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## Wolf's Hole Quarry and Mine Woods, Bridge of Allan

Stirling & Clackmannan RIGS group

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The discovery of fossils made Wolf's Hole Quarry a Site of Special Scientific Interest (SSSI). The fossils can be used to date the rocks in which they are embedded.

This short walk through the woods on the southern slopes of the Ochil Hills, above Bridge of Allan, just to the north of the major Ochil Fault, provides insight into the processes that built the foundations of our landscape, with fine views of the lowland Forth valley – part of the Midland valley of Scotland — and the Highland mountains.

### Access

By train to Bridge of Allan station or by car via M9 leaving the motorway north of Stirling at the roundabout sign-posted to Bridge of Allan. Approaching Bridge of Allan, turn left directly after the Bridge over the River Allan, then first right and first right again. Park at the roadside in Sunnyslaw Road by the meadow below the woods (NS790 981). There is a more detailed description of the route on the inside of this leaflet.

Cover: Fossil sample with superimposed sketch of *Cephalaspis scotica* found in the Old Red Sandstone (ORS) at Wolf's Hole Quarry and held in the collections of the National Museums of Scotland.

© National Museums of Scotland, NMS.G.1891.92.135 The model shows *Zenaspis*, a very similar fish to the *Cephalaspis scotica* holotype fossil specimen shown at the top.

Model maker and original photo: Richard Hammond

The Scottish Fossil Code provides detailed advice on best practice in the collection, identification, conservation and storage of fossil specimens found in Scotland. Further details can be found on the Scottish Natural Heritage website at [www.snh.org.uk/fossilcode/](http://www.snh.org.uk/fossilcode/)

Acknowledgements: [NatureScot](#), [Edinburgh Geological Society](#), Stirling & Clackmannan RIGS group

### Wolf's Hole Quarry and Mine Woods in Bridge of Allan

The rocks underlying the Mine Wood and Wolf's Hole Quarry were laid down nearly 415 million years ago (Early Devonian period). At that time Scotland was about 20° south of the equator on the eastern flank of what is Geological map and section of the Stirling area now North America, on a continent called Laurussia. The climate was hot and seasonally dry. The landscape largely lacked plants as these were only just evolving into terrestrial environments, perhaps present only in damp places.

Large rivers brought great quantities of sand, pebbles and gravel to the Midland valley of Scotland from the north, from Scandinavia and the Highlands, interrupted for a while by frequent eruptions of some 2000 metres of lavas, now forming the bulk of the rocks of the Ochil Hills.

In the valleys south of the Mine Woods, there are 300–350 million years old coal-bearing sedimentary rocks of the Carboniferous Period.

Monument are built on younger igneous intrusions of quartz dolerite. Once molten, these rocks are now more resistant to erosion than the surrounding sediments. Across the valley are the 345 million year old volcanic rocks of the Touch and Gargunnock Hills. Covering most of the Carboniferous rocks are sediments dumped by the ice sheets and glacial

meltwaters of the last ice age. These sediments can be seen across the valleys of the Forth and Devon.

The meadow below the Woods is part of a raised beach, indicating that the sea reached here about 15,000 years ago, after the last ice sheet retreated and melted. Former estuarine deposits and landforms are an extensive element of this local landscape.

The sandstone quarried here in the 19th century was used in the building of Bridge of Allan. It has been suggested that the name 'Wolf's Hole Quarry' may be a corruption of 'Wool's Fold' from a time when sheep were kept here. This was also a holiday place for the young Robert Louis Stevenson and there is plenty of speculation on the influence of the landscape on his later writing.

## **Wolf's Hole Quarry and Mine Woods, Bridge of Allan**

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### **The route**

The walk follows well-marked paths with steps in steep places. It may be muddy in wet weather. Allow at least one hour for the walk. It is unsuitable for wheel chairs. The quarry (1) is easily entered over the grassy verge at the S.W. corner of the wooded area above the meadow. The walk leads upward on the right side of the quarry and through the ancient beech woods of Bridge of Allan (2), highly valued by the local community. Turn right on meeting the golf course and follow the straight path keeping below the golf course. As you cross a small stream look to the right for the sculptured head of the 'Guardian of the Woods' (3) placed high on a tall tree but continue walking ahead. At (4) turn left following the path up the slope at the edge of the golf course to (5) the highest point with a wide view of the Highland mountains to the north and west and across the Midland valley to the south and east. On reaching the surfaced road turn right and after about 30 yards take the signed path on the right that leads obliquely down through the mixed woodland past the copper mine entrance (6), where a bench gives a view of Stirling Castle, the Wallace Monument and the valley of the river Forth. Follow the path back to the quarry, noting exposures of conglomerate with stones of various types of Devonian lavas. Roe deer often graze here, woodpeckers may be heard and red and grey squirrels may be seen.

Because the quarry is a Site of Special Scientific Interest (SSSI), hammering is prohibited. You can find the Scottish Fossil Code at <https://www.nature.scot/>

### **Points of interest**

#### **1 [NS 78896 98047]**

Sandstone from Wolf's Hole Quarry was used in building C19 Bridge of Allan. It was laid down by major braided rivers over 400 million years ago (lower Devonian period). On the quarry face you can see how older river sand deposits were cut across successively by new channels, creating sedimentary structures — cross-bedding and lines of lava and mudstone pebbles. During quarrying, very rare fossil fish were found here — *Cephalapsis* and *Pteraspis*, allowing dating of these deposits. This site is designated a protected SSSI (site of special scientific interest) and hammering of the rock is prohibited, although rock climbing is permitted and popular. Above the 15 metre cliff is a layer of volcanic conglomerate cut by an olivine basalt lava.

#### **2 [NS 79105 98101]**

More of that can be examined at the quarry mouth and in the beech wood above.

#### **3 [NS 79201 98150]**

The sculpture "Guardian of the Woods" is by Lori Anderson, commissioned by Stirling Council and Falkirk College.

#### **4 [NS 79524 97904]**

Here the top of the vertical shaft to the Copper mine is marked by a slight depression and a spoil heap, where a few fragments of malachite (copper ore) and white or pink Baryte may be found. Do not stand in the depression — although protected it might give way without warning.

#### **5 [NS 79741 98017]**

At the top of the woodland there are fine views of the highland mountains (N&W) (see profile). These consist of Dalradian metamorphosed sandstone and mudstone deposited in an ocean 550 million years ago. The landscape was sculpted by glaciers flowing South and East. At Barbush, near Dunblane (NW) gravel from glacial river deposits has been quarried. To the South and East, the Wallace monument and Stirling Castle are perched on igneous Dolerite plugs and beyond, you may see Edinburgh and the Pentland Hills. The Carse clays in the valley below, stretch as far West as Aberfoyle and were deposited 6500 years ago as tidal mudflats.

#### **6 [NS 79541 97852]**

To the right of the returning path is the protected main entrance of the copper mine, in use from 1661 to 1815. Copper from here was minted in Stirling for the 'bawbees' at Queen Mary's coronation in 1543. The conglomerate surrounding the entrance contains locally derived volcanic rocks laid down by rivers in the early Devonian period. In the roof of the entrance is a complex mineral vein, containing pink/ white Baryte (Barium Sulphate) and green copper ore (mainly malachite). Such veins were brought in by hot fluids circulating when the dolerite of Stirling Castle rock was intruded into the Ochil fault. That faulting process, with subsequent weathering and erosion has produced the well-defined scarp of the Ochil Hills. Bridge of Allan prospered as visitors came to 'take the mineral waters' from the Airthrey Well in the Spa that developed below the mine.

### **Figures**

(Front cover)

(Figure 1) Location map.

(Figure 2) Geological map and section of the Stirling area. The map of the rocks under Stirling, below, shows how the Ochil Fault cuts across at the foot of the hills, separating the Early Devonian age rocks to the north from much younger Carboniferous rocks to the south. A section from north to south show the fault separating the two ages of rock. Stirling Castle and Wallace Monument sit on igneous intrusive rocks that are more resistant to erosion than the surrounding sedimentary rocks.

(Figure 3) Map showing stops on the walk.

(Figure 4) View to the West from Mine Woods.

(Figure 5) The woodlands around Wolf's Hole Quarry.

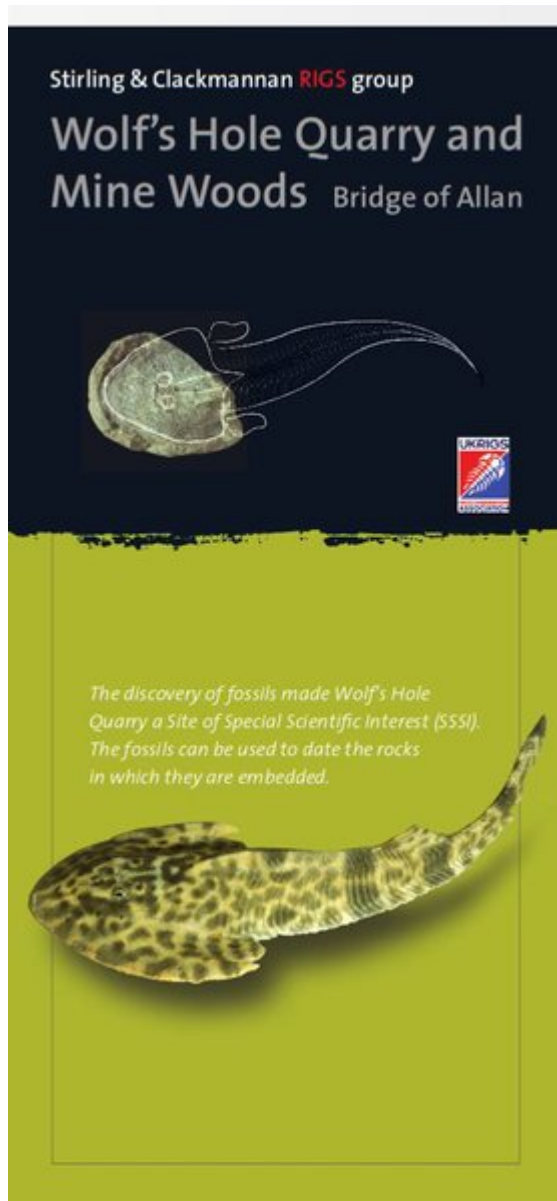
(Figure 6) View to the West from the top of the woodland.

(Figure 7) Sandstone from Wolf's Hole Quarry.

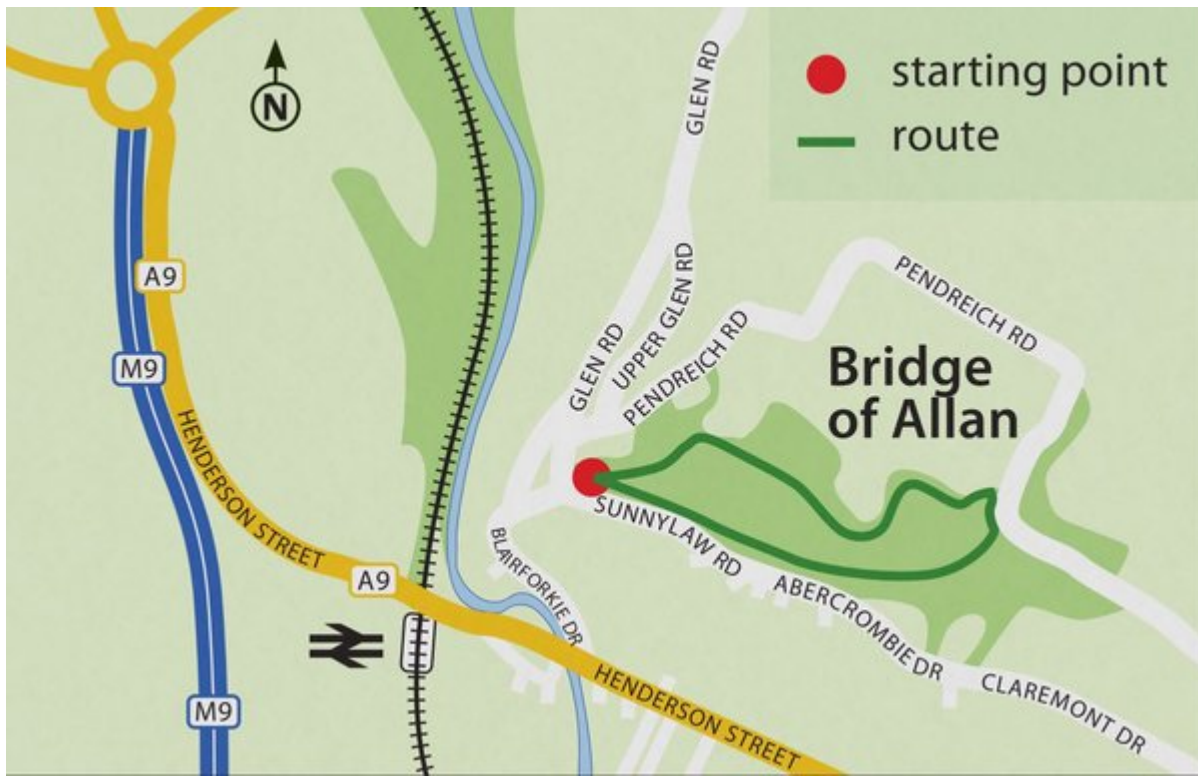
(Figure 8) More sandstone can be examined at the quarry mouth and in the beech wood above.

(Figure 9) Pebble beds (conglomerate) formed by gravel-bed rivers are exposed widely as rocky bluffs on the escarpment face at Mine Wood and along the footpaths. Pebble beds (conglomerate) formed by gravel-bed rivers are exposed widely as rocky bluffs on the escarpment face at Mine Wood and along the footpaths.

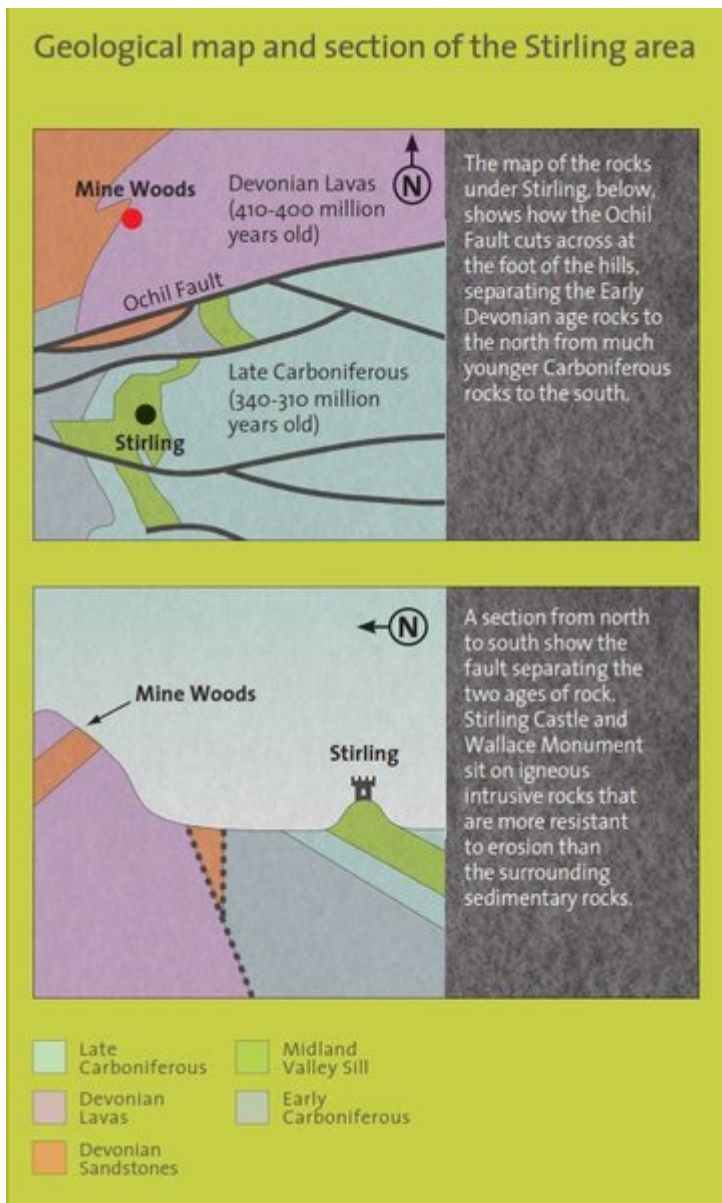
(Figure 10) Detail from the ORS sandstone exposure illustrating cross-bedding resulting from the action of ancient, Devonian rivers building sand sheets and river-bed dunes.



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(Figure 5) The woodlands around Wolf's Hole Quarry.



*(Figure 4) View to the West from Mine Woods.*



*(Figure 6) View to the West from the top of the woodland.*



*(Figure 7) Sandstone from Wolf's Hole Quarry.*





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*(Figure 9) Pebble beds (conglomerate) formed by gravel-bed rivers are exposed widely as rocky bluffs on the escarpment face at Mine Wood and along the footpaths. Pebble beds (conglomerate) formed by gravel-bed rivers are exposed widely as rocky bluffs on the escarpment face at Mine Wood and along the footpaths.*





*(Figure10) Detail from the ORS sandstone exposure illustrating cross-bedding resulting from the action of ancient, Devonian rivers building sand sheets and river-bed dunes.*