THE GEOLOGY OF CIRENCESTER AND DISTRICT

by

H. S. Torrens

INTRODUCTION

Cirencester, being an inland town and one at the far end of the long dip slope of the Cotswold Hills, has never received the amount of attention accorded by geologists to the Costwold Jurassic scarp face, or even better exposed areas of rocks of the same age, such as the Dorset or Yorkshire coasts. Cirencester lies, using S.S. Buckman's (1903) definition of the Cotswold Hills, right on the south-eastern margin of them. The geologically based boundary between the Cotswolds and the Vale of the White Horse farther south-east being effectively the outcrop of the junction between the lithologically quite different Cornbrash limestones and the Kellaways Clay above. This junction runs irregularly just to the south of Cirencester. A further result of the geological position of the town so far down-dip is that natural exposures are rare, being largely confined to those produced first by canals and quarries and then by railway cuttings or more recent road or motorway sections which may be of an unfortunately temporary nature. This lack of permanent exposures means that the adequate recording of temporary sections is a high priority and of course that some parts of the stratigraphic sequence near Cirencester remain badly known to this day.

The notes which follow discuss the development of geology in the Cirencester region and summarize our present knowledge of the stratigraphy within a 5-mile radius of the town. The considerable number of references will, it is hoped, give further information where needed.

HISTORY OF GEOLOGICAL RESEARCH IN THE AREA (TO 1860)

The richly fossiliferous rocks of Middle Jurassic age making up the Cotswolds early on attracted attention. Dr. John Woodward (1665-1728), who is remembered chiefly today for his contributions to geology as author of some important books and founder of the Woodwardian chair of geology at Cambridge University, has recorded how his lifelong interest was first aroused. While botanising on a visit to Sir Ralph Dutton at Sherborne, north-east of Cirencester, he found a fossil brachiopod "in Sir Ralph Dutton's Vineyard at Sherborne, Gloucestershire on Jan 13th, 1689/90. The first fossil shell I ever found." (Eyles, 1973, 7).

An early project to describe these local fossils, which was associated with Cirencester about a century later, was however still-born. Dr. Caleb Hillier Parry (1755-1822) in 1781 issued printed "Proposals for a History of the Fossils of Gloucestershire" which would have been of great interest in view of his Cirencester birth. The promised publication never appeared and the original manuscripts have not been traced. (Torrens, 1978, 221).

The first major impetus to geological investigations near Cirencester came with the excavation of the Thames and Severn Canal and especially the Sapperton tunnel between 1784 and 1789. This canal, running south-west of the town, involved excavation to a massive extent (Household, 1969), especially with the Sapperton Tunnel by far the longest tunnel attempted by then in England. Several important geological visitors to the excavations are recorded including Dr. Charles Blagden (1748-1820) and Henry Cavendish (1731-1810) in July 1785 (Harvey, 1971, 74, 195, 330); and William Smith (1769-1839) – the so-called father of English Geology – in 1788 and again in 1794 (Phillips, 1844, 5, 11). But no details of the sections at Sapperton seem to have been published until the later railway tunnel was constructed nearby in 1843-1845 (Ibbetson, 1847).

Nonetheless the new stratigraphic information and fossils laid bare by the Thames and Severn Canal and other canals connecting with it were certainly used by William Smith in compiling his Geological map of England and Wales of 1815 and his later fine county Geological map of Gloucestershire published in 1819 and reprinted by the British Museum (Natural History) in 1974. A collection of fossils made from the canal near South Cerney enabled him to identify the Kellaways Rock there (Smith, W., 1816-19, 23; 1817) and on his 1819 map the geological formations of the area as then known are shown with remarkable accuracy. He mapped the Inferior and Great Oolite limestones as one in this area; Smith, as others up to the present day, finding it difficult to distinguish the intervening Fullers Earth beds near Cirencester. Above this he mapped Forest Marble limestones and recorded their fossils from Foss Cross, Poulton and Siddington (intervening beds not being recognised here until 1847 – Woodward, 1848). Above he showed Cornbrash and Kellaways Rock separated but mapped as one and capped by Oxford (or for him Clunch) clay.

The next stimulus to the study of geology in the Cotswolds came with the opening of the Literary and Philosophical Institution in Cheltenham in 1833. This brought together those interested in geology in the area and with their encouragement Roderick Murchison published in 1834 his "Outline of the Geology of the Neighbourhood of Cheltenham". Thus aroused, the study of Cotswold geology began to enjoy considerable popularity and a second edition of Murchison's book appeared in 1844 augmented and revised by James Buckman (1814–1884), at this time Honorary Secretary of the Cheltenham Literary and Philosophical Institution, and Hugh Strickland (1811-1853) of Evesham, and later Reader in Geology at Oxford University.

A similar stimulus for the Cirencester area soon followed with the foundation of the Royal Agricultural College there in 1844. Students were accepted from September 1845 and were taught geology by one of the founding professors called Samuel Pickworth Woodward (1821-1865) who was professor of Natural History at the College from 1845-1847 (Woodward, 1884). Woodward had been previously employed as a sub-curator at the Geological Society of London 1839-1845. The same period saw the foundation of the Cotteswold Naturalists Field Club, no doubt encouraged by the newly arrived railway system, which held its first meeting at Birdlip in July 1846. Woodward was one of the founder members, and of the first 25 members nine were from Cirencester, and the publications of the Club soon reflected this Cirencester interest. Volume 1 has a paper by S.P. Woodward "On the Geology of the District Explored by the Cotteswold Club and more particularly the clay subsoil of the College farm" read in 1847 (Lucy, 1888). It was unfortunate that Woodward's tenure of the chair at the College had to cease unexpectedly in 1847 because of financial problems at the College (Woodward, 1884, 289).

The new professor of both Geology and Botany at the College was Cheltenham-born James Buckman who was appointed in 1848. Buckman was a remarkable man with a wide range of interests and the energy to support them. He made fundamental contributions to the geology, palaeontology, botany and archaeology of the Cotswolds. He was also the Honorary Secretary to the Cotteswold Field Club from 1852-1860 and became a regular contributor to its Proceedings. The first volume contains three papers by him, one of archaeological interest, on the Tesserae of a Roman Pavement found at Cirencester in 1849, a subject he expanded in his book published in 1850 with C.H. Newmarch, "Illustrations of the Remains of Roman Art" and two others on the geology of Cirencester and fossil insects.

With the encouragement of the Cotteswold Field Club and the national societies for Geology and Palaeontology based in London, the study of Cotswold geology thereafter greatly prospered and by the time of the publication of James Buckman's paper of 1858 "On the Oolitic Rocks of Gloucestershire and North Wilts.", the major features of the stratigraphy of the Cirencester area had been set down in print and the ground work had been covered. James Buckman resigned from his chair in 1862 having played a vital part in the establishement of Cotswold Geology, and retired to Dorset. The fine collections of Cotswold specimens he had made were left behind at the Royal Agricultural College in Cirencester, where they remained until the first World War. Then "the college was closed . . . but a girls' school in Kent that found it necessary to remove to less nerve-racking quarters occupied it. The Headmistress . . . had no use for this rubbish and turned everything out of the cases helter skelter on the floor of the chemical laboratory and store rooms. By pure accident I (H.H. Swinnerton) heard of this and got permission to secure all the fossils I could. . . . I went systematically through all the heaps picking out everything that I thought would have value, especially when I was informed that what was left would be used for garden paths!! Labels of course were lost . . . Petrological stuff went to Bristol (University) and Cambridge (University)." (Prof. H.H. Swinnerton of

University College, Nottingham *in lit* to S.S. Buckman, April 7th, 1924 – Buckman family archives. See Richardson 1925, 93). This vandalism of the local museum has resulted in the loss of a significant amount of valuable information about the geology of the area and its development.

STRATIGRAPHY OF THE JURASSIC ROCKS WITHIN A 5-MILE RADIUS OF CIRENCESTER

1. *Inferior Oolite*

Of those geological formations found within a five-mile radius the lowest belong to the rocks of the Inferior Oolite Group named by William Smith; because of their inferior position to rocks above called the Great Oolite. The Inferior Oolite outcrops in the floors of the River Churn and Bagendon valleys. Exposures are as a result not often available and our knowledge of the detailed stratigraphy near Cirencester is not good.

The main subdivisions of this group were established by the pioneer work of Cirencester-born S.S. Buckman (1860–1929), the son of James, in papers published in 1895, 1897 and 1901. He showed these rocks could be separated into three major divisions, Upper, Middle and Lower, the base of the Upper division being taken at the base of the lithological unit called the Upper Trigonia Grit and the base of the Middle division at the base of the Lower Trigonia Grit, both of which are deposits laid down unconformably on earlier rocks which had suffered erosion to a greater or lesser degree (see Parsons, 1976). The great majority, if not all, of the Inferior Oolite exposed in our area belongs only to the Upper Inferior Oolite, comprising Upper Trigonia Grit overlain by Clypeus Grit.

At Bull Banks WNW of Duntisbourne Abbots, Richardson recorded (1933, 18-21) 0.6-0.9 m. (2-4 ft.) and 6 m. (20 ft.) of these respectively, and farther east, at Chedworth Wood (1933, 27-28) 1.5 m. (5 ft.) and 6 m. (20 ft.). These thicknesses are considerably increased in the Stowell Park borehole (SP 084118 – Green and Melville, 1956, 13–14) to 2.2 m. (7½ ft.) and 12 m. (38 ft.) respectively. The term Grits applied to these rocks, as with many Cotswold rock terms, betrays their origin in a period when Grit was used for any coarse-grained rock and not only for sandstones. Grit was a term formerly used for what today we would call coarse grain (Arkell and Tomkeieff, 1953, 53). The Clypeus Grit is often but not always a coarse fawn oolitic limestone often with marl partings crowded with the echinoid *Clypeus ploti* (Salter) and common nests of the brachiopod *Stiphrothyris tumida* (Davidson). The Upper Trigonia Grit is a similarly coarse limestone but less oolitic and packed with broken fossils of a large size, often the Trigoniid bivalves, after which the rock is named.

The underlying beds vary greatly in different parts of the Cotswolds depending on the extent of erosion before the deposition of the Upper Trigonia Grit. S.S. Buckman (1897) showed that complications were introduced because these beds had been gently folded before erosion took place, and he produced maps showing the distribution of the rocks immediately underlying the Upper Trigonia Grit (1901, pl. 16) which were modified slightly by Richardson (1904, 143).

At Bull Banks the Upper Trigonia Grit overlay the Upper Freestone as noted by Buckman (see Richardson 1904, 95) but farther east the underlying rocks had been folded by both an anticlinal axis and just east of Cirencester a corresponding synclinal axis. The Notgrove Freestone higher in the sequence was the underlying rock at Chedworth Wood, and when the Stowell Park borehole (1949-51) was drilled Buckman's prediction that this area would show Buckmani Grit beneath the Upper Trigonia Grit was subsequently proven. Other boreholes in the Cirencester area will presumably demonstrate the existence of beds ranging from the Upper Freestone to the Notgrove Freestone as predicted by Buckman. But there is always a very considerable time gap between Middle and Upper Inferior Oolite in the Cotswolds because of erosion.

The beds at the junction of the Inferior Oolite with the overlying Fullers Earth are very badly known throughout the Cotswolds. Near Stroud a unit called the White Oolite forms the topmost part of the Inferior Oolite above the Clypeus Grit, and has yielded critical ammonites of the Zigzag Zone showing it to be Bathonian in age (Richardson, 1904 133; Torrens, 1980, 33).

It was not, however, recognised in sections described farther east at Chalford (SP 900024) west of Cirencester (Channon, 1951) or at Chedworth Wood north-north-east of Cirencester (Richardson, 1933, 27) which exposed the critical junction.

2. *Fullers Earth*

The Fullers Earth near Cirencester is a buff or slaty blue clay about 6.3 m. (21 ft.) thick. It is readily mapped by the clayey soil to which it gives rise and the spring line at its top, but natural exposures are not common and our knowledge of it is limited. At Chalford the normal common occurrence of the small sickle-shaped oyster *Praexogyra acuminata* (J. Sowerby) at or near the top of the Fullers Earth was demonstrated by Channon (1951). The same was found in the Stowell boring where the thickness of the Fullers Earth has increased to over 12 m. (40 ft.). The constant occurrence of this fossil above the Fullers Earth proper suggests that these Acuminata Beds should be separated as a distinct unit, but not one always everywhere of the same age.

Above the Fullers Earth we remain in a part of the geological sequence which is very badly known, because of the large and rapid facies changes over both short distances and small thicknesses, making comparisons between neighbouring sections difficult. Luckily, good sections were described when the railway sections between Cirencester and Chedworth were first made available (Richardson, 1911, 1933; Arkell and Donovan 1952, 246-7). These provide a standard for the development of the higher Great Oolite Group of rocks near Cirencester.

Above the Fullers Earth (with Acuminata Beds at the top about 15 m. (50 ft.) thick) occurred 6 m. (20 ft.) of "Flaggy and shaly coarse shelly limestones" which were assigned by Richardson to the Taynton Stone and the Stonesfield Slates of the area farther north. They have yielded no diagnostic fossils, so their affinities are not clear. Equivalent beds west of Cirencester were recorded by Channon (1951) at Chalford station at the very top of the section he recorded. It is these beds which have been largely quarried for roofing slates in the Cotswolds. Above these beds in the cuttings were a sequence of marls and indurated marls 4 m. (13 ft.) thick. These seem likely to represent the south-westerly attenuation of the Hampen Marly Beds, a series of clays and marls above the Taynton Stone first described at Hampen in Gloucestershire. Farther south at Latton near Cricklade south-east of Cirencester, the Hampen Marly beds are recorded as absent in a borehole (Arkell, 1933).

3. *White Limestone*

Overlying these beds are a series of thick distinctive cream to white micritic limestones named the White Limestone Formation, and comprising one of the most characteristic rock types of the south-east Cotswolds, (Palmer, 1979). The Chedworth to Cirencester railway cuttings again provide a standard sequence for these rocks in this area. Here, the White Limestone can be divided as follows:– (Bed numbers follow those of Richardson, 1911, 1933, but include some *not* assigned by him in the same way).

5– 8 Bladon Member
9–17 Ardley Member
18–32 Shipton Member
Bed characterised by the gastropod *Aphanoptyxis excavata*. (Barker MSS.)
Total 28.5 m. (94 ft.)

The White Limestone of the Cirencester area has yielded an abundance of fossils; of the crucial ammonites, specimens of *Morrisiceras* indicating the Morrisi Zone of the middle Bathonian have been collected from both the railway cuttings (bed 19) and *in situ* from the equivalent bed (2) at Foss Cross Quarry (Torrens (ed.), 1969; Barker, 1976, fig. 1:7). A single ammonite indicating the basal zone of the Upper Bathonian has been collected, also *in situ*, at a higher level at Dagham Downs Quarry (Torrens, 1980, 34–5). The abundant nerineid gastropods which have proved so useful in detailed correlation between sections have been studied recently by Barker (1976). The brachiopods which are very abundant at many levels and which demonstrate all growth stages from juvenile to adult are in serious need of modern research, and are consequently in an unhappy taxonomic state. Corals are locally abundant and those of the celebrated but no longer adequately exposed Fairford Coral bed at the top of the White Limestone at Fairford east of Cirencester have been recently re-described by Negus and Beauvais (1975). One of the most characteristic rock types found within the White Limestone at Cirencester at at least 5 horizons is called "Dagham Stone" (Richardson, 1933, 48) after its occurrence at Dagham Downs. Previously the origin of the irregular ramifying perforations which run characteristically through this stone have been much debated, but Fursich and Palmer (1975) have recently demonstrated their true origin. By making plastic casts of the perforations and then dissolving away the surrounding sediment their fine shape and structure has been demonstrated as the result of burrow systems almost certainly of crustacean origin. These beds have also yielded some unique fossil material, notably the red alga *Solenopora jurassica* Brown which was originally described from Chedworth and where fine material can still be collected of a quality unrivalled in England. A paper defining this taxon on the basis of Chedworth material and discussing its palaeoecology and conditions of deposition is in press (Harland & Torrens, 1981).

Even more remarkable were the fossil reptilian eggs from this horizon collected by a student at the Agricultural College in Cirencester called Dalton and described by James Buckman in 1860. This material, which came from Hare-Bushes Quarry about a mile north-east of Cirencester, is now preserved in the British Museum (Natural History), London.

Because of the many sections available, the White Limestone has also been the subject of some interesting work to determine its mode of origin and conditions of deposition. In general, these rocks are thought to have been deposited under normally quiet, shallow and warm seas. Such conditions allowed a considerable variety of animal life to flourish and to be often preserved more or less in the place it originally lived. Both Silva (1976) and Fursich and Palmer (1975) have described the conditions of deposition and both are in general agreement about the White Limestone being the product of sediments deposited on a very shallow current-swept carbonate platform which was subjected to short periods of erosion with consequent non-deposition. Eliott (1975), again basing his work on Dagham Downs Quarry, has used an interesting fauna of new species of fossil algae which grow under particular conditions to demonstrate that they occur here as a transported fauna in broken and rounded pieces of carbonate sediments. This demonstrates that certain beds were subjected to considerable current action during their deposition but again in a warm marine and shallow environment, and a conclusion reached by Harland and Torrens (1981) working at Chedworth.

4. *Forest Marble*

Above the White Limestone at Cirencester are "the Kemble Beds". These were first named by Woodward (1894, 248, 250, 272) and characterised as a series of false-bedded oolites named after the exposures seen at Kemble railway station, where about 9 m. (30 ft.) were visible. The important distinction in lithology and the presence or absence of false bedding was the basis for their separation from the beds below. Separation from the beds above has been, however, a perennial source of difficulty and confusion. Richardson (1933, 49) classified these beds as follows: (in descending order)

Forest Marble	Wychwood Beds } Bradford Clay }
Great Oolite	Kemble Beds

but he also acknowledged (1933, 72) that in the general Cirencester area it was "very difficult to determine to which formation rocks belong – whether to the Forest Marble or to the Kemble beds presenting a Forest Marble facies. Locally the lithic structure of the two formations is very similar". Richardson and other workers of his generation also believed in the reality of the Bradford Clay as a distinct geological horizon characterised by a distinct fauna by which it could be recognised. The Bradford Clay was first recognised in the Bath area by William Smith. Recent work by Green and Donovan (1969, 24, 26) has shown that the Bradford Clay fauna is found at more than one horizon even in its type area. Thus its occurrence elsewhere may be correlated with any of these horizons. Palmer and Fursich (1974) have clearly demonstrated that much of the type Bradford Clay fauna is a facies fauna not unique but liable, and now proven, to occur whenever the right conditions for its development were found.

The supposed occurrence of the "Bradford Clay" at Cirencester (Richardson, 1933, 50, 76) is thus not a reliable method of separating the Great Oolite and Forest Marble in this area. The Kemble Beds and the overlying Forest Marble can thus be said to be very difficult to distinguish and it must be asked if they are now worthy of separation. Eliott (1973) has undertaken a recent palaeoecological analysis of a "Bradford Clay" type fauna found at Sunhill east of Cirencester. He concludes that the faunas here were displaced from their original sites and that the bed represents a subtidal accumulation produced by rough coastal seas.

5. *Cornbrash*

The Cornbrash of the Cirencester areas has been famous ever since William Smith recorded fossils from Down Ampney and Latton in his pioneer publications of 1817, 1816–19. Douglas and Arkell (1928) published a major and still unsuperceded study of this Formation, and described the sections then available near Cirencester (pp 134–135), and further details and corrections were supplied by Richardson (1933). Douglas and Arkell demonstrated that, as Smith had pointed out in 1819, the faunas of the Cornbrash allowed it to be separated into Upper and Lower divisions: the Upper Cornbrash because of the affinity of its ammonite faunas now being assigned to the Callovian stage, and the Lower Cornbrash, for the same reason, to the Bathonian stage.

Sections no longer available show that both the Upper and Lower Cornbrash are well developed in the Cirencester area. The Upper Cornbrash is the more notable, and between Fairford and Cirencester forms a notable topographic feature on the surface. It is made up of a sequence of often hard limestones which have been quarried for road metal. The total thickness is only about 2-3 m. (7-10 ft.), (Richardson, 1933, 77-81), of which the Upper makes up about 75%. The Upper Cornbrash can be further divided on the basis of the distribution of brachiopods into a sequence at the top yielding *Microthyridina lagenalis* (Schlotheim), which was particularly abundant at Fairford; and a lower sequence yielding *M. siddingtonesis* (Walker), a species whose type locality is Siddington, south-east of Cirencester, where it was, as at Fairford, extremely common.

The fossiliferous nature of the Lower Cornbrash in the Cirencester region is as celebrated as that of the Upper Cornbrash. It is more condensed in thickness and made up of a more marly softer limestone packed with fossils, of which sections have been described at Ampney Crucis and Sharncote.

6. *Kellaways and Oxford Clay*

Above the Cornbrash come typical Kellaways Beds. These were first described in the area north of Chippenham, Wiltshire, where the hamlet of Kellaways (after which the Callovian stage is named) is situated. In the Cirencester memoir, Richardson almost ignored the Kellaways rock of this area, stating there was "no topographical feature that might indicate the presence of hard Kellaways rock", (1933, 81). It is certainly found, however, and had been described at South Cerney up to 6m. (20 ft.) thick by Harker in 1886. Lithologically it is made up of a sequence of decalcified sands with an inter-bedded series of massive huge doggers which are spheroidal masses of calcareous sandstone up to 1.8 m. (6 ft.) in diameter and yielding an abundant series of ammonites in fine preservation with a great deal of plant material. It was underlain by a few feet of Kellaways Clay, which has been worked for bricks in the past at Siddington as noted by Harker, (1866, 184), and by Richardson and Webb, (1910, 242) wrongly as Oxford Clay. It is worth pointing out that the sequence of these rocks in the Cirencester area has proved highly anomalous on two occasions. At Calcutt, south-east of Cricklade, a well supposedly proved Kellaways Beds to a total thickness of 22 m. (74 ft.) (Richardson 1922); while at Lewis Lane in Cirencester a similar boring is claimed to have proved only a total thickness of 1.8 m. (6 ft.) and even more remarkably to have shown the Kellaways Rock resting direct on the Cornbrash and with no Kellaways clay between, (Richardson, 1925, 93-99), despite evidence published by Harker (1886 and 1891). The answer in this last record surely lies in the fact that the drillers in 1924 recovered no cores at Lewis Lane down to this level, and the sequence must have been misinterpreted. The Kellaways Beds of the type area between

Chippenham and Malmesbury to the south have been recently described by Cave and Cox (1975).

The Oxford Clay of the Vale of the White Horse forms the highest rock type found in the Cirencester area. Details of its stratigraphy are not at all well known for several reasons. In the first place, there are no natural exposures, and man-made exposures in brick yards and clay pits are now almost unheard of; secondly, much of the area immediately to the south and south-east of Cirencester which is floored by Oxford clay is covered by thick gravel river terrace deposits which makes natural or other exposures even harder to find. The Oxford clay of the area nearer Swindon has been described in the old Hills Brickyard near Purton Station north-west of Swindon by Arkell (1941). Here higher zones of the Oxford Clay (Oxfordian) were found with abundant ammonites.

POSTSCRIPT

Cirencester has a remarkable record for the study, marrying geology and archaeology, of the source of the stone used in the construction of the Mosaic pavements in the area, the work of the School of mosaic workers named the Corinium School by D.J. Smith (see summary in Rivet, 1969, chapter 3). This study is especially associated with two men with strong Cirencester associations. The first is Samuel Lysons (1763-1819), son of Samuel Lysons, rector of Rodmarton south-west of Cirencester, where he was born. His interest in the subject was aroused by the study of the Great Pavement associated with the Roman Villa at Woodchester, Gloucestershire, from 1793 to 1796. Lysons had a considerable interest in geology as well as archaeology, and this led him to speculate on the sources of the tesserae of which the pavement was composed, (Smith 1973). He identified the red tesserae as of brick; the bluish-grey as limestone from the Lower Lias of the Vale of Gloucester; a light brown material he suggested came from Lypiatt and thus from somewhere in the Great Oolite group; the dark brown he identified as what is now called Old Red Sandstone, and recognised by him as obtainable from Bristol and the Forest of Dean. Only with the cream-white material did he go seriously astray, wrongly suggesting an Italian marble as the source, (Lysons, 1797, 4). The acuteness of his observations on this subject are remarkable on account of the early date at which they were made.

Lysons' work was continued by James Buckman (1850, 1853) and with C.H. Newmarch (1850), who again combined an active interest in both geology and archaeology. Buckman and Newmarch (1850, 49-54) separated six different natural materials which had been used in the Cirencester pavements as tesserae; as at Woodchester, Old Red Sandstone and Low Lias limestones had supplied Chocolate or Slate coloured materials. In addition, Buckman recognised the occasional use of chalk and more frequently, the often hard, micritic White Limestone of the Cirencester Great Oolite (which Lysons thought was Italian) had supplied white and cream coloured materials. Grey and yellow materials were again both local, the Grey from the same White Limestone which had been heated in a fire, this Buckman was able to prove by experiment; and the yellow from the gravel beds of the area. A modern re-appraisal of Lysons' and Buckman's work would be of great interest, and it is perhaps a fitting reminder of today's specialisation that this has not been attempted.

(This report was revised in August 1981. Editors.)