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# Bilham Quarry

[SE 487 066]

## Highlights

Bilham Quarry is important as a representative section of the basal few metres of the Permian sequence in the central part of the Yorkshire Province. The sequence comprises most of the Basal Permian ('Yellow') Sand and lowest beds of the Cadeby Formation of the Magnesian Limestone.

## Introduction

The section at Bilham Quarry (box 6 in (Figure 4.2)) lies amongst trees on the east side of Bilham Lane, about 1100 m south of Hooton Pagnell village church and 300 m north-east of Bilham House; it is all that remains of a large shallow quarry that has otherwise been filled and landscaped. Exposed strata comprise bedded dolomite of the Wetherby Member of the Cadeby Formation (c. 3.45 m+) on Basal Permian ('Yellow') Sands (c. 3.3 m+).

There are no published records of the section now preserved at Bilham Quarry, but Mitchell (1932a, plate 8) illustrated a similar sequence 'at Bilham House' (about 300 m to the south-west) and Mitchell *et al.* (1947, p. 117) recorded (possibly repeated) this section, then specified as 800 yards (730 m), north-east of Bilham House and at a site shown on the six-inch Geological Survey map as a small sand pit.

The face at Bilham Quarry was preserved and landscaped by the South Yorkshire County Council specifically to facilitate geology teaching and research.

## Description

The position of the face at Bilham Quarry is shown in (Figure 4.21); it is about 60 m long and up to 6.8 m high. The face is commonly partly obscured by vegetation and soil-wash and may be difficult to locate in high summer. The general geological sequence in Bilham Quarry is shown below.

	Thickness (m)
Cadeby Formation, Wetherby Member (shelf facies)	up to 3.45
Basal Permian ('Yellow') Sands, base not seen	up to 3.3

The strata are roughly horizontal and there are no faults; the Carboniferous–Permian Unconformity is not now exposed but was revealed temporarily during landscaping and lies an estimated 1–1.5 m below the preserved section.

## Basal Permian Sands

The Basal Permian (or 'Yellow') Sands in the preserved face at Bilham Quarry comprise yellow-brown and yellow-grey, weakly-cemented to almost uncemented, medium-grained sand in generally ill-defined horizontally bedded units; a pale grey-brown bed about 1.35–1.55 m below the top has a dolomite cement and may be a sandy dolomite, and the lowest 1.8 m of the exposed sequence features rhythmic secondary banding similar to that produced by Liesegang rings. Grains in the sand are mainly of quartz and most are sub-angular; many beds contain a few coarse rounded to well-rounded grains, some frosted, and green and red coarse grains are scattered sparingly throughout.

## The Cadeby Formation

The Wetherby Member of the Cadeby Formation at Bilham Quarry mainly comprises flaggy and thin-bedded (beds 0.04–0.20 m thick) buff dolomite wackestones and mudstones with several laminae and thin beds of soft dolomitic clay or

clayey dolomite in the uppermost 2.65 m; the lowest 0.8 m of dolomite present is superficially similar to the overlying beds but may be an altered ooid grainstone or packstone. Scattered casts of bivalves (mainly species of *Bakevella* and *Schizodus*) occur at some levels throughout the section, but the well-known and extensive Bakevella Bed, though present in parts of the former quarry, is absent at this southern extremity. The base of the formation is flat and basal beds are only sparingly sandy.

## Interpretation

Bilham Quarry is an exposure of the Basal Permian (or 'Yellow') Sands, a formation that is generally poorly and only temporarily exposed; though small, the exposure exhibits most of the features typical of this formation at outcrop in Yorkshire. Although most Permian sandstones in Britain are continental in origin and of early Permian age, the Basal Permian Sands in Yorkshire qualify for inclusion in the Marine Permian Review because they are considered (Versey, 1925; Pryor, 1971) to have been completely redistributed during or soon after the late Permian Zechstein transgression.

The Basal Permian Sands crop-out patchily along the escarpment and this patchiness is also apparent from borehole and shaft provings farther east (see Versey, 1925, and the Geological Survey memoirs for Sheets 70, 78, 87 and 100); at outcrop the sands are generally only a few metres thick, but reach a reported 8.2 m at crop at Laughton en le Morthen [SK 52 88] (Eden *et al.*, 1957). The general distribution of the formation, and its geographical relationship to associated basal breccias, was summarized by Smith (1989, fig. 3); it should be noted, though, that the breccia and sand facies are not mutually exclusive and that a thin breccia not uncommonly underlies the sands (Versey, 1925; Smith, 1974b).

The petrography and sedimentology of the Basal Permian Sands at outcrop in Yorkshire were investigated by Versey (1925) and Pryor (1971), and were summarized by Smith (1974b). The deposit is mainly of uncemented to weakly-cemented, fine- to medium-grained, yellow subarkose, which is grey and blue-grey in the subsurface farther east. It owes its outcrop colour mainly to grain-surface pellicles of hydrated iron oxides and, though authigenic kaolinite is relatively abundant, the main cement (where present) is calcite. Grains are mainly of quartz, but up to 10% of potash feldspars are ubiquitous and up to 20% of rock fragments are widespread; they are predominantly rounded to subrounded in the area investigated by Pryor (from Glass Houghton northwards), with less than 10% of the coarse well-rounded grains for which the formation is noted. Level, thick bedding predominates in most exposures, including Bilham Quarry, but is commonly masked by coarse rhythmic Liesegang-type colour banding. The dominant sedimentary structure in the Leeds area is said by Pryor (1971, p. 244) to be tangential trough cross-lamination in sets typically 0.10–0.65 m thick. A suite of abraded heavy minerals dominated by garnet, tourmaline and zircon was thought by Versey (1925, p. 209) to have survived long transport or be multicyclic.

The Basal Permian Sands in Yorkshire were once widely worked for moulding sand, and in a number of places were followed underground by bord and pillar workings in faces up to 3 m high. In a number of places the roofs of such workings have proved to be unstable, leading to severe subsidence problems. All the underground workings are now closed and most of the quarries are filled; there are no present workings and the few remaining exposures are in road and rail cuttings, which are commonly bricked-over, and in small quarries that have so far escaped filling.

## Future research

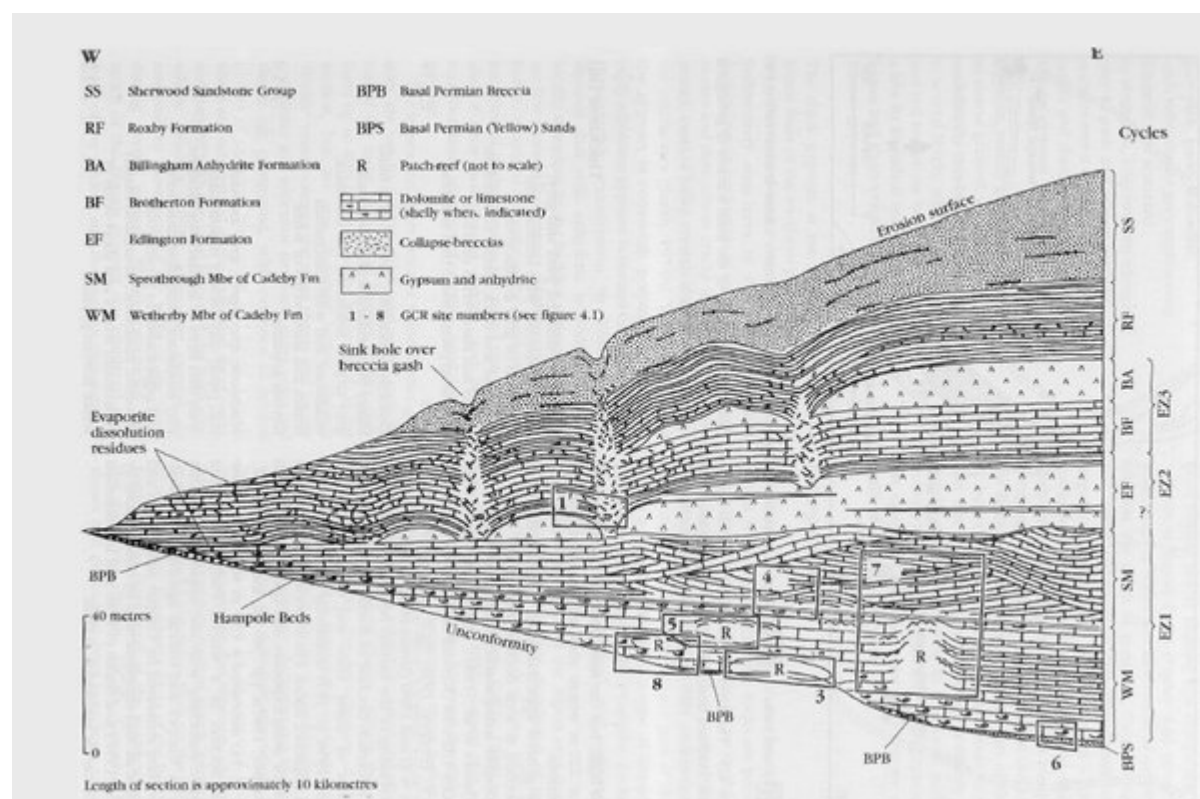
The Basal Permian Sands in Yorkshire, including those at Bilham Quarry, are now indifferently exposed and no longer readily susceptible to regional petrographic and sedimentological investigation. There is, however, scope for further investigation of these aspects in borehole cores from farther east, and for refining knowledge of the distribution of the formation as new borehole data become available.

## Conclusions

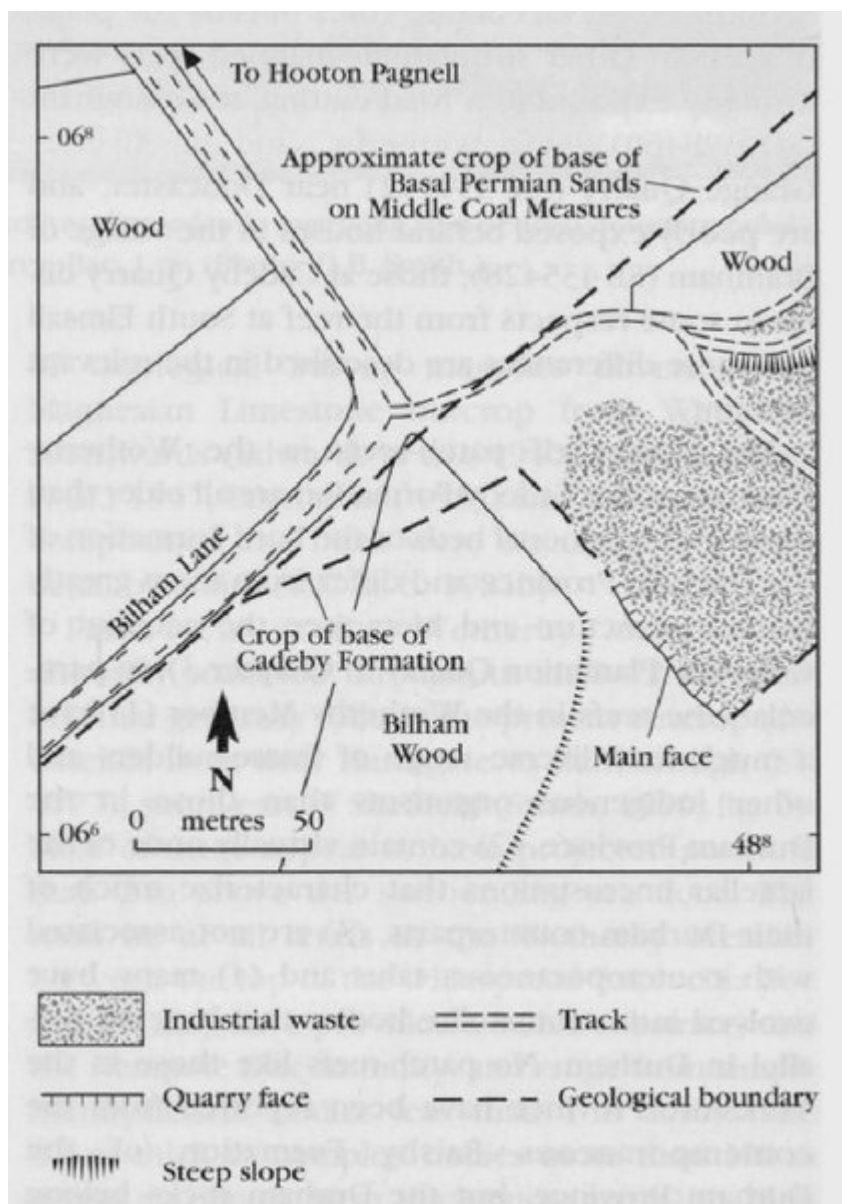
Bilham Quarry is one of only two listed GCR sites in the Yorkshire Province that contain a section in the basal Permian deposits and the lowest beds of the overlying Cadeby Formation, the other being Ashfield Brick-clay Pit. The sands are uncemented or weakly cemented, yellow and thickly bedded. They have been extensively worked for moulding sand, but

the underground workings have now been closed and most of the surface exposures have been filled in. The lower beds of the Cadeby Formation are of fine-grained, thin-bedded dolomite with thin clayey layers and contain a scattered fauna chiefly of bivalves. The sands are considered to owe their origin to reworking of former aeolian sands during the late Permian marine transgression. The site's principal claim for preservation is that it is one of the last remaining exposures of the basal part of the late Permian sequence in Yorkshire.

## References



(Figure 4.2) Approximate stratigraphical position of marine Permian GCR sites in the Yorkshire Province of north-east England (diagrammatic). Some sites cannot be shown on this line of section and have been omitted.



(Figure 4.21) The preserved area of Bilham Quarry and its environs.