Moel Hiraddug

Highlights

Moel Hiraddug is the best available locality for plant fossils in the Visean Foel Formation of North Wales. A number of taxa are unique to here, including *Lepidodendropsis jonesii, Archaeosigillaria stobbsii, Rhacopteris weissii* and *Calathiops dyserthensis.* It is also one of the few Visean localities where the plant fossils have cuticles preserved.

Introduction

This Lower Carboniferous site consists of two small quarries south of Dyserth, North Wales [SJ 061 783] (Figure 5.38). Some authors have referred to it as 'Dyserth' (e.g. Lacey, 1962). There is a Dyserth Quarry *c.* 0.5 km further north, however, and so the alternative name Moel Hiraddug Quarries is used here (named after the hill on the side of which they occur). Plant fossils were first recorded by Morton (1871, 1886, 1898), who noted similarities with Bowman's (1837) assemblage from a similar stratigraphical interval on the opposite side of the Vale of Clwyd, at Craig-y-Forwen near St Asaph. Fossils from Moel Hiraddug were also mentioned by Hind and Stobbs (1906) and Hind (1907), although the first detailed description with illustrations was Walton's (1926) analysis of *Rhacopteris weissii* Walton. Walton (1928), Neaverson (1930) and Hirmer (1939) all briefly mentioned the Moel Hiraddug assemblage, but it was not until Lacey made extensive collections here between 1946 and 1960 that its full diversity could be assessed. Provisional taxonomic lists were given by Lacey (1952a, b) who later published a full monographic treatment (Lacey, 1962).

Description

Stratigraphy

There have been numerous geological accounts of this area (e.g. Morton, 1871, 1886; Strahan, 1885a; Hind and Stobbs, 1906; Neaverson, 1930, 1945; Somerville *et al.,* 1989). The strata exposed at Moel Hiraddug Quarries are about 17 metres of brown limestones, with lenticular shale and sandstone bodies, and they belong to the Foel Formation (traditionally called the Lower Brown Limestones). Somerville *et al.* (1989) have placed this formation in the upper Chadian, and suggest that it represents shallow marine deposits.

Palaeobotany

The fossils are mainly compressions, sometimes with cuticles still preserved. The assemblage comprises the following taxa:

Algae (division unknown):

Koninckopora inflata (de Koninck) Wood

Bythotrepis plumosa Kidston

B. nodosa Lacey

Lycopsida:

Archaeosigillaria stobbsii Lacey

Clwydia decussata Lacey

Lepidodendropsis jonesii Lacey

Lepidostrobophyllum fimbriatum (Kidston) Allen

Lepidodendron sp.

Stigmaria ficoides (Sternberg) Brongniart

Stigmaria sp.

Knorria acicularis Göppert

?Halonia sp.

Equisetopsdia:

Archaeocalamites radiatus (Brongniart) Stur

Bowmanites tenerrimus (Ettingshausen) Hoskins and Cross

Progymnospermopsida(?):

Rhacopteris weissii (Walton) Hirmer

R. subcuneata Kidston

Lagenostomopsida:

Calathiops dyserthensis Lacey

Interpretation

This is the type locality for *Archaeosigillaria stobbsii* (Figure 5.40), and has yielded information on both gross morphology and epidermal structure. It is very similar in gross morphology to *Archaeosigillaria kidstonii* Kräusel and Weyland from the Carboniferous Limestone of Cumbria (Kidston, 1885a, 1901b; Crookall, 1966; Chaloner *in* Boureau *et al.,* 1967). However, since the epidermal structure of *A. kidstonii* is unknown, Lacey (1962) opted to place the better-preserved Moel Hiraddug specimens in a new species.

Associated with the *Archaeosigillaria* stems are slender leafy shoots. Lacey (1962) noted that they had a different phyllotaxis and epidermal structure to *A. stobbsii,* and so assigned them to a different species, *Clwydia decussata* (Figure 5.39). However, similar leafy shoots have been reported in association with *Archaeosigillaria* at other Visean localities (e.g. Kidston, 1885a), and many workers consider them to be parts of the same plant. Central to the debate is the interpretation of two of Kidston's specimens (Chaloner *in* Boureau *et al.,* 1967, fig. 340 c, d) as showing the attachment of such leafy shoots to *Archaeosigillaria* stems. Rowe (1988a) has recently concluded that these specimens are too poorly preserved for the case to be proved, and that the taxonomic separation of the stems and shoots is best retained, at least until the group as a whole can be revised in detail.

Lacey (1952a) identified a single stem fragment as *Lepidophloios* cf. *laricinus* Sternberg, but, in a footnote to the paper, Jongmans suggests that it might be a *Lepidodendropsis.* Lacey (1962) later demonstrated that the stem was eligulate, thus tending to confirm Jongmans' view. It has a very similar gross morphology to *Lepidodendropsis vandergrachtii* Jongmans and Gothan (e.g. Jongmans *et al.,* 1937, figs 33–39, 49), except that the leaf cushions are more elongate and the leaves more obliquely attached. These differences, and the absence of information on the *L. vandergrachtii* epidermal structure, caused Lacey to refer the Moel Hiraddug specimen to *Lepidodendropsis jonesii.*

The lycopsid sporophylls *Lepidostrobophyllum fimbriatum* occur commonly here. Elsewhere, they are often associated with *Eskdalia* stems (e.g. Puddlebrook — see p. 169), but there is no evidence of such stems at Moel Hiraddug. However, at another Foel Formation exposure, at Graig Quarry, stems were identified by Lacey (1962) as *Lepidodendron*

perforatum Lacey, which Rowe (1988c) considers to belong to *Eskdalia* (although he makes no formal transfer of the species).

Equisetopsids are mainly represented by *Archaeocalamites radiatus* stems, without any evidence of the foliage. In addition, Lacey (1962) described a single sphenophyllalean strobilus with incised sporophylls, under the name *Bowmanites tenerrimus;* but again there is no evidence of the foliage.

The only unequivocal evidence of pteridosperms is the fructification *Calathiops dyserthensis.* This form-genus is usually regarded as having been attached to lagenostomalean fronds such as *Diplopteridium* and *Diplothmema,* but no such fronds have so far been reported from Moel Hiraddug.

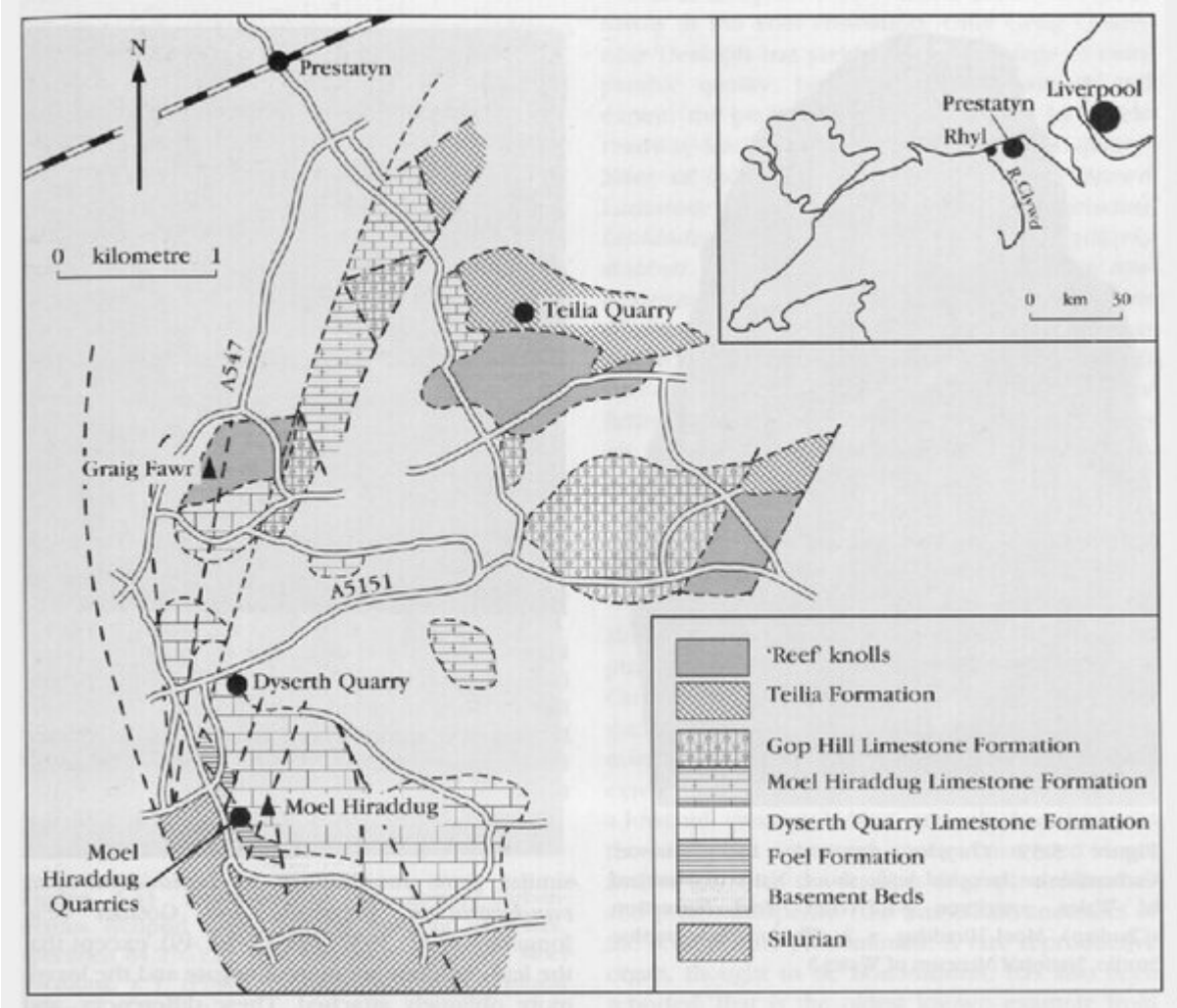
Two species of the ?progymnosperm *Rhacopteris* have been reported, *R. weissii* and *R. subcuneata* (Walton, 1926; Lacey, 1962). The former is only known from this locality and is of interest in being one of the few rhacopterid species from which cuticles have been prepared (Lacey, 1962). This may eventually help resolve the taxonomic position of these leaves.

This is easily the best available locality for plant fossils in the Foel Formation. Only Graig Quarry near Denbigh has yielded an assemblage of comparable quality; but, although this site is still extant, the plant bed is now obscured by a new roadway leading to the upper part of the quarry. Many of the species found in the Lower Brown Limestone are unique to the formation, including *Lepidodendropsis jonesii, Archaeosigillaria stobbsii, Rhacopteris weissii* and *Calathiops dyserthensis;* also '*Lepidodendron*' *perforatum* (*?Eskdalia* sp. — Rowe, 1988c), although this has not so far been reported from Moel Hiraddug. It is also of particular significance as one of the few British Visean palaeobotanical sites where cuticles are still preserved, allowing details of the epidermal structure to be observed.

Conclusion

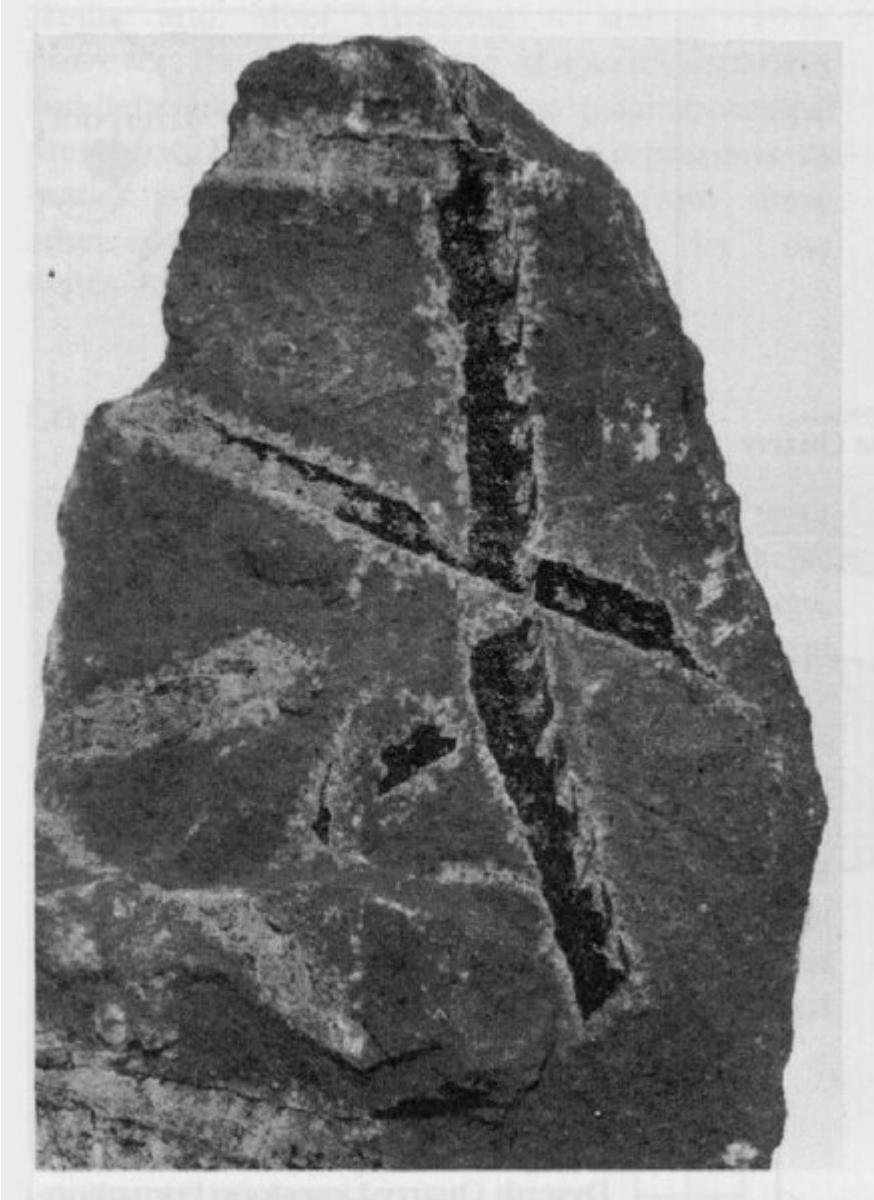
Moel Hiraddug has yielded a diverse assemblage of plant fossils, dating from the early part of the Carboniferous period, about 330 Ma. It represents the remains of vegetation growing on the northern margins of St George's Land (an island that extended over parts of central Britain), probably in a lowland, swampy habitat, and which drifted into the nearby sea. Seventeen species have been identified so far, with the remains of giant club-mosses and progymnosperms (the immediate ancestors of the seed plants) predominant. A rare reproductive organ, thought to be *Bowmanites,* has also been reported, that is the oldest known example from Britain of this particular group of horsetails, which, in the Late Carboniferous, were important members of the tropical swamp vegetation. Of special interest is that many of the fossils still have their outer protective 'skin' (known as the cuticle). Plant cuticles have been widely studied in younger fossil floras and have proved of considerable value, as they are often the only source of anatomical detail still preserved. For reasons that are not clear, however, cuticles are extremely rare in the Lower Carboniferous, which makes their presence at Moel Hiraddug of considerable potential importance.

References



(Figure 5.38) Lower Carboniferous geology of the area south of Prestatyn, showing the position of the quarries at Moel Hiraddug and Teilia. Based on Somerville et at (1989, figure 1).

(Figure 5.40) Archaeosigillaria stobbsii Lacey. Lower Carboniferous lycopsid leafy shoots; Natural History Museum, London, specimen V.16012. Foel Formation (Chadian), Moel Hiraddug. x 1. (Photo: Photographic Studio, Natural History Museum, London.)



(Figure 5.39) Clwydia decussata Lacey. Lower Carboniferous lycopsid leafy shoot; National Museum of Wales, specimen 84.27G125. Foel Formation (Chadian), Moel Hiraddug. x 2. (Photo: Photographic Studio, National Museum of Wales.)