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# Stairhill

## Highlights

Stairhill has yielded the only known plant fossil assemblage from the Lower Permian of Britain, and is comparable to coeval assemblages from continental Europe.

## Introduction

Permian sandstones are exposed in the bed of the River Ayr near Stairhill, Strathclyde Region [NS 452 243] (see (Figure 7.7)). Plant fossils were first reported by Mykura (1960, 1965), and preliminary identifications provided by Chaloner (*in Mykura, 1965*). Some of these identifications were subsequently challenged by Wagner (1966; Wagner *in Smith et al., 1974*), and a full systematic analysis of the assemblage was given by Wagner (1983).

## Description

### Stratigraphy

The plant fossils occur in a one metre thick tuffaceous interval of mudstones and sandstones within the Mauchline Sandstones, and thus comprise part of the New Red Sandstone of the Mauchline Basin. Their chronostratigraphical position has been the matter of some debate, but the plant fossils suggest a probable early Autunian (Asselian) age (Wagner, 1983).

### Palaeobotany

The plant fossils are preserved as impressions. The following species are known:

Equisetopsida:

*Annularia stellata* (Sternberg) Wood

*A. cf. spicata* Gutbier

*Asterophyllites equisetiformis* Brongniart

Filicopsida:

*Lobatopteris geinitzii* (Gutbier) Wagner

*Remia pinnatifida* (Gutbier) Knight

*Pecopteris cf. monyii* Zeiller

Cycadopsida:

*Odontopteris subcrenulata* var. *gallica* Doubinger and Remy

## Interpretation

A variety of equisetopsid foliage was reported from Stairhill by Wagner (1983), who assigned most of that identified to the wide-ranging species *Annularia stellata* and *Asterophyllites equisetiformis*. A single specimen with smaller and stiffer-looking leaves was assigned to *Annularia cf. spicata*. However, these identifications may have to be revised in the

light of the work of Kerp (1984b), who described rather similar foliage from the Lower Permian of Germany as *Annularia carinata* (Gutbier) Schimper. In the absence of any evidence of fructifications, or even of the morphology of the stem that bore the leaves, the status of these Stairhill leaves is difficult to judge.

The dominant fern in the assemblage is *Lobopteris geinitzii*. Wagner (1983) gave a detailed systematic discussion of this species, particularly as to its position relative to the very similar *Lobopteris polypodioides* (Sternberg) Knight, from which it differs by having somewhat larger, squatter pinnules. The Stairhill specimens provide no evidence of fertile structures, but German material (Göppert, 1864) shows *Cyathocarpus*-like sporangia. Together with the predominance of pinnatifid pinnules in the frond, this supports Wagner's inclusion of this species within the form-genus *Lobopteris*. Wagner (1983) described some other fern fragments with pinnatifid pinnules similar to those of *L. geinitzii*. However, these have a denser venation with a different forking pattern, and so Wagner identified them as *Pecopteris pinnatifida*. No fertile specimens have so far been found at Stairhill. They are clearly similar, however, to the frond fragments from Spain, which bear sporangia known as *Remia* (Knight, 1985). Knight proposed that the species should be transferred to *Remia*, a view which is followed here.

A single, near-terminal pinna fragment from Stairhill has been compared with *Pecopteris monyii* by Wagner (1983), although he also pointed out that there was a possible comparison with *Pecopteris densifolia* Göppert. The Stairhill specimen has rather tapered pinnules, and so Wagner made the main comparison with *P. monyii*. A definite identification awaits the discovery of more specimens.

Pteridosperm remains all appear to belong to the medullosan frond species *Odontopteris subcrenulata*. Wagner (1983) assigned this species to the form-genus *Mixoneura*. The distinction between *Odontopteris* and *Mixoneura* is far from clear, however, and needs to be confirmed by additional evidence, such as epidermal structures. The traditional view is therefore accepted here, and the species retained in *Odontopteris*. The Stairhill specimens of *O. subcrenulata* have more or less 'square' lateral pinnules with a short midvein, and large apical pinnules. Wagner therefore assigned them to *O. subcrenulata* var. *gallica*, following the classification of Doubinger and Remy (1958).

Stairhill has yielded the only known Early Permian plant fossils from Britain. Assemblages from the Keele Formation of the English Midlands have been thought to be of similar age (Howell, 1859; Vernon, 1912; Dix, 1935), but recent palynological evidence suggests that at least part of the Keele Formation is late Westphalian D or Cantabrian (B. Besly pers. comm., 1989).

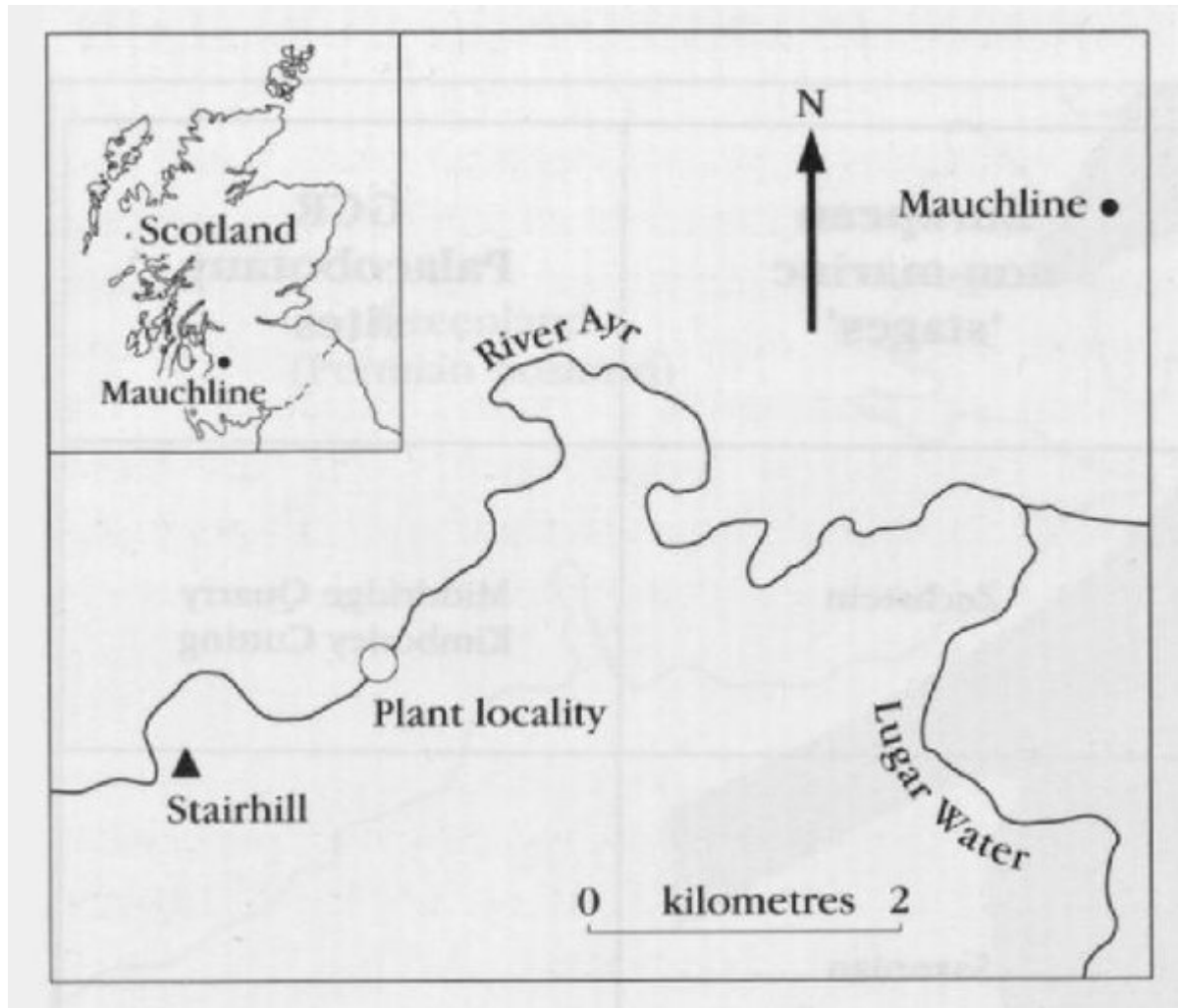
The Stairhill assemblage is in many ways typical of the Eurameria Palaeokingdom (i.e. semi-arid palaeoequatorial) in the Lower Permian. In continental Europe, comparable assemblages have been reported from the uppermost Stephanian and Autunian of both France and Germany (reviewed by Doubinger, 1956; Barthel, 1976; Kerp and Fichter, 1985). In particular, the occurrence of *Lobopteris geinitzii* and *Odontopteris subcrenulata* var. *gallica* supports this comparison. In some ways, the Stairhill assemblage may be regarded as a remnant of the vegetation that flourished on the river levee-banks in the Carboniferous tropical forests, although the lycopsid-dominated swamp vegetation itself had already disappeared (except in China — see Li, 1980). In contrast, many of the coeval assemblages from continental Europe are dominated by conifers (e.g. *Walcbia*) and peltasperms (e.g. *Autunia*), suggesting markedly drier edaphic conditions (Bouroz and Doubinger, 1977).

There is also some comparison with assemblages from the basal Permian of eastern North America, as reviewed by Read and Mamay (1964), although many of these have not been fully documented. The American assemblages share species of *Annularia*, *Odontopteris* and various pecopteroids with Stairhill. However, unlike Stairhill, they often have abundant peltasperms ('callipterids') and conifers. Further west, in Texas, Arizona and New Mexico, fossils are of plants belonging to the North America Palaeokingdom and are quite different from anything seen in Europe, with the occurrence of leaves resembling the gigantopterids of China. Elsewhere, the Lower Permian fossil floras are totally different from what is seen at Stairhill, with the gigantopteroid assemblages of the Cathaysia Palaeokingdom, the *Cordaites/Rufloria* assemblages of the Angara Palaeokingdom and the arberialean assemblages of the Gondwana Palaeokingdom (Vakhrameev *et al.*, 1978; Meyen, 1987; Allen and Dineley, 1988; Cleal and Thomas *in* Cleal, 1991).

## Conclusion

Stairhill has yielded the only plant fossils of indisputably Early Permian age (about 295 million years old) in Britain. They can be compared with some of the floras from continental Europe, such as from southern France and Saarland, which are also dominated by horsetails, ferns and a group of seed plants known as the Trigonocarpaceae. However, most European floras of this age were growing in rather drier habitats, and as a consequence tended to be dominated by other types of seed plants, particularly conifers and the now extinct peltasperms. Plants at Stairhill represent the last, poor remnants of the luxurious tropical swamp-forests that were at their maximum development in the Late Carboniferous (see previous chapter).

### References



(Figure 7.7) Location map for Stairhill. Based on Wagner (1983).