

Supplementary Material

Ordovician–Silurian dispersed spore assemblages

Locality codes refer to those plotted on the palaeogeographical base maps. Data compiled by Philippe Steemans. Certain reported assemblages are omitted either because they are poorly age constrained or too poorly preserved/too high thermal maturity to enable accurate identification. Other assemblages are omitted where spore identification is questionable. Cited references refer to the original paper that reported on the spore assemblage plus subsequent papers that have been used in taxonomic updates of the species list. Note that Tremadoc–Arenig records report only terrestrial spore-like palynomorphs of questionable affinities and are marked with an asterisk.

Tremadoc

Peri-Gondwana (Armorica) – Spain: **Attritasporites messaoudi* (Fombella 1982).

Southern Gondwana – Algeria: **Abacum rudi*, **A. messaoudi*, **A. scabra*, **A. velata* (Combaz 1967; Pittau 1985).

SW Gondwana – Saudi Arabia: **Virgatasporites rudii* (Molyneux & Al-Hajri 2000).

Arenig

Peri-Gondwana (Perunica) – Czech Republic: **Attritasporites messaoudi*, **A. velata*, *

Virgatasporites rudi, **V. baccatus* (Vavrdová 1990a, b).

Llanvirn

Peri-Gondwana (Perunica) – Czech Republic: **Virgatasporites rudi* (Vavrdová 1990a, b).

SW Gondwana – Saudi Arabia: *Stegambiquadrella contenta* (McClure 1988; Gray 1988; Strother *et al.* 1996; Molyneux & Al-Hajri 2000).

Caradoc

Avalonia – UK, Shropshire: *Abditusdyadus histosus*, *Dyadospora murusdensa*, *Laevolancis chibrikovae*, *Moyeria cabottii*, *Pseudodyadospora laevigata*, *Rimosotetras problematica*,

Rugosphaera cerebrata, *Segestrespora laevigata*, *S. rugosa*, *Sphaerasaccus glabellus*,
Strophomorpha ovata, *Tetraedraletes grayae*, *T. medinensis*, *Velatitetras laevigata*, *V. rugosa*,
V. rugulata, *Vestitusdyadus qalibahinus* (Burgess 1991; Richardson 1988; Rubinstein & Vaccari
2004; Steemans *et al.* 1996; Steemans *et al.* 2000; Strother 1991; Turner 1984; Wellman 1996;
Wellman & Richardson 1993).

Southern Gondwana – Libya: *Ambitisporites vavrdovii*, *Imperfectotriletes patinatus*,
Tetraedraletes medinensis (Gray *et al.* 1982; Steemans *et al.* 1996; Steemans *et al.* 2000;
Wellman & Richardson 1993).

SW Gondwana – Saudi Arabia: *Ambitisporites* sp., *Chelinospora* sp., *Leiotriletes* sp., ?
Synorisporites sp. (Steemans *et al.* 2009).

Ashgill

Laurentia – USA: *Nodospora retimembrana*, *Tetraedraletes grayii*, *T. medinensis*, *T.*
medinensis parvus, *Velatitetras laevigata*, *Velatitetras reticulata*, *V. retimembrana*, *V. rugosa*
(Beck & Strother 2008; Burgess 1991; Gray 1985, 1988; Steemans *et al.* 1996; Strother 1991;
Taylor 1995*a, b*; Wellman & Richardson 1993)

Baltica – Germany: *Dyadospora murusdensa*, *Rugosphaera tuscarorensis* (Reitz & Heuse
1994).

Avalonia – Nova Scotia, Canada: *Tetraedraletes medinensis* (Beck & Strother 2008).

Avalonia – Belgium: *Ambitisporites avitus*, *Dyadospora murusattenuata*, *Imperfectotriletes*
patinatus, *I. vavrdovae*, *Moyeria cabottii*, *Pseudodyadospora laevigata*, *Rugosphaera cerebrata*,
R. tuscarorensis, *Segestrespora membranifera*, *S. rugosa*, *Stegambiquadrella contenta*,
Tetraedraletes grayae, *T. medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*,
V. rugosa (Martin 1973; Steemans 2001; Steemans *et al.* 1996; Wellman & Richardson 1993).

Avalonia – southern Britain: *Ambitisporites avitus*, *Imperfectotriletes vavrdovae*, *Rimosotetras problematica*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*, *Tetraedraletes medinensis parvus*, *Velatitetras laevigata*, *V. retimembrana* (Burgess 1991; Steemans et al. 1996).

Peri-Gondwana (Moesian Platform) – Bulgaria: *Tetraedraletes medinensis* (Lakova et al. 1992).

Peri-Gondwana (Perunica) – Czech Republic: *Chaetosporites pollensimillis*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *Laevolancis divellomedium*, *Pseudodyadospora laevigata*, *Quadrisporites horridus*, *Q. variabilis*, *Rugosphaera cerebrata*, *R. tuscarorensis*, *Segestrespora membranifera*, *Stegambiquadrella contenta*, *Tetraedraletes grayii*, *T. medinensis*, *Tritonialetes vacuolus*, *Vallatialetes aureolatus*, *Velatitetras retimembrana*, *V. retimembrana*, *V. rugosa* (Gray 1991; Steemans et al. 1996; Steemans et al. 2000; Strother 1991; Vavrdová 1982, 1984, 1988, 1989; Wellman 1996).

Peri-Gondwana (Taurides) – Turkey: *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Pseudodyadospora laevigata*, *Quadrisporites granulatus*, *Rimosotetras problematica*, *Rugosphaera cerebrata*, *Segestrespora burgessii*, *S. laevigata*, *S. membranifera*, *S. rugosa*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa* (Steemans et al. 1996; Steemans et al. 2000).

SW Gondwana – Saudi Arabia : *Ambitisporites* sp., *Chelinospora* sp., *Leiotriletes* sp., ?
Synorisporites sp (Steemans et al. 2009).

Southern Gondwana – Libya: *Dyadospora murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Pachytetras rugosa*, *Rimosotetras problematica*, *Rugosphaera cerebrata*, *Segestrespora laevigata*, *S. rugosa*, *Tetraedraletes grayae*, *T. medinensis*, *Velatitetras rugulata*

(Burgess 1991; Gray 1991; Gray *et al.* 1982; Hill *et al.* 1985; Richardson 1988; Steemans *et al.* 1996; Steemans *et al.* 2000; Wellman 1996; Wellman & Richardson 1993).

Northern Gondwana – South Africa: *Tetraedraletes medinensis*, *T. medinensis parvus*

(Burgess 1991; Gray 1991; Gray *et al.* 1986; Strother 1991; Wellman & Richardson 1993).

Tarim Terrane – Xinjiang, China: *Dyadospora murusattenuata*, *D. murusdensa*, *Laevolancis chibrikovae*, *Pseudodyadospora laevigata*, *Segestrespora rugosa*, *Tetraedraletes medinensis*, *Velatitetras laevigata* (Rubinstein & Vaccari 2004; Steemans *et al.* 2000; Wang *et al.* 1997).

South China Terrane – Zhejiang, China: *Dyadospora murusattenuata*, *Strophomorpha ovata*, *Tetraedraletes medinensis*, *Velatitetras retimembrana* (Yin & He 2000).

Hirnantian

Avalonia – UK: *Ambitisporites avitus*, *Imperfectotriletes vavrdovae*, *Pseudodyadospora laevigata*, *Rimosotetras problematica*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*, *Velatitetras laevigata*, *V. retimembrana* (Burgess 1991; Steemans *et al.* 1996; Steemans *et al.* 2000).

SW Gondwana – Saudi Arabia: *Ambitisporites* sp., *Chelinospora* sp., *Imperfectotriletes vavrdovae*, *Laevolancis divellomedia*, *Leiotriletes* sp., ?*Synorisporites* sp (Miller & Al-Ruwaili 2007; Steemans *et al.* 2009).

Llandovery

Laurentia – Anticosti, Canada: *Tetraedraletes medinensis*, *Velatitetras retimembrana* (Duffield 1985; Steemans *et al.* 1996; Strother 1991; Wellman & Richardson 1993).

Laurentia – USA: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. patinatus*, *I. vavrdovae*, *Nodospora oylei*, *Pseudodyadospora laevigata*, *P. rugosa*, *Rimosotetras problematica*, *Rugosphaera tuscarorensis*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*,

Stegambiquadrella contenta, *Velatitetras retimembrana*, *V. rugosa* (Burgess 1991; Burgess & Richardson 1991; Gensel *et al.* 1990; Gray 1985, 1991; Gray & Boucot 1971; Gray *et al.* 1982; Gray *et al.* 1992; Johnson 1985; Miller & Eames 1982; Steemans *et al.* 1996; Steemans *et al.* 2000; Strother 1991; Strother & Traverse 1979; Wellman & Richardson 1993).

Avalonia – Belgium: *Moyeria cabottii* (Martin 1973; Wellman & Richardson 1993).

Avalonia – Ireland: *Ambitisporites avitus*, *A. dilutus* (Emo & Smith 1978).

Peri-Gondwana (Moesian Platform) – Bulgaria: *Tetraedraletes medinensis* (Lakova *et al.* 1992).

Peri-Gondwana (Iberia) – Spain: *Ambitisporites avitus*, *A. dilutes* (Rodríguez 1983).

SW Gondwana – Saudi Arabia: *Tetraedraletes medinensis* (Wellman *et al.* 2000a,b).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusdensa*, *Rimosotetras problematica* (Hill *et al.* 1985; Hoffmeister 1959; Richardson 1985; Steemans *et al.* 1996; Wellman & Richardson 1993).

Eastern Gondwana – Brazil: *Rugosphaera rugosa*, *Tetraedraletes medinensis* (Gray *et al.* 1985; Le Hérissé *et al.* 2001; Strother 1991; Wellman & Richardson 1993).

Eastern Gondwana – Paraguay: *Laevolancis chibrikovae*, *L. divellomedium*, *Pseudodyadospora laevigata*, *Segestrespora rugosa*, *Sphaerasaccus glabellus*, *Vellatitetras rugosa* (Mendlowicz Mauller *et al.* 2004).

Northern Gondwana – South Africa: *Tetraedraletes medinensis*, *T. medinensis parvus* (Burgess 1991; Gray 1991; Gray *et al.* 1986; Strother 1991; Wellman & Richardson 1993).

Llandovery: Rhuddanian

Laurentia – Canada: *Tetraedraletes medinensis* (Eley & Legault 1988; Gray 1991).

Laurentia – USA: *Dyadospora murusattenuata*, *D. murusdensa*, *Rugosphaera cerebra*, *R. tuscarorensis*, *Segestrespora laevigata*, *Strophomorpha ovata*, *Tetraedraletes medinensis*, *Velatitetras retimembrana*, *V. rugosa*, *Vermiculatisphaera obscura* (Beck & Strother 2008; Gray 1991; Miller & Eames 1982; Strother 1991; Wellman 1996; Wellman & Richardson 1993).

Avalonia – Nova Scotia, Canada: *Tetraedraletes medinensis* (Beck & Strother 2001)

Avalonia – UK: *Ambitisporites avitus*, *Dyadospora murusattenuata*, *D. murusattenuata*, *Hispanaediscus lamontii*, *Imperfectotriletes vavrdovae*, *Rimosotetras problematica*, *Rugosphaera cerebra*, *Segestrespora burgessii*, *S. laevigata*, *S. membranifera*, *S. rugosa*, *Strophomorpha ovata*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa*, *V. rugulata* (Beck & Strother 2008; Burgess 1991; Richardson 1996; Steemans *et al.* 1996; Steemans *et al.* 2000; Wellman 1993, 1996; Wellman & Richardson 1993).

SW Gondwana – Saudi Arabia: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *A. dilutus*, *Chelinohilates maculatus*, *Complectitetras alhajrii*, *Dyadaspora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis chibrikovae*, *L. divellomedia*, *L. divellomedia*, *L. plicata*, *Pachytetras rugosa*, *Pseudodyadospora laevigata*, *P. petasus*, *Rimosotetras problematica*, *Rugosphaera tuscarorensis*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*, *Sphaerasaccus glabellus*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa*, *Vestitusdyadus qalibahinus* (Steemans *et al.* 2000; Wellman *et al.* 2000a,b).

Southern Gondwana – Libya: *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Pseudodyadospora rugosa*, *Rimosotetras problematica*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*, *Tetraedraletes grayae*, *T. medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa*, *V. rugulata* (Burgess 1991; Gray 1991;

Hill *et al.* 1985; Richardson 1988; Steemans *et al.* 1996; Steemans *et al.* 2000; Strother 1991; Wellman 1996; Wellman & Richardson 1993).

Eastern Gondwana – Argentina: *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis chibrikovae*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Segestrespora laevigata*, *S. membranifera*, *Sphaerasaccus glabellus*, *Tetraedraletes medinensis*, *Velatitetras laevigata*, *V. retimembrana*, *V. rugosa*, *Vestitusdyadus qalibahinus* (Rubinstein & Vaccari 2004).

Eastern Gondwana – Brazil: *Abditusdyadus laevigatus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia*, *Pseudodyadospora laevigata*, *Rimosotetras problematica*, *Segestrespora laevigata*, *S. membranifera*, *S. rugosa*, *Sphaerasaccus glabellus*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa* (Mizusaki *et al.* 2002).

Eastern Gondwana – Paraguay: *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia*, *Rimosotetras problematica*, *Segestrespora laevigata*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana* (Mendlowicz Mauller *et al.* 2004; Steemans & Pereira 2002).

South China Terrane – Zhejiang, China: *Dyadospora murusattenuata*, *Strophomorpha ovata*, *Velatitetras retimembrana* (Yin & He 2000).

Llandovery (Aeronian)

Laurentia – USA: *Nodospora rugosa*, *Velatitetras rugosa* (Gray 1985).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *Tetraedraletes medinensis* (Beck & Strother 2001).

Avalonia – UK: *Ambitisporites dilutus*, *Imperfectotriletes vavrdovae*, *Tetrahedraletes medinensis parvus*, *Velatitetras retimembrana* (Burgess 1991).

Western Gondwana – Iraq: *Ambitisporites avitus* (Al-Ameri *et al.* 1991).

SW Gondwana – Saudi Arabia: *Ambitisporites avitus*, *A. dilutus*, *Chelinohilates maculatus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis chibrikovae*, *L. divellomedia*, *L. plicata*, *Pseudodyadospora laevigata*, *P. petasus*, *Rimosotetras problematica*, *Tetrahedraletes medinensis*, *Velatitetras laevigata*, *V. rugosa* (Stemans *et al.* 2000).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Pseudodyadospora rugosa*, *Rimosotetras problematica*, *Segestrespora membranifera*, *S. rugosa*, *Tetrahedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa*, *V. rugulata* (Burgess 1991; Gray 1991; Hill *et al.* 1985; Richardson 1985, 1988; Stemans *et al.* 1996; Stemans *et al.* 2000; Strother 1991; Wellman 1996; Wellman & Richardson 1993).

Eastern Gondwana – Brazil: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia*, *Pseudodyadospora laevigata*, *Rimosotetras problematica*, *Rugosphaera cerebra*, *Rugosphaera rugosa*, *Segestrespora burgessii*, *S. laevigata*, *S. membranifera*, *S. rugosa*, *Sphaerasaccus glabellus*, *Tetrahedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa* (Le Hérissé *et al.* 2001; Mizusaki *et al.* 2002).

Eastern Gondwana – Paraguay: *Ambitisporites avitus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusttanuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis*

divellomedia, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Rugosphaera cerebra*, *R. rugosa*, *R. tuscarorensis*, *Segestrespora laevigata*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa* (Mendlowicz Mauller *et al.* 2004).

South China Terrane – Zhejiang, China: *Dyadospora murusattenuata*, *Strophomorpha ovata*, *Velatitetras retimembrana* (Yin & He 2000).

Llandovery (Telychian)

Laurentia USA: *Ambitisporites avitus*.

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. dilutus*, *Laevolancis divellomedia*, *Tetraedraletes medinensis* (Beck & Strother 2001).

Avalonia – Ireland: *Tetraedraletes medinensis* (Maziane-Serraj *et al.* 2000).

Avalonia – UK: *Ambitisporites dilutus*, *Tetraedraletes medinensis parvus* (Burgess 1991).

Western Gondwana – Iraq: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Retusotriletes warringtonii* (Al-Ameri *et al.* 1991).

SW Gondwana – Saudi Arabia: *Ambitisporites avitus-dilutus* Morphon, *Archaeozonotriletes chulus*, *Dyadospora murusattenuata – murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia-plicata* Morphon, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *R. problematica*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. rugosa* (Steevens *et al.* 2000).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *A. dilutus*, *Dyadospora murusattenuata*, *D. murusattenuata*, *D. murusdensa*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Pseudodyadospora rugosa*, *Rimosotetras problematica*, *R. problematica*, *Segestrespora rugosa*, *Tetraedraletes medinensis*, *T. medinensis*, *Velatitetras rugulata* (Burgess 1991; Gray 1991; Hill

et al. 1985; Richardson 1988; Steemans *et al.* 1996; Steemans *et al.* 2000; Strother 1991; Wellman 1996; Wellman & Richardson 1993).

Eastern Gondwana – Argentina: *Hispanaediscus verrucatus*, *Laevolancis divellomedia* (Rubinstein & Brussa 1999).

Eastern Gondwana – Brazil: *Ambitisporites avitus*, *A. avitus-dilutus morphon*, *Imperfectotriletes vavrdovae*, *I. vavrdovae*, *Laevolancis divellomedia*, *L. divellomedia*, *Rimosotetras problematica*, *R. problematica*, *Rugosphaera cerebra*, *R. rugosa*, *Segestrespora burgessii*, *S. laevigata*, *S. rugosa*, *Tetraedraletes medinensis*, *Velatitetras anatoliensis*, *V. laevigata*, *V. retimembrana*, *V. rugosa* (Le Hérissé *et al.* 2001).

Eastern Gondwana – Paraguay: *Ambitisporites avitus*, *A. avitus-dilutus Morphon*, *A. dilutus*, *Archaeozonotriletes chulus*, *Archaeozonotriletes chulus-nanus Morphon*, *Dyadospora murusattenuata*, *D. murusttanuata-murusdensa Morphon*, *Laevolancis divellomedia*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *R. problematica*, *Tetraedraletes medinensis*, *T. medinensis*, *Velatitetras anatoliensis* (Mendlowicz Mauller *et al.* 2004; Steemans & Pereira 2002).

Indo-China Terrane – Yunnan, China: *Ambitisporites avitus-dilutus morphon*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis chibrikovae*, *Laevolancis divellomedium*, *Velatitetras rugospora* (Wang & Zhang 2009).

South China Terrane – Zheijiang, China: *Dyadospora murusattenuata*, *Velatitetras retimembrana*, *Strophomorpha ovate* (Yin & He 2000).

Wenlock

Laurentia – USA: *Aremopyra brevicosta*, *Artemopyra radiata*, *Confossuspora reniforma*, *Laevolancis divellomedium*, *Stegambiquadrella contenta* (Burgess & Richardson 1991, 1995; Strother 1991; Strother 1993; Strother & Traverse 1979; Wellman & Richardson 1993).

Laurentia – UK – Scotland: *Ambitisporites avitus*, *A. dilutus*, *Cheilotetras caledonica*, *Dyadospora murusattenuata*, *D. murusdensa*, *Laevolancis divellomedium*, *L. plicata*, *Moyeria cabottii*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Tetraedraletes medinensis* (Wellman & Richardson 1993).

Avalonia – Ireland: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus nanus*, *Artemopyra brevicosta*, *Dyadospora murusattenuata*, *Hispanaediscus verrucata*, *Laevolancis divellomedia*, *L. plicata*, *Tetraedraletes medinensis* (Aldridge *et al.* 1979a, b; Emo & Smith 1978; Wellman & Richardson 1993; Williams *et al.* 1996).

Avalonia – UK: *Ambitisporites dilutus*, *Artemopyra brevicosta*, *Dyadospora murusattenuata*, *D. murusdensa*, *Laevolancis divellomedia*, *Retusotriletes warringtonii*, *Rimosotetras problematica*, *Tetraedraletes medinensis*, *T. medinensis medinensis* (Burgess & Richardson 1991; Dorning 1983; Richardson & Lister 1969; Wellman & Richardson 1993).

Avalonia – UK: *Archaeozonotriletes chulus nanus* (Aldridge *et al.* 1979a, b).

Peri-Gondwana (Armorica) – France: *Ambitisporites avitus* (Deunff & Chateauneuf 1976).

Peri-Gondwana (Iberia) – Spain: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Archaicusporites asturicus*, *Convolutispora sanpetrensis*, *Laevolancis divellomedium*, *Quadrisporites granulatus*, *Q. variabilis*, *Retusotriletes abundo*, *R. minor*, *R. warringtonii*, *Scylaspora vetusta*, *Synorisporites verrucatus* (Richardson *et al.* 2001; Rodríguez 1978a–c, 1983).

SW Gondwana – Saudi Arabia: *Ambitisporites avitus*, *Dyadospora murusdensa*, *Emphanisporites neglectus*, *Laevolancis divellomedium*, *Quadrisporites variabilis*, *Scylaspora chartulata*, *Synorisporites verrucatus*, *Tetrahedraletes medinensis* (Rubinstein & Steemans 2002; Steemans 1995).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *A. tripapillatus*, *Apiculiretusispora spicula*, *A. synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Artemopyra brevicosta*, *A. urubuense*, *Coronaspora subornata*, *Dyadospora murusattenuata*, *Emphanisporites neglectus*, *E. protoannulatus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Hispanaediscus verrucatus*, *Laevolancis divellomedium*, *Quadrisporites variabilis*, *Retusotriletes abundo*, *R. delicatus*, *R. dubius*, *R. frivolus*, *R. goensis*, *R. minor*, *R. warringtonii*, *Scylaspora chartulata*, *S. distincta*, *S. vetusta*, *Synorisporites verrucatus*, *Tetrahedraletes medinensis*, *Tetraletes granulatus* (Beck & Strother 2008; Burgess & Richardson 1991, 1995; Kermandji 2007; Richardson & Ioannides 1973; Richardson *et al.* 2001; Rodríguez 1983; Rubinstein & Steemans 2002; Steemans *et al.* 1996; Steemans *et al.* 2008; Tekbali & Wood 1991; Wellman 1993; Wellman & Richardson 1993).

Wenlock (Sheinwoodian)

Laurentia – USA: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *Dyadospora murusattenuata*, *Laevolancis divellomedia*, *Tetrahedraletes medinensis*, *Velatitetras rugosa* (Beck & Strother 2008).

Laurentia – UK-Scotland: *Ambitisporites avitus*, *A. dilutus*, *Cheilotetras caledonica*, *Laevolancis divellomedia*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Tetrahedraletes medinensis* (Wellman 1993).

Baltica – Norway: *Ambitisporites avitus*, *A. dilutus*, *Quadrisporites variabilis*, *Tetraedraletes medinensis*, *Synorisporites libycus* (Smelror 1987, 1990; Steemans *et al.* 1996; Wellman & Richardson 1993).

Baltica – Sweden: *Ambitisporites dilutus*, *Synorisporites libycus*. (Hagström 1997).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. dilutus*, *Laevolancis divellomedia*, *L. plicata*, *Tetraedraletes medinensis* (Beck & Strother 2001).

Avalonia – Ireland: *Tetraedraletes medinensis* (Maziane-Serraj *et al.* 2000; Smith 1975; Strother 1991).

Avalonia – UK: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Laevolancis divellomedium*, *L. plicata*, *Tetraedraletes medinensis* (Burgess & Richardson 1991, 1995).

Western Gondwana- Iraq: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Retusotriletes warringtonii* (Al-Ameri *et al.* 1991).

Wenlock (Homerian)

Laurentia – UK – Scotland: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Cheilotetras caledonica*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus lamontii*, *H. wenlockensis*, *Laevolancis divellomedium*, *L. plicata*, *Pachytetras rugosa*, *Pseudodyadospora petasus*, *Retusotriletes maculatus*, *Tetraedraletes medinensis* (Burgess & Richardson 1995; Marshall 1991; Richardson 1996; Steemans *et al.* 2000; Wellman 1993).

Baltica – Sweden: *Ambitisporites dilutus*, *Cymbohilates variabilis*, *Laevolancis divellomedia*, *Tetraedraletes medinensis* (Hagström 1997).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. dilutus*, *Chelinospora textilis*, *Hispanaediscus verrucatus*, *Insolisporites bassettii*, *Laevolancis divellomedia*, *L. plicata*, *Quadrисporites variabilis*, *Tetraedraletes medinensis*, *Vermiverruspora rumneyi* (Beck & Strother 2001).

Avalonia – Ireland: *Archaeozonotriletes chulus nanus* (Smith 1979).

Avalonia – UK: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Artemopyra brevicosta*, *A. radiata*, *A. rugaticosta*, *A. temericosta*, *Cheilotetras caledonica*, *Chelinospora vermoluta*, *Concentricosisporites saggitarius*, *Confossuspora reniforma*, *Dyadospora murusattenuata*, *D. murusdensa*, *Emphanisporites protophanus*, *Hispanaediscus lamontii*, *H. rugulatus*, *H. verrucatus*, *H. wenlockensis*, *Insolisporites anchistinus*, *I. bassettii*, *Laevolancis divellomedia*, *L. plicata*, *Pachytetras rugosa*, *Scylaspora chartulata*, *S. downiei*, *S. scripta*, *Tetraedraletes medinensis*, *T. medinensis medinensis*, *Velatitetras cristata*, *Vermiverruspora rumneyi* (Beck & Strother 2001, 2008; Burgess & Richardson 1991, 1995; Dufka 1995; Richardson & Lister 1969; Rubinstein & Steemans 2002; Steemans *et al.* 2000; Wellman & Richardson 1993).

Peri-Gondwana (Perunica) – Czech Republic: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus nanus*, *Artemopyra brevicosta*, *A. radiata*, *A. rugaticosta*, *Confossuspora reniforma*, *Dyadospora murusattenuata*, *Emphanisporites protophanus*, *Hispanaediscus verrucatus*, *Laevolancis divellomedium*, *L. plicata*, *Rugosisporites kozlicus*, *Scylaspora chartulata*, *S. vetusta*, *Synorisporites maculosus*, *Tetraedraletes medinensis* (Dufka 1995; Richardson *et al.* 2001; Rubinstein & Steemans 2002).

Western Gondwana – Iraq: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Retusotriletes warringtonii* (Al-Ameri *et al.* 1991).

SW Gondwana – Saudi Arabia: *Ambitisorites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Artemopyra rugaticosta*, *Dyadospora murusattenuata* *D. murusdensa*, *Hispanaediscus wenlockensis*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia*, *L. plicata*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Tetraedraletes medinensis*, *Velatitetras rugosa* (Wellman *et al.* 2000a, b).

Southern Gondwana – Libya: *Ambitisorites avitus*, *Archaeozonotriletes chulus chulus*, *Artemopyra brevicosta*, *Synorisporites libycus* (Richardson 1996).

Southern Gondwana – Algeria: *Ambitisorites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Emphanisporites neglectus*, *E. protophanus*, *Laevolancis divellomedia*, *Retusotriletes abundo*, *Scylaspora distincta*, *S. kozlica*, *S. vetusta* (Kermandji 2007).

Eastern Gondwana – Argentina: *Ambitisorites avitus*, *A. dilutus*, *Emphanisporites rotates* (Rubinstein & Brussa 1999).

Ludlow

Laurentia – Cornwallis Island, Canada: *Laevolancis divellomedium*, *Moyeria cabottii*, *Tetraedraletes medinensis* (Burgess & Richardson 1991; Gray 1991; McGregor & Narbonne 1978; Strother 1991; Wellman & Richardson 1993).

Laurentia – USA: *Tetraedraletes medinensis* (Aldridge *et al.* 1979a, b; Wellman & Richardson 1993).

Baltica – Estonia: *Ambitisorites avitus* (Aristova & Arkhangel'skaya 1976).

Baltica – Germany: *Ambitisorites avitus*, *A. dilutus*, *Apiculiretusispora synorea*, *Archaeozonotriletes chulus chulus*, *Retusotriletes warringtonii* (Reitz 1987).

Baltica – Sweden: *Tetraedraletes medinensis* (Gray *et al.* 1982; Wellman & Richardson 1993).

Avalonia – Ireland: *Apiculiretusispora synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus* (Aldridge *et al.* 1979a, b).

Avalonia – UK: *Apiculiretusispora synorea*, *Archaeozonotriletes chulus nanus*, *Laevolancis divellomedium*, *Stellatispora inframurinata cambrensis* (Burgess & Richardson 1995; Richardson & Lister 1969; Wellman & Richardson 1993).

Avalonia – UK: *Apiculiretusispora synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus* (Aldridge *et al.* 1979a, b).

Peri-Gondwana (Armorica) – France: *Ambitisporites avitus*, *Synorisporites verrucatus* (Deunff & Chateauneuf 1976).

Peri-Gondwana (Iberia) – Spain: *Ambitisporites avitus*, *A. dilutus*, *Amocosporites miserabilis*, *Anapiculatisporites isidori*, *Archaeozonotriletes chulus*, *Archaicusporites asturicus*, *A. torrestionensis*, *Brochotriletes sanpetrensis*, *Concentricosporites agradabilis*, *C. sagittarius*, *Convolutispora quititae*, *C. sanpetrensis*, *Coronaspora infraornata*, *C. mariae*, *C. primordiale*, *C. reticulata*, *C. subornata*, *Cyclogranisporites zumbonus*, *Emphanisporites perfilum*, *E. protoannulatus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Laevolancis divellomedium*, *Paradominoespora maravedi*, *Quadrisporites granulatus*, *Q. variabilis*, *Retusotriletes abundo*, *R. aureoladus*, *R. minor*, *R. sanpetrensis*, *R. splendidus*, *R. warringtonii*, *Scylaspora vetusta*, *Stenozonotriletes pumillus*, *Streelispora granulata*, *Synorisporites downtonensis*, *S. lobatus*, *S. tripapillatus*, *S. verrucatus* (Cramer 1967; Cramer & Díez 1975; Cramer & Rodríguez 1977; Díez & Cramer 1976; Richardson *et al.* 2001; Rodríguez 1978a–c, 1983).

Peri-Gondwana (Taurides) – Turkey: *Amicosporites splendidus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Convolutispora quititae*, *Cymbosporites catillus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus verrucatus*, *H. wenlockensis*, *Laevolancis*

divellomedium, *Pseudodyadospora laevigata*, *P. petasus*, *Quadrisporites variabilis*, *Retusotriletes warringtonii*, *Rimosotetras problematica*, *Tetrahedraletes medinensis* (Stemans *et al.* 1996).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *A. tripapillatus*, *Amicosporites miserabilis*, *Aneurospora richardsonii*, *Apiculiretusispora perfecta*, *A. spicula*, *A. synorea*, *Archaeozonotriletes chulus*, *A. chulus chulus*, *A. chulus nanus*, *Artemopyra brevicosta*, *A. rugaticosta*, *Chelinospora obscura*, *C. retorrída*, *Clivosispora verrucata convoluta*, *Concentricosisporites agradabilis*, *Coronaspora subornata*, *Cymbosporites multiconus*, *C. verrucosus*, *Dyadospora murusattenuata*, *Emphanisporites neglectus*, *E. protoannulatus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Hispanaediscus lamontii*, *H. verrucatus*, *Iberoespora noninspisatosa*, *Laevolancis divellomedium*, *Pseudodyadospora petasus*, *Punctatisporites dilutus*, *Quadrisporites variabilis*, *Retusotriletes abundo*, *R. delicatus*, *R. dubius*, *R. minor*, *R. triangulatus*, *R. warringtonii*, *Scylaspora chartulata*, *S. distincta*, *S. downiei*, *S. vetusta*, *Stellatispora inframurinata inframurinata*, *Synorisporites verrucatus*, *Tetrahedraletes medinensis*, *Tetraletes granulates* (Beck & Strother 2001, 2008; Buret & Moreau-Benoit 1986; Burgess & Richardson 1991, 1995; Gray *et al.* 1982; Kermadji 2007; Richardson & Ioannides 1973; Richardson *et al.* 2001; Rodríguez 1983; Rubinstein & Stemans 2002; Stemans *et al.* 1996; Stemans *et al.* 2008; Tekbali & Wood 1991; Wellman 1993).

Southern Gondwana – Algeria: *Emphanisporites neglectus* (Jardiné & Yapaudjian 1968).

Eastern Gondwana – Argentina: *Ambitisporites avitus*, *Amicosporites splendidus*, *Emphanisporites neglectus*, *E. rotatus*, *Retusotriletes minor*, *Synorisporites verrucatus* (Grösser & Prössl 1991; Rubinstein 1994).

South China Terrane – Jiangsu and Sichuan, China: *Ambitisporites dilutus*, *Artemopyra brevicosta*, *Cymbosporites sparseus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus verrucatus*, *Laevolancis divellomedia*, *Pseudodyadospora laevigata*, *P. petasus*, *Scylaspora downiei*, *S. scripta*, *Velatitetras laevigata* (Wang & Li 2000; Wang *et al.* 2005).

Ludlow (Gorstian)

Laurentia – Scotland: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Cheilotetras caledonica*, *Dyadospora murusattenuata*, *Hispanaediscus lamontii*, *H. wenlockensis*, *Laevolancis divellomedium*, *L. plicata*, *Pachytetras rugosa*, *Pseudodyadospora petasus*, *Retusotriletes maculatus*, *Tetraedraletes medinensis* (Burgess & Richardson 1995; Marshall 1991; Steemans *et al.* 2000; Wellman 1993).

Baltica – Sweden: *Abditusdyadus chalazus*, *Acontotetras gotlandica*, *Ambitisporites dilutus*, *Tetraedraletes medinensis* (Hagström 1997).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. dilutus*, *A. marginatus*, *Cheilotetras caledonica*, *Hispanaediscus major*, *H. scabiosus*, *Laevolancis divellomedia*, *L. plicata*, *Stellatispora inframurinata inframurinata*, *Tetraedraletes medinensis*, *Vermiverruspora rumneyi* (Beck & Strother 2001).

Avalonia – UK: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Artemopyra radiata*, *A. temericosta*, *Cheilotetras caledonica*, *Chelinospora obscura*, *C. vermoluta*, *Concentricosisporites saggitarius*, *Hispanaediscus lamontii*, *H. rugulatus*, *H. verrucatus*, *Insolisporites anchistinus*, *I. bassettii*, *Laevolancis divellomedia*, *L. plicata*, *Scylaspora downiei*, *Stellatispora inframurinata cambrensis*, *S. inframurinata inframurinata*, *Tetraedraletes medinensis medinensis*, *Velatitetras cristata*, *Vermiverruspora rumneyi* (Beck & Strother 2001; Burgess & Richardson 1995).

Peri-Gondwana (Iberia) – Spain: *Moyeria cabottii* (Rodríguez 1983).

SW Gondwana – Saudi Arabia: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus*, *Artemopyra rugaticosta*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus wenlockensis*, *Imperfectotriletes patinatus*, *I. vavrdovae*, *Laevolancis divellomedia-plicata*, *Pseudodyadospora petasus*, *Rimosotetras problematica*, *Tetrahedraletes medinensis*, *Velatitetras rugosa* (Wellman *et al.* 2000a, b).

Southern Gondwana – Libya: *Ambitisporites avitus*, *Archaeozonotriletes chulus chulus*, *Confossuspora reniforma*, *Emphanisporites protophanus*, *Hispanaediscus verrucatus* (Richardson 1996; Rubinstein & Steemans 2002).

Southern Gondwana – Tunisia: *Ambitisporites avitus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Concentricosisporites sagittarius*, *Dyadospora murusattenuata*, *Emphanisporites protophanus*, *Hispanaediscus verrucatus*, *Laevolancis divellomedia*, *Pseudodyadospora laevigata*, *P. petasus*, *Retusotriletes abundo*, *R. dubius*, *R. minor*, *R. warringtonii*, *Scylaspora downiei*, *Synorisporites verrucatus*, *Tetrahedraletes medinensis* (Spina & Vecoli 2009).

Ludlow (Ludfordian)

Laurentia – USA: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *A. warringtonii*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Concentricosisporites sagittarius*, *Confossuspora reniforma*, *Dyadospora murusattenuata*, *Emphanisporites protophanus*, *Laevolancis divellomedia*, *Retusotriletes abundo*, *Rugosphaera falloambita*, *Scylaspora scripta*, *Tetrahedraletes medinensis*, *Vermiverruspora cotter* (Beck & Strother 2008).

Baltica – Sweden: *Abditusdyadus chalazus*, *Acontotetras gotlandica*, *Ambitisporites avitus*, *A. dilutus*, *A. parvus*, *Artemopyra brevicosta*, *Cheilotetras caledonica*, *Cymbohilates microgranulatus*, *C. variabilis*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus*

verrucatus, *Laevolancis divellomedia*, *L. plicata*, *Pachytetras rugosa*, *P. rugosa*, *Pseudodyadospora laevigata*, *P. petasus*, *Rugosisorites chartulatus*, *Tetraedraletes medinensis* (Hagström 1997; Steemans *et al.* 2000).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. marginatus*, *Cheilotetras caledonica*, *Hispanaediscus imbricatus*, *H. major*, *H. scabiosus*, *Laevolancis divellomedia*, *L. plicata*, *Stellatispora inframurinata inframurinata*, *Tetraedraletes medinensis* (Beck & Strother 2001).

Avalonia – UK: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Cheilotetras caledonica*, *C. obscura*, *C. vermoluta*, *Concentricosisporites sagittarius*, *Hispanaediscus major*, *Insolisporites bassettii*, *Laevolancis divellomedia*, *L. plicata*, *Stellatispora inframurinata cambrensis*, *S. inframurinata inframurinata*, *Tetraedraletes medinensis medinensis*, *Vermiverruspora runneyi* (Beck & Strother 2001; Burgess & Richardson 1995).

Peri-Gondwana (Iberia) – Spain: *Chelinospora canistrata*, *C. cantabrica*, *C. poecilomorpha*, *C. sanpetrensis*, *Concentricosisporites agradabilis*, *C. sagittarius*, *Coronaspora cromatica*, *C. reticulata*, *Emphanisporites splendens*, *Hispanaediscus verrucatus*, *Laevolancis divellomedium*, *L. divellomedium*, *Moyeria cabottii*, *Quadrisporites granulatus*, *Q. variabilis*, *Q. variabilis*, *Scylaspora vetusta* (Burgess & Richardson 1991; Cramer 1966; Richardson *et al.* 2001; Rodríguez 1983; Steemans *et al.* 1996; Wellman & Richardson 1993).

Southern Gondwana – Algeria: *Ambitisporites avitus*, *A. dilutus*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Chelinospora sanpetrensis*, *Cymbosporites triangulatus*, *Emphanisporites neglectus*, *E. protophanus*, *Laevolancis divellomedia*, *Retusotriletes abundo*, *Scylaspora distincta*, *S. kozlica*, *S. vetusta* (Kermandji 2007).

Southern Gondwana – Libya: *Apiculiretusispora synorea*, *Artemopyra robusta*, *Confossuspora reniforma*, *Emphanisporites neglectus*, *E. splendens*, *Hispanaediscus verrucatus*, *Laevolancis divellomedia*, *Tetraletes variabilis* (Richardson 1996; Rubinstein & Steemans 2002).

Southern Gondwana – Tunisia: *Ambitisporites avitus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Chelinospora poecilomorpha*, *Concentricosisporites sagittarius*, *Coronaspora cromatica*, *Cymbohilates comptulus*, *Dyadospora murusattenuata*, *Emphanisporites neglectus*, *E. protophanus*, *E. rotatus*, *Gneudnaspora divellomedia*, *Hispanaediscus verrucatus*, *H. wenlockensis*, *Pseudodyadospora laevigata*, *P. petasus*, *Retusotriletes abundo*, *R. dittonensis*, *R. dubius*, *R. maccullochii*, *R. minor*, *R. triangulatus*, *R. warringtonii*, *Rimosotetras problematica*, *Rugosphaera cerebra*, *Scylaspora downiei*, *Segestrespora membranifera*, *Synorisporites libycus*, *S. verrucatus*, *Tetraedraletes medinensis*, *Velatitetras rugosa* (Spina & Vecoli 2009).

Eastern Gondwana – Brazil: *Ambitisporites avitus* *Morphon*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Chelinospora poecilomorpha*, *Emphanisporites neglectus*, *E. protophanus*, *E. rotatus*, *Laevolancis divellomedium*, *Retusotriletes abundo*, *R. minor*, *Scylaspora downiei*, *Sphaerasaccus glabellus*, *Synorisporites verrucatus*, *Tetraedraletes medinensis*, *Velatitetras rugosa* (Steeemans *et al.* 2008).

Pridoli

Laurentia – Canada: *Archaeozonotriletes chulus chulus* (McGregor & Camfield 1976).

Laurentia – USA: *Abditusdyadus laevigatus*, *Ambitisporites avitus*, *A. warringtonii*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Concentricosisporites sagittarius*, *Confossuspora reniforma*, *Dyadospora murusattenuata*, *Emphanisporites protophanus*, *Laevolancis divellomedia*, *Retusotriletes abundo*, *Rugosphaera falloambita*, *Scylaspora scripta*, *Tetraedraletes medinensis*, *Vermiverruspora cotter* (Beck & Strother 2008).

Laurentia – Scotland: *Tetraedraletes medinensis* (Barron 1989).

Baltica – Estonia: *Emphanisporites protophanus*, *Retusotriletes simplex* (Aristova & Arkhangelskaya 1976).

Avalonia – Nova Scotia, Canada: *Ambitisporites avitus*, *A. capitaneus*, *A. parvus*, *Artemopyra scalariformis*, *Cheilotetras caledonica*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus verrucatus*, *Laevolancis divellomedia*, *L. plicata*, *Quadrisporites variabilis*, *Scylaspora asperverruca*, *Synorisporites verrucatus*, *Tetraedraletes medinensis* (Beck & Strother 2001).

Avalonia – Ireland: *Apiculiretusispora spicula*, *A. synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Cymbosporites echinatus*, *Cymbosporites verrucosus*, *Synorisporites downtonensis*, *S. tripapillatus*, *S. verrucatus* (Aldridge *et al.* 1979a,b).

Avalonia – UK: *Ambitisporites avitus*, *A. dilutus*, *A. parvus*, *A. tripapillatus*, *Amicosporites splendidus*, *Apiculiretusispora spicula*, *A. synorea*, *Archaeozonotriletes chulus*, *A. chulus chulus*, *A. chulus nanus*, *Cheilotetras caledonica*, *Concentricosisporites saggitarius*, *Cymbosporites echinatus*, *C. verrucosus*, *Laevolancis divellomedium*, *L. plicata*, *Retusotriletes charulatus*, *R. dubius*, *Stellatispora inframurinata cambrensis*, *Synorisporites downtonensis*, *S. labeonis*, *S. tripapillatus*, *S. verrucatus*, *Tetraedraletes medinensis medinensis* (Aldridge *et al.* 1979a, b; Burgess & Richardson 1995; Fanning *et al.* 1991a, b; Johnson & Taylor 2005; Richardson 1996; Richardson & Lister 1969; Richardson *et al.* 1981; Wetherall *et al.* 1999).

Avalonia – UK: *Apiculiretusispora spicula*, *A. synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Cymbosporites echinatus*, *C. verrucosus*, *Synorisporites downtonensis*, *S. tripapillatus*, *S. verrucatus* (Aldridge *et al.* 1979a, b).

Avalonia – France: *Emphanisporites neglectus* (Vanguetstaine *et al.* 1986).

Peri-Gondwana (Armorica) – France: *Ambitisporites avitus*, *A. dilutus*, *Amocosporites miserabilis*, *Anapiculatisporites isidori*, *Apiculiretusispora microconus*, *A. Plicata*, *A. spicula*, *Archaeozonotriletes chulus*, *A. chulus chulus*, *Archaeozonotriletes chulus nanus*, *Calamospora microrugosa*, *Convolutispora quititae*, *Emphanisporites neglectus*, *Leiotriletes parvus*, *L. pyramidalis*, *Punctatisporites punctatus*, *Quadrisporites granulatus*, *Q. variabilis*, *Retialetes legionis*, *Retusotriletes eslae*, *R. rotundus*, *R. warringtonii*, *Synorisporites tripapillatus*, *S. verrucatus* (Deunff & Chateauneuf 1976; Moreau-Benoit & Dubreuil 1987; Rauscher & Robardet 1975; Steemans *et al.* 1996).

Peri-Gondwana (Iberia) – Spain: *Ambitisporites avitus*, *A. dilutus*, *Amocosporites miserabilis*, *Anapiculatisporites isidori*, *A. terciensis*, *A. ventae*, *Apiculiretusispora arcidecus*, *A. toriensis*, *Archaeozonotriletes chulus*, *Archaicusporites asturicus*, *A. torrestionensis*, *Brochotriletes sanpetrensis*, *Chelinospora canistrata*, *C. cantabrica*, *C. hemiesferica*, *C. lavidensis*, *C. media*, *C. poecilomorpha*, *C. sanpetrensis*, *Concentricosisporites agradabilis*, *C. borbullatus*, *C. sagittarius*, *Convolutispora quititae*, *C. sanpetrensis*, *Coronaspora cromatica*, *C. infraornata*, *C. mariae*, *C. primordiale*, *C. reticulata*, *C. subornata*, *Cymbosporites dittonensis*, *Emphanisporites disformis*, *E. perfilum*, *E. protoannulatus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Eupoikilofusa cabottii*, *Hispanaediscus berneseae*, *H. leonensis*, *H. verrucatus*, *Iberoespora cantabrica*, *Leiotriletes socorridus*, *L. titanicus*, *Laevolancis divellomedium*, *Paradominoespora maravedi*, *Quadrisporites granulatus*, *Q. variabilis*, *Retialetes legionis*, *Retusotriletes abundo*, *R. aureoladus*, *R. bipellis*, *R. chulus*, *R. coronadus*, *R. minor*, *R. warringtonii*, *Scylaspora elegans*, *S. vetusta*, *Stenozonotriletes pumillus*, *Streelispora granulata*, *Synorisporites downtonensis*, *S. lobatus*, *S. tripapillatus*, *S. verrucatus*, *Tetraletes granulatus*, *T.*

variabilis (Cramer 1967; Cramer & Rodríguez 1977; Cramer & Díez 1977; Richardson *et al.* 2001; Rodríguez 1978a–c, 1983).

Peri-Gondwana (Taurides) – Turkey: *Amicosporites splendidus*, *Archaeozonotriletes chulus*, *Artemopyra brevicosta*, *Clivosispora reticulata*, *Convolutispora quititae*, *Cymbosporites catillus*, *Dyadospora murusattenuata*, *D. murusdensa*, *Hispanaediscus verrucatus*, *H. wenlockensis*, *Laevolancis divellomedium*, *Pachytetras rugosa*, *Pseudodyadospora laevigata*, *P. petasus*, *Quadrisporites variabilis*, *Retusotriletes warringtonii*, *Rimosotetras problematica*, *Tetraedraletes medinensis* (Stemans *et al.* 1996; Stemans *et al.* 2000).

Southern Gondwana – Algeria: *Ambitisporites avitus*, *A. dilutus*, *Amocosporites miserabilis*, *Apiculiretusispora synorea*, *Archaeozonotriletes chulus chulus*, *A. chulus nanus*, *Chelinospora hemiesferica*, *C. poecilomorpha*, *C. sanpetrensis*, *Cymbosporites triangulatus*, *Dictyotriletes gorgoneus*, *Emphanisporites neglectus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Laevolancis divellomedia*, *Retusotriletes abundo*, *R. delicatus*, *R. minor*, *Scylaspora distincta*, *S. kozlica*, *S. radiata*, *S. vetusta*, *Synorisporites tripapillatus*, *S. verrucatus* (Kermandji 2007).

Southern Gondwana – Libya: *Ambitisporites avitus*, *A. dilutus*, *A. tripapillatus*, *Amicosporites miserabilis*, *A. splendidus*, *Aneurospora geikiei*, *A. richardsonii*, *Apiculiretusispora perfecta*, *A. spicula*, *A. synorea*, *Archaeozonotriletes chulus nanus*, *Artemopyra brevicosta*, *A. robusta*, *A. rugaticosta*, *Breconisporites simplex*, *Brochotriletes foveolatus*, *Chelinospora cantabrica*, *C. poecilomorpha*, *C. retorrída*, *Clivosispora reticulata*, *C. verrucata convoluta*, *C. verrucata verrucata*, *Concentricosisporites agradabilis*, *C. sagittarius*, *Coronaspora cromatica*, *Cymbohilates comptulus*, *C. dittonensis*, *C. multiconus*, *C. paulus*, *C. verrucosus*, *Dyadospora murusattenuata*, *D. murusattenuata*, *Emphanisporites neglectus*, *E. protophanus*, *E. rotatus*, *E. splendens*, *Hispanaediscus lamontii*, *H. verrucatus*, *H. wenlockensis*, *Iberoespora cantabrica*, *I.*

noninspisatosa, *Laevolancis divellomedium*, *Perotrilites laevigatus*, *Pseudodyadospora laevigata*, *Punctatisporites dilutus*, *Quadrisporites variabilis*, *Retusotriletes abundo*, *R. bipellis*, *R. dittonensis*, *R. dubius*, *R. maccullockii*, *R. maculatus*, *R. minor*, *R. pychovii*, *R. rotundus*, *R. triangulatus*, *R. warringtonii*, *Rimosotetras problematica*, *Rugosphaera cerebra*, *Scylaspora chartulatus*, *Segestrespora membranifera*, *Stellatispora inframurinata cambrensis*, *S. inframurinata inframurinata*, *Synorisporites libycus*, *S. papillensis*, *S. verrucatus*, *Tetraedraletes medinensis*, *Velatitetras rugosa*, *Verrucosisporites devonicus* (Buret & Moreau-Benoit 1986; Richardson 1996; Rubinstein & Steemans 2002; Spina & Vecoli 2009; Steemans *et al.* 2008; Tekbali & Wood 1991).

Eastern Gondwana – Argentina: *Ambitisporites avitus*, *Amicosporites splendidus*, *Emphanisporites rotatus*, *Synorisporites papillensis* (Rubinstein 1992, 1994, 1995).

Eastern Gondwana – Bolivia: *Ambitisporites dilutes* (McGregor 1984).

Eastern Gondwana – Brazil: *Ambitisporites avitus*, *A. dilutus*, *Aneurospora richardonii*, *Archaeozonotriletes chulus*, *Artemopyra urubuense*, *Brochotriletes foveolatus*, *Chelinohilates sinuosus sinuosus*, *C. cantabrica*, *C. poecilomorpha*, *C. sanpetrensis*, *C. verrucata convoluta*, *C. verrucata verrucata*, *Coronaspora cromatica*, *Cymbosporites verrucosus*, *Dyadospora murusattenuata*, *Emphanisporites multicostatus*, *E. neglectus*, *E. rotatus*, *Hispanaediscus verrucatus*, *Laevolancis divellomedium*, *Quadrisporites horridus*, *Q. variabilis*, *Retusotriletes amazonensis*, *R. minor*, *Synorisporites verrucatus*, *Tetraedraletes medinensis* (Steemans *et al.* 2008).

South China Terrane – Jiangsu and Sichuan, China: *Ambitisporites dilutus*, *Artemopyra brevicosta*, *Cymbosporites sparseus*, *Dyadospora murusattenuata*, *D. murusdensa*,

Hispanaediscus verrucatus, *Laevolancis divellomedia*, *Pseudodyadospora laevigata*, *P. petasus*, *Scylaspora downiei*, *S. scripta*, *Velatitetras laevigata* (Wang & Li 2000; Wang *et al.* 2005).

References

- AL-AMERI, T. K., OMER, S. F. & KHALAF, F. H. 1991. Lower Silurian palynomorphs from Western Iraqi Desert and the paleoclimate. *Journal of Science and Nature*, **1**, 57–65.
- ALDRIDGE, R. J., DORNING, K. J., HILL, P. J., RICHARDSON, J. B. & SIVETER, D. J. 1979a. *Microfossil Distribution in the Silurian of Britain and Ireland*. Geological Society, London, Special Publications, **8**, 433–438.
- ALDRIDGE, R. J., JEPSSON, L. & DORNING, K. J. 1979b. Early Silurian oceanic episodes and events. *Journal of the Geological Society, London*, **150**, 501–513.
- ALLEN, K. C. 1981. A comparison of the structure and sculpture of *in situ* and dispersed Silurian and Early Devonian spores. *Review of Palaeobotany and Palynology*, **34**, 1–9.
- ARISTOVA, K. E. & ARKHANGELSKAYA, A. D. 1976. Microfossils from stratotype sections of Upper Silurian horizons of Estonia. In: BYVSHEVA, T. V. (ed.) *Results of palynological research on Precambrian, Paleozoic and Mesozoic of the USSR*. Trudy Vsesoiuznogo Nauchno-Issledovatel'skogo Geologorazvedochnogo Neftianogo Instituta, Kama Branch, **192**, 28–38.
- BALME, B. E. 1995. Fossil *in situ* spores and pollen grains: an annotated catalogue. *Review of Palaeobotany and Palynology*, **87**, 81–323.
- BANKS, H. P. 1980. Floral assemblages in the Siluro–Devonian. In: DILCHER, D. L. & TAYLOR, T. N. (eds) *Biostratigraphy of Fossil Plants*. Dowden, Hutchinson, & Ross, Stroudsburg, PA, 1–24.

- BANKS, H. P. 1981. Time and appearance of some plant biocharacters during Siluro–Devonian time. *Canadian Journal of Botany*, **59**, 1292–1296.
- BARRON, H. F. 1989. Mid-Wenlock acritarchs from the inlier in the Cheviot Hills, NE England. *Scottish Journal of Geology*, **25**, 81–89.
- BECK, J. H. & STROTHER, P. K. 2001. Silurian spores and cryptospores from the Arisaig Group, Nova Scotia, Canada. *Palynology*, **25**, 127–177.
- BECK, J. H. & STROTHER, P. K. 2008. Miospores and cryptospores from the Silurian section at Allenport, Pennsylvania, USA. *Journal of Paleontology*, **82**, 857–883.
- BERNER, R. A. 2006. Geological nitrogen cycle and atmospheric N₂ over Phanerozoic time. *Geology*, **34**, 413–415.
- BOUCOT, A. J. & GRAY, J. 2001. A critique of Phanerozoic climatic models involving changes in the CO₂ content of the atmosphere. *Earth Science Reviews*, **56**, 1–159.
- BRAYARD, A., ESCARGUEL, G. & BUCHER, H. 2007. The biogeography of Early Triassic ammonoid faunas: clusters, gradients, and networks. *Geobios*, **6**, 749–765.
- BROWN, R. C. & LEMMON, B. E. 1990. Sporogenesis in bryophytes. *In*: BLACKMORE, S. & KNOX (eds) *Microspores: Evolution and Ontogeny*. Academic Press, London, 55–94.
- BURET, M. B. & MOREAU-BENOIT, A. 1986. Données nouvelles apportées par la palynoplantologie sur la formation des alternances argilo-gréseuses (Silurien supérieur de Libye, bassin de Rhadamès). *Comptes Rendus de l'Académie des Sciences de Paris*, **302**, 1009–1014.
- BURGESS, N. D. 1991. Silurian cryptospores and miospores from the type Llandovery area, SW Wales. *Palaeontology*, **34**, 575–599.

- BURGESS, N. D. & RICHARDSON, J. B. 1991. Silurian cryptospores and miospores from the type Wenlock area, Shropshire, England. *Palaeontology*, **34**, 601–628.
- BURGESS, N. D. & RICHARDSON, J. B. 1995. Late Wenlock to early Pridoli cryptospores and miospores from south and SW Wales, Great Britain. *Palaeontographica*, **236**, 1–44.
- CAI, C-Y, YA-WEI, D. & EDWARDS, D. 1993. New observations on a Pridoli plant assemblage from north Xinjiang, NW China, with comments on its evolutionary and palaeogeographical significance. *Geological Magazine*, **130**, 155–170.
- COMBAZ, A. 1967. Un microbios du Trémadocien dans un sondage d'Hassi-Messaoud. *Actes de la Société Linnéenne de Bordeaux*, **104**, 1–26.
- CRAMER, F. H. 1966. Palynomorphs from the Siluro–Devonian boundary in N. W. Spain. *Notas y Comunicaciones del Instituto Geologico y Minero de Espana*, **85**, 71–82.
- CRAMER, F. H. 1967. Palynology of Silurian and Devonian rocks in NW Spain. *Boletin del Instituto Geologico y Minero de Espana*, **77**, 225–286.
- CRAMER, F. H. & DíEZ, M. D. C. R. 1975. Earliest Devonian miospores from the Province of León, Spain. *Pollen et Spores*, **XVII**, 331–344.
- CRAMER, F. H. & DíEZ, M. D. C. R. 1977. *Ovnia*, genero nuevo de Acritarcos del Gedinnense de Arabia Saudita. *Rev. Espanola Micropal.*, **IX**, 85–88.
- CRAMER, F. H. & RODRÍGUEZ, R. M. 1977. Robledo and Arroyacas Formation (Arroyo de las Arroyacas, Province of Palencia, Spain) palynologically dated as late Silurian. *Breviora Geologica Asturica*, **21**, 2–4.
- DEUNFF, J. & CHATEAUNEUF, J. J. 1976. Sur la présence d'un riche microplancton siluro-dévonien à acritarches, chitinozoaires, au sommet des Schistes et Quartzites de Plougastel (Rade de Brest); son intérêt stratigraphique. *Geobios*, **9**, 337–343.

- DÍEZ, M. D. C. R. & CRAMER, F. H. 1976. Acritarches et miospores du Ludlovien de Corniero, Province de León, Espagne. *Revue de Micropaléontologie*, **19**, 121–133.
- DORNING, K. J. 1983. Palynology and stratigraphy of the Much Wenlock Limestone Formation of Dudley, Central England. *Mercian Geologist*, **9**, 31–40.
- DUFFIELD, S. L. 1985. Land-derived microfossils from the Jupiter Formation (upper Llandoveryan), Anticosti Island, Quebec. *Journal of Paleontology*, **59**, 1005–1010.
- DUFKA, P. 1995. Upper Wenlock miospores and cryptospores derived from a Silurian volcanic island in the Prague Basin (Barrandian area, Bohemia). *Journal of Micropalaeontology*, **14**, 67–79.
- ELEY, B. E. & LEGAULT, J. A. 1988. Palynomorphs from the Manitoulin Formation (Early Llandovery) of Southern Ontario. *Palynology*, **12**, 49–63.
- EMO, G. T. & SMITH, D. G. 1978. Palynological evidence for the age of the Lower Palaeozoic rocks of Slieve Aughty, Counties Clare and Galway. *Proceedings of the Royal Irish Academy*, **78**, 287–292.
- FANNING, U., EDWARDS, D. & RICHARDSON, J. B. 1991a. A new rhyniophytoid from the late Silurian of the Welsh Borderland. *Neues Jahrbuch für Geologie und Paläontologie. Abh.*, **183**, 37–47.
- FANNING, U., RICHARDSON, J. B. & EDWARDS, D. 1991b. A review of *in situ* spores in Silurian land plant. In: BLACKMORE, S. & BARNES, S. H. (eds) Systematics Association Special Volume. *Pollen and Spores*, **44**, 25–47.
- FOMBELLA, M. A. 1982. Determinacion palinologica del Tremadoc en la localidad de Verdiago, Provincia de León, NO de España. *Revista Española de Micropaleontologia*, **XIV**, 13–22.

- GENSEL, P. G., JOHNSON, N. G. & STROTHER, P. K. 1990. Early land plant debris (Hooker's 'waifs and strays'?). *Palaios*, **5**, 520–547.
- GRAY, J. 1985. The microfossil record of early land plants; advances in understanding of early terrestrialization, 1970–1984. *Philosophical Transactions of the Royal Society, London*, **B309**, 167–195.
- GRAY, J. 1988. Land plant spores and the Ordovician–Silurian boundary. *Bulletin of the British Museum (Natural History), Geology*, **43**, 351–358.
- GRAY, J. 1991. *Tetraedraletes*, *Nodospora* and the 'cross' tetrad: an accretion of myth. In: BLACKMORE, S. & BARNES, S. H. (eds) Systematics Association Special Volume. *Pollen and Spores*, **44**, 49–87.
- GRAY, J. & BOUCOT, A. J. 1971. Early Silurian spore tetrads from New York: earliest New World evidence for vascular plants. *Science*, **173**, 918–921.
- GRAY, J., MASSA, D. & BOUCOT, A. J. 1982. Caradocian land plant microfossils from Libya. *Geology*, **10**, 197–201.
- GRAY, J., COLBATH, G. K., DE FARIA, A., BOUCOT, A. J. & ROHR, D. M. 1985. Silurian-age fossils from the Paleozoic Paraná Basin, southern Brazil. *Geology*, **13**, 521–525.
- GRAY, J., THERON, J. N. & BOUCOT, A. J. 1986. Age of the Cedarberg Formation, South Africa and early land plant evolution. *Geological Magazine*, **123**, 445–454.
- GRAY, J., BOUCOT, A. J., GRAHN, Y. & HIMES, G. 1992. A new record of early Silurian land plant spores from the Paraná Basin, Paraguay (Malvinokaffric Realm). *Geological Magazine*, **129**, 741–752.

- GRÖSSER, J. R. & PRÖSSL, K. F. 1991. First evidence of the Silurian in Colombia: Palynostratigraphic data from the Quetame Massif, Cordillera Oriental. *Journal of South American Earth Sciences*, **4**, 231–238.
- HABGOOD, K. S. 2000. Two cryptospore-bearing land plants from the Lower Devonian (Lochkovian) of the Welsh Borderland. *Botanical Journal of the Linnean Society*, **133**, 203–227.
- HAGSTRÖM, J. 1997. Land-derived palynomorphs from the Silurian of Gotland, Sweden. *Geologiska Föreningens i Stockholm Förhandlingar*, **119**, 301–316.
- HILL, J. P., PARIS, F. & RICHARDSON, J. B. 1985. Silurian palynomorphs. *Journal of Micropaleontology*, **4**, 27–48.
- HOFFMEISTER, W. S. 1959. Lower Silurian plant spores from Libya. *Micropaleontology*, **5**, 331–334.
- JARDINÉ, S. & YAPAUDJIAN, L. 1968. Lithostratigraphie et palynologie du Dévonien–Gothlandien gréseux du Bassin de Polignac (Sahara). *Revue de l'Institut Français du Pétrole*, **23**, 439–469.
- JOHNSON, N. G. 1985. Early Silurian palynomorphs from the Tuscarora Formation in central Pennsylvania and their paleobotanical and geological significance. *Review of Palaeobotany and Palynology*, **45**, 307–360.
- JOHNSON, T. R. & TAYLOR, W. A. 2005. Single grain analysis of the Late Silurian spore *Cymbosporites echinatus* from the Welsh Borderland. *Review of Palaeobotany and Palynology*, **137**, 163–172.
- KERMANDJI, A. M. H. 2007. Silurian–Devonian miospores from the western and central Algeria. *Revue de Micropaléontologie*, **50**, 109–128.

- LAKOVA, I., GOCEV, P. M. & YANEV, S. 1992. Palynostratigraphy and geological setting of the Lower Paleozoic allochthon of the Derwent Heights, SE Bulgaria. *Geological Balcanica*, **22**, 71–88.
- LE HÉRISSE, A., MELO, J. H. G., QUADROS, L. P., GRAHN, Y. & STEEMANS, P. 2001. Palynological characterization and dating of the Tiangua Formation, Serra Grande Group, northern Brazil. In: MELO, J. H. G. & TERRA, G. J. S. (eds) *Correlação de Sequências Paleozóicas Sul-Americanas*. Ciência-Técnica-Petróleo. Seção: Exploração de Petróleo, Rio de Janeiro, **20**, 25–42.
- MARSHALL, J. E. A. 1991. Palynology of the Stonehaven Group, Scotland: evidence for a Mid Silurian age and its geological implications. *Geological Magazine*, **128**, 283–286.
- MARTIN, F. 1973. Ordovicien supérieur et Silurien inférieur à Deerlijk (Belgique). *Mémoires de l'Institut royal des Sciences naturelles de Belgique*, **174**, 1–71.
- MAZIANE-SERRAJ, N., BRUCK, P. M., HIGGS, K. T. & VANGUESTAINE, M. 2000. Ordovician and Silurian acritarch assemblages from the west Leinster and Slievenamon areas of southeast Ireland. *Review of Palaeobotany and Palynology*, **113**, 57–71.
- MCCLURE, H. A. 1988. The Ordovician–Silurian boundary in Saudi Arabia. *Bulletin of the British Museum (Natural History), Geology Series*, **43**, 155–163.
- MCGREGOR, D. C. 1984. Late Silurian and Devonian spores from Bolivia. *Academia Nacional de Ciencias Cordoba*, **69**, 1–57.
- MCGREGOR, D. C. & CAMFIELD, M. 1976. *Upper Silurian? to Middle Devonian Spores of the Moose River Basin, Ontario*. Geological Survey of Canada, Ottawa, Bulletins, **263**, 1–63.

- MCGREGOR, D. C. & NARBONNE, G. M. 1978. Upper Silurian trilete spores and other microfossils from the Read Bay Formation, Cornwallis Island, Canadian Arctic. *Canadian Journal of Earth Sciences*, **15**, 1292–1303.
- MENDLOWICZ MAULLER, P., PEREIRA, E., GRAHN, Y. & STEEMANS, P. 2004. Análise bioestratigráfica do intervalo Llandoveryano da Bacia do Paraná no Paraguai Oriental. *Revista Brasileira de Paleontologia*, **7**, 199–212.
- MILLER, M. A. & AL-RUWAILI, M. H. 2007. Preliminary palynological investigation of Saudi Arabian Upper Ordovician glacial sediments. *Revue de Micropaléontologie*, **50**, 17–26.
- MILLER, M. A. & EAMES, L. E. 1982. Palynomorphs from the Silurian Medina Group (Lower Llandovery) of the Niagara Gorge, Lewiston, New York, U.S.A. *Palynology*, **6**, 221–254.
- MIZUSAKI, A. M., MELO, J. H. G., LELARGE, M. L. & STEEMANS, P. 2002. Vila Maria Formation, Paraná Basin, Brazil – an example of integrated geochronological and palynological datings. *Geological Magazine*, **139**, 453–463.
- MOLYNEUX, S. G. & AL-HAJRI, S. 2000. Palynology of a problematic Lower Palaeozoic lithofacies in Central Saudi Arabia. In: AL-HAJRI, S. & OWENS, B. (eds) *Stratigraphic Palynology of the Palaeozoic of Saudi Arabia. GeoArabia* (special volume), **1**, 18–41.
- MOREAU-BENOIT, A. & DUBREUIL, M. 1987. Confirmation et découverte du Dévonien inférieur par la palynoplanctonologie dans les schistes et grès de la terminaison orientale du bassin d'Ancenis (sud-est du Massif armoricain). *Géologie de la France*, **1**, 37–54.
- PITTAU, P. 1985. Tremadocian (Early Ordovician) acritarchs of the Arburese Unit, Southwest Sardinia (Italy). *Bolletino della Societa Paleontologica Italiana*, **23**, 61–204.

- RAUSCHER, R. & ROBARDET, M. 1975. Les microfossiles (acritarches, chitinozoaires et spores) des couches de passage du Silurien au Dévonien dans le Cotentin (Normandie). *Annales de la Société Géologique du Nord*, **XCIV**, 81–92.
- REITZ, E. 1987. Silurische Sporen aus einem granatführenden Glimmerschiefer des Vor-Speesart, NW-Bayern. *Neues Jahrbuch für Geologie und Paläontologie. Monatshefte*, **11**, 699–704.
- REITZ, E. & HEUSE, T. 1994. Palynofazies im Oberordovizium des Saxothuringikums. *Neues Jahrbuch für Geologie und Paläontologie Monatshefte*, **6**, 348–360.
- RICHARDSON, J. B. 1985. Lower Paleozoic sporomorphs: their stratigraphical distribution and possible affinities. *Philosophical Transactions of the Royal Society, London*, **309**, 201–205.
- RICHARDSON, J. B. 1988. Late Ordovician and Early Silurian cryptospores and miospores from NE Libya. In: EL-ARNAUTI, A., OWENS, B. & THUSU, B. (eds) *Subsurface Palynostratigraphy of NE Libya*. Garyounis University Publications, Benghazi, Libya, 89–109.
- RICHARDSON, J. B. 1996. Chapter 18A. Lower and Middle Palaeozoic records of terrestrial palynomorphs. In: JANSONIUS, J. & MCGREGOR, D. C. (eds) *Palynology: Principles and Applications*. American Association of Stratigraphic Palynologists Foundation, Salt Lake City, UT, **2**, 555–574.
- RICHARDSON, J. B. & IOANNIDES, N. S. 1973. Silurian palynomorphs from the Tanezzuft and Acacus Formations, Tripolitania, North Africa. *Micropaleontology*, **19**, 257–307.
- RICHARDSON, J. B. & LISTER, T. R. 1969. Upper Silurian and Lower Devonian spore assemblages from the Welsh Borderland and South Wales. *Palaeontology*, **12**, 201–252.

- RICHARDSON, J. B., RASUL, S. M. & AL-AMERI, T. 1981. Acritarchs, miospores and correlation of the Ludlovian–Downtonian and Silurian–Devonian boundaries. *Review of Palaeobotany and Palynology*, **34**, 209–224.
- RICHARDSON, J. B., RODRÍGUEZ, R. M. & SUTHERLAND, S. J. E. 2001. Palynological zonation of Mid- Palaeozoic sequences from the Cantabrian Mountains, NW Spain: implications for inter-regional and interfacies correlation of the Ludford/Prídolí and Silurian/Devonian boundaries, and plant dispersal patterns. *Bulletin Natural History Museum London (Geology)*, **57**, 115–162.
- RODRÍGUEZ, R. M. 1978a. Nuevas mioesporas de la Formación San Pedro en Geras de Gordon, Cordillera Cantabrica (Provincia de León, Noroeste de España). *Breviora Geologica Asturica*, **22**, 9–16.
- RODRÍGUEZ, R. M. 1978b. Miospores de la Formation San Pedro (Silurien–Devonien) à Corniero (Province de León, Espagne). *Revue de Micropaléontologie*, **20**, 216–221.
- RODRÍGUEZ, R. M. 1978c. Mioesporas de la Formación San Pedro/Furada (Silúrico Superior–Devónico Inferior), Cordillera Cantabrica, NO de España. *Palinologia, Número Extraordinario*, **1**, 407–433.
- RODRÍGUEZ, R. M. 1983. *Palinologia de las Formaciones del Silúrico superior – Devonico inferior de la Cordillera Cantabrica*. Servicio de Publicaciones, Universidad de Leon, Leon, 1–231.
- RUBINSTEIN, C. 1992. Palinologia des Silurico superior (Formacion Los Espejos) de La Quebrada de las Aguaditas, Precordillera de San Juan, Argentina. *Ameghiniana*, **29**, 231–248.

- RUBINSTEIN, C. 1994. Palynological investigation in the Lower Paleozoic of Argentina. *Zeitschrift für Geologische und Paläontologie*, **1/2**, 271–230.
- RUBINSTEIN, C. 1995. Acritarchs from the upper Silurian of Argentina: their relationship with Gondwana. *Journal of South American Earth Sciences*, **8**, 103–115.
- RUBINSTEIN, C. V. & BRUSSA, E. D. 1999. A palynomorph and graptolite biostratigraphy of the Central Precordillera Silurian Basin, Argentina. *In*: TONGIORGI, M. & PLAYFORD, G. (eds) *Studies in Palaeozoic Palynology, Selected Papers from the CIMP Symposium at Pisa. Bolletino della Società Paleontologica Italiana, Modena*, **38**, 257–266.
- RUBINSTEIN, C. V. & STEEMANS, P. 2002. Miospore assemblages from the Silurian–Devonian boundary, in borehole A1–61, Ghadamis Basin, Libya. *In*: STEEMANS, P., SERVAIS, T. & STREEL, M. (eds) *Paleozoic Palynology: A Special Issue in Honour of Dr. Stanislas Loboziak. Review of Palaeobotany and Palynology*, **118**, 397–421.
- RUBINSTEIN, C. & VACCARI, N. E. 2004. Cryptospore assemblages from the Ordovician/Silurian boundary in the Puna region, NW Argentina. *Palaeontology*, **47**, 1037–1061.
- SMELROR, M. 1987. Llandovery and Wenlock miospores and spore-like microfossils from the Ringerike district, Norway. *Norsk Geologisk Tidsskrift*, **67**, 143–150.
- SMELROR, M. 1990. Palynomorphs from the *Cyrtograptys centrifugus* graptolite zone (Early Wenlock, Silurian), Bornholm. *Bulletin of the Geological Society of Denmark*, **39**, 83–89.
- SMITH, D. G. 1975. Wenlock plant spores and tetrads from County Mayo Ireland. *Geological Magazine*, **112**, 411–414.
- SMITH, D. G. 1979. The distribution of trilete spores in Irish Silurian rocks. *In*: HARRIS, A. L., HOLLAND, C. H. & LEAKE, B. E. (eds) *The Caledonides of the British Isles – Reviewed*. Geological Society of London, London, 423–431.

- SPINA, A. & VECOLI, M. 2009. Palynostratigraphy and vegetational changes in the Siluro–Devonian of the Ghadamis Basin, North Africa. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **282**, 1–18.
- STEEMANS, P. 1995. Silurian and Lower Emsian spores in Saudi Arabia. *Review of Palaeobotany and Palynology*, **89**, 91–104.
- STEEMANS, P. 2001. Ordovician cryptospores from the Oostduinkerke borehole, Brabant Massif, Belgium. *Geobios*, **34**, 3–12.
- STEEMANS, P. & PEREIRA, E. 2002. Llandovery miospore biostratigraphy and stratigraphic evolution of the Paraná Basin, Paraguay – palaeogeographic implications. *Bulletin de la Société géologique de France*, **173**, 407–414.
- STEEMANS, P., LE HÉRISSE, A. & BOZDOGAN, N. 1996. Ordovician and Silurian cryptospores and miospores from southeastern Turkey. *Review of Palaeobotany and Palynology*, **93**, 35–76.
- STEEMANS, P., HIGGS, K. T. & WELLMAN, C. H. 2000. Cryptospores and trilete spores from the Llandovery, Nuayyim-2 Borehole, Saudi Arabia. In: AL-HAJRI, S. & OWENS, B. (eds) *Stratigraphic Palynology of the Palaeozoic of Saudi Arabia. GeoArabia* (special volume), **1**, 92–115.
- STEEMANS, P., RUBINSTEIN, C. & MELO, J. H. G. 2008. Siluro–Devonian miospore biostratigraphy of the Urubu River area, western Amazon Basin, northern Brazil. *Geobios*, **41**, 263–282.
- STEEMANS, P., LE HERISSE, A., MELVIN, J., MILLER, M. A., PARIS, F., VERNIERS, J. & WELLMAN, C. H. 2009. Origin and radiation of the earliest vascular land plants. *Science*, **324**, 353.

- STROTHER, P. K. 1991. A classification schema for the Cryptospores. *Palynology*, **15**, 219–236.
- STROTHER, P. K. 1993. Clarification of the Genus *Nematothallus* Lang. *Journal of Paleontology*, **67**, 1090–1094.
- STROTHER, P. K. & TRAVERSE, A. 1979. Plant microfossils from the Llandoveryan and Wenlockian rocks of Pennsylvania. *Palynology*, **3**, 1–21.
- STROTHER, P. K., AL-HAJRI, S. & TRAVERSE, A. 1996. New evidence for land plants from the lower Middle Ordovician of Saudi Arabia. *Geology*, **24**, 55–58.
- TAYLOR, W. A. 1995a. Spores in earliest land plants. *Nature*, **373**, 391–392.
- TAYLOR, W. A. 1995b. Ultrastructure of *Tetraedraletes medinensis* (Strother and Traverse) Wellman and Richardson, from the Upper Ordovician of Southern Ohio. *Review of Palaeobotany and Palynology*, **85**, 183–187.
- TEKBALI, A. O. & WOOD, G. D. 1991. Silurian spores, acritarchs and chitinozoans from the Baní Walíd Borehole of the Ghadámis Basin, NW Libya. *Geology of Libya*, **IV**, 1243–1273.
- TURNER, R. E. 1984. Acritarchs from the type area of the Ordovician Caradoc Series, Shropshire, England. *Paleontographica*, **190**, 85–157.
- VANGUESTAINE, M., STEEMANS, P. & STREEL, M. 1986. Microfossiles végétaux. In: RACHEBOEUF, P. R. (ed.) *le Groupe de Liévin. Pridoli-Lochkovien de l'Artois (N. France). Biostratigraphie du Paléozoïque*. Mém. Soc. Géol. Min., Bretagne, **3**, 47–55.
- VAVRDOVÁ, M. 1982. Recycled acritarchs in the uppermost Ordovician of Bohemia. *Casopis pro Mineralogii a Geologii*, **27**, 337–345.
- VAVRDOVÁ, M. 1984. Some plant microfossils of the possible terrestrial origin from the Ordovician of central Bohemia. *Vestník Ceskeho Geologickeho Ustavu*, **59**, 165–170.

- VAVRDOVÁ, M. 1988. Further acritarchs and terrestrial plant remains from the Late Ordovician at Hlasna Treban (Czechoslovakia). *Casopis pro Mineralogii a Geologii*, **33**, 1–10.
- VAVRDOVÁ, M. 1989. New acritarchs and miospores from the Late Ordovician of Hlasna Treban, Czechoslovakia. *Casopis pro Mineralogii a Geologii*, **34**, 403–420.
- VAVRDOVÁ, M. 1990a. Early Ordovician acritarchs from the locality Myto near Rokycany (late Arenig, Czechoslovakia). *Casopis pro Mineralogii a Geologii*, **35**, 239–250.
- VAVRDOVÁ, M. 1990b. Coenobial acritarchs and other palynomorphs from the Arenig/Llanvirn boundary, Prague basin. *Vestník Ceskeho Geologickeho Ustavu*, **65**, 237–242.
- WANG, Y. & LI, J. 2000. Late Silurian trilete spores from northern Jiangsu, China. *Review of Palaeobotany and Palynology*, **111**, 111–125.
- WANG, Y. & ZHANG, Y. D. 2009. Llandovery sporomorphs and graptolites from the Manbo Formation, the Mojiang County, Yunnan, China. *Proceedings of the Royal Society London B – Biological Sciences*, **277**, 267–275.
- WANG, Y., ZHU, H. C. & LI, J. 2005. Late Silurian plant microfossil assemblage from Guangyuan, Sichuan, China. *Review of Palaeobotany and Palynology*, **133**, 153–168.
- WELLMAN, C. H. 1993. A land plant microfossil assemblage of Mid Silurian age from the Stonehaven Group, Scotland. *Journal of Micropalaeontology*, **12**, 47–66.
- WELLMAN, C. H. 1996. Cryptospores from the type area for the Caradoc Series (Ordovician) in southern Britain. *Palaeontology*, **55**, 103–136.
- WELLMAN, C. H. & RICHARDSON, J. B. 1993. Terrestrial plant microfossils from Silurian inliers of the Midland Valley of Scotland. *Palaeontology*, **36**, 155–193.

- WELLMAN, C. H., HIGGS, K. T. & STEEMANS, P. 2000a. Spore assemblages from a Silurian sequence in Borehole Hawiyah-151 from Saudi Arabia. *In*: AL-HAJRI, S. & OWENS, B. (eds) *Stratigraphic Palynology of the Palaeozoic of Saudi Arabia. GeoArabia* (special volume), **1**, 116–133.
- WELLMAN, C. H., HABGOOD, K., JENKINS, G. & RICHARDSON, J. B. 2000b. A new plant assemblage (microfossil and megafossil) from the Lower Old Red Sandstone of the Anglo-Welsh Basin: its implications for the palaeoecology of early terrestrial ecosystems. *Review of Palaeobotany and Palynology*, **109**, 161–196.
- WETHERALL, P. M., DORNING, K. J. & WELLMAN, C. H. 1999. Palynology biostratigraphy, and depositional environments around the Ludlow–Pridoli boundary at Woodbury Quarry, Herefordshire, England. *Bolletino della Societa Paleontologica Italiana*, **38**, 397–404.
- WILLIAMS, D. M., HARKIN, J. & HIGGS, K. T. 1996. Implications of new microfloral evidence from the Clew Bay Complex for Silurian relationships in the western Irish Caledonides. *Journal of the Geological Society, London*, **153**, 771–777.
- YIN, L. & HE, S. 2000. Palynomorphs from the transitional sequences between Ordovician and Silurian of northwestern Zhejiang, South China. *Palynofloras and Palynomorphs of China*, 186–202.