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Review of Palaeobotany and Palynology 113 (2000) 57–71

Review of Palaeobotany & Palynology

www.elsevier.nl/locate/revpalbo

Ordovician and Silurian acritarch assemblages from the west Leinster and Slievenamon areas of southeast Ireland

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Received 9 December 1999; accepted for publication 17 February 2000

Abstract

The Lower Palaeozoic sequences west of the Leinster Granite and in the Slievenamon Inlier of southeast Ireland have been palynologically re-investigated. Most of the productive samples yielded sufficient identifiable acritarchs for positive stratigraphical age determinations for several of the formations. The samples also include rare cryptospores, scolecodonts and tubular structures. Previous work in the area west of the Leinster Granite proposed an unbroken succession from Early Ordovician Ribband Group turbidites and volcanics passing up conformably to Early Ordovician to Late Silurian Kilcullen Group. The new palynological data clearly show that the Kilcullen Group in this area is entirely Silurian (Llandovery–early Wenlock) in age, also results obtained from the same group at Slievenamon confirm the previously reported Silurian age. Ordovician acritarchs found in the Kilcullen Group of both study areas are reworked and range in age from late Tremadoc to Llanvirn. The new data reveal a major stratigraphic break between the Ribband Group dated as Early and Middle Ordovician and the Silurian Kilcullen Group. This major break extends some hundreds of kms southwest to the Dingle Peninsula and possibly equates with a similar discontinuity in the Isle of Man to the northeast. This break would thus appear to be a major feature within the northwestern Avalonian margin sequence.

Keywords: Ordovician; Silurian; acritarchs; stratigraphy; Southeast Ireland

1. Introduction

The Ordovician and Silurian sequences investigated in the current study lie west of the Leinster Granite and in the Slievenamon Inlier some 90 km to the south (Fig. 1). The succession comprises the Ribband and Kilcullen Groups (Brück et al., 1979) and the spatial distribution of these are shown in Fig. 1.

In the Ribband Group and Kilcullen Group succession west of the Leinster Granite, early field mapping and palynological studies (Brück, 1972; Brück et al., 1974; Brück and Downie, 1974) suggested that the sequence was a continuous and conformable turbiditic succession. The Early Ordovician distal turbidites and volcanics of the 1100 m thick Ribband Group were considered to pass conformably up into the more proximal turbidites of the 3000 m thick Kilcullen Group (dated as Early Ordovician to Llandovery or Wenlock). However, further south in the Slievenamon Inlier, Colthurst and Smith (1977) obtained Upper Cambrian acritarch assemblages from the Ribband Group and Silurian (Llandovery to Wenlock) assemblages from the overlying Kilcullen Group (see also Brück et al., 1979).

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PII: S0034-6667(00)00052-X

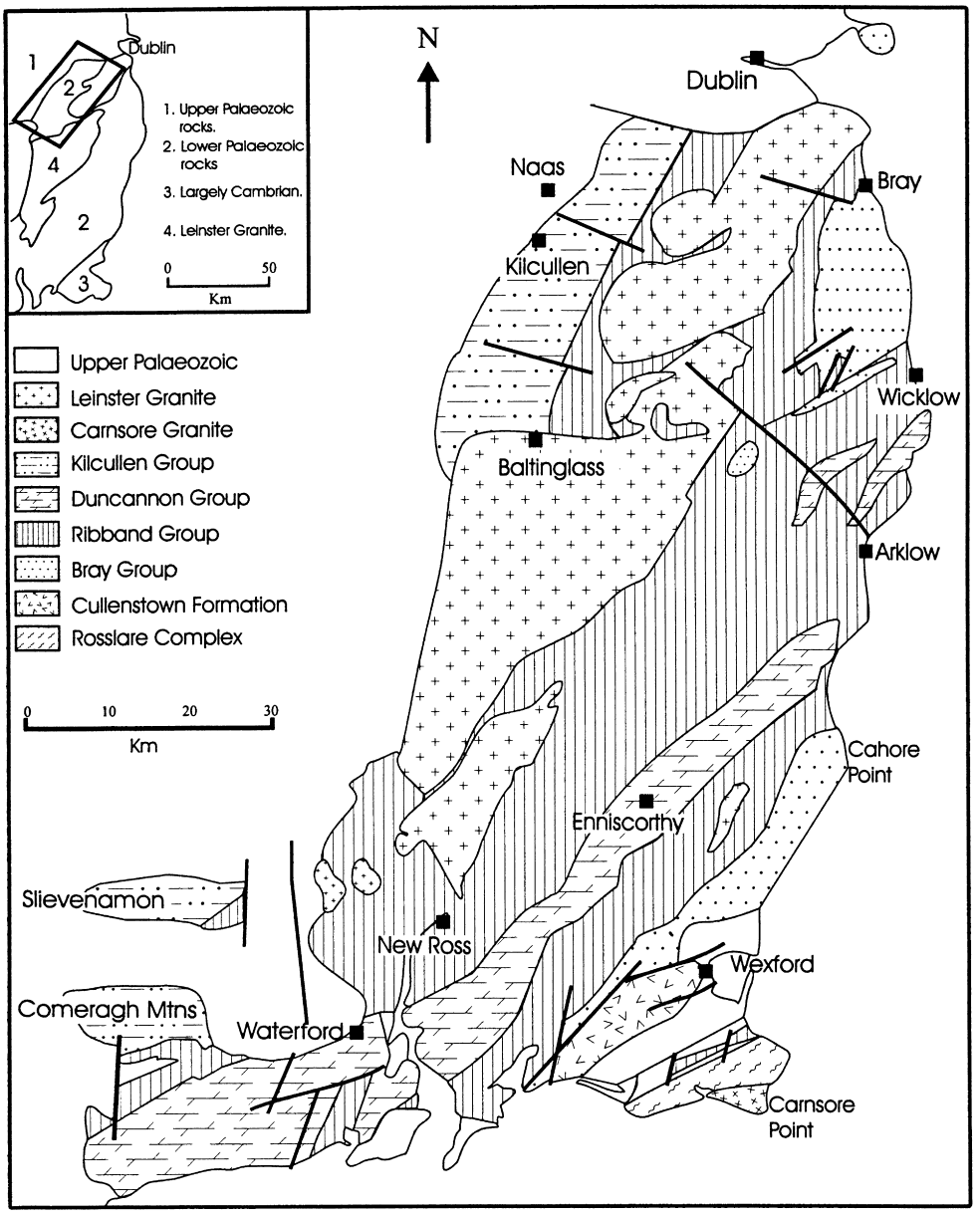


Fig. 1. Geological map of southeast Ireland showing the location of the principal lithostratigraphic units.

The aim of the present study is to re-investigate the Ribband and Kilcullen Groups in the two areas using palynology and to provide more definitive biostratigraphic data that will clarify the stratigraphic relationship between the two groups.

2. Stratigraphy

The stratigraphy of the sequence west of the Leinster Granite (Brück et al., 1974) comprises two formations in the Ribband Group and five in the

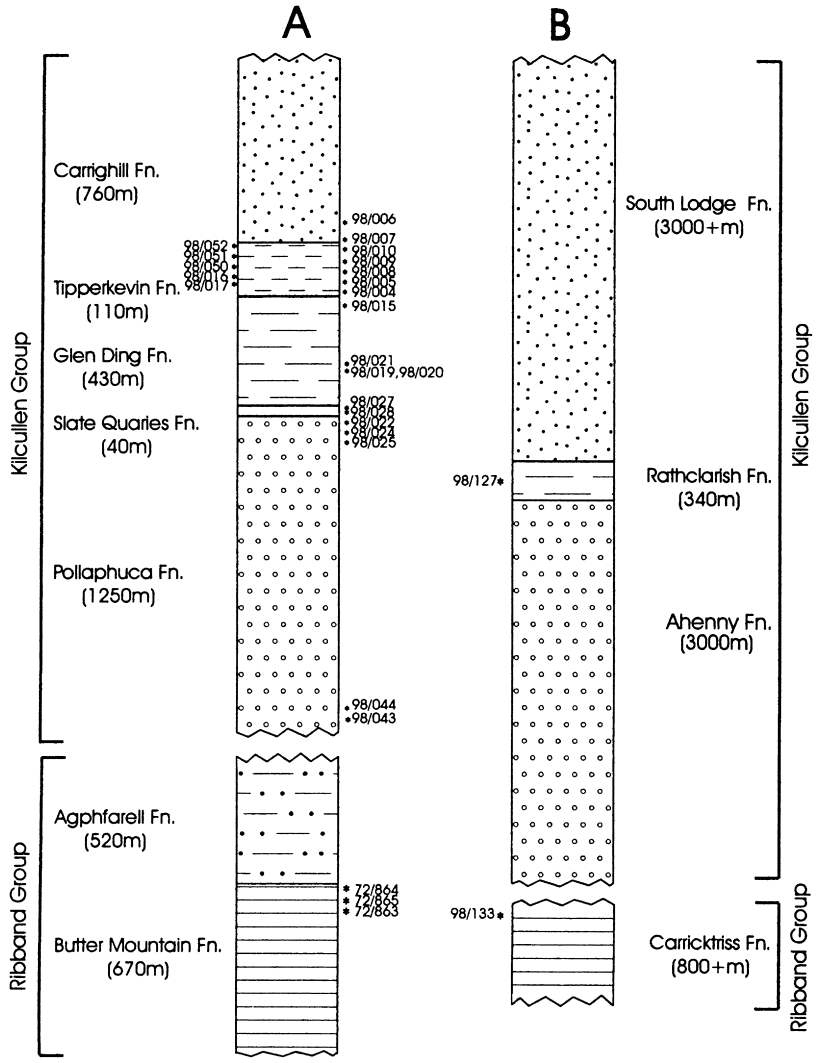


Fig. 2. Sketch stratigraphic logs of the Lower Palaeozoic sequences showing the position of the age diagnostic palynological samples; (A) West of the Leinster Granite, (B) Slievenamon Inlier.

Kilcullen Group (Fig. 2A). The succession in the Slievenamon Inlier (Colthurst and Smith, 1977) comprises one formation of the Ribband Group and three formations in the Kilcullen Group (Fig. 2B). Fig. 2 also shows the stratigraphic positions of the productive age diagnostic samples in both areas. Fig. 3 shows the geographical locations of productive samples from west of the Leinster Granite. Table 1 gives the grid references of all of the productive age diagnostic samples.

3. Palynology

In the current study, 78 samples have been collected from throughout all the formations of the Ribband and Kilcullen Groups west of the Leinster Granite and from their equivalents in the Slievenamon Inlier (Fig. 1). The main emphasis has been placed on clarifying the age of the Kilcullen Group, i.e. establishing whether the sequence is Early Ordovician to Silurian (Llandovery–Wenlock) as proposed by

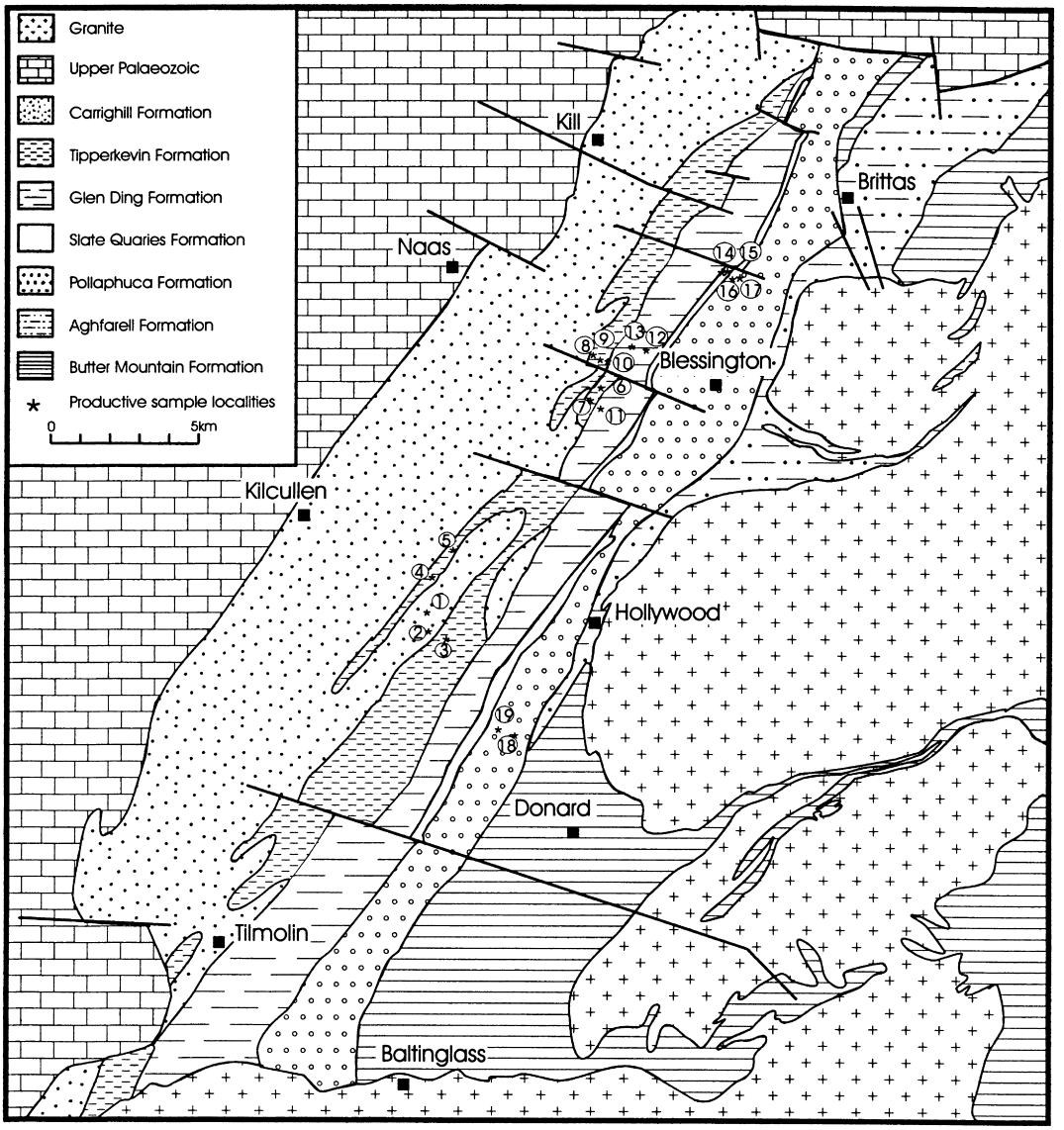


Fig. 3. Geological map of the Lower Palaeozoic rocks west of the Leinster Granite showing the localities of the productive samples.

Brück et al. (1974) and Brück and Downie (1974) or whether the Kilcullen Group is entirely Silurian as suggested by Colthurst and Smith (1977).

3.1. Preparation of samples

The samples collected were mudstones and siltstones lithologies. Between 30 and 40 g weight of rocks were processed using standard laboratory maceration techniques. In all cases sparse organic residues were obtained and the palynomorphs are dark-brown to black in colour indicating a high degree of thermal alteration. They were oxidised for 2 hours in the first instance and if the organic matter was still dark the residues were oxidised for between 2 and 7 hours depending on the degree of carbonisation. The slides were examined in both transmitted light and reflected light microscopy. All the slides and figured

Table 1
Productive samples from west of the Leinster Granite and Slievenamon

Formations	Sample number	Locality number (Fig. 3)	Grid reference
1. *West of the Leinster Granite*			
Carrighill Formation	98/006	1	N865035
	98/007	2	N867035
Tipperkevin Formation	98/004	3	N872039
	98/005	3	N872039
	98/008	4	N981075
	98/009	4	N981075
	98/010	5	N981076
	98/016	6	N942140
	98/017	7	N941139
	98/050	8	N938151
	98/051	9	N939151
	98/052	10	N940150
Glen Ding Formation	98/015	11	N940110
	98/019	12	N961152
	98/020	12	N961152
	98/021	13	N960152
Slate Quaries Formation	98/027	14	N992083
	98/028	15	N993081
Pollaphuca Formation	98/022	16	N990182
	98/024	16	N990182
	98/025	17	N989183
	98/043	18	N912011
	98/044	19	N911012
2. *The Slievenamon Inlier*			
Rathclarish Formation	98/127		N398315
Carricktriss Formation	98/133		N485291

specimens are catalogued and stored in the Department of Geology, University College Cork.

Only 27 samples were productive, however most of these yielded sufficient identifiable palynomorphs for positive age determinations. Acritarchs are mostly rare, while cryptospores and scolecodonts are only occasionally present. Although the number of acritarchs found was small, their diversity was moderate. The state of preservation is poor to moderately good. The palynomorph composition of 25 of the 27 productive samples is listed in Table 2 and a selection of the palynomorphs and some of the particulate organic matter is shown in Plates I–III (Plate captions list the taxonomic name of the figured specimen, followed by the formation, slide number, sample number and the England Finder co-ordinates of the specimen. All magnifications are 1000 ×.).

The new palynological data are described below in ascending stratigraphic order for each region studied.

3.2. West of the Leinster Granite

From 62 samples collected in this region, 16 were from the Ribband Group and 46 were from the Kilcullen Group. The stratigraphical location of the productive samples are shown on Fig. 2A.

3.2.1. Ribband Group

3.2.1.1. Butter Mountain and Aghfarell Formations. All of the samples collected from these two formations were barren of palynomorphs and only contained rare black and indeterminate organic particles. The Early Ordovician age assigned to the Ribband Group in this

Table 2
The occurrence of palynomorph taxa recorded in the productive samples from west of the Leinster Granite and at Slievenamon

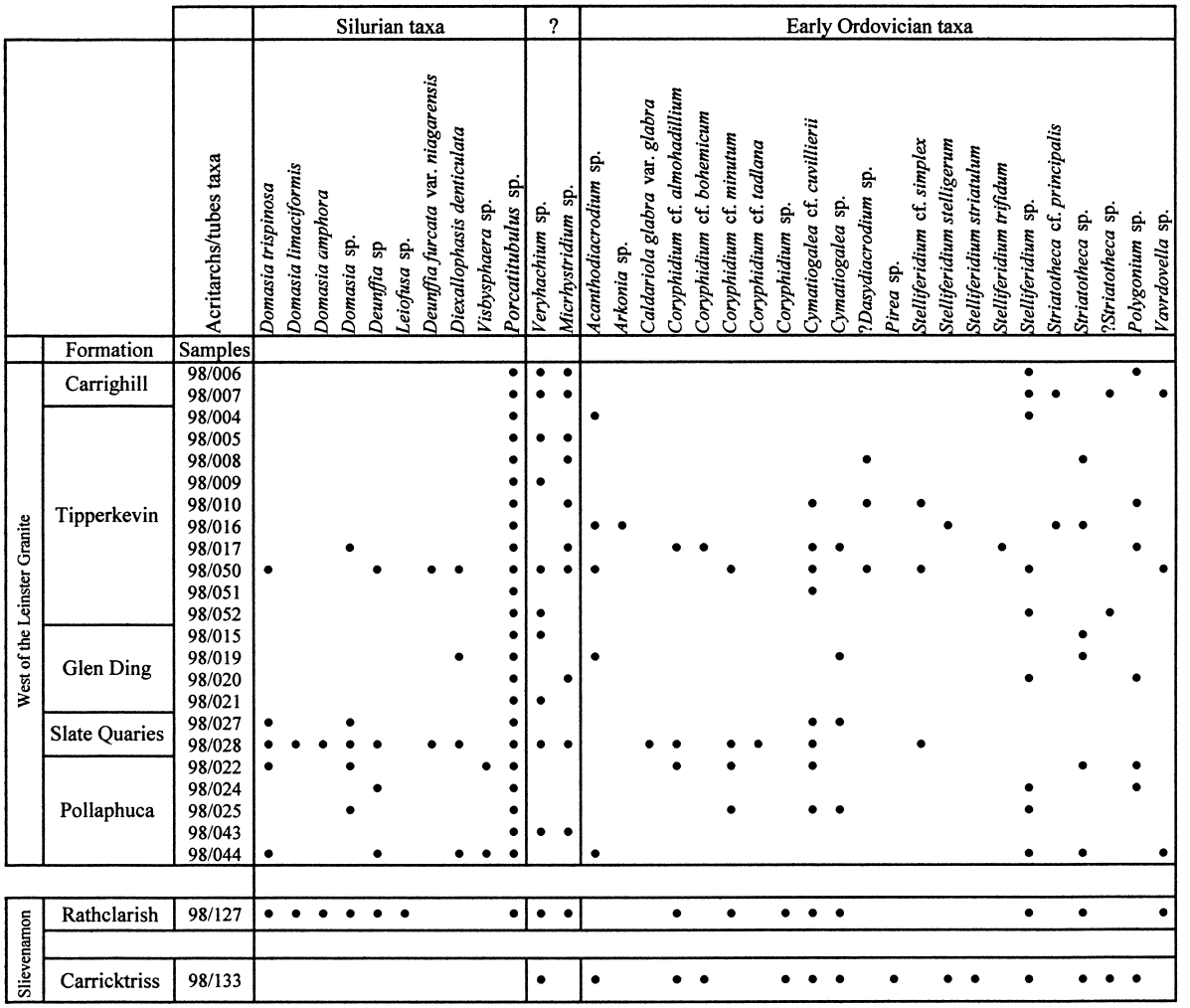
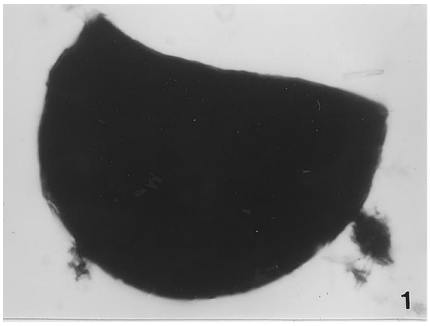
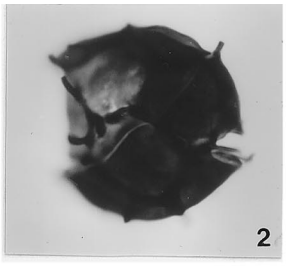
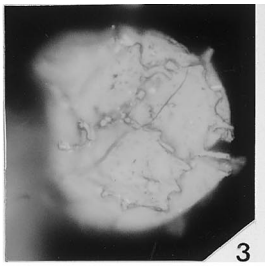


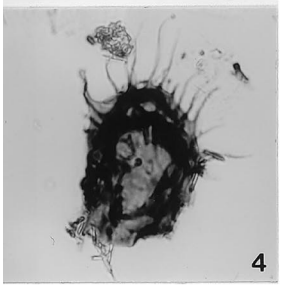
PLATE I

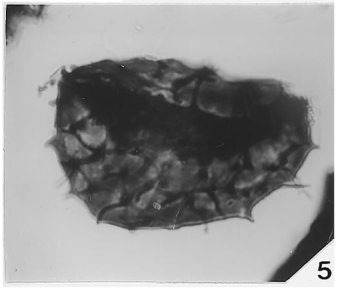
1 *Caldariola glabra* (Martin, 1973a) Molyneux in Molyneux and Rushton, 1988 var. *glabra*. Slate Quarries Formation, 51666 sample PB/028, P51/1.
2, 3 *Cymatiogalea* sp. Tipperkevin Formation, 51672 sample 98/017, H47/4.
4 ? *Dasydiacrodium* sp. Tipperkevin Formation, 51361 sample 98/010, X46/1.
5, 6 *Stelliferidium* cf. *simplex* (Deunff, 1961) emend Deunff et al., 1974. Tipperkevin Formation, 51360 sample 98/010, O43/1-2.
7 ? *Dasydiacrodium* sp. Tipperkevin Formation, 51530 sample 98/050, S55.
8 *Veryhachium* sp. Tipperkevin Formation, 51554 sample 98/050, V56/1.
9 *Coryphydium* cf. *bohemicum* Vavrdová 1972. Tipperkevin Formation, 51552 sample 98/017, F43.
10 *Arkonia* sp. Tipperkevin Formation, 51671 sample 98/016, H50/1-2.
11 ? *Striatotheca* sp. Tipperkevin Formation, 51671 sample 98/016, F47/4.
12 *Striatotheca* cf. *principalis* Burmann, 1970 var. *parva*. Carrighill Formation, 51294 sample 98/007, F47/4.

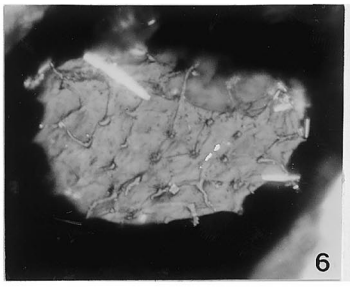


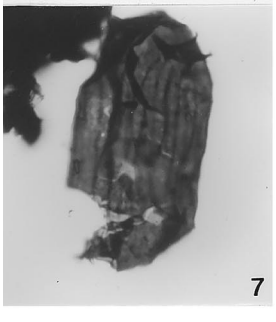


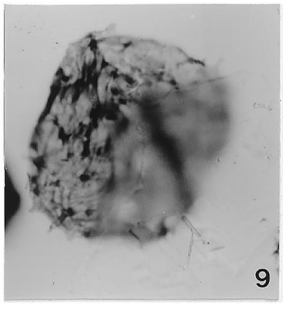


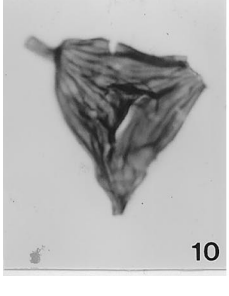


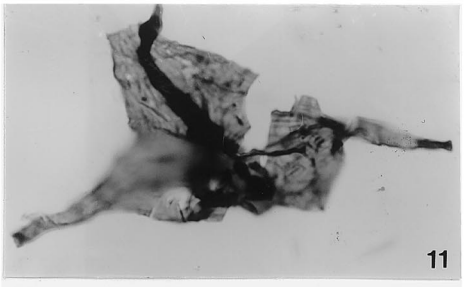












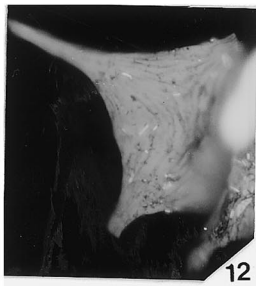


PLATE I

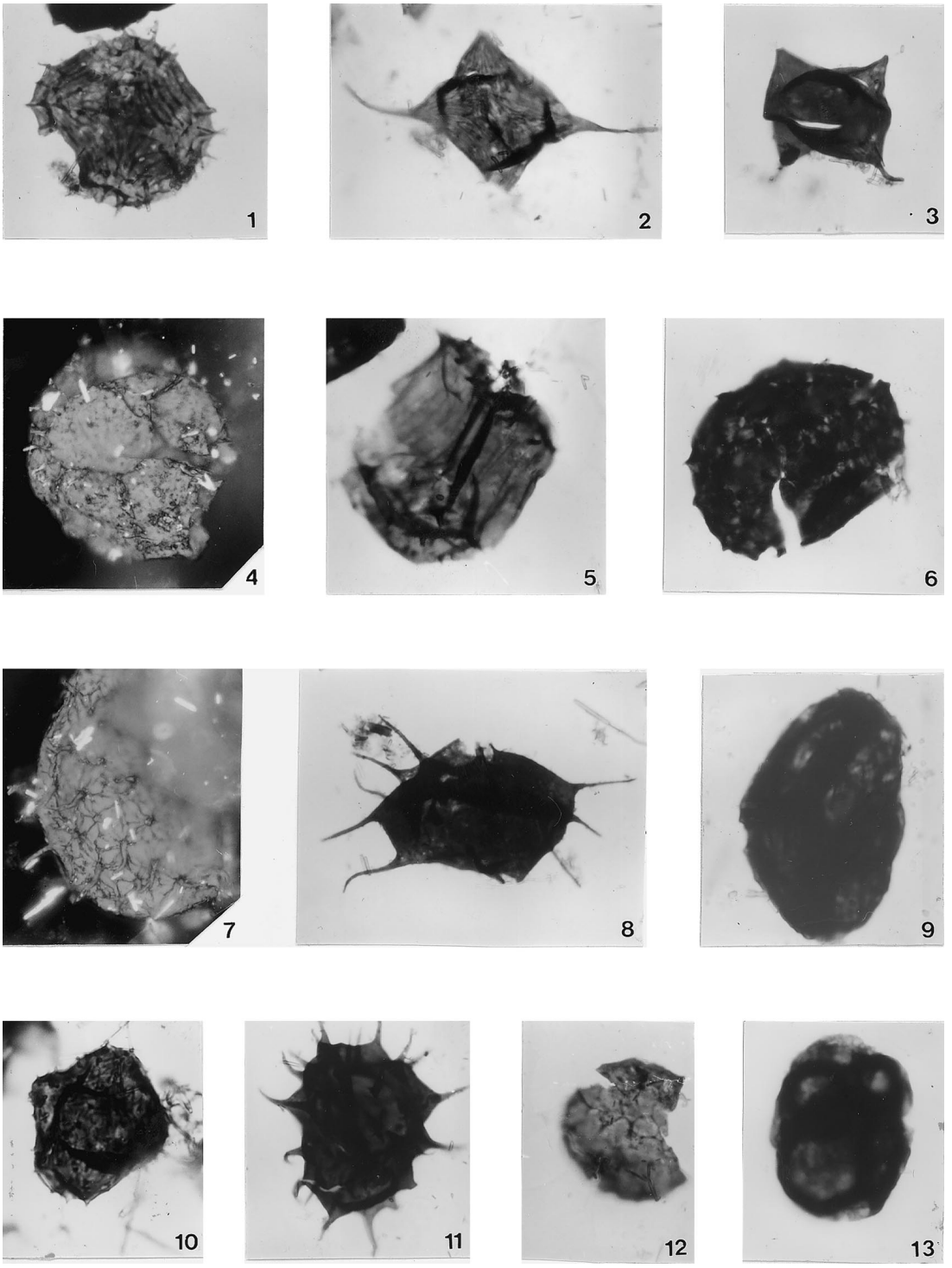


PLATE II

area must therefore be based on the limited palynological data reported by Brück et al. (1974) from the Butter Mountain Formation (see samples 72/863, 864, 865 — Fig. 2A, this study).

3.2.2. Kilcullen Group

3.2.2.1. Pollaphuca Formation. Sixteen samples were collected from this formation of which five were productive. The palynological composition of the productive samples is shown in Table 2. The acritarchs are generally broken but sufficient age diagnostic taxa were recorded. The palynofacies is composed of miscellaneous organic fragments, smooth tubes assignable to *Laevitubulus* Burgess and Edwards, 1991 and banded tubes assignable to *Porcatitubulus* Burgess and Edwards, 1991. A few scolecodonts and cryptospores were also recorded.

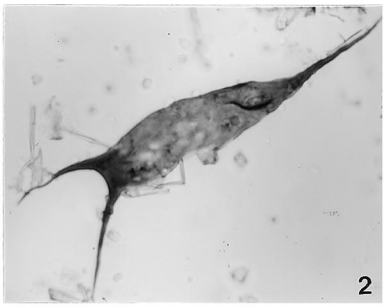
The acritarch assemblages contain *Domasia trispinosa* Downie, 1960, *Deunffia* sp., *Diexallophasis denticulata* (Stockmans and Willière, 1963) Loeblich, 1970 and *Visbysphaera* sp. These taxa are characteristic of the Silurian, in particular, *Deunffia* and *Domasia* are important taxa for the Llandovery–Wenlock interval. The acritarch assemblages also contain taxa such as, *Acanthodiacrodium* sp., *Coryphidium* cf. *almohadillum* Cramer and Díez, 1976, *Cymatiogalea* cf *cuvillierii* (Deunff, 1961) Deunff, 1964, *Cymatiogalea* sp. and *Stelliferidium* sp. These taxa are known from the Early Ordovician (Tremadoc and early Arenig) and their occurrence clearly indicates an important reworking event of Early Ordovician acritarchs into Early Silurian assemblages. The productive samples yielded sufficient microflora to demonstrate a Silurian age, most probably (Telychian) to early Wenlock (Sheinwoodian) age and the reworked material is Early Ordovician in age.

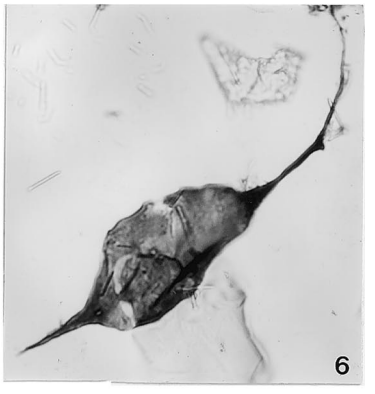
3.2.2.2. Slate Quarries Formation. Four samples were collected from this formation of which two were barren. The two productive samples contain identifiable acritarchs, cryptospores and rare scolecodonts. The organic matter is very similar to the productive samples from the Pollaphuca Formation. It should be noted that the identifications are based on a very low number of specimens, which are poorly preserved and mostly fragmentary. Two different types of assemblage are present;

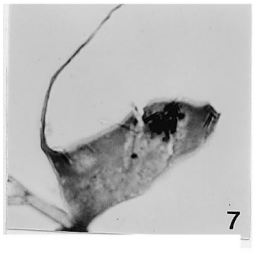
Assemblage 1: is composed of a few cryptospores such as, *Tetrahedraletes medinensis* Strother and Traverse, 1979 emend Wellman and Richardson, 1993 and *Velatitetras* sp. Burgess, 1991 and acritarch taxa such as, *Domasia amphora* Martin, 1969, *Domasia limaciformis* (Stockmans and Willière, 1963) Cramer, 1970 emend Hill, 1974, *Domasia trispinosa* and *Domasia* sp. These acritarch species are biostratigraphically important and they indicate a Silurian (Llandovery–Wenlock) age. The diagnostic species identified in the samples are listed in Table 2. Previous records of these taxa show that they significantly increase in abundance near the Llandovery–Wenlock boundary, particularly in lower palaeolatitudes (Cramer, 1970; Le Hérissé, 1989; Molyneux et al., 1996). The species *Domasia limaciformis* and *D. trispinosa* range from about middle Llandovery to

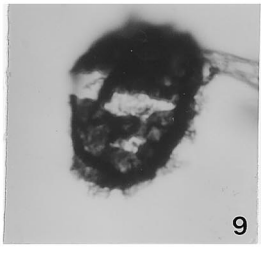
PLATE II

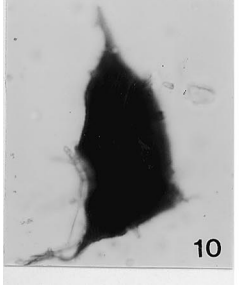
1 *Coryphydium* cf. *bohemicum* Vavrdová, 1972. Carricktriss Formation, 52102 sample 98/133, H39/3.
2 ? *Striatotheca* sp. Carricktriss Formation, 52103 sample 98/133, K42/1.
3 *Striatotheca* sp. Carricktriss Formation, 52103 sample 98/133, Q41.
4 *Cymatiogalea* cf. *cuvillierii* (Deunff, 1961) Deunff, 1964. Carricktriss Formation 52103 sample 98/133, W42/1
5 *Acanthodiacrodium* sp. Carricktriss Formation, 52102 sample 98/133, O48/25
6 *Stelliferidium* sp., Carricktriss Formation, 52103 sample 98/133, E58/2.
7 *Stelliferidium striatulum* (Vavrdová, 1966) Deunff et al., 1974. Carricktriss Formation, 52103 sample 98/133, O41.
8 *Acanthodiacrodium* sp. Carricktriss Formation, 52103 sample 98/133, T42/1-3.
9 *Velatitetras* sp. Slate Quaries Formation, 51666 sample PB/028, G41/2.
10 *Coryphidium* sp. Rathclarish Formation, 52071 sample 98/127, D38/2.
11 *Polygonium* sp. Carricktriss Formation, 52103 sample 98/133, S46.
12 *Cymatiogalea* sp. Carricktriss Formation, 52102 sample 98/133, W42/1.
13 *Tetrahedraletes medinensis* Strother and Traverse, 1979 emend Wellman and Richardson, 1993. Tipperkevin Formation, 51671 sample 98/016, K39/1-3.

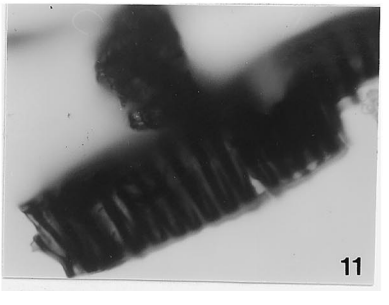












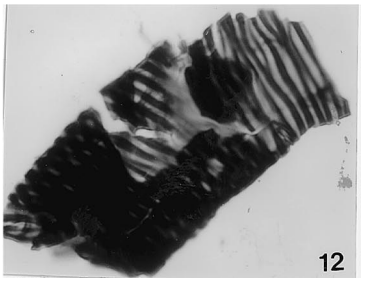


PLATE III

upper Wenlock (Le Hérissé and Gourvennec, 1995). The presence of *Domasia amphora* is particularly significant as this species is diagnostic of the late Llandovery to early Wenlock and so its presence is particularly important for correlation around the Llandovery–Wenlock boundary (Molyneux et al., 1996).

Assemblage 2: is a distinctive assemblage of acritarchs of Early Ordovician age, with taxa such as, *Acanthodiacrodium* sp., *Caldariola glabra* (Martin, 1973a) Molyneux in Molyneux and Rushton, 1988 *Coryphidium* cf. *almohadillum*, *Coryphidium* cf. *minutum* Cramer and Díez, 1976 *Coryphidium* cf. *tadlanum* Cramer and Díez, 1976, *Cymatiogalea* cf. *cuvillierii*, *Cymatiogalea* sp. and *Stelliferidium* cf. *simplex* (Deunff, 1961) Deunff et al., 1974. It is considered that assemblage 2 is entirely reworked into Llandovery–Wenlock aged sediments.

3.2.2.3. Glen Ding Formation. In the four productive samples, poorly preserved acritarchs are extremely rare and not very diversified. A few scolecodonts were found in two of the samples. The palynodebris is composed of many miscellaneous organic fragments including tubes such as *Laevitubulus* and *Porcatitubulus*.

The assemblage also contains, *Acanthodiacrodium* sp., *Cymatiogalea* sp., *Polygonium* sp., *Stelliferidium* sp., *Striatotheca* sp., which suggest an Early to Middle Ordovician age. However, the presence of banded tubes of *Porcatitubulus* indicates a Silurian age, no older than late Llandovery (Edwards and Burgess, 1990; Edwards and Wellman, 1996). Therefore, it is clear that the Early to Middle Ordovician acritarchs are reworked into assemblages of Silurian age.

3.2.2.4. Tipperkevin Formation. Ten productive samples obtained from this formation contain very few palynomorphs and although the number of acritarchs is small the taxonomic diversity is moderately high. Table 2 lists the taxa identified in the productive samples. The assemblages recorded are very similar to those found in the Slate Quarries and Pollaphuca Formations and contain *Deunffia furcata* Downie, 1960 var. *niagarensis* Thusu, 1973 (=*Domasia intermedia* Kiryanov, 1978, =*Downiea* cf. *argentina* Pöthé de Baldis, 1974). This species is particularly significant as it was found in the lower Wenlock, Rochester Formation of Ontario (Thusu, 1973) and in the upper Llandovery to lower Wenlock in the La Chilca Formation in San Juan in Argentina (Pöthé de Baldis, 1975). The short range of this species is important for correlation around the Llandovery–Wenlock boundary. Two species of cryptospores are also found; *Rugosphaera cerebra* Miller and Eames, 1982 and *Tetrahedraletes medinensis*. These assemblages also contain the acritarch taxa, *Acanthodiacrodium* sp., *Arkonia* sp., *Coryphidium* cf. *almohadillum*, *Coryphidium* cf. *bohemicum* Vavrdová, 1972, *Coryphidium* cf. *minutum* Cramer and Díez, 1976, *Cymatiogalea* cf. *cuvillierii*, *Cymatiogalea* sp., ? *Dasydiacrodium* sp., *Stelliferidium stelligerum* (Górka, 1967) Deunff et al., 1974, *Stelliferidium* cf. *simplex*, *Stelliferidium trifidum* (Rasul, 1974) Fensome et al., 1990, *Striatotheca* cf. *principalis* Burmann, 1970 var. *parva* and ? *Striatotheca* sp. Taxa such as *Stelliferidium trifidum* and *Coryphidium.* cf. *bohemicum* are characteristic of

PLATE III

1 *Domasia trispinosa* Downie, 1960. Slate Quarries Formation, 51666 sample PB/028, N50.
2 *Domasia trispinosa* Downie, 1960. Slate Quarries Formation, 51666 sample PB/028, T53/3.
3 *Domasia* sp. Slate Quarries Formation, 51666 sample PB/028, H49/3.
4 *Deunffia furcata* Downie, 1960 var. *niagarensis* Thusu, 1973. Tipperkevin Formation, 51530 sample 98/050, U40/2.
5 *Domasia amphora* Martin, 1969. Slate Quarries Formation, 51666 sample PB/028, O39/2.
6 *Deunffia furcata* Downie, 1960 var. *niagarensis* Thusu, 1973. Rathclarish Formation, 52071 sample 98/127, C41/3-4.
7 *Domasia limaciformis* (Stockmans and Willière) Cramer, 1970 emend Hill, 1974. Rathclarish Formation, 52082 sample 98/127, Y34/3.
8 *Deunffia furcata* Downie, 1960 var. *niagarensis* Thusu, 1973. Rathclarish Formation, 52083 sample 98/127, J51/3.
9 *Visbysphaera* sp.; Pollaphuca Formation, 51737 sample 98/044, T46/2-4.
10 *Domasia limaciformis* (Stockmans and Willière) Cramer 1970 emend Hill, 1974. Slate Quarries Formation, 51666 sample PB/028, O39/4
11, 12 *Porcatitubulus* sp. tubes with annular thickenings. 11, Tipperkevin Formation 51358, sample PB/008, J40/3; 12, Glen Ding Formation, 51668, sample PB/019, W43/1.

the Early Ordovician (late Tremadoc and early Arenig), however others such as, *Striatotheca* cf. *principalis* and *Arkonia* sp. are indicative of a middle Arenig to Llanvirn age (Brocke et al., 1995) These data clearly indicate that Early and Middle Ordovician acritarchs are reworked into Silurian material and have been sourced from different aged Ordovician strata. Therefore, the age of the Tipperkevin Formation is late Llandovery (Telychian) to early Wenlock (Sheinwoodian).

3.2.2.5. Carrighill Formation. The Carrighill Formation was previously considered to be Silurian in age (probably Llandovery–Wenlock) based on the occurrence of chitinozoa in the underlying Tipperkevin Formation (Brück and Downie, 1974; Brück et al., 1974). In the present study palynological assemblages are recorded from the Carrighill Formation for the first time. Eight samples were processed, however, only two samples yielded acritarchs, scolecodonts and tubular structures. The sparse assemblages contain the acritarch taxa, *Striatotheca* cf. *principalis* var. *parva*, *Stelliferidium* sp., *Vavrdovella* sp., *Veryhachium* sp. The presence of *S.* cf. *principalis* is indicative of an Early to Middle Ordovician (Arenig–Llanvirn) age. However, the presence of banded tubes assignable to *Porcatitubulus* indicates a Silurian age for the assemblage. This type of tubular structure first appears in the late Llandovery (Edwards and Burgess, 1990; Edwards and Wellman, 1996) and then becomes common in the Wenlock and Ludlow (Strother, 1988; Gensel et al., 1990).

The Early and Middle Ordovician acritarchs are considered to be entirely reworked into the Silurian material. Therefore, the most likely age of this formation is late Llandovery to Wenlock.

3.3. The Slievenamon inlier

Sixteen samples were collected from the Carricktriss, Ahenny, Rathclarish and South Lodge Formations.

3.3.1. Ribband Group

3.3.1.1. Carricktriss Formation. Two samples were collected from the Carricktriss Formation of which one was productive. This sample yielded a small acritarch assemblage of low taxonomic diversity. However, the assemblage contains several species such as, *Acanthodiacrodium* sp., *Coryphidium* cf. *bohemicum, Coryphidium* cf. *almohadillum, Coryphidium* sp., *Cymatiogalea* cf. *cuvillierii, Cymatiogalea* sp., *Pirea* sp., *Stelliferidium stelligerum, Stelliferidium striatulum* (Vavrdová, 1966) Deunff et al., 1974,, *Stelliferidium* sp., *Striatotheca* cf. *principalis* Burmann var. *parva* and ? *Striatotheca* sp. These taxa are characteristic of the Early and Middle Ordovician.

The Carricktriss Formation was originally palynologically dated by Colthurst and Smith (1977) as Upper Cambrian to Tremadoc. Subsequently, Smith (1979) re-examined the same palynological preparations and concluded that the Upper Cambrian acritarchs were reworked into Early Ordovician (Tremadoc–Arenig) material. This revised age is more consistent with the recorded occurrence of scolecodont fragments from the formation (Colthurst and Smith, 1979), because the oldest known unquestionable scolecodonts are from the Arenig (Szaniawski, 1996). The new palynological data clearly indicate an Early to Middle Ordovician age for this formation.

3.3.2. Kilcullen Group

3.3.2.1. Ahenny Formation. Five samples were collected from this formation of which only two samples were productive. The acritarch assemblages obtained from these samples are extremely sparse and very poorly preserved, and so the samples are not shown on Figs. 2B and 3. The only palynomorphs identified are *Micrhystridum* sp. and a few sphaeromorphs, therefore it is impossible to give an age for this material. However, previous palynological work by Smith (1979) has shown the Ahenny Formation to be Silurian throughout, most probably late Llandovery to early Wenlock in age.

3.3.2.2. Rathclarish Formation. Three samples were collected from this formation, however, only one (98/127) was productive. The acritarchs recorded are relatively well preserved and the presence of the distinctive *Domasia–Deunffia* complex allows a positive age determination to be made. In particular, the presence of *Deunffia furcata* var. *niagarensis*

gives a late Llandovery–early Wenlock age. The assemblage also contains acritarchs which are characteristic of an Early Ordovician age, such as *Coryphidium* cf. *minutum, Cymatiogalea* cf. *cuvillierii, Cymatiogalea* sp., *Stelliferidium* sp., *Striatotheca* sp. and *Vavrdovella* sp.

The age of the Rathclarish Formation is considered to be late Llandovery (Telychian) to early Wenlock (Sheinwoodian) in age and the Early and Middle Ordovician acritarchs are believed to be reworked. The Rathclarish assemblage is very similar in composition to those recorded from the Kilcullen Group west of the Leinster Granite.

3.3.2.3. South Lodge Formation. All seven samples collected from this formation were barren. The Silurian (Wenlock) age assigned to this formation is based on palynological data described previously by Colthurst and Smith (1977) and Smith (1979).

4. Discussion about reworking

In general, Early Ordovician acritarchs are commonly reworked into Silurian palynological assemblages, for example in the Condroz and Brabant areas of Belgium (Martin 1969, 1973b), Wales (Richardson and Rasul, 1990) and in the Killanena Formation of Slieve Aughty, central Ireland (Emo and Smith, 1978). In the present study, reworked Ordovician acritarchs have been recorded in all the productive Silurian samples of the Kilcullen Group. The state of preservation and thermal maturity of the reworked acritarchs is very similar to that of the in situ Silurian material. However, the reworked acritarchs are generally more abundant in Silurian samples from west of the Leinster Granite where they comprise up to 90% of the total acritarch assemblage, whereas in Silurian samples from Slievenamon they form up to 50% of the assemblage. Based on the documented first appearances of important Ordovician taxa (Molyneux et al., 1996), the reworked material ranges from: late Tremadoc to early Arenig with forms such as *Stelliferidium trifidum, Caldariola glabra* var. *glabra*; early to middle Arenig with forms such as *Coryphidium* cf. *bohemicum, Stelliferidium striatulum*, and late Arenig to Llanvirn as characterised by *Arkonia* sp. *Striatotheca principalis*.

5. Conclusions

The new palynological work shows that the Kilcullen Group west of the Leinster Granite is entirely Silurian in age and that the Ordovician palynomorphs found in it are reworked. This situation is also confirmed for the Kilcullen Group at Slievenamon, as had been previously been described by Colthurst and Smith (1977). The data now shows that the previous interpretation of a conformable sequence extending from the Early Ordovician Ribband Group into a "Lower Ordovician to Llandovery or Wenlock" Kilcullen Group (Brück et al., 1979) in the area west of the Leinster Granite is no longer tenable. The palynological evidence shows that a major stratigraphic break is present between the Ribband and Kilcullen Groups west of the Leinster Granite and at Slievenamon. The former group is of Early Ordovician age, while the latter is entirely Silurian. On the Dingle Peninsula recent work by Todd et al. (2000) has shown that there is a similar significant stratigraphic break to that seen in Leinster, between the Early Ordovician Annascaul Formation of Ribband Group aspect and the overlying Silurian, Ballynane Formation. Furthermore, a similar break is seen on the Isle of Man between the Manx Group, which in age and lithology closely correlates with the Ribband Group, and the Silurian Niarbyl Formation of the Dalby Group (Morris et al., 1999). Thus all the evidence points to the presence of a major break of regional importance extending southwestwards from the Isle of Man, through west Leinster and Slievenamon and into the Dingle Peninsula.

Acknowledgements

The authors especially acknowledge Marcella Mezzatesta-Giraldo for processing samples and Willy Strouvens (University of Liège) for the photographs and Jim Smith (University College Cork) for his help with production of some figures. Thanks also to the editors and the two referees M. Montenari and M. Tongiorgi for constructive comments that have improved the original manuscript.

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