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# Llanbradach Quarry

## Highlights

Llanbradach Quarry yields the best examples of plant petrifications from the South Wales Pennant Measures. The only other Upper Carboniferous petrifications known from Britain are the rather older (early Langsettian) coal-balls of northern England.

## Introduction

This site is a disused quarry in upper Westphalian sandstones (Figure 6.21), south of the village of Llanbradach, 3 km north of Caerphilly [SO 146 894]. The only detailed account of the plant fossils from here is that given by Crookall (1931b). They appear to have been first discovered by J. Storrie, at some time in the second half of the nineteenth century, and Storrie's collection formed the basis of Crookall's work. Additional material was, however, also collected during the 1920s by W.D. Ware.

## Description

### Stratigraphy

The plant fossils here occur in the Brithdir Beds, the topmost member of the Lower Pennant Measures. They are therefore early Westphalian D in age (Cleal, 1978). Some ten metres of mainly massive Pennant sandstones are exposed here. The best preserved specimens were found in conglomeratic bands within the coarse sandstones. They clearly underwent considerable transportation before being entombed in the sediment, and so any palaeoecological interpretation is difficult. They are, however, unlikely to represent plants from the swampy, peat-forming parts of the forests, but rather levee-bank or extra-basinal assemblages.

### Palaeobotany

The fossils are calcareous petrifications, with only the more robust, woody tissue being preserved. Crookall mentioned the following taxa:

*Calamites* sp. *Psaronius* sp.

cf. *Mesoxylon* spp.

*Dadoxylon* sp.

### Interpretation

The Llanbradach specimen of *Calamites* only shows secondary wood. It was assigned to this form-genus because the wood has mainly scalariform pitting on the radial xylem walls, the rays consist of vertically elongate cells, and the presence of 'infra-nodal canals'.

Llanbradach has yielded only the second known species of the marattialean tree-fern *Psaronius* from Britain, the other being the coal-ball species *P. renaultii* Williamson. The specimens described by Crookall show the characteristic peripheral 'root-zone', that forms the outer part of the *Psaronius* stems. Although some evidence of the vascular and cortical structure was found by Crookall, better preserved material will be needed before a specific identification can be made.

The remaining specimens from Llanbradach are probably cordaite wood. Two of them described by Crookall show a siphonostele and were identified as cf. *Mesoxylon* sp. They are unusual for cordaite stems in that they have very poorly developed rays in the secondary wood. However, neither specimen was well enough preserved to demonstrate the maturation of the cauline stele or the structure of the leaf traces, which is essential for a reliable identification of such stems. The situation is further complicated by the proposals by Rothwell and Warner (1984) and Trivett and Rothwell (1985) to change the concept of the two main form-genera of petrified cordaite stems, *Cordaixylon* Grand'Eury (synonyms *Cordaioxylon* Felix and *Pennsylvanioxylon* Vogellehner) and *Mesoxylon* Scott and Maslen, to include fertile structures and leaves, thus making them in effect whole-plant genera.

The specimens assigned by Crookall to *Dadoxylon* sp. are mainly just fragments of secondary wood. One might have a siphonostele, but the primary region in the centre of the stem is not preserved. The identification of such secondary wood in isolation is difficult but, in the Upper Carboniferous, it usually belongs to the cordaites. The tracheid pitting and form of the rays would seem to support this.

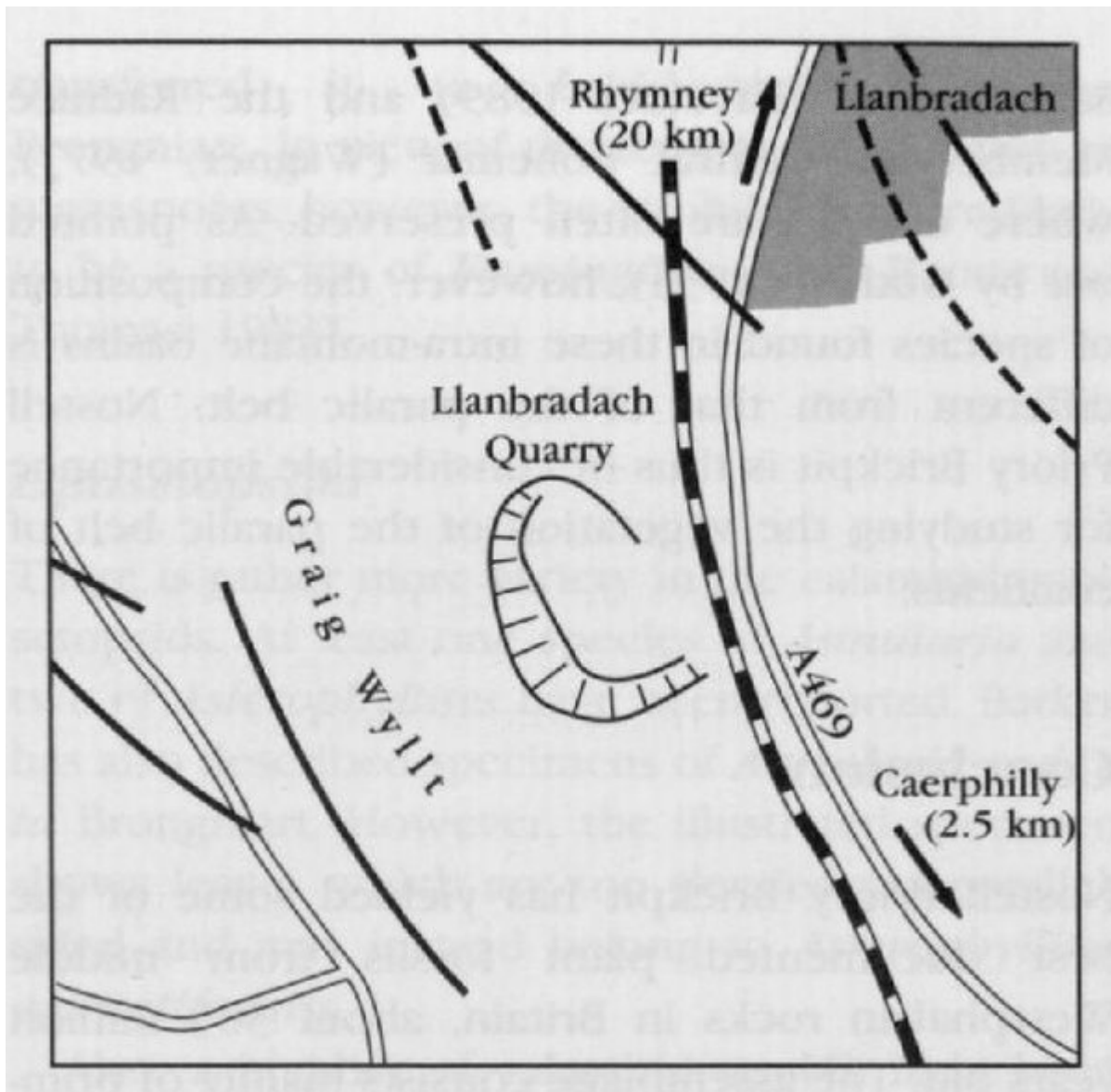
This is the best site for plant petrifications in the Pennant Measures. Lillie (1910) and Crookall (1927) describe similar specimens from Staplehill near Bristol, although this site no longer exists. Elsewhere in Britain, Upper Carboniferous plant

Faults petrifications are known only from the coal-balls of the basal Coal Measures (lower Langsettian) of northern England (Phillips, 1980). These are not only significantly older than the Pennant fossils, but represent quite a different, swampy habitat, dominated by lycopsids. Abroad, the nearest comparisons are with coal-ball assemblages from the Upper Moscovian of the Ukraine (Snigirevskaya, 1972) and the middle of the Carbondale Formation of Indiana (Canwright, 1959), but again these contain predominantly the lycopsids of the swamp habitats, rather than the equisetes, ferns and pteridosperms of the levee vegetation. Llanbradach thus yields the only known anatomically-preserved plant fossils representing the levee-bank vegetation of the early Westphalian D.

## Conclusion

Llanbradach Quarry is the only site in Britain to yield plant fossils from the upper Coal Measures with anatomical features preserved. The fossils include the remains of giant horsetails, tree-ferns and seed plants, which were growing on raised levee-banks of rivers flowing through the tropical swamp-forests of the time. The fossils nearest in age showing details of anatomy are some five million years older, found in the Coal Measures of northern England, and these are dominated by quite different types of plant, mainly giant club-moss trees that grew within the wetter parts of the swamp-forests. Although the Llanbradach fossils were subject to a considerable degree of transport and erosion, having drifted some distance down rivers, they give a good impression of the type of vegetation growing in South Wales in the late Westphalian times, about 305 million years before the present.

## [References](#)



(Figure 6.21) Locality map for Llanbradach Quarry.