
Auchensail Quarry

R.J. Rayner

Highlights

Auchensail Quarry has yielded some of the best preserved plant fossils from the Emsian of Britain (Figure 4.20). These include exceptionally well-preserved examples of *Sawdonia*, and the youngest examples of *Prototaxites* known from Britain.

Introduction

Recent quarrying near Cardross, Strathclyde Region, has exposed Lower Devonian sandstones containing abundant plant fossils [NS 345 795]. They were first reported by Scott *et al.* (1976) and Morton (1976). Some of the species have since been studied in detail by Rayner (1982, 1983, 1984), and revealed considerable anatomical detail.

Description

Stratigraphy

The geology is described by Scott *et al.* (1976). The sequence consists of units of shallow-water, red siltstones and mudstones, up to 2 metres thick, alternating with well indurated, grey, upward-fining sandstones (Figure 4.21). They belong to the Strathmore Group (*sensu* Armstrong and Paterson, 1970), and were interpreted by Scott *et al.* as fluvial in origin. An Emsian age has been suggested by Richardson (*in* Rayner, 1983).

Palaeobotany

The plant fossils occur abundantly in the sandstones. Mats of coalified compressions occur mainly within the upper part of the sandstone units, while discrete pyrite petrifications occur throughout the beds.

Phaeophycophyta(?):

Prototaxites sp.

Rhyniophytoid:

?*Sporogonites* sp.

Zosterophyllopsida:

Zosterophyllum sp.

Sawdonia ornata (Dawson) Hueber

Lycopsida:

Drepanophycus spinaeformis Göppert

Trimerophytopsida:

Dawsonites sp.

Interpretation

Prototaxites is represented here by axes 5–50 mm wide. They have not been described in detail in the published literature, but are of interest as the youngest British specimens of this form-genus (younger specimens have been described from North America by Arnold, 1952).

Occurring within the mats of coalified compressions are many examples of narrow axes (<10 mm wide) that branch pseudomonopodially, have circinate vernation, a papillate epidermis and are covered with swollen-tipped spines. Despite the lack of well-preserved cuticles, these specimens have been identified as *Sawdonia ornata* (Rayner, 1983). The form of two fertile specimens, the first of such to be reported from Europe, indicate that the plant was a true zosterophyll (*sensu* Banks, 1968) with lateral sporangia apparently arranged in a terminal spike. The sporangia are sessile, oval in shape and up to 4 mm across. Several have a 'V-shaped incision on the axial surface, which might be a dehiscence scar. Spores have been isolated from several sporangia and are small (35–40 µm), subtriangular, with an indistinct trilete mark.

The internal anatomy of the *Sawdonia* axes from here has been investigated using plastic embedding and sectioning techniques (Rayner, 1983). The most striking feature is its large vascular strand, which may be as much as three quarters of the width of the axis, and which divides unequally before branching. The strand is made up of annular or spirally thickened tracheids, and maturation is apparently exarch. The epidermis is missing on all examples so far found here, but both thick-walled cortical cells and the characteristic spines are preserved. In well-preserved coalified compressions found in the finer-grained parts of the sandstone units, the surface features of *Sawdonia* are comparable to cuticle preparations from Ballanucater Farm and elsewhere (Edwards, 1924; Zdebska, 1972;

Chaloner *et al.*, 1978; Edwards *et al.* 1982; Rayner, 1983). The papillae form prominent features on the axis surfaces, and their purpose may have been to act as a shield against excessive radiation.

Drepanophycus spinaeformis Göppert forms a small but important part of the Auchensail assemblage. It is mainly represented by broad, leafy axes, up to 25 mm across, and often showing a narrow zone of vascular tissue. The leaves may still be attached to the axis or, where they have been detached, be represented by oval leaf scars. A few examples show compact vascular strands made up of tracheids with annular thickenings. Petrifications from another Strathmore Group exposure at Keltie Water (Rayner, 1984) have shown that the xylem had a deeply lobed cross-section, but this has yet to be observed in specimens from Auchensail.

Pairs of *Dawsonites*-type sporangia have been found here at the ends of dichotomizing branches. Several have yielded spores similar to those from Ballanucater Farm. The axes, which are up to 5 mm wide, are naked but have a series of longitudinal striations preserved on the upper surfaces. There is no evidence, however, of axillary structures.

Other terminal sporangia found here are similar to *Sporogonites* Halle. These sporangia have been compressed to form an oval capsule at the end of a simple striated stalk. The specimens have failed to yield spores, and they may only be compared with Halle's (1916) description on gross morphology.

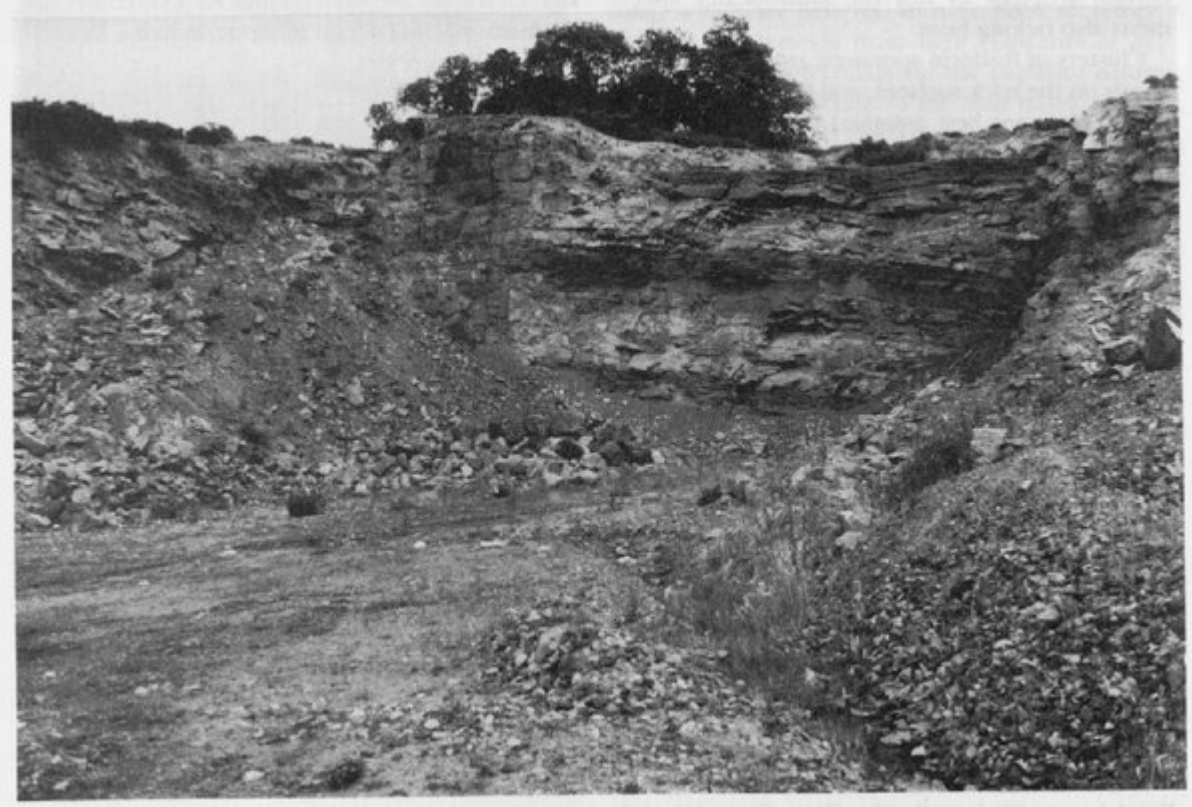
This site has yielded plant fossils typical of the Strathmore Group of Scotland, and similar to those found at Ballanucater Farm (a discussion on similar plant fossil assemblages, from both Britain and abroad, is given in the section dealing with Ballanucater Farm). However, it differs from the latter site in having *Prototaxites* and *Sporogonites*, but lacking *Psilophyton*. More significant is the presence of petrifications at Auchensail, which provide unique anatomical evidence of some of these early land plants, especially the zosterophyll *Sawdonia*.

Conclusion

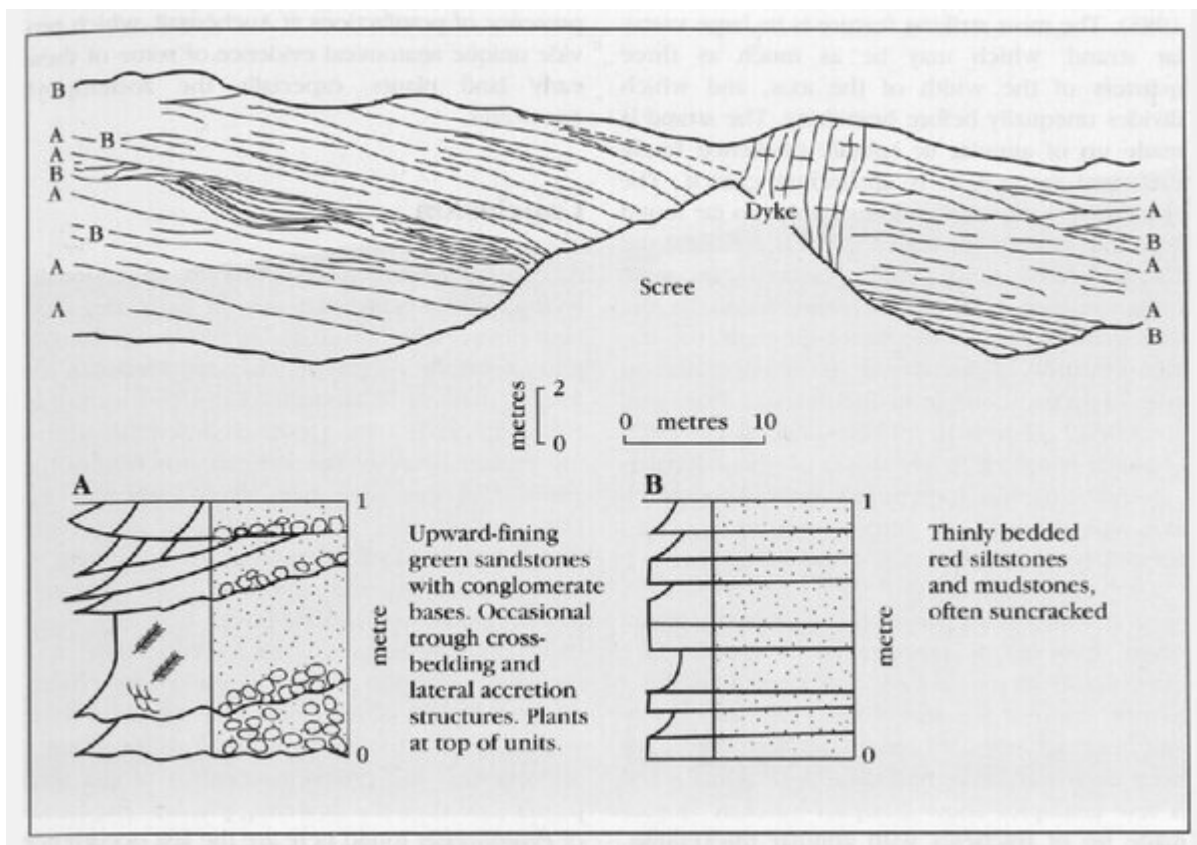
Auchensail Quarry has yielded an exceptionally well-preserved suite of fossils of Early Devonian land plants, which lived about 390 Ma on the Old Red Sandstone continent. They are similar to the fossils found at Ballanucater Farm (see earlier in this chapter), but are preserved differently, showing greater detail of the internal structure of the plant. This has been particularly important for obtaining a fuller understanding of *Sawdonia*, which belongs to the primitive group known as the

zosterophylls, and which were the ancestors of the club-mosses. Also found here are some excellently preserved fructifications (sporangia) of the group of plants known as the trimerophytes, showing details of how on the living plant these sporangia split to release the spores. This group is important as the probable ancestor of the seed plants (and thus the flowering plants). The fossils of *Prototaxites* found here are the last occurrence of this large, enigmatic alga in Britain, although Late Devonian examples have been reported from North America. These algae were an important component of land vegetation in the Late Silurian and earliest Devonian, but became displaced by the better adapted vascular plants during the later part of the Early Devonian.

References



(Figure 4.20) Auchensail Quarry. Emsian sandstones and shales of the Strathmore Group. Note the igneous dyke just to the left of centre of the quarry face as shown. (Photo: C.J. Cleal.)



(Figure 4.21) Sedimentology of the Strathmore Group (Emsian) at Auchensail Quarry. Based on Scott et al. (1976).