

SHORT NOTE

THE MIDDLE DEVONIAN PLANT COLLECTIONS OF FRANCOIS STOCKMANS RECONSIDERED.

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(2 figures)

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ABSTRACT. The Middle Devonian plant fossils described by Stockmans from Sart-Dame-Avelines and Feluy, Belgium in 1968 were briefly restudied. Of the 12 taxa described from Sart-Dame-Avelines as few as only four distinct 'whole plants' may be present, due to progress in understanding the reconstruction and intraspecific variability of Middle Devonian plants. The material from Feluy is more fragmentary, and only three taxa were confirmed. Nevertheless, the phytogeographical significance of the collection is important, as is the extensive material of the early archaeopteridalean progymnosperm *Svalbardia*. Study of this last material is likely to reveal significant new data about the evolution of the Progymnospermopsida at a time when they were competing with large cladoxylopsid trees like *Wattieza*, also found in Stockmans' collection, to form early forest ecosystems.

KEY WORDS: Middle Devonian; Plants; Belgium; Archaeopteridales

Introduction

In 1968, Stockmans described three plant assemblages from the Middle Devonian of the Brabant Massif, Belgium. These were Source du Try-Coquia à Sart-Dames Avelines – 12 species, Chemin au Sud-est de l'écluse N° 26 a Feluy – 8 species, and Plan Incliné de Ronquières – 22 species. As these localities rival the more famous Goé locality in apparent diversity (see e.g. Berry and Fairon-Demaret, 2001) they have potential to be informative with regard to particularly palaeogeography.

All three of these localities I understand to be presently unavailable for restudy, because of the nature of the original exposure, and therefore Stockmans' collections from these areas are irreplaceable. Locality details can be found in Stockmans (1968).

The most diverse assemblage is Ronquières, where fossils came from the foundations of the tower constructed for the Plan Incliné. As nearby localities have recently been found and extensively collected by Gerrienne and Meyer-Berthaud (2006), and significant results are expected which will doubtless inform re-examination of Stockmans' material, I decided to concentrate my work on his collections from the other two locations. Some initial observations on, and interpretations of, the Ronquières material can be found in Berry and Fairon-Demaret (2001). For the present work, I was able to spend one day

preceding the conference working on the collections to supplement observations I had made in 1994/5 while working at the University of Liège with Muriel Fairon-Demaret. The intention of this extended abstract is to present my conclusions about the identities of the fossils described by Stockmans, with colour illustrations, for use in future palaeobiogeographic analyses.

Fossils are retained in the collections of the Institut Royal des Sciences Naturelles, Brussels, prefix Pb. Source du Try-Coquia à Sart-Dame-Avelines

Reniera verrucosa Stockmans Fig. 1c.

Stockmans 1968, p. 11-12; Pl. III figs 5, 5a.

This unusual specimen is a bulbous thin sheet of carbon, approximately 4 mm diameter, with regularly spaced perforations in it through which the internal sediment cast protrudes, giving a verrucate appearance to both the areas where the carbon is preserved and to where the cast only is exposed. Stockmans discussed the similarity with certain non-vascular plants such as *Protosalvinia* and *Pachytheca*. To my mind the appearance is more suggestive of certain verrucate arthropod carapaces, although the carbon layer is somewhat thick. This fossil remains problematic.

Wattieza givetiana Stockmans Fig. 1a, b.

Stockmans 1968, p. 13-14; Text-fig. 1; Pl. II figs 7, 7a.

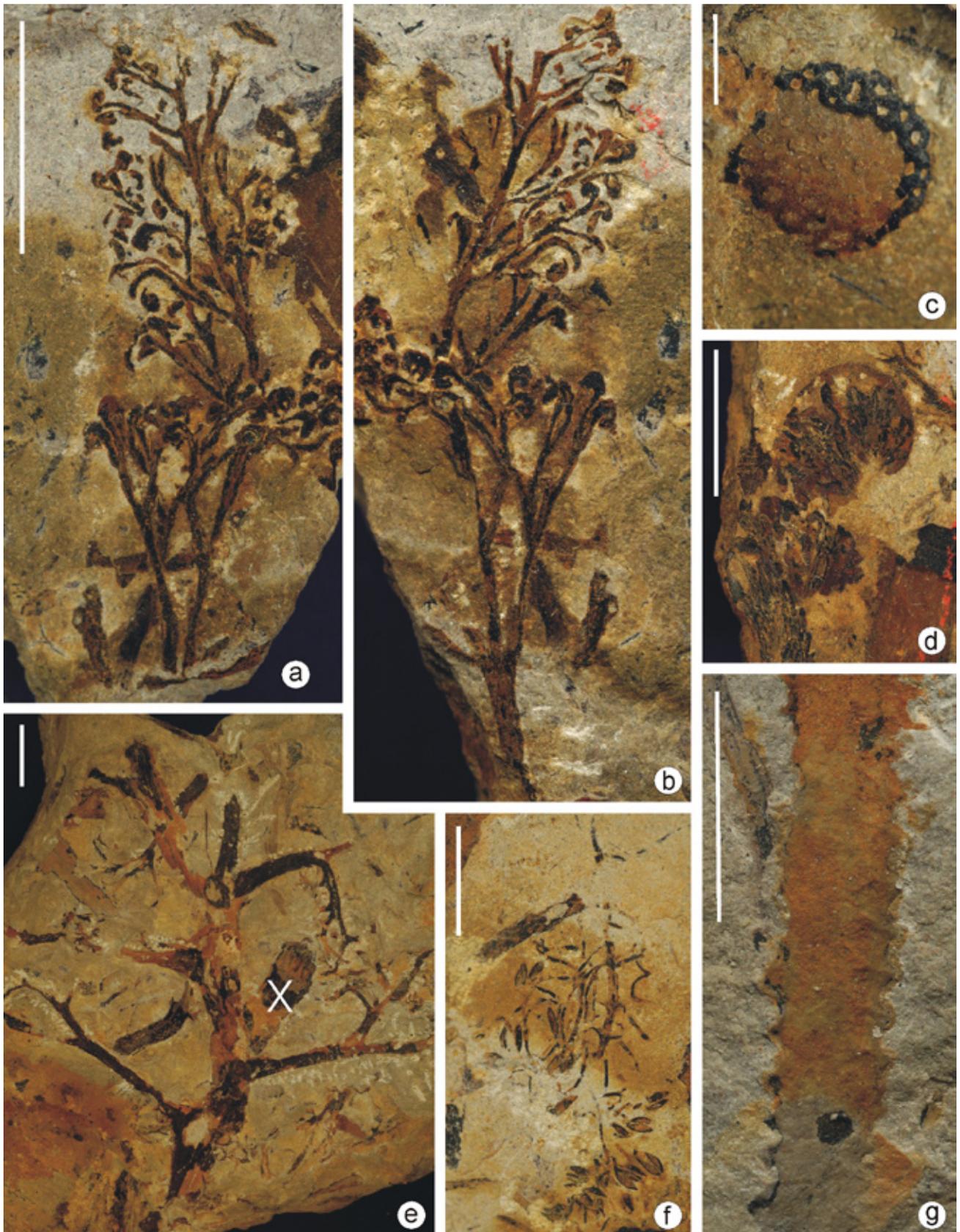


Figure 1: (a, b) *Wattieza givetiana* Stockmans, Pb 21759, Pb 21731. (c) *Reniera verrucosa* Stockmans Pb 21766. (d) *Protopteridium thomsonii* (Dawson) Kräusel et Weyland Pb 21748. (e) *Aneurophyton* (?) *furcatum* Stockmans Pb 21860. (f) *Niassioidea belgica* Stockmans Pb 24758. (g) *Serrulacaulis furcatus* Hueber et Banks Pb 91640. Scale Bars – a, b, d, g = 10 mm, c = 2 mm, f = 5 mm.

Berry 2000, p. 127-131; Text-fig. 1; Pl. I

Wattieza givetiana is based on a single illustrated specimen, part and counterpart, but another even smaller fragment is present in the collection (Pb 21447). Detailed morphology and comparison to fragments with identical overall morphology but more robust size from Venezuela is given by Berry (2000). The characteristics of the 35 mm long fragment are the central axis and the whorls of dichotomising laterals which terminate in elongate recurved sporangia where known. The name *Wattieza* has become more significant recently because similar fragments have been shown to be the distal fertile leaf-equivalent appendages carried on the digitate branches of the first forest tree found in New York State Stein *et al.* (2007) belonging to the family Pseudosporochnaceae in the Class Cladoxylopsida. This is the type material of the genus. With such a fragmentary specimen it is impossible to determine if the plant grew to the same tree size (at least 8 m) as in New York. Further parts of the whole plant may be represented by two other species recorded by Stockmans (below).

***Pseudosporochnus krejicii* Stur**

Stockmans 1968, p. 29; Pl. III figs 6, 6a.

A single fragment from Sart-Dame-Avelines (Pb 21760) shows a cluster of linear axes about 20 mm long rarely bifurcating at a narrow angle. The tips are slightly inflated and rounded. These are very similar to the tips of the lateral units found attached to a central axis in both *Wattieza* (Berry, 2000) and *Pseudosporochnus nodosus* Leclercq et Banks (Berry and Fairon-Demaret (1997)). As they are not attached to the central axis of the appendage, it cannot be determined to which genus they belong (in *Wattieza* they are whorled, in *Pseudosporochnus* they are sub-opposite). However because of the density, and also because of the occurrence of *Wattieza* at this locality, they probably represent the non-fertile leaf-equivalent of the *Wattieza* tree.

***Avelinesia antiqua* (Dawson) Stockmans**

Stockmans 1968, p. 33-34; Pl. IV fig. 7.

As explained by Stockmans, this plant fragment (not presently located), about 20 mm long, bears an external nodose ornament long considered typical of the genus *Pseudosporochnus*, but which is also found in *Wattieza* and related cladoxylopsids. At Sart-Dame-Avelines, such material is most likely to be derived from *Wattieza*, the only cladoxylopsid recognized on the basis of diagnostic characters. Stein and Hueber (1989) have demonstrated that the nodose ornament is caused by nests of sclereid cells in the cortex of the branches.

***Protopteridium thomsoni* (Dawson) Kräusel et Weyland**
Fig. 1d.

Stockmans 1968, p. 20-21; Pl. IV figs 4, 4a, 5, 5a.
Recurved axes with clusters of sporangia (e.g. Pb 21748) attached on short axes along the inner margin are typical of the aneurophytalean progymnosperm *Protopteridium*.

Stockmans' determination seems sound, with the reservation that there is no material of the rest of the plant for comparison with other material. This taxon is more usually referred to as *Rellimia thomsonii* (Leclercq and Bonamo, 1973).

***Aneurophyton* (?) *furcatum* Stockmans** Fig. 1e.

Stockmans 1968, p. 21-22; Text-fig. 5; Pl. III fig. 1.

The fragment is a 6 mm diameter main axis which is angled at each node, with lateral branches which are bifurcate both at the base (e.g. Fig. 1e, top right) and distally, inserted in a three-dimensional, possibly helical pattern. Stockmans made comparison with *Rhacophyton* and *Aneurophyton*, neither of which taxon is really comparable. Stenokoleales are an order of permineralized Middle Devonian plants for which a morphological concept is not yet established, but some authors emphasize the insertion of paired lateral branches (Matten, 1992). The genus *Crossia* Beck et Stein (1993) is a Middle Devonian example of the order which is found anatomically preserved at Ronquières (Gerrienne and Meyer-Berthaud, 2006). It will be interesting to see if material will be forthcoming that will allow direct comparison with Stockmans' specimen.

***Svalbardia avelinesiana* Stockmans** Fig. 2a, e.

Stockmans 1968, p. 23-24; Pl. II figs 1-6a; Pl. III figs 2-3.

***Svalbardia boyi* Kräusel et Weyland**

Stockmans 1968, p. 25; Pl. III figs 7, 7a. (presently not located)

***Thamnocladites vanopdenboschii* Stockmans**
Fig. 2b, c, d.

Stockmans 1968, p. 39-40; Pl. I figs 1-7.

***Sphenopteris brabantica* Stockmans** Fig. 2f.

Stockmans 1968, p. 38; Pl. I fig. 8.

Within these four taxa are represented a variety of axes, leaves and leafy axes that probably belong to one species of plant. The basic plan is of a relatively wide penultimate axis to which narrower ultimate axes are inserted at less than 45°. Sterile leaves include several intergrading morphologies which are wedge-shaped with a narrow base, but which differ in their degree of dissection and width. In some large leaves are seen to be attached to penultimate axes and smaller leaves are inserted laterally on the ultimate axes. Penultimate axes are often longitudinally striated. Fertile leaves are dichotomous and have elongate sporangia inserted in a line along one side.

This degree of variability is now recognised to be found in the leafy branches of Middle and Upper Devonian archaeopteridalean progymnosperms (e.g. Fairon-Demaret and Leponce, 2001; Hammond, 2004). The degree of dissection of the leaves is most typical of Givetian (late Mid Devonian) plants often attributed to the genus *Svalbardia* Høeg.

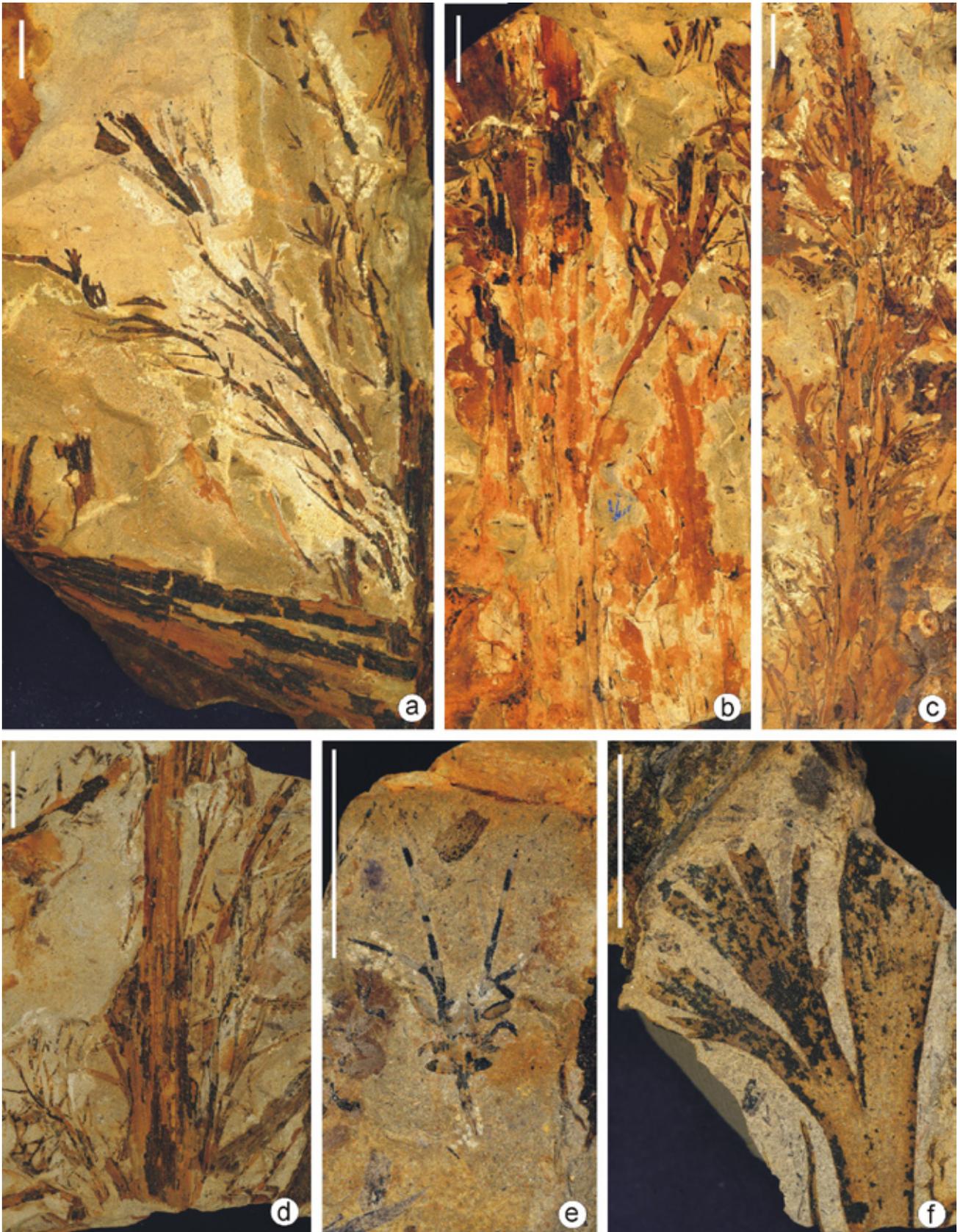


Figure 2: (a, e) *Svalbardia avalinesiana* Stockmans, Pb 21840, Pb 21782. (b, c, d) *Thamnocladites vanopdenboschii* Stockmans Pb 21764, Pb 21817, Pb 24607. (f) *Sphenopteris brabantica* Stockmans, Pb 21783. All scale bars = 10 mm.

There are several important questions which this material may answer, as in addition to the illustrated material there are at least an extra 10 drawer of specimens available. Critically, anatomy of the penultimate branches is apparently preserved in limonite, which may allow detailed comparison with *Archaeopteris*. This is the only plant collected in abundance enough to perhaps get an insight into the overall habit of the plant, which may not be a huge tree like some Upper Devonian Archaeopteridales.

***Niassioidea belgica* Stockmans** Fig. 1f.

Stockmans 1968, p. 14-16; Text-fig. 2; Pl. II figs 8, 8a.

This tiny fragment (Pb 24758) with dichotomous appendages terminating in elongate sporangia is too small to make further comment, and remains problematic.

Feluy

***Serrulacaulis furcatus* Hueber et Banks** Fig. 1g.

Stockmans 1968, p. 17-18; Pl. XIV figs 1, 1a.

This axis (Pb 91640) has two rows of triangular-prism shaped emergences placed oppositely, diagnostic of the zosterophyll genus *Serrulacaulis* as demonstrated by Berry and Edwards (1994).

***Thamnocladites vanopdenboschii* Stockmans**

Stockmans 1968, p. 39-40; Pl. I fig. n8.

This specimen (Pb 91757) shows an irregularly dichotomised axis which has the appearance of a distal branch of *Calamophyton*. However it does not bear characteristic appendages. It does not belong to *Svalbardia* as do the specimens from Sart-Dame-Avelines.

***Protopteridium thomsoni* (Dawson) Kräusel et Weyland**

Stockmans 1968, p. 20-21; Pl. XIV fig. 2.

More recurved axes with clusters of sporangia (Pb 91799) also seem closely comparable to *Protopteridium* as at Sart-Dame-Avelines.

***Calamophyton primaevum* Kräusel et Weyland**

Stockmans 1968, p. 34-35; Pl. XIV figs 7, 7a.

Only one of the specimens illustrated by Stockmans (1968) is likely to be a cladoxylopsid, possibly *Calamophyton*, because of the characteristic nodose compression surface. The generic attribution is in doubt because the appendages are not visible. However this specimen was not located during my visit. The other specimens (figs 5, 6) have no diagnostic characters at all.

***Svalbardia avelinesiana* Stockmans**

Stockmans 1968, p. 23-24; Pl. XIV fig. 9.

This specimen could not be located during my visit.

Conclusions

The Sart-Dames-Avelines assemblage, of Givetian age (Berry, 2000), is probably not as diverse as suggested by Stockmans' species list. The probable plants represented include the cladoxylopsid *Wattieza*, aneurophytalean and archaeopteridalean progymnosperms (*Protopteridium/Rellimia*, *Svalbardia*), and the enigmatic, possibly stenokolealean *Aneurophyton* (?) *furcatum*. Other material is too fragmentary for sensible analysis. This diversity is reduced considerably from Stockmans' species list.

The Feluy assemblage, probably of equivalent age, is more fragmentary still, but includes the zosterophyll *Serrulacaulis furcatus* and the aneurophytalean progymnosperm *Protopteridium/Rellimia*.

Both of these assemblages are typical of the plants growing across a wide expanse of the Laurussia and north western Gondwana at the time (Berry and Fairon-Demaret, 2001), although lacking iridopteridaleans, and are clearly less endemic than suggested by the idiosyncratic species list of Stockmans (1968). Amongst the most important material is the type of *Wattieza*, and the undescribed and described material belonging to *Svalbardia*.

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