

King's Cross
London
West Range

Characterisation of a stone sample from the
West Range, together with
recommendations on replacement material

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Geology & Petrography in Conservation, Restoration & Archaeology

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King's Cross London West Range

Characterisation of a stone sample from the
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SUMMARY

The sample of stone which was received for analysis is a fine-grained sandstone, probably from the Silesian 'Coal Measures' of West Yorkshire. Although a large number of quarries were producing building stone at the time when King's Cross was being built, the current range of materials is now extremely limited. However, it is considered that the stone sample is very close in composition to modern Woodkirk stone. It is therefore suggested that this stone is used as a replacement, being compatible with the original. The Woodkirk stone which is being currently produced can be greenish grey in colour, weathering to reddish brown. The stone from the higher beds is already naturally weathered to a more reddish colour. It is strongly recommended that suitable blocks are selected on site at the quarry if a more rapid colour blending is required.

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1 INTRODUCTION

King's Cross railway station was built by Lewis Cubitt in 1851-2 for the Great Northern Railway. The West Range was part of the complex and, in common with other parts of the station, incorporated both brick and stone in its construction. Restoration is currently being undertaken at the site. Due to the historical importance of the buildings, it is important to ensure that any stone used for repairs at King's Cross are as close as possible to the original both in appearance and petrography. This will ensure that any potential adverse chemical or weathering reactions with the existing fabric are avoided. It is therefore necessary to characterise the original stone in order to identify a similar material which is currently available. This is achieved by petrographic analysis of samples of stone from the building.

2 SAMPLE FROM THE STONWORK

A sample of stone from the West Range was submitted by Stonewest Limited for analysis. The actual location of the stonework and the position from which the sample was obtained, are not known. It has been assumed, therefore, that the sample is representative of the stonework to be repaired. The slab-like sample appears to have been removed from the corner of a larger block, two edges being dressed smooth whilst, whilst a third large side, at right angles to the other two is weathered and worn. The bedding is at right angles to this large side and parallel to one of the smooth surfaces. Unlike previous samples from the site, there is little sign of contamination apart from a little iron staining, presumably from associated ironwork.

3 ANALYSIS OF THE SAMPLE

The sample is fine-grained and is typically yellowish brown in colour, about 10YR 6/4 on the Munsell® colour scale. However, there are slight variations from this colour due to the presence of reddish coloured banding in the stone. This is due to variations in iron content of the material

and is not related to the bedding, being a late-stage feature in the stone. Such colour variations can vary in intensity and it is not known whether or not those in the sample studied, which are relatively minor, are typical of the building stone in the West Range.

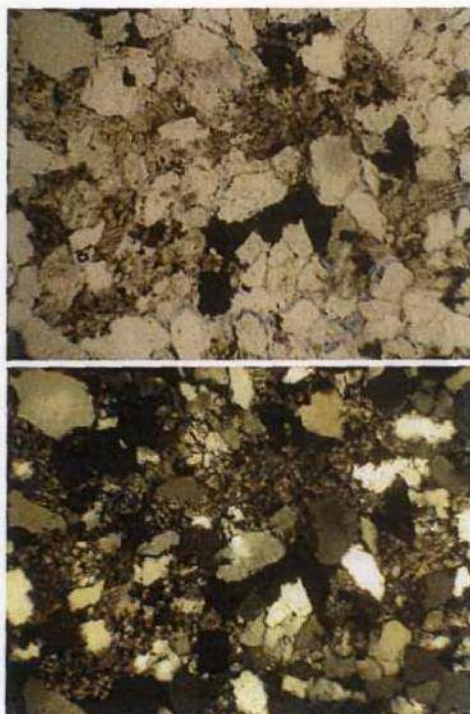


Figure 1. Photomicrograph of the sample of stone from the West Range. Upper picture photographed in ordinary light, the lower picture is the same view in polarized light. The clear grains in the upper picture, which are various shades of grey in polarized light, are quartz. The finely composite grains, both brown and cloudy in ordinary light, are metamorphic rock fragments. The porosity is shown in blue in the upper picture. Width of the pictures is 1.36 mm.

In thin section the stone is seen to be composed of sub-angular to sub-rounded clasts, relatively uniform in size, being about 220 microns in diameter; the rub-rounded particles tend to be the result of syntaxial mineral growth on original sub-angular grains. The particles consist of quartz and fine-grained metamorphic rock, although there are also small quantities of feldspar and traces of mica, the latter sometimes chloritized. There are also traces of carbonaceous material. The iron mineral, which gives the stone its colour, is goethite, although some grains of ilmenite have been identified. The stone is well compacted with no discernable matrix. This has resulted in a low porosity of about 4%. The natural cement in the stone is silica often, as noted above, in the form of syntaxial rims which have grown out from individual clasts and merged to give the stone its structural strength. A photomicrograph of the stone is shown in Figure 1.

The petrography of this stone is typical of many of the sandstones found in the Silesian Westphalian Series, previously known as the Coal Measures, of the Carboniferous succession in West Yorkshire. It appears likely, therefore, that the stone for the West Range was imported from this area, where innumerable quarries existed at the time that King's Cross was being built.

4 REPLACEMENT STONE

Although large numbers of sandstone quarries existed in West Yorkshire at the time the station was being developed, the number of available sandstones is now extremely limited. Petrographic comparison with those which are currently available suggests that Woodkirk stone from Morley would be the most compatible material. A photomicrograph of this stone is shown in Figure 2

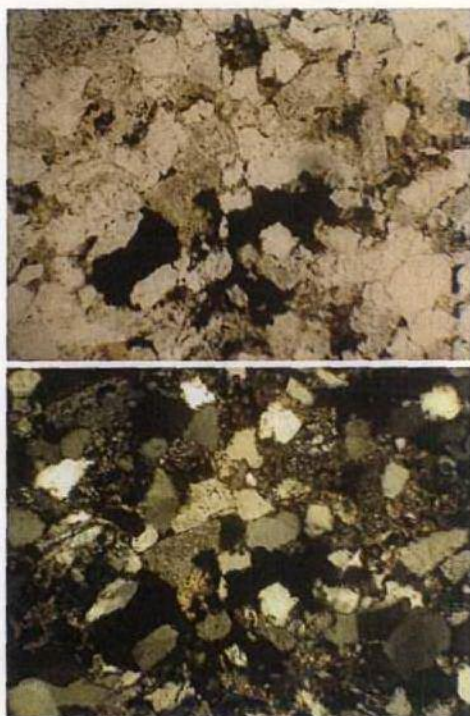


Figure 2. The similarity in the petrography of this sample of Woodkirk stone with the stone from the Western Range, shown in Figure 1, is shown in this photomicrograph. The width of the pictures is 1.36 mm.

for comparison with the sample from the West Range. However, modern Woodkirk from low in the quarry can be greenish grey in colour, although it becomes more reddish brown on weathering. The stone from the higher beds, that is those worked in the 19th century, is already naturally weathered to a more reddish brown colour similar to that in the station. It is strongly recommended, therefore, that suitable blocks are selected on site at the quarry in Morley if a more rapid colour blending is required. The supplier is -

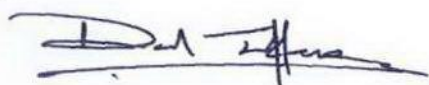
Woodkirk Stone
Brittania Quarry
Rein Road
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5 CONCLUSIONS

The sample of stone from the Western Range which was received for analysis and characterisation, is a fine-grained sandstone, probably from the Silesian 'Coal Measures' of West Yorkshire. Although a large number of quarries were available for the supply of stone at the time

when King's Cross was being built, the range of materials now available is extremely limited. However, it is considered that the stone from the Western Range is very close in composition to modern Woodkirk Stone. It is therefore suggested that Woodkirk stone is used as a replacement. However, since the Woodkirk stone which is being currently produced is from the lower benches in the quarry, it is greenish grey in colour, although it becomes more reddish brown on weathering. The stone from the higher beds, that is those worked in the 19th century, is already naturally weathered to a more reddish colour. It is strongly recommended that suitable blocks are selected on site at the quarry if a more rapid colour blending is required.

A handwritten signature in black ink, appearing to read 'Dr David Jefferson', with a horizontal line drawn underneath the name.

Dr David Jefferson

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3.2.2 *Jefferson Consulting Ltd Report dated September 2009*

- East Elevation Plinth