

Ferricrete: London's forgotten Medieval building stone.

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Introduction and Objectives

This paper reviews the use of iron-cemented gravels or ferricretes in the Medieval buildings of Greater London and postulates some new sources for the provenance of ferricrete. Ferricretes are defined here according to Widdowson (2003) as land surface-forming, geological horizons wherein near-surface sediments are cemented into a hard crust by iron oxide minerals. Such deposits are normally only a few tens of centimetres thick but may be laterally extensive. Although aluminium oxides may also be present in the cement, this definition distinguishes ferricretes from laterites which formed in, specifically, tropical environments. Ferricrete duricrusts may well have formed in a warm or even tropical palaeoenvironment but it is not possible to link a climatic environment to field occurrences of these deposits within the UK. Bog iron ores and iron pans are related materials and have also been used in Europe as building stones (see Kraczkowska et al, 2001) and are known to be forming in today's British climate at, for example, Dersingham Bog in Norfolk (Stevenson & Masson, 2016). It is important to remember that ferricrete formation may significantly post-date the original formation of the sediment and is rarely pervasive throughout the entire lithology. It tends to form as discrete layers (Fig.1a).

Ferricretes have found use as building stones in France and in Southern Britain and very probably far more widely. One of the purposes of this paper is to highlight their use as construction materials. These are easily ignored and largely under-published building stones perhaps due to their lumpy and unattractive appearance. Nevertheless they were important building stones during the long European Medieval period (6th – 15th Centuries CE) and occur in a number of surviving buildings of significant cultural and heritage importance. In Brittany, Western France, Chauris (2010) has described '*pierre-des-landes*' ('moor stones') which are superficial Pleistocene-Holocene age ferricretes encountered in numerous locations on the Armorican Massif, overlying Lower Palaeozoic and older basement. They were particularly abundant in the Baie-de-St Brieuc area where they have been used in ~30 structures locally. In SW Wales, ferricretes are encountered in superficial sediments associated with the last glaciation in Britain (Devensian 115-12 ka) and were used in Medieval and (probably) later building. Their use as building stones were described as early as 1603 (Miles, 1994) and they have been observed in the fabric of the 13th Century St Dogmael's Abbey.

In Southern England, ferricretes were widely used as building stones across East Anglia (Norfolk, Suffolk and Essex), the Greater London area and the Hampshire Basin (Berkshire, Surrey and Sussex). The occurrence of ferricretes in the fabric of churches of the London Basin has been thoroughly surveyed by John François Potter (1932-2019) who highlighted their presence in a number of publications (Potter, 1987, 2001, 2013). Potter (2001) observed ferricrete in 282 churches predominantly in the counties of Essex and Surrey with around 10 structures using significant amounts of ferricrete identified in the Greater London area, all located N of the River Thames. Ferricrete is used as both coursed ashlar and rubble masonry structures and is restricted to use in Medieval buildings. Churches are the buildings from this period that are most likely to have survived because they have witnessed continued use since their construction. An important and rare secular structure, partially constructed from ferricrete is Harmondsworth Barn (Fig. 1b), built in the early 15th Century and remaining in use until c. 1970, an astonishing survival. What is remarkable about the use of stone in these buildings is that despite the unwieldy appearance of ferricretes, they are frequently used in buildings as relatively well-shaped ashlar blocks and used as quoins and dressings. It should also be noted that high status buildings in London were more likely to have been funded by wealthy benefactors and are constructed of more expensive, imported stone.

Geologically, the London Basin is dominated by a series of marine, Palaeocene-Eocene strata. The sandy Thanet Formation is overlain by the clay-rich Lambeth and Thames Groups. The latter includes the London Clay Formation which is the dominant sub-crop in the Greater London area. The overlying

and youngest Eocene unit exposed is the Bracklesham Group (Bagshot Sand Formation) which outcrops on high points in the Basin such as on Hampstead Heath and Harrow-on-the-Hill. An extensive series of Pleistocene fluvial gravels dominate the valleys of the Thames and its major tributary, the River Lea, which are subdivided into pre- and post-Anglian gravels (see Ellison et al., 2004). Ferricretes are known to have developed in the Thanet Sands and Pleistocene gravels. However outcrops of the Thanet Formation are outside the area considered in this study.



Figure 1a. Ferricrete layers (dark brown) in the fluvial Kesgrave Gravels (642-615 ka) exposed at Highwood Quarry, Essex. Ferricrete formation is secondary to the deposition of the gravel and follows large-scale cross bedding structures; b., Harmondsworth Barn; c., St Mary's Tower, Hornsey; d., ferricrete and flint masonry at St Mary's Church, Monken Hadley (*photos by the author*).

Methodology

Eight buildings in the Greater London area, all featuring significant amounts of ferricrete in their fabric were visited and the stones used surveyed. Details of these buildings and a description of the stone are detailed in Table 1 below. At each location the structure and composition of ferricrete was found to be homogenous. There was not a mixture of ferricrete used, suggesting that it was obtained from one, presumably very local source. The position of the buildings within London's geology and geomorphology was noted along with the proximity of potential outcrop or river access for easy transport of stone. Field work was also conducted in order to identify potential provenance.

Results and Discussion

Three clearly distinct facies of ferricrete were observed. The most abundant, assigned here as Type A, are composed of iron cemented flint cobbles. The origin of these stones is immediately obvious; they are derived from the extensive deposits of the Taplow and Kempton Park Gravels (post Anglian, Pleistocene fluvial sediments). These outcrop in abundance in the Thames Valley close to Harmondsworth (Fig. 2a) and in the Lea Valley where Waltham Abbey is located. St James's Friern Barnet is built on Pre-Anglian Dollis Hill Gravel but also lies 1 km away from outcrops of the Taplow Gravel in a tributary to the River Lea. It is likely that these deposits were the source of the stone used.

A distinctly different stone was observed at Hornsey, Harrow-on-the-Hill and Pinner. This is a medium grained sandstone containing sparse well-rounded flint pebbles. Hornsey Tower (Fig. 2b) is located in north London within 2 km of Hampstead Heath which has a substantial outcrop of Eocene Bagshot Formation sands. Observation of exposures of Bagshot Sands on Hampstead Heath has revealed previously unrecorded rounded flint pebbles and patches of ferricrete formation (Fig. 2d.) suggesting that this sequence of poorly consolidated Eocene sands could be a previously unrecognised source of ferricrete. Iron pans are well-developed in the Bagshot Sands and indeed form the seal for a series of ponds on the Sandy Heath section of Hampstead Heath. The Heath is well-wooded today although it is known that much of the woodland has developed over the last century (see Clements, 2012). It is not impossible that ferricrete duricrusts could have existed here 1000 years ago which have subsequently been quarried out or built over. Harrow Hill is also capped with Bagshot Formation. This relationship is less obvious at Pinner which lies on Lambeth and Thames Group Clays but lies only 4 km NW of Harrow. It is possible stone could have been brought overland from Harrow-on-the-Hill. The church at Pinner is distinctive in having well-cut quoins of ferricrete (Fig 3.).

Building, Age & Location	Description of the stone	Type
Harmondsworth Great Barn (1426) 51.489697, -0.47994375 Fig 1b.	Coarse grained, very poorly sorted, angular to rounded clasts of flint in a bright orange cement. Weak bedding laminations	A – River Gravels
St Mary’s Church, Harmondsworth (12 th -14 th Century) 51.489372, -0.47910154	Coarse grained, very poorly sorted, angular to rounded clasts of flint in a bright orange cement. Weak bedding laminations	A – River Gravels
St James’s the Great Church, Friern Barnet (?13 th Century) 51.620999, -0.16368985	Coarse grained, very poorly sorted, sub-angular to rounded clasts of flint in a dark red-orange cement. Unstratified.	A – River Gravels
Waltham Abbey Chapter House (12 th -13 th Century) 51.687939, -0.0024032593	Coarse grained, very poorly sorted, sub-angular to rounded clasts of flint in a dark red-orange cement. Unstratified.	A – River Gravels
St Mary’s Tower, Hornsey (1496) 51.587322, -0.11578962 (Fig. 1c)	Medium grained iron-cemented sandstone with strings of rounded flint pebbles and bedding laminations. Cement varies in colour from yellow through brown to black.	B - Sandstones
St Mary’s Church, Harrow-on-the-Hill (1094) 51.574156, -0.33743799	Medium grained iron-cemented sandstone with strings of rounded flint pebbles and bedding laminations. Cement varies in colour from yellow through brown to black.	B - Sandstones
St John the Baptist’s Church, Pinner (1320) 51.594543, -0.37917584	Medium grained iron-cemented sandstone with strings of rounded flint pebbles and bedding laminations. Cement varies in colour from yellow through brown to black.	B - Sandstones
St Mary’s Church, Monken Hadley, High Barnet (1494) 51.661575, -0.19393981 (Fig. 1d).	Fine grained, ochreous iron-cemented siltstone. Colour varies from purple, red, yellow, brown, orange. Unstratified.	C – Ironstone

Table 1. London buildings wherein ferricrete is used in the construction with a description and classification of the varieties of stone used. Locations are quoted as decimal latitude, longitude.

An outlier is the distinctive ferricrete used at Monken Hadley, a village near High Barnet, which appears to be a high purity, multicoloured iron oxide. The village stands on a substantial outcrop of

Stanmore Gravels, the earliest of the pre-Anglian deposits of the London Basin. This unit is poorly exposed and not well understood, having been interpreted as either beach or fluvial gravels (Ellison et al., 2004). Although predominantly composed of flint-rich gravels, pockets of sand, silts and peats have been recorded. It is quite possible that the ferricrete used here is a bog-iron ore.

Conclusions

Following the pioneering work of John Potter, this work has revisited several churches and Harmondsworth Barn in W, N, and NW London. These structures all have elements constructed of ferricrete which was formed in different strata and at different times. It appears certain that not all of London's ferricretes were obtained from the pre-Anglian Thames gravels, as suggested by Potter (2001). The stones observed can be subdivided into three main typologies; Type A, derived from Pleistocene river gravels associated with the Thames and its tributaries (as determined by Potter; 2001); Type B, iron-cemented sandstones possibly extracted from horizons in the Eocene Bagshot Sandstone Formation and finally Type C which was encountered in St Mary's Church, Monken Hadley, a high iron-content sediment presumably obtained from the Stanmore Gravels. The Stanmore Gravels clearly require further investigation as potential sources of bog-derived or even sand-derived ferricretes. However the lack of good exposure is a major obstacle in this instance.



Fig 2a. Large Type A ferricrete block (70 x 30 cm) at Harmondsworth Barn; b., Type B ferricrete at Hornsey Tower. Field of view is 50 cm; c., Type C ferricrete at Monken Hadley. FoV is 40 cm; d. ferricrete formation in the Bagshot Formation on Hampstead Heath.

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Fig. 3. Flint and ferricrete rubble masonry and ferricrete quoins at St John the Baptist's Church at Pinner, West London.

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