966, SMITH and BUTTERWORTH 1967) and from the North Western Territories of Canada (BARSS 1967).

Punctatisporites glaber (NAUMOVA) PLAYFORD 1962

Pl. I, figs. 8, 10.

1938 *Azonotriletes glaber* (NAUMOVA) WALTZ in LUBER and WALTZ, p. 11; pl. 1, fig. 2 and pl. A, fig. 3.

1956 *Leiotriletes glaber* NAUMOVA – ISCHENKO, p. 18; pl. 1, figs. 7, 8.

1958 *Leiotriletes glaber* NAUMOVA – ISCHENKO, p. 34; pl. 1, fig. 4.

1962 *Punctatisporites glaber* (NAUMOVA) PLAYFORD, p. 576; pl. 78, figs. 15, 16.

Description. Miospores trilete, acavate. Diameter 42–75 μ , mean 60 μ (21 specimens). Amb circular to strongly convexly triangular with broadly rounded apices. Suturæ simple, straight, distinct, 0.5–0.8 radius of spore. Exine laevigate to very finely infragranular, 1.5–2.5 μ thick (commonly 2 μ), often with a few compression folds.

Remarks. This species is not clearly distinguished from *P. nitidus* HOFFMEISTER, STAPLIN and MALLOY 1955 and allied forms. A list of species possibly belonging to *P. glaber* is given by PLAYFORD (1962).

Stratigraphical range. Up. Devonian to L. Namurian.

Geographical distribution. *P. glaber* and allied forms have been recorded from several localities in Europe, North America and U.S.S.R.

Punctatisporites cf. limbatus HACQUEBARD 1957

Pl. II, fig. 2.

Description. Miospores trilete, acavate. Diameter 62–103 μ , mean 77 μ (10 specimens). Amb circular to slightly oval. Suturæ simple to labrate, straight, distinct, 0.5–0.8 radius of spore. Labra, when present, 1–3 μ high, membraneous, raised. Exine laevigate to finely infrapunctate, 1–1.5 μ thick. A pseudolimbus commonly 5 μ in width, may be developed by a collapse of the thin exine along the equator. Within this pseudolimbus a row of pyrite crystals is often seen (see pl. II, fig. 2), which shows that the two layers of the exine have been in close contact but not united. Concentric folding is often observed along the inner borderline of a “limbus”.

Remarks. *P. ? limbatus* HACQUEBARD (1957, p. 308; pl. 1, figs. 9–11) is larger (111–206 μ) than the spores described above. In other respects they are identical. The spores described by PLAYFORD (1963b) as *P. limbatus* have a thick exine (4–8 μ) and broad labra. They are not regarded to be identical with *P. ? limbatus* HACQUEBARD. *P. ? limbatus* is described from the Horton Group (Mississippian) of Nova Scotia, Canada.

***Punctatisporites pseudolevatus* HOFFMEISTER, STAPLIN and MALLOY 1955**
Pl. II, fig. 1.

1955 *Punctatisporites pseudolevatus* HOFFMEISTER, STAPLIN and MALLOY, p. 394; pl. 36, fig. 5.

Description. Miospores trilete, acavate. Diameter 56–77 μ (5 specimens). Amb circular to strongly convexly triangular with broadly rounded apices. Suturae simple to labrate, straight to slightly sinuous, 0.6–0.8 radius of spore. Labra, when present, 1–3 μ high, raised, membranous. Exine distinctly infragranular with fine grana spread over the surface, 1.5–2.5 μ thick. Arcuate folding common.

Remarks. The optical section of the exine of this species is difficult to study due to the granular structure of the exine. It differs from *P. glaber* (NAUMOVA) only by differences in the structure of the exine (cf. *P. glaber* p. 26). The size variation of the type specimens is 50–74 μ .

Stratigraphical range. Viséan to Namurian.

Geographical distribution.

Europe: Scotland (BUTTERWORTH and WILLIAMS 1958, LOVE 1960).

North America: U.S.A. (HOFFMEISTER, STAPLIN and MALLOY 1955).

***Punctatisporites platirugosus* (WALTZ) SULLIVAN 1964 var. *minutus* WALTZ**
Pl. I, figs. 6–7.

1956 *Leiotriletes platirugosus* (WALTZ) var. *minutus* WALTZ – ISCHENKO, p. 16; pl. 1, figs. 5–6.

1964a *Punctatisporites platirugosus* (WALTZ) SULLIVAN, p. 358; pl. 57, figs. 7–9.

Description. Miospores trilete, acavate. Diameter 30–47 μ , mean 42 μ (12 specimens). Amb circular. Suturae simple or labrate, straight, distinct, 0.5–0.8 radius of spore. Labra, when present, 1–2 μ high, raised, membranous. Exine laevigate to punctate (corrosion), 1–1.5 μ thick, often folded.

Remarks. ISCHENKO records a size range of this variety of 30–50 μ . The size variation of the type material is according to ISCHENKO 32–47 μ . The size variation of the above described spores agrees closely with those ranges. The size ranges given by SULLIVAN is 30–70 μ . This range comprises the two varieties *minutus* and *minor*. Many species, e.g. *P. obliquus* KOSANKE 1950, *P. minutus* KOSANKE and *P. debilis* HACQUEBARD 1957, are comparable to *P. platirugosus* var. *minutus*. and may prove to be identical with the latter.

Stratigraphical range. Tournaisian? to Namurian.

Geographical distribution.

Europe: England (SULLIVAN 1964a).

U.S.S.R.: ISCHENKO (1956), KEDO (1966).

Punctatisporites sp. (SI 361 SM)

Pl. II, figs. 3-4.

Description. Miospores trilete, acavate. Diameter 47-78 μ (7 specimens). Amb circular to broadly convexly triangular with rounded apices. Suturæ simple, straight, distinct, 0.6-0.8 radius of spore. Exine laevigate (may be pitted by corrosion), 3-4 μ thick, rarely folded, fractures common.

Remarks. *P. solidus* HACQUEBARD 1957 differs from *P. sp.* (SI 361 SM) in being distinctly labrate. *Leiotriletes microgranulatus* PLAYFORD 1962 is more triangular than *P. sp.* (SI 361 SM) and the structure of the exine is granular in this species.

Punctatisporites? sp. (SI 289 SM)

Pl. I, figs. 4-5.

Description. Miospores trilete, acavate. Diameter 62 μ (only one specimen is recorded). Amb circular. Suturæ labrate, straight, distinct, 22-28 μ . Labra very low and flat, individually 2-4 μ in width, having lobate borders. Exine laevigate, of uneven thickness (0.5-3 μ). Thickenings inwardly and outwardly directed. The thickened areas more or less rounded, appr. 5-10 μ in diameter, slightly darker than the thinner areas.

Remarks. *P. sinuatus* (ARTÜZ) NEVES 1961 (cf. also SMITH and BUTTERWORTH, 1967, pl. 2, fig. 2) and *Convolutispora planimuricata* BUTTERWORTH and SPINNER, 1967, p. 7, have a type of sculpture comparable to the above described spore. The characteristic development of the labra of *P.?* sp. (SI 289 SM) is not seen in these two species, both having simple suturæ. This spore type is tentatively included in the genus *Punctatisporites*, since the sculpture is extremely low and badly defined.

Genus *Retusotriletes* (NAUMOVA) STREEL 1964**Retusotriletes sp. (SI 353 SM)**

Pl. III, fig. 1.

Description. Miospores trilete, acavate. Diameter 70 μ and 95 μ (only two specimens). Amb circular, outline irregular due to folding. Suturæ labrate, straight, distinct, 0.5 radius of spore. Labra a few μ high, membraneous. Contact areas depressed and ornamented with irregular, circular to elongated crooked flat elements. Sculptural elements 2-5 μ long, 1.5-2 μ in width and 0.5-1 μ high. The distance apart is appr. twice the width of the elements. Exine outside contact area smooth, laevigate to finely punctate (corrosion?), two-layered. Outer layer (exoexine) 1.5 μ thick, inner layer (intexine) 1 μ thick. The two layers are not seen separated from each other. Exine folded.

Remarks. This species is included in the genus *Retusotriletes*, although the contact areas are sculptured. *Apiculiretusispora* STREEL 1964 is characterized

by a sculptured exine with the ornament reduced or absent on the contact areas. Therefore it seems most reasonable to include the above described spore type in *Retusotriletes*.

Infraturma Apiculati (BENNIE and KIDSTON) POTONIÉ 1956
 Subinfraturma Granulati DYBOVA and JACHOWICZ 1957
 Genus *Granulatisporites* (IBRAHIM) POTONIÉ and KREMP 1954
Granulatisporites sp. (SI 415 SM)

Pl. III, figs. 5–6.

Description. Miospores trilete, acavate. Diameter 41–54 μ , mean 47 μ (6 specimens). Amb convexly triangular with rounded apices. Suturae simple, straight, distinct, 0.8–0.9 radius of spore. Contact area may be depressed, but curvaturae are not developed. Exine densely and finely granular. Grana rounded, appr. 0.5 μ in diameter. The ornament may be destroyed in the equatorial region by corrosion. Exine 1.5–2 μ thick, seldom folded.

Genus *Cyclogranisporites* POTONIÉ and KREMP 1954
Cyclogranisporites cf. commodus PLAYFORD 1963

Pl. III, figs. 2, 7, 8.

1967 *Cyclogranisporites commodus* PLAYFORD – BUTTERWORTH and SPINNER, p. 5; pl. 1, fig. 4.

Description. Miospores trilete, acavate. Diameter 29–50 μ , mean 38 μ (10 specimens). Amb circular to broadly convexly triangular with rounded apices. Suturae simple, straight, distinct, 0.7–0.9 radius of spore. Exine more or less distinctly granular (oil immersion may be necessary). Grana flat-topped, with rounded to polygonal outlines, closely spaced, forming a fine negative reticulum. Diameter of grana 0.5–1.5 μ . Exine 2 μ thick, frequently folded.

Remarks. *C. commodus* differs from the above described spores and from the spores described by BUTTERWORTH and SPINNER as *C. commodus* in its relatively thinner exine (1 μ). As this difference is rather considerable in view of the size of the spores, complete identity cannot be maintained.

Cyclogranisporites sp. (SI 290 SM)

Pl. XVII, figs. 4, 7, 8.

Description. Miospores trilete, acavate. Diameter 37–61 μ , mean 48 μ (20 specimens). Amb circular to rounded convexly triangular. Suturae simple, straight to sinuous, not always distinct, 0.7–0.9 radius of spore. Surface of spore covered with minor grana and tubercula, 1 μ in diameter, 1 μ high. Distally they are closely spaced being polygonal in outline. Proximally the ornament

is absent or reduced. Exine 3.5–4 μ thick, massive, not folded.

Remarks. This thick walled spore type has an outer resemblance to granulate cingulate forms referred to the genus *Stenozonotriletes*, e.g. *S.?* *bracteolus* (BUTTERWORTH and WILLIAMS) SMITH and BUTTERWORTH 1967.

Subinfraturma Verrucati DYBOVA and JACHOWICZ 1957
Genus *Verrucosisporites* (IBRAHIM) POTONIÉ and KREMP 1954
Verrucosisporites nitidus (NAUMOVA) PLAYFORD 1963
Pl. III, figs. 9–10.

- 1953 *Lophotriletes grumosus* NAUMOVA, p. 57; pl. 7, figs. 14–15.
? 1956 *Lophotriletes* aff. *grumosus* NAUMOVA – ISCHENKO, p. 40; pl. 6, fig. 74.
1963b *Verrucosisporites nitidus* PLAYFORD, p. 13; pl. 3, figs. 3–6.
? 1964b *Verrucosisporites grumosus* (NAUMOVA 1953) SULLIVAN, p. 1252; pl. 1, figs. 9–15.
1971 *Verrucosisporites nitidus* (NAUMOVA) PLAYFORD – CLAYTON, p. 592; pl. 4, fig. 7.

Description. Miospores trilete, acavate. Diameter 37–57 μ , mean 42 μ (17 specimens). Amb circular to broadly rounded, convexly triangular. Suturæ simple, straight, distinct, 0.7–0.8 radius of spore. Exine sculpture verrucate. Verrucae flat, rounded polygonal, forming a negative reticulum. Diameter of verrucae 0.5–6 μ (commonly 3–5 μ). The height is less than 1 μ . The size of the sculptural elements is reduced on the proximal surface. Exine 1.5–2.5 μ thick, often folded.

Remarks. The specimens are relatively finely ornamented and they are comparable with *Convrrucosisporites parvinodosus* PLAYFORD 1963b, p. 15; pl. 3, figs. 7–9, a species not clearly defined from *V. nitidus*. Although the sculptural variation within *V. nitidus* is wide, the including of such coarse sculptured types as *Lophotriletes* aff. *grumosus* NAUMOVA described by ISCHENKO 1956 and *Verrucosisporites grumosus* (NAUMOVA) SULLIVAN 1964b (especially figs. 14–15) is questionable.

Stratigraphical range. Up. Devonian to Viséan.

Geographical distribution.

Europe: Scotland (CLAYTON 1971), England and Eire (SULLIVAN 1964b, DOLBY 1970, DOLBY and NEVES 1970, JOHNSON and MARSHALL 1971), France (COMBAZ and STREEL 1970), Belgium and Germany (PAPROTH and STREEL 1970).

U.S.S.R.: NAUMOVA (1953), ISCHENKO (1956).

North America: Canada (PLAYFORD 1963b).

Verrucosisporites scoticus SULLIVAN 1968
Pl. IV, fig. 5.

- 1968 *Verrucosisporites scoticus* SULLIVAN, p. 121; pl. 25, figs. 11–12.

Description. Miospores trilete, acavate. Diameter 30–46 μ (3 specimens). Amb circular to broadly rounded triangular. Suturæ simple, straight, covered by the ornament, 0.5–0.6 radius of spore. Exine ornamented with closely spaced verrucae, frequently united at their bases. Verrucae rounded in profile and in outline. Basal diameter 4–6 μ , height 2–3 μ . Distance apart of verrucae commonly 1–2 μ . Appr. 20 verrucae are counted equatorially. Exine 3–5 μ thick incl. sculpture.

Remarks. A reduction of the ornament on the proximal surface is not observed in the studied specimens, cf. the diagnosis of SULLIVAN: "ornament mainly confined to distal surface". Otherwise they do not differ from the specimens described by SULLIVAN.

Stratigraphical range. Tournaisian.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968).

Verrucosisporites spp.

Pl. IV, fig. 3.

Remarks. A few specimens recorded take up a morphological intermediate position between *Verrucosisporites variotuberculatus* SULLIVAN 1968 and *Pustulatisporites multicapitis* n. sp. (cf. p. 35). Their knotty verrucate ornament has some resemblance to the sculptural elements of *P. multicapitis*, but the dimensions of the verrucae agree with those of *V. variotuberculatus*. As in the latter species a proximal sculptural reduction is seen. They differ from *V. variotuberculatus* in having a more open sculpture (not polygonal bases). In relation to *P. multicapitis* the sculpture is too low and closely spaced. Also a proximal reduction is not seen in *P. multicapitis*. Their size range is 54–62 μ excl. sculpture.

Genus *Schopfites* KOSANKE 1950

Schopfites claviger SULLIVAN 1968

Pl. IV, figs. 4, 6, 7.

1968 *Schopfites claviger* SULLIVAN, p. 121; pl. 25, figs. 9–10.

1971 *Schopfites claviger* SULLIVAN – CLAYTON, p. 588; pl. 3, figs. 3–5.

Description. Miospores trilete, camerate. Diameter (excl. sculpture) 34–54 μ , mean 47 μ (20 specimens). Amb circular to oval. Suturæ simple, straight to slightly sinuous, rarely visible, 0.5–0.8 radius of spore. Ornament of closely spaced pila covers the distal surface. Pila 2–5 μ high (commonly 3 μ). Heads of pila 1–2 μ in diameter. Proximal surface devoid of ornament. Exoexine coarsely infrapunctate, less than 1 μ thick, commonly folded. The structure of the exoexine (including the pila) seen in the S.E.M. is spongy. Intexine thin, difficult to observe due to the non-transparency of the exoexine.

- 1967 *Anaplanisporites baccatus* (HOFFMEISTER, STAPLIN and MALLOY) – SMITH and BUTTERWORTH, p. 166; pl. 7, figs. 1–5.
 1971 *Anaplanisporites baccatus* (HOFFMEISTER, STAPLIN and MALLOY) SMITH and BUTTERWORTH – CLAYTON, p. 579; pl. 1, figs. 1–2.

Description. Miospores trilete, acavate. Diameter 24–30 μ , mean 27 μ (28 specimens). Amb circular to broadly rounded triangular with rounded apices. Suturae simple to labrate, straight, frequently indistinct, almost equal to spore radius. When labrate, labra very fine and membranous, less than 1 μ high. Distal surface, equatorial region and a 1–2 μ broad concentric zone of proximal surface ornamented with closely spaced coni or bacula, rounded or truncate. The dimensions of elements vary from 0.5 \times 0.5 μ to 1 \times 1 μ . Their bases are circular to polygonal. Their distance apart is less than or equal to diameter of bases. Contact areas smooth or with scattered small grana. The exine of the contact areas is very thin and is often deformed by secondary pyrite crystals. The remaining part of the exine is thicker and more rigid, but less than 1 μ thick. As the thick part of the exine continues on to the proximal surface, a dark equatorial zone is seen in transmitted light, but this must not be mistaken for a cingulum (cf. pl. VI, fig. 4). Curvaturae are not seen in the S.E.M. and the change in exine thickness is believed to be even.

Remarks. Compared with the holotype the above described specimens are sculptured more finely and densely. The ornamentation of this species seems to vary a good deal and more variants have been described (STAPLIN 1960, KALIBOVA 1971). *Anaplanisporites* sp. (SI 302 SM), described below, is possibly a variety of *A. baccatus*.

Stratigraphical range. Tournaisian to Westphalian.

Geographical distribution.

Europe: Scotland (LOVE 1960, SULLIVAN and MARSHALL 1966, CLAYTON 1971), England (BUTTERWORTH and WILLIAMS 1958, SMITH and BUTTERWORTH 1967, LLEWELLYN, BACKHOUSE and HOSKIN 1969, MARSHALL and WILLIAMS 1970), Poland (JACHOWICZ 1967), Czechoslovakia (KALIBOVA 1971).

North America: U.S.A. (HOFFMEISTER, STAPLIN and MALLOY 1955), Canada (STAPLIN 1960).

***Anaplanisporites* sp. (SI 302 SM)**

Pl. V, fig. 8; pl. VI, figs. 5–6.

Description. Miospores trilete, acavate. Diameter 27–36 μ (7 specimens). Amb broadly rounded triangular with rounded apices. Suturae simple, straight, 0.8–1 radius of spore. Distal surface and equatorial region ornamented with fine, closely spaced grana, with rounded or polygonal bases. Grana 0.5 \times 0.5 μ to 0.7 \times 0.7 μ . Contact areas unsculptured. Exine thin, especially in the contact

areas. Curvaturae not present.

Remarks. The typical granular ornament and the size are the criteria used to distinguish this spore type from *A. baccatus*, which is characterized by a microbaculate to microconate ornament. It may probably be regarded as a variety of *A. baccatus*.

Anaplanisporites? cf. globulus (BUTTERWORTH and WILLIAMS)

SMITH and BUTTERWORTH 1967

Pl. V, fig. 10.

Remarks. Two specimens probably referable to *A. globulus* were recorded. They differ from the type material (re-studied by SMITH and BUTTERWORTH 1967) by the occurrence of a reduced proximal ornament. They are only tentatively included in *Anaplanisporites*, a genus characterized by laevigate contact areas. *A. globulus* is restricted to Upper Viséan? and Lower Namurian deposits in Great Britain (SMITH and BUTTERWORTH 1967, MARSHALL and WILLIAMS 1970).

Genus *Pustulatisporites* POTONIÉ and KREMP 1954

Pustulatisporites multicapitis n. sp.

Pl. VII, figs. 1–6; text-fig. 7.

Holotype. Pl. VII, fig. 4; SI 273 SM. Diameter 63 μ (excl. sculpture).

Type locality. Ørslev No. 1 borehole, D.G.U. file No. 238.502.

Type stratum. Marlstone, black-grey. Borehole depth 7743'0". Lower. Viséan

Derivation of name. Of *multus* (lat.) = much and *caput* (lat.) = head.

Diagnosis. A *Pustulatisporites* species ornamented with relatively coarse, mammiliform, conate extensions with characteristic expanded, "knotty" heads. Diameter (excl. sculpture) 48–75 μ . Amb circular to broadly, convexly triangular. Suturæ simple, straight, 0.5–0.7 radius of spore. Exine 2–4 μ thick. Apr. 15–30 elements, commonly 6–7 μ high, project from the margin.

Description. Miospores trilete, acavate. Diameter 48–75 μ , mean 60 μ (25 specimens). Amb circular to broadly, convexly triangular with rounded apices. Proximal and distal profiles originally convex. Suturæ simple, straight, normally distinct, 0.5–0.7 radius of spore. Proximal and distal surfaces sculptured with conate to mammiliform, smooth to knotty extensions. The heads of the elements formed by constrictions are characteristically subdivided into two or more semiglobular parts on most specimens (e.g. pl. VII, figs. 1–2). Some elements have simple heads. Other elements are formed like rounded, knotty coni and verrucae (pl. VII, figs. 5–6). The height of the sculpture is commonly 6–7 μ , but may reach 9 μ . The bases of the elements are rounded, commonly 7–8 μ in diameter, but when elongated they may be up to 12 μ . Whereas the height of the sculpture seems to be rather constant in single specimens, the



Text-fig. 7: The ornament types of *P. multicapitis* n. sp. $\times 1000$.

diameter of the bases varies. Generally, specimens with wide elements bear few, specimens with narrow elements many of these. The number of extensions projecting from the equator is approximately 15–30. The surface of the exine may be smooth or covered by grana between the elements. Exine 2–4 μ thick (excl. sculpture).

Comparison and discussion. *Pustulatisporites gibberosus* (HACQUEBARD) PLAYFORD 1963b (p. 18; pl. 3, figs. 18–20) differs from *P. multicapitis* n. sp. by its sculptureless contact area and more simple ornament types. The sculpturing elements of *Raistrickia ponderosa* PLAYFORD 1963b (p. 25; pl. 6, figs. 11–12; pl. 7, fig. 1) are closer spaced, and their basal parts are cylindrical rather than conate. The number of elements per spore is larger and the elements are more uniform than those found in *P. multicapitis*. The species is assigned to the genus *Pustulatisporites* since the sculpturing elements are not closely spaced and are of mixed conate verrucate type. It is not to be referred to either *Verrucosisporites* or *Raistrickia*.

Genus *Apiculatisporites* (IBRAHIM) SMITH and BUTTERWORTH 1967

***Apiculatisporites* sp. (SI 238 SM)**

Pl. IV, figs. 1–2.

Description. Miospores trilete, acavate. Diameter 78–108 μ (4 specimens). Suturae simple, indistinct (covered by ornament), 0.4–0.6 radius of spore. Exine evenly or unevenly ornamented with low, more or less rounded conii, which are often united at their bases. Conii 1–2 μ high, 1–4 μ in diameter. Exine 2 μ thick (excl. sculpture), folded on the recorded specimens.

Genus *Acanthotriletes* (NAUMOVA) POTONIÉ and KREMP 1954

***Acanthotriletes spinosus* (NAUMOVA) ISCHENKO 1956**

Pl. VIII, figs. 6, 8.

1938 *Azonotriletes spinosus* (NAUMOVA) WALTZ in LUBER and WALTZ, p. 13; pl. 1, fig. 13; pl. 5, fig. 62.

1956 *Acanthotriletes spinosus* NAUMOVA – ISCHENKO, p. 28; pl. 4, figs. 39–41.

1958 *Acanthotriletes spinosus* NAUMOVA – ISCHENKO, p. 45; pl. 3, figs. 33–36.

? 1963 *Acanthotriletes dominans* KEDO, p. 43; pl. 2, figs. 53–54.

? 1966 *Acanthotriletes dominans* KEDO, p. 55; pl. 1, figs. 34–35.

Description. Miospores trilete, acavate. Diameter 39–50 μ , mean 44 μ (11 specimens). Amb circular to oval. Proximal and distal surfaces semiglobular. Suturae (only observed in one specimen) simple, straight, (0.6 radius of spore). Exine ornamented with evenly distributed, somewhat irregular spinae and conii,

0.5–2 μ high (commonly 1.5 μ), with rounded bases 0.5–1 μ in diameter. Distance apart of elements 1–5 μ , commonly 1–2 μ . Exine thin (less than 1 μ , non-measurable), folded, structureless.

Remarks. *Acanthotriletes dominans* KEDO 1963 is possibly identical with *A. spinosus* (NAUMOVA) ISCHENKO, but the identity cannot be established on the basis of the descriptions and figures published.

Stratigraphical range. Devonian to Namurian.

Geographical distribution.

U.S.S.R.: Recorded from various parts of the Soviet Union by LUBER and WALTZ (1938), ISCHENKO (1956, 1958) and KEDO? (1963, 1966).

Genus *Apiculiretusispora* STREEL 1964

Apiculiretusispora multisetata (LUBER) BUTTERWORTH and SPINNER 1967

Pl. VIII, figs. 5, 7.

1938 *Azonotriletes multisetatus* LUBER in LUBER and WALTZ, p. 23; pl. 5, fig. 61.

1962 *Acanthotriletes multisetatus* (LUBER) POTONIÉ and KREMP – PLAYFORD, p. 590; pl. 80, figs. 14–15.

1963 *Acanthotriletes multisetatus* (LUBER) KEDO, p. 43; pl. 2, figs. 51–52.

1966 *Acanthotriletes multisetatus* (LUBER) KEDO – KEDO, p. 56; pl. 1, figs. 36–38.

1967 *Apiculiretusispora multisetata* (LUBER) BUTTERWORTH and SPINNER, p. 5; pl. 2, figs. 13, 18.

1967 *Acanthotriletes multisetatus* (LUBER) POTONIÉ and KREMP – BARSS, pl. 7, fig. 17.

1970 *Apiculiretusispora multisetata* (LUBER 1938) BUTTERWORTH and SPINNER – KAISER, p. 93; pl. 18, fig. 7.

Description. Miospores trilete, acavate. Diameter 34–54 μ , mean 41 μ (27 specimens). Amb circular to oval. Suturae simple, indistinct, more than half the radius of spore. Exine ornamented with closely spaced spinae, straight to crooked, commonly 1.5–2 μ high. Studied on the S.E.M. the spinae sometimes seem to be rounded bacula rather than spinae. Ornament may be reduced on the proximal surface. Exine thin, less than 1 μ , commonly folded and partly destroyed by secondary pyrite crystals.

Remarks. Curvaturae have not been observed in a convincing way. Otherwise the above described specimens conform with the descriptions given by the authors in the synonym list. One specimen was found to be camerate and probably more careful studies may show, that some of the specimens must be referred to *Tholisporites* cf. *decorus* BHARADWAJ and VENKATACHALA; NEVES and IOANNIDES (in press) as described by CLAYTON (1971, p. 590).

Stratigraphical range. (Devonian?) Tournaisian to Viséan.

Geographical distribution.

Europe: Scotland (LOVE 1960), England (BUTTERWORTH and SPINNER 1967).

U.S.S.R.: LUBER and WALTZ 1938, KEDO 1957, 1963, 1966.

Arctic region: Spitsbergen (PLAYFORD 1962), Bear Island (KAISER 1970).

North America: Canada (BARSS 1967).

A variety has been described from the Middle Old Red Sandstone deposits of the Orcadian Basin of Scotland by RICHARDSON (1965, p. 566). This variety is larger (over 60 μ) than *A. multiseta* and the extension of the stratigraphical range of *A. multiseta* to the Devonian is therefore questionable.

Apiculiretusispora sp. (SI 304 SM)

Pl. VIII, figs. 2–4.

Description. Miospores trilete, acavate. Diameter 69–77 μ (5 specimens). Amb circular to broadly, convexly triangular with rounded apices. Suturae simple, straight, indistinct, 0.6–0.8 radius of spore. Curvaturae present, approximately merging with the inner borderline of the exine, when studied in optical section. Contact areas laevigate to scabrate. Remaining part of the exine densely ornamented with grana and stout bacula or pila, 0.5–3 μ high, 1 μ in diameter. Exine 4–5 μ thick measured at the equator.

Remarks. It has not been possible to find descriptions of species comparable to the above described spore type. The majority of species of the genus *Apiculiretusispora* seem to be restricted to Devonian stages.

Subinfraturma Baculati DYBOVA and JACHOWICZ 1957

Genus *Baculatisporites* THOMSON and PFLUG 1953

***Baculatisporites fusticulus* SULLIVAN 1968**

Pl. III, figs. 3–4.

1968 *Baculatisporites fusticulus* SULLIVAN, p. 117; pl. 25, figs. 1–2.

1971 *Baculatisporites fusticulus* SULLIVAN – CLAYTON, p. 580; pl. 1, fig. 4.

Description. Miospores trilete, acavate. Diameter 63–90 μ , mean 76 μ (9 specimens). Amb circular to oval. Suturae simple, straight to sinuous, often indistinct, 0.5–0.7 radius of spore. Exine evenly and densely granular to micro-baculate. Grana and bacula (rounded) commonly 1 μ high and less than 1 μ in diameter. Densely spaced elements may have polygonal bases, otherwise the bases are circular. Exine 1–1.5 μ thick, frequently folded.

Remarks. The specimens studied have a lower type of ornament, than the spores described by SULLIVAN and CLAYTON. This is partly ascribed to secondary corrosion phenomena, since several of the observed specimens have bare, sculptureless, corroded areas.

Stratigraphical range. Tournaisian.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968, CLAYTON 1971), England (LLEWELLYN, BACKHOUSE and HOSKIN 1969, JOHNSON and MARSHALL 1971), Belgium-Germany (STREEL 1970).

Baculatisporites sp. (SI 243 SM)

Pl. IX, figs. 6–7.

Remarks. A few specimens referable to the genus *Baculatisporites* have been recorded. Most of them have short, more or less cylindrical bacula as shown in the scanning micrograph (pl. IX, fig. 7).

Genus *Raistrickia* SCHOPF, WILSON and BENTALL 1944***Raistrickia corynoges* SULLIVAN 1968**

Pl. IX, figs. 1, 4.

1963 *Acanthotriletes macrurus* (LUBER) NAUM. – KEDO, p. 44; pl. 3, fig. 57.1963 *Acanthotriletes sphaerites* KEDO, p. 44; pl. 3, fig. 58.1964b *Raistrickia* sp. A. SULLIVAN, p. 1252; pl. 1, fig. 8.1968 *Raistrickia corynoges* SULLIVAN, p. 119; pl. 25, figs. 6–8; text-fig. 2.1970 *Raistrickia corynoges* SULLIVAN – COMBAZ and STREEL, p. 232; pl. 4, figs. 12–13.1971 *Raistrickia corynoges* SULLIVAN – CLAYTON, p. 587; pl. 3, fig. 1.

Description. Miospores trilete, acavate. Diameter (excl. sculpture) 65–85 μ , mean 74 μ (21 specimens). Amb circular. Suturæ simple or faintly labrate, indistinct in transmitted light, straight, more than half radius of spore in length. Ornament baculate. Bacula 10–15 μ high, 2–6 μ or even more in diameter. In horizontal section they are rounded, circular to elongated oval. The tops are rounded, truncate or composed of a row of smaller extensions formed by bifurcation of the outer part of the bacula. At their bases the bacula are connected by flanges of 2–3 μ broad muri. The profiles of the connections forming a more or less perfect reticulum with the bacula situated at the connection points, are concave. The lumina of the network are cup-shaped. The complexity of the ornament has a wide variation and is demonstrated in the scanning micrographs (pl. IX, figs. 1 and 4), which also show the sporadic reduction of bacula to rounded conical. Exine otherwise laevigate, 2–3 μ thick measured in the centers of lumina.

Remarks. The spores are generally larger than those described by SULLIVAN, which have a size range from 50–(64)–75 μ . A proximal reduction of the ornament is not marked on well preserved specimens. Compressed specimens may have a polar reduction caused by breakage of the massive elements (an ultragranular spongy mass is seen in the interior of the broken bacula in the S.E.M.), but this reduction is secondary.

Acanthotriletes sphaerites KEDO 1963 is in the author's opinion only a variety of *R. corynoges* and it is therefore included in the synonym list.

Stratigraphical range. Tournaisian.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968, CLAYTON 1971), England (SULLIVAN 1964b, UTTING and NEVES 1970, JOHNSON and MARSHALL 1971), France (COMBAZ and STREEL 1970), Belgium-Germany (STREEL 1970).

U.S.S.R.: KEDO 1963, not LUBER and WALTZ 1938.

Raistrickia nigra LOVE 1960

Pl. IX, figs. 2-3.

1960 *Raistrickia nigra* LOVE, p. 114; pl. 1, fig. 5; text-fig. 4.1966 *Raistrickia nigra* LOVE - SULLIVAN and MARSHALL, p. 269; pl. 1, figs. 27-28.1968 *Raistrickia nigra* LOVE - NEVILLE, p. 436; pl. 1, fig. 2.1969 *Raistrickia nigra* LOVE - HIBBERT and LACEY, p. 424; pl. 78, figs. 5-6.

Description. Miospores trilete, acavate. Diameter (excl. sculpture) 45-58 μ (3 specimens). Amb convexly triangular with rounded apices. Suturæ simple, straight, distinct, 0.7-0.8 radius of spore. Exine sculptured with bacula or coni, rounded, sometimes obliquely truncated. Elements 4-7 μ high, 4-5 μ in diameter. Bases circular. Distance apart 1-2 \times the diameter of elements. Proximal ornament reduced or missing. 16 and 21 extensions along the margin on two specimens. Exine otherwise laevigate, 3 μ thick.

Remarks. Specimens conform with the original diagnosis of LOVE, but are slightly smaller than originally stated for this species (60-75 μ). They fall within the size ranges given by SULLIVAN and MARSHALL (1966) and NEVILLE (1968). A proximal reduction of sculpture is not mentioned by LOVE, but noted by SULLIVAN and MARSHALL ("Ornamentation ... mainly confined to the distal surface" (p. 270)).

Stratigraphical range. Viséan.

Geographical distribution.

Europe: Scotland (LOVE 1960, SULLIVAN and MARSHALL 1966, NEVILLE 1968), England (HIBBERT and LACEY 1969).

Genus *Umbonatisporites* (HIBBERT and LACEY) CLAYTON 1971***Umbonatisporites distinctus*** CLAYTON 1971

Pl. VIII, fig. 1.

1971 *Umbonatisporites distinctus* CLAYTON, p. 591; pl. 4, figs. 4-6.

Description. Miospores trilete, acavate. Diameter (excl. sculpture) 33-54 μ (2 specimens). Amb circular. Suturæ, simple, straight, indistinct, 0.3 radius of spore. Contact area corroded, without ornament. Exine otherwise evenly ornamented with 6-7 μ high, subcylindrical bacula, 2 μ in basal diameter, but tapering to 1 μ at the top. A collar with a central 1-2 μ long spina terminates the elements. Distance apart of the elements is equal to their height. Exine otherwise laevigate, less than 1 μ thick, folded.

Remarks. The characteristic ornament of the spores corresponds closely to the original description of CLAYTON.

Stratigraphical range. Tournaisian.

Geographical distribution. Hitherto only recorded from Scotland.

Infraturma Murornati POTONIÉ and KREMP 1954

Genus *Convolutispora* HOFFMEISTER, STAPLIN and MALLOY 1955***Convolutispora amplecta* (LUBER) JACHOWICZ 1967 f. *kasachstanensis* LUBER**
Pl. X, figs. 1-2.

- 1938 *Azonotriletes amplectus*, forma *kasachstanensis* LUBER in LUBER and WALTZ, p. 25; pl. 5, fig. 71.
 1967 *Convolutispora amplecta* (LUBER) f. *kasachstanensis* (LUBER) JACHOWICZ, p. 29; pl. 15, figs. 2-5.

Description. Miospores trilete, acavate. Diameter 48-82 μ , mean 62 μ (18 specimens). Amb circular to irregular oval. Suturae simple, covered by ornament, straight, half the radius of spore in length. Exine ornamented with muri, 2-5 μ wide and 1-4 μ high, rounded in profile, partly anastomosing forming an irregular reticulum. Lumina long, irregular and usually narrow. Their width is approximately the width of the surrounding muri, on average. Exine otherwise laevigate, 2.5-3 μ thick measured in the centers of lumina.

Remarks. The size range of specimens is greater than stated by LUBER (70-80 μ). The measurements of JACHOWICZ (1967) show a corresponding width of the size range, but the values are slightly higher (58-78.5-92 μ). The spores figured by ISCHENKO (1956, pl. 7, figs. 92-94) as *Periplecotriletes amplectus* f. *kasachstanensis* seem to have a wide morphological span of variation. Only fig. 94 agrees with the author's opinion of the variety *kasachstanensis*.

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Europe: Poland (JACHOWICZ 1967).

U.S.S.R.: LUBER and WALTZ 1938, ISCHENKO 1956.

***Convolutispora circumvallata* CLAYTON 1971**

Pl. XIV, figs. 5-6.

- 1971 *Convolutispora circumvallata* CLAYTON, p. 582; pl. 1, figs. 5-7.

Description. Miospores trilete, acavate. Diameter 73-90 μ (3 specimens). Amb circular to oval. Suturae simple, straight, partly covered by ornament, more than half radius of spore in length. Exine ornamented with an irregular, imperfect reticulum of muri 2-11 μ in width, up to 7 μ high. Muri more or less mushroom-shaped in transverse section. Reduced muri may form isolated cylindrical elements. Lumina and ornament-free part of exine constitute approximately 50% of the surface of spore. The height of the sculpture decreases towards the proximal pole. Exine 7-11 μ thick including the ornament.

Remarks. The sculpturing of this species is extremely variable. The above described specimens are most in accordance with fig. 6 of CLAYTON (1971).

Stratigraphical range. Tournaisian.

Geographical distribution. Hitherto only recorded from Scotland.

Convolutispora aff. crassa PLAYFORD 1962

Pl. X, fig. 6.

Description. Miospores trilete, acavate. Diameter 44–68 μ (3 specimens). Amb circular. Suturae simple, straight, 0.6–0.8 radius of spore. Exine ornamented with muri, 3–4 μ high, 2–5 μ in width and flat-topped. Muri anastomosing, forming an imperfect reticulum. Lumina narrow, long, irregular, commonly having a width of approximately 1 μ . Exine 6–9 μ thick (incl. sculpture).

Remarks. Specimens conform with the diagnosis of PLAYFORD (1962), except for the size range. They are smaller than stated by PLAYFORD (61–85–115 μ).

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Arctic region: Spitsbergen (PLAYFORD 1962).

U.S.S.R.: For possible records cf. PLAYFORD (1962).

Convolutispora densorugosa n. sp.

Pl. XII, figs. 5–7.

Holotype. Pl. XII, fig. 5; Sl 254 SM. Diameter 88 μ .

Type locality. Ørsløv No. 1 borehole, D.G.U. file No. 238. 502.

Type stratum. Marlstone, black-grey. Borehole depth 7716'0–7". Lower Viséan.

Derivation of name. Of *densus* (lat.) = dense and *rugosus* (lat.) = wrinkled.

Diagnosis. A *Convolutispora* species characterized by an ornament of closely packed, wrinkled muri, 1–5 μ in width and up to 3 μ high and rounded triangular in transverse section. Diameter 84–111 μ . Amb circular to broadly, convexly triangular with rounded apices. Suturae straight to sinuous, 0.5–0.7 radius of spore. Exine 7–10 μ thick (incl. sculpture), distinctly two-layered, the layers being not separated. Inner layer (intexine) 2 μ thick, infrapunctate.

Description. Miospores trilete, acavate. Diameter 84–111 μ , mean 90 μ (13 specimens). Amb circular to broadly, convexly triangular with broadly rounded apices. Suturae simple, straight to slightly sinuous, distinct, partly covered by ornament, 0.5–0.7 radius of spore. Exine ornamented with closely packed, wrinkled muri, 1–5 μ wide and up to 3 μ high. Muri rounded, more or less triangular in transverse section. The ornament is modified along the suturae, which are not "crossed" by the muri. Double rows of muri mark the position of suturae (pl. XII, fig. 7), but they are not interpreted as labra. Exine 7–10 μ thick (incl. sculpture), distinctly two-layered. The two layers are not separated from each other. Inner layer (intexine) 2 μ thick, infrapunctate.

Comparison. *C. densorugosa* shows a sculptural resemblance to *Convolutispora finis* LOVE 1960 (p. 115; pl. 1, fig. 7 and text-fig. 5). They have approximately the same size range (*C. finis*: 85–110 μ), but the ornament of the latter is lower

and more rounded and the exine is thinner (4–5 μ incl. sculpture). *C. ampla* HOFFMEISTER, STAPLIN and MALLOY 1955 (p. 384; pl. 38, fig. 12) is smaller than *C. densorugosa* and the sculpture is more open with recognizable lumina (“depressions”).

***Convolutispora finis* LOVE 1960**

Pl. II, fig. 6.

1960 *Convolutispora finis* LOVE, p. 115; pl. 1, fig. 7; text-fig. 5.

Description. Miospores trilete, acavate. Diameter 55–80 μ (5 specimens). Amb circular. Suturæ simple, straight, distinct, 0.6–0.8 radius of spore. Ornament vermiculate. Vermiculi approximately 1 μ deep, form an irregular imperfect reticulum. Muri rounded, 1–2 μ wide. Exine 2–4.5 μ thick, with arcuate folds.

Remarks. The above described specimens are identical with *C. finis* although their diameter is smaller than stated by LOVE (1960) cf. the preceding description. The figured specimen has been compared with the holotype of *C. finis* stored in Sheffield. *Punctatisporites parvivermiculatus* PLAYFORD 1962 (p. 577; pl. 78, fig. 14) has a much finer, but comparable sculpture.

Stratigraphical range. Viséan.

Geographical distribution. Hitherto only recorded from Scotland. Comparable but not identical forms are described by PLAYFORD (1963b) and BUTTERWORTH and SPINNER (1967).

***Convolutispora turgida* n. sp.**

Pl. XI, figs. 3, 5.

Holotype. Pl. XI, fig. 3; SI 319 SM. Diameter 133 μ .

Type locality. Ørslev No. 1 borehole, D.G.U. file No. 238.502.

Type stratum. Marlstone, black-grey. Borehole depth 7739'4–9". Lower Viséan.

Derivation of name. Of *turgidus* (lat.) = turgid.

Diagnosis. A *Convolutispora* species characterized by an ornament of “turgid”, partly anastomosing muri, distally 10–20 μ in width, semicircular in transverse section, proximally reduced. Lumina irregular, narrow and subordinate. Diameter 81–150 μ . Amb convexly triangular with broadly rounded apices. Suturæ simple or with minor raised labra, straight, not covered by ornament, almost equal to the radius of the spore body. Exine commonly 15–20 μ thick (not exceeding 25 μ) measured in the equatorial region (and incl. sculpture).

Description. Miospores trilete, acavate. Diameter 81–150 μ , mean 118 μ (17 specimens). Amb convexly triangular with broadly rounded apices. Suturæ simple or with minor raised labra, straight, distinct, not covered by ornament,

almost equal to the radius of the spore body. Exine ornamented with a coarse, convolute sculpture. Muri rounded with semicircular profile in transverse section, sinuous, variable in width and height, partly anastomosing, partly united in platelike thickenings. Lumina narrow, irregular, subordinate to muri in width. Proximal ornament with reduced dimensions. Proximal width of muri about 10 μ ; distal width commonly between 10 and 20 μ . Exine commonly 15–20 μ (not exceeding 25 μ) measured in the equatorial region (and incl. sculpture).

Remarks. The author has failed in the search for *Convolutispora* species which could be mistaken for *C. turgida* or could be referred to this.

***Convolutispora vermiformis* HUGHES and PLAYFORD 1961**

Pl. XI, fig. 2.

- 1961 *Convolutispora vermiformis* HUGHES and PLAYFORD, p. 30; pl. 1, figs. 2–4.
 1962 *Convolutispora vermiformis* HUGHES and PLAYFORD – PLAYFORD, p. 593; pl. 82, figs. 5–6.
 1963b *Convolutispora vermiformis* HUGHES and PLAYFORD – PLAYFORD, p. 27; pl. 7, figs. 8–9.
 1967 *Convolutispora vermiformis* HUGHES and PLAYFORD – FELIX and BURBRIDGE, p. 374; pl. 57, figs. 5.
 1969 *Convolutispora vermiformis* HUGHES and PLAYFORD – HIBBERT and LACEY, p. 425; pl. 79, figs. 6–7.
 1970 *Convolutispora vermiformis* HUGHES and PLAYFORD – KAISER, p. 95; pl. 18, figs. 14–16.

Description. Miospores trilete, acavate. Diameter 67–74 μ (3 specimens). Amb circular to broadly rounded triangular. Suturae simple, straight, 0.6–0.7 radius of spore. Exine ornamented with a reticulum formed by rounded muri, 5–8 μ in width, up to 5 μ high, sinuous. Lumina irregular to polygonal. The width of lumina is equal to the width of the surrounding muri or (commonly) larger. Exine 2–7 μ thick (incl. sculpture).

Stratigraphical range. Tournaisian to Viséan. Namurian?

Geographical distribution.

Europe: England (HIBBERT and LACEY 1969, LLEWELLYN, BACKHOUSE and HOSKIN 1969, MORTIMER, CHALONER and LLEWELLYN 1970, JOHNSON and MARSHALL 1971).

Arctic region: Spitsbergen (HUGHES and PLAYFORD 1961, PLAYFORD 1962), Bear Island (KAISER 1970).

North America: U.S.A. (FELIX and BURBRIDGE 1967), Canada (PLAYFORD 1963b).

***Convolutispora cf. vermiformis* HUGHES and PLAYFORD 1961**

Pl. XI, fig. 4.

Remarks. In addition to the spores which are identified with *C. vermiformis* some smaller specimens (34–41 μ) have been noticed. Their sculpture resembles

that of *C. vermiformis*, but it is too coarse in relation to their size. They are also too small to be referred to *C. vermiformis*, the lower size limit of which is about 40 μ . *C. florida* HOFFMEISTER, STAPLIN and MALLOY 1955 (p. 384; pl. 38, figs. 5–6) has a more complex, not so coarse type of ornament, but the size (39–50 μ) is comparable.

***Convolutispora* sp. (SI 227 SM)**

Pl. X, fig. 7; Pl. XI, fig. 1.

Description. Miospores trilete, acavate. Diameter 86–95 μ (6 specimens). Amb circular to subcircular. Suturae simple, straight, covered by ornament, 0.6–0.8 radius of spore. Exine ornamented with muri 3–8 μ in width, 3–4 μ in height, rounded, partly anastomosing, sinuous. Lumina irregular, narrow, furcate, not exceeding the surrounding muri in width. Exine 7–11 μ thick (incl. sculpture).

Remarks. *C. mellita* HOFFMEISTER, STAPLIN and MALLOY 1955 (p. 384; pl. 38, fig. 10) differs from *C. sp.* (SI 227 SM) by its smaller size (60–85 μ) and finer sculpture. *C. usitata* PLAYFORD 1962 (p. 595; pl. 82, figs. 4, 7, 8) has a more dense, fine sculpture, but a comparable size (84–112 μ).

***Convolutispora* sp. (SI 222 SM)**

Pl. X, figs. 3–5.

Description. Miospores trilete, acavate. Diameter 64–82 μ (8 specimens). Amb circular to convexly triangular with broadly rounded apices. Suturae simple, straight, commonly not covered by ornament, 0.5–0.8 radius of spore. Exine ornamented with muri 2–8 μ (commonly 3–5 μ) in width, 2–3 μ in height, forming a reticulum with narrow meshes. Minor transverse grooves or wrinkles are seen on the flanks of the muri (cf. pl. X, figs. 3, 5). Lumina narrow, rounded, proximally elongated, seldom more than 2 μ wide. Suturae are situated in a Y-formed system of united, narrow lumina and may be partly covered by the ornament. Towards the distal pole the lumina decrease in diameter on most specimens. Exine 4–8 μ thick (incl. sculpture). The thickness increases gradually towards the distal pole.

Remarks. Specimens possibly conform with *C. mellita* HOFFMEISTER, STAPLIN and MALLOY 1955, but an identification based on the original description and illustration is not possible. *C. cf. usitata* PLAYFORD described by SMITH and BUTTERWORTH (1967, p. 188; pl. 9, figs. 7–8) is also comparable. The characteristic reduction of lumina towards the distal pole observed on the above described specimens is not mentioned in the descriptions of the two species in question.

Genus *Dictyotriletes* (NAUMOVA) SMITH and BUTTERWORTH 1967
Dictyotriletes cancellatus (WALTZ) POTONIÉ and KREMP 1955
 Pl. XV, fig. 1.

- 1938 *Azonotriletes cancellatus* WALTZ in LUBER and WALTZ, p. 13; pl. 1, fig. 8; pl. 5, fig. 73.
 1955 *Dictyotriletes (Azonotriletes) cancellatus* (WALTZ) POTONIÉ and KREMP, p. 108.
 1956 *Dictyotriletes cancellatus* (WALTZ) ISCHENKO, p. 45; pl. 7, figs. 88–89.
 1957 *Reticulatisporites varioreticulatus* HACQUEBARD and BARSS, p. 17; pl. 2, figs. 15–16.
 1958 *Dictyotriletes cancellatus* (WALTZ) ISCHENKO – ISCHENKO, p. 55; pl. 5, fig. 63.
 1961 *Corbulispora (Azonotriletes) cancellatus* (WALTZ) BHARADWAJ and VENKATACHALA, p. 24.
 1962 *Reticulatisporites cancellatus* (WALTZ) PLAYFORD, p. 597; pl. 82, figs. 11–13; pl. 83, fig. 1–2.
 1963 *Dictyotriletes cancellatus* (WALTZ) ISCHENKO – KEDO, p. 54; pl. 4, fig. 93.
 1967 *Reticulatisporites cancellatus* (WALTZ) PLAYFORD – JACHOWICZ, p. 30; pl. 16, fig. 6; pl. 17, fig. 1.
 1969 *Dictyotriletes cancellatus* (WALTZ) POTONIÉ and KREMP – HIBBERT and LACEY, p. 427; pl. 79, fig. 11.

Description. Miospores trilete, acavate. Diameter 62–146 μ (11 specimens). Amb circular to polygonal. Suturae labrate, straight to slightly sinuous, 0.6–0.9 radius of spore. Labra developed as flat thickenings with slightly lobate borderlines. Width of labra (single labrum) 4–7 μ . Exine ornamented with a coarse-meshed reticulum with more or less polygonal meshes. Muri rounded, parallel-sided, smooth, 2–6 μ wide, 3–8 μ high, but uniform within the single specimen. Width of lumina exceeds the width of muri several times. Exine otherwise laevigate, 2–3 μ thick measured in the centers of the lumina.

Remarks. *D. cancellatus* is presumedly conspecific with *D. subalveolaris* (LUBER) POTONIÉ and KREMP 1955, cf. the discussions in BUTTERWORTH and SPINNER (1967) and DOLBY and NEVES (1970).

Stratigraphical range. Up. Devonian to Viséan.

Geographical distribution (incl. *D. subalveolaris*).

Europe: Scotland (LOVE 1960, CLAYTON 1971), England (SULLIVAN 1964a and b, BUTTERWORTH and SPINNER 1967, NEVES and DOLBY 1967, HIBBERT and LACEY 1969, DOLBY and NEVES 1970, UTTING and NEVES 1970, JOHNSON and MARSHALL 1971), Eire (DOLBY 1970), Belgium-Germany (STREEL 1970), Poland (JACHOWICZ 1967).

U.S.S.R.: LUBER and WALTZ 1938, ISCHENKO 1956, 1958; KEDO 1963.

Arctic region: Spitsbergen (PLAYFORD 1962).

North America: Canada (HACQUEBARD and BARSS 1957, BARSS 1967).

Dictyotriletes cheveriensis (PLAYFORD 1963) **comb. nov.**

Pl. XIV, figs. 1–3.

- 1963b *Reticulatisporites cheveriensis* PLAYFORD, p. 30; pl. 9, figs. 1–3.

Description. Miospores trilete, acavate. Diameter 66–78 μ (4 specimens). Amb circular to oval. Suturae simple, straight, often obscured by ornament, more than half of the spore radius in length. Exine bears imperfect reticulate sculpture. Muri thin, membraneous, 4–6 μ high. Lumina irregular and angular, commonly about 10–15 μ wide. Exine 1.5–2.5 μ thick, laevigate.

Remarks. Specimens are small compared with the size range quoted by PLAYFORD (1963b) as 69–(103)–130 μ . The occurrence of larger specimens in the original samples is confirmed by fragments in the slides studied. *Reticulatisporites* type B of LOVE (1960, p. 117; pl. 1, fig. 11 and text-fig. 7) has a much coarser sculpture than *D. cheveriensis*. It is identical with *Dictyotriletes pactilis* SULLIVAN and MARSHALL 1966 and is not comparable with *D. cheveriensis* as suggested by PLAYFORD.

Stratigraphical range. Tournaisian.

Geographical distribution. Hitherto only recorded from Canada.

***Dictyotriletes membranireticulatus* n. sp.**

Pl. XIII, figs. 1–4.

Holotype. Pl. XIII, figs. 1–2; SI 284 SM. Diameter 55 μ .

Type locality. Ørslev No. 1 borehole, D.G.U. file No. 238.502.

Type stratum. Marlstone, black-grey. Borehole depth 7743'0'', Lower Viséan.

Derivation of name. Of *membrana* (lat.) = a thin skin and *reticulum* (lat.) = dim. of *rete*, a net.

Diagnosis. A *Dictyotriletes* species characterized by a fine, rather imperfect reticulum formed by 1–2 μ high, membraneous muri. Lumina about 2–3 μ wide. Diameter 50–67 μ . Amb convexly triangular with rounded apices. Suturae simple, straight, almost equal to spore radius. Exine 2–4 μ thick.

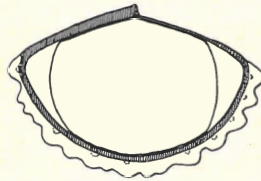
Description. Miospores trilete, acavate. Diameter 50–67 μ , mean 56 μ (10 specimens). Amb convexly triangular with rounded apices. Suturae simple, straight, distinct, almost equal to spore radius. Exine ornamented with a rather imperfect reticulum. Muri 1–2 μ high, basally 1 μ wide, with membraneous edges. Mural junctions may be slightly thickened. Lumina about 2–3 μ wide, polygonal to irregularly angular. Exine 2–4 μ thick, rarely folded.

Discussion and comparison. This species is included in *Dictyotriletes* despite the small size of lumina and the irregular, imperfect reticulation. In *Microreticulatisporites* (KNOX) POTONIÉ and KREMP 1954 the lumina generally are subordinated to muri in width and are rounded. *Dictyotriletes cheveriensis* (PLAYFORD 1963) comb. nov. has basically the same type of ornament, but differs from *D. membranireticulatus* by a more perfect and better developed reticulation and a different shape and size. Spore type 4 of LOVE (1960, p. 124; pl. 2, fig. 13 and text-fig. 15) has the same sculpture, but the size is larger and the suturae shorter than observed in *D. membranireticulatus*.

Dictyotriletes cf. submarginatus PLAYFORD 1963

Pl. XIII, figs. 5-9; text-fig. 8.

Description. Miospores trilete, camerate. Diameter 55-74 μ , mean 61 μ (15 specimens). Amb convexly triangular with rounded apices. Suturæ labrate, straight to sinuous, equal to radius of spore. Labra raised, 1-2 μ in width, 2-6 μ high (commonly 3 μ). Curvaturæ concentric with the equator commonly marked by a fine line. Contact areas may be depressed (pl. XIII, fig. 7). Radius of contact areas about two thirds radius of spore. Proximal surface laevigate to scabrate. Distal surface ornamented with partly anastomosing muri forming an imperfect reticulum or with rugulae. Muri 2-5 μ wide, 2-4 μ high, sinuous and rounded. Lumina irregular to polygonal, commonly $\frac{1}{2}$ -2 times the width of muri in diameter. Exoexine (excl. sculpture) 2 μ thick outside contact areas. Exoexine of contact areas thin (less than 2 μ). The difference in thickness of the exoexine gives rise to the observation of a darker equatorial ring on many specimens, when studied in transmitted light. Another characteristic feature of this species is the occurrence of basal mural narrowings, observable along the equator of the spore cavity as outwards directed tongue-shaped "cavities" (cf. pl. XIII, fig. 5 and text-fig. 8). Intexine thin, commonly detached in the equatorial region, not always visible.

Text-fig. 8. Diagrammatic section of *Dictyotriletes cf. submarginatus* PLAYFORD 1963. $\times 500$.

Remarks. Specimens closely agree with *D. submarginatus* PLAYFORD 1963 in general appearance, although they are slightly more coarsely ornamented than most of the specimens figured. They apparently differ from the type material in being camerate. The basal mural narrowings are not confined to the equatorial region only and they are not comparable with the vacuoles of *Vallatisporites*. The stratigraphical range of *D. submarginatus* is Tournaisian to Viséan. (PLAYFORD 1963, VARMA 1969, KAISER 1970, HIBBERT and LACEY 1969, MORTIMER, CHALONER and LLEWELLYN 1970).

Dictyotriletes sp. (SI 224 SM)

Pl. XIV, fig. 4.

Description. Miospores trilete, acavate. Diameter 53-84 μ (4 specimens). Amb convexly triangular with rounded apices. Suturæ simple, straight, partly

covered by ornament, 0.4–0.8 radius of spore. Exine ornamented with a regular reticulum. Muri parallel-sided in profile, flat-topped, 2–5 μ in width, 2–3 μ high. Lumina rounded angular to narrowed irregular, equal to or less than the width of the surrounding muri in diameter. Exine 5–6 μ thick incl. sculpture.

Remarks. Several comparable spore types have been described and figured, e.g. *Convolutispora sculptilis* FELIX and BURBRIDGE 1967, *Dictyotriletes planus* (HUGHES and PLAYFORD 1961), “*Reticulatisporites*” type A of LOVE 1960. An identification to species has not been attempted.

Dictyotriletes sp. (SI 396 SM)

Pl. XV, figs. 2–3.

Description. Miospores trilete, acavate. Diameter (excl. sculpture) 47–58 μ (3 specimens). Amb convexly triangular with rounded apices. Suturæ simple, straight, distinct, 0.5–0.8 radius of spore. Exine distally ornamented with a perfect, polygonal reticulum. Muri 1.5–2 μ high, and wide, semicircular in transverse section. Lumina about 5–10 μ in diameter. Reticulation disintegrates on the proximal surface into minor, individual but closely spaced rugulae and grana partly covering the suturæ. Small grana (0.5 μ in diameter) are spread on surface among the major elements. Exine 2 μ ? thick.

Subturma Zonotriletes WALTZ 1935

Infraturma Cingulati (POTONIÉ and KLAUS) DETTMANN 1963

Genus *Stenozonotriletes* (NAUMOVA) POTONIÉ 1958

Stenozonotriletes sp. (SI 303 SM)

Pl. XVII, fig. 3.

Description. Miospores trilete, acavate. Diameter 38–57 (72?) μ (6 specimens). Amb convexly triangular with broadly rounded apices. Suturæ simple, sinuous, indistinct, extending to spore body margin. Cingulum 5–8 μ wide. Exine infragranular to infravermiculate.

Remarks. Specimens are possibly identical with spores described as *S. cf. stenozonalis* (WALTZ 1938) by HACQUEBARD (1957) and JACHOWICZ (1967).

Stenozonotriletes sp. (SI 306 SM)

Pl. XVII, figs. 1–2.

Description. Miospores trilete, acavate. Diameter 41–62 μ , mean 48 μ (20 specimens). Amb circular to broadly, convexly triangular with rounded apices. Suturæ simple, straight, often indistinct, extending to spore body margin. Cingulum 3–4 μ wide. Exine infragranular.

Remarks. This form shows affinity to *S. extensus* var. *major* NAUMOVA 1953, as described by HACQUEBARD (1957).

Stenozonotriletes spp.

Remarks. Some unidentified and undescribed small specimens referable to *Stenozonotriletes* have been observed in the samples. Many species of this genus are unprecisely defined and of limited stratigraphical importance and a description of all recorded types is therefore omitted. Pl. XVII, figs. 5–6 shows a specimen belonging to this category.

Genus *Murospora* (SOMERS) POTONIÉ 1966
Murospora sublobata (WALTZ) PLAYFORD 1962
 Pl. XVI, fig. 1.

- 1938 *Zonotriletes sublobatus* WALTZ in LUBER and WALTZ, p. 17; pl. 2, fig. 22.
 1957 *Triquirites tendoris* HACQUEBARD and BARSS, p. 18; pl. 2, figs. 18–19.
 1960 *Murospora laevigata* STAPLIN, p. 29; pl. 6, fig. 21.
 1962 *Murospora sublobata* (WALTZ) PLAYFORD, p. 613; pl. 86, figs. 17–19.
 1967 *Murospora sublobata* (WALTZ) PLAYFORD – JACHOWICZ, p. 42; pl. 22, fig. 9.

Description. Miospores trilete, acavate. Diameter 42 μ (2 specimens). Amb triangular with slightly convex to concave sides and rounded apices. Suturæ simple, straight, distinct, almost extending to spore body margin. Spore body concavely triangular. Diameter 25–28 μ . Cingulum 6–9 μ wide, apically increasing in width, with a few marginal incisions. Exine laevigate, thin.

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Europe: Poland (JACHOWICZ 1967).

U.S.S.R.: LUBER and WALTZ 1938.

Arctic region: Spitsbergen (PLAYFORD 1962), Bear Island? (KAISER 1970).

North America: Canada (HACQUEBARD and BARSS 1957, STAPLIN 1960).

***Murospora* sp. (SI 298 SM)**

Pl. XVI, figs. 4–5.

Description. Miospore trilete, cambrate. Diameter 40 μ . Amb triangular with straight to slightly convex sides and rounded apices. Suturæ finely labrate (membraneous labra), straight, distinct, almost extending to spore body margin. Spore body triangular, 27 μ in diameter. Cingulum of uniform width, 3–4 μ . A thin walled intexine is seen in the spore cavity. Exoexine laevigate, thin.

Remarks. This specimen is possibly referable to *M. conduplicata* (ANDREJEVA) PLAYFORD 1962 (p. 613, pl. 86, figs. 14–15).

Genus *Knoxisporites* (POTONIÉ and KREMP) NEVES 1961
Knoxisporites hederatus (ISCHENKO) PLAYFORD 1963
 Pl. XVIII, fig. 1.

- 1956 *Euryzonotriletes hederatus* ISCHENKO, p. 58; pl. 10, fig. 121.
 1958 *Euryzonotriletes hederatus* ISCHENKO – ISCHENKO, p. 62; pl. 6, fig. 77.
 1963a *Knoxisporites hederatus* (ISHCHENKO) PLAYFORD, p. 634; pl. 90, figs. 9–12.
 1964b *Knoxisporites hederatus* (ISHCHENKO) PLAYFORD – SULLIVAN, p. 1253; pl. 2, figs. 1–2.
 1967 *Knoxisporites hederatus* (ISCHENKO) PLAYFORD – JACHOWICZ, p. 51; pl. 29, figs. 1–2;
 pl. 30, fig. 4.
 1967 *Knoxisporites hederatus* (ISCHENKO) PLAYFORD – FELIX and BURBRIDGE, p. 394;
 pl. 60, figs. 4–5.

Description. Miospores trilete, acavate. Diameter 65–91 μ (12 specimens). Amb circular to subcircular. Suturæ simple, straight, distinct, extending almost to cingulum. Cingulum irregular, 6–13 μ wide. Distal surface ornamented with (commonly three) broad, flat muri, interradially connected with cingulum, mutually united in an irregular pattern. Muri 2–12 μ wide, commonly 7–8 μ . Proximal surface sculptureless. Exine laevigate to finely infrapunctate, sometimes finely pitted by corrosion.

Remarks. In some cases this species is difficult to distinguish from *K. pristinus* SULLIVAN, described below. To the criteria of separation mentioned at page 52, may be added that *K. hederatus* is seldom deformed due to a stronger and thicker exine.

Stratigraphical range. Devonian to Namurian.

Geographical distribution.

Europe: England (SULLIVAN 1964b, BUTTERWORTH and SPINNER 1967, DOLBY and NEVES 1970, JOHNSON and MARSHALL 1971), Poland (JACHOWICZ 1967).

U.S.S.R.: ISCHENKO 1956, 1958.

Arctic region: Spitsbergen (PLAYFORD 1963a).

North America: U.S.A. (FELIX and BURBRIDGE 1967), Canada (BARSS 1967).

Knoxisporites pristinus SULLIVAN 1968
 Pl. XVIII, figs. 3–6.

- 1968 *Knoxisporites pristinus* SULLIVAN, p. 123; pl. 27, figs. 1–5.
 1969 *Knoxisporites pristinus* SULLIVAN – HIBBERT and LACEY, p. 428; pl. 81, figs. 5, 6, 9.

Description. Miospores trilete, acavate. Diameter 62–81 μ , mean 70 μ (11 specimens). Amb irregular, polygonally rounded. Suturæ simple or with finely raised, membraneous labra, straight, distinct, extending almost to cingulum. Cingulum 4–7 μ (polar view), uniform. Distal surface ornamented with more

or less distinct muri, interradially connected with cingulum, commonly connected with a thickened distal ring or irregularly fused. Proximal surface sculptureless. The finely granular structure of the exine is seen in pl. XVIII, fig. 5 (scanning micrograph).

Remarks. *K. rotatus* HOFFMEISTER, STAPLIN and MALLOY 1955 (p. 390; pl. 37, fig. 13) differs from *K. pristinus* in having a more regular, circular amb and proximal thickenings connecting the termini of suturae with the cingulum. *K. hederatus* (ISCHENKO 1956) and *K. pristinus* can not always be distinguished from each other on the basis of ornamentation, as they form the same type of irregular distal mural pattern. Specimens identified with *K. pristinus* are all characterized by a granular exine structure. But it must be emphasized, that the structure of the exine is not described by either SULLIVAN (1968) or HIBBERT and LACEY (1969).

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968), England (HIBBERT and LACEY 1969, LLEWELLYN, BACKHOUSE and HOSKIN 1969, JOHNSON and MARSHALL 1971).

Knoxisporites spp.

Remarks. In addition to the two above described species of *Knoxisporites*, some rare forms referable to this genus were recorded. One specimen, pl. XVI, fig. 2, is identified with *K. literatus* (WALTZ) PLAYFORD 1962; the others, pl. XVIII, fig. 2, pl. XIX, figs. 1–2, are unidentified. *K. literatus* has frequently been recorded from Lower Carboniferous deposits.

Genus *Reticulatisporites* (IBRAHIM) NEVES 1964

***Reticulatisporites copiosus* n. sp.**

Pl. XIX, fig. 6; pl. XX, figs. 2, 3, 5.

Holotype. Pl. XX, fig. 2; SI 334 SM. Diameter 130 μ .

Type locality. Ørslev No. 1 borehole, D.G.U. file No. 238.502.

Type stratum. Marlstone black-grey. Borehole depth 7739'4–9". Lower Viséan.

Derivation of name. Of *copia* (lat.) = plenty.

Diagnosis. A *Reticulatisporites* species characterized by a wide (20–25 μ), peripherally thickened cingulum and a distal ornament, partly reticulate, of coarse (6–10 μ wide, 15–25 μ high), rounded muri connected with the cingulum. Diameter 96–154 μ . Amb rounded polygonal. Border with incisions. Suturae labrate, extending to cingulum. Labra rounded, elevated muri, totally 15–20 μ wide. Spore body convexly triangular with rounded apices, 0.6–0.7 diameter of spore. Exine 1 μ thick finely infrapunctate.

Description. Miospores trilete, acavate. Diameter 96–154 μ , mean 135 μ (70 specimens). Amb rounded polygonal. Border with incisions. Suturae labrate, straight to slightly sinuous, distinct, extending to cingulum. Labra developed as a double row, 15–20 μ wide, of muri, semi-circular in transverse section and separated from each other (cf. pl. XX, fig. 3). Cingulum 20–25 μ wide, overlaps slightly onto the spore body, with a peripheral zone of thickening, sometimes incised. A variable number of muri, connected with the thickened zone of the cingulum, form a distal, irregular ornament pattern which is partly reticulate. Muri rounded, parallel-sided in transverse section, 6–10 μ wide, 15–25 μ high. Proximal surface without ornamentation (except labra) or with a few rounded tubercula. Spore body convexly triangular with rounded apices, conform with outline of spore. Diameter of spore body 70–(88)–113 μ = 0.6–0.7 diameter of spore. Exine 1 μ thick, finely infrapunctate.

Discussion and comparison. This species is included in the genus *Reticulatisporites* (IBRAHIM) NEVES 1964 as the cingulum is differentiated in accordance to the emended diagnosis of NEVES (1964). The cingulum of *Cincturasporites* HACQUEBARD and BARSS 1957 is simple and cuneiform in transverse section (cf. H. & B. 1957, p. 21, fig. 2), as it is in *Knoxisporites* (POTONIÉ and KREMP) NEVES 1961, the latter having only minor overlap of the cingulum onto the spore body.

R. copiosus closely resembles *R. intestinalis* (HIBBERT and LACEY 1969, p. 429; pl. 81, figs. 11–13; pl. 82, figs. 1–3) comb. nov. *R. intestinalis* has a narrower cingulum and ornamented proximal surface, but has the same size range as *R. copiosus*. *Cincturasporites magnus* FELIX and BURBRIDGE 1967 (p. 399; pl. 61, fig. 4) also has the same size range, but has a simple cingulum which is even narrower. For comparison the size ranges and the widths of cingula of the three species are given below:

<i>C. magnus</i> FELIX and BURBRIDGE 1967	d. 90–125 μ	cing. 8–12 μ
<i>R. intestinalis</i> (HIBBERT and LACEY 1969)	d. 92–143 μ	cing. 10–19 μ
<i>R. copiosus</i> n. sp.	d. 96–154 μ	cing. 20–25 μ

Genus *Anulatisporites* (LOOSE) POTONIÉ and KREMP 1954

***Anulatisporites?* sp. (SI 375 SM)**

Pl. XIX, fig. 3.

Description. Miospores trilete, acavate. Diameter 97–118 μ (4 specimens). Amb circular to convexly triangular with broadly rounded apices. Suturae simple, straight, distinct, 0.6 radius of spore body. Cingulum uniform in width on a single specimen, 13–25 μ wide and differentiated in thickness in an equatorial darker zone and a thinner (and lighter) peripheral zone. Cingulum slightly overlaps the spore body. Spore body diameter 66–71 μ . Proximal surface and cingulum without ornament. Distal surface shows different shadow-

like pattern, which can be interpreted as original thickenings (muri) or secondary phenomena of compression. Exine (spore body wall) 2–3 μ thick, infrapunctate.

Remarks. If specimens originally were unsculptured, they are closely comparable with *Anulatisporites orbiculatus* (WALTZ) PLAYFORD 1963 (p. 619; pl. 88, fig. 1), a species recorded from the Lower Carboniferous of the U.S.S.R. and Spitsbergen. As this question is unanswered, they are tentatively referred to *Anulatisporites* only, since this genus does not include ornamented forms.

Genus *Lycospora* SCHOPF, WILSON and BENTALL 1944

Lycospora pusilla (IBRAHIM) SOMERS in press

Pl. XXI, figs. 1, 3, 5.

1932 *Sporonites pusillus* IBRAHIM in POTONIÉ, IBRAHIM and LOOSE, p. 448; pl. 15, fig. 20.

A comprehensive list of synonyms is given by SOMERS.

Remarks. Specimens are frequently destroyed by corrosion and secondary growth of pyrite crystals. They conform closely with the diagnosis of SOMERS.

Stratigraphical range. Up. Tournaisian or L. Viséan to Stéphanian (? Autunian) (SOMERS in press).

Geographical distribution. According to SOMERS this species has a nearly world-wide geographical distribution. It has not been recorded from the Asiatic part of the Soviet Union.

Lycospora? rugulosa BUTTERWORTH and SPINNER 1967

Pl. XXI, fig. 2.

? 1960 *Cyclogranisporites tripapillatus* STAPLIN, p. 9; pl. 1, fig. 29.

1967 *Lycospora rugulosa* BUTTERWORTH and SPINNER, p. 10; pl. 2, figs. 1–2.

1970 *Lycospora rugulosa* BUTTERWORTH and SPINNER – MARSHALL and WILLIAMS, pl. 1, fig. 22.

1970 *Cyclogranisporites tripapillatus* STAPLIN – NEVES and WILLIAMS, pl. 11, figs. 3–4.

Description. Miospores trilete, acavate. Diameter 26–41 μ , mean 35 μ (48 specimens). Amb convexly triangular with rounded apices. Suturae simple or with very finely developed labra, straight, distinct, extending to spore body margin. Cingulum 2–3 μ wide with crenulate margin, undifferentiated in thickness (tapering). Distal surface bears rugulate ornament, proximal surface unsculptured except for three apical papillae, semiglobular, 2 μ in diameter. Exine thin, infrapunctate, rarely folded.

Remarks. The mean size of the Danish specimens is higher than the mean size quoted by BUTTERWORTH (20–(29)–38 μ for 60 specimens), otherwise they are identical with the type material. The cingulum is not differentiated in an inner thickened zone and an outer thinner zone (zona) as it is in the genus

Lycospora and therefore the species is only tentatively referred to this genus.

Stratigraphical range. Viséan.

Geographical distribution. Hitherto only? recorded from the Northumbrian Province of Great Britain (BUTTERWORTH and SPINNER 1967, MARSHALL and WILLIAMS 1970, NEVES and WILLIAMS 1970). The closely related, if not identical form *C. tripapillatus* STAPLIN 1960 was recorded from the Upper Mississippian Golata Formation of Canada.

Genus *Cristatisporites* POTONIÉ and KREMP 1954

***Cristatisporites echinatus* PLAYFORD 1963**

Pl. IX, figs. 5, 8.

1963a *Cristatisporites echinatus* PLAYFORD, p. 637; pl. 91, figs. 1–4; text-fig. 10 f.

1963 *Cristatisporites echinatus* PLAYFORD – DETTMANN and PLAYFORD, p. 680; pl. 96, figs. 3–5.

1963b *Cristatisporites echinatus* PLAYFORD – PLAYFORD, p. 36; pl. 10, fig. 10.

Description. Miospores trilete, camerate. Diameter 67–76 μ (3 specimen). Amb convexly triangular, apices slightly pointed. Suturae labrate, extending almost to the equator. Labra raised, 5 μ high and 2 μ wide. Proximal surface laevigate. Distal surface evenly ornamented with rounded coni, 1–2 μ high and 1–2 μ in diameter, rather closely spaced, the distance apart being 0–3 μ . Cingulum (width non-measurable) distally ornamented. The proximal surface of cingulum shows radiating furrows corresponding to the intervals or incisions between the coni or the groups of fused coni along the equator (pl. IX, fig. 8). Exoexine infrapunctate. Intexine thin and folded.

Remarks. The ornament of the above described specimens corresponds to that of the specimen pl. 91, fig. 4 (PLAYFORD 1963a).

Stratigraphical range. Devonian? to Tournaisian.

Geographical distribution.

Europe: England (UTTING and NEVES 1970), France (COMBAZ and STREEL 1970), Belgium-Germany (PAPROTH and STREEL 1970).

Arctic region: Spitsbergen (PLAYFORD 1963a).

North America: Canada (PLAYFORD 1963b).

Infraturma Patinati BUTTERWORTH and WILLIAMS 1958

Genus *Tholisporites* BUTTERWORTH and WILLIAMS 1958

***Tholisporites decorus* BHARADWAJ and VENKATACHALA 1961**

Pl. XXI, figs. 4, 6.

1961 *Tholisporites decorus* BHARADWAJ and VENKATACHALA, p. 39; pl. 10, figs. 142–146.

Description. Miospores trilete, camerate. Diameter 36–54 μ , mean 45 μ (28 specimens). Amb circular to convexly triangular with broadly rounded apices.

Suturæ simple, frequently split open, extending to the border of the intexine. Exoexine distally thickened, distinctly infrapunctate to minutely infravermiculate. Intexine very thin, more or less conforming with the equator, attached to exoexine in the polar regions.

Remarks. The patinate nature of specimens is indistinct.

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Europe: Scotland (GUEINN, pers. communication).

Arctic region: Spitsbergen (BHARADWAJ and VENKATACHALA 1961).

***Tholisporites* sp. (SI 388 SM)**

Pl. XX, figs. 1, 4.

Description. Miospores trilete, camerate. Diameter 53–80 μ , mean 69 μ (18 specimens). Amb irregularly subcircular to triangular with rounded apices. Suturæ simple or with fine, raised labra, straight to sinuous, extending to the margin of the spore cavity. Exoexine strongly infrapunctate, distally and equatorially slightly thickened. Intexine thin, structureless, attached to exoexine in the proximal and equatorial region. Distally it may be independently folded. Spore cavity diameter more than two thirds diameter of spore.

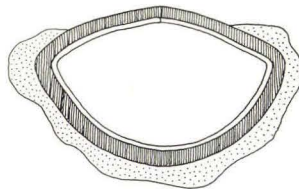
Remarks. As in the former *Tholisporites* species it is not distinctly patinate.

***Tholisporites* sp. (SI 345 SM)**

Pl. XIX, figs. 4–5; text-fig. 9.

Description. Miospores trilete, acavate. Diameter 70–79 μ (2 specimens). Amb convexly triangular with broadly rounded apices. Suturæ simple, straight, distinct, 0.6 radius of spore. Exine distinctly stratified. Intexine 1.5 μ thick. Exoexine 3.5 μ thick (unthickened part). Exoexine except over contact areas distinctally thickened. Patina up to 6 μ thick along the equator, thinner distally, irregular in thickness. Contact areas irregularly defined, with indistinct low rugulate ornament.

Remarks. This species differs from *T. scoticus* BUTTERWORTH and WILLIAMS 1958 (p. 382; pl. 3, figs. 48–50) by its larger size and more well-defined exine stratification.



Text-fig. 9: Diagrammatic section of *Tholisporites* sp. (SI 345 SM), $\times 500$.

Infraturma Zonati POTONIÉ and KREMP 1954
 Genus *Auroraspora* HOFFMEISTER, STAPLIN and MALLOY 1955
Auroraspora macra SULLIVAN 1968
 Pl. XXIII, figs. 5–6.

1968 *Auroraspora macra* SULLIVAN, p. 124; pl. 27, figs. 6–10.

1971 *Auroraspora macra* SULLIVAN – CLAYTON, p. 580; pl. 1, fig. 3.

Description. Miospores trilete, monopseudosaccate. Diameter 50–70 μ , mean 63 μ (8 specimens). Amb circular to subcircular. Diameter of spore body (intexine) 34–51 μ , mean 41 μ . Outline of spore body circular to convexly triangular with broadly rounded apices. Suturæ simple, straight distinct, 0.6–0.8 radius of spore body. Exoexine membraneous, finely infrapunctate and pitted, with dark, shadowed areas along the peripheri (partial collapse?) and radiating minor folds. Intexine 1.5–2 μ thick, laevigate to scabrate. Exoexine and intexine in proximal contact only.

Stratigraphical range. Tournaisian.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968, CLAYTON 1971), England (LLEWELLYN, BACKHOUSE and HOSKIN 1969, UTTING and NEVES 1970, JOHNSON and MARSHALL 1971).

Auroraspora cf. *solisortus* HOFFMEISTER, STAPLIN and MALLOY 1955
 Pl. XXIII, figs. 7–8.

Description. Miospores trilete, monopseudosaccate. Diameter 61–76 μ , mean 67 μ (10 specimens). Amb circular to subcircular. Diameter of spore body (intexine) 36–42 μ , mean 38 μ . Outline of spore body circular to convexly triangular with broadly rounded apices. Suturæ simple or with fine, raised labra, straight, distinct, 0.6–0.8 radius of spore body. Exoexine membraneous, infrapunctate and non-coloured. Minor radiating folds are common. Intexine 1.5–2 μ thick, laevigate to scabrate. Exoexine and intexine in proximal contact only.

Remarks. This form is possibly identical with *A. solisortus*. However, the exoexine is described as being finely granular in the original description and in a later description by FELIX and BURBRIDGE (1967, p. 411), in contradiction to the infrapunctate structure seen in the Danish material. *A. solisortus* has a stratigraphical range from Tournaisian to Namurian. It has been recorded previously from U.S.A. and Great Britain.

The above described specimens resemble the spores identified with *A. macra*, but their thinner and colourless exoexine contrasts with the brown-shadowed one of the latter species.

Genus *Aculeisporas* ARTÜZ 1967***Aculeisporas* sp. (SI 261 SM)**

Pl. XXIII, figs. 1–2.

Description. Miospores trilete, monopseudosaccate. Diameter 49–62 μ (5 specimens). Amb subcircular to oval. Diameter of spore body (intexine) 35–40 μ . Outline of spore body convexly triangular with rounded apices. Suturæ labrate, straight, distinct, 0.7–0.8 radius of spore body. Labra a few μ high, membranous. Exoexine membranous, infrapunctate, frequently folded. Unevenly spread grana and rounded conia, 1–2 μ high make up a poor ornament. Intexine laevigate, 1.5–2.5 μ thick. Exoexine and intexine in proximal contact only.

Remarks. The limited, conate sculpture of specimens is characteristic of *Aculeisporas*. The exoexine of *A. macra* is laevigate, but corroded specimens of this species closely resemble *A. sp.* (SI 261 SM).

***Aculeisporas* sp. (SI 259 SM)**

Pl. XXIII, figs. 3–4.

Description. Miospores trilete, monopseudosaccate. Diameter 58–67 μ (5 specimens). Amb circular to oval. Spore body (intexine) diameter 37–46 μ . Outline of spore body circular to oval. Suturæ labrate, straight to slightly sinuous, distinct, 0.5–0.8 radius of spore body. Labra raised, 1 μ wide, 1–2 μ high. Exoexine membranous, infrapunctate and ornamented with densely spaced bacula, 0.5–1 μ in diameter, 2–3 μ high, straight to crooked, terminally rounded or truncated. Distance apart of bacula frequently 0–2 μ . Ornament reduced or absent on the proximal surface. Intexine laevigate, 1 μ ? thick, only proximally attached to the exoexine.

Remarks. The above described specimens are referred to the genus *Aculeisporas* on the basis of the baculate ornament. *Rhabdosporites* RICHARDSON 1960 has a baculate ornament, but the bacula are very small in proportion to the size of spore (micro-bacula).

Genus *Grandispora* HOFFMEISTER, STAPLIN and MALLOY 1955***Grandispora echinata* HACQUEBARD 1957**

Pl. XXII, figs. 1–2.

- 1957 *Grandispora echinata* HACQUEBARD, p. 317; pl. 3, fig. 17.
 1963b *Grandispora echinata* HACQUEBARD – PLAYFORD, p. 22; pl. 5, fig. 2.
 1966 *Grandispora echinata* HACQUEBARD – SULLIVAN and MARSHALL, p. 280; pl. 4, figs. 1–3.
 1966 *Grandispora echinata* HACQUEBARD – NEVES and OWENS, p. 350; pl. 3, fig. 6.
 1968 *Grandispora echinata* HACQUEBARD – SULLIVAN, p. 126; pl. 27, figs. 11–13.
 1968 *Grandispora echinata* HACQUEBARD – NEVILLE, p. 447; pl. 2, fig. 8.
 1969 *Grandispora echinata* HACQUEBARD – VARMA, p. 311; pl. 2, fig. 18.
 ? 1970 *Grandispora echinata* HACQUEBARD – KAISER, p. 111; pl. 24, figs. 1–2.

Description. Miospores trilete, monopseudosaccate. Diameter 41–73 μ , mean 58 μ (27 specimens). Amb convexly triangular with rounded apices. Suturæ labrate, straight to sinuous, distinct, extending almost to the equator. Labra raised, narrow, sinuous and tapering in height towards the apices. Max. height 4–6 μ , width 1–2 μ . Exoexine ornamented with spinae and conii, 1–2 μ high and 1–1.5 μ in diameter, the distance apart of which is (commonly) 2–3 μ . Ornament mainly confined to distal surface. Exoexine less than 1 μ thick, infrapunctate. Commonly it forms a “pseudo-limbus”. Intexine conforms with outline of spore, is less than 1 μ thick. Diameter of intexine about four fifths diameter of spore. Specimens frequently occur in tetrads.

Remarks. The variation of ornament described by SULLIVAN (1968) is also observed in the Danish material. The spores described from Canada generally seem to be larger than those recorded from Great Britain and Denmark. For comparison the following list is compiled:

Canada.

HACQUEBARD 1957:	diam. 62–93 μ (12 specimens)
PLAYFORD 1963b:	59–(73)–96 μ (32 specimens)
VARMA 1969:	64–91 μ (15 specimens)

Europe.

SULLIVAN and MARSHALL 1966:	50–(64)–77 μ (13 specimens)
SULLIVAN 1968:	52–(62)–70(80) μ (42 specimens)
Present study:	41–(58)–73 μ (27 specimens)

Sizes are not quoted by NEVES and OWENS (1966) and NEVILLE (1968). The record of KAISER (1970) is debatable.

Stratigraphical range. Tournaisian to Namurian.

Geographical distribution.

Europe: Scotland (SULLIVAN and MARSHALL 1966, SULLIVAN 1968, NEVILLE 1968), England (NEVES and OWENS 1966, LLEWELLYN, BACKHOUSE and HOSKIN 1969, MARSHALL and WILLIAMS 1970, UTTING and NEVES 1970, JOHNSON and MARSHALL 1971), Eire (DOLBY 1970), Belgium-Germany (STREEL 1970).

North America: Canada (HACQUEBARD 1957, PLAYFORD 1963b, VARMA 1969).

Genus *Spelaeotriletes* NEVES and OWENS 1966

Spelaeotriletes cf. *pretiosus* (PLAYFORD) NEVES and BELT 1970

Pl. XXII, fig. 5.

1971 *Spelaeotriletes* cf. *pretiosus* (PLAYFORD) NEVES and BELT – CLAYTON, p. 590; pl. 3, figs. 7–8.

Description. Miospores trilete, monopseudosaccate. Diameter 80–95 μ (5 specimens). Amb convexly triangular with rounded apices. Suturae labrate, straight to sinuous, extending almost to the equator. Labra raised, narrow, sinuous and sometimes terminally split, 1–2 μ in width. Exoexine about 2 μ thick, irregularly infragranular, ornamented with grana and rounded to pointed conical, 0.5–2 μ high, 1–3 μ in diameter. Ornamentation not very dense, proximally reduced. Intexine very thin, conforms with outline of spore. Diameter of intexine one half to two thirds diameter of spore. Spores folded and corroded.

Remarks. Specimens poorly preserved. The size range observed agrees with that quoted by CLAYTON (1971) for *S. cf. pretiosus* (59–(75)–101 μ). The original size range of *S. pretiosus* is 98–(149)–195 μ (PLAYFORD 1963b). The known stratigraphical range of *S. pretiosus* is restricted to the Tournaisian.

Gen. et sp. indet. (SI 295 SM)

Pl. XXII, fig. 3.

Description. Miospore trilete, monopseudosaccate. Diameter 62 μ . Amb convexly triangular with rounded apices. Suturae labrate, slightly sinuous, distinct, extending to the equator. Labra raised, narrow, sinuous and tapering in height towards the equator. Max. height 5 μ . Exoexine evenly and densely verrucate. Verrucae very low, rounded in profile, with irregularly rounded bases, about 2 μ in diameter, delimiting a fine, negative reticulum. Intexine thin and indistinct, conforms with outline of spore. Diameter of intexine two thirds diameter of spore. Exoexine and intexine in proximal contact only. Based on the folding and colour (light yellow) the thickness of the exoexine is estimated to be less than 1 μ .

Genus *Discernisporites* (NEVES) NEVES and OWENS 1966

Discernisporites cf. micromanifestus (HAQUEBARD) NEVES and BELT 1970

Pl. XXII, fig. 6.

Description. Miospores trilete, cavate. Diameter 55–74 μ (7 specimens). Amb convexly triangular with rounded apices. Suturae labrate, straight, distinct, extending almost to the equator. Labra raised, narrow, up to 4 μ high. Exoexine distinctly infragranular, 1.5–2 μ thick, rarely folded. Intexine thin and indistinct, conforms with outline of spore, not folded. Exoexine and intexine attached proximally and distally.

Remarks. Specimens differ from most of the spores referred to this species by the relatively larger diameter of the intexine, being about four fifths the diameter of spore. *D. micromanifestus* has a stratigraphical range from Devonian to Namurian (JOHNSON and MARSHALL 1971).

Genus *Spinozonotriletes* (HACQUEBARD) NEVES and OWENS 1966

***Spinozonotriletes* sp. (SI 310 SM)**

Pl. XXII, fig. 4.

Description. Miospores trilete, cavate. Diameter 57–62 μ (3 specimens). Amb convexly triangular with broadly rounded apices. Suturae simple, straight, indistinct, 0.6–0.8 radius of spore. Distal surface ornamented with thorn-like spinae and a few rounded coni, both types with rounded bases, 2–3 μ in diameter. Spinae 3–4 μ high. About 20 spinae extend from the equator. Proximal surface unsculptured. Exoexine otherwise laevigate, thin (less than 1 μ ?). Intexine finely infrapunctate, conforms with the outline of spore. Diameter of intexine about four fifths diameter of spore. Exoexine and intexine attached proximally and distally.

Remarks. The damaged specimen (pl. XXII, fig. 4) shows that the exoexine separates from the intexine only in the equator region, which is why specimens are referred to *Spinozonotriletes* rather than to *Grandispora*, in accordance with the emended diagnosis of the former genus by NEVES and OWENS (1966). Specimens show sculptural affinity to *Grandispora spinosa* HOFFMEISTER, STAPLIN and MALLOY 1955, the originally described size of which is larger (100–143 μ).

Genus *Perotrilites* (ERDTMAN) COUPER 1953

***Perotrilites magnus* HUGHES and PLAYFORD 1961**

Pl. XV, fig. 6.

1961 *Perotrilites magnus* HUGHES and PLAYFORD, p. 33; pl. 2, figs. 5–6.

1962 *Perotrilites magnus* HUGHES and PLAYFORD – PLAYFORD, p. 602; pl. 85, fig. 8.

1963b *Perotrilites magnus* HUGHES and PLAYFORD – PLAYFORD, p. 32; pl. 9, fig. 5.

1969 *Perotrilites magnus* HUGHES and PLAYFORD – HIBBERT and LACEY, p. 433; pl. 83, fig. 7.

Description. Miospores trilete, camerate. Diameter (of intexine) 93–141 μ (4 specimens). Amb circular to oval. Suturae simple, straight, 0.6–0.7 radius of spore body. Exoexine thin, clear and structureless. It encloses the spore body in a distance from 4–10 μ . Intexine (spore body wall) laevigate, 1.5–2 μ thick, commonly folded.

Remarks. The membranous exoexine (“perine”) is frequently deformed by minor pyrite crystals. As the pyrite is removed in the preparation, the membrane sometimes has a secondary reticulate ornament formed by the impressions of crystals.

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution.

Europe: Scotland (SULLIVAN 1968, CLAYTON 1971), England (HIBBERT and LACEY 1969, JOHNSON and MARSHALL 1971).

Arctic region: Spitsbergen (HUGHES and PLAYFORD 1961, PLAYFORD 1962).

North America: Canada (PLAYFORD 1963b).

Perotrilites perinatus HUGHES and PLAYFORD 1961

Pl. XV, figs. 4–5.

- 1961 *Perotrilites perinatus* HUGHES and PLAYFORD, p. 33; pl. 2, figs. 7–10.
 1962 *Perotrilites perinatus* HUGHES and PLAYFORD – PLAYFORD, p. 602; pl. 85, figs. 6–7.
 1963b *Perotrilites perinatus* HUGHES and PLAYFORD – PLAYFORD, p. 33; pl. 10, fig. 5.
 1966 *Perotrilites perinatus* HUGHES and PLAYFORD – SULLIVAN and MARSHALL, p. 282; pl. 4, fig. 4.
 1967 *Perotrilites perinatus* HUGHES and PLAYFORD – BUTTERWORTH and SPINNER, p. 11; pl. 1, figs. 14, 17.
 1967 *Perotrilites perinatus* HUGHES and PLAYFORD – FELIX and BURBRIDGE, p. 379; pl. 57, figs. 14–15.
 1969 *Perotrilites perinatus* HUGHES and PLAYFORD – VARMA, p. 310; pl. 2, figs. 16, 21.
 1969 *Perotrilites perinatus* HUGHES and PLAYFORD – HIBBERT and LACEY, p. 433; pl. 83, fig. 6.
 1970 *Perotrilites perinatus* HUGHES and PLAYFORD – KAISER, p. 108; pl. 23, fig. 1.

Description. Miospores trilete, camerate. Diameter (of intexine) 46–66 μ (4 specimens). Amb convexly triangular with broadly rounded apices. Suturae simple, straight, distinct, 0.6–0.9 radius of spore. Exoexine membranous, clear, structureless, normally folded or wrinkled and partly destroyed. Distance between exoexine and intexine commonly less than 10 μ . Intexine (spore body wall) laevigate, 1.5–3 μ thick, rarely folded.

Stratigraphical range. Tournaisian to Namurian.

Geographical distribution.

Europe: Scotland (SULLIVAN and MARSHALL 1966, CLAYTON 1971), England (BUTTERWORTH and SPINNER 1967, HIBBERT and LACEY 1969, MARSHALL and WILLIAMS 1970, UTTING and NEVES 1970, JOHNSON and MARSHALL 1971).

Arctic region: Spitsbergen (HUGHES and PLAYFORD 1961, PLAYFORD 1962), Bear Island (KAISER 1970).

North America: U.S.A. (FELIX and BURBRIDGE 1967), Canada (PLAYFORD 1963b, BARSS 1967, VARMA 1969).

Genus *Rugospora* NEVES and OWENS 1966***Rugospora corporata*** NEVES and OWENS var. ***verrucosa*** NEVILLE 1968

Pl. XVI, figs. 3, 6, 7.

- 1966 *Velamisporites rugosus* BHARADWAJ and VENKATACHALA – SULLIVAN and MARSHALL, p. 282; pl. 4, figs. 7, 9, 11.
 1968 *Rugospora corporata* var. *verrucosa* NEVILLE, p. 450; pl. 3, figs. 2–3.
 ? 1971 *Rugospora* cf. *corporata* NEVES and OWENS var. *verrucosa* NEVILLE – CLAYTON, p. 587; pl. 3, fig. 2.

Description. Miospores trilete, camerate. Diameter 90–130 μ (7 specimens). Amb subcircular to oval, irregular. Spore body (intexine) diameter 80–111 μ .

Outline of spore body circular to oval. Suturae simple, straight, not always visible, 0.5–0.7 radius of spore body. Exoexine wrinkled and folded, scabrate, granular or micro-verrucate, thin. Intexine laevigate, 1–1.5 μ thick, commonly with few major folds.

Stratigraphical range. Tournaisian to Viséan.

Geographical distribution. Hitherto only described from Great Britain.

Rugospora minuta NEVES and IOANNIDES in press

Pl. XII, figs. 1–4.

? 1967 ? *Secarisporites* spp., BARSS, pl. 6, figs. 20, 21, 22, 26, 27.

Description. Miospores trilete, camerate. Diameter 32–52 μ , mean 44 μ (46 specimens). Amb circular to convexly triangular with broadly rounded apices or (commonly) oval. Suturae simple, straight to slightly sinuous, indistinct, 0.6–0.8 radius of spore. Exoexine densely folded in a “brain-like” pattern. Folds 1.5–3 μ wide, equatorially 3–8 μ high. A radial pattern is commonly seen in the equatorial region, where some of the folds may extend as lobes. Folds generally smooth, but scanning micrograph may show the presence of minor grana at their flanks or in the incisions between the folds. Intexine is seen as a darker circular to oval body. Thickness of exoexine and intexine less than 1 μ .

Stratigraphical range. Tournaisian to Viséan. (NEVES, pers. communication).

Geographical distribution. Known from Canada? (BARSS 1967) and Scotland (NEVES and IOANNIDES in press).

ALGAE INCERTAE SEDIS

Classis Hystrichophyta MÄDLER 1963

Ordo Tasmanales MÄDLER 1963

Familia Tasmanaceae SOMMER 1956

Genus *Tasmanites* NEWTON 1875

Tasmanites spp.

Remarks. Several specimens referable to this genus have been observed. Some of them are identified with *T. sommeri* WINSLOW 1962 (p. 84) and *T. huronensis* (DAWSON) WINSLOW 1962 (p. 81). The figured specimen (pl. XXIV, fig. 1) may possibly be identified with *T. sinuosus* WINSLOW 1962 (p. 83).

Ordo Leiosphaeridiales (EISENACK) MÄDLER 1963

Familia Leiosphaeridiaceae (EISENACK) MÄDLER 1963

Genus *Leiosphaeridia*? EISENACK 1958

Remarks. Some globoid bodies (pl. XXIV, fig. 5) are tentatively referred to this genus, although they are rather thick walled. They have no visible pore channels and a pylome has not been observed.

DANSK SAMMENDRAG

EN NEDRE KARBON MIKROFLORA FRA BORINGEN ØRSLEV NR. 1, FALSTER, DANMARK

INDLEDNING

Lag af karbon alder blev for første gang med sikkerhed påvist i Danmark med boringen Ørslev nr. 1 (D.G.U. arkiv nr. 238.502). Boringens beliggenhed er vist på tekstfig. 1. Boringen, der blev udført af Dansk Undergrunds Konsortium (D.U.C.), nåede slutdybden 2573 m i januar 1968.

Under en serie evaporiter af øvre perm (zechstein) alder gennemboredes 229 m rødlige skifre, siltsten og sandsten, der kan henføres til øvre karbon eller nedre perm (rotliegendes). Herunder fulgte, fra dybden 2051 m til bunden af boringen (2573 m), vekslende lag af grå og sorte lersten og skifre, mergelsten og kalksten, gennemgående med en rig benthonisk fauna af brachiopoder, koraller, crinoider, foraminiferer og ostracoder.

Sidstnævnte lagserie er behandlet i to nyligt publicerede arbejder af CHRISTENSEN (1971) og MICHELSEN (1971). CHRISTENSEN giver en lithologisk beskrivelse af de to kærneborede afsnit (2088–2103 m, kerne nr. 1 og 2343–2361 m, kerne nr. 2), samt en oversigt over fossilindholdet i kærnerne. Ved sammenligning med den karbone lagserie på Rügen, D.D.R., henfører han afsnittet over basis af kerne nr. 2 til viséen, medens den nederste del af lagserien muligvis bør henføres til tournaisien.

MICHELSEN giver en sammenfattende beskrivelse af hele det nedre karbone profil. Gennem en detaljeret analyse af foraminiferfaunaen og sammenligning af denne med det nedre karbone typeområde i Belgien, er han i stand til at korrelere Ørslev lagserien med nedre viséen (V₁) og muligvis tillige (den øverste del af afsnittet) med mellem viséen (V₂).

Resultaterne af miospore analyser fra forskellige niveauer af karbonafsnittet behandles i dette arbejde. Som supplement bringes kortfattede beskrivelser af andre mikrofossiler af organisk materiale, scolecodonter, hystricosphaerider og alger? af *Tasmanites* type, da disses tilstedeværelse kan vise sig at være et værdifuldt bidrag til forståelsen af sedimentationsmiljøet.

Alle dybder er angivet i engelske fod (ukorrigerede prøvedybder) og meter (korrigerede dybder efter Schlumberger logs) under Kelly Bushing (KB).

MATERIALE OG METODER

Tekstfig. 2 viser prøveniveauerne markeret på et lithologisk profil udarbejdet af MICHELSEN (1971). Flertallet af prøverne er udtaget i kærne nr. 2, men ikke alle er anvendt, da det ved tællinger i bund, midte og top af kærnen blev klart, at sporeselskabet ikke ændrede sig nævneværdigt gennem denne. Endvidere er prøver fra intervallet mellem de to kærner blevet analyseret. Lokaliseringen i profilet af de undersøgte isolerede cuttings fra disse (skylle)prøver er baseret på Schlumberger logs. Prøver udtaget af kærne nr. 1 var golde med hensyn til sporer. Prøver fra afsnittet under kærne nr. 2 er ikke undersøgt, da cuttings i dette interval ikke kan lokaliseres med den fornødne præcision.

Da prøvematerialet var ret ensartet i lithologisk sammensætning (grå skifre, lersten og mergelsten) er den samme procedure fulgt ved hver tilberedning. Ca. 5 g prøve knuses mellem to lag plastfolie med en hammer og fraktionen under 1 mm overføres til et polyætylen bægerglas. Derpå opløses mesteparten af de forskellige uorganiske bestanddele i følgende bade: 20% HCl i 24 timer, 40% HF, kogning i 1 time, 3 gange konc. HCl, kogende, under omrystning, Schulzes opløsning (konc. HNO₃ + KClO₃) i 3–5 min., 1% NH₄Cl, idet der mellem hvert bad foretages en udvaskning i dest. vand (centrifugering). Efter en afsluttende vask på en rustfri stålsigte (maskevidde 14 µ) overføres sporekoncentratet via alkohol og benzol til opbevaring i silicone olie. Af hver centrifugerest er tilberedt mindst 3 flerkornspræparater. Dertil kommer adskillige hundrede enkeltkornspræparater.

En del sporer er undersøgt i scanning elektron mikroskop. Ved monteringen isoleres sporen fra en dråbe af centrifugeresten, der er smurt ud på et objektglas, med en fin »eethårspensel«. Efter vask i benzol i et urglas, kan sporen monteres på specimen-holder'en. Som klæbemiddel anvendtes »næsefedt« eller Araldit emulgeret i alkohol og påført knappen som en fin dughinde.

STRATIGRAFISK UNDERSØGELSE

Mikrofloraens sammensætning.

Resultatet af tællingerne fremgår af tekstfig. 3. Selskabet i kærne nr. 2 er domineret af *Tholisporites decorus* BHARADWAJ & VENKATACHALA og *Rugospora minuta* NEVES & IOANNIDES *in press* associerede med *Schopfites claviger* SULLIVAN, *Anaplanisporites baccatus* (HOFFMEISTER, STAPLIN & MALLOY) SMITH & BUTTERWORTH og *Apiculiretusispora multiseta* (LUBER) BUTTERWORTH & SPINNER, der er almindelige i alle prøver. De øvrige former er gennemgående sjældne. Bemærkelsesværdigt er forekomsten af *Lycospora pusilla* (IBRAHIM) SOMERS *in press* også i den nederste kærneprøve, da denne art spiller en afgørende rolle i den stratigrafiske analyse. De artsmæssigt rigeste og mest velbevarede selskaber er fundet nederst i kærnen.

Selskabet fra skylleprøven 7270'–80' er karakteriseret ved en voldsom dominans af *Lycospora? rugulosa* BUTTERWORTH & SPINNER, associeret med de førnævnte 5 arter.

I prøverne lige under kerne nr. 1, 6980'–90' og 6950'–60', genfindes selskaber, der omend artsfattige, i sammensætning minder stærkt om selskabet i kerne nr. 2, hvorfor forfatteren i den stratigrafiske analyse har valgt at behandle hele mikrofloraen som et sporeselskab, idet introductionen af *L. ? rugulosa* i skylleprøverne er det eneste kriterium for en opsplætning af mikrofloraen i to zoner. Den »afvigende« prøve, 7270'–80', indeholder ingen scolecodonter, men rigelige mængder af cuticula-stumper, hvorfor denne prøve antagelig repræsenterer en autochton, stærkt lokalpræget mikroflora, aflejret i et limnisk miljø.

De øvrige prøver indeholder scolecodonter og mikroalger, hvilket tyder på en sedimentation i littoralzonen, eftersom scolecodonterne tolkes som maxillae af polychæte orme, Errantida, der nutildags er karakteristiske i denne zone. Makrofossilerne, der hyppigt ses sammenskyllede i tynde lag, forekomsten af enkelte velbevarede plantefossiler (CHRISTENSEN 1971) og den benthoniske foraminiferfauna (MICHELSEN 1971) peger i samme retning. Sporeselskaber, der afsættes i dette milieu, vil derfor tilnærmelsesvist repræsentere gennemsnitsfloraen fra et større vegetationsområde, idet der foregår en vis opblanding under transporten og sedimenteringen. Fra et stratigrafisk synspunkt er et sådant sporeselskab langt mere værdifuldt end det lokale, stærkt facielt prægede selskab. Af samme grund er prøve 7270'–80' ikke behandlet særskilt i den stratigrafiske analyse.

Hovedparten af de former, der er henført til beskrevne arter, har vist sig at have en stratigrafisk udbredelse begrænset til nedre karbon. Til brug for en mere præcis korrelation er sporeselskabet blevet sammenlignet med mikrofloraerne fra naboregionerne indenfor det nordeuropæiske sedimentationsområde.

Tidligere studier af nedre karbone mikrofloraer i Nordvesteuropa.

Tekstfig. 4 viser de lokalitetsområder i Nordvesteuropa, hvorfra nedre karbone miosporeselskaber er blevet beskrevet.

Miosporeselskaber fra devon/karbon overgangslagene er blevet detaljeret beskrevet fra Sydirlend af DOLBY (1970), fra det sydvestlige England af SULLIVAN (1964b), NEVES & DOLBY (1967), DOLBY (1970), DOLBY & NEVES (1970) og UTTING & NEVES (1970), fra det nordvestlige Frankrig af COMBAZ & STREEL (1970) og fra det Ardennisk-Rhinske bassin af STREEL (1966, 1968, 1969, 1970) og PAPROTH & STREEL (1970). De beskrevne selskaber er alle ældre end mellem tournaisien (Tn₂) incl.

I de nævnte områder, som inkluderer typeområderne for de nedre karbone kronostratigrafiske enheder avonian, tournaisien og viséen og typelokaliteten for basis af karbon systemet (Hönnethal), overlejreres de sporeførende overgangslag

af mægtige kalkstensserier. Derved udelukkes muligheden for at etablere en palynologisk zonerings af de yngre nedre karbone lagserier i disse områder. Kun én mikroflora af viséen alder er hidtil blevet publiceret fra området der indbefattes af de ovennævnte arbejder (SULLIVAN 1964a).

Heraf følger at kronostratigrafiske dateringer af yngre nedre karbone mikrofloraer fra andre områder, specielt disse fra non-marine aflejringer, ofte vil være en følge af en eller flere indirekte korrelationer, hvis værdi i mange tilfælde må betvivles.

Mægtige nedre karbone lagserier, ikke udviklede i Kohlenkalk facies (Carboniferous Limestone f.), er aflejrede i de northumbriske og skotske provinser (bassiner) i Storbritannien (jf. GEORGE 1969). Brakvandsaflejringer, deltaaflejringer og søaflejringer er hovedkomponenterne i disse bassiner. Marine horisonter er sparsomme, undtagen i de øverste aflejringer i begge bassiner og i den basale del af lagserien i den sydvestlige del af den northumbriske provins. I disse bassiner har etableringen af en koral-brachiopodzonerings derfor vist sig vanskelig. På den anden side har man i denne region haft muligheden for at følge udviklingen og forandringerne af miosporeselskaberne gennem store dele af nedre karbon.

Miosporeselskaber er beskrevet fra adskillige lokaliteter i den skotske Midland Valley (LOVE 1960, SULLIVAN & MARSHALL 1966, SULLIVAN 1968, NEVILLE 1968, CLAYTON 1971 og NEVES & IOANNIDES *in press*), hvoraf sidstnævnte forfatteres profil fra Spilmersford boringen, East Lothian, er det mest fuldkomne der hidtil er bearbejdet. Beskrivelser af mikrofloraer fra den northumbriske provins er givet af BUTTERWORTH & SPINNER (1967), SMITH & BUTTERWORTH (1967), NEVES & WILLIAMS (1970) og MARSHALL & WILLIAMS (1971). Sammenlignet med den skotske provins er mikrofloraerne fra dette område mindre velkendte.

Miosporer er beskrevet fra den britiske centralprovins af HIBBERT & LACEY (1969), LLEWELLYN, BACKHOUSE & HOSKIN (1969), MORTIMER, CHALONER & LLEWELLYN (1970) og JOHNSON & MARSHALL (1971). Selskabet beskrevet af HIBBERT & LACEY er af viséen alder (S_2 eller D_1), medens de øvrige antages at være af tournaisien alder.

Fra det nordeuropæiske fastland er der kun publiceret få palynologiske beskrivelser af nedre karbone aflejringer, hvis man ser bort fra det Ardennisk-Rhinske bassin. DOUBINGER & RAUSCHER (1966) har beskrevet en mikroflora af øvre viséen alder, fra Vogeserne i Østfrankrig. Lagserien var tidligere dateret på basis af brachiopoder.

KALIBOVA (1971) har beskrevet en nedre karbon mikroflora fra boringen Tb-1 i Bøhmen, Tjekkoslaviet, medens en omfattende beskrivelse af mikrofloraerne fra Zaręby lagserien i Swieto Krzyz bjergene (Hellig Kors bjergene), Sydøstpolen er givet af JACHOWICZ (1967 og 1970). Disse lag blev oprindeligt dateret til tournaisien af ZAKOWA (1962). Øvre viséen selskaber er også publiceret af JACHOWICZ (1970) o.a. fra forskellige egne af det sydlige Polen. De nedre

karbone mikrofloraer fra Rügen er, ifølge KNÜPFER & WEYER (1967) under bearbejdelse.

Det turde fremgå af den foranstående diskussion, at ækvivalenter til Ørslev miosporeselskabet, der indirekte ved hjælp af foraminiferer kan dateres til at have en nedre viséen alder, muligvis er tilstede i den skotske provins, da dette område sandsynligvis er det eneste i Nordvesteuropa, hvor sammensætningen og udviklingen af mikrofloraen kan følges kontinuerligt gennem den største del af nedre karbon. En direkte korrelation til Belgien er udelukket, siden det i dette område kun er muligt at følge udviklingen af mikrofloraen gennem den ældste del af nedre karbon, på grund af tilstedeværelsen af en kalkstens-facies i de yngre lagserier. De yngste bevarede selskaber findes i Belgien således i Tn₂ underetagen.

Korrelation med Skotland og det nordlige England.

Ørslev selskabet er direkte sammenligneligt med selskaberne i *Lycospora pusilla* (Pu) zonen beskrevet fra Spilmersford boringen i East Lothian, Skotland af NEVES & IOANNIDES *in press*. Zonen adskilles fra den underliggende *Schopfites claviger-Auroraspora macra* (CM) zone ved den første forekomst af *L. pusilla* (IBRAHIM) SOMERS *in press*, en art der er tilstede i Ørslev selskabet, omend i ringe mængde. Zonen er karakteriseret ved tilstedeværelsen af *L. pusilla* associeret med adskillige arter der også er fundet i Ørslev selskabet: *Verrucosiporites nitidus* (NAUMOVA) PLAYFORD, *Schopfites claviger* SULLIVAN, *Baculatisporites fusticulus* SULLIVAN, *Raistrickia corynoges* SULLIVAN, *Knoxisporites literatus* (WALTZ) PLAYFORD og *Auroraspora macra* SULLIVAN.

Tholisporites decorus BHARADWAJ & VENKATACHALA, *Dictyotriletes cancellatus* (WALTZ) POTONIÉ & KREMP og *Anaplanisporites baccatus* (HOFFMEISTER, STAPLIN & MALLOY) SMITH & BUTTERWORTH, af hvilke den først- og sidstnævnte art er almindelige i Ørslev selskabet forekommer også i denne zone, samt i zonerne umiddelbart over og under i Spilmersford boringen.

Vallatisporites ciliaris (LUBER) SULLIVAN og *Knoxisporites stephanorus* LOVE er arter, der markerer overgangen til den overliggende *Perotrilites tessellatus-Schulzospora campyloptera* (TC) zone (NEVES, GUEINN, CLAYTON, IOANNIDES & NEVILLE *in press*). Ingen af disse former eller andre, der optræder for første gang i TC zonen er fundet i de undersøgte prøver. Forekomsten af *Lycospora? rugulosa* BUTTERWORTH & SPINNER i skylleprøverne fra den øvre del af det undersøgte interval, indikerer at selskaberne i disse prøver bør korreleres med den mellemste del af Pu zonen, siden den ældste forekomst af denne art synes at være i Cambeck Beds, Nordvestengland (BUTTERWORTH & SPINNER 1967), hvor den forekommer associeret med arter fra den øverste del af Pu zonen (*V. ciliaris*). Cambeck Beds (C₂ alder) er korreleret med nedre viséen (DAY 1970).

Da resultaterne af NEVES & IOANNIDES undersøgelser i Spilmersford boringen

endnu ikke er publicerede, er det ikke muligt at bringe en detaljeret sammenligning mellem selskaberne herfra og fra Ørslev. CLAYTON's selskab fra Cockburnspath området i Sydøstskotland synes at være noget ældre end selskabet i kerne nr. 2. Bortset fra mangelen af *Lycospora* spp., former der ifølge CLAYTON (1971, p. 597) forekommer kun 30 ft over den yngste prøve beskrevet fra Birnieknowes boringen, er selskaberne meget ens. CLAYTON's artsliste er gengivet i tekstfig. 5.

Selskaberne beskrevet af BUTTERWORTH & SPINNER (1967) (jf. tekstfig. 5) fra the Cambeck Beds (C₂) og de ældre Bewcastle Beds (C₁, jf. DAY 1970) fra Nordvestengland er korreleret med den øverste del af Pu zonen baseret på forekomsten af *V. ciliaris* (NEVES, GUEINN, CLAYTON, IOANNIDES & NEVILLE *in press*). Disse selskaber er ret artsfattige og kan bedst sammenlignes med selskabet i skylleprøven 7270'-80'. De har ikke den samme udtalte lighed med selskabet i kerne nr. 2, som selskabet fra Cockburnspath. De er imidlertid de eneste Pu zone selskaber der indtil nu er publicerede fra de to nordlige provinser.

Pu zonen antages at være mere eller mindre ækvivalent med koral-brachiopod zone C₁ (NEVES, GUEINN, CLAYTON, IOANNIDES and NEVILLE *in press*). Nye undersøgelser af foraminiferfaunaerne i sydvest provinsen (GEORGE 1969) af England har medført at the *Caninia* Oolite bør korreleres med nedre viséen i Belgien (V_{1a} eller muligvis V_{1b}) jf. CONIL & GEORGE (1971). Den øvre del af the Lower *Caninia* Zone (C₁) inkluderende the *Caninia* Oolite kan derfor jævnføres med nedre viséen i Belgien og ikke som tidligere antaget med øvre tournaisien. Aflejringer karakteriseret af Pu zone selskaber kan derfor indirekte korreleres med det belgiske øvre tournaisien-nedre viséen.

Korrelation med nedre karbone mikrofloraer udenfor Nordvesteuropa.

U.S.S.R.

En sammenligning er foretaget med sporeselskaberne beskrevet af KEDO (1963, 1966) fra Pripet sænken, et område nordvest for Kiev, Hvide Rusland. Ørslev selskabet kan antagelig bedst sammenlignes med selskaberne fra Bobrikov 2 »komplekset«.

Dette er karakteriseret ved den første optræden af *L. pusilla*. *Apiculiretusispora multiseta* (LUBER) BUTTERWORTH & SPINNER og *Acanthotriletes dominans* KEDO = ? *Acanthotriletes spinosus* (NAUMOVA) ISCHENKO, begge almindelige i Ørslev selskabet, er karakteristiske komponenter af både Bobrikov 1 og Bobrikov 2 selskaberne (jf. KEDO 1966, p. XII).

Skønt Pripet sænken må antages at have været beliggende på nogenlunde samme palæobredde som Ørslev og the Midland Valley (Scotland), har selskaberne herfra ikke megen lighed med selskaberne fra de sidstnævnte områder. Bobrikov horisonten er af PAPROTH (1969, p. 289, table VII) blevet jævnført med det belgiske viséen (V_{1b}) og med C₁d i Donetsk bassinet.

Sammenligningerne med Donetz bassinet er baseret på udbredelsestabellerne udarbejdet af ISCHENKO (1956). Kun få af arterne i Donetz selskaberne findes i Ørslev.

Convolutispora amplecta f. *kasachstanensis* (LUBER) JACHOWICZ, *Dictyotriletes cancellatus*, *Knoxisporites hederatus* (ISCHENKO) PLAYFORD og *Knoxisporites literatus* har en vertikal udbredelse omfattende C_1^t og $C_1^y a-e$. *Punctatisporites platirugosus* (WALTZ) SULLIVAN var. *minutus* WALTZ, *Punctatisporites glaber* (NAUMOVA) PLAYFORD, *A. spinosus* og *L. pusilla* forekommer ikke i lag ældre end $C_1^y a$. *Leiotriletes ornatus* ISCHENKO er begrænset til aflejringer yngre end $C_1^y f$. *Lophotriletes* aff. *grumosus* NAUMOVA = ? *Verrucosisporites nitidus* (NAUMOVA) PLAYFORD er ikke fundet i lag yngre end C_1^d .

På basis af disse arters udbredelse kan Ørslev selskabet korreleres med $C_1^y a-e$ intervallet i Donetz bassinet. Dette modsvarer omtrentligt nedre viséen i Belgien, da den overliggende subzone $C_1^y f_1$ med nogen sikkerhed kan korreleres med V_{2b} i Belgien og C_1^c kan korreleres med Tn_{2b-2c} (AISENVERG, BRAZHNIKOVA & VDOVENKO 1971). Intervallet mellem disse to horisonter er vanskeligt at korrelere med Belgien p. gr. af forskellig faciel udvikling i de to områder.

Adskillige af arterne anvendt i den ovenstående korrelation har vist sig at have en større vertikal udbredelse i Donetz bassinet end anført ovenfor (ISCHENKO 1958). Dette ændrer dog ikke den generelle korrelation.

Canada.

Et sporeselskab afbildet af BARSS (1967, pl. 5-6) har mange lighedspunkter med Ørslev selskabet. Bemærkelsesværdigt er de mange illustrationer af cavate eller »perinate« sporer. Former anført som *Secarisporites*? spp. er muligvis identiske med *Rugospora minuta* NEVES & IOANNIDES *in press*, en dominerende art i Ørslev selskabet.

Dette selskab stammer fra en horisont i den østcanadiske Windsor Group og dets alder anføres som viséen af BARSS. Det præcise niveau i gruppen er ukendt og den generelle korrelation mellem Windsor gruppen og den europæiske standard zoner er endnu uafklaret. PLAYFORD (1963b) nævner at den nederste del af Windsor gruppen, på basis af en marin fauna, må være af ældre viséen alder. NEVES & BELT (1970) mener at gruppen er af mellem til yngre viséen alder. Selskabet afbildet af BARSS er forskelligt fra selskaberne beskrevet fra den øverste del af the Windsor Group af NEVES & BELT, der er sammenlignelige med selskaber af yngre viséen alder i Skotland. Alderen af selskabet afbildet af BARSS er derfor muligvis ældre eller mellem viséen.

Sporeselskaber fra den underliggende Horton Group er beskrevet af HACQUEBARD (1957), PLAYFORD (1963b) og VARMA (1969). Mikrofloraen i den øverste formation i gruppen, Cheverie formationen, er sammenlignelig med *Schopfites claviger-Auroraspora macra* (CM) zonen i Skotland og flere af arterne fra Ørslev forekommer i disse lag. De ældre selskaber fra the Undifferentiated

Horton Group kan sammenlignes med selskaberne beskrevet fra the Lower Limestone Shales of Burrington Combe (DOLBY & NEVES 1970) og Forest of Dean (SULLIVAN 1964b), idet de har flere diagnostiske arter tilfælles.

De nedre karbone miosporeselskaber fra Nordvestcanada, beskrevet af HACQUEBARD & BARSS (1957) og PLAYFORD & BARSS (1963), blev af SULLIVAN (1965) henregnet til *Monilospora* »suiten«, repræsentativ for en nordlig flora-provins, sammen med selskaberne beskrevet fra Spitsbergen af HUGHES & PLAYFORD (1961), BHARADWAJ & VENKATACHALA (1961) og PLAYFORD (1962–1963a). En sammenligning med disse selskaber er ikke foretaget i dette arbejde.

Konklusioner.

Miosporeselskabet fra Ørslev boringen er sammenligneligt med selskaber beskrevet fra det østlige Canada (nedre del af the Windsor Group og den underliggende Cheverie Formation i the Horton Group), Skotland (Pu zonen i the Calciferous Sandstone Measures), det nordlige England (Bewcastle Beds og Cambeck Beds) og Sovjetunionen (Bobrikov 2 horisonten i Pripet sænken, Hvide Rusland, samt C₁ etagen i Donetz bassinet).

Der er størst overensstemmelse med selskaberne fra Skotland, Nordengland og Canada. Dette tolkes som en følge af en datidig mere samlet beliggenhed af områderne. Det synes samtidig at vise, at det sporeproducerende plantesamfund, der eksisterede langs sydranden af det tidligere »Old Red kontinent«, var ensartet over større afstande. Palæomagnetiske målinger og facies udviklingen (revdannelser etc.) viser at klimaet må have være tropisk. Det semi-aride miljø, der antages at have været forudsætningen for dannelsen af den såkaldte »Cementstone facies« i Canada og Skotland (BELT *et al.* 1967, NEVES & BELT 1970), har antagelig også eksisteret inden for det danske område.

Selskaberne, som er anført som sammenlignelige med selskabet fra Ørslev boringen, er alle indirekte blevet henført til øvre tournaisien eller nedre viséen, som defineret i Belgien. Ørslev selskabet lader sig derved indirekte korrelere med det belgiske typeområde på en måde, der understøtter MICHELSEN's konklusioner, idet han jævnførte det nedre karbone afsnit i boringen til nedre og mellem? viséen og CHRISTENSEN, der henførte afsnittet til tournaisien? og viséen.

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Geological Survey of Denmark
Thoravej 31
DK-2400 København NV
Denmark

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PLATES

PLATE I
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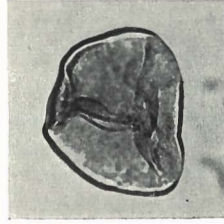
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Figs. 1-2. <i>Leiotriletes ornatus</i> ISCHENKO..... 7743'0'', SI 268 SM. Distal view. Fig. 1: low focus, fig. 2: high focus. Diameter: 46 μ.	1972-FB-1	24
Fig. 3. <i>Leiotriletes?</i> sp. (SI 291 SM)..... 7743'0'', SI 291 SM. Proximal view. Diameter: 41 μ.	1972-FB-2	25
Figs. 4-5. <i>Punctatisporites?</i> sp. (SI 289 SM)..... 7743'0'', SI 289 SM. Distal view. Fig. 4: low focus, fig. 5: high focus. Diameter: 62 μ.	1972-FB-3	28
Figs. 6-7. <i>Punctatisporites platirugosus</i> (WALTZ) SULLIVAN var. <i>minus</i> WALTZ..... 7743'0'', SI 281 SM. Distal view. Fig. 6: low focus, fig. 7: high focus. Diameter: 46 μ.	1972-FB-4	27
Fig. 8. <i>Punctatisporites glaber</i> (NAUMOVA) PLAYFORD..... 7739'4-9'', SI 279 SM. Proximal view. Diameter: 60 μ.	1972-FB-5	26
Fig. 9. <i>Leiotriletes</i> sp. (SI 412 SM)..... 7743'0'', SI 412 SM. Proximal view. Diameter: 75 μ.	1972-FB-6	25
Fig. 10. <i>Punctatisporites glaber</i> (NAUMOVA) PLAYFORD..... 7743'0'', SI 276 SM. Proximal view. Diameter: 66 μ.	1972-FB-7	26



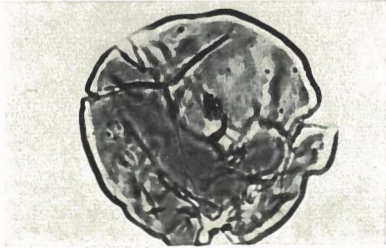
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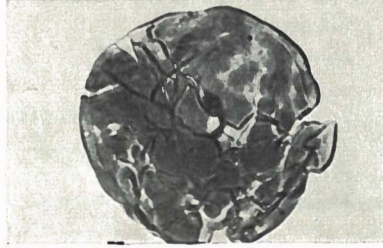
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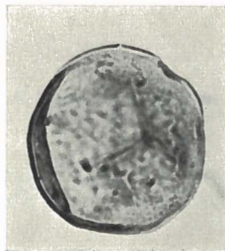
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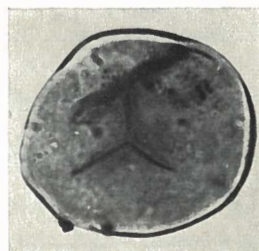
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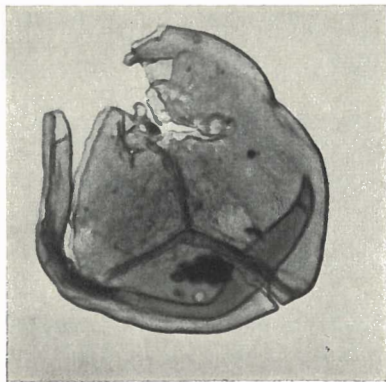
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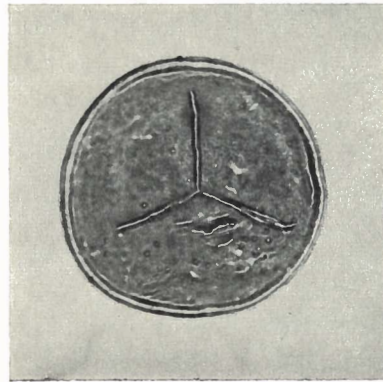
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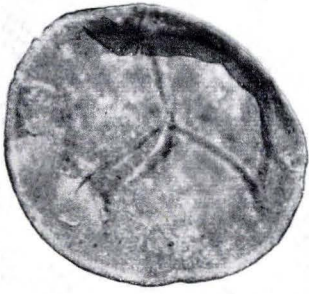


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PLATE II

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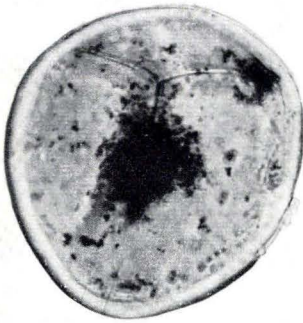
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Fig. 1. <i>Punctatisporites pseudolevatus</i> HOFFM., STAPL. and MALL. 7743'0'', SI 391 SM. Proximal view. Diameter: 77 μ .	1972-FB-8	27
Fig. 2. <i>Punctatisporites</i> cf. <i>limbatus</i> HACQUEBARD 7743'0'', SI 280 SM. Proximal view. Diameter: 78 μ .	1972-FB-9	26
Fig. 3. <i>Punctatisporites</i> sp. (SI 361 SM)..... 7739'4-9'', SI 361 SM. Proximal view. Diameter: 78 μ .	1972-FB-10	28
Fig. 4. <i>Punctatisporites</i> sp. (SI 361 SM)..... 7743'0'', SI 392 SM. Proximal view. Diameter: 76 μ .	1972-FB-11	28
Fig. 5. <i>Punctatisporites</i> aff. <i>aerarius</i> BUTTERWORTH and WILLIAMS 7739'4-9'', SI 360. Proximal-equatorial view. Diameter: 63 μ .	1972-FB-12	25
Fig. 6. <i>Convolutispora finis</i> LOVE..... 7739'4-9'', SI 368 SM. Proximal view. Diameter: 80 μ .	1972-FB-13	43



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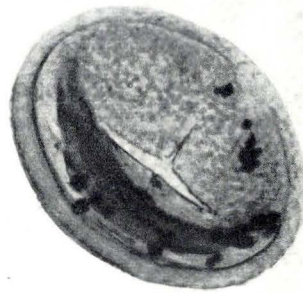
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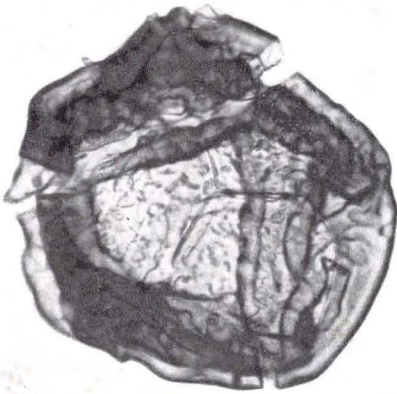


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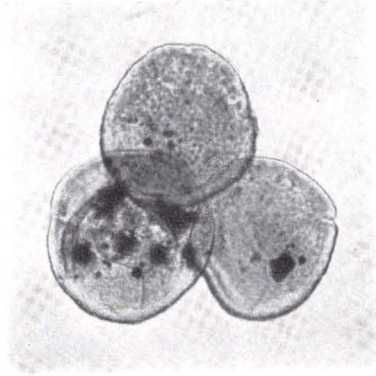
PLATE III

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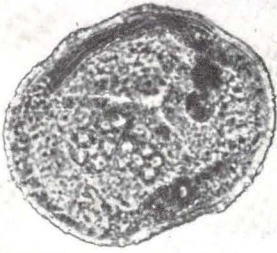
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Fig. 1. <i>Retusotriletes?</i> sp. (SI 353 SM)..... 7743'0'', SI 353 SM. Proximal view. Diameter: 95 μ.	1972-FB-14	28
Fig. 2. <i>Cyclogranisporites</i> cf. <i>commodus</i> PLAYFORD..... 7739'4-9'', SI 384 SM. Defective tetrad. Diameters: 40-42 μ.	1972-FB-15	29
Fig. 3. <i>Baculatisporites fusticulus</i> SULLIVAN..... 7743'0'', SI 416 SM. Proximal view. Diameter: 69 μ.	1972-FB-16	38
Fig. 4. <i>Baculatisporites fusticulus</i> SULLIVAN..... 7739'4-9'', SI 385 SM. Distal view. Diameter: 73 μ.	1972-FB-17	38
Figs. 5-6. <i>Granulatisporites</i> sp. (SI 415 SM)..... 7743'0'', SI 415 SM. Proximal view. Fig. 5: high focus, fig. 6: low focus. Diameter: 41 μ.	1972-FB-18	29
Figs. 7-8. <i>Cyclogranisporites</i> cf. <i>commodus</i> PLAYFORD..... 7719'5'', SI 009 PM: 6.5-121.3. Proximal view. Fig. 7: low focus, fig. 8: high focus. Diameter: 40 μ.	1972-FB-19	29
Fig. 9. <i>Verrucosisporites nitidus</i> (NAUMOVA) PLAYFORD..... 7743'0'', SI 257 SM. Equatorial view. Diameter: 43 μ.	1972-FB-20	30
Fig. 10. <i>Verrucosisporites nitidus</i> (NAUMOVA) PLAYFORD..... 7743'0'', SI 256 SM. Proximal-equatorial view. Diameter: 43 μ.	1972-FB-21	30



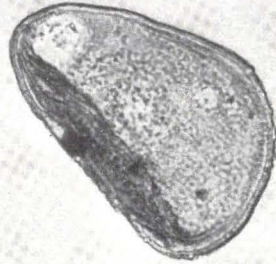
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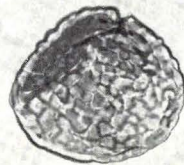
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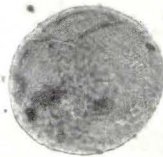
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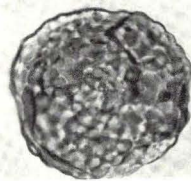
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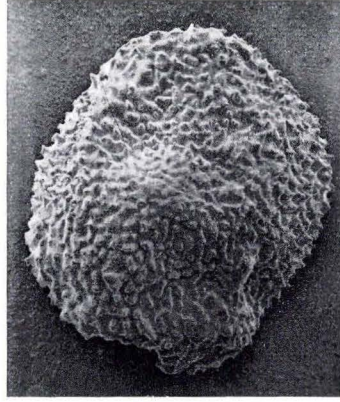
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PLATE IV
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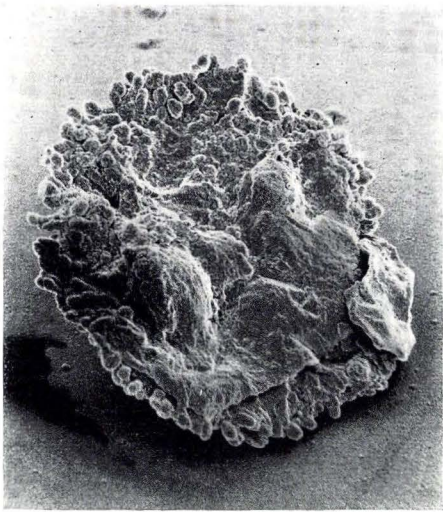
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Apiculatisporites</i> sp. (SI 238 SM) 7739'4-9'', SI 242 SM. Distal? view. Diameter: 108 μ.	1972-FB-22	36
Fig. 2. <i>Apiculatisporites</i> sp. (SI 238 SM) 7743'0'', SH-14-FB. Scanning micrograph, distal view. Diameter: Appr. 90 μ.	1972-FB-23	36
Fig. 3. <i>Verrucosisporites</i> sp. (SI 408 SM)..... 7743'0'', SI 408 SM. Distal view. Diameter: 62 μ. excl. sculpture.	1972-FB-24	31
Fig. 4. <i>Schopfites claviger</i> SULLIVAN..... 7743'0'', SH-5-FB, No. 15. Scanning micrograph, proximal view, × 1000. Diameter: 49 μ excl. sculpture.	1972-FB-25	31
Fig. 5. <i>Verrucosisporites scoticus</i> SULLIVAN..... 7739'4-9'', SI 216 SM. Distal view. Diameter: 46 μ, excl. sculpture.	1972-FB-26	30
Fig. 6. <i>Schopfites claviger</i> SULLIVAN..... 7743'0'', SI 267 SM. Distal view. Diameter: 47 μ, excl. sculpture.	1972-FB-27	31
Fig. 7. <i>Schopfites claviger</i> SULLIVAN..... 7743'0'', SI 266 SM. Equatorial view. Diameter: 44 μ, excl. sculpture.	1972-FB-28	31



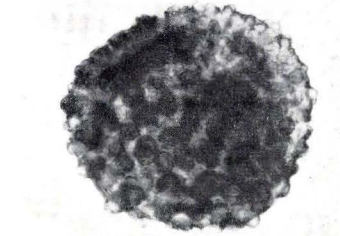
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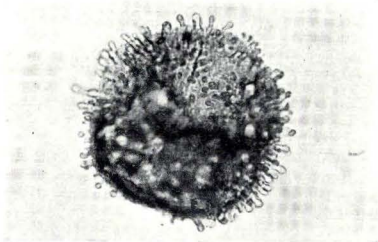
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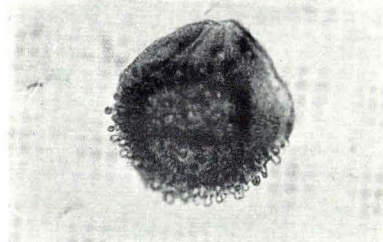
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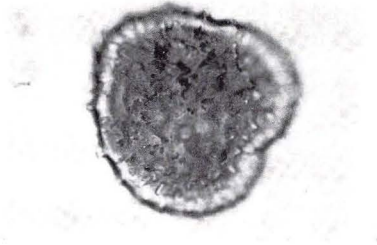
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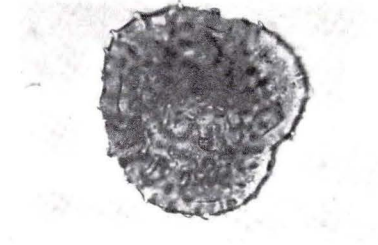
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PLATE V
 × 500 (fig. 6, × 5000)

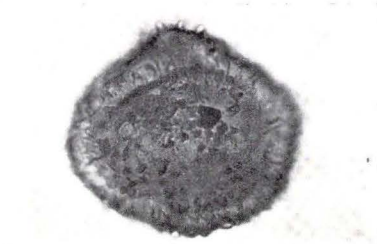
	D.G.U. Catalogue No.	Text page
<p>Figs. 1–2. <i>Lophotriletes linguaeformis</i> n. sp. 7739'4–9'', SI 250 SM. Holotype. Distal view. Fig. 1: high focus, fig. 2: low focus. Diameter: 51 μ, excl. sculpture.</p>	1972–FB–29	32
<p>Figs. 3–4. <i>Lophotriletes linguaeformis</i> n. sp. 7739'4–9'', SI 244 SM. Equatorial-proximal view. Fig. 3: high focus, fig. 4: low focus. Diameter: 58 μ, excl. sculpture.</p>	1972–FB–30	32
<p>Figs. 5–6. <i>Lophotriletes linguaeformis</i> n. sp. 7743'0'', SH–17–FB, No. 1. Scanning micrographs, proximal view. Fig. 5: × 500, fig. 6: × 5000. Diameter: 56 μ, excl. sculpture.</p>	1972–FB–31	32
<p>Fig. 7. <i>Anaplanisporites baccatus</i> (HOFFM., STAPL. and MALL.) SMITH and BUTTERWORTH. 7743'0'', SI 399 SM. Distal view. Diameter: 28 μ.</p>	1972–FB–32	33
<p>Fig. 8. <i>Anaplanisporites</i> sp. (SI 302 SM) 7743'0'', SI 302 SM. Proximal view. Diameter: 32 μ.</p>	1972–FB–33	34
<p>Fig. 9. <i>Lophotriletes tribulosus</i> SULLIVAN. 7743'0'', SI 405 SM. Proximal-equatorial view. Diameter: 34 μ, excl. sculpture.</p>	1972–FB–34	33
<p>Fig. 10. <i>Anaplanisporites?</i> cf. <i>globulus</i> (BUTTERWORTH and WIL- LIAMS) SMITH and BUTTERWORTH. 7743'0'', SI 404 SM. Distal view. Diameter: 28 μ.</p>	1972–FB–35	35



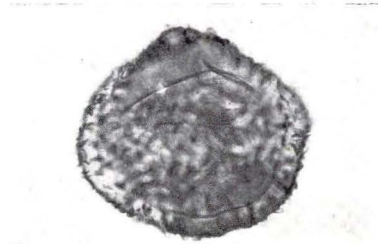
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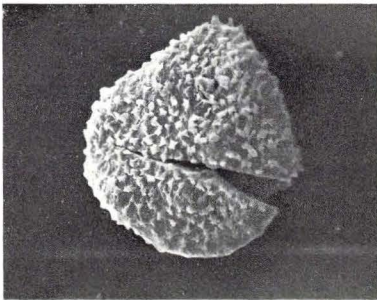
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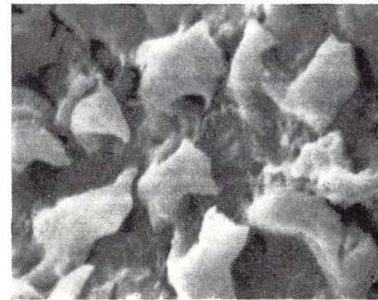
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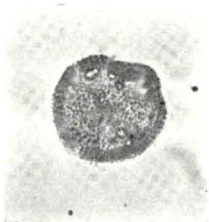
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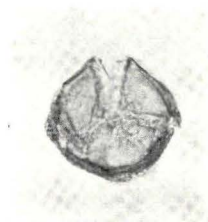
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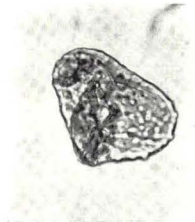
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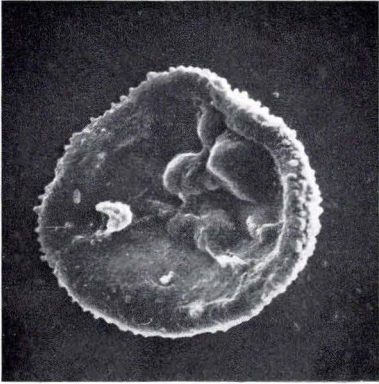


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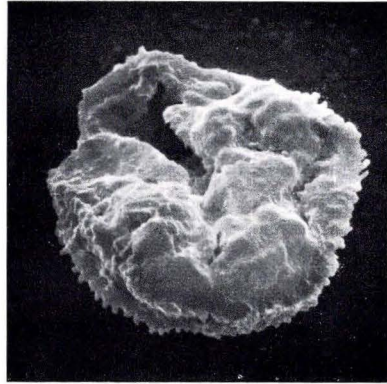
PLATE VI

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Anaplanisporites baccatus</i> (HOFFM., STAPL. and MALL.) SMITH and BUTTERWORTH.	1972-FB-36	33
7743'0'', SH-6-FB, c. Scanning micrograph, proximal view, $\times 1500$. Diameter: appr. 30 μ .		
Fig. 2. <i>Anaplanisporites baccatus</i> (HOFFM., STAPL. and MALL.) SMITH and BUTTERWORTH.	1972-FB-37	33
7743'0'', SH-6-FB, a. Scanning micrograph, equatorial-proximal view, $\times 1750$. Diameter: appr. 30 μ .		
Figs. 3-4. <i>Anaplanisporites baccatus</i> (HOFFM., STAPL. and MALL.) SMITH and BUTTERWORTH.	1972-FB-38	33
7743'0'', SH-6-FB, b. Fig. 3: Scanning micrograph, distal view, $\times 1400$. Fig. 4: Scanning micrograph, equatorial view, $\times 2600$. Diameter: appr. 30 μ .		
Figs. 5-6. <i>Anaplanisporites</i> sp. (SI 302 SM).....	1972-FB-39	34
7743'0'', SH-6-FB, d. Fig. 5: Scanning micrograph, equatorial view, $\times 1700$. Fig. 6: Scanning micrograph, dist. surface section, $\times 4300$. Diameter: appr. 30 μ .		

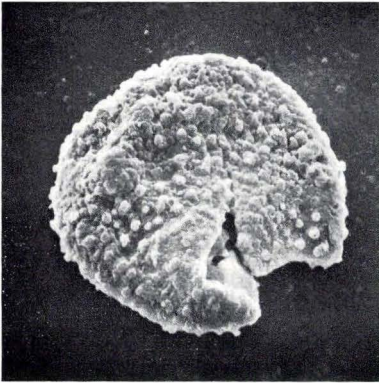
Phot. J. FUGLSANG.



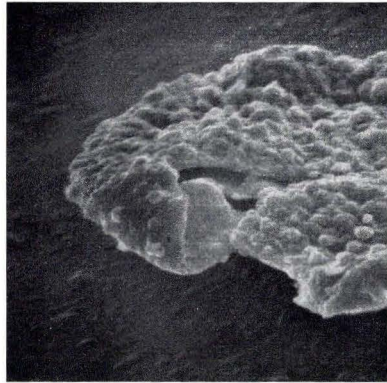
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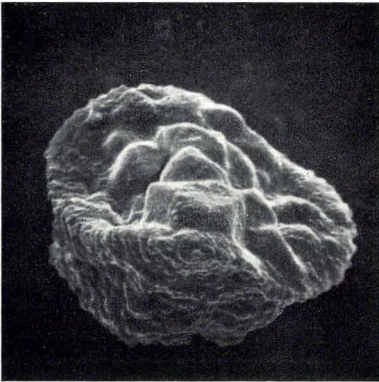
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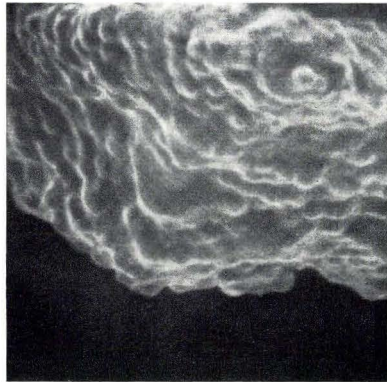
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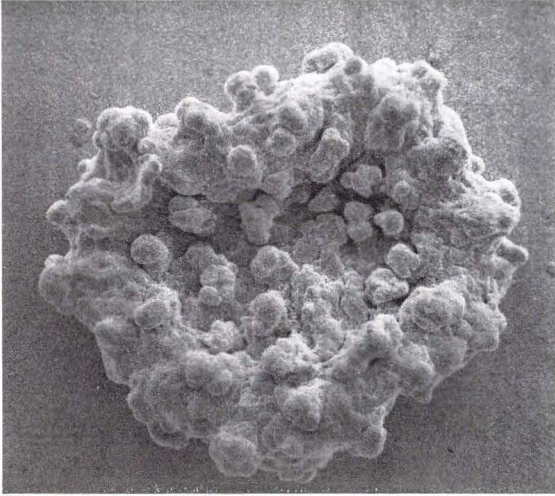


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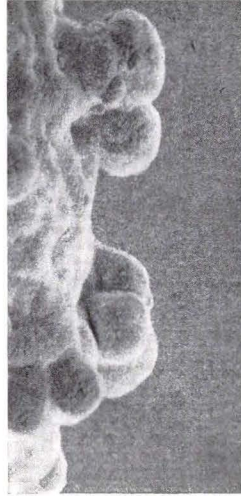
PLATE VII

	D.G.U. Catalogue No.	Text page
Figs. 1–2. <i>Pustulatisporites multicapitis</i> n. sp.	1972–FB–40	35
7743'0'', SH–5–FB, No. 65.		
Fig. 1: Scanning micrograph, $\times 1000$.		
Fig. 2: Scanning micrograph, equatorial section, $\times 3000$.		
Diameter: appr. 60 μ , excl. sculpture.		
Fig. 3. <i>Pustulatisporites multicapitis</i> n. sp.	1972–FB–41	35
7743'0'', SI 272 SM.		
Proximal view, $\times 500$.		
Diameter: 66 μ , excl. sculpture.		
Fig. 4. <i>Pustulatisporites multicapitis</i> n. sp.	1972–FB–42	35
7743'0'', SI 273 SM.		
Holotype, proximal view, $\times 500$.		
Diameter: 63 μ , excl. sculpture.		
Figs. 5–6. <i>Pustulatisporites multicapitis</i> n. sp.	1972–FB–43	38
7743'0'', SH–5–FB, No. 52.		
Fig. 5: Scanning micrograph, $\times 700$.		
Fig. 6: Scanning micrograph, $\times 2900$, central section.		
Diameter: appr. 60 μ , excl. sculpture.		

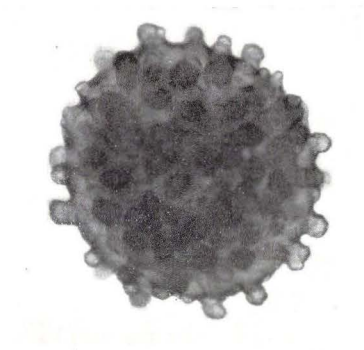
Figs. 5–6: Phot. J. FUGLSANG.



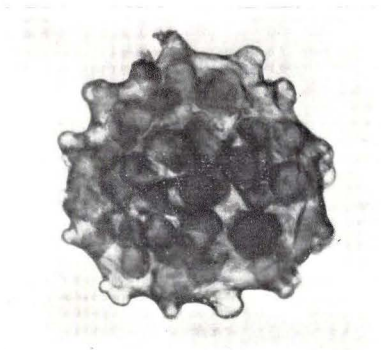
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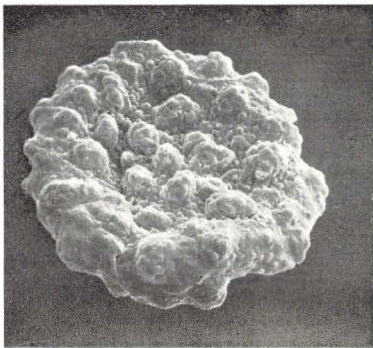
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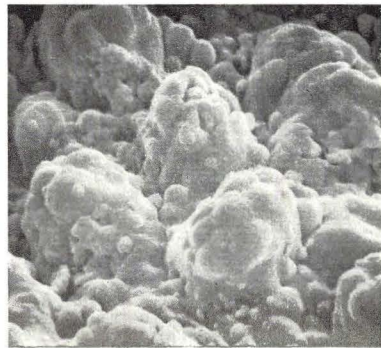
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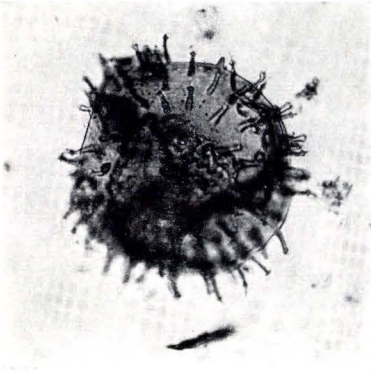


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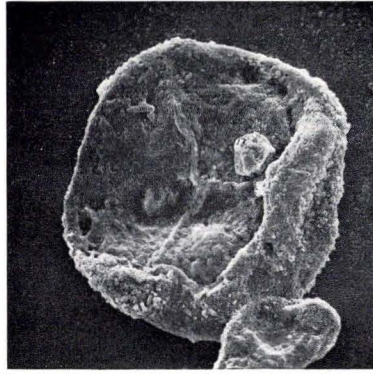
PLATE VIII
 × 500 (fig. 2, × 550)

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Umbonatisporites distinctus</i> CLAYTON 6950'–6960', SI 024 PM: 13.0–117.6. Proximal view. Diameter: 54 μ.	1972–FB–44	40
Fig. 2. <i>Apiculiretusispora</i> sp. (SI 304 SM) 7743'0'', SH–7–FB. Scanning micrograph, proximal view, × 550. Diameter: 76 μ.	1972–FB–45	38
Figs. 3–4. <i>Apiculiretusispora</i> sp. (SI 304 SM) 7743'0'', SI 304 SM. Proximal view. Fig. 3: high focus, fig. 4: low focus. Diameter: 70 μ.	1972–FB–46	38
Figs. 5, 7. <i>Apiculiretusispora multisetata</i> (LUBER) BUTTERWORTH and SPINNER 7743'0'', SI 403 SM. Distal view. Fig. 5: high focus, fig. 7: low focus. Diameter: 39 μ, excl. sculpture.	1972–FB–47	37
Figs. 6, 8. <i>Acanthotriletes spinosus</i> (WALTZ) ISCHENKO 7743'0'', SI 409 SM. Distal? view. Fig. 6: high focus, fig. 8: low focus. Diameter: 40 μ, excl. sculpture.	1972–FB–48	36

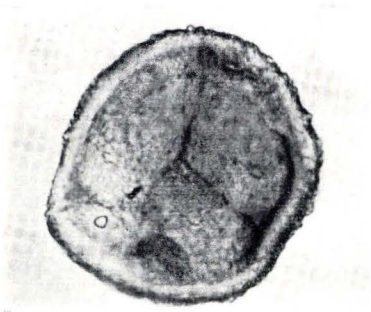
Fig. 2: Phot. J. FUGLSANG.



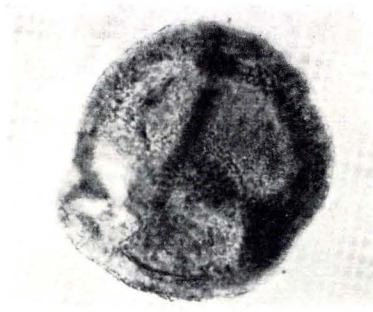
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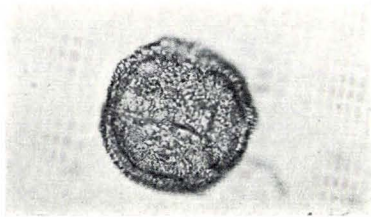
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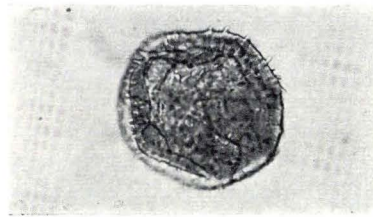
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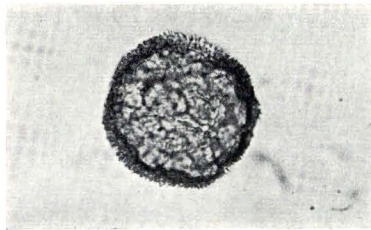
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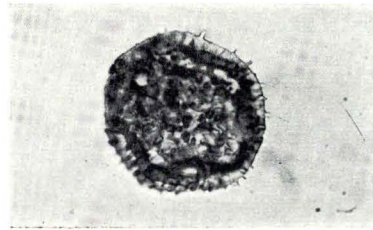
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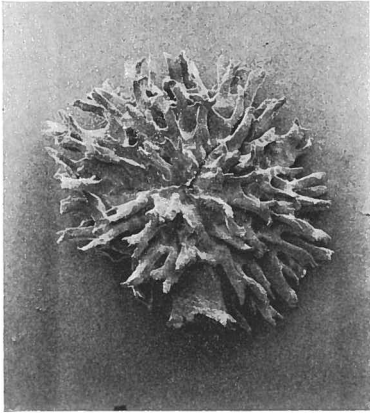


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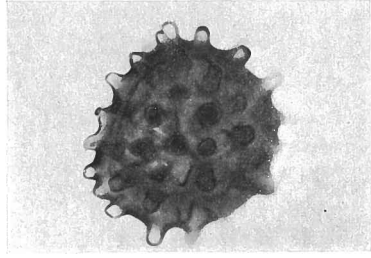
PLATE IX
 ×500 (fig. 8, ×800)

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Raistrickia corynoges</i> SULLIVAN. 7743'0'', SH-13-FB, No. 2. Scanning micrograph, proximal view, ×500. Diameter: appr. 60 μ, excl. sculpture.	1972-FB-49	39
Figs. 2-3. <i>Raistrickia nigra</i> LOVE 7743'0'', SI 002 PM: 11.8-130.2. Distal view. Fig. 2: high focus, fig. 3: low focus. Diameter: 47 μ, excl. sculpture.	1972-FB-50	40
Fig. 4. <i>Raistrickia corynoges</i> SULLIVAN 7743'0'', SH-5-FB, No. 33. Scanning micrograph, distal view, ×500. Diameter: appr. 70 μ, excl. sculpture.	1972-FB-51	39
Fig. 5. <i>Cristatisporites echinatus</i> PLAYFORD. 7743'0'', SI 002 PM: 7.7-130.2. Equatorial view. Diameter: 75 μ.	1972-FB-52	55
Fig. 6. <i>Baculatisporites</i> sp. (SI 243 SM) 7739'4-9'', SI 243 SM. Proximal-equatorial view. Diameter: 54 μ, excl. sculpture.	1972-FB-53	39
Fig. 7. <i>Baculatisporites</i> sp. (SI 243 SM) 7743'0'', SH-5-FB, No. 2. Scanning micrograph, distal view, ×500. Diameter: appr. 50 μ, excl. sculpture.	1972-FB-54	39
Fig. 8. <i>Cristatisporites echinatus</i> PLAYFORD. 7743'0'', SH-5-FB, No. 6. Scanning micrograph, proximal-equatorial view, ×800. Diameter: appr. 55 μ.	1972-FB-55	55

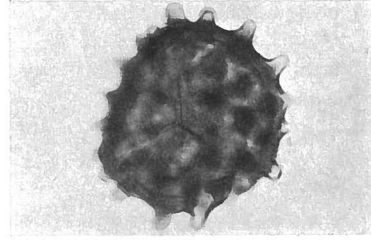
Figs. 4, 7, 8: Phot. A. NØRGÅRD.



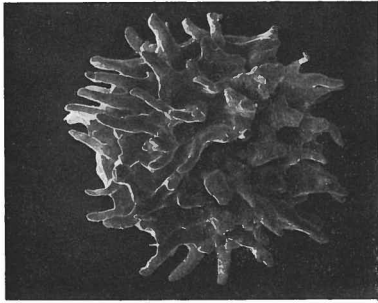
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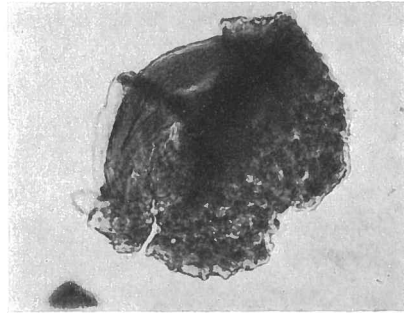
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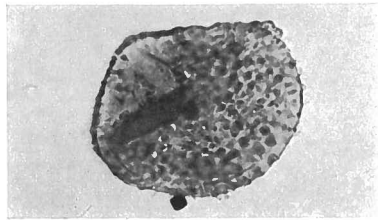
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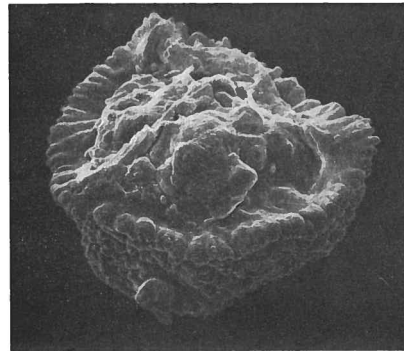
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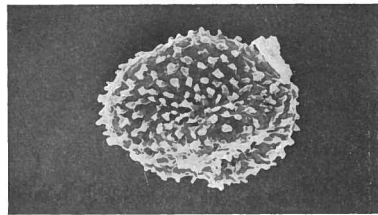
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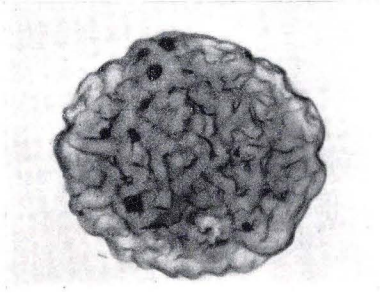


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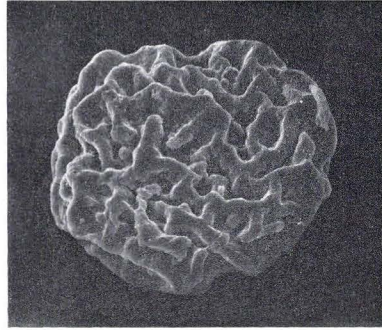
PLATE X
 × 500

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Convolutispora amplexa</i> (LUBER) JACHOWICZ f. <i>kasachstanensis</i> LUBER 7739'4-9'', SI 245 SM. Distal view. Diameter: 67 μ .	1972-FB-56	41
Fig. 2. <i>Convolutispora amplexa</i> (LUBER) JACHOWICZ f. <i>kasachstanensis</i> LUBER 7743'0'', SH-9-FB. Scanning micrograph, distal view. Diameter: appr. 80 μ .	1972-FB-57	41
Fig. 3. <i>Convolutispora</i> sp. (SI 222 SM)..... 7743'0'', SH-5-FB, No. 23. Scanning micrograph, distal view. Diameter: appr. 60 μ .	1972-FB-58	45
Fig. 4. <i>Convolutispora</i> sp. (SI 222 SM)..... 7739'4-9'', SI 222 SM. Proximal view. Diameter: 75 μ .	1972-FB-59	45
Fig. 5. <i>Convolutispora</i> sp. (SI 222 SM)..... 7743'0'', SH-4-FB, No. 1. Scanning micrograph, equatorial view, distal pole to the left. Diameter: appr. 65 μ .	1972-FB-60	45
Fig. 6. <i>Convolutispora</i> aff. <i>crassa</i> PLAYFORD 7716'0-7'', SI 220 SM. Proximal view. Diameter: 68 μ .	1972-FB-61	42
Fig. 7. <i>Convolutispora</i> sp. (SI 227 SM)..... 7716'0-7'', SI 227 SM. Proximal view. Diameter: 90 μ .	1972-FB-62	45

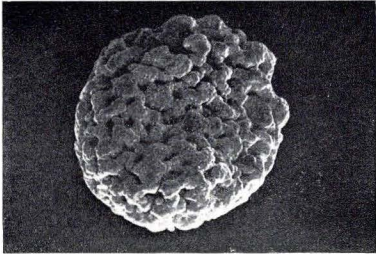
Fig. 2: Phot. OWAJAKI; figs. 3, 5: Phot. A. NØRGÅRD.



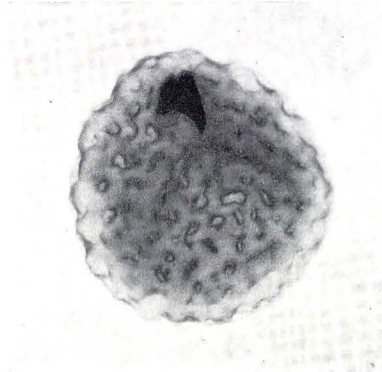
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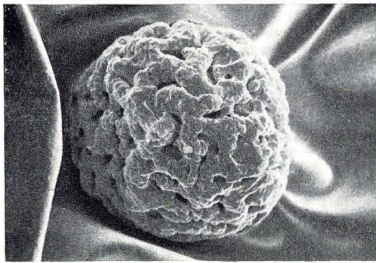
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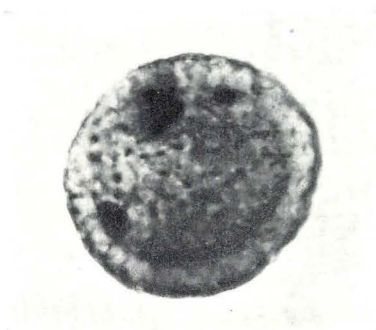
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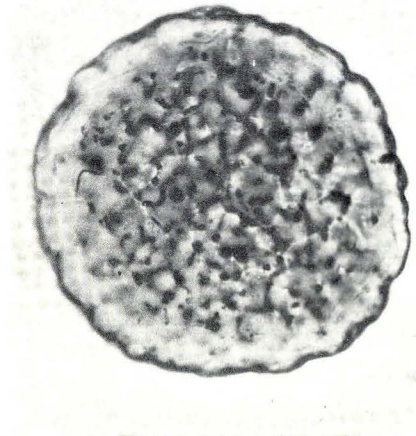
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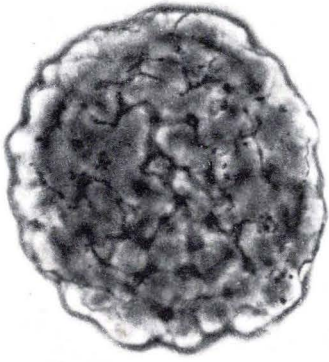


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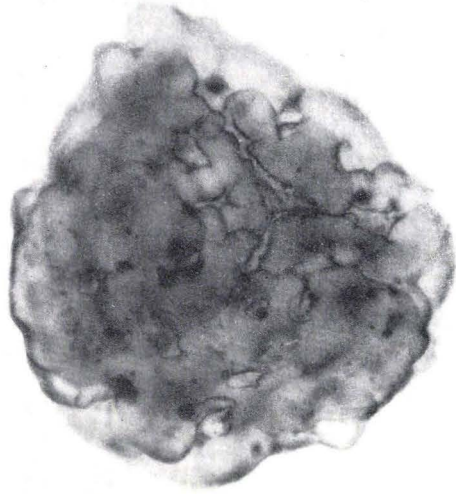
PLATE XI

× 500

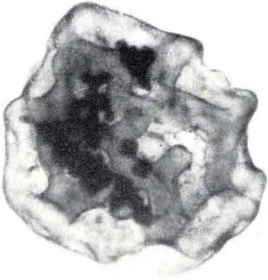
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Convolutispora</i> sp. (SI 227 SM)..... 7716'0-7'', K 2,1: 11.2-128.2. Proximal view. Diameter: 86 μ.	1972-FB-63	45
Fig. 2. <i>Convolutispora vermiformis</i> HUGHES and PLAYFORD..... 7716'0-7'', SI 239 SM. Distal view. Diameter: 71 μ.	1972-FB-64	44
Fig. 3. <i>Convolutispora turgida</i> n. sp..... 7739'4-9'', SI 319 SM. Holotype, proximal view. Diameter: 133 μ.	1972-FB-65	43
Fig. 4. <i>Convolutispora</i> cf. <i>vermiformis</i> HUGHES and PLAYFORD... 7739'4-9'', SI 233 SM. Proximal view. Diameter: 37 μ.	1972-FB-66	44
Fig. 5. <i>Convolutispora turgida</i> n. sp..... 7716'0-7'', SI 318 SM. Proximal view. Diameter: 149 μ.	1972-FB-67	43



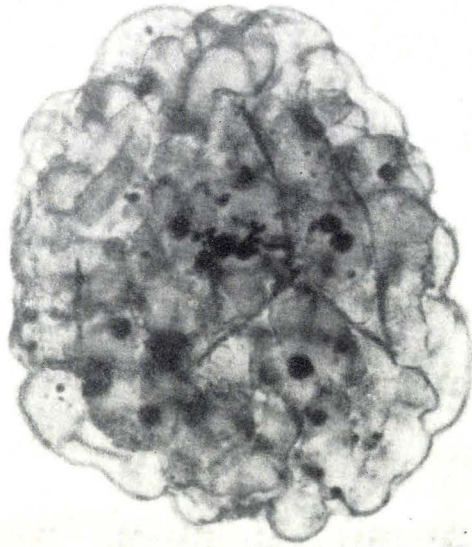
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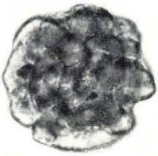
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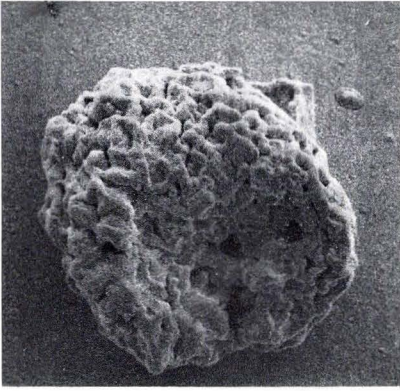


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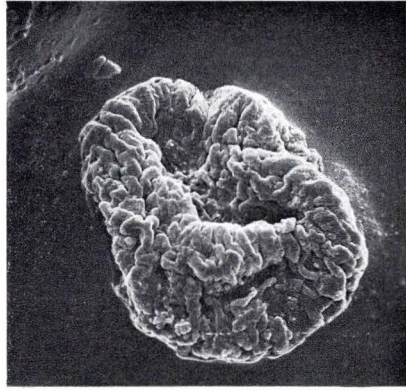
PLATE XII
 × 500 (fig. 1, × 1000; fig. 2, × 1050)

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Rugospora minuta</i> NEVES and IOANNIDES..... 7743'0'', SH-5-FB, No. 19. Scanning micrograph, × 1000. Diameter: appr. 45 μ.	1972-FB-68	63
Fig. 2. <i>Rugospora minuta</i> NEVES and IOANNIDES..... 7743'0'', SH-4-FB, No. 8. Scanning micrograph, × 1050. Diameter: appr. 40 μ.	1972-FB-69	63
Fig. 3. <i>Rugospora minuta</i> NEVES and IOANNIDES..... 7739'4-9'', SI 329 SM. Proximal view. Diameter: 42 μ.	1972-FB-70	63
Fig. 4. <i>Rugospora minuta</i> NEVES and IOANNIDES..... 7743'0'', SI 309 SM. Proximal view. Diameter: 46 μ.	1972-FB-71	63
Fig. 5. <i>Convolutispora densorugosa</i> n. sp..... 7716'0-7'', SI 254 SM. Holotype, proximal view. Diameter: 88 μ.	1972-FB-72	42
Fig. 6. <i>Convolutispora densorugosa</i> n. sp..... 7716'0-7'', K 2.1: 4.1-128.2. Proximal view. Diameter: 80 μ.	1972-FB-73	42
Fig. 7. <i>Convolutispora densorugosa</i> n. sp..... 7716'0-7'', SH-15-FB, No. 3. Scanning micrograph, proximal view, × 500. Diameter: appr. 80 μ.	1972-FB-74	42

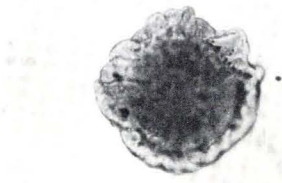
Fig. 2: Phot. A. NØRGÅRD.



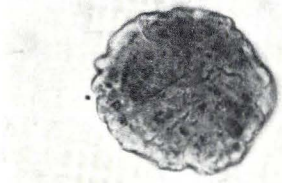
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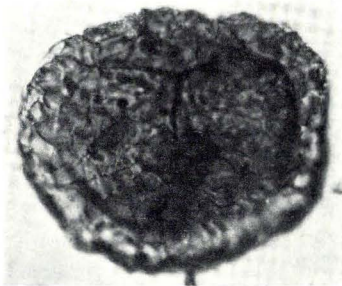
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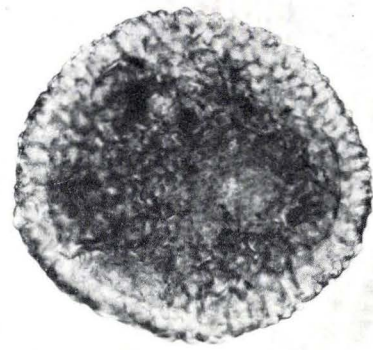
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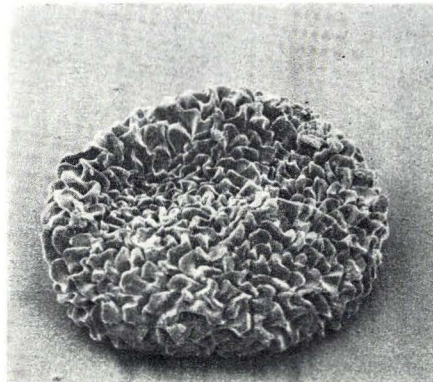
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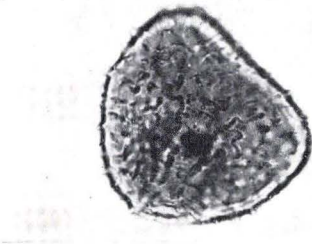


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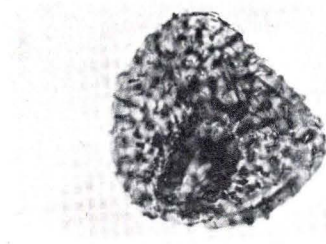
PLATE XIII
 × 500 (figs. 8–9, × 425)

	D.G.U. Catalogue No.	Text page
Figs. 1–2. <i>Dictyotriletes membranireticulatus</i> n. sp. 7739'4–9'', SI 240 SM. Holotype. Distal view. Fig. 1: high focus, fig. 2: low focus. Diameter: 55 μ, excl. sculpture.	1972–FB–75	47
Fig. 3. <i>Dictyotriletes membranireticulatus</i> n. sp. 7743'0'', SI 284 SM. Distal view. Diameter: 56 μ, excl. sculpture.	1972–FB–76	47
Fig. 4. <i>Dictyotriletes membranireticulatus</i> n. sp. 7743'0'', SH–14–FB. Scanning micrograph, proximal view. Diameter: appr. 60 μ, excl. sculpture.	1972–FB–77	47
Figs. 5–6. <i>Dictyotriletes</i> cf. <i>submarginatus</i> PLAYFORD 7743'0'', SI 265 SM. Distal view. Fig. 5: low focus, fig. 6: high focus. Diameter: 58 μ, incl. sculpture.	1972–FB–78	48
Fig. 7. <i>Dictyotriletes</i> cf. <i>submarginatus</i> PLAYFORD 7743'0'', SH–14–FB. Scanning micrograph, proximal view. Diameter: appr. 60 μ.	1972–FB–79	48
Figs. 8–9. <i>Dictyotriletes</i> cf. <i>submarginatus</i> PLAYFORD 7743'0'', SH–5–FB, No. 4. Scanning micrographs, × 425. Fig. 8: equatorial view, fig. 9: distal view. Diameter: appr. 60 μ.	1972–FB–80	48

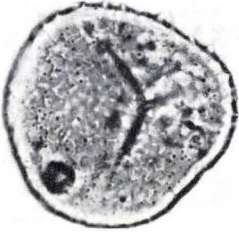
Figs. 8–9: Phot. A. NØRGÅRD.



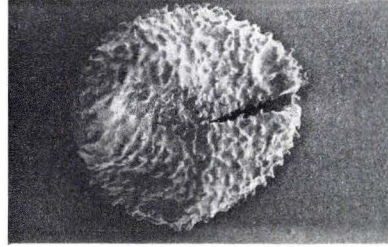
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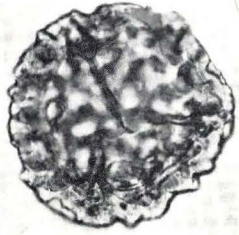
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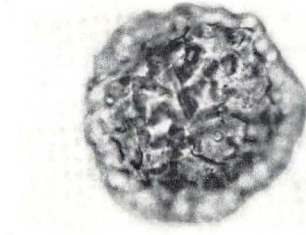
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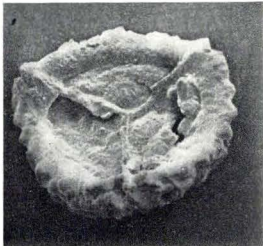
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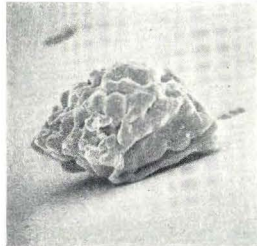
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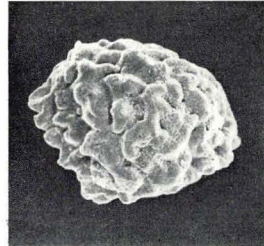
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7



8



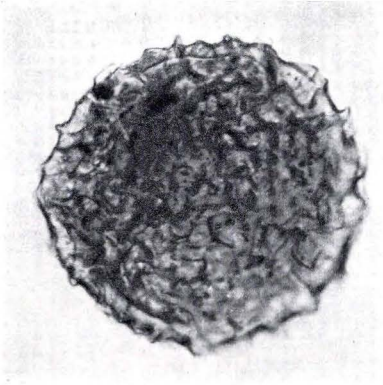
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PLATE XIV

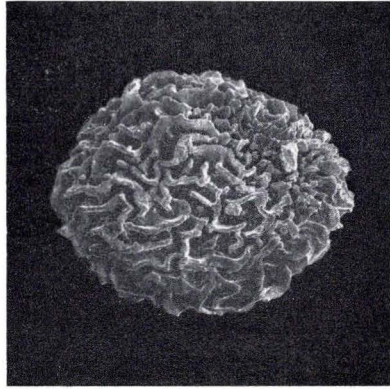
× 500

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Dictyotriletes cheveriensis</i> (PLAYFORD) comb. nov. 7716'0-7'', SI 235 SM. Proximal view. Diameter: 78 μ, excl. sculpture.	1972-FB-81	46
Fig. 2. <i>Dictyotriletes cheveriensis</i> (PLAYFORD) comb. nov. 7743'0'', SH-5-FB, No. 11. Scanning micrograph, distal? view, × 500. Diameter: appr. 75 μ, excl. sculpture.	1972-FB-82	46
Fig. 3. <i>Dictyotriletes cheveriensis</i> (PLAYFORD) comb. nov. 7743'0'', SI 269 SM. Proximal-equatorial view. Diameter: 72 μ, excl. sculpture.	1972-FB-83	46
Fig. 4. <i>Dictyotriletes</i> sp. (SI 224 SM) 7716'0-7'', SI 224 SM. Proximal view. Diameter: 84 μ.	1972-FB-84	48
Fig. 5. <i>Convolutispora circumvallata</i> CLAYTON 7716'0-7'', SI 247 SM. Distal view. Diameter: 78 μ, incl. sculpture.	1972-FB-85	41
Fig. 6. <i>Convolutispora circumvallata</i> CLAYTON 7739'4-9'', SI 248 SM. Equatorial view. Diameter: 90 μ, incl. sculpture.	1972-FB-86	41

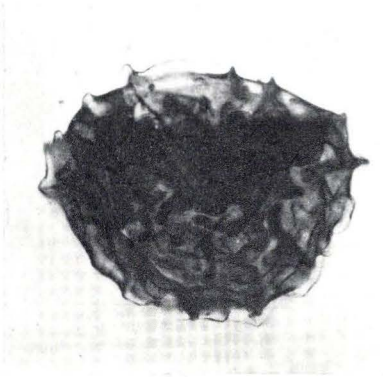
Fig. 2: Phot. A. NØRGÅRD.



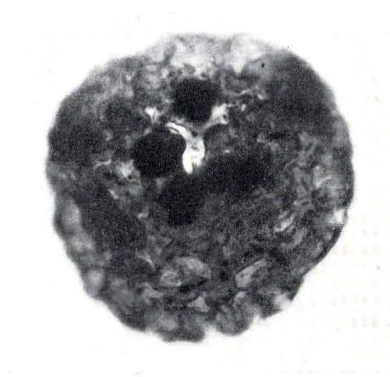
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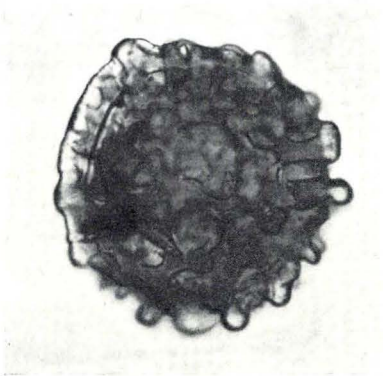
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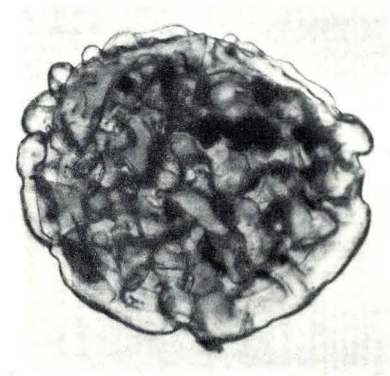
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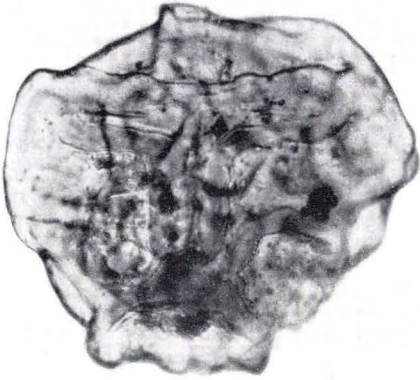


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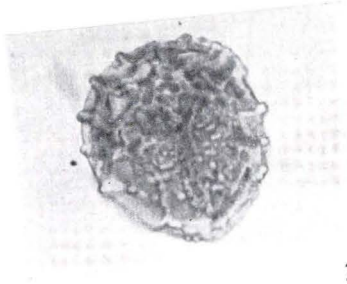
PLATE XV

× 500

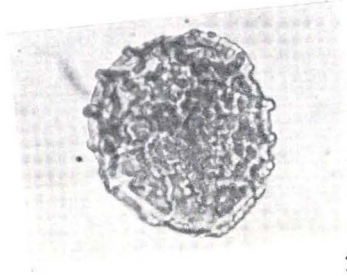
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Dictyotriletes cancellatus</i> (WALTZ) POTONIÉ and KREMP. 7716'0-7'', SI 249 SM. Proximal view. Diameter: 111 μ, incl. sculpture.	1972-FB-87	46
Figs. 2-3. <i>Dictyotriletes</i> sp. (SI 396 SM) 7743'0'', SI 396 SM. Distal view. Fig. 2: high focus, fig. 3: low focus. Diameter: 51 μ, incl. sculpture.	1972-FB-88	49
Fig. 4. <i>Perotrilites perinatus</i> HUGHES and PLAYFORD 7716'0-7'', K. 2.1: 4.8-130.7. Proximal view. Diameter: 46 μ (intexine).	1972-FB-89	62
Fig. 5. <i>Perotrilites perinatus</i> HUGHES and PLAYFORD 7743'0'', SI 283 SM. Proximal view. Diameter: 65 μ (intexine).	1972-FB-90	62
Fig. 6. <i>Perotrilites magnus</i> HUGHES and PLAYFORD. 7716'0-7'', SI 209 SM. Orientation unknown. Diameter: 141 μ (intexine).	1972-FB-91	61



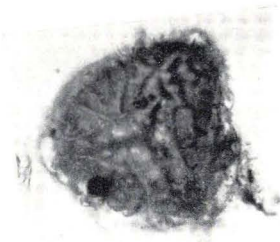
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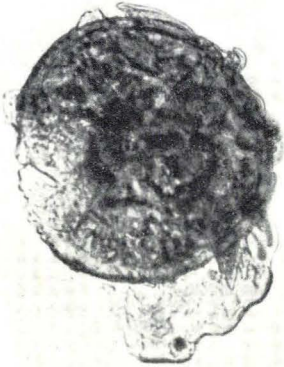
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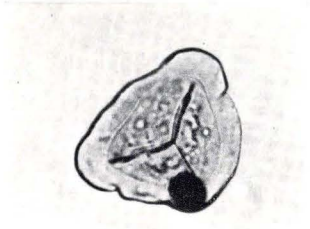
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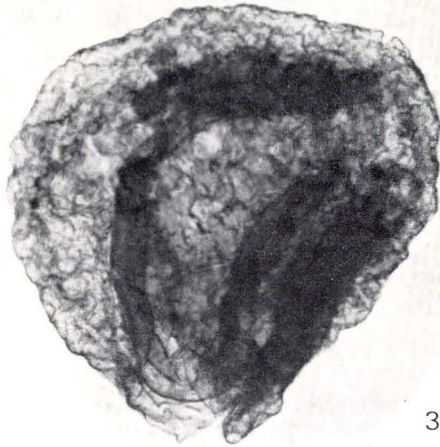
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PLATE XVI
 × 500 (fig. 6, × 300)

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Murospora sublobata</i> (WALTZ) PLAYFORD..... 7743'0'', SI 285 SM. Proximal view. Diameter: 42 μ.	1972-FB-92	50
Fig. 2. <i>Knoxisporites literatus</i> (WALTZ) PLAYFORD..... 7739'4-9'', SI 349 SM. Distal view. Diameter: 89 μ.	1972-FB-93	52
Fig. 3. <i>Rugospora corporata</i> NEVES and OWENS var. <i>verrucosa</i> NEVILLE..... Proximal view. Diameter: 109 μ.	1972-FB-94	62
Figs. 4-5. <i>Murospora</i> sp. (SI 298 SM)..... 7743'0'', SI 298 SM. Proximal view. Fig. 4: high focus, fig. 5: low focus. Diameter: 40 μ.	1972-FB-95	50
Fig. 6. <i>Rugospora corporata</i> NEVES and OWENS var. <i>verrucosa</i> NEVILLE..... 7743'0'', SH-14-FB. Scanning micrograph, × 300. Diameter: appr. 120 μ.	1972-FB-96	62
Fig. 7. <i>Rugospora corporata</i> NEVES and OWENS var. <i>verrucosa</i> NEVILLE..... 7739'4-9'', SI 206 SM. Proximal view. Diameter: 122 μ.	1972-FB-97	62



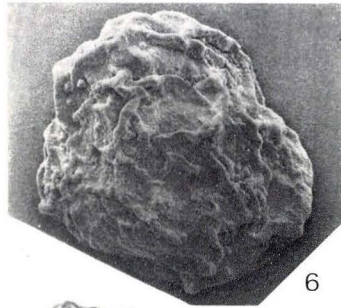
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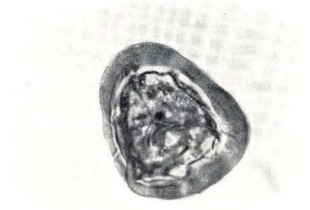
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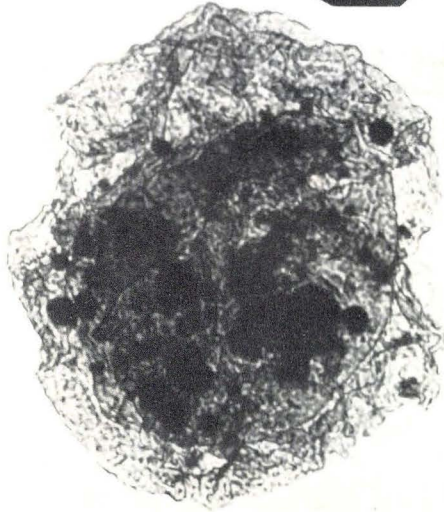
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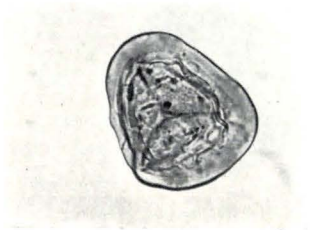
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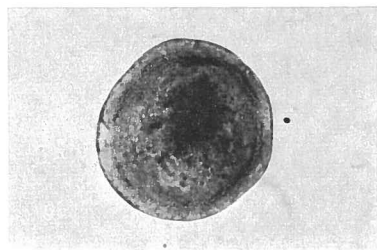


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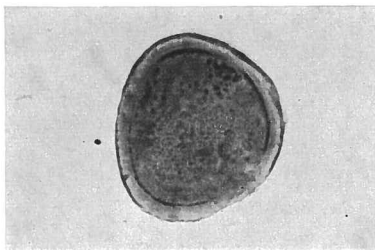
PLATE XVII

× 500

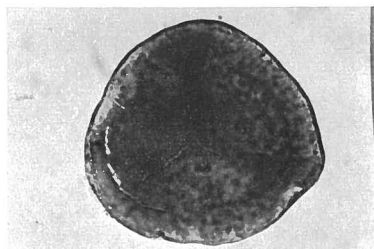
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Stenozonotriletes</i> sp. (Sl 306 SM)..... 7743'0'', Sl 306 SM. Distal view. Diameter: 45 μ.	1972-FB-98	49
Fig. 2. <i>Stenozonotriletes</i> sp. (Sl 306 SM)..... 7739'4-9'', Sl 365 SM. Distal view. Diameter: 47 μ.	1972-FB-99	49
Fig. 3. <i>Stenozonotriletes</i> sp. (Sl 303 SM)..... 7743'0'', Sl 303 SM. Proximal view. Diameter: 57 μ.	1972-FB-100	49
Fig. 4. <i>Cyclogranisporites</i> sp. (Sl 290 SM)..... 7743'0'', Sl 394 SM. Proximal view. Diameter: 47 μ, excl. sculpture.	1972-FB-101	29
Figs. 5-6. <i>Stenozonotriletes</i> sp. (Sl 275 SM) 7743'0'', Sl 275 SM. Distal view. Fig. 5: high focus, fig. 6: low focus. Diameter: 42 μ.	1972-FB-102	50
Figs. 7-8. <i>Cyclogranisporites</i> sp. (Sl 290 SM)..... 7743'0'', Sl 290 SM. Distal view. Fig. 7: high focus, fig. 8: low focus. Diameter: 48 μ, excl. sculpture.	1972-FB-103	29



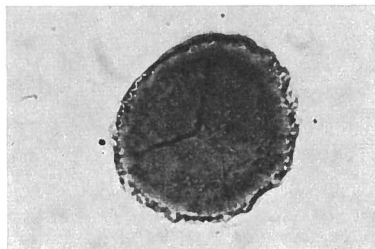
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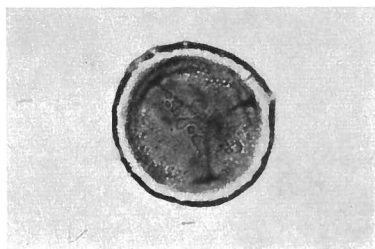
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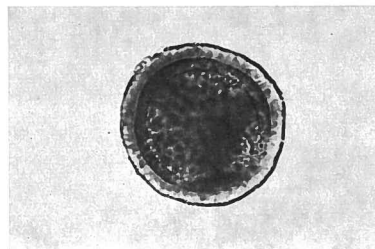
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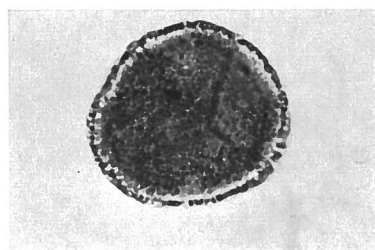
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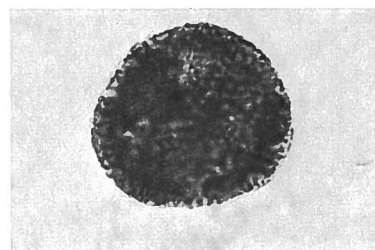
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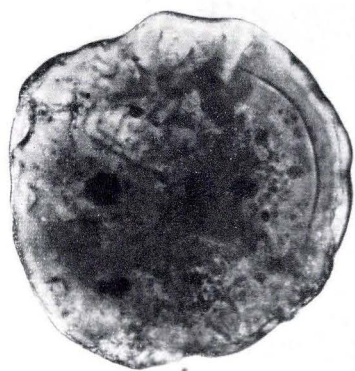


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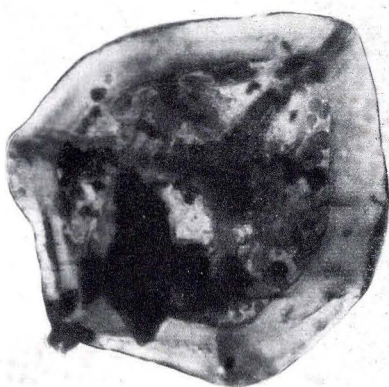
PLATE XVIII
 × 500 (fig. 6, × 2200)

	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Knoxisporites hederatus</i> (ISCHENKO) PLAYFORD..... 7739'4-9'', SI 351 SM. Distal view. Diameter: 88 μ.	1972-FB-104	51
Fig. 2. <i>Knoxisporites</i> sp. (SI 316 SM)..... 7739'4-9'', SI 316 SM. Proximal view. Diameter: 102 μ.	1972-FB-105	52
Figs. 3-4. <i>Knoxisporites pristinus</i> SULLIVAN..... 7716'0-7'', SI 315 SM. Proximal view. Fig. 3: high focus, fig. 4: low focus. Diameter: 74 μ.	1972-FB-106	51
Figs. 5-6. <i>Knoxisporites pristinus</i> SULLIVAN..... 7743'0'', SH-5-FB, No. 50. Scanning micrographs, distal view. Fig. 5: section of distal murus, × 2200. Diameter: appr. 75 μ (fig. 6).	1972-FB-107	51

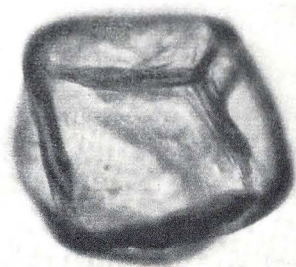
Figs. 5-6: Phot. A. NØRGÅRD.



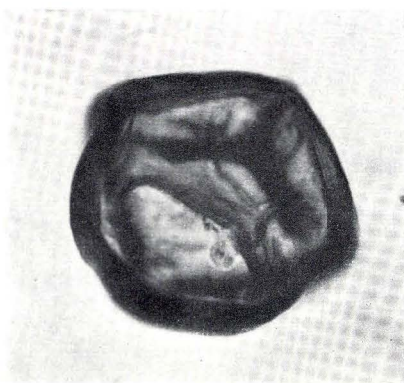
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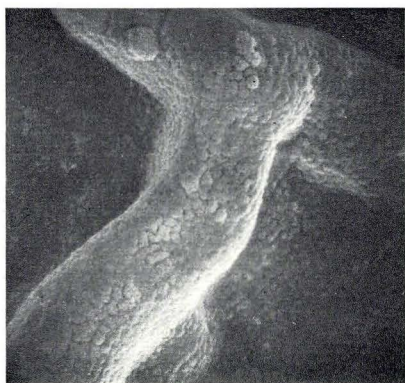
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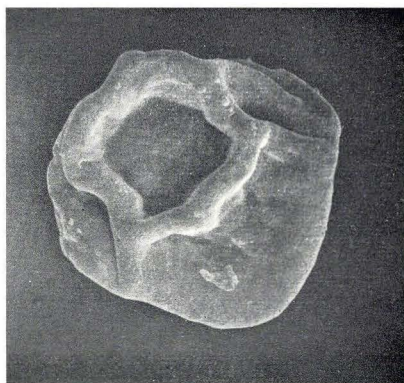
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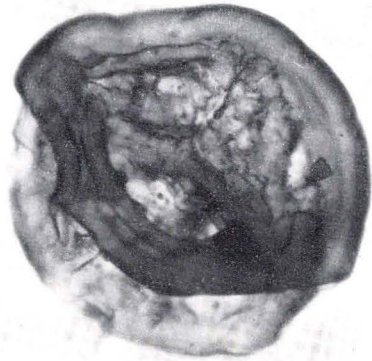
PLATE XIX

× 500

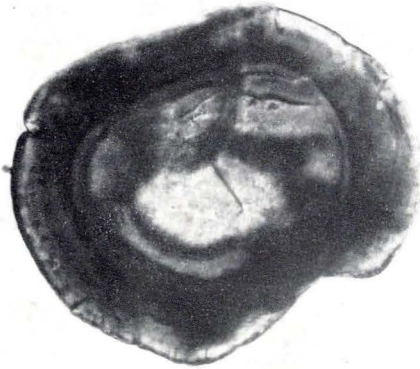
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Knoxisporites</i> sp. (SI 342 SM)..... 7716'0-7'', SI 342 SM. Distal view. Diameter: 90 μ.	1972-FB-108	52
Fig. 2. <i>Knoxisporites</i> sp. (SI 342 SM)..... 7739'4-9'', SI 343 SM. Proximal-equatorial view. Diameter: 97 μ.	1972-FB-109	52
Fig. 3. <i>Anulatisporites?</i> sp. (SI 375 SM)..... 7739'4-9'', SI 375 SM. Distal view. Diameter: 98 μ.	1972-FB-110	53
Fig. 4. <i>Tholisporites</i> sp. (SI 345 SM)..... 7743'0'', SI 344 SM. Distal view. Diameter: 79 μ.	1972-FB-111	56
Fig. 5. <i>Tholisporites</i> sp. (SI 345 SM)..... 7743'0'', SI 345 SM. Proximal view. Diameter: 70 μ.	1972-FB-112	56
Fig. 6. <i>Reticulatisporites copiosus</i> n. sp. 7739'4-9'', SI 336 SM. Distal view. Diameter: 118 μ.	1972-FB-113	52



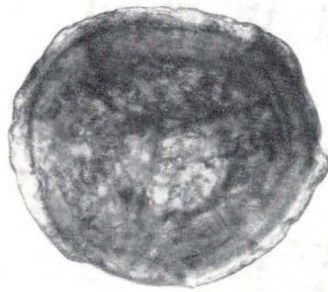
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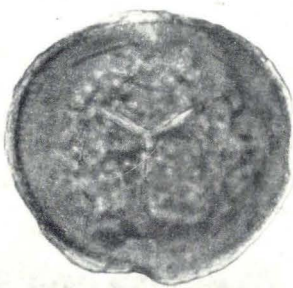
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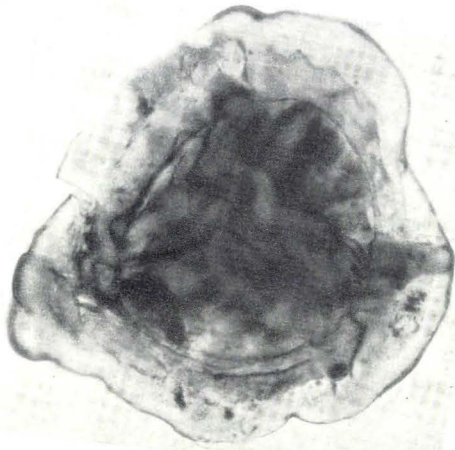
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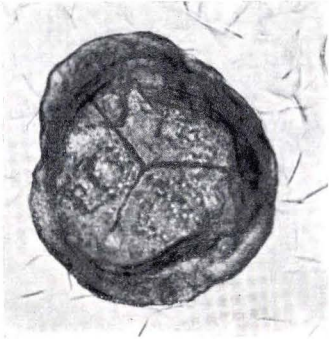


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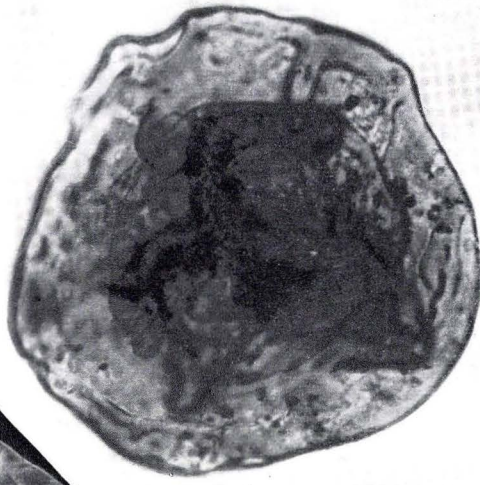
PLATE XX

× 500

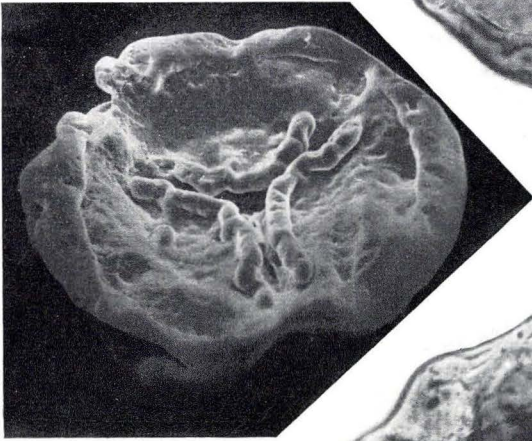
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Tholispurites</i> sp. (SI 388 SM)..... 7743'0'', SI 388 SM. Proximal view. Diameter: 68 μ.	1972-FB-114	56
Fig. 2. <i>Reticulatisporites copiosus</i> n. sp..... 7739'4-9'', SI 334 SM. Holotype, proximal view. Diameter: 130 μ.	1972-FB-115	52
Fig. 3. <i>Reticulatisporites copiosus</i> n. sp..... 7716'0-7'', SH-15-FB, No. 2. Scanning micrograph, proximal view. Diameter: appr. 120 μ.	1972-FB-116	52
Fig. 4. <i>Tholispurites</i> sp. (SI 388 SM)..... 7739'4-9'', SI 378 SM. Distal view. Diameter: 73 μ.	1972-FB-117	56
Fig. 5. <i>Reticulatisporites copiosus</i> n. sp..... 7739'4-9'', SI 337 SM. Distal view. Diameter: 149 μ.	1972-FB-118	52



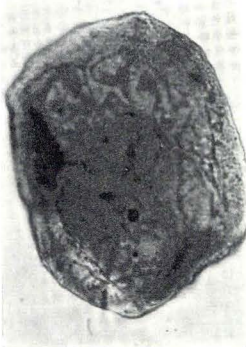
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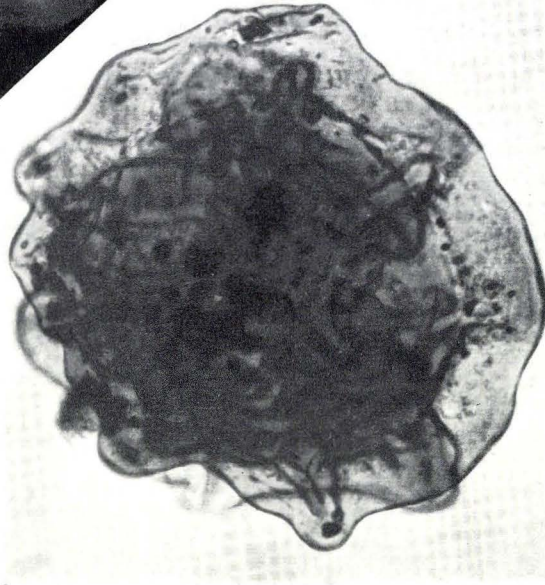
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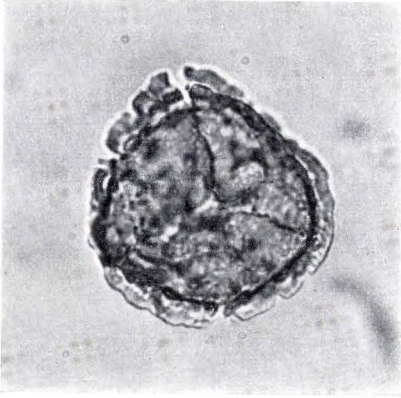


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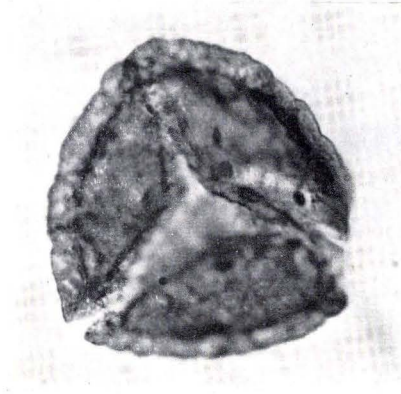
PLATE XXI

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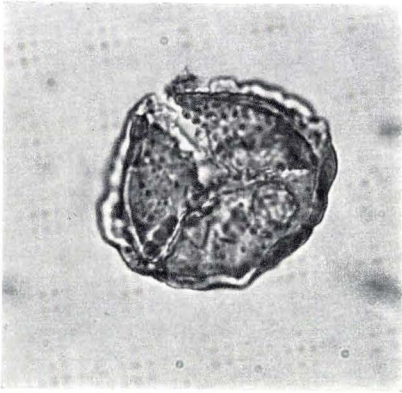
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Lycospora pusilla</i> (IBRAHIM) SOMERS. 7743'0'', SI 297 SM. Distal view. Low focus (proximal surface). Diameter: 31 μ.	1972-FB-119	54
Fig. 2. <i>Lycospora? rugulosa</i> BUTTERWORTH and SPINNER 7270'-80', SI 444 SM. Distal view. Low focus (proximal surface). Blue filter. Diameter: 38 μ.	1972-FB-143	54
Fig. 3. <i>Lycospora pusilla</i> (IBRAHIM) SOMERS. 7743'0'', SI 410 SM. Proximal view. Diameter: 31 μ.	1972-FB-120	54
Fig. 4. <i>Tholiosporites decorus</i> BHARADWAJ and VENKATACHALA . . . 7739'4-9'', SI 443 SM. Proximal view. Diameter: 41 μ.	1972-FB-121	55
Fig. 5. <i>Lycospora pusilla</i> (IBRAHIM) SOMERS. 7743'0'', SI 282 SM. Proximal view. Diameter: 27 μ.	1972-FB-122	54
Fig. 6. <i>Tholiosporites decorus</i> BHARADWAJ and VENKATACHALA . . . 7701'3'', SI 442 SM. Proximal view. Diameter: 46 μ.	1972-FB-123	55



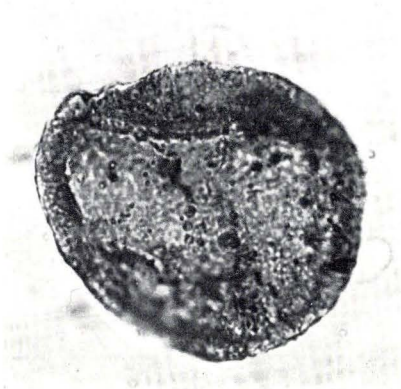
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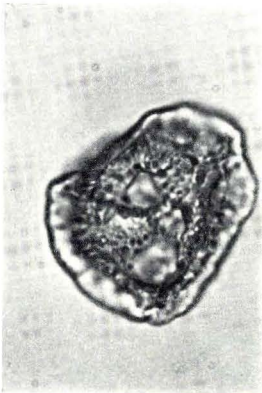
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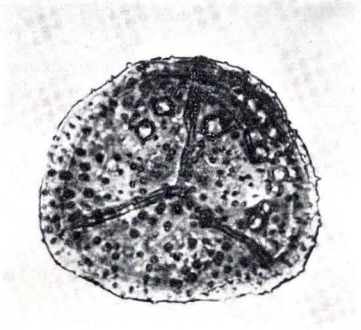


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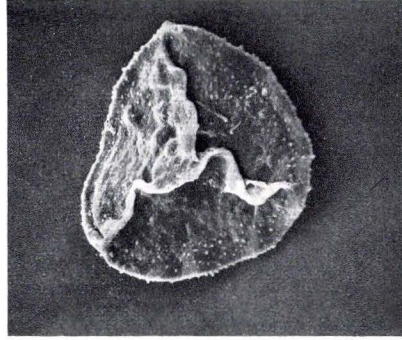
PLATE XXII

× 500

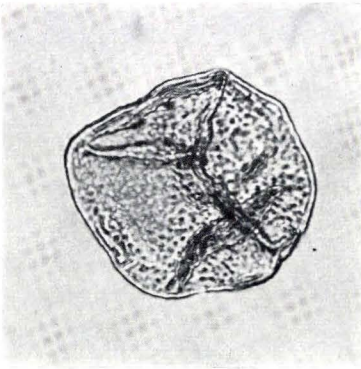
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Grandispora echinata</i> HACQUEBARD	1972-FB-124	58
7743'0'', SI 260 SM. Distal view. Diameter: 67 μ .		
Fig. 2. <i>Grandispora echinata</i> HACQUEBARD	1972-FB-125	58
7743'0'', SH-17-FB, No. 3. Proximal view. Scanning micrograph. Diameter: 68 μ .		
Fig. 3. Gen. et sp. indet. (SI 295 SM)	1972-FB-126	60
7743'0'', SI 295 SM. Distal view. Diameter: 62 μ .		
Fig. 4. <i>Spinozonotriletes</i> sp. (SI 310 SM).....	1972-FB-127	61
7743'0'', SI 310 SM. Distal view. Diameter: appr. 60 μ .		
Fig. 5. <i>Spelaeotriletes</i> cf. <i>pretiosus</i> (PLAYFORD) NEVES and BELT	1972-FB-128	59
7701'3'', SI 427 SM. Distal view. Diameter: 82 μ .		
Fig. 6. <i>Discernisporites</i> cf. <i>micromanifestus</i> (HACQUEBARD) NEVES and BELT	1972-FB-129	60
7743'0'', SI 294 SM. Proximal view. Diameter: 69 μ .		



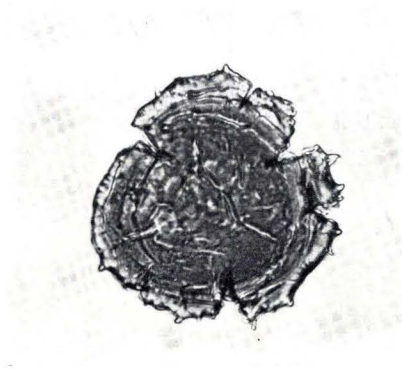
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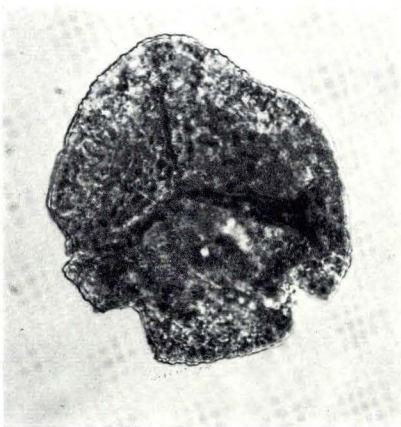
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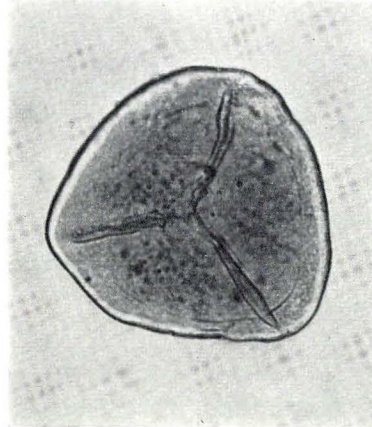
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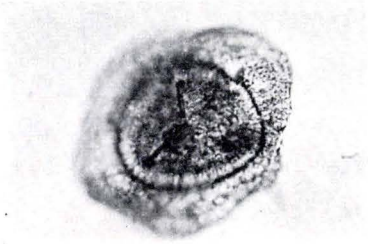


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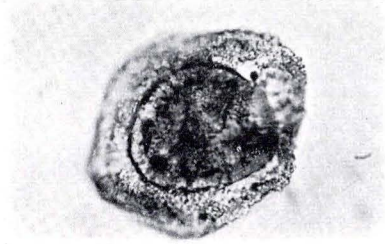
PLATE XXIII

× 500

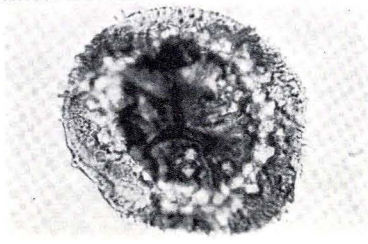
	D.G.U. Catalogue No.	Text page
Figs. 1–2. <i>Aculeisporas</i> sp. (SI 261 SM) 7743'0'', SI 261 SM. Proximal view. Fig. 1: high focus, fig. 2: low focus. Diameter: 60 μ.	1972–FB–130	58
Figs. 3–4. <i>Aculeisporas</i> sp. (SI 259 SM) 7743'0'', SI 259 SM. Distal view. Fig. 3: low focus, fig. 4: high focus. Diameter: 61 μ.	1972–FB–131	58
Fig. 5. <i>Auroraspora macra</i> SULLIVAN 7739'4–9'', SI 201 SM. Distal view. Diameter: 62 μ.	1972–FB–132	57
Fig. 6. <i>Auroraspora macra</i> SULLIVAN 7739'4–9'', SI 203 SM. Distal view. Diameter: 70 μ.	1972–FB–133	57
Fig. 7. <i>Auroraspora</i> cf. <i>solisortus</i> HOFFMEISTER, STAPLIN and MALLOY 7743'0'', SI 263 SM. Distal view. Diameter: 61 μ.	1972–FB–134	57
Fig. 8. <i>Auroraspora</i> cf. <i>solisortus</i> HOFFMEISTER, STAPLIN and MALLOY 7743'0'', SI 262 SM. Proximal view. Diameter: 62 μ.	1972–FB–135	57



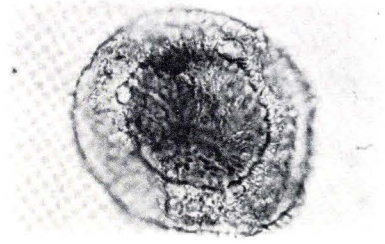
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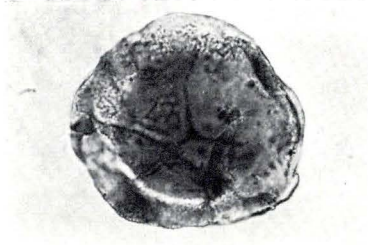
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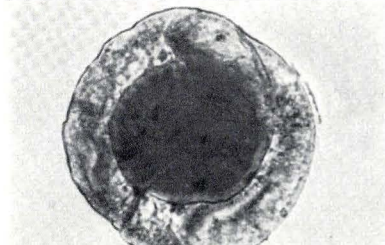
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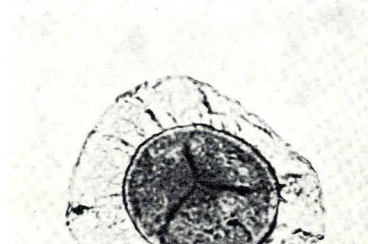
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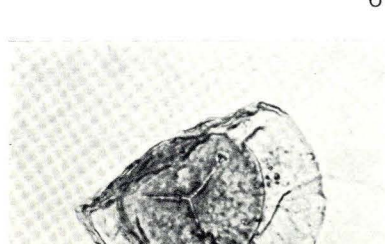
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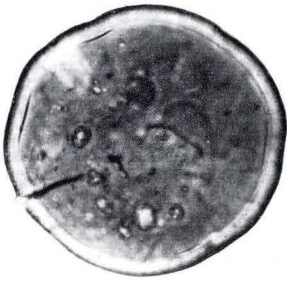
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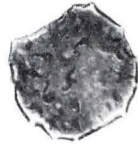
8

PLATE XXIV
 × 500 (figs. 4, 6 × 200)

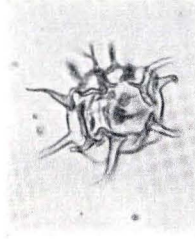
	D.G.U. Catalogue No.	Text page
Fig. 1. <i>Tasmanites</i> sp. 7743'0'', SI 292 SM. Diameter: 69 μ.	1972-FB-136	63
Fig. 2. <i>Baltisphaeridium</i> sp. 7743'0'', SI 402 SM. Diameter: 31 μ.	1972-FB-137	65
Fig. 3. <i>Baltisphaeridium</i> sp. 7743'0'', SI 002 PM, 11.8-130.2. Diameter (body): 28 μ.	1972-FB-138	65
Figs. 4, 6. Scolecodonts 7716'0-7'', SI K 2,6.	1972-FB-139, 140.	65
Fig. 5. <i>Leiosphaeridia</i> ? sp. 7739'4-9'', SI 362 SM. Diameter: 96 μ.	1972-FB-141	63
Fig. 7. <i>Cavatisporites microreticulatus</i> (JACHOWICZ) emend. 7716'0-7'', SI 364 SM. Diameter: 112 μ.	1972-FB-142	64



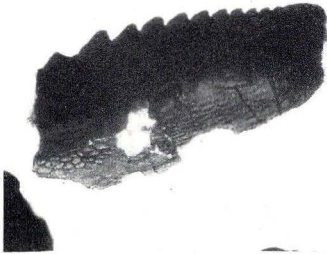
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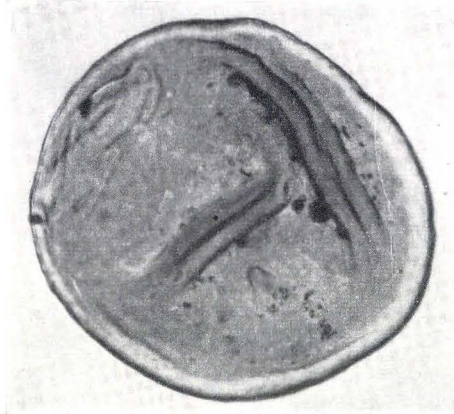
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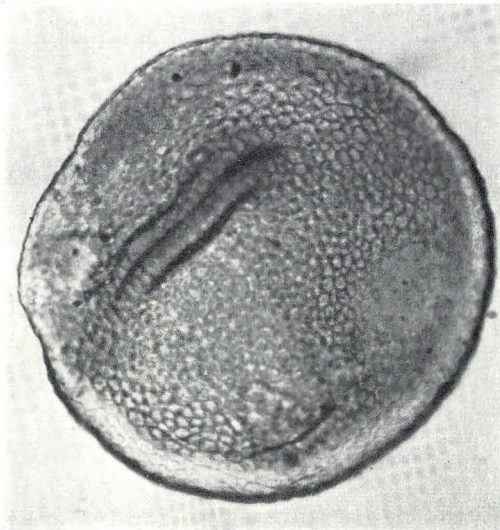
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