
Wolf's Hole Quarry, Stirlingshire

[NS 790 981]

Potential ORS GCR site

M.A.E. Browne and W. J. Barclay

Introduction

The importance of Wolf's Hole Quarry, at Bridge of Allen in Stirlingshire (Figure 3.32), lies mainly in the fossil fish specimens recovered from a coarse-grained, pinkish brown quartz- and feldspar-rich arkose. It is already an established GCR site for its fossil fishes (Dineley and Metcalf, 1999) and only a brief summary is provided here. No fossils have been found recently, but the lithology of museum specimens matches the sandstones in the basal and middle parts of the section exposed today. The strata belong to the basal part (the Sheriffmuir Sandstone Member) of the Scone Sandstone Formation of the Arbuthnott–Garvock Group. A thin, porphyritic, andesitic lava flow at the top of the quarry is the highest occurrence of lava (of the Ochil Volcanic Formation) on the southern side of the Strathmore Basin.

No fossils have been found since the quarry closed in 1898, most of the fish specimens being found in the 1860s and 1870s when the sandstones were worked for building stone. The fish may have been preserved in one or more lenses, in a similar fashion to the preservation of some cephalaspids and pteraspids in the Welsh Borderland (Dineley, 1999c). The quarry is primarily selected as a GCR site for its small, but unique fish assemblage, including the type specimens of four agnathan species. Dineley (1999c) summarized the details of the fauna, which includes *Pteraspis mitchelli*, *Cephalaspis scotica*, *Securiaspis waterstoni* and *Securiaspis caledonica*.

Description

Wolf's Hole Quarry (Figure 3.33) exposes 25 m of cross-bedded sandstones with some siltstones, overlain by a flow of basaltic-andesite amygdaloidal lava (Francis *et al.*, 1970). The lowest 6 m of strata exposed in the quarry comprise several fining-upward sandstone–siltstone–mudstone cycles, each about 2–3 m thick and grading upwards from gritty, cross-bedded sandstones to siltstones and then green mudstones. The base of each unit rests on an erosion surface veneered by intraformational conglomerate. Sandstones become more dominant upwards, the cyclic beds passing into 10 m of cross-bedded sandstones. Within these, a persistent, thin (50–150 mm) grey mudstone can be traced across the width of the quarry face. At the top of the section 2 m of flaggy sandstones are truncated at the uneven base of the overlying lava. This is accessible at the north-east end of the quarry, where the lava base is amygdaloidal with mailed pipe vesicles. The lava flow is generally altered, rotten and feldspar-phyric.

Interpretation

Comparison can be made with the key section in the Scone Sandstone Formation at Crossgates-Burnside south-west of Perth described by Bluck (2000) (see Whiting Ness GCR site report, this chapter). None of the very large (> 12 m) bar forms seen at Crossgates-Burnside can be recognized at Wolf's Hole, perhaps because the section is smaller. However, it is likely that after a high-sinuosity fluvial regime represented by the fining-upward cycles at the base of the section, braided river channel systems became dominant, with minor overbank or floodplain mud/silt deposition. Mudstone drapes on cross-sets are only rarely preserved, and mudstone rip-up lasts in the sandstones represent the destruction and reworking of most of the fine sediment. The uneven basal surface of the lava may reflect the palaeotopography, the flow appearing to infill channels locally. The flow may have been emplaced from the 'south', from the volcanic terrane represented by the Ochil Volcanic Formation.

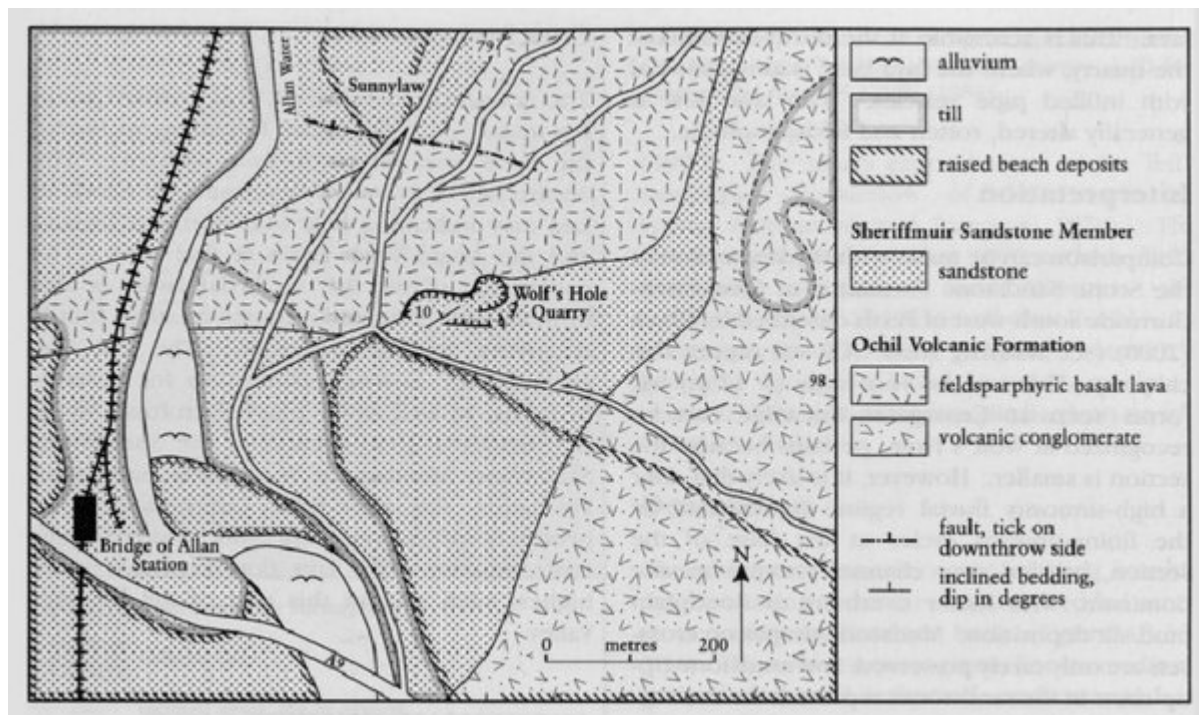
Dineley (1999c) discussed the fossil fishes fauna, its affinities and habitat. *Pteraspis mitchelli* is a very rare pteraspid occurrence in Scotland, although pteraspids are common in the Dittonian of the Welsh Borderland. The taxonomy of

Pteraspis mitchelli remains in some doubt, Blicek (1981, 1984) noting affinities with *Protopteraspis* and similarities to *Pteraspis rostrata*. The affinity with *P. rostrata* suggests a connection with the Fintona Beds of County Fermanagh (Harper and Hartley, 1938), from which *P. rostrata* is recorded, the only pteraspid known from Ireland. *Securiaspis* is confined elsewhere to the Dittonian (Lochkovian–Pragian) of the Welsh Borderland and Spitsbergen, and this is the only occurrence in Scotland. The fauna as a whole suggests a correlation with the Dittonian of the Anglo-Welsh Basin. Palynological investigation of the grey and green beds at Wolf's Hole may offer a further correlation. The preservation of the fish in fluvial facies is also more akin to the Anglo-Welsh Basin occurrences, unlike the predominantly lacustrine facies in which most of the Lower and Middle Old Red Sandstone fossil fish of Scotland are found.

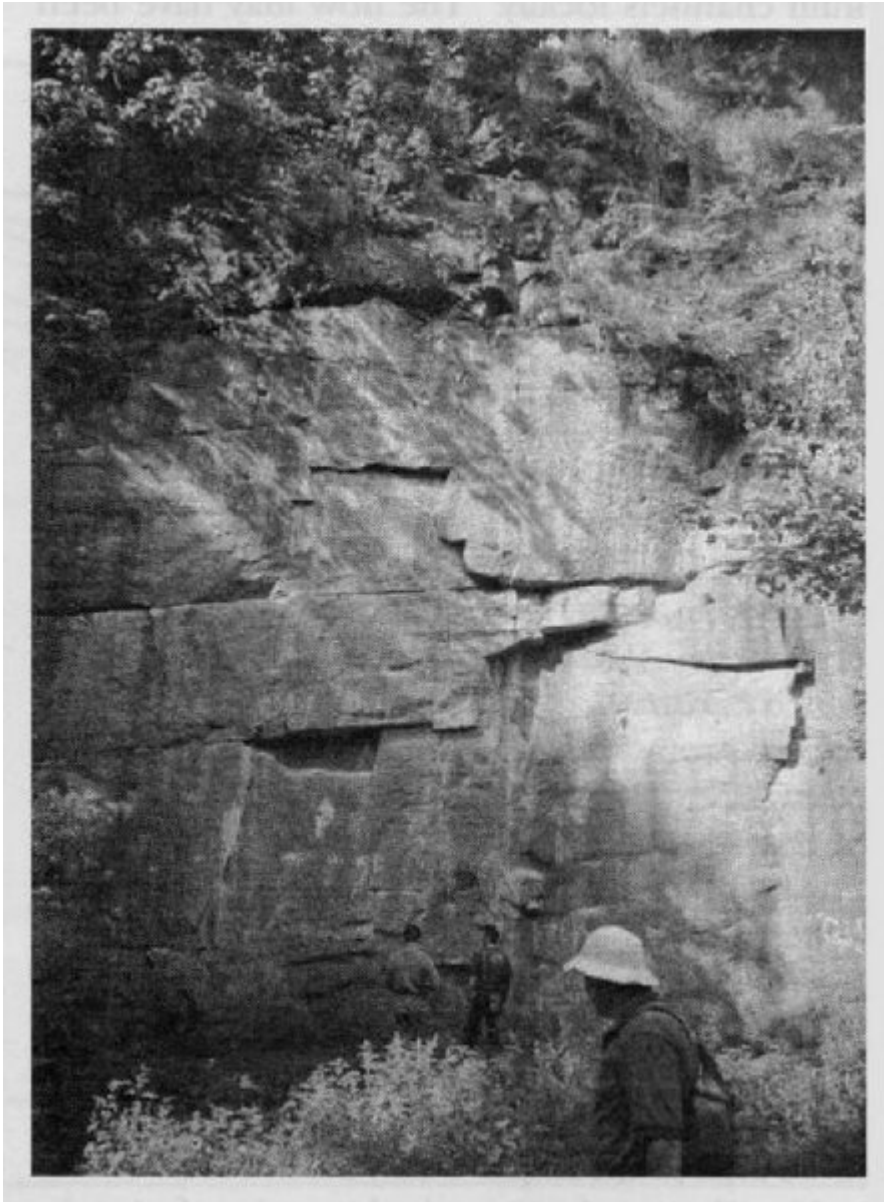
Conclusions

The conservation value of Wolf's Hole Quarry lies mainly in its important fish fauna, including the type specimens of four species. The occurrence of *Pteraspis* is unusual for Scotland and may indicate a link with northern Ireland and the Anglo-Welsh Basin at that time. The occurrence of the fish in fluvial facies is also unusual in Scotland, most of the fossils occurring in lake deposits. The site has potential for further examination for remains of fishes, as well as for plant microfossil study. It provides a good section of the Sheriffmuir Sandstone Member of the Scone Sandstone Formation, the strata being interpreted as the products of meandering and braided river environments. The lava flow exposed is the highest such unit in this part of the Midland Valley.

References



(Figure 3.32) Geological map of the area around Wolf's Hole Quarry. After British Geological Survey 1:10 560 Sheet NS 79NE (1976).



(Figure 3.33) Wolf's Hole Quarry. A lava flow at the top of the section rests on thick-bedded sandstones. (Photo: M.A.E. Browne.)