

# STRATEGIC STONE STUDY

## A Building Stone Atlas of RUTLAND

Published May 2011



ENGLISH HERITAGE

# Rutland Bedrock Geology



## Rutland Bedrock Geology

- BUILDING STONE SOURCES
- KELLAWAYS FORMATION AND OXFORD CLAY FORMATION (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE
- GREAT OOLITE GROUP - SANDSTONE, LIMESTONE AND ARGILLACEOUS ROCKS
- INFERIOR OOLITE GROUP - LIMESTONE, SANDSTONE, SILTSTONE AND MUDSTONE
- LIAS GROUP - MUDSTONE, SILTSTONE, LIMESTONE AND SANDSTONE

Click on this link to visit Rutland's geology and their contribution to known building stones, stone structures and building stone quarries (Opens in new window <http://maps.bgs.ac.uk/buildingstone?County=Rutland>)

# Introduction

The Rutland landscape has an individual and distinctive character. It is a slightly hilly and rolling county deeply cut by wide valleys whose features reflect the underlying Jurassic geology. Despite its attractive scenery the geology of Rutland is fairly simple.

Rutland's **FERRUGINOUS SANDSTONES** and **IRONSTONES** have commonly been used for building throughout the county, while two of its **LIMESTONES** (at Ketton and Clipsham) provide building stones of both local and national importance. Rutland is a rural county having undergone very little large scale industrial growth. The development of the two main market towns, Oakham and Uppingham have been confined due to the instigation of conservation area policies. This has meant that a lot of the county's stone built village character has been retained. Apart from Oakham Castle and the Bishop of Lincoln's house at Lyddington, little medieval stone architecture of importance has survived in the county, however, there are still many good examples of the smaller stone manor houses, yeomen's dwellings, and cottages of the late 16C and 17C.

The first systematic geological survey was undertaken between 1867 and 1871 by J.W. Judd, an officer of the Geological Survey of the United Kingdom, much of the research for the Strategic Stone Study for Rutland is founded on his work. In the past almost every town and village had its own quarry, therefore many of the buildings are a reflection of their underlying geology.

The geological **STRATA** of Rutland were deposited during the Jurassic. They range in age from the Lias Group of the Lower Jurassic to the Kellaways Formation at the top of the Middle Jurassic.

There is only minor folding and faulting of the strata and, because of their low angle of dip, the rivers deeply dissect the sequence and some of the oldest beds can be found in the valleys of the Gwash and the Welland, as far east as the county boundary at Tickencote and Tinwell. Thin irregular and unconsolidated spreads of Boulder Clay and some superficial sands and gravels, which were deposited during the Pleistocene glaciations, conceal the solid geology over large parts, mainly in the hilly areas in the southwest and northeast, of the county. To the west of the county, the underlying **MUDSTONES** and limestones of the Triassic and Lower Jurassic form the floor of the lowland area eventually on-lapping against the outliers of hard Precambrian crystalline rocks which form the prominent hills in the neighbouring county of Leicestershire.

To the east of the county, the Middle Jurassic strata dip gently eastwards producing characteristic north-south scarp lands, similar to those of the Cotswolds. The scarps are predominately formed by the sandy and **OOIDAL** ironstones, ferruginous sandstones and ooidal limestones, being the principal **LITHOLOGIES** of the Middle Jurassic of this area. In Northamptonshire and Rutland the lower beds of the Middle Jurassic are sandy and iron rich and are less resistant to weathering than the overlying limestones. Where they crop out in east and central Rutland they produce rich red soils.

By contrast the overlying ooidal limestones show little change in character over the length of their outcrop. They comprise the Lincolnshire Limestone Formation which underlies much of the eastern half of the county. These limestones form a plateau which dips gently away to the east before disappearing beneath the mudstones of the Upper Jurassic and recent Fenland deposits.

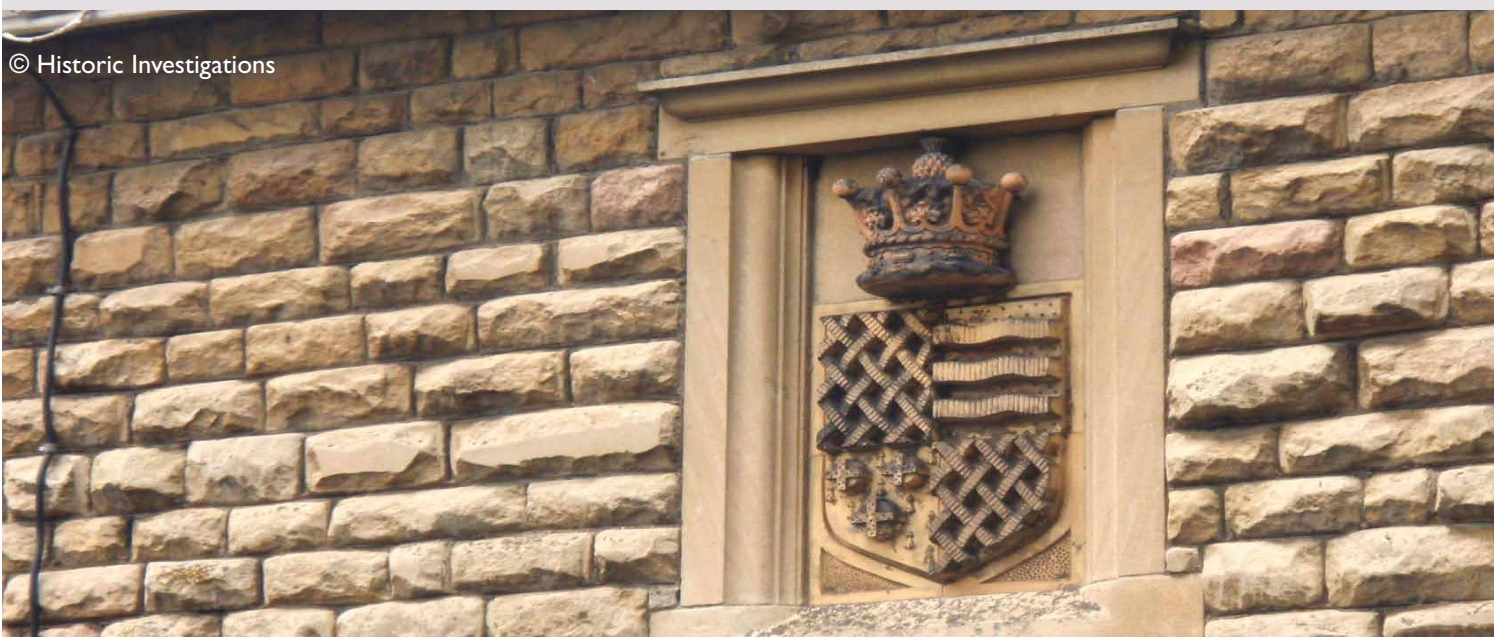
The ferruginous beds of both the Marlstone Rock and the Northampton Sand were exploited from earliest times as building stones. However, in the early 20C these ironstones were primarily exploited as ore on a wide scale after the newly invented Bessamer Converter was introduced. This enabled the extraction of iron previously difficult to obtain from the stone and meant that the lower quality “iron” stone could now be used by the industry. Large open surface mines were created in the ironstone outcrops around Pilton and Market Overton. This resource is now virtually exhausted both as an ore and as a building stone source.

Limestones are **SEDIMENTARY** rocks that accumulated in layers or beds. In general the beds in the quarries can range from coarse grained, shelly varieties which are difficult to work, but often quite durable (**RAGSTONES** and weatherbeds), to the close grained and even textured ooidal beds of the best **FREESTONES**, which are less hard and more amenable to working and carving by the stone mason.

Many of the ooidal limestones in Rutland are generally held in high regard as fine quality building stones. The best freestone beds are composed predominantly of **OIDS** which are small spherical

carbonate grains the size of a pin head or less, with an internal structure of concentrically layered calcium **CARBONATE** crystals. Not all the Rutland limestones however are ooidal and some beds include varying proportions of coarse shell fragments (bioclasts). The amount of **CALCITE CEMENT** that binds these grains together can also vary. In some of the limestones there are sparse fine crystals of calcium carbonate cement, as in the porous Ketton Stone, in other limestones there is a more pervasive calcite cement producing a harder, less porous building stone like Clipsham Stone.

In the past the county of Rutland came under the ownership of two great estates: Ancaster (Lincolnshire) and Burghley (Peterborough). Each estate utilised its own quarries for the building and maintenance of their estates. **The quarry at Ancaster was the favoured stone of the Earl of Ancaster when building at Empingham and the stone was used to display coats of arms on buildings, as can be seen in the below image,** and boundary stones in the estate fields. Ancaster Stone is an ooidal and bioclastic limestone which is white to pale yellow and although not quarried within the county was used in many buildings in the past.



## LOWER JURASSIC

### Lias Group

#### LIAS 'LIMESTONES'

These are two series of finely laminated calcareous mudstones with thin limestones occurring towards the base of the lower and upper Lias successions, which were used for lime burning in brickyards rather than as building stone.

#### Marlstone Rock Formation

##### Marlstone and Marlstone Rock

This formation is a hard **FOSSILIFEROUS**, ferruginous limestone (locally an ironstone), with a variable thickness. Due to extensive quarrying of the stone as an iron ore there is very little of the Marlstone left in the county, the stone used for conservation repair is the Oxfordshire Marlstone, known as Banbury Ironstone, which also weathers to a distinctive golden orange/brown colour.

Marlstone is seen in many buildings of the pre-industrial quarrying era, for example in the villages and towns of Pilton, Glaston, Lyddington, Uppingham and Oakham. Oakham High Street in particular with the 15C Flores House, chapel and shop fronts (below image) show a varied use of this stone.



## MIDDLE JURASSIC

### Inferior Oolite Group

#### Northampton Sand Formation

All the beds of the Northampton Sand Formation are ferruginous to some degree, the rocks weather in warm shades of brown to yellow, but the range of rock types varies across the outcrop. Long before the iron ore industry took over, this Rutland ironstone was dug for building stone in small stone pits and quarries on local outcrops. These former stone pits were engulfed by the subsequent iron ore excavations and lost when the landscape was restored to agriculture, or used as landfill sites, for example within Morcott Parish. Two kinds of Northampton Sand can be distinguished, the plum-cored brown, burrowed, calcareous stone which is also seen as **ASHLAR** and **QUOINS**, and more ochreous, rusty and sandy ironstone. Both building stones are seen within the few kilometres towards Uppingham.

The above image shows a 17C thatch roofed house on Main Street in the village of Caldecott, demonstrating the colour differential of Northampton Stone with ashlar banding in Uppingham Stone and Upper Lincolnshire Limestone.



## Uppingham Stone

This deep brown stone with shades of yellow was quarried in various locations just outside the town of Uppingham where it has been used extensively, especially in the High Street and high status boundary walls. The unweathered stone is a very hard dark grey/green/blue rock. It was used for properties in the village of Caldecott, Lyddington and Glaston. Commonly the Marlstone is seen with contrasting paler limestone **LINTELS, DRESSINGS** and **MOULDINGS** from Ketton and Clipsham, or other local Lincolnshire limestones quarries. *Image to the right shows one of the many walls in Uppingham built of Northampton Stone with an Uppingham Stone **SEGMENTED** arch.*



© Historic Investigations

## Northampton Stone

This stone has been quarried extensively for building stone. Cropping out at Uppingham, Lyddington, Caldecott, Pilton, Glaston and in a small outcrop at Barrowden, mostly the whole of the western side of the county. It is a medium brown ironstone with a purplish to grey core and has been used for houses, churches and walls.

In older buildings the ironstone has crumbled and deteriorated. Lower levels in the succession were known as the “Bastard Stone” by quarrymen as it contained no iron ore. *At Lyddington (below image), the English Heritage property “Bede House” built in the late 15C is an good example of a building using Northampton Stone with Limestone quoins and decoration, also used in the Braunston cottages, with smaller blockwork being prevalent.*



© Historic Investigations

## Lincolnshire Limestone Formation

The Lincolnshire Limestone Formation is the most thickly developed Middle Jurassic limestone unit in the East Midlands and is an important source of building stone and lime for cement manufacture at Ketton. The formation is subdivided informally into lower and upper Lincolnshire Limestone units. The principal building stone quarries (Ketton, Clipsham, Stamford and Casterton) all lie within the upper division of the formation. The use of Lincolnshire Limestone as both ashlar freestone and smaller **RUBBLESTONE** blocks is ubiquitous in buildings throughout the county. It has been used for side and rear elevations, interior walls and for the lining of the inside of freestone ashlar walls. *Many lower status buildings of the late 18C are built using Lincolnshire limestone as can be seen in the image top right.*

## 'Lower' Lincolnshire Limestone

This informal unit of the formation includes numerous thin limestone beds which were locally used for wallstones. However, the most important building stone produced from this interval is the fissile sandy limestone known as the Collyweston Slate.

## Collyweston Slate

The slate mines lie just outside the eastern boundary of the county in Northamptonshire but have historically supplied stone roofing slates for numerous buildings in Rutland and its adjacent counties.



© Historic Investigations

The stone was used extensively for roofing and evidence from the Roman towns at Great Casterton and Thistleton confirm its early use as a slate. There are still potentially workable deposits at Collyweston and Easton on the Hill but despite extensive efforts to kick-start the industry new production of this roofing material is still minimal. Fine examples of the use of these slates can be seen at Apethorpe Hall, Rockingham Castle, the Guildhall (in London) and numerous buildings in Stamford.

The Collyweston Slaters Association provides extensive instruction on how to use the slate and also suggest that builders today are buying the old slate from homeowners, replacing the roof with a more contemporary material in order to maintain a second hand supply which reduces the demand for a new supply from the mines. Prior to the 19C, Collyweston Slate was used extensively in Rutland but with the advent of the railway it became cheaper to "import" Welsh slate for roofing material. *Below image shows a Collyweston Slate roof.*



© Amanda White

## 'Upper' Lincolnshire Limestone

This informal unit includes the most important freestone limestones of the county.

### Ketton Stone

This is a fine quality porous, ooidal limestone quarried in large blocks. It is cream to pale yellow in colour and occasionally contains pale pink-stained beds. It has often been described as the perfect oolite because of its well sorted, spheroidal ooidal texture. The quarries have been commercially worked since the 1500s. Ketton Stone has been more widely used outside the county than within, most notably at Cambridge where it has been used in many of the colleges for over 300 years, for example at the 17C Wren Library at Trinity, the Wren chapel's at Pembroke and Emmanuel colleges and extensively in the buildings of Clare College. Large quantities of Ketton Stone were used to build Burghley House in Stamford (1553-87). During the 18C thousands of headstones and monuments of Ketton Stone were made for churchyards in Rutland and its neighbouring counties. Ketton Stone was again used extensively in the 19C in new Cambridge college buildings and extensions at King's Trinity and St John's, and also for dressings in Sandringham House, Norfolk. In the 20C new buildings at Downing and Christ's colleges were constructed using Ketton Stone. Hibbins House, image below, in Ketton is a fine example of the stone's versatility with carved ashlar frontage displaying the pink hue and carved doorways.



© Historic Investigations

Ketton Quarry is also a major producer of finely crushed Ketton lime for cement.

### Ketton Rag (Top & Bottom Rags)

This is a hard, dark brown, banded stone, more pervasively cemented than the Ketton Stone with visible intergranular, crystalline (spar) calcite cement and a more coarsely bioclastic (shelly) texture. It often has white calcitic veins running through it and is widely used as a walling stone in and around Ketton (above image).



© Historic Investigations



## Stamford & Great Casterton Stones

These fine grained ooidal freestones are relatively free from bioclastic debris, and are quarried in the north-west of the county. Over the years there have been five quarries some within the boundary of Stamford and others at Great Casterton, hence the dual names, but it is the same bed that is being worked in both locations.

Many of the houses in Great Casterton are built of this stone and it was used extensively to rebuild Stamford's medieval churches after they were destroyed in the War of the Roses, and many of the town's buildings are faced with this stone. It is comparatively easy to work by hand. Stamford Stone was also used at Downing College in Cambridge and at Ely Cathedral. Below the freestone is a bed of a hard, well cemented and lighter coloured ooidal limestone which was commonly termed Stamford Marble and used internally for fireplaces, flooring slabs and steps. The image top right shows an early 1900s house on Great Casterton High Street, constructed of Stamford and Great Casterton stones. The below image also on the High Street shows the stones weathered colour:



## Edith Weston Stone

This stone is very similar to the Stamford and Ketton stones but was not as heavily exploited. It has been used for building and memorial stones. Below the main bed of limestone is a "slate" bed which is denser than that found at Collyweston.



## Clipsham Stone

The quarries at Clipsham have a long history of use from Romans times. It has been used extensively to repair many decaying Oxford college buildings, for example, All Soul's, Christ Church and New College etc. Elsewhere it was used at Windsor Castle in the 14C and in the 20C it was used extensively for the restoration of the Palace of Westminster and re-building the blitzed House of Commons. Much of the famous façade of the Houses of Parliament is now re-faced with Clipsham Stone. Locally, because of its durable character, it was used for more decorative purposes in **PINNACLES, CORNICES** and sills. The stone has a shelly texture and is cream in colour, sometimes with a light blue hue (blue hearted), it is hard but not difficult to work and weathers to silver grey. *The top image shows the use of Clipsham stone in the village of Clipsham.*

The quarries at Clipsham are substantial and have exploited several limestone beds. The umbrella name of "Clipsham Stone" covers all the stone quarried including a high quality fine grained silver/white stone used for internal features such as stone fireplaces. Many of the new buildings within the county utilise Clipsham limestone from the present quarry. Currently a number of companies supply these stones, which use various commercial names, including Clipsham Gold, Clipsham White, Stretton Honey and White Stretton. Houses built today use a variety of products from these quarries including sawn, hand hammered, cropped or tumbled stones. In Church Street, North Luffenham many of the cottages that have been renovated have used this stone for new ancillary buildings such as garages,

## Greetham Stone

The quarry at Greetham originally contained a coarse grained, bioclastic limestone used only for aggregate. In the past two years, however, an upper bed suitable for masonry was exposed, it is fine grained and honey yellow in colour and has a fine fossiliferous layer.



## MIDDLE JURASSIC Great Oolite Group

### *Blisworth Limestone Formation*

### **Great Oolite Limestone, Blisworth Limestone**

This lithologically highly variable limestone contains oysters and other shells, **PELOIDAL** grains and ooids in a micritic muddy matrix. The principal quarries are near Oundle in Northamptonshire, however the limestone is found at Ketton Quarry overlying the Rutland Formation. As of 2007 it had not been used as building stone

### *Cornbrash Formation*

### **Cornbrash limestone**

This unit is exposed as the uppermost limestone at Ketton Quarry and is a rough, fossiliferous, muddy, hard grey limestone which can only be quarried by blasting. When weathered it breaks up onto flat layers of a light brown colour. It is principally used for rough walling and as a road aggregate.

# Glossary

**Ashlar:** Stone masonry comprising blocks with carefully worked beds and joints, finely jointed (generally under 6 mm) and set in horizontal courses. Stones within each course are of the same height, though successive courses may be of different heights. 'Ashlar' is often wrongly used as a synonym for facing stone.

**Calcite:** A mineral made of calcium, carbon and oxygen —  $\text{CaCO}_3$ ; the principle carbonate component of limestone, Chalk and marble.

**Carbonate:** A general term used for sedimentary rocks consisting of 50 per cent or more of either calcite (calcium carbonate) or dolomite (magnesium carbonate).

**Cemented:** The materials which bind the grains and/or fossil components together to form a rock.

**Cornice:** A moulded projection crowning an entablature, moulding, pedestal, wall, or opening. It is also the ornamental moulding around the top of a wall below the ceiling, or the external moulding where the roof meets the wall.

**Dressings:** To say a building is constructed of brick with stone dressings means that worked stone frames the corners and openings of the structure.

**Ferruginous:** Containing iron minerals usually in the form of an iron oxide which gives the rock a 'rusty' stain.

**Fossiliferous:** Bearing or containing fossils.

**Freestone:** Term used by masons to describe a rock that can be cut and shaped in any direction without splitting or failing.

**Ironstone:** Sedimentary rock which is composed of more than 50% iron-bearing minerals.

**Limestone:** A sedimentary rock consisting mainly of calcium carbonate ( $\text{Ca CO}_3$ ) grains such as ooids, shell and coral fragments and lime mud. Often highly fossiliferous.

**Lintel:** A horizontal beam over an opening to support the wall over it.

**Lithology:** The description of a rock based on its mineralogical composition and grain-size e.g. sandstone, limestone, mudstone etc.

**Mouldings:** Anything with a contour or section, either projecting or inset, to give emphasis, usually to horizontal and vertical lines.

**Mudstone:** A fine-grained sedimentary rock composed of a mixture of clay and silt-sized particles.

**Ooid:** A spheroidal grain of calcium carbonate formed by precipitation (by algae) of calcium carbonate in concentric layers.

**Pinnacle:** A summit or apex. The crown of a buttress, or a vertical abutment terminating in a spirelet, cone or pyramid.

**Quoin:** The external angle of a building. The dressed alternate header and stretcher stones at the corners of buildings.

**Ragstone:** Coarsely shelly limestone.

**Rubble:** Rough, undressed or roughly dressed building stones typically laid uncoursed (random rubble) or brought to courses at intervals. In squared rubble, the stones are dressed roughly square, and typically laid in courses (coursed squared rubble).

**Sandstone:** A sedimentary rock composed of sand-sized grains (i.e. generally visible to the eye, but less than 2 mm in size).

**Sedimentary Rock:** A rock that is commonly formed by the binding together (lithification) of sediment particles (e.g. sandstone, siltstone, mudstone, limestone).

**Segment (Arch):** A part cut off. A segmental arch is one which consists of part of a circle, less than a semicircle.

**Stratigraphy:** Branch of geoscience dealing with stratified rocks (generally of sedimentary origin) in terms of time and space, and their organisation into distinctive, generally mappable units.

# Acknowledgements

This study, written by Carole Bancroft-Turner and Debbie Frearson of Historic Investigations, Rutland, is their contribution to the Strategic Stone Study, sponsored by English Heritage.

Edited by Graham Lott, British Geological Survey

Designed by Tarnia McAlester, English Heritage

We are grateful for advice from the following:

Don Cameron, British Geological Survey

Graham Lott, British Geological Survey

## Further Reading

Alexander, J. S. (1995) Building Stone from the East Midlands Quarries: Sources, Transportation and Usage *Journal Medieval Archaeology*, Leeds, Society for Medieval Archaeology.

Arkell, W. J. (1933) *The Jurassic System in Great Britain*. Oxford. Clarendon Press.

Arkell, W. J. (1950) Rutland Stone. *Leicestershire and Rutland Magazine*.

Beaver, S. H. (1982) Ironstone in Rutland: in *Rutland Record* No 3, RRS.

Clements, R. G. (2004) *Grange Top Quarry, Ketton*. Leicester: University of Leicester.

Clifton-Taylor, A. & Simmons, J. (1987) *The Pattern of English Building*. London. Faber and Faber.

Cooper, J. (2006) The Extraction and Marketing of Ketton Freestone in the Nineteenth Century. *Rutland Record* No.24. Rutland Local History and Record Society.

Curl, J. S. (2003) *Encyclopaedia of Architectural Terms*. Donhead.

Hewlett, H. B. (1935, 1979 (reprint)) *The Quarries, Grantham*. Harrison.

Hudson, J. D. & Clements, R. G. (2007) The Middle Jurassic Succession at Ketton, Rutland. *Proceedings of the Geologists' Association*, p.255-258, Leicester: University of Leicester.

Ireson, A. S. (1986) *The Stones of Stamford*. Stamford. Speigl.

Jones, C. (1990) *Geology: Rutland Natural History Society 21st Anniversary booklet*. Eaton & Kirk, ed. Stamford, Speigl.

Judd, J. W. (1875) *The Geology of Rutland: Memoirs of the Geological Survey*, London. Longmans & Co.

Kearey, P. (2001) *Dictionary of Geology*. Penguin Books.

Mounfield & Turnock (1989) Rutland's Ironstone Quarries in 1930: from *Rutland Record* No9, RRS. Rutland.

Purcell, D. (1967) *Cambridge Stone*. Faber and Faber Ltd.

Sutherland, D.S. (2003) Northamptonshire Stone. Dorset. Dovecot Press.

Taylor & Ireson (1983) English Stone Building. Hampshire. BAS.

Toghill, P. (2010) The Geology of Britain - An Introduction. Airlife.

## Internet Sources

Collyweston Slate information, available at: [www.collywestonstoneslaterstrust.org.uk](http://www.collywestonstoneslaterstrust.org.uk).

British Geological Survey Lexicon of Named Rock Units, available at: [www.bgs.ac.uk/lexicon/](http://www.bgs.ac.uk/lexicon/).

University of Southampton Archaeology, Stone in Archaeology, available at: [www.ads.ahds.ac.uk/catalogue](http://www.ads.ahds.ac.uk/catalogue).



ENGLISH HERITAGE