Wolf's Hole Quarry

[NS 790 981]

Highlights

Wolf's Hole Quarry has been the source of only a small number of fossil fish specimens, but these present a unique faunal assemblage. This includes the original material of four agnathan fish species, *Pteraspis mitchelli, Cephalaspis scotica, Securiaspis waterstoni* and *Securiaspis caledonica (Figure 5.11)*.

Introduction

Wolf's Hole Quarry, near Bridge of Allen in Forfarshire, has yielded fossil fish specimens from a coarse, pinkish brown quartz- and feldspar-rich sandstone. This lithology, as determined from museum specimens, matches the sandstones seen in the basal and middle parts of the section exposed today. All the specimens were found in the 1860s and 1870s when the sandstones were worked for building stone. Nothing has been found since, so the fishes were probably entombed in one, or several, lens-like accumulations, in a similar fashion to the preservation of cephalaspids and pteraspids in the Welsh Borders.

The first record of fossil fishes from Wolf's Hole Quarry was given by H. Mitchell (1862), who noted *Pteraspis.* A little later, 'unaware of Mitchell's discoveries', Powrie (1870, p. 285) also collected some specimens of *Cephalaspis* and *Pteraspis* from the site. The rather small total collection from the quarry is housed in Montrose Museum (Mitchell Collection) and the National Museum of Scotland (Powrie Collection).

Description

Wolf's Hole Quarry exposes 25 m of massive cross-bedded sandstones with some siltstones, overlain by a basic amygdaloidal lava at the base of the Sheriffmuir Formation in the upper part of the Lower Old Red Sandstone. The lowest 6 m of strata exposed in the quarry consist of sandstones and green mudstones, representing several fining-upward cycles, each about 2–3 m thick, and each showing a gradation upwards from gritty cross-bedded sandstones to siltstones and green mudstones. The base of each unit rests upon an eroded surface lined with an intraformational conglomerate. Upon these, the sandstones gradually dominate the cycles, passing into 10 m of cross-bedded sandstones above. These contain one persistent thin (50–150 mm) grey mudstone that may be traced across the width of the quarry face. The top 2 m of the sedimentary section is made up of flaggy sandstones, which are cut off by the base of the lava.

Fauna

AGNATHA

Osteostraci: Cephalaspidiformes:

Cephalaspididae

'*Cephalaspis*' *scotica* White, 1963

Securiaspis waterstoni White, 1963

S. caledonica White, 1963

Heterostraci: Pteraspidiformes: Pteraspididae

Pteraspis mitchelli (Lankester, 1868)

Five recognizable fragments of cephalaspid headshields are known from Wolf's Hole Quarry (Figure 5.11). Powrie (1863) was the first to mention their occurrence, recording them as *Cephalaspis lyelli,* which at that time was the name applied to all cephalaspids discovered in Scotland. When White (1963) re-examined these specimens, he concluded that they represented three new species, one cephalaspid and two securiaspids. *Cephalaspis scotica* is based on a unique imperfect cephalic shield, which Stensiö (1932) had noted was similar to *C. websteri* Stensiö, although it probably could not itself be attributed to the latter species. *Securiaspis caledonica* and *S. waterstoni* are also each represented by single cephalic shields in the original descriptions (White, 1963). *Securiaspis* is confined elsewhere to the Lower Devonian in the Welsh Borders and Spitsbergen (Janvier, 1985), and this is the only occurrence in Scotland.

Pteraspis mitchelli was first discovered at Wolf's Hole Quarry by H. Mitchell (1862), and it was named after him by Powrie (1864), but without designation of a holotype. Three specimens were figured by Lankester (1868), but the first adequate description of *P. mitchelli* was given by White (1963), who designated one of Lankester's (1868) figured specimens as the lec-totype (Figure 5.12). *Pteraspis mitchelli* is very rare, being known from only a few large pieces of dorsal shield, and some fragments that include scraps of ventral shield. It is readily distinguished by its large rostrum and small cornua. Blieck (1981, 1985) noted the similarities of this species to both *P. rostata* and to *Protopteraspis,* but resisted (1985) moving it to *Protopteraspis.*

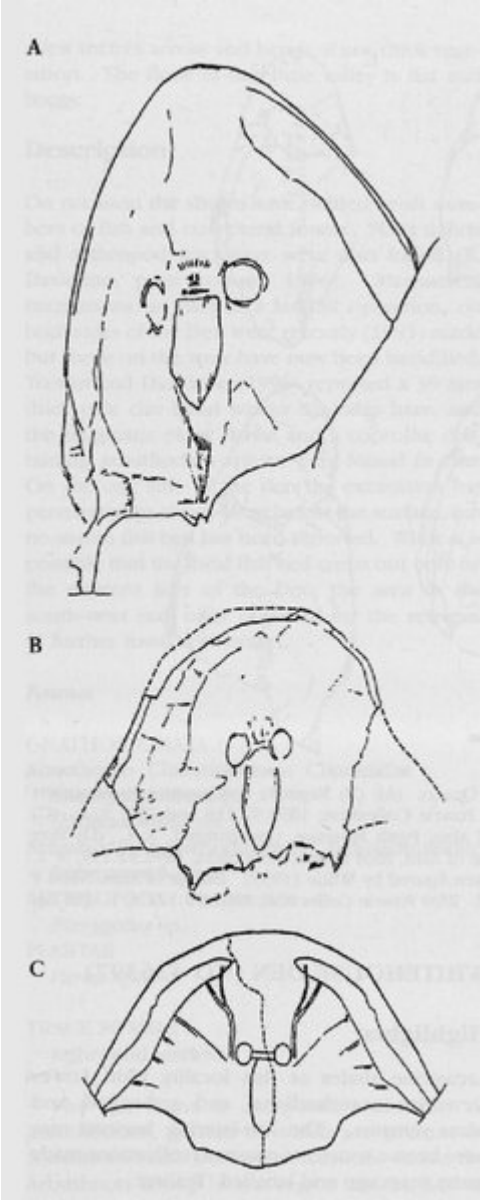
Interpretation

Pteraspidids are very rare in Scotland, although they are common in the Welsh Borders. The only other place in Scotland where pteraspidids have been discovered is Auchtertyre, near Newtyle, which also yields rare *Pteraspis mitchelli.* White (1963) argued that pteraspids were inhabitants of moving waters, are usually found within current-bedded deposits and are rarely associated with other vertebrates except a few isolated cephalaspid headshields. The cephalaspids may have favoured the Scottish Old Red Sandstone lakes and backwaters, whereas pteraspids ventured more readily into moving waters. Cephalaspids are present, though rare in the Scottish Middle Old Red Sandstone and in the ?lacustrine or lagoonal Escuminac Formation (Upper Devonian) of eastern Canada. White (1963) suggested that *P. mitchelli* might have been a peculiar species in being adapted to conditions that were avoided by the rest of the pteraspids. This argument does not take into account that the fossils from Wolf's Hole are, in fact, found in current-bedded deposits that are unlike the lacustrine silts and fine sandstones of the other Scottish Lower Old Red Sandstone fish sites. The assemblage and sedimentology here are closer to those found in the Dittonian of the Welsh Borders, where they are considered to be fluvial in origin. This pteraspid material was also considered by Blieck (1981, 1984), who was not without some doubt about its taxonomy, noting possible affinities with *Protopteraspis* and similarities to *P. rostrata.* Meanwhile it remains the only pteraspid from Scotland. This possible affinity with *P. rostrata* is of interest since the only pteraspid from Ireland is *P. rostrata* from the Fintona Beds of County Fermanagh (Harper and Hartley, 1938). Perhaps then the Caledonian basin was directly linked to that in the north of Ireland.

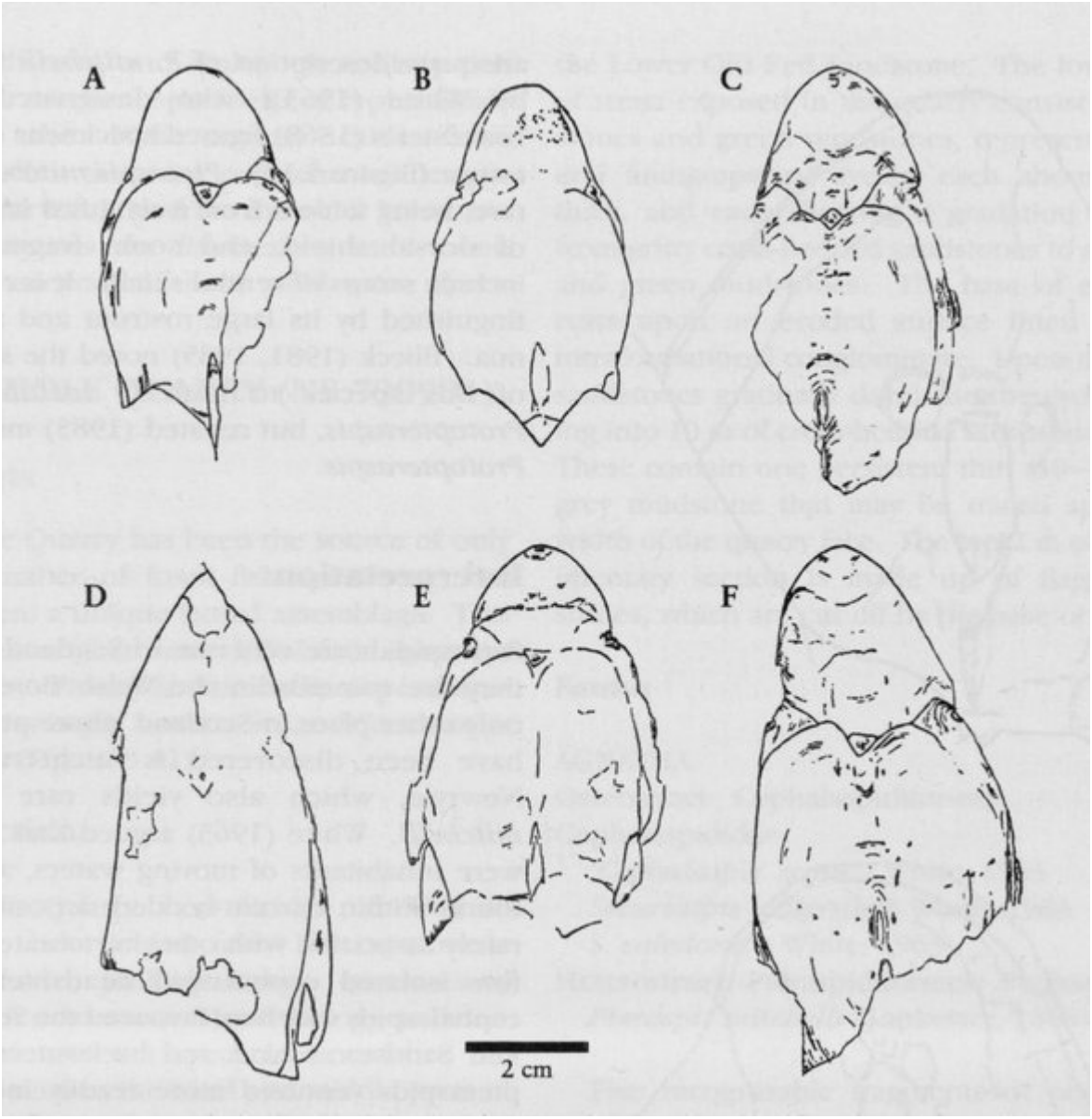
Conclusion

Wolf's Hole Quarry has produced a limited, but important, fish fauna, hence its conservation value. The specimens include type specimens of four species, and in some ways the conditions of deposition may be more comparable with some of the fluvial sandstone deposits of the Early Devonian of the Welsh Borders. The occurrence of *Pteraspis* is unusual for Scotland and may indicate a link with northern Ireland and the Anglo-Welsh Basin. The site has not yielded any specimens recently, but the fish-bearing sandstones are exposed and could be worked again in the future.

References



(Figure 5.11) Cephalaspids from Wolf's Hole Quarry. (A) Cephalaspis scotica White, imperfect headshield is dorsal aspect, holotype RSM Powrie collection 1981.92.135, x 2. (B) Securiaspis waterstoni White, imperfect headshield in dorsal aspect, holotype, Perth Museum, unregistered, x 1. (C) Securiaspis caledonica White, external impression of headshield. Area to left of dotted line is restored. Perth Museum, unregistered, slightly less than natural size. (From White, 1963)



(Figure 5.12) Pteraspis mitchelli Powrie from Wolfs Hole Quarry (A), (B) Negative and positive counterparts of a small dorsal shield. Lectotype, Bridge of Alan, RSM Powrie Collection, 1891.92.118 and 117, x 1. (C) External impression of imperfect dorsal shield, Bridge of Alan, Perth Museum, unregistered, x 1. (D) Very imperfect dorsal shield figured by Lankester (1868), Bridge of Alan, RSM Powrie Collection, 1892.92.119, x 1. (E) External impression if imperfect dorsal shield. Specimen figured by White (1935). Bridge of Alan, NHM P 16808, x 1. (F) external impression of small dorsal shield. RSM Powrie Collection, 1892.92.122 x 1. (All figures from White, 1963.)