

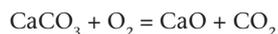
# ◆ Lime-burning in West Sussex, and the Newbridge Wharf Limekilns, Billingshurst

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*Documentary research and excavations have indicated that a block of four limekilns which operated alongside the Arun Navigation at Newbridge Wharf, Billingshurst, from before 1823 until about 1890, were of the intermittent or flare type. During the spring and summer 1998, excavations took place at Newbridge Wharf, Billingshurst, at the site of a set of limekilns, by the side of the Arun Navigation, to ascertain the extent to which evidence of the kilns and their construction still remained, buried beneath the surface. The remains of three kilns were found. They are typical of the type of kilns that were designed to produce lime for dressing agricultural land in that part of the Weald at that time, and were served by the canal which had opened as far as Newbridge Wharf in 1787 and went out of use in 1888.*

## LIME AND ITS USES

Lime is produced when a calcareous rock, often chalk but sometimes limestone, is heated to around 900°C in a kiln. Within this reducing environment, the following reaction takes place.



The end product of this process is quicklime [CaO]. This is often mixed with water to produce calcium hydroxide or slaked lime [Ca(OH)<sub>2</sub>].

In West Sussex, the majority of lime produced in the post-medieval period was used in farming. It was spread upon the acidic clay soils of the Weald to make them more productive. Liming has two major benefits on these soils. Firstly, it improves the structure of heavy clay soils, reducing stickiness and thus facilitating easier ploughing of the land. Secondly, it raises the alkalinity of the soil, which increases the population of bacterial micro-organisms responsible for the breakdown of organic matter into nitrogen (Ministry of Agriculture 1981). However, too much liming can damage a soil, as was pointed out in the early 19th century by Arthur Young (1813, 202).

Other regular uses of lime are in the construction industry, where it is used as a mortar, or for lime-washing walls. Outside the Weald, lime was also used during the post-medieval period in many other industries. Charles Tennant discovered in 1799 that lime mixed with chlorine produced bleaching powder (Williams 1972). Lime was used in the glass

industry as a stabilizing agent, and also to increase the resistance of the glass to moisture attack (Douglas & Frank 1972, 25–6). Lime has also been used as a flux in the steel industry, although limestone was preferred at the larger scale industrial sites (Cossons 1993).

## LIMEKILN TYPES

There are three principal limekiln types, the most basic, a simple sow or sod kiln (Crossley 1990) being the smallest form. Constructed within a ring of stones, or simply built into a dip in the hillside, these temporary kilns were packed with layers of limestone and wood and then covered in turf. They were then burnt until all the wood was exhausted and the limestone converted to lime. This type of kiln is rare within West Sussex.

By far the most prevalent kiln design in West Sussex is the flare or periodic kiln (see for example Figs 1 & 2). A contemporary drawing of a flare or periodic kiln from 1815/16 is reproduced in Farrant (2001, 282). These structures, with circular walls of brick or stone, between two to three metres high and of a similar diameter, are more permanent than the sow kiln. Flare kilns were often built into a hedgerow or bank of sufficient height, or a mound of earth was built around the back of the kiln, to facilitate loading the chalk into the top of the kiln. Initial loading was carried out inside the kiln, building an arch of chalk above the hearth, strong enough to withstand the load of the rest of chalk on top of it. This chalk was built up into a slight dome, over which the largest blocks of chalk were arranged (Holt 1970). Marshall

(1798, 75) describes the process of loading a kiln as follows:

it took four loads of chalk to fill each kiln, a task completed by a man and a boy in one day;

then a thousand faggots were used for firing, a process which required the continuous effort of two men to maintain the necessary high temperature for 24 hours.

Once the kiln had been fired, it would then have been left to cool for a few days until unloading was possible.

The final type of kiln from this period found throughout Sussex is the continuous or draw kiln. This kiln operates on a much larger scale than the other two types of kiln, and as the name suggests, is capable of burning continually, without stopping for loading and unloading. Structurally, they are larger than any flare kiln and are sometimes referred to as bottle kilns, reflecting their inverted bottle shape. To accommodate their size, and



Fig. 1. A typical flare kiln, Ebernoe Common [SU 9680 2790] (photograph by the author).

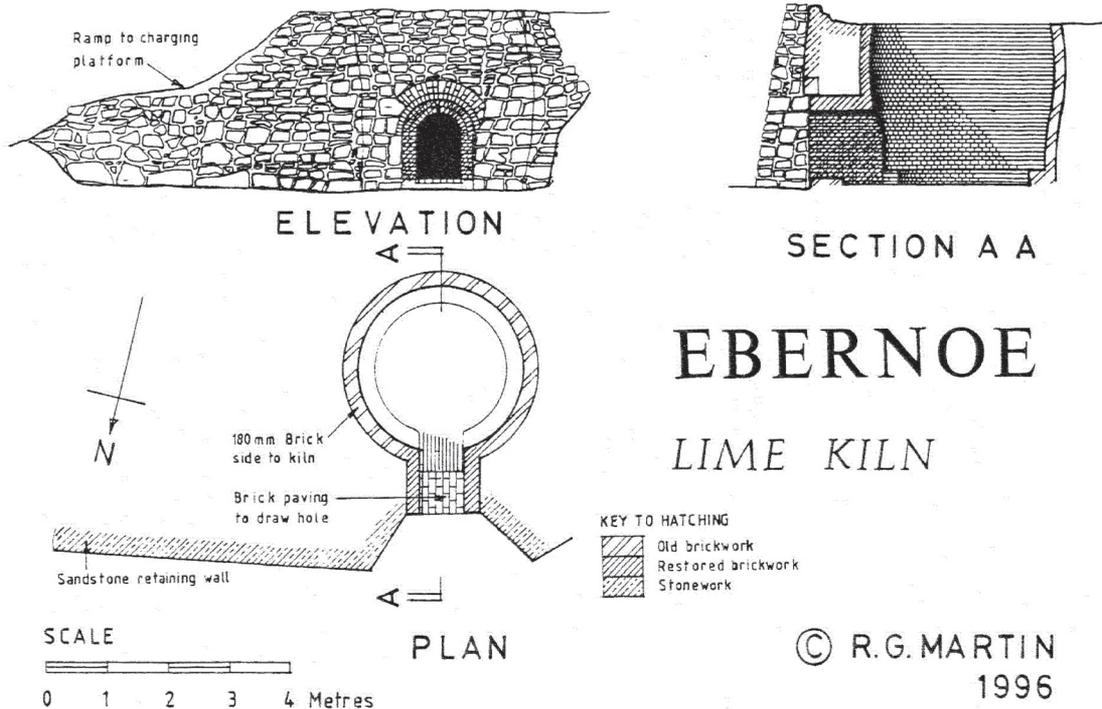


Fig. 2. The kiln at Ebernoe Common, image from R. Martin, 1997. Some Sussex limekilns. (*Sussex Industrial History* 27, 34-9, copyright by kind permission.)



Fig. 3. A continuous kiln at Duncton Hanger [SU 9612 1624] (photograph by the author).

charging requirements, these kilns are set into hillsides, often close to the source of the raw materials (see Figs 3 & 4). They are between two and five metres in height, with the largest examples occurring near large quarries. In West Sussex they are usually brick-lined, although in other areas of the country where other building materials are available (such as stone), this is not always the case.

These kilns often occur in pairs or groups, allowing not only continual burning in each kiln, but also ensuring that if one kiln is temporarily out of action, burning is still taking place. The raw materials for firing are fed in from the top, and burnt lime extracted from the

base. The kilns are filled with alternating layers of chalk (or limestone) and fuel (either wood or coal) and then fired from the base. The fire would pass up through the kiln, converting the chalk to lime in the process. When the fire reached the middle of the kiln, lime would be drawn off from the bottom, the contents of the kiln would sink down into this void, and then more chalk or coal could be added in at the top. It was possible to keep up this routine for many days, even weeks, stopping only to repair the kiln, or when the raw materials were temporarily exhausted.

### LIME PRODUCTION AND THE GEOLOGY OF WEST SUSSEX

There are over 100 limekilns listed in the West Sussex Sites and Monuments Record (SMR) on which most of the information relating to limekilns has been compiled from early editions of the Ordnance Survey 6-inch maps and 25-inch plans. Doubtless there were many more kilns which had gone out of use or were for other reasons not recorded at that time. The

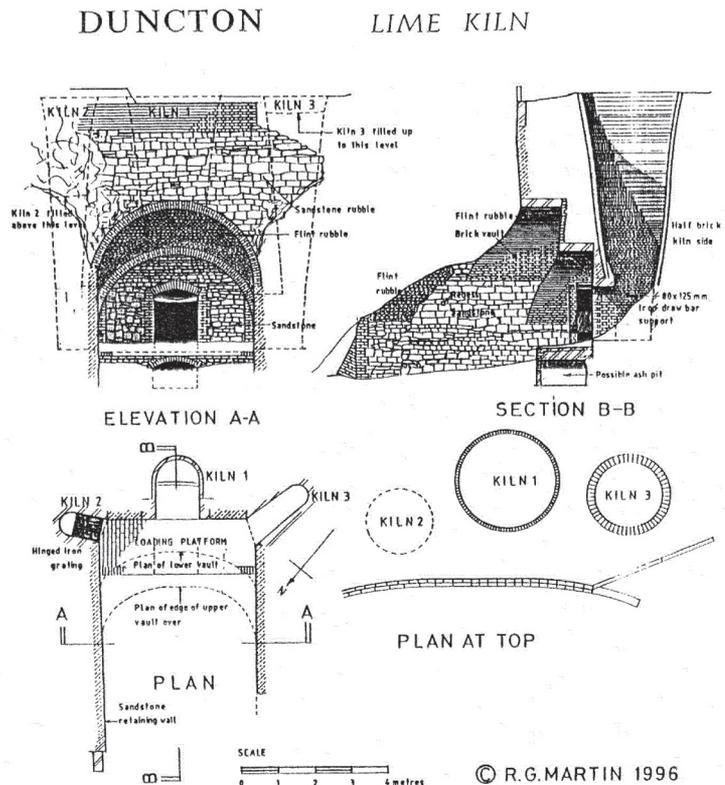


Fig. 4. The kilns at Duncton Hanger. (Image from Martin, R. 1997. Some Sussex limekilns. *Sussex Industrial History* 27, 34–9, copyright by kind permission.)

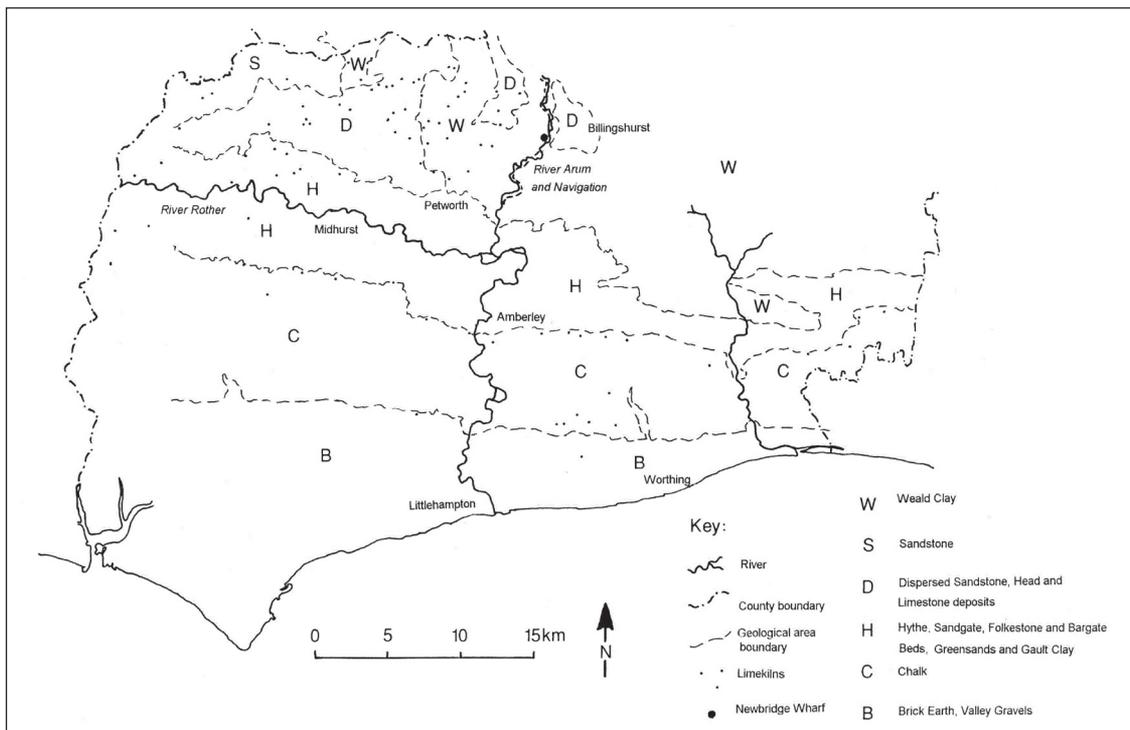


Fig. 5. Geological map of West Sussex, showing the location of the limekilns recorded on the SMR, including the kilns at Newbridge Wharf (illustration by Rowan May).

distribution of the kilns can be seen to fall into two distinct geographical regions, their locations shown on Figure 5. This distribution has also been remarked upon by Martin (1997). There were at least 20 kilns along the north-facing edge of the South Downs and at least 64 kilns in an area of north-west Sussex. This latter area can be regarded as having distinct boundaries within this study, created naturally by the River Rother to the south, the River Arun to the east and artificially by the Surrey and Hampshire borders in the north and west.

The geographic organization of lime-burning is dependent upon the availability of raw materials. The distribution map (Fig. 5) shows the distribution of limekilns in relation to the principal underlying geological zones. From the south coast northwards, the rough outline of the geological map runs: Brickearth and Gravel, Chalk, Upper Greensands and the Gault Clay, and then Weald Clay or the Hythe Sandgate and Folkestone beds. These deposits are dissected by river gravels along the Arun and Adur rivers and also the Dispersed Head, Sandstone and Limestone Deposits in the north-west around

Northchapel and Fernhurst. The geology of the central and northern parts of West Sussex can be seen as predominantly a mix of Chalk and Weald Clay. It is likely that the presence of both chalk and clay is an influencing factor in the construction and operation of so many kilns in this area, as, at least some of the chalk was used to make lime applied to the clay soils of the Weald.

The distribution of the kilns matches these two geological areas. Along the base of the South Downs there are at least 20 kilns, located on what is the main chalk deposit in the county. To the north of these kilns there are deposits of Gault Clay, and further north (5–10 miles away) there are large areas where Weald Clay is the underlying geological unit. If the farmers in this region of the Weald were regularly liming their clay soils, the kilns along the Downs could have provided them with the means to do this.

The other area of kilns, in the north-west of the county, is an area devoid of chalk, and most of these kilns are between 5–10 miles away from the nearest chalk source. However, as discussed above, many of

the farmers of the Weald erected kilns on their farms, for the purpose of producing lime to spread on their own lands. The geological map shows this area as Weald Clay, and Dispersed Head, Sandstone and Limestone deposits. The soil map for this area, which contains at least 64 kilns, describes drift deposit over Cretaceous clay or mudstone, interspersed with areas of Jurassic and Cretaceous clay and river terrace drift (Ministry of Agriculture 1983). It is possible that the soil quality in this area was so poor that it was in constant need of improvement.

Although there are no chalk deposits in the north-west region of West Sussex, there are deposits of limestone. Documentary research has produced no records attesting to its use in lime production, but there are none that categorically state that it was not. In the south-east of the county, lime-burning on the Ashburnham Estate exploited limestone deposits from the Purbeck beds, deep-mined and burnt at Glaziers Forge, Burwash (Beswick 1985/86, 18). Young (1813, 11) remarked that limestone 'affords a very valuable manure, equal, and by some thought to be superior, to chalk, and cheaper to those who live near the place where it is dug'. However, the limestone in the north-west region of West Sussex is Paludina limestone or Sussex Marble, a decorative building stone 'equal to most in beauty and quality, when highly polished' (Young 1813, 10–11). Whether such a valuable material would be burnt for lime, especially in this area, where Young claims that it is found in its 'highest perfection' is open to question. However, it is possible that some of the kilns in this area may have exploited this local source of raw material at some time.

#### KILN DESIGN AND DISTRIBUTION

As well as the apparent correlation between limekiln location and the geology of the local area, the kilns also seem to fall into the same distribution zones on the basis of kiln type. The majority of the kilns along the South Downs are continuous kilns, while those in the Weald, especially in the north-west of the county, all appear to be flare kilns. It is likely that the type of kiln firing regime and the amount of time in each year that the kiln was in use would have had an impact on the kiln design. The smaller kilns of the Weald belonged to individual landowners or farmers, and would have been used a few times during the year, possibly rotating the particular fields for liming and fallow over different years. The Downland kilns

on the other hand, were most likely run as a lime-burning enterprise, and would have burnt lime for much longer periods of the year, on a commercial basis. Smaller (flare) kilns situated in Downland locations did exist, but to date no evidence has come to light that suggests the presence of continuous kilns away from the chalk escarpments.

Of those sites visited, the continuous kilns at Duncton Hanger (*see* Figs 3 & 4) [SU 9612 1624], Washington [TQ 1190 1230] and Amberley/Houghton [TQ 0300 1200] are mostly in reasonable condition. The flare kiln at Ebernoe Common [SU 9717 2778] is in a good condition and has recently been restored, and the illustration by Martin (Fig. 2) highlights both the restored and new bricks. However, most of the other flare kilns of the Weald are not well-preserved, partly because they were smaller and much more temporary than the kilns on the Downs. In many cases the only remaining evidence is a hollow in a bank (for example at Spring Copse [SU 9575 2719] near Colhook, and Jay's Farm [SU 9339 3116], near Lurgashall) and sometimes only a scatter of limed bricks (for example at Frithfold Farm, Pipers Lane [SU 9882 2873], between Kirdford and Northchapel). In some other cases no physical evidence of the kiln remains, as at Newbridge Wharf, near Billingshurst [TQ 0680 2575]. This kiln is the focus of the rest of this paper.

#### EVIDENCE OF LIMEKILNS AT NEWBRIDGE WHARF

The evidence for limekilns at Newbridge Wharf comes from a number of sources: from the minutes of the Arun Navigation Company, other documentary sources, and from contemporary maps.

#### THE ARUN NAVIGATION MINUTES WSRO

The minutes of the Arun Navigation Company are kept at the West Sussex County Record Office. Both the notes and the minute books survive, but the evidence is occasionally incomplete. The information listed below comes from one of these minute books (WSRO IN/Arun/M1/1). Further information relating to individuals at the end of this subsection comes from Vine (1986).

On 25 June 1786, the minutes record that 'all persons who wish to erect sheds, warehouses and coal pens on the proprietors' grounds at their own expense to apply to the committee appointed ... for their lease...'. On 3 December 1810 it was agreed that

a storehouse be built to allow limekilns to be erected. There is no further reference to coal, nor to kilns as far as can be made out, until an order of 4 December 1826, which states that:

William Warren of Pulborough lime-burner be empowered to erect two kilns on Newbridge Wharf in such a manner as not to interfere with the business of the wharf or the roads thereat at a rent of 10 shillings each annum, and that the occupiers of the present kilns at the said wharf be required to quit at the earliest legal notice or to pay the yearly rent of 10 shillings for each kiln from Christmas next. Rent per coal pen to be 5s.

The presence of kilns before 1826 can be inferred from the text above ('occupiers of the present kilns'), and is also remarked upon by Cobbett in 1823 (*see below*). Some conciliation over rent appears to have taken place in the course of the following year as the minute entry of 4 June 1827 records:

rent of one shilling be paid for each limekiln in the Newbridge Wharf and that the yearly rent of two shillings and sixpence be paid for each coal pen in the said wharf to the proprietors by the several occupiers thereof instead of 10s. and 5s.

The entry for 1 December 1828 records that 'Messrs Seward and Henly pay 2 years rent for their 2 coal pens and 3 kilns at 1 shilling amounting to 10s.'. Although ambiguous, it could be suggested that the rent for coal pens had by then been reduced to one shilling, otherwise the amount of total rent paid is difficult to account for. The next entry relating to rents for kilns and coal dates to 5 December 1831, when 12 shillings rent was received for coal pens and limekilns. The same amount of rent is also recorded for the next three years. The rise in rent from 10 to 12 shillings is not explained in the minutes, and may relate to the acquisition of two further coal pens, or perhaps to the building of a fourth kiln and one further coal pen. On 5 June 1835 the 1826 order on kilns was suspended until the December meeting and was again suspended at the December meeting, until the following June. Rent of 12 shillings was paid in 1836, rising to 14 shillings for 1837 and 1838. Again it could be argued that this represents a further kiln or more coal pens, rather than a rise in the rent charged. Rent collected decreased the following year to 12 shillings, rose to 13 shillings in 1842 and 1843, fell to 11 shillings in 1844, and rose again to 12 shillings each year from 1845 to 1847.

In 1848, the minutes recorded 'Rent of coal pens, lime kilns and Warren's Store 13s.', perhaps indicating that William Warren of Pulborough finally received permission to erect his kilns, or take over the running of the existing ones. The linking of the rent for the kilns, pens and store may indicate that the store owner was also responsible for the management of the kilns. The rent entry remained the same until 1854 when the store was transferred to Saunders, 'Rent of coal pens, lime kilns and Saunders (formerly Warren's) store 13s.'. The store changed hands again in 1860 when it became the property of Child and Henly, and income from rent remained unchanged until 1865 when it declined to 6s. It stayed at this figure until 1888, when rent was received for kilns and pens for the last time.

Vine (1986) provides a little information about some of these personalities that were involved with the management of the limekilns. The name Seward is linked with the Arun Navigation, and three members of this family were superintendents of the company from 1790 to 1856. The last one, Richard Seward was also the Wharfinger at Newbridge. Furthermore, a John Seward also operated two boats out of Loxwood (Vine 1986, 252). However, it is likely that the Seward from Messrs Seward and Henly paying rent in 1828, was related to Arundel carriers Seward and Co. In 1823 an amalgamation led to the formation of Seward, Henly and Co., after which the barge company then underwent a number of changes in name (Vine 1986, 119). It was acquired in 1844 by Arundel coal merchants Child and Henly (possibly related or the same individual), and passed two years later to Thomas Bonamy and Son (Vine 1986, 121). Between 1837 and 1855, there was no Chairman of the Arun Navigation Company, and the position was filled by a management committee, including J.P. Henly (Vine 1986, 252).

#### OTHER DOCUMENTARY SOURCES

One of the earliest records of the kilns comes from William Cobbett, in a description of a ride from Billingshurst to Petworth;

1st August 1823 ...

Soon after quitting Billingshurst I crossed the river ARUN which has a *canal* running alongside of it. At this there are large *timber* and *coal* yards, and kilns for *lime*. This appears to be a grand receiving and distributing place (Cobbett 1830, 98).

Earlier documentary records that allude to the presence

of limekilns at Newbridge Wharf have been collated by Vine (1986). In 1641 a bill was introduced to the House of Lords 'for making a river navigable for boats and barges to pass from the haven of Arundell [*sic*] through the counties of Sussex and Surrey into the River of Thames 1641'. The Act included passages on the burning of lime and land improvement and on the advantages of water rather than land carriage: it would be less dangerous, less difficult and viable all year round.

However, no progress appears to have been made until May 1785 when the Arun Navigation Act was passed. In 1787 the canal was open as far as Newbridge (Vine 1986, 20–30). In 1805 magistrates refused to 'grant licence for a public house at Newbridge wharf unless proprietors of the Arun Navigation approved the application'. No objection was raised to this proposal, for it would be a 'great convenience and accommodation' to both merchants and public.

The Limeburners' Arms still exists as a pub name today, although its site at Newbridge was moved to the top of the hill, towards Billingshurst, when barge traffic ceased (Vine 1986, 44). In 1837 a 'cottage was built at the wharf for under-wharfinger' and in 1839:

a large rectangular double-storied brick warehouse with a slate roof was constructed adjacent to the canal. Furthermore, the company were willing to provide two horses for 'gratuitously assisting all wagons carrying coal and lime up the hill' from the wharf (Vine 1986; 127).

However, competition with the railways soon led to decreases in both canal tolls and the amount of traffic using the canal (Vine 1986, 137–62). On 1 April 1874 the Arun Navigation Company ceased to act as wharfingers at Newbridge (Vine 1986, 196) and by 1887 fewer than 2000 tons was carried on the Arun Navigation all year, with only two boats belonging to Henry Doick working on the canal (Vine 1986, 198).

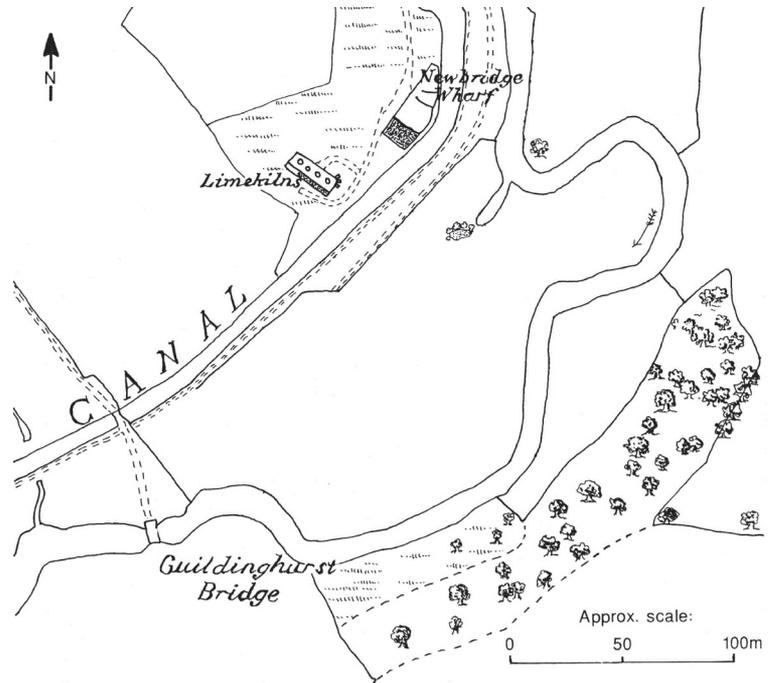


Fig. 6. Facsimile of 1st-edition OS map, showing the Arun Navigation, Newbridge Wharf and the limekilns, illustration by Rowan May.

On 1 January 1888 the Arun Navigation closed, and on 20 June 1888, Henry Doick 'left Houghton carrying his last load of chalk; 10 tons for Lee Farm and 20 bound for Newbridge' (Vine 1986, 199).

#### CONTEMPORARY MAP EVIDENCE

Many of the entries in the West Sussex Sites and Monuments Record (SMR) were taken from the 1842 Tithe Map, and the 1st and 2nd edition Ordnance Survey (OS) 25-inch plans, published in 1876 and 1898. Limekilns are usually shown on the OS plans marked *Limekiln[s]* and on the Tithe maps as a circle within a semicircle. The limekilns at Newbridge Wharf are not shown in this manner on the 1842 Tithe map, but the apportionment indicates the presence of limekilns at the site. The relevant entry for plot 1567 showed that the landowner was the Arun Canal Company; that the occupier was the Company itself, and that the Newbridge Wharf Lime Kiln Company's land covered 9 acres, 2 rods, 6 poles.

The kilns do, however, appear on the 1st edition OS plan of 1876 as four circles within a single rectangular structure labelled *Limekilns* (Fig. 6), and

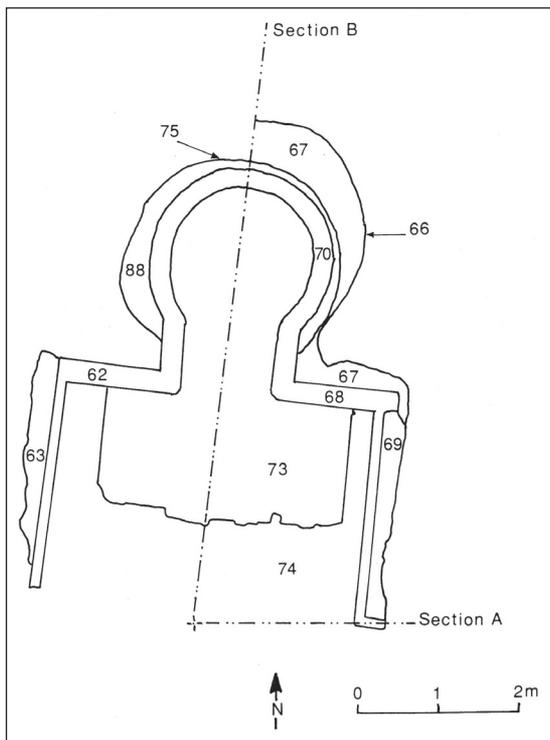


Fig. 7. Plan of kiln 1, illustration by Rowan May.

on the 2nd edition OS plan listed as *Old Limekilns*. Also shown at the site on the maps is the wharf house. This was one of the main administration centres for the Arun Canal, which passes adjacent to the site. The kilns are completely absent from the 3rd edition OS map of 1913.

#### THE ARCHAEOLOGICAL INVESTIGATION OF THE KILN AT NEWBRIDGE

Although it was clear from the documentary sources that a kiln had once stood at the wharf at Newbridge, no details of the design, construction or loading method were available. As the land-owner had indicated a desire to make small changes to the ground level on part of the area probably occupied by the kilns, this provided an opportunity to investigate archaeologically the nature of the site. The main objective of the excavation was to ascertain the extent of the below ground preservation of the kilns at Newbridge wharf. The full details of the excavation, made possible by the kind support and assistance of

the landowner, and carried out as a training exercise for 'A level' archaeology students during two weeks of the spring and summer of 1998, can be found in the appendix, held on the ADS web site.

During the excavation it became clear that despite large-scale demolition at the turn of the 20th century, and probable removal of the original kiln material from above ground, much of the kilns remained intact below the ground level. At the eastern end of the site, an intact kiln base (kiln 1) was uncovered, with a floored working area to the south of it (used for unloading lime or loading fuel). In the middle of the site, a quarter section was removed from the pot (the actual part of the kiln in which lime was produced) of another kiln (kiln 2), to a layer of packing below the floor level. At the west end of the site, excavation concentrated on the working area at the back of kiln 3, rather than the kiln pot itself. Also excavated were sections of walls around the north, west and south sides of the site. The entire site was on a slope dipping down to the east. The difference in the heights at the beginning of the excavation between the north-west and south-east corners was 1.80 m.

#### KILN DESIGN

Undoubtedly the most significant discovery of this excavation was the complete base section of kiln 1 (see Figs 7 & 8). Although only four brick courses high within the kiln and seven in the working area to the rear of the kiln, this area holds the key to many of the questions relating to kiln design, as this structure represents the base of a flare kiln pot. It has an internal basal diameter of 1.35 m at its widest point and the distance from the front of the loading/stoke-hole to the back of the kiln is just over 2 m. The evidence of the height of the other two kilns excavated on site suggests that the kiln would have reached at least 1.30 m high. Immediately to the south of the kiln, there is a paved area roughly 3 m square, which would have offered a firm working area for loading the kiln and unloading the lime after firing.

The main evidence to suggest that the Newbridge Wharf limekilns were flare kilns comes from the shape of the pot and also from the design of the base of the kilns. There is, for example, no evidence of structures that would allow converted lime to be drawn off in a continuous operation. Equally, the burning of the floor bricks of kiln 1 would suggest that this was where the principal heat source was located, rather than within the main body of the kiln. This is further

confirmed by the evidence of the conversion of chalk packing below the floor level of kiln 2 to lime, which would attest to a fairly high and constant source of heat on the floor. One typical feature of a flare kiln that does appear to be missing from the design, however, is a step in the kiln base (visible in the kiln at Ebernoe Common (see Fig. 1), on which the framework of chalk was usually built before firing (R. Martin pers. comm.). Whether this step was higher up than the courses left after demolition, or had been replaced by a grate or other variation in loading technique could not be determined.



Fig. 8. Kiln 1 after excavation (photograph by the author).

#### BUILDING STRUCTURE AND USE

Apart from the design of the kiln base and overall layout of the firing and loading areas, this excavation also revealed further data relating to the building's structure. Firstly, it is assumed from the excavations and plan of the site that the kilns consisted of a line of four pots set into a rectangular building, three of which are shown in Figure 9. Between the outside of the pots and this rectangular exterior wall would have been hard-core packing, most likely chalk, flint and the surrounding subsoil and natural. The three-metre distance between the wall of the pot and the exterior wall would have given extra insulation and stability. The kilns would have been loaded mainly from the top, and one may conjecture that the large area at the top of the kilns for a horse and cart, or a hand barrow to be manoeuvred. A ramp to the top of the kilns was probably necessary and the trackways marked on the 1st edition Ordnance Survey plan (Fig. 6) would suggest that this came in from the north-east. Evidence of roofing tiles on the base of the working areas of kilns 1 and 3 indicate that these areas may

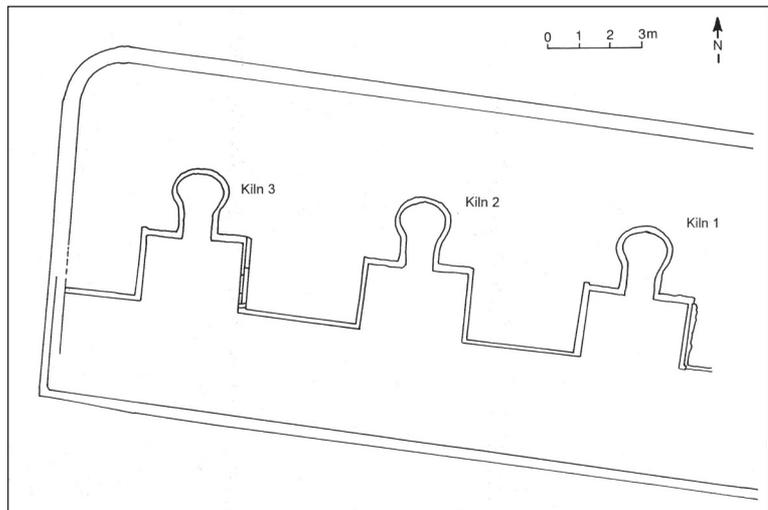


Fig. 9. Reconstruction plan of major walls (illustration by Rowan May).

have been roofed in tile.

Additionally, the bases of the kilns were dug into the surrounding soil which rises towards the west, away from the canal: 0.5 m at kiln 1, up to 1.30 m for kiln 3 at the top of the slope. This use of the natural slope on site would have reduced the amount of material needed to fill in around the pots and the outer retaining wall, and would also have aided insulation at the base of each kiln. It is assumed that the wall located 4 m to the south of the working area for kiln 3 was also associated with the kilns, placed to prevent the soil into which the kiln

had been cut from collapsing onto the limed floor of the firing area.

#### **KILN OPERATION AND ABANDONMENT**

A large amount of coal was discovered during the excavation, and had also been recovered in the adjacent field by the landowner. The Arun Navigation Minutes (*see above*) contain numerous references to coal pens, and whilst the site may mainly have operated as a distribution centre for such materials, as Cobbett suggests on his August 1823 Rural Ride (also *see above*), it is equally plausible to suggest that coal, brought up the River Arun and Arun Navigation may have been used in the kilns at Newbridge. In the introductory sections of this paper it was suggested that, on the basis of current evidence, coal use was mainly associated with continuous kilns within West Sussex, whilst the principal fuel used in flare or intermittent kilns was coppice wood. It is likely that at this more industrialized site, where the placement of four kilns provided the option of almost continuous firing, it was far more economical to use coal rather than wood. Interestingly, it should also be noted that the site is not situated as close to large areas of coppiced woodland as are many of its other Wealden neighbours.

The kilns were left abandoned for some time before they were demolished, as is indicated by the 2nd edition Ordnance Survey plan. This is also supported by finds from the excavation of the working areas. On the floors of these areas lay roofing tiles that had fallen in and amongst them, a small number of animal bones. When the kilns were demolished, most of the bricks were removed, and the remaining rubble was then tipped into the open kilns and working areas. Great care appears to have been taken on some parts of the site to remove as many bricks as possible (presumably for re-use), and this was particularly clear in kiln 2, where part of the floor and floor packing had been removed to allow access to the foundation bricks of the kiln walls. In contrast, less effort was made to retrieve materials in the demolition of kiln 1, and the surviving walls stand up to seven courses high.

#### **EVIDENCE OF DIFFERENT PHASES OF CONSTRUCTION**

The summary of information contained within the Arun Navigation Minutes above, may be interpreted to suggest that over time, the number of kilns on site increased, and that perhaps originally, fewer than four kilns were operated. However, during the two

weeks of excavation, it was not possible to identify any evidence for this. Partly this was a result of the limited area that we had chosen to excavate, which did not include enough of the south wall, identified at the back of kiln 3. Ideally, excavation would have continued along the length of this wall, east, to the area behind kiln 1, in the hope that at some point different phases of kiln building might have been identified.

However it is also worth considering that the positioning of the excavation trench was based purely on the only accurate location information available, which was the gained from the 1876 and 1898 Ordnance Survey (OS) 25-inch plans. Whilst this therefore indicated the position of the kilns in 1876, it is entirely possible that these represent a later phase of construction to that of the kilns discussed within the Arun Navigation Minutes, which may either have been added to, or conversely demolished. However, it is equally plausible that the earlier kilns may have been constructed in a different area of the site altogether.

#### **CONCLUSION**

The documentary and archaeological investigation of the limekilns on the wharf at Newbridge has demonstrated that by the latter half of the 19th century, a series of flare kilns constructed within a single structure were being operated. In contrast to the majority of the other flare kilns in the Wealden area of West Sussex, which likely served only the immediate local agricultural community, these kilns operated as a commercial venture (similar to the kilns at Houghton), and were supplied with chalk and coal by barges using the Arun Navigation and River Arun. When the navigation fell into disuse in 1888, the kilns would not have been economically viable and would have closed shortly afterwards. These kilns are some of the furthest east of all of the Wealden limekilns in West Sussex, and although few documents survive providing details of where the lime was traded from Newbridge, the kilns were certainly well placed to take advantage of a number of roads and the canal for the transport of the lime.

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**Information within appendix on ADS web site:**

PROJECT SUMMARY AND OBJECTIVES  
GEOPHYSICAL SURVEY

EXCAVATION

Kiln 1

Kiln 2

Kiln 3

Retaining walls

FINDS

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