

## A NEW SPORE ASSEMBLAGE TO CORRELATE BETWEEN THE BRECONIAN (BRITISH ISLES) AND THE GEDINNIAN (BELGIUM).<sup>1</sup>

by

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(2 figures, 1 plate)

**ABSTRACT.**- A new Lower Devonian miospore assemblage zone is described and its distribution recorded in the Dinant Synclinorium, Belgium, and the Anglo-Welsh Basin, south Wales. By reference to a recent review of heterostracan faunas (Blieck and Jahnke, 1980), and the new spore evidence, we suggest an upper Gedinnian age for the zone. In Belgium the zone ranges through the upper Oignies and throughout the St-Hubert Beds and in Wales the lower part of Senni Beds. Two name species are described *Breconisporites breconensis* gen. et sp. nov. and *Emphanisporites zavallatus* sp. nov. and the base of the zone is drawn at their first appearance. The base and range of the zone are briefly described and reference sections proposed in successions from Belgium and south Wales. In both areas the new zone succeeds the *micromatus-newportensis* assemblage zone and is distinct from it as the new zone represents a major change in miospore floras. The genera *Aneurospora* and *Streelispota* are emended.

**RESUME.**- Une nouvelle zone d'assemblage de spores du Dévonien Inférieur est décrite et sa distribution est démontrée dans le Synclinorium de Dinant, Belgique, ainsi que dans l' "Anglo-Welsh Basin", au sud du Pays de Galles. Se référant à une récente revue des faunes d'hétérostracés (Blieck et Jahnke, 1980), et aux nouvelles informations sur les spores, nous suggérons un âge Gedinnien Supérieur pour cette zone. En Belgique, la zone s'étend de la partie supérieure des couches d'Oignies à l'ensemble des couches de St-Hubert ; au Pays de Galles, à la partie inférieure des Senni Beds. Deux espèces sont décrites : *Breconisporites breconensis* gen. et sp. nov. et *Emphanisporites zavallatus* sp. nov. et la base de la zone correspondante est définie par leur première apparition. La base et l'extension de la zone sont brièvement décrites et des coupes de référence proposées en Belgique et au Pays de Galles. Dans les deux régions, la nouvelle zone succède à la zone d'assemblage *micromatus-newportensis* et est distincte de celle-ci en ce que la nouvelle zone d'assemblage représente un changement majeur de la flore. Les genres *Aneurospora* et *Streelispota* sont amendés.

### INTRODUCTION

André Dumont (1848) divided the Lower Devonian into Gedinnian, Coblenzian and Ahrian. He defined the beginning of the Gedinnian at the base of a conglomeratic unit (Poudingue de Fépin) resting unconformably on the "Terrain Ardennais" (Cambrian). As described by Dumont, the top of the Gedinnian is marked by the uppermost occurrence of greenish shales and sandstones (Schistes de St-Hubert). Dorlodot (1900) originally used the term Siegenian as a stage in Belgium based on Kayser's (1881) "Siegener Grauwaacke" in the Siegerland, but traditionally the Siegen - Schichten in Siegerland are regarded as the type for the stage. Fossil finds in the basal Siegen-Schichten are rare but Schmidt (1959) recorded the heterostracan *Pteraspis* (*Rhinopteraspis*) *leachi* from the Siegerland. Subsequently Blieck and Jahnke (1980), after an extensive review of this material along with new Pteraspid material from the

Siegerland, reassigned Schmidt's fossil to *Rhinopteraspis dunensis*. Although the complete ranges of *R.dunensis* and *Althaspis leachi* have still to be determined, the finds of *dunensis* zonal fossils in basal Siegenian in the type area necessitates a reappraisal of the position of the Gedinnian/Siegenian boundary in the Ardennes and Anglo-Welsh areas. In the Ardennes *Althaspis leachi* (White) occurs in the St-Hubert Shales (White, 1956, p. 3). On Schmidt's interpretation the lower Siegen-Schichten is equivalent to at least a part of the St-Hubert Beds (upper Gedinnian *sensu* Dumont).

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*Althaspis leachi* and *Rhinopteraspis dunensis* occur in sequence in the Wihéries Beds (northern flank of the Dinant synclinorium) at a level which is, more or less equivalent, on the basis of spores (Steevens, 1982 a), to the top of St-Hubert Beds. Consequently the Blicek and Jahnke (1980) interpretation shows the Gedinnian/Siegenian boundary to occur, more or less, at the top of the St-Hubert Beds. In the Black Mountains and Brecon Beacons the only two vertebrate fossils are from loose blocks in quarries containing both the BZ, and overlying (III), palynological zones. *Rhinopteraspis dunensis* (*cornubica*) occurs in the Lower Senni Beds of the Black Mountains and *Althaspis senniensis* Loeffler and Thomas (1980), from lower Senni Beds of the Brecon Beacons. The fish evidence in the latter two areas of south Wales is therefore equivocal. However, on the Blicek and Jahnke interpretation of the Rhenish vertebrates, the *leachi* zone is uppermost Gedinnian and in Belgium *leachi* occurs in the BZ palynological zone. The latter zone is confined to the lower Senni Beds, which are, therefore, on the above interpretation, upper Gedinnian in age. In either event the important macrofloras from the Senni Beds, described in a series of publications (Edwards, 1968, 1969 a, 1969 b, 1970, 1980) overlie the BZ zone and are therefore Siegenian, and probably lower Siegenian, in age. Whereas that described by Leclercq (1942) at Nonceveux (Belgium), including *Zosterophyllum fertile*, is associated with *Belgicaspis crouchi* (Blicek, 1982) and occurs in beds estimated to be 34 m below the BZ zone and 14 m above beds containing spore assemblages of the MN zone. Floras from the Brown Clee Hill region (Shropshire) which occur above beds containing *Althaspis leachi* (Edwards and Richardson, 1974, p. 315) contain "specimens ... possibly related to *Zosterophyllum fertile*, but ... placed in *Zosterophyllum* sp." The associated spores, "although clearly unrepresentative of the spore flora of the upper part of the Ditton Group, are typically Dittonian ..." (Edwards and Richardson, 1974) (cf. fig. 1)

## ZONATION

*Breconisporites breconensis* - *Emphanisporites zaval-latus* (BZ) Assemblage zone.

Age : Uppermost Gedinnian.

### Reference sections for the base of the zone :

Nonceveux section along the road between Remouchamps and Trois-Ponts. Topographical map I.G.M., 1 : 25,000, Sheet 49, 3-4 ; Lambert grid X :

246500 and Y : 129750. Base of the zone 35 m above the base of Bois d'Ausse Beds.

Brecon Beacons, Glyn Tarell stream section, map reference SN 9752 2163. Base of the zone more or less coincides with the base of the Senni Beds, that is the lowest productive sample occurs within, but not at the base of the basal sandstone unit of the Senni Beds.

### Range of the zone :

At Nonceveux the zone includes at least 270 m of the Bois d'Ausse Beds. In the southern part of the Dinant synclinorium the zone covers at least 400 m of strata. It covers the lower 64 to 90 m of the Senni Beds in the Black Mountains and Brecon Beacons respectively.

**Description :** Incoming of bizonate spores with a distal annulate thickening (*B.breconensis*) and *Emphanisporites* with coarse distal sculpture and a distinct pattern of proximal muri which fuse towards the apex (*E.zavallatus*) ; incoming of forms with a flimsy zona (*Camptozonotriletes* cf. *caperatus*) and *Clivosisporites verrucata* McGregor, 1973 ; persistence of *Cirratiradites* sp. A (Streef et al., 1981), *Verrucosisporites* cf. *polygonalis* Lanninger 1968 and *Aneurospora* sp.N.

**Distribution :** Lower and middle Bois d'Ausse Beds, south-east part of Dinant synclinorium ; upper Oignies Beds and St-Hubert Beds, southern Dinant synclinorium. Brecon Beacons and Black Mountains, Powys and Gwent, south Wales ; subsurface Moesian Platform, Roumania (Beju, 1967) ; and possibly Shashuvian Suite, Kunkoyay Settlement, borehole 12, Lithuania, (Archangel'skaya, 1978).

## SYSTEMATIC DESCRIPTIONS

The figured spores are preserved in the collections of the Department of Palaeontology, University of Liège and the Department of Palaeontology (Palynology Section) British Museum (Natural History), London. Co-ordinates of specimens (light photomicrography), are given by England Finder (London).

### Genus *Emphanisporites* Mc Gregor 1961

Type species : *E. rotatus* Mc Gregor 1961

**Comments upon the genus :** Specimens may be ornamented by variously shaped proximal ridges which fuse to a variable extent near the proximal polar apex. Because ridge development is a matter of degree, the extreme variation observed on *E.zavallatus* sp. nov., is not regarded as a criterion for distinguishing a new genus.

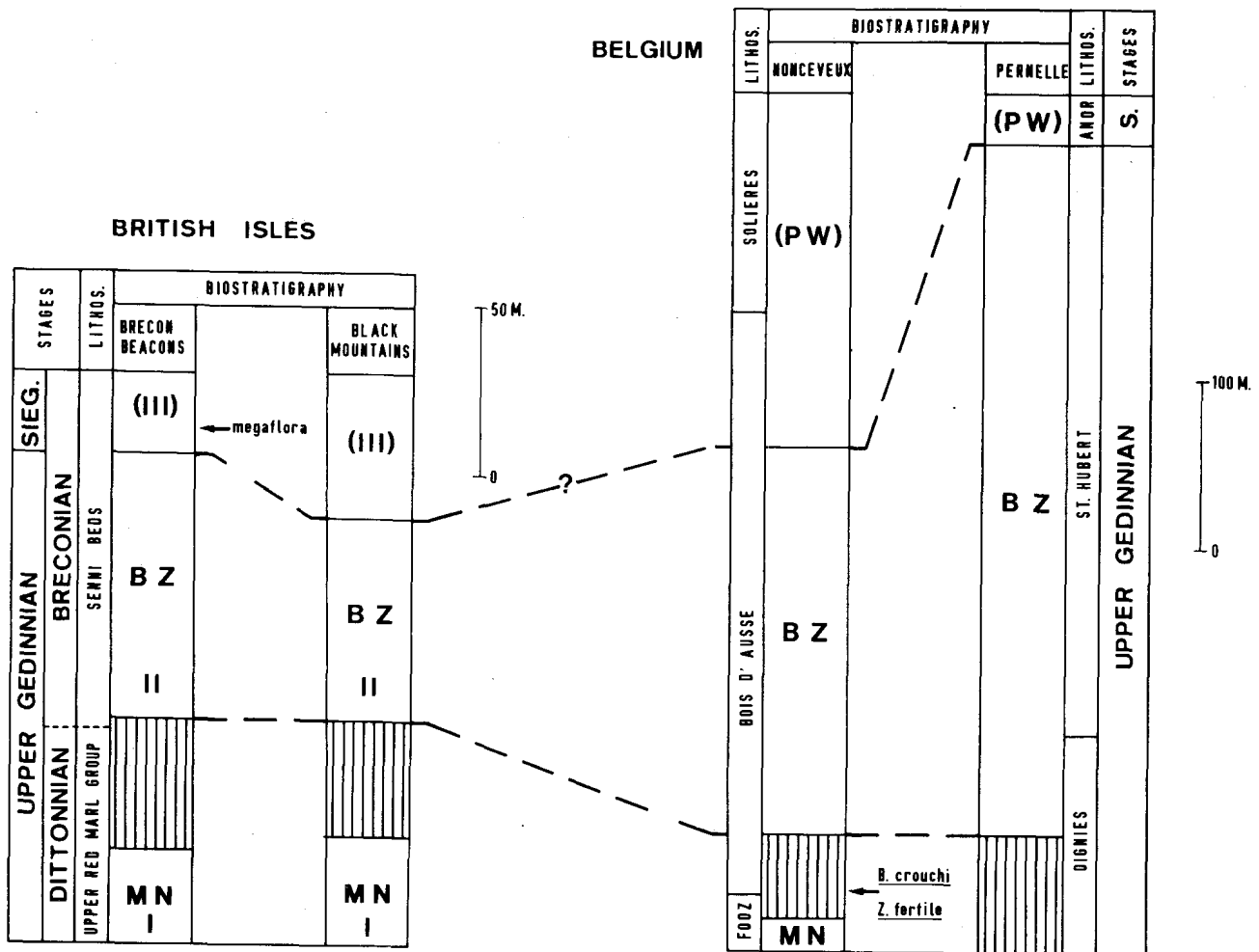


Figure 1.- Correlation between the British Isles and Belgium on the basis of palynological zones. For the extent of MN zone, see Richardson et al. 1981 and Steemans, 1982 a,b.

*Emphanisporites zavallatus* sp. nov.  
Pl. 1, figs. 1-6

1981 *Emphanisporites* sp. C Steemans, pl. 2, figs. 1 and 2  
1981 *Emphanisporites* sp. C Steemans in Streel et al., pl. 1, figs. 12-14.

**Diagnosis :** An *Emphanisporites* with distinct labrate sutures, unconnected at the apex, and distinct *curvaturae perfectae*; each contact area with radial muri which fuse near the apex, the outer pair of muri are longer, most pronounced and parallel with the labra; distally and proximo-equatorially sculptured by parallel-sided to slightly tapered spinae with flat-topped to slightly rounded truncated apices, elements sometimes biform and bearing coni, broad based biform elements are also present.

**Holotype :** Diameter 35  $\mu$ m, sample no. 78, slide no. 780, England finder reference F 32/3-V.61170.

**Type locality :** Heol Senni Quarry, Powys, Wales; map reference SN 9143 2218.

**Type horizon :** Base of the quarry section, siltstone in multistorey channel sandstone north side of the quarry, lower Senni Beds, circa 53 m above the base of the unit.

**Derivation of name :** Za, greek, very, vallo-vallatus, latin, surrounded by a wall or rampart. Emphasizing the strongly developed muri which parallel the labra.

**Description :** Amb circular, subcircular to subtriangular, spores originally subspherical with flattened proximal pole, may be preserved in oblique compression. Exine

distally and equatorially 0.5 to 2.5  $\mu\text{m}$  thick, thinner over the contact areas. Laesurae labrate, lips distinct up to 2.5  $\mu\text{m}$  wide and each trilete branch may be fused together and single, or separated into paired labra, on a single specimen; rays equal 2/3 to 8/9 amb radius and terminate in curvatural ridges which are usually distinct and 0.5 to more than 1  $\mu\text{m}$  in width. Radial muri 4 to 8 in each inter radial sector some of which bifurcate towards but do not reach, the apex and more commonly bifurcate towards the equator; muri 1–4  $\mu\text{m}$  wide, converge and fuse near the apex to form a thickening which is sometimes prominent and up to 9  $\mu\text{m}$  wide; outer muri of each sector prominent and separated from the labra by depressions <0.5 to 6  $\mu\text{m}$  wide, commonly 0.5 to 2  $\mu\text{m}$ . Exine outside the contact areas sculptured, elements in profile consist of a mixture of parallel-sided units with rounded to flattened sharply truncated apices, spinose elements, biform spinae either with tubercular bases and slender conate tips or with more or less parallel-sided trunks and sharply truncated near the apex to a slender conate termination or with a constriction at a variable distance from the apex.

Elements more or less rounded in plan, basal width 0.5 to 2.5  $\mu\text{m}$ , height 0.5 to 5  $\mu\text{m}$ , and 0.5 to 3  $\mu\text{m}$  apart (small and large elements may occur together on a single specimen).

**Dimensions** : 27 to 46  $\mu\text{m}$ , mode 35  $\mu\text{m}$ , 236 specimens measured.

**Remarks** : The sculptural elements of the Belgium specimens appear to have pointed tips but this may be a preservational feature.

Specimens which lack the prominent proximal ridges but are otherwise identical also occur in the Senni Beds.

**Comparison** : *Emphanisporites nodosus* var. *nodosus* and *E. nodosus* var. *gracilis* Schultz, 1968, have a similar proximal pattern of ridges and labra but the distal sculpture is cristate.

**Distribution** : Appears at 2 to 5 m. from the base of the Senni Beds and is confined to the *breconensis-zavallatus* zone, Brecon Beacons and Black Mountains, south Wales. In the south east part of the Dinant synclinorium, Belgium, *E. zavallatus* appears near the base of the Bois d'Ausse Beds and occurs in the lower and middle part of these beds. In the southern part of the Dinant synclinorium this species appears in the upper part of the Oignies Beds and continues in the St-Hubert Beds.

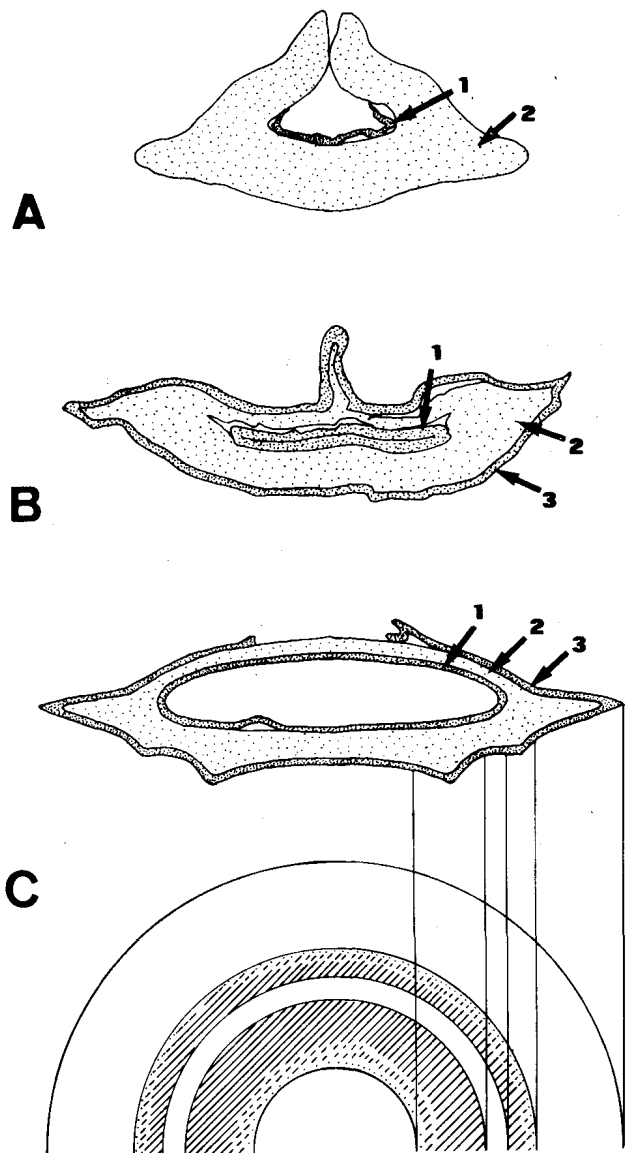


Figure 2.— Diagrams to show the structure of three (bi)zonate spores.

A. *Cirratriradites elegans* (Waltz) Potonié and Kremp in Hughes et al. 1962. (Lower carboniferous). Drawing from pl. 38, fig. 7: section showing two-layered exine.

1. intexine 2. ? inner exoexine.

B. *Cirratriradites avius* Allen 1965. (Middle–Upper Devonian). Drawing from pl. 99, fig. 12: section showing a three-layered exine.

1. intexine  
2. inner exoexine  
3. outer exoexine.

C. *Breconisporites breconensis* gen. & spec. nov. (Lower Devonian). Reconstruction of hypothetical section showing a three-layered exine.

1. ? intexine  
2. inner exoexine  
3. outer exoexine.

Diagrammatic polar view showing relative thicknesses as view in transmitted light.

**Genus *Breconisporites* gen. nov.**

Type species : *Breconisporites breconensis* gen. et sp. nov.

**Diagnosis** : Radial, trilete, miospores with a differentially thickened zona (bizonate). Exine probably two-layered (possibly 3 layered), layers closely appressed over most of the surface. Contact areas distinct, characterised by three inter-radial, transverse "cristate" - plicated "ridges" and small radial folds probably produced by rupture of a thin exo-exinal layer in the polar region. Zona with a narrow inner thickening indistinctly separated from a thinner outer zone. Proximally laevigate, distally laevigate, infragranulate or sculptured with cones and, or, granules.

Type species distally annulate.

**Comparison** : The genera *Lycospora*, *Cirratiradites*, *Cingulizonates* and *Amicosporites* have some features in common with *Breconisporites* but none has the thin apical area bordered by transverse plicated "ridges". The cingulizonate forms of *Lycospora sensu* Somers 1972 are similar in equatorial structure. Specimens of *Cirratiradites* from the Carboniferous have a more extensive zona but their structure is basically different from *Breconisporites* in which there is a greater differentiation between the thickness of the proximal and distal exine over the polar areas (compare the specimen and thin section of Carboniferous *Cirratiradites*, in Hughes, Dettman and Playford, 1962 pl. 38, figs. 5 and 7 with Devonian "*Cirratiradites*" Allen 1965, pl. 10, figs. 10, 11 and 12). Carboniferous *Cirratiradites* may be also distally foveolate. *Cingulizonates* has a cingulum which is sharply differentiated from the central area (a cuesta). *Amicosporites* has a distal annulus as in the type species of *Breconisporites* but the equatorial thickening is not bizonate. *Camptozonotriletes* has a distal sculpture of irregular, in part connected, ridges.

**Remarks** : The authors' interpretation of the structure of *Breconisporites* is shown in text figure 2. In this interpretation there is probably a thin outer exoexinal layer which is disrupted over the proximal apical area, an inner part of the exoexine which is proximally relatively thin and distally thick and additionally is differentially thickened distally over one or two areas, the first is the inner part of the zona and the second forms a annulus, more or less concentric with the equator, and occurring only in the type species. The evidence for the thin outer layer is the nature of the folds and "cristate" plicate "ridges" around the proximal pole. That such a thin outer exinal layer really exists in Middle Devonian zonate spores can be seen from a

study of the thin sections of *Cirratiradites avius* (Allen, pl. 99, figs. 11 and 12). The latter species has a comparable differentiated zona to *B. breconensis*. All the species allocated herein to *Breconisporites* show the two characters of proximal folds, or ridges, and a differentially thickened zona with an inner narrow thickened area and an outer thinner part. Specimens viewed under the S.E.M. (pl. 1, figs. 7-8) show that this thickening is not on the proximal surface.

*Breconisporites breconensis* sp. nov.

Pl. 1, figs. 7-11

1967 *Cirratiradites* sp. F, Streele, pl. V, ph. 56-58

1967 *Cingulizonates* ? sp. 1, Beju, pl. 1, fig. 27

1981 *Cirratiradites* sp. F, Streele in Steemans, pl. 2, fig. 13.

1981 *Cirratiradites* sp. F, Streele in Streele et al., pl. 3, figs. 5-9

**Holotype** : Maximum diameter 41.5  $\mu\text{m}$ , Brecon Beacons sample number 119, slide number 1227, England Finder co-ordinates Q40/4.V-61174.

**Type locality** : Byddagai Valley, map reference SN 9868 2267.

**Type horizon** : Lower Senni Beds circa 5 m from the base of the unit.

**Diagnosis** : A *Breconisporites* with a distal annulus.

**Description** : Amb subtriangular with convex sides and rounded apices. Exine laevigate, probably two-layered or possibly three-layered, outer layer of the exoexine thin and possibly absent over the proximal polar region, inner exoexine forming a differentially thickened zona ; a darkened, ? thickened, area occurs over the proximal pole in some specimens, a thin intexine may also be present. Proximal plicate ridges surround the thin apical area, ridges up to 1.5  $\mu\text{m}$  wide and high best seen under the S.E.M. (pl. 1, fig. 8). Distal surface with a distinct annular thickening 4-13  $\mu\text{m}$  wide (usually 6-9  $\mu\text{m}$ ) which may be partially, but occasionally completely, coincident with the cingulum giving the appearance, in polar compression, of a broad thickened inner zone to the cingulum (pl.1, fig.11) or may be just inside the cingulum and separated from it by a furrow < 0.5 to 3  $\mu\text{m}$  wide. Exoexine forms a differentially thickened zona, outer zona thin, 1.5 to 8  $\mu\text{m}$  wide, grades into inner thickened zona 1 to 5.5  $\mu\text{m}$  wide. Sutures indistinct, accompanied by straight to slightly sinuous smooth lips or folds, < 0.5 to 2  $\mu\text{m}$  wide and high, two thirds or nearly equal, to the spore radius, sometimes terminate at the inner part of the cingulum.

**Size range :** Maximum diameter 33–63  $\mu\text{m}$ , mode 41  $\mu\text{m}$ , 422 specimens measured.

**Comparison and remarks :** *Cingulizonates glaber* Archangel'skaya 1978 has distinct *curvaturae perfectae* and lacks a distal annulus (Archangel'skaya, pl. 11, figs. 9 to 12 see especially lateral view fig. 12).

**Distribution :** Appears at the base of the Senni Beds and continues through 180 m of strata of the lower and middle Senni Beds. Common in the *breconensis-zavallatus* zone, Brecon Beacons and Black Mountains, south Wales. In the south-east part of the Dinant Basin, Belgium, *B. breconensis* appears near the base of Bois d'Ausse Beds, is present in the lower and middle part of these beds (BZ zone), and continues sporadically through all the following Siegenian formations up to and including the Acoz Beds. In the southern part of the Dinant Basin this species appears in the upper part of the Oignies Beds and continues in the St-Hubert Beds.

#### Other species referred to the genus

*Breconisporites* (*Cingulizonates*) *glaber* (Archangel'skaya) comb. nov.

1978, *Cingulizonates glaber* Archangel'skaya, p. 252, pl. 11, figs. 9–12

*Breconisporites* (*Lycospora*) *culpa* (Allen) comb. nov.  
1965 *Lycospora culpa* Allen, p. 713, figs. 7 and 8.

*Cirratriradites avius* Allen 1965 has a similar structure and may represent another species of *Breconisporites* but the specimens illustrated by Allen do not show the characteristic "plicated folds" on the proximal surface.

#### Genus *Streelispora* (Richardson and Lister) emend.

**Type species :** *Streelispora newportensis* (Chaloner and Stree) Richardson and Lister, 1969.

**Emended diagnosis.** Radial, trilete, miospores with more or less equatorial crassitude. Exine two-layered (possibly three-layered), layers closely appressed over most of the surface. Contact areas distinct, characterised by tangential folds and small radial folds of the outer thin exo-exinal layer. Spores distally sculptured with grana, coni, spinae or biform elements. Proximally smooth or with interradsial papillae.

**Comparison :** *Breconisporites* gen. nov. is bizonate, *Aneurospora* (Stree) emend. does not have the proximal folds indicating a thin outer exoexinal layer, *Leonispora* Cramer and Diez has a similar structure but is distally laevigate.

**Remarks :** The thin layer, outer exoexine, seen on several Devonian spores sectioned by Allen (1965) is also apparent on a number of Gedinnian spores in addition to *Breconisporites*. The species *S. newportensis*, *S. granulata*, *Leonispora argovejae* for example all show a series of tangential folds on the proximal surface which often radiate from, or surround, proximal papillate thickenings which form part of a second, and thicker, underlying exoexinal layer. This membrane sometimes appears ruptured in the proximal polar area indicating a structure akin to *Breconisporites*.

#### Species included in *Streelispora* are as follows :

*Streelispora newportensis* (Chaloner and Stree) Richardson and Lister 1969, pl. 41, figs. 3–6.

1981 *Granulatisporites newportensis* var. A, Steemans, pl. 1, fig. 6.

*Streelispora granulata* Richardson and Lister, 1969, pl. 41, figs 7–9.

#### Species included in *Leonispora* are as follows :

*Leonispora argovejae* Cramer and Diez 1975, pl. 1, fig. 3.  
1978 *Leonispora argovejae* Cramer and Diez in Rodriguez, pl. 4, figs. 7 and 11.

1978 *Leonispora* aff. *argovejae* Cramer and Diez in Archangel'skaya, pl. 11, figs. 5–6.

#### Genus *Aneurospora* (Stree) emend.

**Type species :** *Aneurospora goensis* Stree 1964.

**Neotype :** The holotype (pl. 1, fig. 18, Stree 1964) has been destroyed. A new type is therefore here designated as follows : Lele and Stree 1969 pl. 1, fig. 22, slide 3114, ref.grid. n<sup>o</sup> 3 : 2409, Goé quarry, bed V, sample 27 III.

**Emended diagnosis :** Radial, trilete, miospores with a subequatorial proximal region which is especially rigid and probably thickened so as to appear like a dark band (equatorial crassitude) ; the inner limits of it are often ill-defined and its width is also  $\pm$  variable even in the same specimen. Spores distally sculptured with grana, coni, spinae and biform elements. Proximally smooth, or with interradsial papillae, or variously sculptured.

**Comparison :** *Synorisporites* Richardson and Lister has a distal sculpture of verrucae and/or muri. Some species of *Lycospora* (Ibrahim) Somers (e.g. some specimens of *L. orbicula* (Potonié and Kremp) Smith and Butterworth in Somers, 1972, pl. XIV, fig. 11), appear similar in structural organisation to *Aneurospora* but a complete review of such forms is beyond the scope of this work.

*Ambitisporites* Hoffmeister has a similar structure but is distally laevigate.

**Species included in *Aneurospora*** (i.e. lacking the proximal differentiation of *Streelispora*) are as follows :

*Aneurospora* (*Granulatisporites*) sp. N var. B comb. nov.  
1981 *Granulatisporites newportensis* var. B Steemans, pl. 1, figs. 7-8.

1981 *Granulatisporites newportensis* var. C (printing error, really var. B) Streel *et al.*, pl. 2, fig. 14.

1982 b *Granulatisporites newportensis* var. B in Steemans, pl. 1, figs. 2-3.

*Aneurospora* (*Granulatisporites*) sp. N var. C comb. nov.  
1981 *Granulatisporites newportensis* var. C Steemans, pl. 1, fig. 9.

*Aneurospora* (*Anapiculatisporites*) *isidori* (Cramer and Diez) comb. nov.

1975 *Anapiculatisporites isidori* Cramer and Diez, pl. 1, figs. 18-19.

1981 *Anapiculatisporites isidori* in Streel *et al.*, pl. 2, fig. 2-3.

*Aneurospora* (*Streelispora*) *riegelensis* (Rodriguez) comb. nov.

1978 *Streelispora riegelensis* Rodriguez, pl. 4, fig. 13.

*Aneurospora* (*Lycospora*) *bracteola* (Butterworth and Williams) comb. nov.

1958 *Lycospora bracteola* Butterworth and Williams, pl. 3, figs. 26-27.

**Species excluded from *Aneurospora*.**

*Ambitisporites* (*Retusotriletes*) *semizonalis* (McGregor) comb. nov.

1964 *Retusotriletes semizonalis* McGregor, pl. 2, figs. 1-5.

1969 *Aneurospora semizonalis* (McGregor) Lele & Streel, pl. 2, fig. 29.

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## PLATE 1

x 1000 unless stated otherwise.

1-6 *Emphanisporites zavallatus* sp. nov.

1-2 S.E.M. showing proximal area and sculpture, trilete ridges which are separated at the apex and fusion of radial ridges towards spore apex, sample 137 (stub 137/1), V 61173, Senni Beds. 1. x 2400, 2. x 3700.

3. Holotype, sample 78, slide 780, F 32/3, V 61170, Héol Senni Quarry, Senni Beds, Brecon Beacons.

4-5 Showing well developed *curvaturae perfectae* and rod-like spinae elements, sample 78, slide 782, E 36, Senni Beds.

5. x 2000.

6. Showing biform spinae elements, sample 132, slide 1530, L 4/2, V 61171, Senni Beds. x 2000.

7-11 *Breconisporites breconensis* gen. nov. et sp. nov.

7. S.E.M. showing proximal area, sculpture and trilete ridges, St Hubert 121, Pernelle Valley, Belgium.

8. S.E.M. showing proximal area, trilete ridges and "cristae", St Hubert 121, Pernelle Valley, Belgium.

9. Holotype, sample 119, slide 1227, Q 40/4, V 61174, Byddegai valley, lower Senni Beds, Brecon Beacons.

10. Specimen in oblique compression showing distal annulus, furrow and bizonate equatorial extension, sample 78, slide 786, P 33/3, V 61175, Senni Beds.

11. Specimen in which furrow is not seen, proximal view, polar compression, sample 116, slide 1195, W 10/2 - V 12/4, V 61176, Senni Beds.



