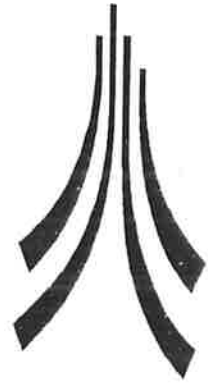


LANCASTER
UNIVERSITY
ARCHAEOLOGICAL
UNIT



June 2000

**NORTHUMBERLAND AND
NORTH PENNINES AONB,
NORTHUMBERLAND
Limekilns**

An archaeological survey

Northumberland and North Pennines AONB
Northumberland

Limekilns: archaeological survey

Archaeological Survey

Report no 1999-2000/ (089)/8992

Checked by Project Manager.

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The survey was conducted, the report and database compiled by Jo Bell. Project management and editing were by Richard Newman and Alison Plummer.

SUMMARY

This report presents the results of a survey of lime kilns in the Northumberland and North Pennines Area of Outstanding Natural Beauty (AONB), mostly in an area of Tynedale concentrated around NY 780 510. It was commissioned by Northumberland County Council as a tool for management and to help in decisions on grant allocation.

The survey was conducted during May 2000 by Lancaster University Archaeological Unit (LUAU). The products of the survey are this report, the Access 97 database which accompanies it and a photographic archive. The report presents general findings on the nature of the kilns, as well as a brief historical background against which to interpret them.

The kilns are particularly vulnerable to neglect because they are no longer in use. However, they are highly characteristic features of the Tynedale landscape in which a mixed economy, involving both agriculture and industry, formed the distinctive regional landscape. The survival and maintenance of the kilns are important to the character of the AONB, and can be utilised in its drive to encourage 'low-key green tourism' as stated in the North Pennines Management Plan.

1. INTRODUCTION

1.1 BACKGROUND TO SURVEY

1.1.1 The reason behind this survey is summarised in a recent work on industrial archaeology.

If we can establish what exists for a particular industry, and make some value judgements about the relative importance of the remains, then limited resources can be deployed to their best advantage' (Palmer and Neaverson 1998, 103).

1.1.2 This survey was commissioned as part of just such an ongoing process of evaluation. Administration of the Northumberland and North Pennines AONB requires a sound knowledge of the archaeological resource and its present condition, just as for other aspects of the AONB such as its ecology or agricultural use.

1.1.3 The client therefore required a visual survey and assessment of historic limekilns lying within the boundaries of the AONB, and to this end supplied a list of known kilns based on the county Sites and Monuments Record. Based on this list, with input from local experts and available sources, all the accessible kilns believed to have visible remains were visited. Descriptions of these structures and an assessment of their value in categories such as condition, amenity value and fragility have been incorporated into an Access 97 database which accompanies this report. A photographic archive, consisting of black and white prints and colour slides, has also been compiled.

1.1.4 This report presents a brief history of limekilns and their use in the AONB, and a summary of survey results with LUAU's recommendations for further work. More detailed information on individual kilns should be sought in the database.

2. HISTORICAL BACKGROUND

2.1 COMPOSITION AND USE OF LIME

- 2.1.1 The limestone which outcrops at various points in the Tynedale area is, like other limestones, largely composed of calcium carbonate (CaCO_3). When burnt, or calcined, at about 900°C or above (Williams 1979, 118), it is converted to calcium oxide (CaO) or quicklime. In the process it gives off carbon dioxide, an unpleasant and potentially dangerous by-product. The resultant quicklime itself is unstable and caustic. The addition of water starts a reaction which creates slaked or hydrated lime, neutralising its corrosive properties.
- 2.1.2 The main historic use of burnt lime and that for which most of the AONB's limekilns were built, was as a fertiliser. It had many other uses, the most important being as a vital component of building mortar. It was also used as an ingredient in whitewash, as a flux in iron smelting, as a disinfectant, and in industrial processes including tanning, bleaching, glass manufacture and paper making (Trueman 1990, np). It was as a soil dressing, however, that it was most in demand in the study area during the late eighteenth and early nineteenth centuries. It could be slaked on site near the kiln, or (more commonly) applied to fields as quicklime and left to effectively slake itself under exposure to the elements. It acted by increasing the pH value of acid soils, which are common in the poor upland terrain around Tynedale, and breaking down heavy clays to a more friable texture (Leach 1995, 145).
- 2.1.3 The use of lime as a soil improver was known from at least the Middle Ages in Britain, and a *Boke of Husbandrye* written by one Fitzherbert of Norbury in the early sixteenth century specifically mentions the use of burnt lime in agriculture (Harris 1971, 60). However, the widespread use of permanent or semi-permanent structures for burning limestone dates only from the late sixteenth century.
- 2.1.4 The earliest kilns known in Northumberland were 'sow' kilns, built of cleared stone and turf (Crossley 1990, 208) and probably contemporary with similar kilns used in the seventeenth and eighteenth century in Derbyshire (Leach 1995, 156). They were in use by the late seventeenth century, though they probably continued in use until the late nineteenth century (Robertson 1999, 11).
- 2.1.5 Surviving limekilns in the study area belong to a later tradition, explained more fully below. They are valuable evidence of Northumberland's involvement in the national campaign of enclosure and improvement which was undertaken between the mid-sixteenth and the nineteenth centuries. In Northumberland as elsewhere, the greatest part of this activity took place in the late eighteenth and early nineteenth centuries. Between 1790 and 1810 alone, two million acres of land were brought into cultivation for the first time in Britain (McElvaney 1993, 41). The enclosure of land increased the demand for soil dressings including lime, for 'the effective reclamation of many acid

upland areas would have been impossible without the lime from such kilns' (Harvey 1980, 69). Limed land increased the value of a farm, and landowners often encouraged their tenants to apply lime (Robertson 1999, 13). This was the heyday of the small field kiln, and indeed most (if not all) of the kilns surveyed in the AONB date from the late eighteenth and early nineteenth centuries.

- 2.1.6 Regardless of its date or type, which will be discussed below, the site of any lime kiln was chosen with reference to its main requirements. The foremost of these was a good supply of limestone, and so the location of the kilns was largely dependent on geology. The kilns of the AONB are inevitably found near a small quarry, or where cleared stone might have been available from newly enclosed fields (Leach 1995, 146). They are usually built into a hillside, sometimes into a 'bench' of the quarry supplying the kiln so that stone could be loaded directly into the top of the kiln without building a ramp.
- 2.1.7 In addition, a kiln needed supplies of fuel. At first this might be charcoal from nearby woodlands, but by the eighteenth century coal was the usual fuel, and needed to be brought in by road or track. For larger kilns, the greater quantities of fuel needed would make this a major consideration in the siting of the kiln. A source of water was desirable (though not apparently vital) so that lime could be slaked on site, and the vast majority of kilns were built within easy reach of a river or burn.
- 2.1.8 Transport was a further consideration. The roads or trackways by which coal arrived were also used for the outward transport of processed lime, and this too was an important factor for larger commercial kilns. If it was not slaked on site before transportation, quicklime was sometimes carried away raw by packhorse or cart to be slaked later by the purchaser. The volatile nature of quicklime, and the dubious quality of the roads, meant that it was unlikely to be transported more than a few miles (Atkinson 1974, 104) before the coming of the railways. The early markets for burnt lime were therefore usually local, consisting of people farming or building in nearby communities. By the mid-nineteenth century the railway had arrived, including a connection to the limeworks at Slaggyford.
- 2.1.9 The labour force was also local: the small kilns typical of the study area were not operated as independent industrial concerns, but as elements of a farm. Surplus lime might be sold off to other farmers or to builders, but the usual purpose of the kilns was to produce lime for immediate use by the farm. The burning of lime usually done at times of year when farm work was relatively slack, or when early modern roads were passable. Atkinson's view was that many small kilns were worked 'in the summer months by leadminers as a healthful change from their underground labours' (Atkinson 1974, 103).

2.2 DESIGN OF THE KILN

- 2.2.1 In 1788, a date roughly contemporary with many of the study area's kilns, William Marshall described Northumberland limekilns in the following words:

the materials are either limestone entirely or limestone lined with bricks, and no other air-holes are made than the 'eyes' at which they are kindled. The form of the cavity is an irregular cone inverted. At the bottom are generally two eyes opposite to each other, the cavity being here contracted to a narrow trough, the width of the eyes. The proportion between the depths and the diameters of these kilns is that of the depth being generally about one and a half diameter of the top. The size varies from six to 40 chaldrons' (Atkinson 1974, 103). [1 chaldron = 50 cwt].

2.2.2 These were the stone-built kilns which succeeded the sow or clamp kiln. Marshall's description suffices for the general structure and proportion of local kilns, although most kilns in the AONB have only one eye. They invariably conform to the following generic pattern, with major deviations only in style and scale. The exterior is a stone-built structure of roughly square plan and tapers in section, widening toward the bottom. It is built into a hillside or quarry floor, to allow ease of charging from above and emptying from below. One or two draw arches – sometimes round, sometimes pointed – define a recess or porch, deep enough to protect the emerging quicklime from the elements. At the back of each draw arch at ground level are one or more small openings called 'eyes'. These supplied and regulated the necessary draught, and from them the burnt lime was taken. Above the eye there may be a poking hole, through which an iron poker was pushed to riddle or stir the burning lime. Inside the kiln, and usually visible from above, is the 'pot' or cavity, lined with stone or brick. It is usually cylindrical or oval. It may taper slightly at the top, and will narrow noticeably at the bottom where it meets the eye.

2.2.3 To start a campaign or burn, fist-sized chunks of limestone were loaded into the kiln top in alternate layers with fuel. The proportions were usually one load of fuel to three or four of limestone (Stanier 1993, 35; Atkinson 1974, 104). The fuel used in most of the AONB kilns would have been low-grade coal, layered with the limestone to sustain an even burn, and with gaps between stones to allow carbon dioxide to escape. In earlier years, particularly in the seventeenth century, wood, peat or furze was used. An eighteenth century commentator said that

'the morelands [sic] for the last fifty years have furnished coals for limeburning. The seam of this coal is thin and the quality very ordinary. Before the discovery of these coals, lime was burnt with furze and other brushwood. About three chaldrons of lime are burnt from one chaldron of coals coals' (Atkinson 1974, 104).

2.2.4 Dry sticks and kindling at the base of the kiln were lit, and as the fire took hold the draught was regulated by the opening or closing of the eye, usually with an iron shutter. An even burn was vital to the successful conversion and ultimate quality of the lime. The object of the whole construction was that most of the burning and decomposition of lime should take place in the upper part of the pot, so that it cooled gradually on its descent through the kiln and arrived at the eye in powdery fragments rather than as a solid block (Harris 1971, 62). A robust structure was always necessary to withstand the intense heat.

2.2.5 Lime kilns in this region are usually divided into two main types; those designed for intermittent, and those for continuous use. The nomenclature of kiln types has suffered from some confusion, and from misunderstandings of

regional variations in use. However, the majority of the single-arch kilns in the survey were probably designed for intermittent use. This means that they were charged [loaded], fired and allowed to burn the whole charge in a single episode. The firing might last for four or five days (Robertson 1999, 7), with burnt lime being removed once a day. These are usually described as *flare kilns*.

- 2.2.6 Kilns in continuous use, usually described as *draw kilns*, were loaded in the same way, but regularly charged with fresh stone and fuel in the top as the burnt lime sank through the kiln. They might have more than one eye to better regulate the burn, or more than one pot so that one pot could be burning while the other was loaded or repaired. Because markets for lime were not large enough to require continuous burning until the early decades of the nineteenth century, these kilns are often later in date than the flare kilns.
- 2.2.7 To some extent the distinction between intermittent and continuous kilns is an artificial one. In practise, the small flare kilns seen throughout the study area could be operated continuously if need be. Fresh stone and fuel could be loaded into the top of the pot so that the burn was maintained. This was an efficient use of fuel; the kiln would not have to heat up repeatedly from a cold start if the burn was simply continued. However, a continuous burn was seldom necessary for the requirements of the private farmer running a small kiln. The fieldworkers involved in English Heritage's Monuments Protection Programme have commented on the difficulty in firmly distinguishing between flare and draw kilns (LUAU 1997, 5). Nonetheless it is usually possible, if only by inference, to distinguish these small flare kilns from the draw or continuous kilns which were specifically built with the intention of continuous running.
- 2.2.8 Such purpose-built continuous kilns usually date from the early decades of the nineteenth century when demand for lime was at its highest. The industrial uses of lime became increasingly important as local industry (notably lead mining) and building trades expanded. At this time the larger estates invested in large, double-arched kilns such as those at Harsondale (65) and Allenhead (48). The kilns were larger, more robust and better-built than their field-kiln predecessors. They supplied a larger market, and so tended to be situated near a particularly rich source of limestone and a good transport route, for instance a turnpike road which could bring in fuel and take out processed lime. They also needed to withstand long exposure to intense heat, and often incorporate firebrick in the pot lining and eye arches.
- 2.2.9 Unlike these commercial enterprises the ubiquitous small flare kiln was one component of a working farm, and was operated within the cycle of the farming year. The kiln would be fired at times of year when other tasks allowed. At each firing, enough lime was produced for the farm's own requirement. If there was a surplus, however, the small kilns too would sell it on. It could be sold 'to builders for use in mortar, to tanners and candle-makers, to smelters of lead and iron (onwards from the seventeenth century) for use as a flux in the removal of impurities, or sold to farmers of other districts' (Harris 1971, 62).

- 2.2.10 Toward the mid-nineteenth century the larger kilns came to dominate the market, and were able to supply local needs so that the smaller kilns declined and fell out of use. Improved communications by road and rail meant that a few large kilns could supply a large catchment area. At the same time Portland cement, a clay/chalk mixture with greater strength and water-resistance than ordinary lime, came to dominate the market for mortar, and new types of fertiliser including ‘artificial’ or chemical products offered alternatives to lime as a soil improver. After the mid-nineteenth century, therefore, the general need for lime lessened considerably and even the larger kilns became less viable as commercial concerns. By the end of the nineteenth century the limekilns’ usefulness was fading, and very few continued in use beyond the 1930s although at least two, Allenhead (48) and Far House (E) were in use within living memory.
- 2.2.11 The present condition and role of the limekilns is discussed in greater detail below. However, it can briefly be said that none of them remains in use for its original purpose, although one (2) was seen in use for burning other material, which gave a vivid impression of the kilns’ appearance in use. All the kilns which survive to any extent, regardless of size or type, are important and striking features in the regional landscape, and a valuable reminder of the human activities which have affected it.

3. METHODOLOGY

3.1 PREPARATION

- 3.1.1 The client supplied a list of sites identified from the county Sites and Monuments Record, which had been arbitrarily numbered. The numbering system has been retained in the present survey's database, for sake of consistency.
- 3.1.2 Many of these sites were included in the SMR as the result of a wide-ranging survey of kilns undertaken between 1976 and 1981 by Dr Stafford Linsley, a noted industrial historian and archaeologist based at the Centre for Lifelong Learning, University of Newcastle upon Tyne. The list was checked against LUAU's own sources. It was then passed for comment to Stafford Linsley and to Iain Hedley of the Northumberland National Park, an archaeologist with considerable experience of limekilns and lime working sites throughout Britain. Neither Mr Hedley nor Dr Linsley suggested any further additions. Dr Linsley kindly gave access to the original records made during his survey. This was particularly useful for the sketch plans of many sites, which allowed rapid location and identification of several remote or obscure kilns.
- 3.1.3 Scrutiny of the list suggested a number of sites which seemed to be duplicate records of the same kiln from different sources: site 58 = 49, 33 = 40, 34 = 41. Where this could be definitely established, database records make it clear. In each case the lower number was retained and the higher discarded. There was one record (site 56) which referred to a quarry and kiln. Since the kiln had already been included as site 52 and the quarry was not directly relevant to the study, this site was deleted from the database.
- 3.1.4 The owners of kilns were identified and contacted in advance wherever possible, so that they would not be inconvenienced (nor the survey slowed down) by unexpected visits to ask permission for fieldwork. Some concerns were expressed by landowners and their agents - particularly the Allenheads Estate and the Whitfield Estate, which own a number of kilns - as to the purpose and nature of the survey. In particular the Whitfield Estate were concerned that the survey might feed into the statutory protection process and result in some of their kilns becoming listed or Scheduled.

3.2 LOCAL LIBRARY AND INTERNET SEARCH

- 3.2.1 A local library and internet search was conducted. The results of the former are incorporated in the bibliography below. Internet sites directly relevant to the study area and its limekilns include the AONB's own web site at www.countryside.gov.uk/what/aonbs/25_npenn.htm, and several others including the following:

<http://rudi.herts.ac.uk/biblio/larkham/archlark.htm>, a bibliography of conservation, heritage and archaeology

www.thenortheast.com/history/his_www.html, a site with many links to north eastern historical and archaeological sites

<http://freespace.virgin.net/np.ht/mainmenu.htm> the North Pennines Heritage Trust site including files on Denton and Skears limekilns

www.trp.dundee.ac.uk/research/glossary, a glossary of terms for built archaeology including limekilns

www.wellingtonnews.co.uk/articles/features/articl028.html, a site from Blackdowns AONB in southern England

3.3 EXCLUSIONS FROM FIELDWORK

- 3.3.1 The Whitfield Estate felt unable to allow fieldwork on any of their kilns although their agent, Mr Jonathan Archer, was most helpful. Mr Graham of Stonehall, Slaggyford, who owns kilns C, E, F and G chose not to allow survey on his land, citing concerns about disturbance to livestock. In fact some of these were visible from a distance, allowing compilation of partial records. A kiln at Intakehead (**49**) was barred from access by a padlocked gate and guard dogs, and ownership could not be established to ask consent. To these must be added sites which could not be visited even though permission had been granted, because of health and safety concerns for a lone fieldworker or to avoid disturbing livestock. The presence of livestock, particularly cattle and horses with young, prevented two visits but one of these (**50**) was assessed from a neighbouring field. Farmers occasionally advised against disturbing particular groups of animals, one farmer having recently been badly injured in an attack by cattle and several wishing to avoid disturbance to lambing ewes.
- 3.3.2 The wishes of landowners were of course respected. However, it was possible to create records for almost all of these excluded sites. Some were visible from public footpaths or tracks, and information from other sources was used whenever available. In particular it was usually possible to assess the amenity value of the site, an important part of this survey, without direct access to the kiln. We are particularly grateful to Alan Williams of the Archaeological Practice at the University of Newcastle, who supplied information about the Ouston limekiln (**1**) which he has recently surveyed.
- 3.3.3 A last category of exclusions from fieldwork was the group of sites which were deliberately omitted from fieldwork because previous surveys had established that they survived only as 'grassy mounds' or 'sites of' kilns. A list of suggested omissions was submitted to Sarah Rushton of the county archaeology service, whose comments were incorporated into the fieldwork programme. A number of these sites were in fact visited, initially to establish that the 'grassy mound' descriptions were generally accurate and from then on whenever they lay within reach of other kilns in the fieldwork programme. Since several were next to roads or tracks, it was easy to incorporate them without delaying fieldwork on the upstanding sites. Only 13 sites were therefore omitted in this group.

3.3.4 A very few sites were deleted from the list because they were found to be duplicates of other records, or to be based on clearly mistaken co-ordinates. Although this was disappointing, it was of course part of our purpose to identify such errors in the field and correct the database.

3.4 ADDITIONS

3.4.1 No sites were added to the list in advance of fieldwork, but during fieldwork three 'new' kilns (ie, kilns not previously known to the SMR) were encountered and added to the database; these were sites **75-77**. These were pointed out by farmers as nearby kilns were being visited.

3.5 FIELDWORK

3.5.1 In advance of fieldwork a skeleton database was created, with fields to allow the entry of all data requested by the project brief and design. A laminated printout of the basic database form was used in the field as a prompt sheet, so that a full record of each kiln could be made using a dictaphone and then rapidly transcribed into the database. Fieldwork was undertaken throughout May 2000 by Jo Bell. Photographs, as specified in the project brief and design, were also taken and cross-referenced to the database records using photo index sheets.

3.5.2 Fieldwork was straightforward: each site was visited, notes made on the dictaphone and photographs were taken with a 2m scale in shot wherever possible. Where farmers or landowners were available, they were asked if they knew anything of their kiln's history, or of any other kilns in the area. Most of the kilns for which information was supplied were already in the database.

3.6 DATABASE

3.6.1 With the exception of the sites which had duplicate entries or which were included in error (see above) all sites listed by the SMR were included in the database, even those which were not visited. This allows for later expansion by AONB or other fieldworkers.

3.6.2 Fields included in the database were as follows:

- An arbitrary number or letter to identify each site, following the numbering system supplied by the SMR and with new sites added as numbers **75-77**.
- A site name, usually that supplied by the SMR or, where previously unnamed, the name of a nearby farm or feature if possible.
- The national grid reference. This was divided into three sections: the prefix (always NY), easting and northing, to allow ease of searching.

- District/Parish. The district was Tynedale for every site; the parish varies and was supplied by the SMR.
- SMR number: the map sheet-based identifying number for each site known to the SMR.
- SM number: the number, if any, of a Scheduled Monument associated with the site. Only one site is believed to have such an association.
- Area status: shows the statutory or other agreed status of the site and its immediate area, for instance not only Area of Outstanding Natural Beauty but also Environmentally Sensitive Area, Site of Special Scientific Interest or Listed Building.
- Type: lime kiln, in every case.
- Period: post medieval, in every case.
- Form: SS indicates a standing structure, RS a ruined structure, EW an earthwork and SO the site of a kiln.
- Archaeological event: a field designed to record information about any excavation or survey that may have occurred. No excavations are known.
- Description: a basic but thorough description of the site from visual inspection and any other sources. All information about Stafford Linsley's surveys of the 1970s and 1980s is taken from the SMR. The description includes a summary of the physical appearance of the kiln, with dimensions and a description of any associated features such as a ramp or trackway.
- Amenity value: a judgement balancing several aspects of the site, for instance its extent and quality, and that of associated or contemporary features. The level of public access, the proximity of other heritage features and the importance of the kiln in the local landscape are also taken into account. Categorized as high, medium or low.
- Fragility: the likelihood of collapse or decay in the near future. Categorized as high, medium or low.
- Threat: an expression of any known threat. By definition this is hard to assess, as some threats may not be obvious; for example, if a nearby quarry is to expand toward the kiln. However, erosion or damage by stock can be more readily anticipated. Categorized as high, medium or low.
- Importance: the archaeological and historical importance of the kiln, in the context of other kilns known from this survey and elsewhere in the country. The variety of remains, their representativity and context are considered as contributory factors. Categorized as national, regional, district or local.
- Condition: Categorized as good, fair, poor or demolished/site of. 'Good' would suggest a standing kiln with at least 70% of its original fabric intact. It implies

that the pot is visible, if not entirely clear, and that the arch is intact. 'Fair' suggests a deteriorating structure, perhaps 50% intact but with some collapse of the pot or façade, or serious defects such as bowing or cracking. 'Poor' suggests a kiln which is perhaps 30% intact, where for instance the arch is recognisable but the remainder of the kiln is collapsed beyond repair. Demolished or 'site of' are self-explanatory, with the caveat that 'site of' is only used where the fieldworker was satisfied that there was indeed formerly a kiln on the site. If not, the category is left blank.

- Sources: in all cases initial information came from the SMR, and where this was supplemented by other sources, the 'source' field will make it clear.
 - Other fields – visited by, date of last update, photo numbers and owner – are self-explanatory. AJB are the initials of Jo Bell, the fieldworker who conducted the survey.
- 3.6.3 A dash (-) shows that no data is available in a particular field, but that it is a valid field; for instance, that no photographs were taken because the site was obstructed. An entirely empty field indicates that no data can be supplied for the field – for instance in the 'form' field where there was no evidence of any kiln having ever existed, so that it cannot even be described as a 'Site of'.

4. RESULTS

4.1 THE KILNS

4.1.1 The kilns divided into two main types, described below, with a few kilns which could sit credibly in either group, or may represent a transition between them. There was only one possible deviation from these two types; this was site **77** at Far Black Cleugh, a small circular kiln on relatively flat ground. It is difficult to date but may be a simple flare kiln of mid-eighteenth century or earlier date, and was possibly superseded by kiln **15** nearby.

4.1.2 The two main types of kilns were firstly, small private field kilns with a single draw arch and secondly, the larger double-arch estate or commercial kilns. No kilns were encountered with more than two draw arches.

4.2 SMALL SINGLE-ARCHED KILNS

4.2.1 The first type of kiln is highly characteristic of the AONB. Rubble-built in drystone or occasionally mortared stone, these drew on simple, even crude vernacular construction techniques which might well be employed by those used to building drystone walls and farm buildings. Because of this their character sits particularly well with local vernacular buildings. Building into a slope to give easy access to the top and bottom of the kiln, these structures had a single draw arch. Usually this had a corbelled interior, formed by simply bringing in each successive course of stone as the arch was built until the two sides met. There was some local variation in the style of arch, for instance corbelled arches being brought to a point in **23**, but left as a truncated point with a single slab to form a combined roof and lintel at **51**. The kilns are occasionally corbelled or stepped at the sides to give the kiln a tapered section (as at **10**). The structure thus leant in on itself, and had an inherent strength except at the thinnest point, the base of the pot where it met the eye. At this point almost all the kilns have collapsed.

4.2.2 It is tempting to suggest a progression from kilns such as **47** or **75** whose arch is effectively a corner between two curving walls, to those such as **64** where the arch, though still pointed, has a more evenly curving interior and seems to employ more professional techniques. These might equally, however, be only local variations in style, resulting from the nature of building stone available, the skill of the builder or simple unfamiliarity with other techniques. It is however likely that kilns with a voussoired or dressed round-headed arch, such as **31**, represent a late phase in the single-arch kiln. Kilns such as **D** or **18**, associated with well-used trackways and probably in use as small-scale commercial kilns, are thought to be later still, and to represent the most developed form of the small, single-arch flare kiln in the AONB. The relatively good preservation of these kilns, and their occasional use of firebrick as a pot-lining, reinforces this interpretation

- 4.2.3 Most commonly the single draw arch was found in association with a single pot and a single eye. The pointed arch is usually found with a stone-lined pot (**4**), the round-headed arch occasionally with a brick-lined pot (**2**), reinforcing the interpretation of these as later kilns. The small kilns were often unconnected to major tracks or roads, although small tracks were sometimes in evidence as at **A**. The size of such kilns, and often their relative isolation near a single farmstead, confirm that they were usually built to fulfil the needs of a single farmer or builder. Most are dilapidated and at least partially collapsed, but those which stand to any height are testimony to the skill of the builders, who adapted familiar building methods to a new use.
- 4.2.4 Although difficult to date typologically, the extent of weathering and collapse suggests a relatively early date for such kilns. They may be tentatively and generally dated to the late eighteenth and early nineteenth centuries, when agricultural improvements were at their climax and kilns most in demand. These kilns, their earthworks or associated trackways are occasionally overlain by field walls as at **23**, suggesting that they pre-dated the major campaign of enclosures. In these cases, it is likely that the kilns were built at an early stage in the campaign to enclose land and improve its yield by extensive liming; they may have made use of cleared stone from newly enclosed fields as one source of limestone.

4.3 LARGER KILNS

- 4.3.1 The second main type of kiln encountered during the survey is distinguished by scale, and the level of structural sophistication. Although the principle on which these kilns operated was the same as that of the smaller kilns – a mixed-feed pot feeding towards an eye within a stone structure – the structure was usually larger and more substantial than the field kilns described above. Firebrick pot-linings were common (though not ubiquitous: see site **65**). There was usually a double draw arch, or at least a single arch with a pair of eyes. Curved pilasters or segmental-headed arches were also encountered. These kilns represented a greater investment than the small drystone field kilns. They may also commemorate the beginnings of full-time industrial work amongst a population formerly used to occasional seasonal work at the kilns, although in this landscape of quarries and lead mines it is likely that industrialised labour was familiar to most occupants of Tynedale.
- 4.3.2 Relatively simple examples, which might be seen as an intermediate or transitional type between small field kilns and estate kilns, were **D** and **18**. At **D**, a single-arch kiln of the usual rough-coursed rubble construction incorporates some elements more usually seen in larger double-arch buildings. It lies between two well-used tracks, suggesting at least small-scale commercial use, and incorporates some firebrick. At Smallburns **18** might be seen as a further development of a kiln serving local or more distant markets; a larger structure than **D**, it is a well-built single-arch kiln with segmental-headed arch and twin brick-lined eyes, situated on a broad farm track. The use of transport links was clearly vital to the expansion of markets for lime.

- 4.3.3 A better representative of the larger estate kiln is **25**, Keenley Thorn. A double-arched kiln in an area of former quarries and built at the side of a minor road, the kiln includes firebrick elements and a substantial stone-revetted ramp, with two eyes to each arch. An interesting variation on the double-arch kiln was **65**, Harsondale, where the twin arches are of the pointed construction usually seen in field kilns, rather than the round-headed shape more commonly found in these larger constructions. Harsondale also retains some evidence for a small shelter or tool store.
- 4.3.4 Only one kiln seen (**48**) had more than one pot. This was a double-pot kiln at Allenhead, probably built to burn continuously with the pots running in alternation. A double-pot kiln would be more expensive to build and to operate, and presumably reflected considerable demand for its product in the mid-nineteenth century when it was built. It was built close to a road to give easy access to and from its markets.
- 4.3.5 The earthworks seen near kilns are usually in proportion to the kiln. Smaller kilns usually lay close to shallow quarries or were not near an obvious source of stone, suggesting that they made some use of cleared stone at the time of enclosure. The tracks and paths that connect the smaller kilns to a single farmhouse or to fields are usually insubstantial. As one would expect, larger kilns tended to be located close to larger quarries and wider roads or substantial tracks.

4.4 CONDITION OF THE KILNS

- 4.4.1 The condition of the kilns is best assessed by consulting individual records within the database which accompanies this report. However, it can generally be said that the kilns in the AONB are usually victims of benign neglect, and sometimes of deliberate destruction. Kiln **3** has been filled in by a landowner concerned about the safety of the public, and another (**61**) was demolished in the post-war years to provide track make-up. Kilns **21** and **43** are examples of those which have collapsed beyond recognition.
- 4.4.2 The majority of the kilns have collapsed to some degree, particularly around the eye where the kiln's structure was under particular strain. The corners too are prone to decay, particularly where cattle are kept in the field and tend to rub against them. Few kilns were discovered with the eye entirely intact. The better preserved kilns were those larger kilns which have benefited from listing status. Where it is in force, listing seems to have succeeded in preserving kilns; or has perhaps been applied to those which are best preserved. Some listed kilns (notably **25** and **48**) are nonetheless in urgent need of consolidation. Very few are sufficiently well-maintained to make further works superfluous.
- 4.4.3 Throughout the survey, it was commonly found that kilns recorded in Stafford Linsley's survey of 1976 or 1981 as partially intact had suffered markedly from further collapse in subsequent years. For example site **21**, described in

Stafford's survey as a single-arch, single-pot kiln with the pot partly filled has collapsed almost beyond recognition, and is now little more than a spread of stone. Because of their drystone construction, the smaller kilns are particularly prone to decay once the structure has been breached. Site **75** is a case in point: intact until five years ago it is now badly collapsed on one side.

- 4.4.4 It was frequently found that sites whose SMR record was based on a 1997 data exchange with RCHM did not exist, site **A** being a notable exception. Kilns located from other sources were usually found in some form, even as an indistinct earthwork or scatter of burnt stone, but the RCHM 'kiln' sites were sometimes found to be duplicates of existing records, or were not found at all. Several, such as **44** and **45** on precipitous and trackless slopes far from water near Staward Pele, seem extremely unlikely ever to have been kiln sites. The records for these sites were perhaps created on the basis of incorrect grid references, or data from aerial photographs. They must unfortunately be considered suspect when looking limekilns in the field.
- 4.4.5 Without treading every field in the AONB, it is not possible to claim that every kiln has been included in the survey. Remaining kilns will of course be confined largely to the limits of the limestone geology. Where previously 'unknown' sites have been located, they have been visited and included in the database: some of these were more or less intact standing structures, for instance **75** at Hesley Well, and one was the intriguing small kiln site **77** at Far Black Cleugh. There will be other sites which have not yet come to light. The best source of information is the farmers themselves, who have been asked at every opportunity if they know of other kilns in the area and who have usually proved very knowledgeable on the subject.

5. CONCLUSIONS

5.1 FORM AND DATE OF THE KILNS

- 5.1.1 All of the kilns included in the survey are believed to date from the later eighteenth or nineteenth centuries. The forms are varied within the general framework of kiln architecture, but it is possible to make useful generalisations. Small, simple kilns usually date from the early end of this date range. They were built for private, local use, primarily supplying lime as a soil dressing via farm tracks and trails to the owner's farm, and sometimes producing surplus for sale to other local farms or for local use in building, tanning or other practices. Larger or more sophisticated kilns are usually later in date, capitalising on the greater demand from the early decades of the nineteenth century as industry, particularly the lead mining industry of Allendale, developed. These kilns were built by estate owners in response to increasing commercial demand, and often situated next to a road giving access to suppliers, and a trade route.
- 5.1.2 In terms of form we find, as did Alistair Robertson, that 'the horizontal topped arch is found only in the smallest field kiln for farmers' own use. Pointed arches are found mainly in field kilns and smaller commercial kilns' (Robertson 1999, 9). Single-arch kilns with round-headed arches or with brick components such as pot-linings and eyes are assumed to be later in date than these pointed-arch kilns; the larger double-arched kilns post-date both.
- 5.1.3 The earliest kiln seen is probably **77**, a small circular kiln on flat ground at Far Black Cleugh which represents a simple flare kiln. The latest is probably **11**, a large concrete-faced kiln on the Ayle Burn in use until fairly recent years. Kiln **48** too has been in use well into the twentieth century, and retains part of its last fill of lime.

5.2 IMPORTANCE OF THE KILNS

- 5.2.1 The limekilns of the Northumberland and North Pennines AONB make an important contribution to the regional landscape. Some are striking and well-preserved, making attractive landscape features. Perhaps even more valuable, because hitherto less valued and therefore more vulnerable, are those which are *not* particularly striking or technically accomplished. Limekilns are generally described under the heading of 'industrial archaeology' and such they are, but this perhaps belies their role in an integrated local economy which incorporated small-scale industry alongside agriculture. The kilns are tangible evidence of the industry that 'farmers' or 'miners' in Tynedale practised alongside their other occupations. The division between industrial and agricultural labour may be one that they themselves would not have acknowledged.
- 5.2.2 Like barns or mineshafts, limekilns were built not as monuments but as durable working structures, and they are characteristic components of a

landscape shaped by several working traditions. Notable amongst these traditions are those of pastoral farming, lead mining and stone extraction which are much in evidence in all the areas where kilns are found. The kilns testify particularly to an era of agricultural improvement when much marginal land was made cultivable for the first time, and the Northumberland landscape underwent enormous change. At present, with much of the study area reverting to moorland or pasture, the kilns are a salient reminder of the changing influence of human activity in familiar landscapes.

5.3 PRESENT PLACE OF KILNS IN THE LANDSCAPE AND ROLE IN THE AONB

- 5.3.1 In their working lifetime, the kilns were landmarks and focal points for the local community. Where located in a farm enclosure they were often on high land or near a track, and the smoke from a burning kiln would be seen for some distance – as was seen during the survey, when one kiln (**2**) was found in use for burning other materials. Larger kilns would have been imposing features of an estate, and reminders of a major landholder's presence in the landscape. Each would have been, in the words of Richard Moore-Colyer, 'a warm and rather friendly place. On a cool evening in the lime burning season, it might attract all manner of people to its precincts so, like the smithy and pub, becoming a focal point for the local community' (Moore-Colyer 1992, 25).
- 5.3.2 The small drystone kilns which are most typical of limeburning during its long history do not generally survive well. Nonetheless they are in a better condition than might be expected of two-hundred year old built using simple techniques borrowed from drystone walling and other farm structures. Because of their very mundaneness and vernacular style, where they survive they are particularly valuable and unusual. Fine examples are **A** and **D**.
- 5.3.3 Larger or later kilns survive in better condition – examples are Allenhead (**48**) and Harsondale (**65**). Both are double-arched kilns and well-preserved. In the case of Allenhead this may be partly due to its listed status; the Harsondale kiln, perhaps surprisingly in view of its fine preservation and distinctive pointed arches, is not listed. Another good example of a later kiln is Smallburns (**18**) where a single arched nineteenth century kiln survives in good condition.
- 5.3.4 The role of kilns in the modern landscape is an interesting one, since they are no longer useful for their original purpose and their value is partly cosmetic. However they contribute to the Northumberland landscape not only aesthetically, but also as a reminder that the now remote and sometimes bleak corners of the county were formerly centres of small-scale agricultural and industrial activity, which shaped the land as we now see it. The kilns are associated with quarries or pits, stone clearance and trackways which have all altered the local and regional landscape.
- 5.3.5 The range of kiln types, from very small and short-lived field kilns to the larger estate kilns makes them varied and interesting features, and attractive ones which will add to the enjoyment of visitors to the AONB. The AONB management plan makes it clear that low-key, 'green' tourism is to be

encouraged within the study area. Many of the kilns visited during the survey sit very well within this philosophy. Where they are close to or visible from footpaths, and particularly where one or more kiln is seen in conjunction with other remains such as quarries, mineshafts or agricultural buildings, limekilns could be used as key points of interest on a walk or even a themed trail between different sites. In several cases LUAU recommends consolidation or the erection of an information board, to preserve the kilns and explain them to visitors. Even the smallest kilns of the AONB are an asset to its tourist economy.

5.4 CONSERVATION AND RESEARCH PRIORITIES FOR THE FUTURE

5.4.1 In a recent text on industrial archaeology, Palmer and Neaverson emphasise that

'any industrial structure is not an isolated monument but part of a network of linkages relating to the methods and means of production....these associations include not only the economic ones of sources of raw materials, methods of processing and transport networks which industrial archaeologists do normally consider, but also the social context of production' (Palmer and Neaverson 1998, 4).

5.4.2 The study of kilns should be viewed therefore as one component in a wider landscape study incorporating social, ecological and other elements. This approach is clearly a part of the AONB management strategy.

5.4.3 Statutory protection in the AONB has undoubtedly favoured the larger estate kilns whose visual appeal and architectural importance is more immediately apparent than that of the smaller kilns. This leaves many of the most characteristic kilns unprotected. Since these kilns are in any case more vulnerable to erosion, damage by stock or simple neglect, serious consideration should be given to identifying those which are most suitable for listing or even scheduling. LUAU would suggest that sites **D** and **2** are sites eminently suitable for listing, and Harsondale (**65**) for scheduling: the latter is on National Trust land.

5.4.4 The kilns functioned as only one element in a landscape with multiple uses. Quarries and coal mines were vital to the functioning of the limekilns, as were the roads which connected them. These transport routes, in particular, allowed the development of commercial links which encouraged industrial activity in Tynedale. Local landscape surveys could be made of the landscape surrounding a few individual kilns representing different types or periods such as **D**, **18** or **48**. Such a survey would record important features such as farmhouse, kiln, track and quarry. A body of several such studies would develop an understanding of the kilns' importance to local communities, and would provide a comparison which might also be used in the public presentation of kilns.

5.4.5 The nature of lime kilns as structures with no present-day function leaves them particularly vulnerable to decay and neglect, a point made in the Tynedale Buildings at Risk Survey of 1994. Whilst most farmers and landowners feel a responsibility to look after the kilns and maintain them, they naturally have

different priorities and some of the kilns are now in a state of advanced decay (see Results).

- 5.4.6 Several large kilns, eg Allenhead (**48**) are listed. This is both cause and effect of their good level of preservation, which is generally better than that of their smaller neighbours. The inclusion of several smaller kilns such as **D** or **2** in the county lists would make the lists more representative. It would remedy the current imbalance, which operates in favour of the architecturally impressive estate kiln rather than the more characteristic, small private farmer's kiln. Both types of kiln could benefit from the comparison between well-preserved examples.
- 5.4.7 It has been noted throughout the survey that many kilns which were seen by Stafford Linsley and his team in 1976 or 1981, and described then as 'collapsing' or in 'fair' condition, have deteriorated very markedly in the intervening decades. Where consolidation is undertaken, works should therefore be instigated as quickly as possible to arrest further collapse. In many cases only small-scale works such as repointing or tree clearance are required to secure the survival of kilns which have remained standing for two centuries and are now under grave threat.

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ILLUSTRATIONS

- Fig 1 The boundaries of the AONB
- Plate 1 Kiln 10, Ayle. A good example of a ‘bottle-shaped’ arch with stone lintel, in a kiln with corbelled sides
- Plate 2 Kiln 16, Black Cleugh. A fully pointed arch
- Plate 3 Kiln 2, Kirkhaugh. A small round-arched kiln in use
- Plate 4 Kiln D, Pry Head. A round-arched kiln incorporating brick, with well-used tracks nearby
- Plate 5 Kiln 48, Allenhead: a large estate kiln next to a road
- Plate 6 Kiln 65, Harsondale: unusual double pointed arches in a quarry complex

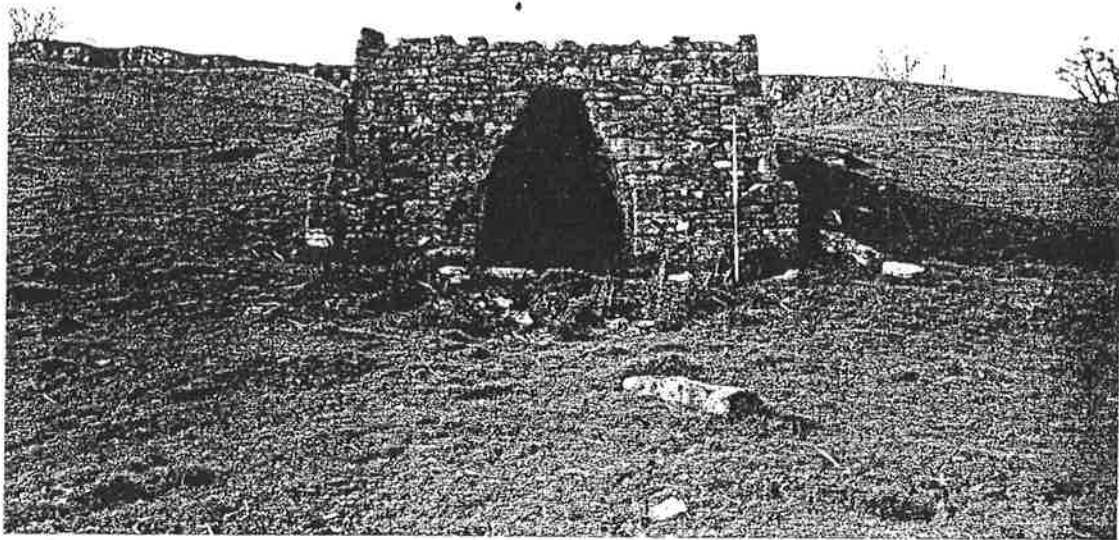


Plate 1: Kiln 10, Ayle. A good example of a 'bottle-shaped' arch with stone lintel, in a kiln with corbelled sides.



Plate 2: Kiln 16, Black Cleugh. A fully pointed arch.



Plate 3: Kiln 2, Kirkhaugh. A small round-arched kiln in use.



Plate 4: Kiln D, Pry Head. A round-arched kiln incorporating brick, with well-used tracks nearby.



Plate 5: Kiln 48, Allenhead. A large estate kiln next to a road.



Plate 6: Kiln 65, Harsondale. Unusual double pointed arches in a quarry complex.

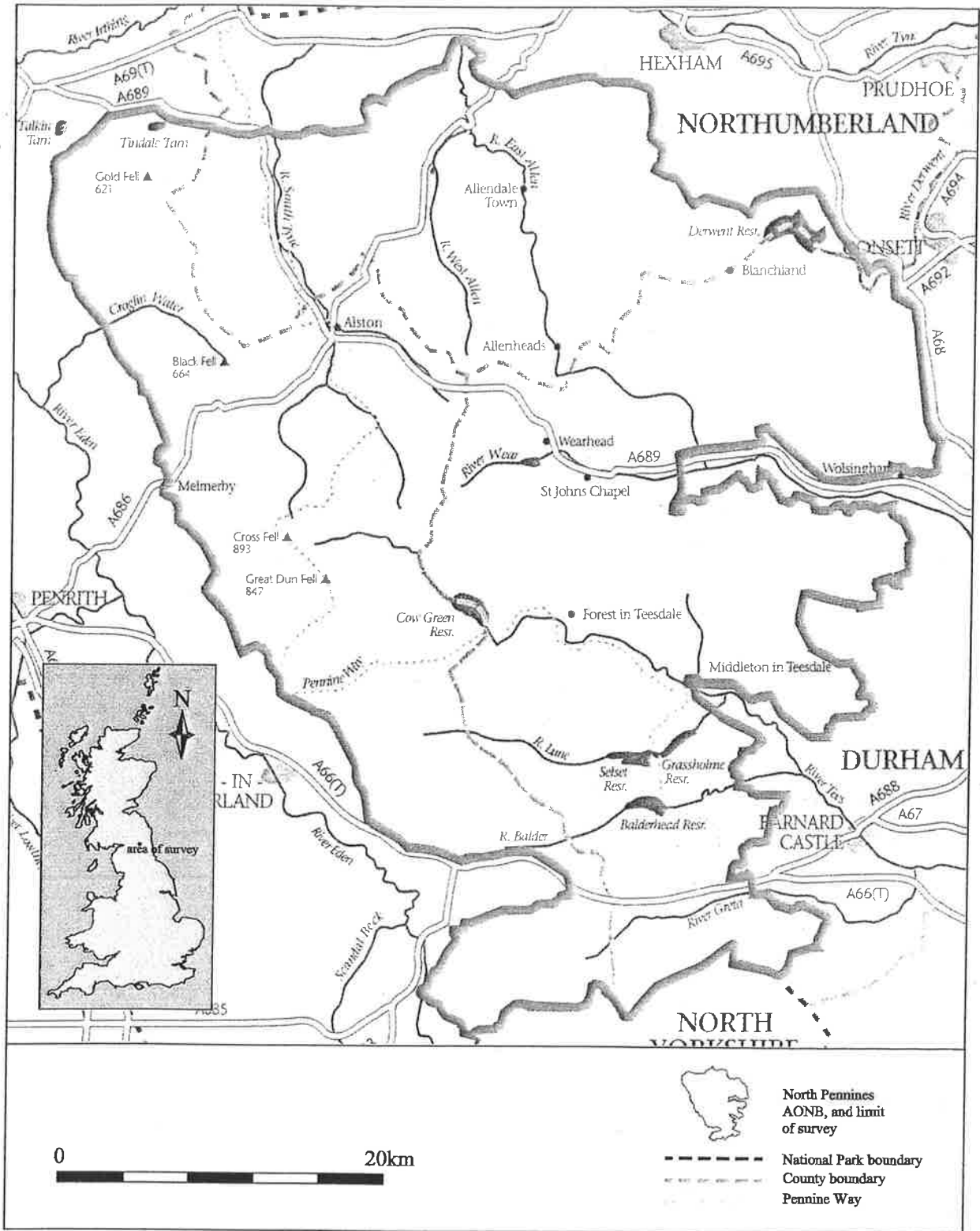


Figure 1 Site Location