
Nant Llech

Highlights

Nant Llech has yielded the best known example of a lower *Lyginopteris hoeninghausii* Zone plant assemblage from Britain. It is of particular interest as being coeval with the coal-ball horizons from northern England, which have played such a significant role in developing a better understanding of Late Carboniferous palaeoequatorial floras.

Introduction

This locality exposes Westphalian Coal Measures in the bed of Nant Llech, near Abercrave, Powys [SN 836 123]. Plant fossils were first discovered here by a local geologist, W.D. Ware, probably in the 1920s. They were briefly mentioned by Robertson (1932), but a more complete account was provided by Dix (1933) including some illustrations. Her identifications were partly modified in a later published list (Dix, 1934). Specimens from here were also figured by Crookall (1959).

In passing, it is worth mentioning the *in situ* lycopsid stumps, discovered here in the 1830s by W.E. Logan. They were the first examples of such stumps in Europe to be properly excavated, and are of some historical interest (see account in North, 1931). However, as the trunks were removed from the site shortly after their discovery, to be placed in the grounds of the Royal Institution at Swansea, they can no longer be regarded as an integral part of the interest of the site.

Description

Stratigraphy

The geology of the basal Coal Measures on the north crop of the South Wales Coalfield has been described by Leitch *et al.* (1958), who included a stratigraphical log for this locality (summarized in (Figure 6.12)). Three shale beds yielding plant fossils are known and were named by Dix (1933): Bed B, immediately above the Farewell Rock; Bed C, 15 metres higher; and Bed D, 9 metres above that. The palaeontology indicates that they are early Langsettian in age. They are almost certainly interdistributary bay deposits in a lower delta-plain setting.

Palaeobotany

The plant fossils are preserved here as impressions. The following species are known, with their occurrence in the three plant beds (B, C and D) given in parentheses:

Lycopsida:

Lepidodendron aculeatum Sternberg (B,C)

Sigillaria elegans (Sternberg) Brongniart (C,?D)

Lepidoploios acerosus Lindley and Hutton (B,D)

Botbrodendron minutifolium Boulay (B)

B. punctatum Lindley and Hutton (B,C)

Lepidostrobophyllum lanceolatum (L. and H.) Bell (B,D)

Lepidostrobus ornatus Brongniart (B)

Flemingites olryi (Zeiller) Brack-Hanes and Thomas (B)

Equisetopsida:

Asterophyllites equisetiformis Brongniart (B)

Calamites sp. (B,C,D)

Calamostachys sp. (C,D)

Filicopsida:

Pecopteris plumosa (Artis) Brongniart (B,C)

P. volkmannii Sauveur (D)

P. minor Kidston (C,D)

Renaultia gracilis (Brongniart) Zeiller (B,C)

R. crepinii (Stur) Kidston (B)

Sphenopteris warei Dix (C)

Cycadopsida:

Alethopteris lonchitica Sternberg (B,C)

A. decurrens (Artis) Zeiller (B,D)

A. valida Boulay (D)

Neuralethopteris jongmansii Laveine (B,C,D)

N. rectinervis (Kidston) Laveine (C,D)

Paripteris gigantea (Sternberg) Gothan (C)

Trigonocarpus sp. (B)

Lagenostomopsida:

Karinopteris acuta (Brongniart) Boersma (B,C,?D)

Eusphenopteris hollandica (Jongmans and Gothan) Novik (D)

Lyginopteris hoeninghausii (Brongniart) Gothan (B,C)

L. baeumleri (Andrae) Gothan (B,C)

Adiantites tenellus Kidston (B)

Pinopsida:

Cordaites principalis (Germar) Geinitz (B,C,D)

Interpretation

The lycopsids, as listed in Dix's papers, are represented by a variety of stems and fructifications. Some of the identifications mentioned by Dix have been generally accepted in the literature (e.g. *Sigillaria elegans* by Crookall, 1966). There are problems with others, however, which are in clear need of critical revision. For instance, she lists both *Lepidodendron obovatum* and *L. cf. aculeatum*, two species which have frequently been confused, and which Thomas (1970) places in synonymy. The list given above only mentions *L. aculeatum*, the earliest published of these two names; but it is possible that the specimens might instead belong to *Lepidodendron mannebachensis* Presl (compare comments by Thomas, 1970, pp. 149–51). As pointed out by Crookall (1966), similar problems arise with the species of strobili *Lepidostrobus ornatus* and *L. variabilis*, both of which were again mentioned from Nant Llech. Crookall's interpretation of *L. ornatus* is very flexible, and means little more than compressed 'cigar-shaped' strobili; but Brack-Hanes and Thomas (1983) give a much narrower circumscription, including details of the spores that it contained. The Nant Llech strobili need to be reexamined in the light of the observations by Brack-Hanes and Thomas.

Among the equisetopsid remains, Dix mentioned from Nant Llech stem pith casts as *Calamites cf. cistiiformis* Stur. However, *C. cistiiformis* Stur does not normally occur as high as the Westphalian (Leggewie and Schonenfeld *in* Gothan *et al.*, 1959), and so the Nant Llech specimens are listed here merely as *Calamites* sp.

The ferns are represented by a number of species, which can be essentially divided into two groups: the *Pecopteris* species with *Senftenbergia*-type sporangia and belonging to the family Tedeleaceae (Botryopteridales), and the *Renaultia* species, which belong to the Urnatopteridaceae (Urnatopteridales). Dix recorded *Sphenopteris lanarkiana* Kidston from here, but Brousmiche (1983) has transferred this species to *Renaultia crepinii*, although she made no reference to the Nant Llech material (Figure 6.13). Dix's *Sphenopteris warei* has been retained in the list, although it is based on very inadequate material and has been virtually ignored in the literature.

Dix (1933) documented the pteridosperm foliage fragments in rather more detail than the other elements in the assemblage. A number of her identifications have been reviewed and in some cases revised (e.g. *Lyginopteris* by Pateisky, 1957; *Neuraethopteris* by Laveine, 1967; *Eusphenopteris* by van Amerom, 1975) and the species list quoted above has taken these amendments into account.

In addition to the listed pteridosperm taxa, Dix recorded *Neuropteris cf. beterophylla* (Brongniart) Sternberg and *Mariopteris cf. sphenopteroides* (Lesquereux) Zeiller. *N. beterophylla* has been substantially revised since Dix's work (Laveine, 1967; Cleal and Shute, 1991) and is now normally thought to occur at higher stratigraphical levels. It is possible that Dix's record refers to distal fragments of *Neuraethopteris*.

As pointed out by Boersma (1972), *M. sphenopteroides* is a taxon of doubtful validity. He does not refer directly to the Nant Llech material, but argued that the only record of the species from Europe prior to Dix was by Zeiller (1886–1888, pl. 19, figs 3 and 4), and that this belongs to *Fortopteris latifolia* (Brongniart) Boersma. Dix's identification needs to be reviewed in the light of Boersma's comments.

This assemblage belongs to the lower part of the *Lyginopteris hoeninghausii* Zone of Wagner (1984), now referred to as the *Neuraethopteris jongmansii* Subzone of Cleal (1991), and is the best example of its type in Britain (Figure 6.14). Similar assemblages are known from the Tenby–Saundersfoot coast in Pembrokeshire (Goode, 1913; Jenkins, 1962) but the fossils from there are not as well preserved, due largely to tectonic deformation. They are also known from the Bideford Formation in North Devon (Arber, 1904b), mainly from 'culm workings' which are no longer in existence. Despite extensive outcrop of the formation along the Devon coast near Westward Ho!, few plant fossils have been found there. From northern Britain, similar assemblages have been reported from the basal Coal Measures, such as above the Black Coal (Walton, 1932) and the Kilburn Coal (Dix, 1934), but there are no sites now yielding the fossils.

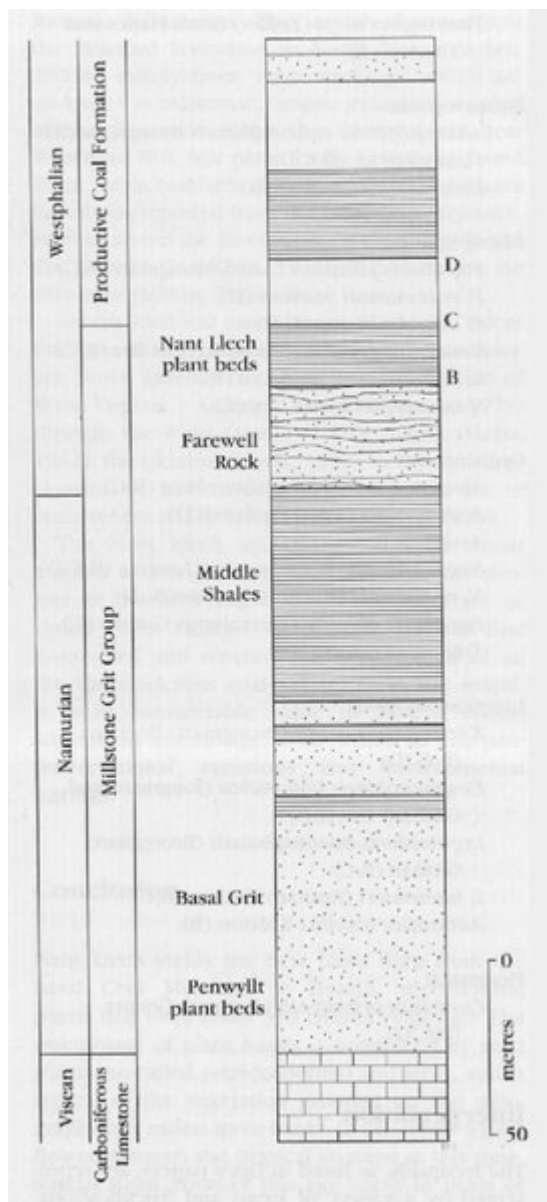
Almost identical assemblages of species occur throughout the palaeoequatorial belt, from eastern North America (e.g. New River Formation of West Virginia — Gillespie and Pfefferkorn, 1979) through the Ruhr (Josten, 1962), Silesia (Stopa, 1962), the Ukraine (Novik, 1952) to the Caucasus (Anisimova, 1979) (for a more complete list of occurrences and references, see Wagner, 1984).

The Nant Llech assemblage is of particular interest as being coeval with the coal-ball horizon of northern England (the Halifax Hard or Union coals; Phillips, 1980). This was the first discovered and remains the best studied of all the Carboniferous coal-ball seams in the world. It is of considerable value to have a coeval assemblage, with which to compare preservational variations and environmental settings.

Conclusion

Nant Llech yields the best fossil flora from the basal Coal Measures in Britain, representing plants that lived about 310 million years ago. The assemblage of plant fossils is dominated by seed plants (so-called pteridosperms) and ferns, and is typical of the vegetation growing on the topographically raised levee-banks of the rivers which flowed through the tropical swamps at this time. Similar fossil floras of this age occur in many of the coalfields of North America and Europe, including West Virginia, the Ruhr, Silesia, Ukraine and the Caucasus. They represent the start of the growth of the large-scale swamp-forests that spread throughout the tropical belt at this time and lasted for some 10–15 million years. The peats generated by these forests were converted by geological processes into the economically important coal deposits of Europe, North America and China.

References



(Figure 6.12) Stratigraphical section at Nant Llech, showing position of plant beds. Based on Dix (1933).



(Figure 6.13) *Renaultia crepinii* (Stur) Kidston. Part of frond from a small herbaceous fern; Natural History Museum, London, specimen V.23353. Lower Productive Coal Formation (Langsettian), Nant Llech. x 2. (Photo: Photographic Studio, Natural History Museum, London.)



(Figure 6.14) *Neuralethopteris jongmansii* Laveine. Part of trigonocarpalean frond; Natural History Museum, London, specimen V.23359. Lower Productive Coal Formation (Langsettian), Nant Llech. x 1. (Photo: Photographic Studio, Natural History Museum, London.)