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# Osebury Rock, Hereford and Worcester

[SO 737 554]

## Introduction

Osebury Rock provides significant exposures of Permian sediments at the western margin of the Worcester Basin. The Haffield Breccia, comprising texturally immature ephemeral stream conglomerates, was the product of marginal alluvial fans developed along the fault-bounded eastern margin of the Malvern Hills. Overlying the Haffield Breccia is the Bridgnorth Sandstone Formation, an aeolian dune sandstone. This site shows the best Permian succession in the Worcester Basin, and illustrates different aspects of basin fill in arid desert conditions during the Early Permian Epoch.

The Permian rocks of the Malvern Hills, and Osebury Rock, are mentioned *en passant* by Whitehead and Pocock (1947), Mitchell *et al.* (1961), Phipps and Reeve (1967), Penn and French (1971), and Barclay *et al.* (1997). The 'Haffield Conglomerate' was initially described by Phillips (1848); it was renamed the 'Haffield Breccia' by Groom (1902), and was described in detail by Blackith (1956).

## Description

Osebury Rock is a natural, 500-m-long linear exposure that runs along the top of a small, wooded hillside, and is located at the edge of the Birmingham Plateau Natural Area. The exposure faces north-west, and overlooks the River Teme. At the south-western end of the cliffs the sequence is dominated by the Haffield Breccia, and towards the north-eastern end the Bridgnorth Sandstone Formation is exposed.

The oldest unit exposed at Osebury Rock is the Haffield Breccia, which reaches a maximum thickness of some 120–140 m here, and rests unconformably on rocks of Silurian age. In the surrounding area, the Haffield Breccia is seldom more than 30 m thick (Phipps and Reeve, 1967). The sediments are very coarse grained, poorly sorted, and generally composed of subangular fragments. Several clast types have been identified, including Malvernian rocks (mainly sheared pinkish-brown granite and dark green dolerite), and Silurian and Old Red Sandstone rock fragments, all with a thin, dark reddish-brown coating of haematite. The matrix is dominantly argillaceous, and purple or dark brown. The clasts are generally less than 0.1 m in diameter, although there are occasional larger blocks up to 0.45 m. In places, there are lenses of coarse-grained sandstone (Blackith, 1956; Phipps and Reeve, 1967). The Haffield Breccia frequently occurs as lenses, which may infill depressions in the surface of the underlying rocks.

Sedimentary structures are common, and frequently well preserved. Individual beds are well defined, and may be lenticular in overall form. Some of the beds rest on erosional or scoured surfaces with a relief of as much as 0.3 m.

The overlying Bridgnorth Sandstone Formation appears to succeed the Haffield Breccia conformably and with no evidence of lateral passage from one to the other. It comprises reddish-brown, medium- to coarse-grained, well sorted sandstones, with rounded or subrounded sand grains. The dominant grain type is quartz. The reddish-brown colour is caused by a coating of haematite around each sand grain, but there is little interstitial cement, and the sandstone is soft and friable, and readily weathers to a sandy soil. The Bridgnorth Sandstone Formation here shows many fine examples of large-scale cross-bedding, with individual sets up to 15 or 20 m thick, and with foresets, approximately 4 m thick, which dip to the south and south-west.

## Interpretation

The Lower Permian sediments at Osebury Rock are an important source of palaeogeographical and palaeoenvironmental information on the western margin of the tectonically controlled Worcester Basin. The Haffield Breccia and the Bridgnorth Sandstone Formation were deposited under continental conditions in an arid, desert-type climatic regime. The proto-Malvern Hills to the immediate west of the Worcester Basin were probably undergoing uplift in

Late Carboniferous and Early Permian times, while the basin was subsiding as a result of contemporary fault movements. Material was eroded from the hills and washed down into the neighbouring basinal areas, forming alluvial fans. Later, a vast sand sea, represented by the Bridgnorth Sandstone Formation, spread over much of the Midlands. Much of this unit was subsequently eroded, and it is now seen only around the periphery of the basin.

The Haffield Breccia, with large pebbles and erosive, scoured bases to individual beds, was deposited in braided streams on large alluvial fans, located along the margins of the proto-Malvern Hills (Phipps and Reeve, 1967). It is likely that most of the sediment accumulation took place during periodic flood events, when large amounts of debris were transported and reworked from the surrounding local area. The source of pebbles was probably the Worcester Horst to the east, which was uplifted at the time, and has since been eroded (Barclay *et al.*, 1997).

It has been suggested that the Haffield Breccia may be correlated with the Clent Breccia, which crops out over substantial areas of South Staffordshire (Fleet, 1927; Smith *et al.*, 1974). Evidence for this correlation comes from the analysis of heavy minerals (Phipps and Reeve, 1967) and from lithological and regional evidence that all the basal breccias in the Permo-Triassic basins in the English Midlands are probably roughly coeval (Smith *et al.*, 1974). Whether the Haffield Breccia is Early Permian or Late Carboniferous in age is, however, unclear. Barclay *et al.* (1997, p. 48) note the possibility that the Haffield Breccia pre-dates the rifting and formation of the Worcester Graben, since it is found west of the East Malvern Fault (Figure 1.5), and hence may be Late Carboniferous in age.

The Bridgnorth Sandstone Formation, consisting of uniform, well-sorted sandstone displaying large-scale cross-beds, is interpreted as the product of large dune systems migrating south and south-west through a desert (Mader and Yardley, 1985).

## **Conclusions**

The natural crags of Osebury Rock preserve one of the best sections through the Lower Permian Haffield Breccia and the overlying Bridgnorth Sandstone Formation in the English Midlands. The sequence exposed here provides critically important information on the Permian palaeogeography and palaeoenvironments of the Worcester Basin.

## **[References](#)**



(Figure 1.5) The principal Permo-Triassic sedimentary basins and syndepositional normal faults in England. Intensity of stippling indicates sediment thicknesses. Abbreviations: CB, Cheshire Basin; CF, Clopton Fault system; DB, Dorset Basin; EMF, East Malvern Fault; IF, Inkberrow Fault; KB, Knowle Basin; LBB, Lyme Bay Basin; NB, Needwood Basin; PeB, Pewsey Basin; SB, Stafford Basin; SoB, Solway Basin; WaB, Wardour Basin; WB, Worcester Basin; WRRF, Wem-Red Rock Fault system.