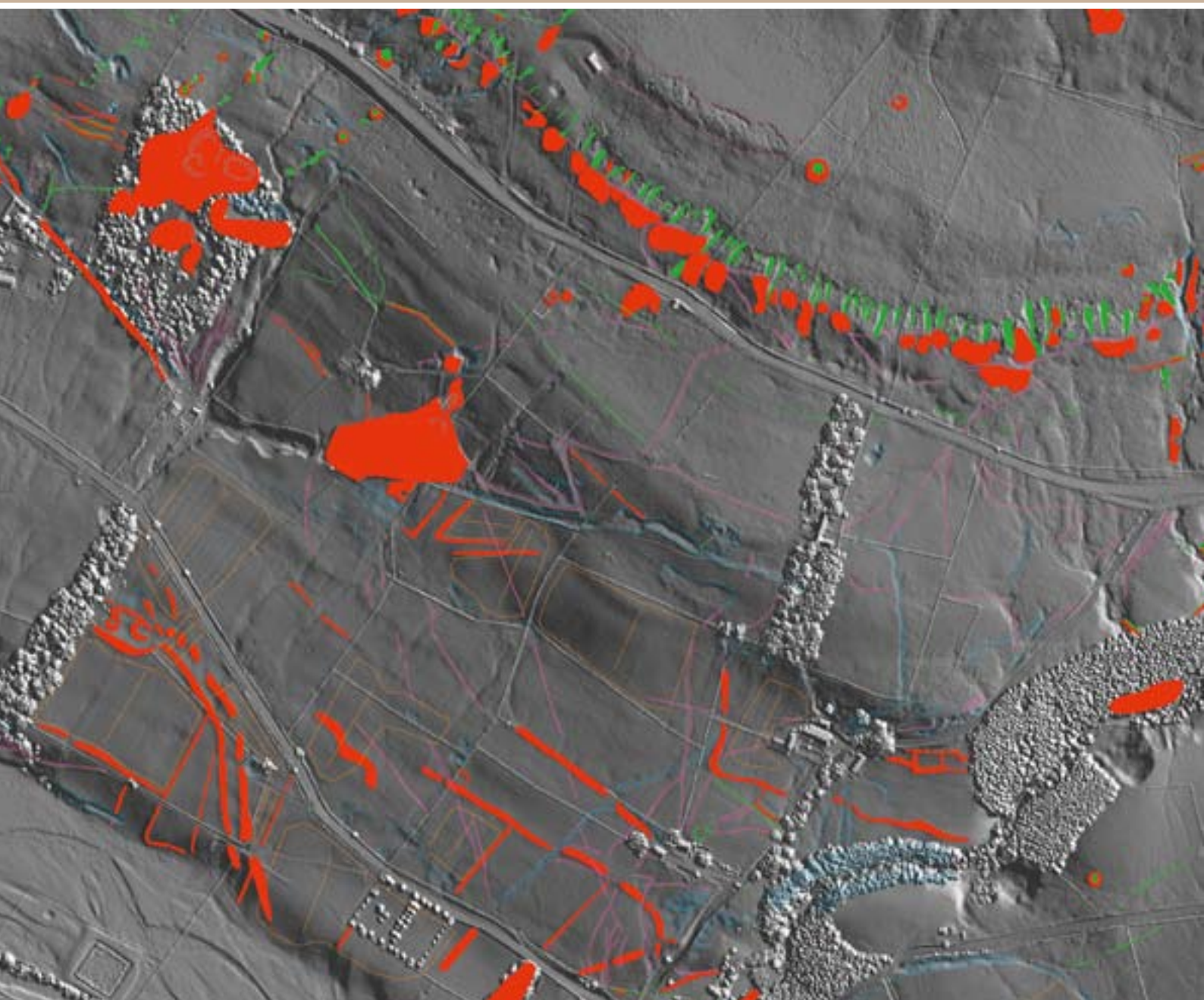


RESEARCH REPORT SERIES no. 4-2012

ALSTON MOOR,
NORTH PENNINES
MINER-FARMER LANDSCAPES
OF THE NORTH PENNINES AONB NMP

AERIAL INVESTIGATION AND MAPPING REPORT

Matthew Oakey, Sally Radford and David Knight



REMOTE
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NORTH PENNINES**

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Matthew Oakey, Sally Radford and David Knight

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SUMMARY

This report describes the specification and methodology for the mapping and recording followed by an overview of selected results from the North Pennines desk-based aerial survey mapping. This work fulfils Module 1 of the 'Miner-Farmer Landscapes of the North Pennines AONB' project and forms part of the National Mapping Programme. The aerial survey and mapping ran from 13 August 2009 to 1 June 2011 and encompasses the whole of the historic manor of Alston, spanning three counties, Cumbria, Northumberland and a small part of Durham. It comprises eight whole and seven part Ordnance Survey 1:10,000 scale quarter sheets totalling 234sq km. Digital maps and supporting records were created by English Heritage's Aerial Survey and Investigation team based in York. The project identified and mapped sites ranging from Bronze Age burial cairns through to 20th-century military and industrial remains. New records were made for 1,865 sites and a further 505 existing records were enhanced.

CONTRIBUTORS

Mapping and recording was carried out by Yvonne Boutwood, David Knight, Jane Monk, Matthew Oakey and Sally Radford of English Heritage's Aerial Survey and Investigation team. Tara-Jane Sutcliffe participated as part of the English Heritage Professional Placements in Conservation (EPPIC) scheme.

ACKNOWLEDGEMENTS

The authors wish to thank members of Archaeological Survey and Investigation (York) for sharing their expertise and providing training in aspects of field survey. Thanks are also due to Architectural Investigation for their advice on the local vernacular. Yvonne Boutwood, Pete Horne, Dave MacLeod and Stewart Ainsworth provided many helpful comments on early drafts of this report. Thanks, as ever, to Luke Griffin of Enquiry and Research Services at the NMR for supplying the air photographs and Petra Wade, Heritage Data Coordinator, for recording advice and support. Simon Crutchley's assistance with the initial lidar processing, along with his and Fiona Small's training in the use of lidar were extremely helpful in the early stages of the North Pennines project. We would like to thank Alastair Robertson, local historian, for sharing his extensive knowledge regarding the history of Alston Moor. Finally, thanks are due to Paul Frodsham, of the North Pennines AONB, who was instrumental in facilitating Aerial Survey and Investigation's outreach work as part of the 'Altogether Archaeology' initiative.

This project was carried out in collaboration with Cambridge University's Unit for Landscape Modelling (ULM): their contribution being the loan of air photographs (until the closure of the archive in July 2010). The supply of HER data by staff at Cumbria HER, Northumberland HER and Durham HER is much appreciated.

Cover image: A multi-phase archaeological landscape in the South Tyne Valley, revealed by lidar (DSM) and overlain by air survey mapping.

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BACKGROUND TO THE MINER-FARMER PROJECT

In 2008, English Heritage's Research Department (now part of the Heritage Protection Department) initiated a five-year project called 'Miner-Farmer Landscapes of the North Pennines Area of Outstanding Natural Beauty' (Ainsworth 2008). This multidisciplinary landscape investigation is intended primarily to investigate the interwoven influences of historic industry and farming on the development of the landscape and settlement pattern of the AONB. The findings will inform the conservation, protection and management not just of the historic environment, but also of the so-called 'natural' environment, which has been widely, profoundly, and in many places obviously, shaped by past human activity. The project is being undertaken in partnership with the North Pennines AONB Staff Unit, the Environment Agency, Natural England and the North Pennines Heritage Trust and brings together, through a modular programme of research described below, contributions from all the partner organisations, from several specialist teams within English Heritage's Research Department, and from a number of contractors. Main funding has been provided by English Heritage's Historic Environment Enabling Programme (HEEP), now the National Heritage Protection Commissions Programme (NHPCP).

At almost 2000sq km, the AONB, which was designated as such in 1988, is the second largest in England and Wales, spanning parts of the counties of Cumbria, Northumberland and Durham. In 2003, the AONB was awarded European Geopark status, a UNESCO designation for areas with world-class geological heritage, making it Britain's first protected landscape with this status and also a founding member of the UNESCO Global Parks Network. The research concentrates on an area in and around Alston Moor, a remote upland massif lying between the confluence of the Rivers Nent and North Tyne (Fig 1). In geological terms, the so-called 'Alston Block' is particularly complex, formed by alternating bands of limestone, sandstone and shales, within which are seams of coal, lead, iron and other minerals. As elsewhere in the AONB, all these resources have been intensively exploited for hundreds, if not thousands, of years, leaving a rich and diverse legacy of industrial remains.

The Miner-Farmer project contributes to the 2004 Statement of Joint Accord between English Heritage and the National Association of AONBs, which pledged the organisations to work together to further the understanding, conservation, enhancement and public enjoyment of the historic environment within these 'protected landscapes' (see also English Heritage 2005a). With potential to deliver methodological models for holistic landscape research which will inform a range of national conservation, protection, management and research agendas for the wider environment, but especially for upland and industrial (particularly lead mining) landscapes, the project responds to key national themes and priorities identified for research (English Heritage 2005b). It also addresses gaps in knowledge identified in the Regional Research Frameworks for the North-East and the North-West (Petts and Gerrard 2006; Brennand 2006) and The North Pennines Lead Industry: Key sites and proposals for action (North Pennines Partnership 1998). It meshes well with the Peatscapes project, (in its final stages at the start of the Miner-Farmer Landscapes project), which is examining peat primarily as a natural resource (in other words, disregarding its historic use as a form of domestic and industrial fuel)

and dealing with issues such as the damaging artificial drainage of blanket bogs (North Pennines AONB Partnership 2008). Both projects contribute to the objectives of the AONB's own management plan for the period 2004-9 (North Pennines AONB 2009), many of which correspond closely to English Heritage's (2005b) Research Agenda.

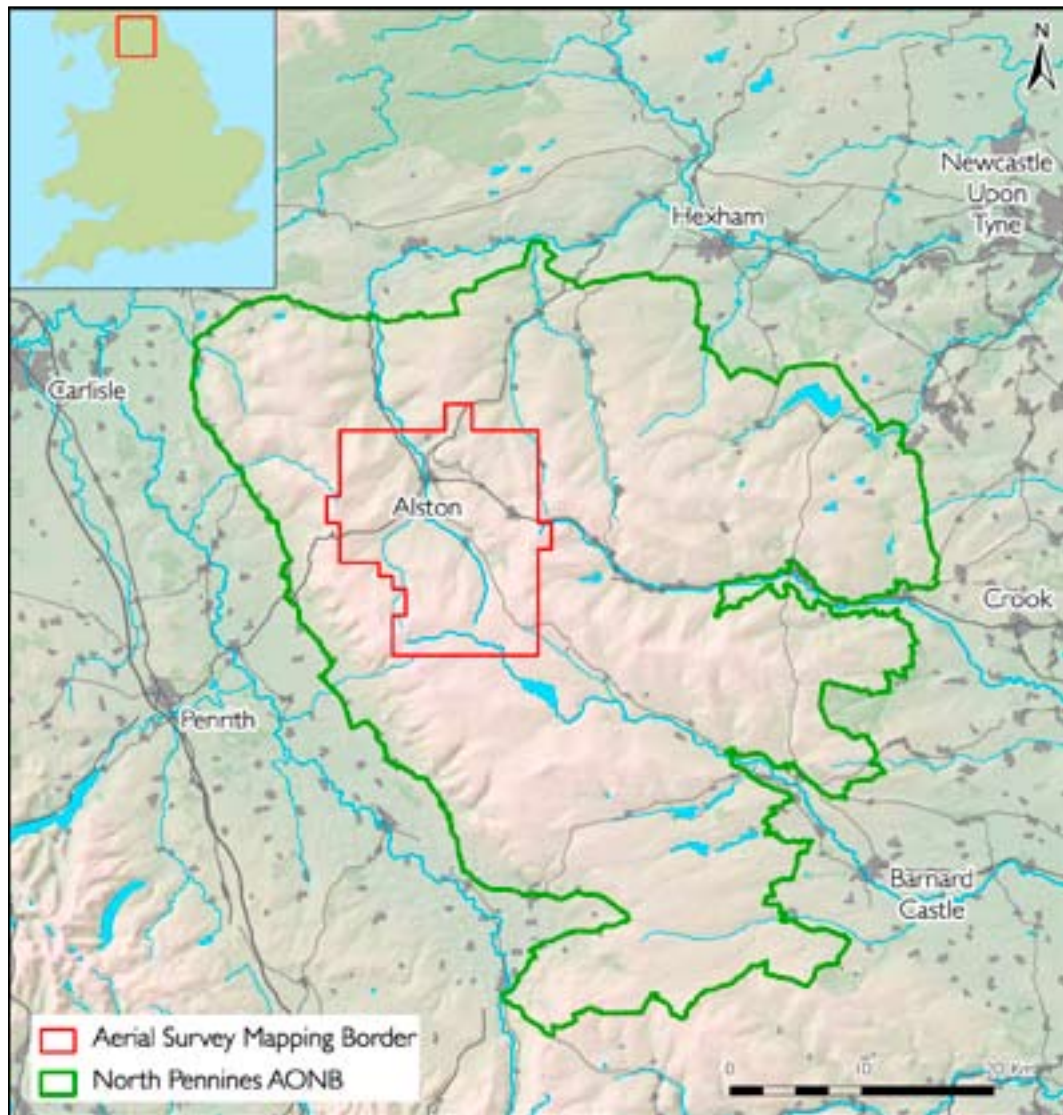


Fig 1: The North Pennines NMP project area, located within the North Pennines AONB. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

The extent to which industrial activity has contributed to both the creation and destruction of the wider historic environment through time has been poorly understood. Previous recording of these landscapes has been too often restricted to individual buildings and/or archaeological sites with little regard to the overall development of the landscape and the historical, archaeological and architectural context within which the different elements reside. Nor has there been any systematic evaluation of threats that

are pertinent to these landscapes to inform long-term conservation and management.

The Miner-Farmer project consists of the following modules

Module 1: Desk-based aerial survey of 234sq km as part of the National Mapping Programme being undertaken by the English Heritage Aerial Survey and Investigation team (Heritage Protection Department).

Module 2.1: Supply of aerial imagery, including lidar, RGB full spectrum and infrared orthophotography, and hyperspectral data. Contract awarded to Infoterra Ltd. Funded by Historic Environment Enabling Programme (NHPCP 5330), Peatscapes Project (AONB), and Living North Pennines Project (AONB).

Module 2.2: Archaeological ground survey of 32sq km of the core sample area by the English Heritage English Heritage Archaeological Survey and Investigation team (Heritage Protection Department).

Module 2.3: Capacity-building: archaeological ground survey of 18sq km of the core sample area to be surveyed under contract by North Pennines Archaeology Limited. Funded by the Funded by Historic Environment Enabling Programme (NHPCP 6072).

Module 2.4: Applications of remote-sensing: research, in collaboration with VISTA Spatial and Technology Unit at Birmingham University, into the identification of moorland industrial activity and the relationship with the natural environment and erosion, including gathering of environmental data. Funded by the Funded by Historic Environment Enabling Programme (NHPCP 5761)

Module 2.5: Landscape characterisation study of farmstead types by the English Heritage Historic Landscape Characterisation team (Heritage Protection Department).

Module 2.6: Study of the built environment within the project area by the English Heritage Architectural Survey and Investigation team (Heritage Protection Department).

Module 2.7: Study of the consequences of mineral procurement, environmental impact and pollution by the English Heritage Archaeological Science team (Heritage Protection Department).

Module 3: Targeted ground survey by the English Heritage Archaeological Survey and Investigation team (Heritage Protection Department).

Module 4: Targeted geophysical survey by the English Heritage Archaeological Science team (Heritage Protection Department).

Module 5: Publication of results.

INTRODUCTION

The Miner-Farmer Landscapes of the North Pennines AONB NMP project (AMIE Event UID: 1504078) forms Module 1 of the broader Miner-Farmer Landscapes of the North Pennines AONB project (AMIE Event UID: 1501202).

The desk-based aerial survey component, undertaken by the Aerial Survey and Investigation team in York, was completed between 13 August 2009 and 1 June 2011. This module aimed to enhance our understanding of the archaeology of Alston Moor through the consistent and accurate mapping of archaeological features visible on air photographs, for an area of 234sq km. Of this area, 96sq km was enhanced by lidar coverage. The digital mapping (AMIE Parent Collection UID: EHC01/164) provides primary information for all archaeological sites and landscapes, from the Neolithic period to the 20th century, providing a wider context for the core research area and other research modules of the project.

The mapping and recording conventions followed are those developed for the National Mapping Programme (NMP) methodology but the accuracy and level of depiction for this project exceeded normal NMP specifications due to the high level of detail and accuracy afforded by the use of lidar and orthophotography. The aim of the NMP is to enhance the understanding of past human settlement, by providing primary information and synthesis for all archaeological sites and landscapes visible on aerial photographs or other airborne remote sensed data. In the context of the North Pennines all the archaeological features were visible as either earthworks or structures.

This summary report describes the specification, methodology, scope and results of the aerial survey interpretation and mapping, with a synthesis of the archaeology, analysing its character, diversity, distribution and associations in the landscape.

SCOPE OF THE SURVEY

Geographical scope

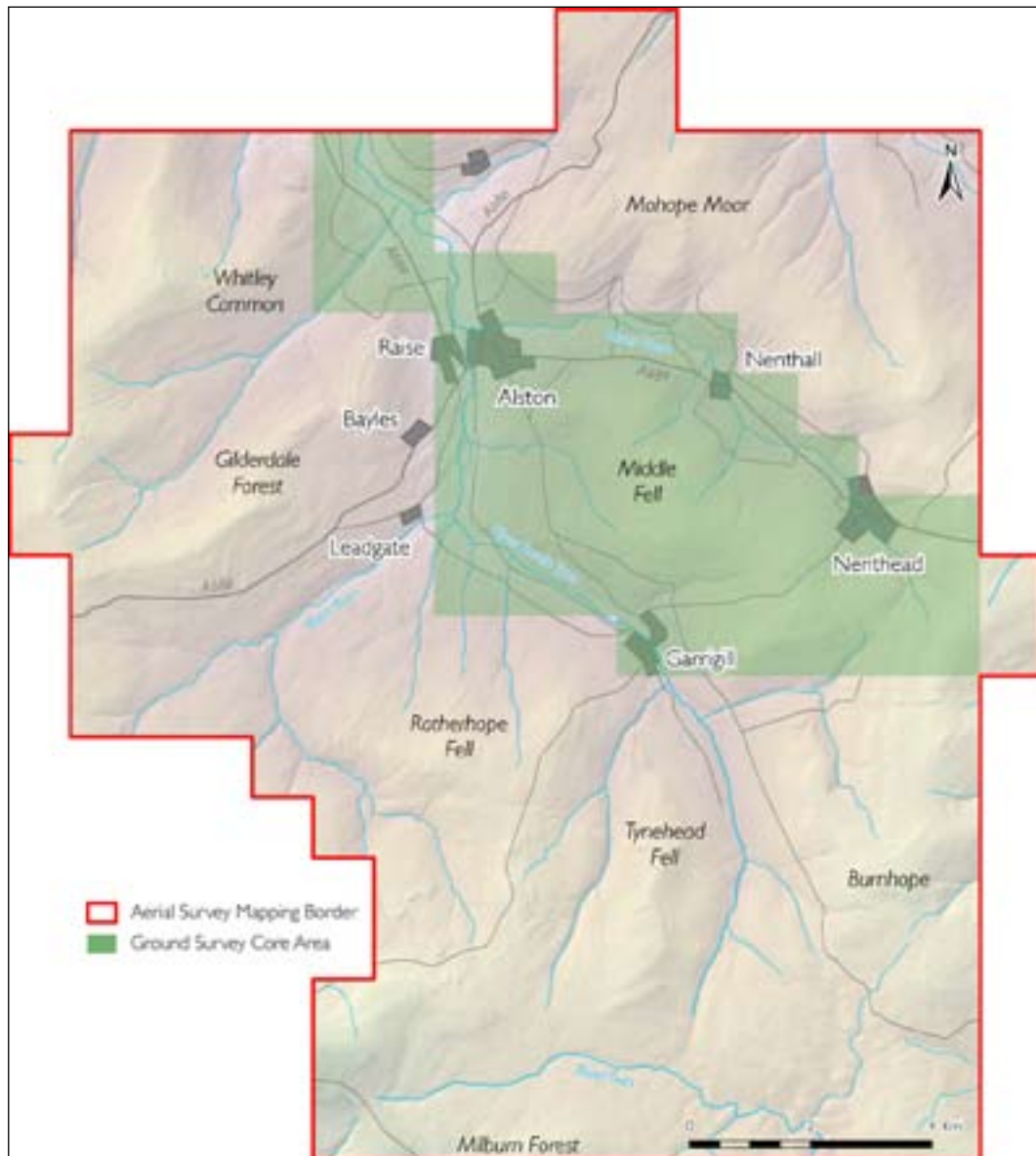


Fig 2: The desk-based aerial survey (Module 1) focuses on 234sq km of the historic manor of Alston Moor and encompasses the smaller core area subject to rapid analytical field survey (Modules 2.2 and 2.3). ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

The aerial survey and mapping area (Module 1) encompasses the whole of the historic manor of Alston, spanning three counties, Cumbria, Northumberland and a small part of Durham (Fig 2). It comprises eight whole and seven part Ordnance Survey 1:10,000 scale quarter sheets totalling 234sq km (see APPENDIX I). This encompasses the smaller core

research area which is subject to rapid analytical field survey on the ground (Modules 2.2 and 2.3).

Archaeological scope

The project forms part English Heritage's National Mapping Programme (NMP), the aim of which is to enhance the understanding of past human settlement, by providing primary information and synthesis for all archaeological sites and landscapes visible on aerial photographs or other airborne remote sensed data. NMP delivers high-quality baseline information for the management of change in the historic environment through the planning and other statutory systems, and as a basis for further research (Horne 2009). The scope of the project adheres to the guidelines set out in the NMP Sphere of Interest (Boutwood and Winton 2004) and the main aspects relevant to this project are summarised below.

Earthworks

All extant and subsequently levelled earthworks identified as archaeological in origin were mapped and recorded.

Cropmarks, soilmarks and parchmarks

In this landscape no features were visible as cropmarks, soilmarks or parchmarks.

Post medieval and modern field boundaries

Field boundaries (upstanding or levelled) that are visible on air photographs or lidar but are also depicted on Ordnance Survey first edition or later edition maps were not generally mapped. The exception to this was where they formed part of a more extensive field system that was not depicted on historic maps.

Ridge and furrow

All ridge and furrow surviving as earthworks was mapped and recorded. Using a simplified depiction, the extent of the blocks of ridge and furrow and the direction of ploughing were delineated. Remains were characterised as medieval or post medieval in date. When the form was not diagnostic as to an explicit date it was identified as medieval/post medieval.

Industrial features and extraction

All industrial features and extraction were mapped as seen. The lidar imagery revealed a greater level of detail than would have been visible on traditional air photographs. The mapping correspondingly depicted that detail and the specification for mapping extraction was enhanced by including small scale pits. Where features were too amorphous to depict, they were defined by an extent of area. Major transport features such as main railway lines already depicted on the OS base were not mapped, however

smaller features with associations to industrial complexes, such as tramways, were mapped and recorded.

20th-century military remains

Military features up to and including the Cold War period were mapped as seen.

Buildings and structures

The foundations of buildings visible as earthworks and ruined stonework were mapped and recorded. Standing roofed or unroofed buildings or structures and those that were depicted on the Ordnance Survey first edition or later edition maps were generally not recorded unless they fell within the NMP Sphere of Interest, such as military or industrial sites. Sheep folds were mapped irrespective of whether they were depicted on Ordnance Survey maps.

Parkland, landscaped parks, gardens and country houses

Earthwork and levelled landscape park and garden features were mapped and recorded. Urban and 20th-century parks and gardens and were not recorded.

Urban areas

Archaeological features of the pre-urban landscape meeting the previous criteria, when identified either as islands of survival or from historic photography, were mapped.

Geological features

Geological features were generally not mapped or recorded but may be mentioned in the monument record when they occurred in close proximity to archaeological features and there was a risk of confusion with archaeological features. Elements of natural features that had been modified, for example through industrial or agricultural processes, were depicted.

SOURCES

Air photographs

All air photographs held by the National Monuments Record (NMR) were consulted (loan ref 35433); the coversearch was carried out on 20 January 2009. A total of 588 specialist obliques and 1,120 vertical prints were examined. The vertical photography ranged in date from 1946 to 1978 and the obliques from 1948 to 2007. The oblique photographs included a number of large format colour prints that were taken in advance of the project on 10 September 2007.

Additional prints were loaned to the project by the Cambridge University Collection of Air Photographs (CUCAP) administered by the Cambridge University Unit for Landscape Modelling. However access to the CUCAP photography was suspended on 31 July 2010 following the closure of the Unit for Landscape Modelling. Consequently, only prints relating to quarter sheets NY 74 NW, NY 74 SE and NY 74 SW were available to the project.

Orthorectified vertical photographs were supplied to English Heritage by Next Perspectives™ through the Pan Government Agreement (PGA) as 1sq km tiles in TIFF format, covering the entire project area.

Three HERs hold photographic collections for the North Pennines project area, namely Cumbria, Northumberland and Durham, with Cumbria forming the majority. Typically NMP projects consult these sources, but after a quantification assessment using available catalogue descriptions, comparing against features mapped from other sources, it was decided not to access the HER photographs.

Commissioned photography

Vertical photography at a resolution of 25cm was commissioned for the project from Infoterra Global Ltd covering approximately 96sq km of the NMP area (Fig 3). The photography was captured on 12th April 2009 and was provided as orthorectified 1sq km tiles in TIFF format. In addition to this the original un-rectified frames were provided digitally as TIFF files and as prints for viewing stereoscopically. The orthophotography was accurate to within ± 11 cm RMSE in x and ± 13 cm RMSE in y. Although both RGB and colour-infrared photography was captured, only the RGB imagery was utilised. The colour balance of the photography was altered in Adobe Photoshop by Infoterra to enhance the appearance of archaeological features, particularly lead mining dressing waste and spoil heaps. In the object data table (see APPENDIX 3) and AMIE this was referred to as 'Miner-Farmer Imagery'.

Lidar

Airborne lidar was commissioned for the project from Infoterra Global Ltd. This covered approximately 96sq km of the NMP area (Fig 3). The data was captured on three occasions between 2008 and 2009. Both Digital Surface Model (DSM) and Digital

Terrain Model (DTM) data at a resolution of 50cm were provided as 1sq km tiles. The accuracy of the lidar was better than $\pm 15\text{cm}$ RMSE in z and $\pm 24\text{cm}$ RMSE in x & y. Gridded ASCII data were converted to rasters in ESRI ArcMap which were added as raster surfaces in AutoCAD Map 3D. Applied Imagery's Quick Terrain Modeler was used to convert the ASCII data into Quick Terrain (.qtt) format files.

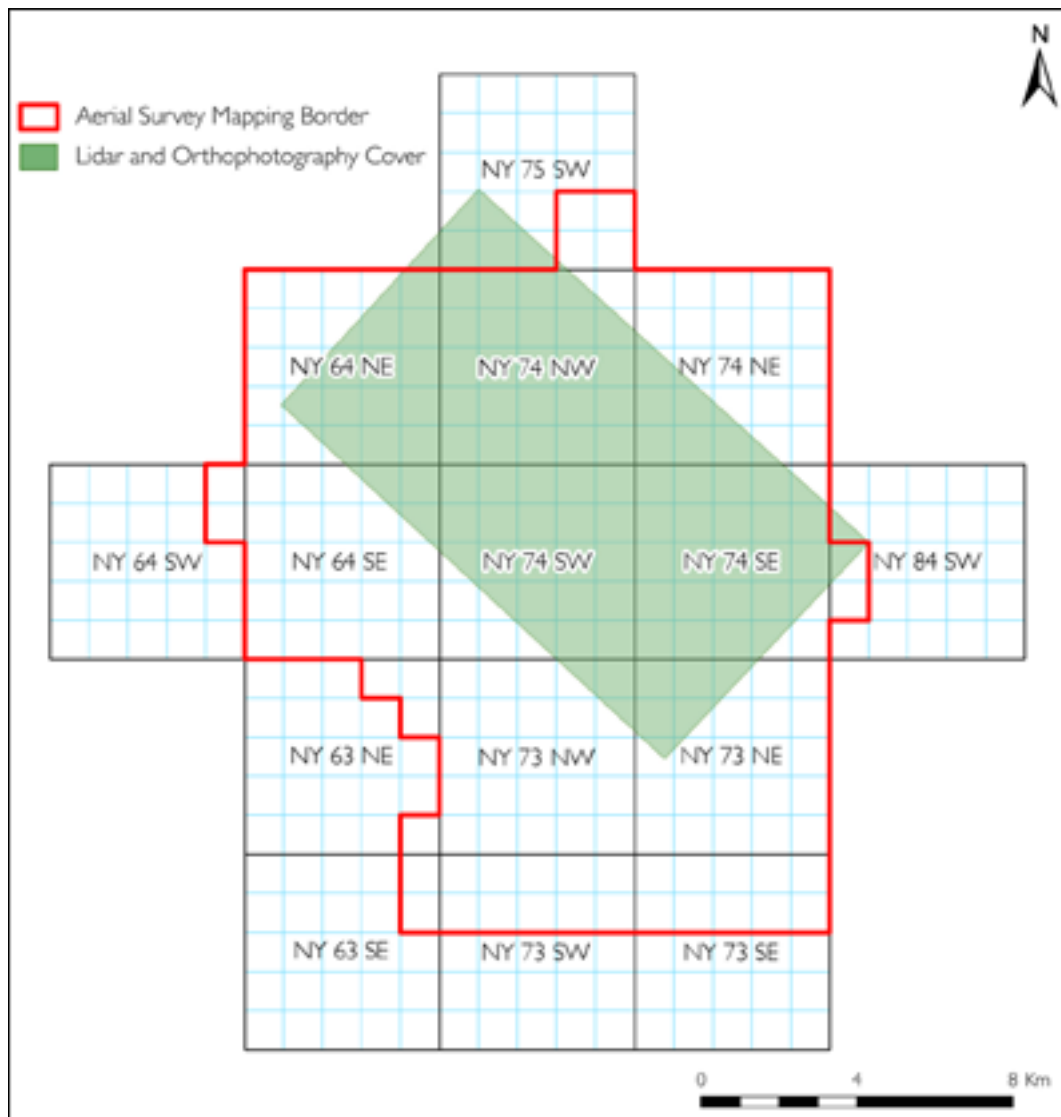


Fig 3: The commissioned orthophotography and lidar covers approximately 96sq km of the 234sq km NMP area.

Monument data

The English Heritage National Monuments database, AMIE, was consulted as were the HERs for Cumbria, Northumberland and Durham.

Additional sources

Other sources used to aid interpretation were available via English Heritage's WebGIS datasets, including historic Ordnance Survey maps. 1:50,000 scale geology maps were also consulted.

Some survey work had already been done in the project area. The results of two survey projects were migrated into the AMIE database and many of the monument records created were enhanced by the aerial survey mapping and recording. The RCHME: North Pennines Industrial Archaeology project (AMIE Event UID: 922755), examined first and second edition Ordnance Survey maps and the Northumberland/North Pennines AONB Lime Kiln Survey (AMIE Event UID: 1384894) assessed the condition of lime kilns on the ground.

Other higher level surveys, for example, the 1992–3 survey of the scheduled mines at Nenthead (RCHME: Nenthead Survey, AMIE Event UID: 1011955) and the 2009 survey of Whitley Castle (AMIE Event UID: 1517799), were used to aid mapping and interpretation.

METHODOLOGY AND RECORDING

Mapping methods

The mapping conventions broadly adhered to NMP methodology but the accuracy and level of depiction exceeded normal NMP specifications due to the high level of detail and geospatial accuracy afforded by the use of lidar and orthophotography.

Evaluation

- Where possible, air photographs were viewed stereoscopically and under magnification. There were no prints of the PGA orthophotography so this was viewed digitally on screen. The interpreter could alter the colour balance of the PGA orthophotography in Adobe Photoshop to enhance the appearance of some archaeological features.
- Quick Terrain Reader was used to view and manipulate the lidar data in a 3D environment. It was used alongside AutoCAD Map on dual screens to inform the interpretation and depiction of archaeological features from lidar.

Rectification

- Oblique and vertical photographs were scanned and then rectified using the specialist AERIAL 5.29 software. Control was derived from the commissioned 25cm resolution orthophotography. Outside the area of the commissioned imagery, control was derived from 25cm resolution PGA orthophotography.
- Topographic information derived from the 5m interval contour data supplied to English Heritage by Next Perspectives™ through the PGA was used in AERIAL to improve the accuracy of rectification.
- Rectification of photographs is normally within $\pm 2\text{m}$ of the source used for control but in areas with large topographic variation this may be higher.

Mapping

- Features were mapped in AutoCAD Map 3D. The mapping conventions and the layer structure used are summarised in APPENDIX 2.
- Georeferenced orthophotography and rectified images were inserted into AutoCAD where archaeological features were mapped.
- Lidar data were added as raster surfaces in AutoCAD where archaeological features were mapped. Hillshading and vertical exaggeration were manipulated in 2D model space.

Recording

- All mapped features were recorded in the English Heritage National Monuments Record database, AMIE. New records were created or existing monument records were amended, following NMR Heritage Datasets: Monument Recording Guidelines.
- The RCHME: North Pennines Industrial Archaeology project (AMIE Event 922755) had created several records covering large areas. Where appropriate, records covering smaller areas were created as child records and linked to the appropriate parent record.
- Where possible, concordance between the HER data and AMIE records was made; this is identified as an SMR number in the Other Identifiers field. However, no facility exists to comment on HER records that were not verified by the project.
- Within the AutoCAD drawing files monument data was also recorded in an object data table (see APPENDIX 3).
- The latest known condition of the monuments was assessed from the lidar or latest available photography. This was recorded in the EVIDENCE_2 field in the object data table in AutoCAD (see APPENDIX 3) and in AMIE.

Quality Assurance

- Each team member had the mapping and recording for at least 1sq km checked by another member of the Aerial Survey and Investigation team.

PROJECT ROLES

Mapping and recording were carried out by Yvonne Boutwood, David Knight, Jane Monk, Matthew Oakey and Sally Radford of English Heritage's Aerial Survey and Investigation team. Tara-Jane Sutcliffe participated as part of the English Heritage Professional Placements in Conservation (EPPIC) scheme.

Yvonne Boutwood managed the day to day running of the project and Dave MacLeod retained responsibility for line management of the team.

DATA ARCHIVE AND DISSEMINATION

Copyright

The copyright of the aerial survey mapping and associated records produced by this project lies with English Heritage. Permission to reproduce and publish any of this material must be sought from NMR Enquiry and Research Services, National Monuments Record, The Engine House, Fire Fly Avenue, Swindon, SN2 2EH. Licence to use the data extends to project stakeholders under the ALGAO agreement or by agreement with the NMR.

Project archive

This project produced 15 AutoCAD Map drawing files, one for each partial or complete Ordnance Survey 1:10,000 quarter sheet (see APPENDIX 1). Copies of the digital drawing files are deposited in the archives of the NMR in Swindon. Aerial Survey and Investigation York also retain copies of the digital files for day-to-day access.

Project dissemination

The data and results of the project were disseminated in a number of ways to a wide range of audiences, during the project. Progress reports and presentations were made to the Project Board and conferences attended by English Heritage teams, stakeholders and other professionals provided a wider forum. Results were also disseminated to community groups through workshops as part of the AONB's 'Altogether Archaeology' initiative.

Some of the NMP project highlights and the Summary Report can be found at <http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/national-mapping-programme/npaonb-nmp/>

The data have been supplied to project stakeholders, Cumbria, Durham and Northumberland HERs and North Pennines AONB Partnership. The digital mapping was exported from AutoCAD Map in ESRI Shapefile format. The monument records created and amended in the AMIE database were output as PDFs and via Discoverer Plus as Excel tables and in CSV format. The AMIE records created by the project will be available to professionals and the public via PastScape <http://www.pastscape.org.uk/> and signposted via Heritage Gateway <http://www.heritagegateway.org.uk/gateway/>.

A parent project GIS has been created and is in the process of being populated, combining the aerial survey shapefiles with the datasets from the other project modules, enhancing the research capability of the GIS. The digital mapping, monument records and polygons have also been imported into English Heritage's corporate GIS, where they can be displayed against other archaeological datasets, facilitating research for internal English Heritage teams.

GEOLOGY, TOPOGRAPHY AND MODERN LAND USE

The project area falls within an upland area of the North Pennines designated an Area of Outstanding Natural Beauty (AONB). It forms part of the Alston Block centred round the confluence of the rivers Nent and South Tyne (Bulman 2004, 1–10; Natural England 2011; North Pennines AONB 2009).

The plateau, reaching 880m in places, is incised by glacial valleys, meltwater channels and smaller streams, creating a topographic pattern of upland moorland and dales. The underlying Carboniferous rocks, form a sequence of limestones, sandstones, shales and coal seams, known as the Yoredale cyclothem. Glaciation and differential weathering of these strata has given rise to distinctive stepped slopes, particularly evident in the Nent Valley. Here the south to south-west facing valley side has stepped benches, which contrasts with the opposite side, which is blanketed and smoothed by glacial till deposits. Alluvial terraces are also noted for the River Nent and River South Tyne (Clarke 2008, 41).

Igneous intrusions into the faulted Carboniferous rocks have given rise to exceptionally rich mineral veins, providing valuable lead and zinc ores with fluorite, barytes and witherite gangue minerals. These have been extensively exploited and at their peak in the 18th and 19th centuries the Alston Moor lead mines were the leading producer of lead ore in the world. These industrial mining remains are one of the key characteristic aspects of this landscape (Natural England 2011). The Carboniferous rocks have also been exploited for stone resources and disused limestone and sandstone quarries scar the landscape.

The landscape of the North Pennines is very distinctive with high moorland ridges covered with extensive areas of peat blanket bog with heather and acid grassland, managed for sheep and grouse. These areas remain largely unenclosed, except the moorland fringe which has regular parliamentary-type enclosure dating from the 18th and 19th centuries. In contrast, the dales are characterised by pasture and hay meadows enclosed by drystone walls that mark the current agricultural limits. The valleys have waterlogged clay soils with fertile brown earths on the valley floors and alluvium or glacial sands and gravels on the narrow floodplains. In this context archaeological remains may survive as earthworks, but if levelled there is little potential for cropmark formation. Trees and woodland are sparse, mainly restricted to the valleys and along watercourses and the largest areas are coniferous plantations.

The pattern of settlement is characterised by dispersed farmsteads and small villages or hamlets located in the dales and on the moorland fringes. The market town of Alston is situated at the confluence of the rivers Nent and South Tyne and represents the largest settlement within the project area.

SUMMARY OF RESULTS

The following is intended to give a brief overview of the archaeological features recorded by the aerial survey mapping on a broad period-by-period basis. It is not intended as a comprehensive list of sites. The majority of archaeological remains that were seen on historic aerial photographs were earthworks, with most surviving in that condition to the present day. A complete list of monument types recorded by the project can be found in APPENDIX 4. Where references are made to specific sites these are followed by their AMIE UID numbers.

The archaeological features recorded range in date from the later prehistoric to the 21st century. New records were made for 1,865 sites and a further 505 existing records were enhanced. The morphology of features was primarily used to date sites as few excavations have taken place. Where a narrow date term could not be attributed to a feature, broader date terms such as 'later prehistoric/Roman' were used.

Selected highlights of the project have been published elsewhere (Oakey 2010; Oswald and Oakey 2011).

The contribution that the aerial survey mapping (Module 1) has made to the overarching aims and objectives of the Miner-Farmer Landscapes of the North Pennines AONB project (Ainsowrth 2008, 4) are summarised in APPENDIX 5.

LATER PREHISTORIC AND ROMANO-BRITISH

The aerial survey mapping has greatly enhanced our knowledge and understanding of the later prehistoric, Iron Age and Romano-British periods in the Alston Moor area. Very few sites had existing HER or AMIE records which had sometimes led to the misconception that it was a largely unpopulated landscape (Robertson 2002, 5). Remains are broadly characterised by settlements and field systems suggestive of arable cultivation and livestock management.

Funerary monuments

Round mounds or cairns of Early Bronze Age date are widespread in the north-east, occurring singly or in groups (Tolan-Smith 2006). It is perhaps not surprising then that the Bronze Age within this project area is almost exclusively represented by these funerary monuments, specifically six round cairns.



Fig 4: Two Bronze Age round cairns to the west of Ayle (looking south). NMR NY 7049/21 20681/08 10-SEP-2007 ©English Heritage. NMR.

To the west of Ayle, a group of three scheduled Bronze Age round cairns (15072) are visible as low turf covered mounds on a prominent natural bench overlooking the River South Tyne (Fig 4). The largest of these (situated at NY 7073 4921), with a diameter of approximately 24m, is also the highest at 343m OD. These two characteristics ensure it maintains a relatively imposing position in the landscape. The second round cairn of this group is located 203m to the west of the first, at NY 7054 4929 and at a height of 334m OD. It has a markedly oval form, measuring approximately 10.5m by 6m, most likely resulting from a period of over-ploughing during the medieval period for ridge and

furrow cultivation (1538022). Excavations of the round cairn were undertaken in 1935. A number of finds were recovered including, a crushed food vessel, a gold earring, and flint implements; though no bone fragments were found (Maryon 1936, 207). The third round cairn of this group is located at NY 7086 4911 at a height of 339m OD and has a diameter of approximately 6m. Excavations, again in 1935, uncovered a cist (ibid). The fact that archaeological excavations have occurred make them atypical in the context of the North Pennines.

A second group, formed of two probable Bronze Age round cairns, was newly discovered on lidar as part of this research. The cairns are defined by a low turf mound and sit on a natural bench overlooking the River Nent at heights of approximately 405m (Fig 5). The first of the pair of round cairns (1536000) is situated at NY 7482 4706 and measures approximately 13m in diameter. The second (1536003), is smaller and measures approximately 5m in diameter. The similarities of both form and topographic location, when compared to the previous known cairn group (described above), give credence to their interpretation as funerary monuments.

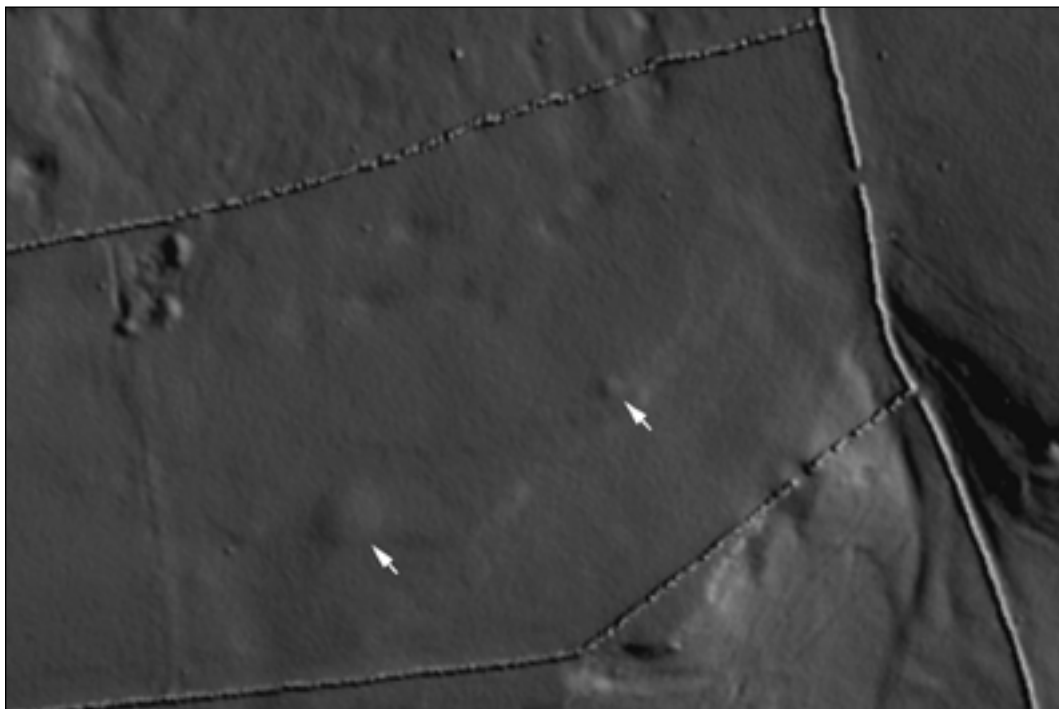


Fig 5: Two newly discovered Bronze Age round cairns overlooking the River Nent at West Foreshield (north is to the top of the image). LIDAR NY7447 DSM 01-APR-2009.

Finally, a known isolated round cairn (13752), was recorded, situated on a prominent ridge, Benty Hill at NY 6692 4306. The cairn is visible as an exposed stone mound on air photographs measuring approximately 7.5m in diameter, with evidence for the remains of an outer kerb along the southern edge. Comparisons with another recently excavated cairn at Birkside Fell, Weardale, can be drawn, where a kerb, formed of substantial boulders, survives along its southern edge (Tolan-Smith 1997 and 1998). The Birkside Fell excavation led to the recovery of an excellently preserved Collared Urn containing about

2kg of cremated bone, which were radiocarbon dated and confirmed the burial occurred during the earlier part of the 2nd millennium BC (Tolan-Smith 2005, 59).

Potential henge at Rotherhope

An unusual circular 'enclosure' comprising two concentric rings of ditch with outer bank, and a central, circular, depressed area was mapped from lidar (I518507) (Fig 6) having previously been recorded from air photographs within Cumbria's Historic Environment Record (Cumbria HER UID 6236). The outer ring measures 95m by 83m in diameter, although the eastern extent of the enclosure is not fully visible. The feature is centred at NY 7217 4243 and is located on the strip of land between Dry Burn and Little Dry Burn. Hollow ways crossing Dry Burn through, or close to, the enclosure are presumably later in date and are therefore recorded separately (I518722). The form of the monument is curious, and with no parallels within the wider project area to draw from, a broad later prehistoric date was attributed.



Fig 6: A potential henge, east of Rotherhope Farm (north is to the top of the image). LIDAR NY7242 DSM 01-APR-2009.

In November 2010 a large-scale (1:1,000) analytical earthwork survey and geophysical survey were carried out at the site as part of Modules 3 and 4 of the Miner-Farmer Landscapes of the North Pennines AONB project. Published results from the geophysical survey suggest that the earthwork's outer enclosure is not entirely circular in form and provides some tentative evidence for interruptions in the ditch circuit (Payne 2011, 4), although these findings were not corroborated on the lidar and air photographs. This, combined with a possible compartmentalised outer bank construction represented in the earthwork survey, has led to the interpretation of the feature as a hengiform monument

dating to the Neolithic period (D McOmish, pers comm).

Settlements

A total of 30 enclosures that have been attributed later prehistoric to Roman dates are recorded within the project area and a further three sites consisting of multiple conjoined enclosures have also been identified. Most of these enclosures have been dated to the Iron Age/Roman period based on their morphology although some may have origins in the Bronze Age. Some 25 sites have been interpreted as settlements, commonly when they contained internal features such as hut circles or platforms. While some of these settlements occur in isolation, others are in direct association with extensive field systems of contemporary date. Four tentative unenclosed hut platforms, possibly representing Bronze Age settlement, have also been identified.

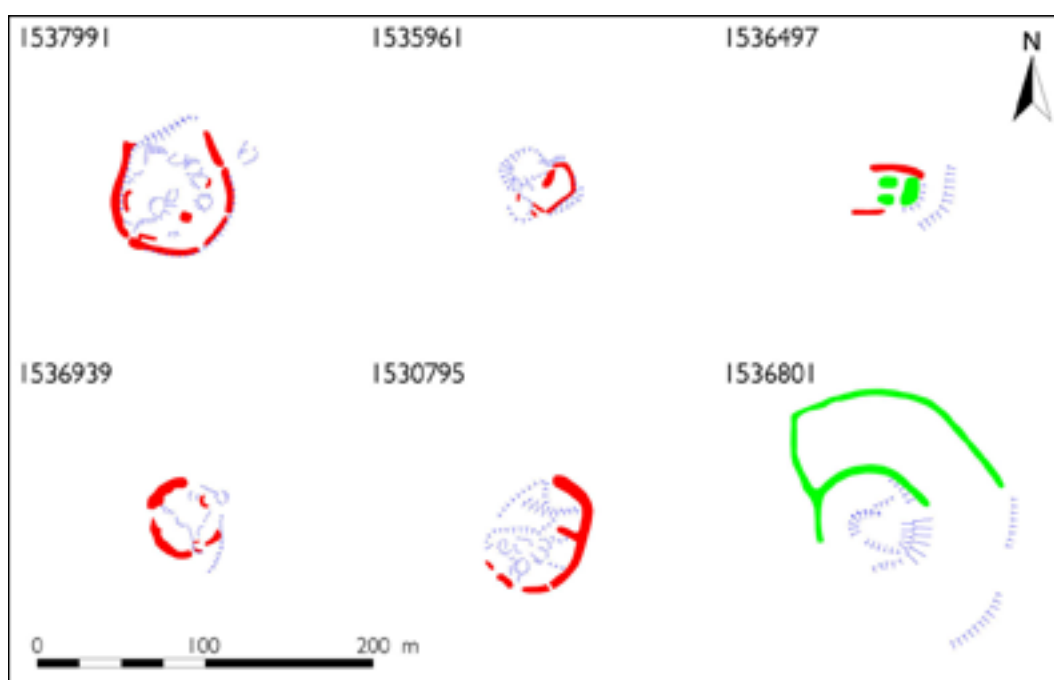


Fig 7: Examples of later prehistoric/Roman settlement sites.

The great majority of enclosed settlements are defined by a bank. The apparent absence of a ditch in many instances suggests this is likely to represent the collapsed remains of a rubble wall. Morphologically they range from simple curvilinear enclosures to more complex forms incorporating subdivisions, scooped areas and platforms (Fig 7).

Traces of hut circles or platforms have been identified within 11 of the settlement enclosures. Hut platforms are the most common, with diameters ranging from approximately 5m to 10m and usually taking the form of a terrace cut back into the slope with a crescent shaped scarp on the downslope side (Fig 7). This form of construction reflects the fact that the settlements are often placed on sloping sites. Whether these internal structures represent a single phase or successive phases of construction within the settlements can usually only be clarified through excavation or, in some instances,

analytical field survey. Similar forms of settlements with hut platforms have been identified in the Yorkshire Dales and the orders. Excavation often reveals complex sequences, such as at Healaugh, Swaledale where evidence from the Late Iron Age to Romano-British periods and perhaps beyond was identified (Fleming 1998, 149-53). It would not be unreasonable to suggest that similar sequences are likely to exist in the North Pennines.

Scooped elements are evident at some of the settlements such as Ayle (1537991) and Howgill Rigg (1535961) where the creation of levelled areas in this way was a practical solution to the sloping topography. It is possible that these can be placed in the category of 'scooped enclosures' identified in Northumberland by Jobey (1962) which are likely to date to the Late Iron Age or early Roman period (Cunliffe 1991, 289).



Fig 8: The well preserved remains of an Iron Age/Roman settlement site, near Ayle (looking north-west). NMR NY 7149/9 NMR 20681/1 10-SEP-2007 ©English Heritage. NMR.

Probably the best preserved of the settlements is at Ayle (1537991) (Fig 8). Here the enclosure is cut back into a natural slope and defined by a broad bank. It contains a stepped series of hut platforms, possibly arranged around a central courtyard. The plan of the enclosure appears to be D shaped, and therefore possibly unique for the survey area, but equally may be the consequence of later ploughing along the northern side.

The settlement at Low Bayles (1536497) is one of the few sites that could be described as rectilinear in form. Land improvement regimes have severely denuded the enclosure to the point at which it is only just visible on lidar when lit from a shallow angle. As far as can be discerned, the form of the enclosure is three scooped areas with traces of a

broad enclosing bank. This is reminiscent of another form of enclosure identified by Jobey (1960) which he termed type 'A' and are assumed to be Roman in date.

Another distinctive settlement is at Fairhill (1536939) where three curvilinear enclosures are located within a broadly contemporary field system. The southernmost, and best preserved, of these is circular in plan, defined by a broad bank and contains at least five hut platforms. This enclosure stands out because of the regularity of its form and may have a parallel in the enclosure at Forcegarth Pasture South in Upper Teesdale (Fairless and Coggins 1986). Excavation here provided firm Roman dates although the authors describe the settlement as 'Roman in period yet Iron Age in culture'. The circular plan is also reminiscent of some palisaded enclosures identified in Northumberland such as High Knowles (Jobey and Tait 1966) and Northfieldhead Hill (Topping 2008, fig 3).

The settlement at Whitlow (1530795) is of particular interest because of a close morphological similarity with a site that has recently been excavated at Glencoyne Park, Cumbria, where radiocarbon dates from 200 BC to AD 200 are recorded (Hoan and Loney 2010, 101). The Whitlow settlement is defined by an ovoid banked enclosure situated on a gentle south-east facing slope on the northern bank of Gilderdale Burn. A number of densely spaced hut platforms are visible, terraced into the slope along with other terraced or embanked divisions. The close similarity with the Glencoyne Park example would suggest that Whitlow can be dated to the Iron Age/Roman period with a degree of confidence.

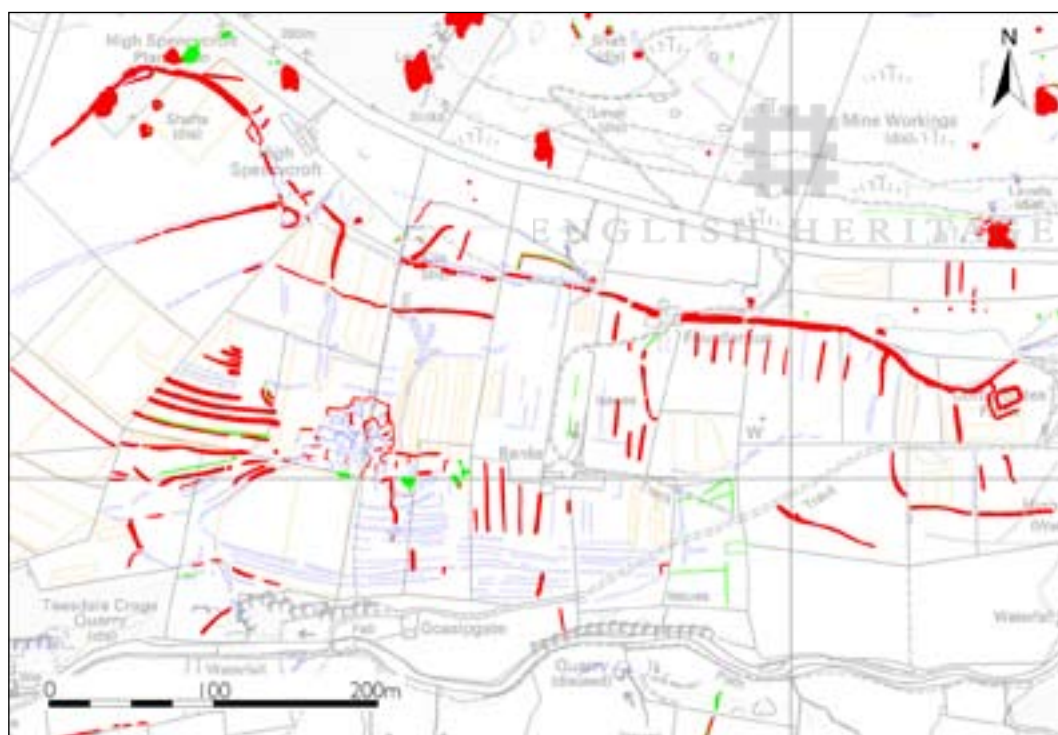


Fig 9: A plan of the extensive earthworks north of Gossipgate. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

Harbut Lodge (1536801) is unusual in the context of the settlements in being ditch rather than bank defined. In terms of size, the settlement is comparable to others within the survey area, measuring approximately 70m across. It is also curvilinear in form with traces of internal disturbance including a scooped area. An additional distinguishing feature is the large annexe appended to the north-east side which is unique to this site. The most probable function of the annexe was for the corralling of livestock, a practice that must have been carried out at other sites, though it is unclear why this is the only settlement to exhibit this form.

The Rotherhope monument aside, only two other enclosures (1521640 and 1521599) are ditch-defined, both being curvilinear in form with an internal bank and no traces of internal features. The construction of ditched enclosures may have been influenced by the depth of soil, the need for drainage or the localised paucity of stone suitable for rubble wall construction. Alternatively it may have been a convenient form of boundary if a substantial wall or bank was not required. The possibility also exists that other enclosures or settlements may have also had ditched elements which may exist in a less well preserved state.

The settlement at Gossipgate (1537041) is unique within the survey area both in terms of its size and complexity. It is irregular in plan and is formed by several conglomerated enclosures, commonly defined by scooped areas cut back into the slope (Fig 9). The remains of nine hut platforms were identified from the air photographs and lidar but subsequent field survey (Modules 2.2 & 3) has potentially increased this number to 47 (Oswald and Oakey 2011, 21). The complex and accreted nature of Gossipgate indicates that the settlement as we see it is the result of several phases of development and

expansion. It is also possible that the site continued in use into the post-Roman period. The continued use of some of the settlement sites beyond the Roman period would certainly be logical. Gates (2004, 22) has suggested that this could be the case at some sites along Hadrian's Wall and other examples have been identified elsewhere in the region (Brennand 2006, 97).

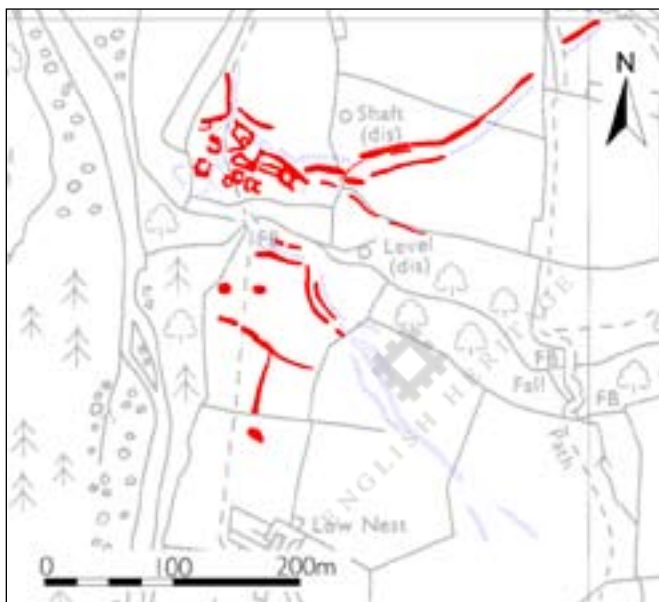


Fig 10: A plan of the earthworks at Annat Walls. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

The only other site that exhibits a comparable pattern and form lies to the south-west of Annat Walls (1525633) (Fig 10). Although smaller than Gossipgate, the settlement is defined by a series of rectilinear enclosures or

platforms and has similar conglomerated nature. Another similarity is the presence of two broad hollow ways or drove ways leading to the settlement which have been interpreted as being contemporary.

Why these larger scale settlement complexes occur can only be speculated and would require a precise understanding of the chronologies of occupation at all of the settlement sites. It is possible that they represent a nucleation of the surrounding population or even a repopulation of the area after a period of abandonment of the discrete settlements. Topping (2008, 360) has speculated that an improvement in climate and resultant intensification of arable cultivation in the Late Iron Age may have related to the development of 'proto-villages' in the south-east Cheviots. Their form may also reflect their function, with elements of the sites being used as stock corrals and the presence of hollow ways could also lend weight to this argument.

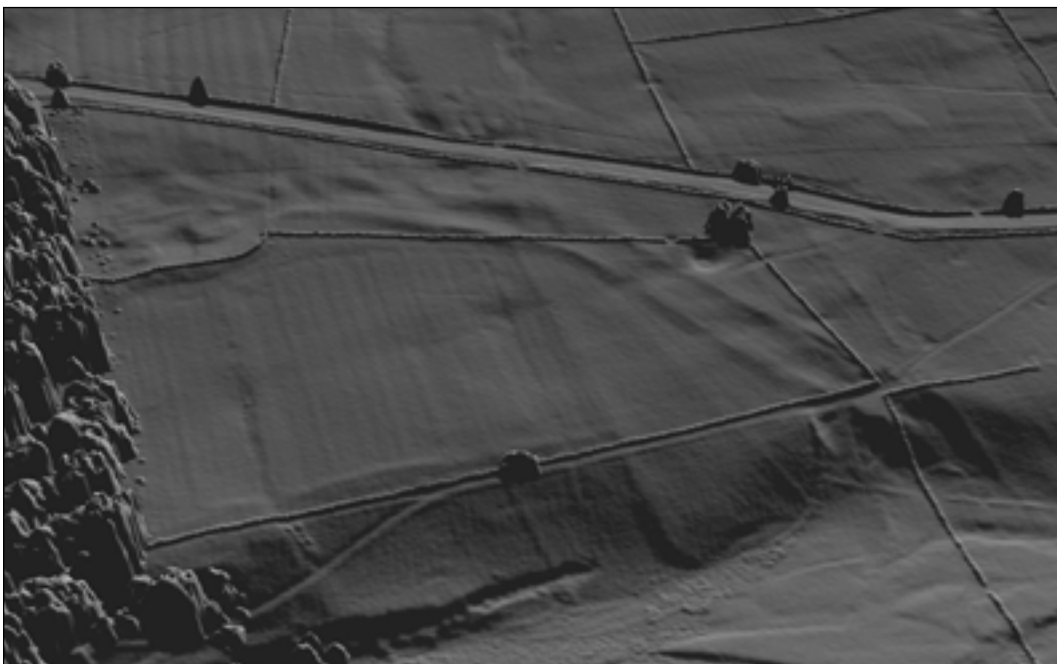


Fig 11: Parallel banks define a droveway which heads towards the south-east facing entrance to the settlement, located to the north-west of Lowhouses Bridge. LIDAR NY7342 DSM 01-APR-2009.

Evidence for hollow ways associated with settlements has been identified at a small number of sites but one settlement (1520413) is worthy of note (Fig 11). Here the enclosure has an entrance approached from the south-east by a double bank defined trackway or droveway, presumably to control the movement of stock. This could be considered a 'banjo' type enclosure and similar examples such as Thorny Hill, Cumbria (927851), which was mapped as a cropmark by the Hadrian's Wall NMP project, have been identified in the region.

Field systems

Areas of field systems still survive as earthworks, notably in the South Tyne Valley below Ayle Common and the Nent Valley below Newshield Moss (Fig 12). It is certainly the case that the field systems must once have been more widespread and would likely have occurred in association with more of the settlement enclosures than noted above. While some areas will have been levelled by subsequent ploughing and pasture improvement regimes, other elements are likely to have persisted and become incorporated into later land divisions, it is certain that the piecemeal survival of field system remains will inevitably bias any analysis.

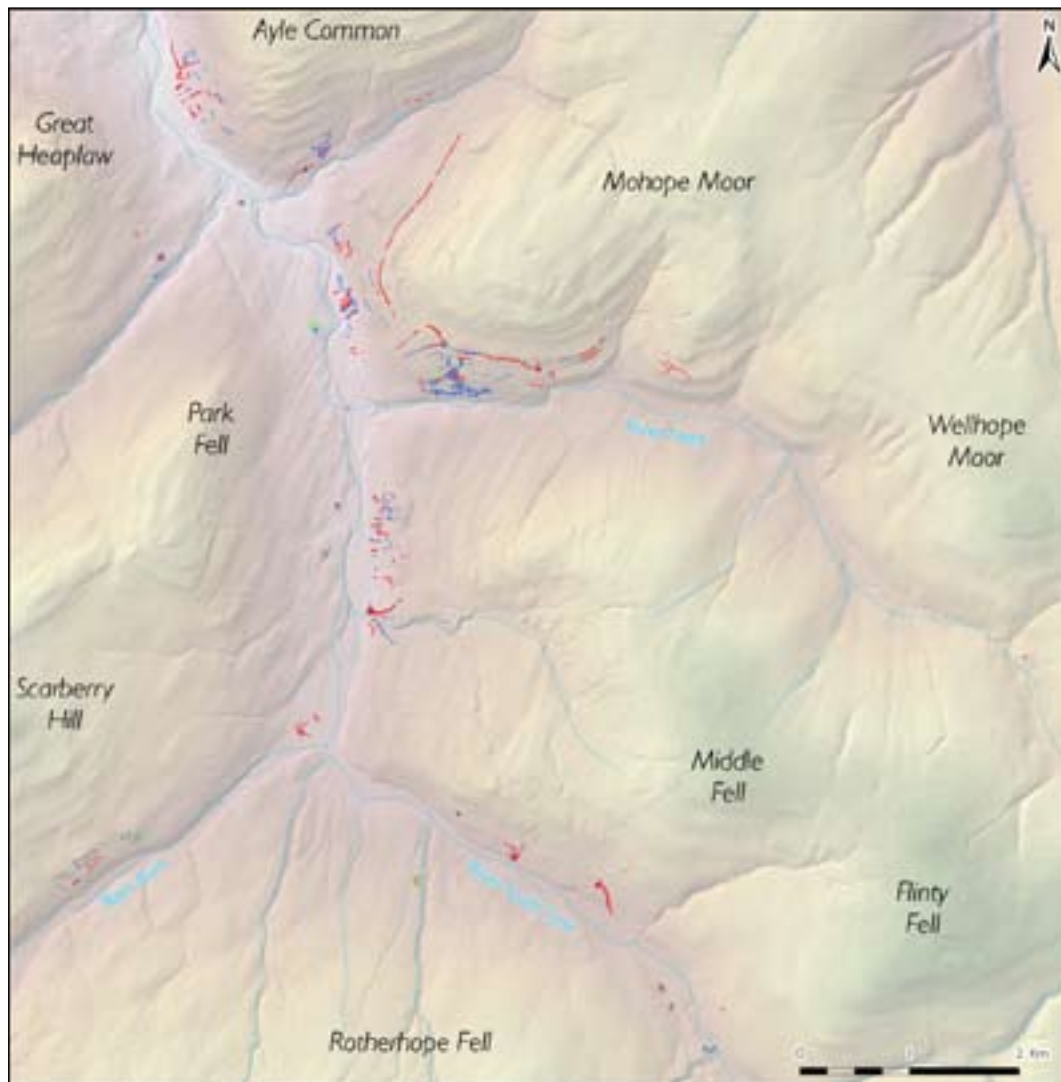


Fig 12: Later prehistoric/Roman settlements and field systems. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

The field systems identified by the project are most commonly defined by positive and negative lynchets, a reflection of the steep, valley side topography. In places clearance cairns have also been identified and these are sometimes incorporated into the field

boundaries. The field systems have generally been attributed a later prehistoric/Roman date as it is considered possible that elements of the systems may have originated in the Bronze Age. In an interesting contrast to other parts of Cumbria and Northumberland, there is no evidence for cord rig cultivation. A possible explanation for this could be that later ploughing and land improvement regimes levelled these relatively slight remains whilst leaving the more substantial lynchets unlevelled.

To the north-west of Kirkside Wood is a system of small, irregular fields defined by a combination of rectilinear negative lynchets and broad positive lynchets (1536956). Elements of the negative lynchets are overlain by later ridge and furrow but other areas of ploughing appear to respect the lynchets. The positive lynchets and embanked boundaries are most marked on the slightly steeper slopes and their form suggests that they have been enhanced and remodelled by later ploughing episodes. No evidence of associated settlements can be seen apart from a tentative unenclosed hut platform.

A similar form of field system can be seen at Fairhill (1536939) where traces of irregular fields defined by negative and positive lynchets are visible. Here the field system is predominantly laid out as a series of broad east-west aligned embanked boundaries. These are probably largely formed by ploughing but the presence of several cairns, some of which are incorporated into the boundaries, suggests that they were also formed by stone clearance of the fields.

Unlike at Kirkside Wood, the Fairhill system incorporates a linear arrangement of three curvilinear enclosures. The subtleties of the chronology at this site are not clear from the remote sensing data, the settlements and field system must be broadly contemporary though it is possible that the settlements were superimposed on a pre-existing field system. The enclosure group to the south (1525633) may also have been laid out with respect to the orientation of the field system.

At Tynedale a subtly different form can be observed with the field system characterised by broad lynchets running obliquely down slope (1536677). This is in all probability due to the local topography dictating the most efficient direction to plough. Here again two settlements with the remains of hut platforms can be seen in direct association with the lynchets and there is also a possible unenclosed hut platform. Traces of further lynchets can be seen to the north, much denuded by post medieval narrow ridge and furrow (1536695). Although these are now separated from the lynchets to the south by roads and woodland, they must almost certainly have once been part of the same field system.

At both Gossipgate (1537041) (Fig 9) and Ayle (1537991) traces of narrow terraces have been recorded running along the contours on the very steep slopes of the valley side. These are as narrow as 1.5m wide in places, suggesting cultivation by hand rather than with animals, and so have been attributed a pre-medieval date (Oswald and Oakey 2011, 20). A direct association between the terraces and the settlements is assumed at both sites. At Gossipgate another system of parallel field boundaries (1537249) was identified to the south of a head dyke (see below) defining plots of land between 19m and 24m in width. No clear stratigraphic relationship could be identified between these boundaries and the Iron Age/Roman features so they were attributed a medieval/post medieval date.

It is not improbable, though, that they are a coaxial field system which is contemporary with the settlement. Similarly regular field systems of comparable width have been identified in the Yorkshire Dales such as Halton Gill (591506) and are presumed to date to the later prehistoric or Roman periods (Horne and MacLeod 1995, 36).

Other areas of field system are less clearly defined. On the northern valley side of the river South Tyne between Garrigill and the Black Burn is a very dense system of field boundaries dated to the medieval and post medieval periods. Nine settlements and enclosures dating from the later prehistoric to Romano-British periods are embedded within this system but while the relative phasing of some of the boundaries was possible from the lidar data, only boundaries that appeared to have a direct association with the enclosures were attributed a pre-medieval date. It is highly likely, however, that other field boundaries are fossilising boundaries that were also contemporary with the enclosures.

Two field systems exhibit a different form of construction to the broad banks and lynchets that characterise the remains elsewhere. At Black Burn (1301139) are a series



Fig 13: Curvilinear field boundaries and enclosures defined by stone banks at Black Burn (north is to the top of the image). Next Perspectives PGA Imagery NY6942 30-MAY-2009. Aerial Photography: Licensed to English Heritage for PGA, through Next Perspectives™.

of curvilinear field boundaries and enclosures defined by stone banks, some of which are partially turf covered (Fig 13). It is possible that some or all of the boundaries actually date to the medieval period and are associated with sheep folds at the same location but a possible parallel for this site could be Simy Folds in Upper Teesdale where it has been suggested that some of the curvilinear boundaries could have their origins in the Bronze Age period (Coggins *et al* 1983).

Another curvilinear, bank defined field system is located at NY 7443 4713 (1536475) although it is unclear whether this is constructed from turf or has a rubble core. It is again possible that this may be medieval in date like those at Greenber Edge, Wensleydale (1054851). The form of these systems is quite probably due to function, presumably management of stock rather than arable cultivation.

Landscape setting for settlements and field systems

The settlements and field systems are almost exclusively located along the river valleys of the Nent and South Tyne, commonly on south or south-west facing slopes which would have received more sun and therefore been warmer (Fig 12). Evidence of settlement is concentrated in a relatively narrow band up to an elevation of approximately 400m OD, which still broadly marks the present day agricultural limit. The lower limit of settlement appears to be no lower than 10m above the level of the rivers, thus remaining above the level of any seasonal flooding. No evidence for later prehistoric or Romano-British settlement has been identified outside of this band on the unenclosed moorland. The locations of the settlements and field systems also tend to correspond with the areas of lighter soils. While the location of settlements on sloping valley sides is a reflection of the limited flat topography, this will also have afforded a degree of shelter.

This apparent distribution could be caused by blanket bog and heather moorland masking archaeological features above the 400m contour. Monuments such as unenclosed round houses and slight field systems that characterise Bronze Age upland settlement in Cumbria and Northumberland would certainly be more prone to this. However, elevations in the range of 274m – 427m commonly mark the limit of known settlement remains from the Bronze Age in Northumberland and Cumbria (Higham 1986, 82). In the south-east Cheviots 400m was identified as the limit to prehistoric agriculture (Topping 2008, 330) while in Upper Teesdale Coggins (1985, 167) proposed 457m as the limit of prehistoric settlement. This range of elevations can reasonably be extrapolated to the North Pennines which suggests that this does represent the genuine extent of the settlements and enclosed fields.

Numerous sections of broad boundary banks have been recorded following the contours of the river valleys which have therefore been interpreted as intake boundaries or head dykes. Apart from one exception at Gossipgate (see below), no firm chronological relationships were identified on the air photographs or lidar data that would indicate a pre-medieval date for these features. They have therefore been attributed a medieval date and will be discussed below (see MEDIEVAL) but they could represent landscape divisions that have persisted for many hundreds or even thousands of years.

Just one of these boundaries has been attributed a later prehistoric/Roman date. The head dyke at Gossipgate can be traced for a distance of over 3km, enclosing the southern and western edges of Newshield Moss. At Corby Gates farm a bank related to an Iron Age/Roman settlement can be seen overlying the head dyke and this provides the only firm example of phasing between the head dykes and a pre-medieval feature. Although the dyke is considered to be a single feature, not all sections are necessarily contemporary. Stretches show with varying degrees of definition but this is likely to be due to a combination of survival and maintenance.

If the establishment of some or all of these boundaries does lie in the pre-medieval period it would mark a very early phase of land division and enclosure. Possible parallels for these dykes have been recorded elsewhere. The dykes noted at Ravenstonedale (Higham and Jones 1985, 85) are morphologically similar to those found in the current project, comprising a broad bank with a ditch on the upslope side. Higham and Jones

(1985) suggest that the ditch was caused by the removal of turf for the construction of the bank but an alternative interpretation could be that they functioned as route ways; the broad, shallow and irregular nature of the ditches may support this. It is probable that both interpretations are, in fact, true and an upslope ditch may also help to control livestock. If it can be demonstrated that these head dykes are pre-medieval this would lend further weight to the argument that the pattern of the known later prehistoric/Roman field systems and enclosures is indicative of their actual limits.

Problems of dating features

The paucity of firmly dated settlements of the later prehistoric within the region has been recognised in other studies (Hoare and Loney 2003; Brennan 2006; Petts and Gerrard 2006) and it has been argued that this has led to an over simplistic attribution of a Romano-British date to most settlements. No previous survey or excavation had taken place on any of the settlements within the project area and the dearth of previous survey and excavation in the North Pennines necessitates looking at adjacent regions such as northern areas of Northumberland for possible parallels.

The use of morphology for dating can be problematic as both curvilinear and rectilinear forms of enclosure have been dated to the Late Iron Age (Hunter and Ralston 1999, 154). Regional variation of pre-Roman Iron Age enclosures in Northumberland has been noted, with curvilinear enclosures commonly found in the Cheviots and rectilinear enclosures further south (Cunliffe 1991, 286; Petts and Gerrard 2006, 39). The assumption that rectilinear forms of enclosure in northern Cumbria are indicative of a Roman date has been challenged (McCarthy 2000, 136) and work in the Scottish Borders has demonstrated that a variety of rectilinear and curvilinear forms are pre-Roman in origin (RCAHMS 1997).

Recent work in the Lake District National Park has indicated a greater degree of continuity of settlement at several sites surveyed than had previously been recognised (Hoare and Loney 2003; 2010). It would be fair to assume that some of the settlement sites identified by the current project have their origins in the Bronze Age, even if the surviving structural elements date from the Iron Age onwards.

ROMAN

Within the project area very few sites, apart from the Roman military features, can be attributed a Roman date, though some settlements and field systems are likely to have continuity from the Iron Age into the Roman period (see above). The Roman military features are primarily represented by the Maiden Way and Whitley Castle (Fig 14). The Maiden Way is a major military road linking the forts of Kirkby Thore in the south to Carvoran in the north (Margary 1967, 393–5). Whitley Castle Roman fort is situated at the approximate midway point of the road. Elements of a civilian settlement, or vicus, survive to the west and north of the fort. The fort has recently been the subject of an analytical earthwork survey and Research Department Report (Went and Ainsworth 2009), so this detail is not replicated here. Only two Roman industrial features have been identified, a quarry relating to the construction of Whitley Castle (first recorded by Went and Ainsworth 2009, 25) and lead workings, tentatively dated to the Roman period, adjacent to the River South Tyne (Raistrick and Jennings 1989, 11).

Military features

The earthworks at Whitley Castle Roman fort (13725) are extensive, occupying a natural knoll situated just west of the Maiden Way, between Castle Nook and Whitlow. The fort's defences survive well as a complicated series of impressive earthworks, consisting of multiple banks and ditches (Fig 15). The fort has a unique lozenge shape, having apparently been constructed to suit the confines of the site's geographic location; a strategic position within the South Tyne Valley. The earthwork ramparts are for the most part clearly defined although partially denuded at the northern most corner where an extractive pit and the remains of the fort's bath



Fig 14: The route of the Maiden Way Roman road passing Whitley Castle Roman fort with secondary Roman roads leading to the fort. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

house are located. Additionally, a single extractive pit and associated spoil heap (1530881) are cut into the ramparts at the southernmost corner, slighting the earthworks at this location. Within the fort, a complex series of earthworks are present, some representing buildings and building platforms. However, at least one of these, and likely more, appear to represent a post medieval imposition. Two post medieval field boundaries cut across the fort and one of these (1530905) extends beyond the fort at the north-western entrance and could be mistaken for the course of the Roman road (1530892), which is offset, to the east.



Fig 15: An air photograph of Whitley Castle Roman fort, revealing the unusual lozenge shape of the ramparts (looking north-west). NMR NY 6948/56 NMR 20677/43 10-SEP-2007 ©English Heritage. NMR.

Earthworks visible to the north and west of the fort appear to represent the civilian settlement or vicus (1530980). Despite the fairly amorphous nature of these earthworks numerous rectilinear enclosures, plots and platforms have been recorded. No evidence for extra-mural settlement was recorded to the south or east of the fort, where medieval ridge and furrow is ubiquitous.

The route of the Maiden Way Roman road (Parent UID 1001823) has been intermittently traced for approximately 11km, between Kirkhaugh and Melmerby Fell. Air photographs and lidar have revealed the road in various states of survival between these two points. Particularly striking on these sources is the section of road to the east of Whitley Castle where a central agger and parallel ditches are noted (1530664). Oblique air photography, taken in 1971, reveals medieval ridge and furrow partially overlying the road so we can surmise that it had fallen out of use by at least this period. Despite this localised evidence for disuse, a post medieval trackway is noted on first edition (1867)

Ordnance Survey mapping on the same alignment between Castle Nook and Holymire, suggesting that parts of the road remained a prominent feature in the landscape. A 55m section of the road appears to have been levelled by an extension to Castle Nook farm subsequent to the 1971 photograph.

Less certain linear earthwork elements, tentatively recorded as the Maiden Way, are situated to the north of Castle Nook Farm towards the Mill Burn at Kirkhaugh (1530584). Though the feature diverts slightly from the conjectured route of the Roman road, it continues the alignment of known sections of the road previously discussed and located to the south (1530664). In addition to the earthwork evidence, the route is demarcated by notably straight post medieval field boundaries and trackways. Unfortunately, it is evident that the feature has been utilised for drainage in its more recent history, leading to some uncertainty in interpretation.

Two additional roads were recorded, both providing access to Whitley Castle Roman fort. The first (1530892) appears to diverge from the Maiden Way in the vicinity of Whitlow, heading north-west towards the southern entrance of the fort. The road runs through the fort and is traceable as far as Lort Burn to the north. The precise location of its junction with the Maiden Way is not traceable on the available air survey sources, having apparently been destroyed by the settlement at Whitlow or by post medieval extraction to the south. The second road (1530959) leaves the fort at the southwest side and is traceable for a short distance through the vicus, where small ditch defined plots lie flanking the road.

Exploitation of mineral resources

There has long been the belief that Whitley Castle Roman fort was located just north of Alston in order to oversee lead production (Petts and Gerrard 2006, 54) and that the Maiden Way was intended for traffic in connection with the mines (Margary 1967, 394). In light of the area's development as a significant centre for lead mining in the post medieval period this would appear to be a sensible conclusion. However, there are substantial problems associated with the identification of early lead mining remains in the North Pennines. Firstly, the total obliteration of these features as a consequence of large-scale post medieval mining and secondly as a consequence of the inherent difficulties in identifying Roman mining remains from their morphology.

It is perhaps not surprising then that the survey has highlighted only one area of lead workings that have been tentatively attributed to the Roman period (1543372). A Roman date for these features was first hypothesised by Raistrick and Jennings (1989, 11) who having visited the site on the ground, discovered high quality ore, but of their associated 'work' camp, this survey found no trace. The workings are situated at NY 7602 3857, south of Hole House on the east bank of the River South Tyne. Their form is atypical when compared to post medieval lead mining in the area, consisting of a series of very shallow irregular surface workings covering an area of approximately 0.6ha. Additionally, they are labelled as 'old workings' as opposed to 'disused' on the 1891 1:2,500 Ordnance Survey mapping. However, although this site could be related to Roman lead mining, no conclusive evidence has come to light in support of this supposition. Easily accessible lead

ore, in loose river gravels, is liable to exploitation throughout all periods of history and pinning down these surface remains to any particular period is difficult without additional supporting evidence.

The only recorded Roman quarry (1530620) is visible as an earthwork on lidar at NY 6911 4859. This had previously been recorded through field investigation (Went and Ainsworth 2009, 25) and is the suggested source of building material for the nearby Whitley Castle Roman fort, located approximately 189m to the east. The quarry is partially masked by vegetation and erosion making interpretation difficult, though the feature covers an area of approximately 1.2ha.

MEDIEVAL

Extensive medieval remains are present within the air survey mapping area, the majority of the recorded medieval features relate to pastoral and agricultural farming practices. The number of positively identified medieval industrial remains is somewhat limited, with only one example of small scale stone quarrying recorded. Documentary evidence indicates medieval exploitation of resources such as lead, coal, and stone, but the remains as seen on air photographs are not morphologically distinct from the post medieval extraction that has been recorded by the aerial survey mapping (see POST MEDIEVAL INDUSTRIAL).

Fields systems

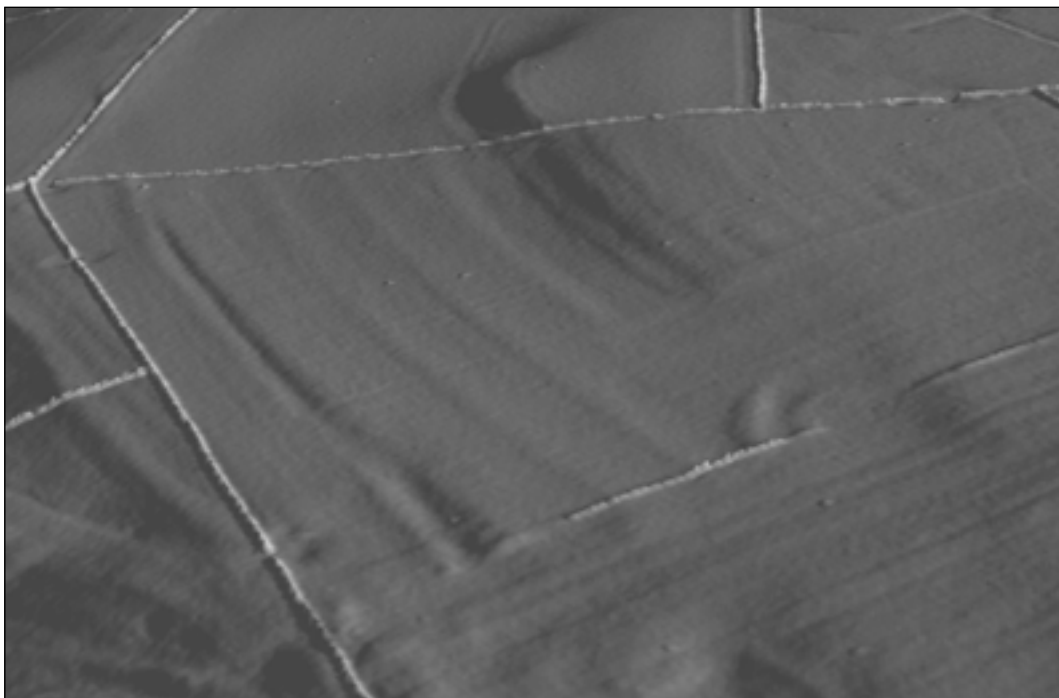


Fig 16: Medieval lynchets adjacent to the Iron Age/Roman settlement site at Gossipgate (looking west). LIDAR NY7247 DSM 01-APR-2009.

Although arable fields are not a major component of the current landscape, traces of ridge and furrow, representing medieval agriculture, are present. The ridge and furrow is largely located on the lower valley sides, below 385m OD with the majority along the River South Tyne, Gilderdale Burn and Ayle Burn. Winchester (2000, 160) suggests that these areas of ridge and furrow represent a high tide of ploughing in the 13th and 14th centuries and notes that by the 17th century, Alston Moor was considered a pastoral area. This cultivation pattern mirrors that seen in the geographically similar Yorkshire Dales NMP (Horne and MacLeod 1995, 24), where almost all the ridge and furrow lies on ground below 366m OD and the frequency decreases further up into the individual dales. The form of medieval ridge and furrow is distinctive; the ridges are 5m or greater and tend to have a simple curving shape. This was a deliberate technique to raise as

much soil as possible into a relatively dry raised bed (ridge), separated from the next by a furrow that helped drain it (Stamper 2009, 341). As the areas of ridge and furrow are largely located on soils subject to seasonal waterlogging (RIVINGTON 2 (541g) and BRICKFIELD 3 (713g) (Soil Survey of England and Wales 1983)), this method of cultivation may have been particularly appropriate in the North Pennines. It is worth noting that some areas of medieval ridge and furrow may have been re-ploughed in the post medieval period.

Medieval lynchets are widespread, distributed along the lower valley sides of the River South Tyne, River Nent, Ayle Burn and Black Burn and sometimes coincident with the ridge and furrow. The lower slopes were presumably cultivated because of the constraints of the steep valley sides and narrow floodplain. The form of these lynchets is exemplified on land overlooking the confluence of the River Nent and River South Tyne, at NY 7228 4707 (Fig 16). Here a system of bank or scarp defined lynchets can be seen (1537052) partially overlain by post medieval ridge and furrow (1537253). The proximity of these lynchets to the Iron Age/Roman site at Gossipgate (1537041) is tantalising and leads to suspicions that the lynchets could have pre-medieval origins. This situation is repeated across the project area, with a medieval or pre-medieval date likely. Without firm evidence to support an earlier date a medieval date was deemed most appropriate considering their association with medieval ridge and furrow and their generally larger form (Taylor 1975, 88–92).

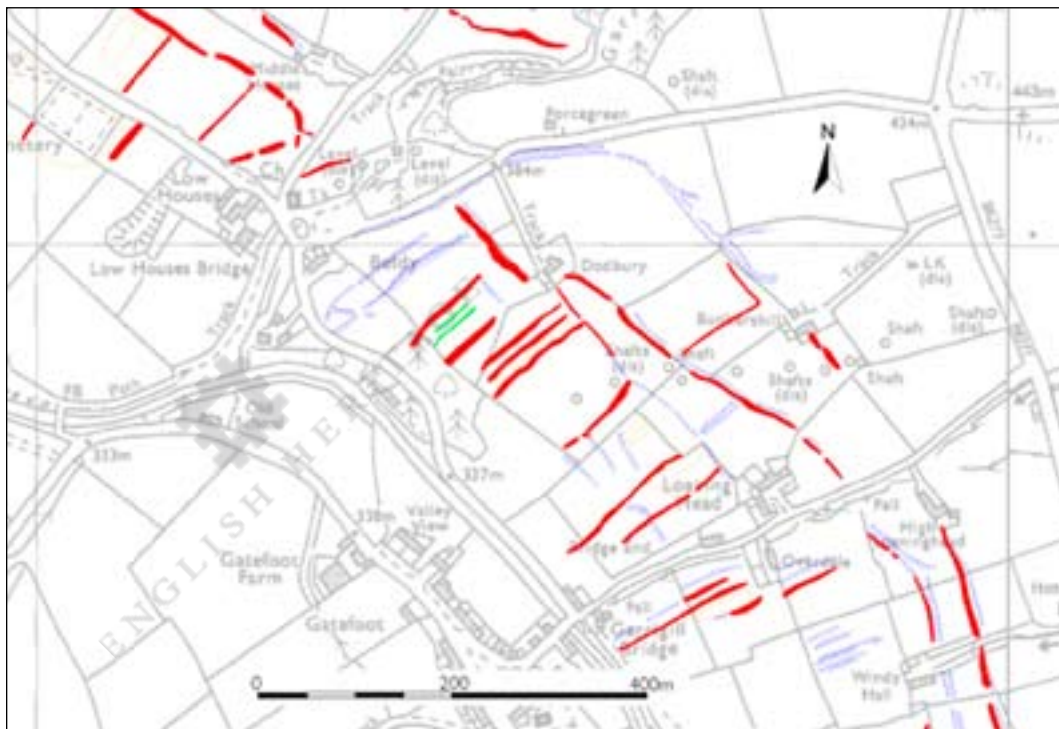


Fig 17: Field boundaries, defined by broad, regularly spaced, parallel earthwork banks are widespread. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

Field boundaries are also prevalent within the river valleys, dating to the medieval period. Of these boundaries, one form is particularly distinctive, being broad, regularly spaced, straight and aligned counter to the contours of the slope (Fig 17). This form is illustrated by an arrangement at Dodbury, centred at NY 7455 4186 (1522266). Here, a regular series of parallel field boundaries defined by banks and scarps, lies on a north-south alignment. The relationship between the field boundaries and ridge and furrow is complicated and makes relative dating difficult. In some locations, such as at NY 7173 4928 (1536982), south of Ayle, they appear broadly contemporary while elsewhere, such as at NY 7451 4189 (1522266), it is uncertain whether the field boundaries are contemporary with the ridge and furrow or are a later imposition on an existing open field system. One further field system at Gossipgate (1537249) is broadly comparable in form to these medieval examples but has been discussed previously because of ambiguities in dating resulting from its proximity to an Iron Age/Roman settlement (see LATER PREHISTORIC AND ROMANO-BRITISH).

Head dykes

Numerous sections of linear earthworks have been recorded (ie 1522262, 1522278, 1537399 & 1528458). The form of these monuments is consistently that of a broad boundary bank with a hollow way on the upslope side. The boundaries broadly follow the contours of the valley sides and as such have been interpreted as head dykes (Fig 18). Though the section of head dyke above Gossipgate (1537151) was given a later prehistoric/Roman date due to its association with a prehistoric settlement site, the remainder have been attributed a medieval date. This is not to suggest that all the head dykes do not have later prehistoric origins, but is simply a practical *terminus ante quem* resulting from contemporary sources (see Paine Roll below) indicating that the head dykes were in use during this period.

The head dykes can be traced throughout the project area but are particularly striking on the valley sides of the River South Tyne (1528458), centred at NY 7591 3894. Although here the head dyke is partially overlain by post medieval field boundaries it survives as earthworks visible on the lidar DTM. On the eastern valley side, the head dyke is confined to 420m OD and 450m OD, whilst on the western valley side the head dyke drops to a low of 405m. Occasional access ways appear to head up the valley slope from the lowlands, in the form of hollow ways possibly providing access to the unenclosed lands above the head dyke.

Although all the field systems discussed above appear to be broadly bounded by the head dykes a direct relationship between the various features remains elusive. Further investigations at NY 7455 4192 may provide clarification of the chronological relationship between the head dyke (1522262) and the field system (1522266) as there is a physical relationship between the dyke and elements of the field system at this point. A similar recommendation can be made for NY 7271 4309, above Nether Craig Cottage, where again the field boundaries (1524545) appear to abut the head dyke (1522278).

Pertinent to the dating of the head dykes to the medieval period is the Paine Roll, a code of civil law for Alston Moor, which states that '2.29 Item that everie man make his hedges

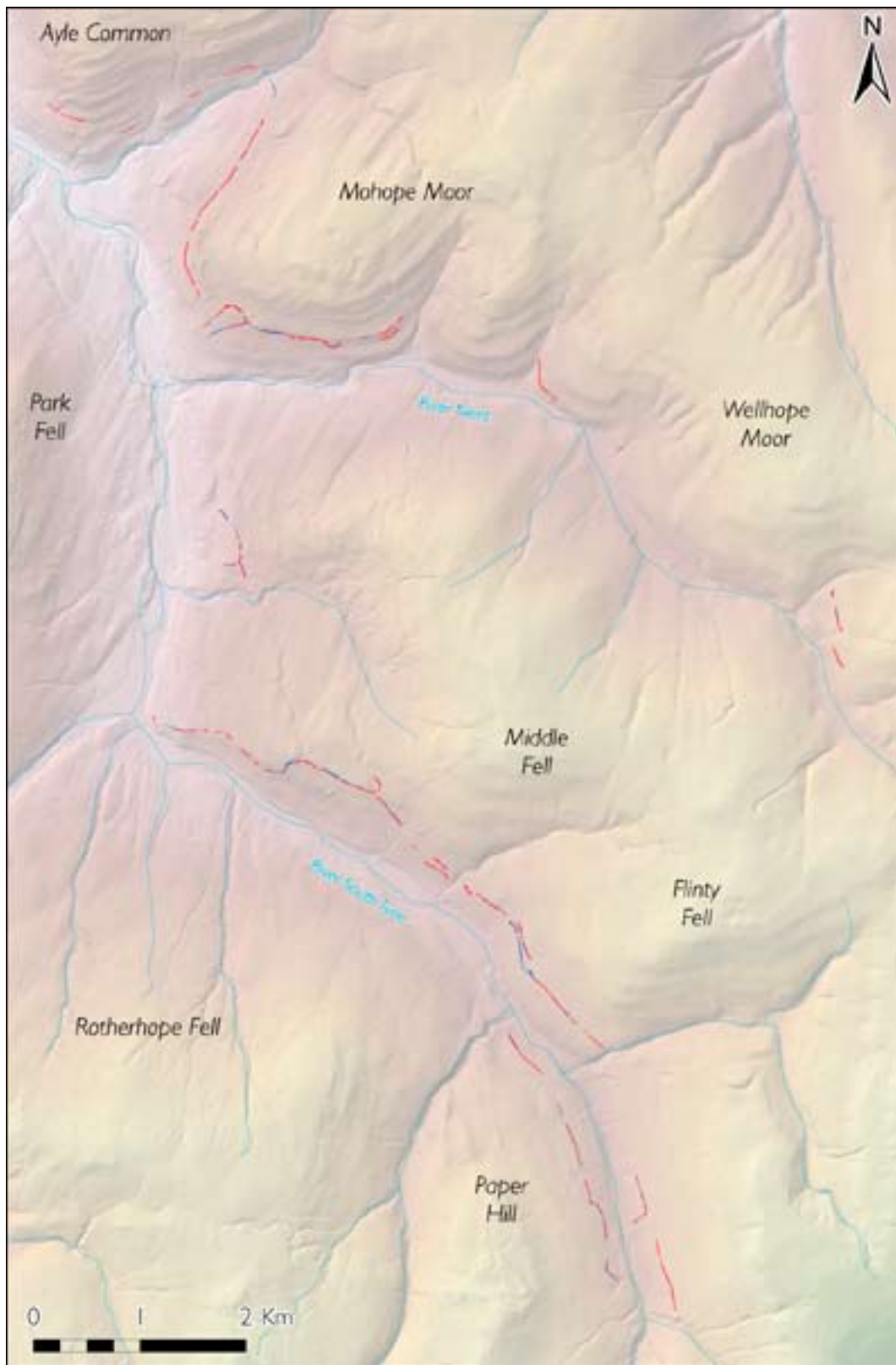


Fig 18: The distribution of the linear earthworks, interpreted as head dykes, appears to define the enclosed pasture and agricultural lands. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

of his head dyke sufficient and able before St Helen daie yerelie sub pena vi^d totie[n]s quotie[n]s and that none suffer anye gaps to be in there outer hedges sub pena for everie gap vi^d.' (Winchester 2000, 164). The Paine Roll was first made in the reign of Henry VII (1485–1509) and copied on several later occasions (Robertson 2002, 20). Two of these later versions survive, one dated 1597 and the other 1692 (Winchester 2000, 160). The dykes would have provided a physical barrier to prevent animals from straying back into the agricultural lowlands and thus reduced grazing pressure on the enclosed pasture and agricultural lands. The fact that they were protected by law confirms their importance in medieval farming practices.

Above the head dykes

As previously described the head dyke typically defines the limit of arable farming and improved pasture within the medieval period, above this zone the majority of features relate to industrial activities. A notable exception is at NY 7596 4074, on the south facing slope overlooking Ashgill Bridge. Here, an embanked field system (1522362), probably medieval in date, is visible on air photographs and lidar above the head dyke at an elevation of 464m OD. The field system consists of a series of bank defined rectilinear field boundaries, the irregular nature of these earthworks suggestive of collapsed stone walls. The largest of the fields measures approximately 124m by 88m. Two further field boundaries are partially visible on the available air survey sources and enclose field areas of at least 115m by 67m and 72m by >73m. An embanked rectilinear enclosure is located within the wall of the larger field system at NY 7588 4076. It is comparatively small, measuring 14m by 16m, and perhaps represents the remains of a sheep fold, leading to the supposition that this complex is associated with stock management, rather than arable cultivation.

Across the River South Tyne Valley an isolated earthwork enclosure (1301133) is located at NY 7350 4155, above High Redwing Farm. This large, rectilinear enclosure is principally

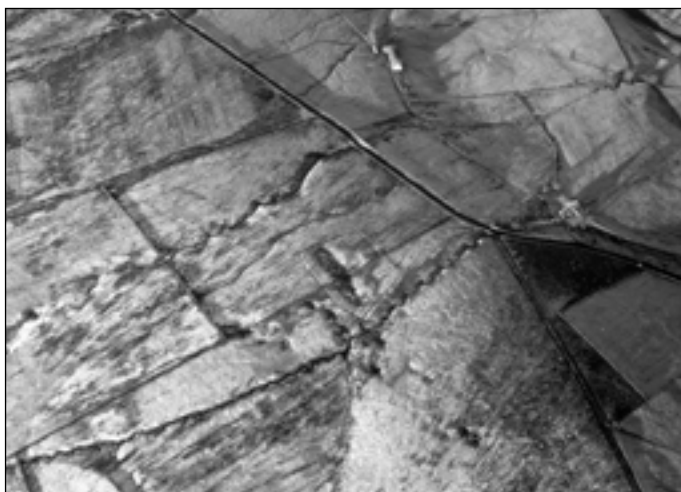


Fig 19: An isolated rectilinear enclosure (centre of image), located to the west of Garrigill (looking north). NMR NY 734111 NMR 17212153 11-JAN-1999 ©Crown copyright. NMR.

ditched but has embanked elements both internally and externally (Fig 19). The date of the feature is uncertain, but it is overlain by enclosure act stone walled field boundaries and has been tentatively dated to the medieval period. The feature measures approximately 61m by 84m and lies at a height of 395m OD. A possible entrance was noted on the north-western corner. No archaeological features were recorded within the enclosure although a number of large sinkholes scar

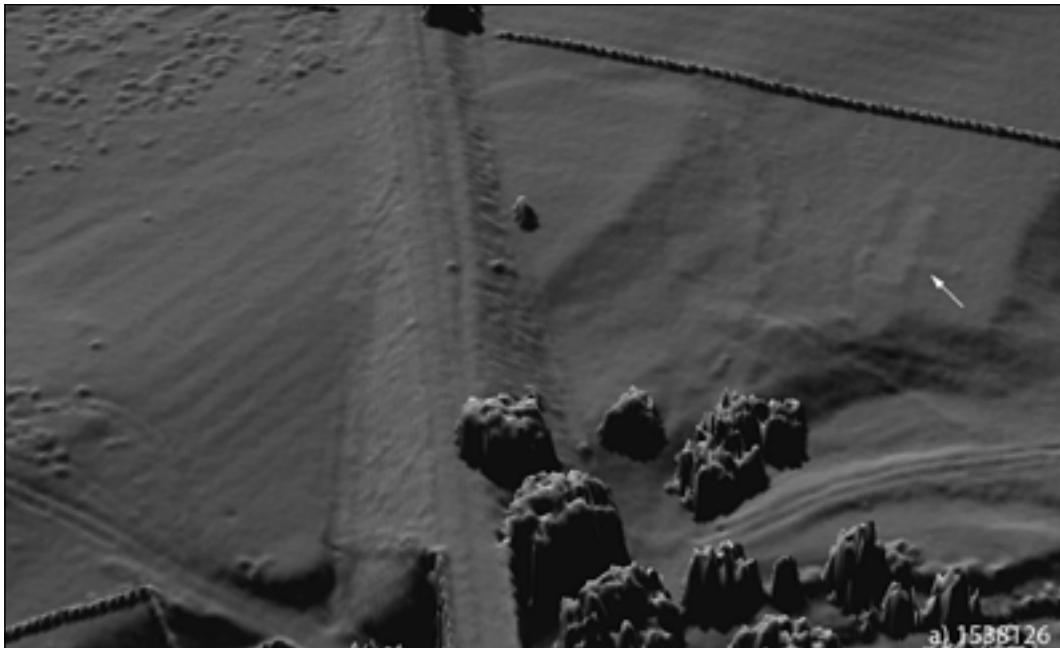


Fig 20a: Lidar image revealing a medieval building with opposed entrances and associated ridge and furrow, north of Howgill Rigg (looking north-west). LIDAR NY6948 DSM 01-APR-2009



Fig 20b: A second building in an isolated location on Linkin How (looking west). NMR NY 7439/3 NMR 20677/23 10-SEP-2007 ©English Heritage. NMR.

approximately half of the interior. The enclosure is unusual in both its location and form within the North Pennines context.

Buildings

Within the survey two elongated rectilinear earthworks are particularly distinctive and appear to represent the remains of medieval buildings (Fig 20), though their contrasting topographic locations perhaps suggest varying functions. The first building (1538126) is located at NY 7032 4874 on a low lying terrace overlooking the Gilderdale Burn. The building survives reasonably well as low lying earthworks, though the northern end of the building could not be traced. It measures 5m by at least 22m and has two opposed entrances in its long sides. The building may represent a medieval sheep house or sheepcote, being comparable in size and form to three of this type at Settlingstones Burn, Northumberland and others elsewhere in England (Oakey 2009, 17). An adjacent broad boundary bank, 'U' shaped in plan, encloses an area of medieval/post medieval ridge and furrow. As Dyer (1995, 155) notes, most sheepcotes were located close to arable fields, so that a source of fertilizer was always close by. By this reasoning it could be assumed that the ridge and furrow cultivation was contemporary with the sheep house, a situation similar to that found in Carrant Valley, North Gloucestershire (Bishop 2009, 48). Its location adjacent to a water source could have also facilitated fleece washing during shearing time (Dyer 1995, 154).

The second building (1525629) is situated at NY 7426 3993 on Linkin How, an exposed area of high ground above Cross Gill. The building survives as low lying earthworks measuring approximately 21m by 9m, with no obvious openings to signify an entranceway. A small quarry is situated to the south and considering its isolated location may have provided stone for the construction of the building. Though lead mining is present in the valley bottom, it seems unlikely that the features are associated due to their disparate locations at 400m OD for the lead mining and 444m OD for the building. Also, an extant building at that time would have been recorded on first edition Ordnance Survey mapping and that isn't the case here. Given its exposed location with no obvious agricultural remains close by, the interpretation as another sheep house is debatable, and its precise function is unclear.

Park Pale

In his history of Alston Moor, Robertson (2002, 16) notes that on 2nd November 1337 Robert de Veteripont (Lord of Alston Moor) was granted a licence to empark Walnewood (now Wanwood) for the creation of a deer park. Deer parks were a common phenomenon in the medieval period, designed to securely enclose and retain deer for both hunting and as a source of fresh meat. Most commonly a park pale would take the form of a broad, high, earth bank upon which a fence was constructed, and an internal ditch (Dennison 2005, 23).

A possible candidate for the remains of the Walnewood park pale is a large sub-square enclosure (1537195) situated at NY 7057 4651 (Fig 21). This is some distance south of present day Wanwood, though perhaps the area was more extensive in the 14th century.

Boundary banks flanked by internal ditches can be seen, surviving particularly clearly on the eastern border and enclosing an area of approximately 56ha. This is well within the average deer park dimensions; usually between 40ha and 80ha (Dennison 1988). Access to fresh water was obviously an important requirement of any deer park and considerable effort was put into improving pools and streams to cater for them (Birrell 1992, 119) and it is known that natural watercourses were sometimes incorporated into park pales (Dennison 2005, 23). This enclosure would have been well placed, as there are numerous springs within the enclosed area, feeding into the larger Eller Well, a small tributary of the River South Tyne. The linear nature of these spring lines may suggest their course has been altered by human intervention. Finally and perhaps most convincingly, within the enclosure and recorded on first edition (1859) Ordnance Survey mapping, are a number of farms, named Low Park, Park, Mid Park, Nether Park, High Midpark and High Park, giving additional credibility to the park pale interpretation.

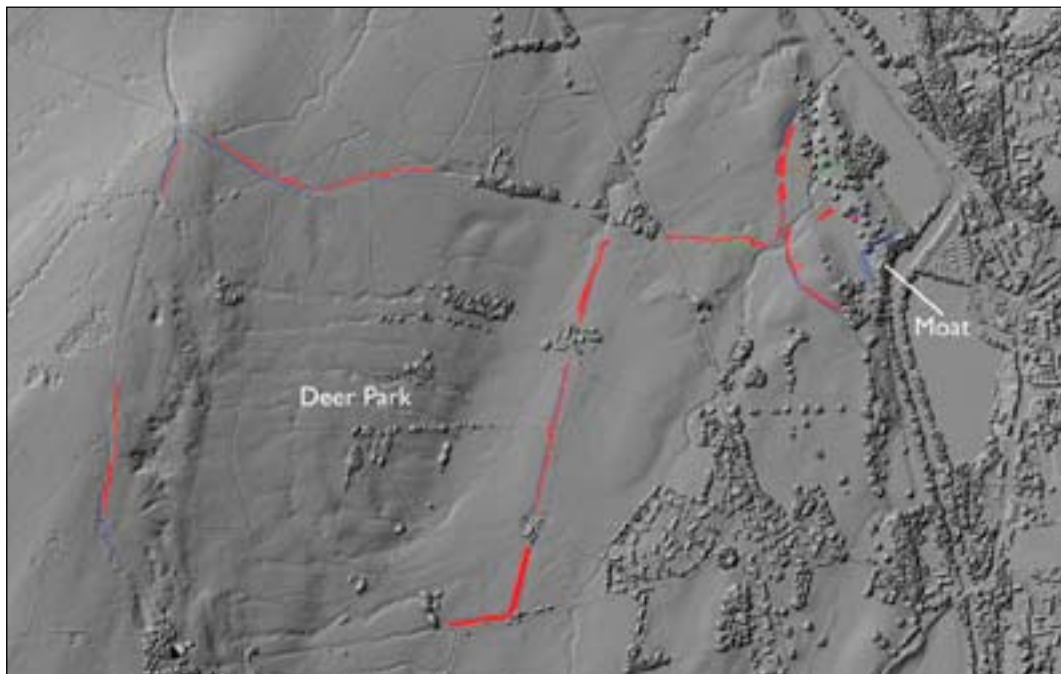


Fig 21: The sub square earthworks perhaps represent the remains of a medieval park pale, located on Park Fell. The moated site and associated earthworks are located to the east (north is to the top of the image). LIDAR NY7046 DSM 01-APR-2009.

Moated site

On the west bank of the River South Tyne, 500m east of the presumed park pale on the lower valley slopes a moated site at Hallhill (15068) has long been recorded, at NY 7146 4672 (Fig 21). Only two sides of the broad ditched enclosure are visible, cut into what is believed to be a natural moraine mound. The southern and eastern sides appear to have been eroded away by the river. It seems unlikely that the feature ever held water given the 3m gradient between the surviving northern and western arms. Although no building survives on the site, archaeological field investigators surveying the area in 1972

(AMIE Event UID: 574002), recorded fragments of decaying brick, suggesting the former existence of a building. This field evidence, along with the general form of the earthworks are suggestive of a medieval moated site, albeit a dry one.

A number of earthwork boundaries appear to be associated with the moat, some newly discovered. The first, located to the north-west, is a narrow ditch with a counterscarp bank and causewayed entrance (I5068). This earthwork is cut into a moraine mound and appears to funnel towards the moat, effectively controlling access on the northern side. A second finer ditch and bank crosses the mound further to the north-west and abuts additional boundary banks. These newly discovered boundary banks and hollow ways (I537119) are located at NY 7128 4678. One of these banks is visible for nearly 400m and encloses an area to the west of the moraine mound and moat. Presumably, its eastern border would have been formed by the meander in the course of the River South Tyne. The southern half of the enclosed area is overlain by post medieval narrow ridge and furrow (I538251), providing a fixed chronology. A further boundary bank and ditch heads west, towards the north-eastern corner of the park pale.

The function of these rather complex earthworks remains somewhat uncertain. One tentative suggestion is that they represent the site of a hunting lodge associated with the nearby deer park. As Dennison (2005, 27–8) states, although deer parks often had high status lodges within their boundaries 'detached lodges' positioned on the edge or further away from their parks are not unknown. These impressive lodges, built for the owners of the park, were often moated and used as a base for either hunting or as a place for entertainment.

Enclosed settlement

A small number of farms were noted as having traces of medieval ditched and banked enclosures in close proximity to upstanding farm buildings (Fig 22). The enclosures are largely limited to the north of the project area at Kirkhaugh, West Allen Dale and West Natrass. The likelihood is that these features predate the extant farm buildings and is probable evidence for a continuity of occupation from the medieval period to the present day. Only four possible examples were recorded by the aerial survey assessment, so a detailed description of each is attempted below.

At Mill House (formerly known as Kirkhaugh Cottage), curvilinear field boundaries (I530576) appear to radiate from the modern building, at NY 6926 4978. The boundaries create a large enclosed area, with a figure of eight arrangement, covering an area of approximately 38ha (Fig 22a). The field boundaries are primarily ditched with slight remnants of embanked up-cast, whilst a hollow way defines the perimeter of the field system on the northern edge. The association of medieval ridge and furrow and plough headlands within the enclosure suggests a contemporary date for the enclosure.

At Wolfcleugh, NY 7984 4958, a curvilinear enclosure (I531606) with a substantial internal bank and outer ditch lays adjacent to High Wolfcleugh Farm (Fig 22b). The southern section of the enclosure is not visible on the available air survey sources, so its full extent is uncertain. The enclosure's form is similar to that at Mill House (described

above) so a medieval date is perhaps appropriate. Traces of post medieval narrow ridge and furrow (1531614) lie within the enclosure signifying continued use into this period. Ploughing has denuded the earthworks and levelled the eastern boundary.

To the west of the River West Allen, at Farney Shield a medieval/post medieval hollow way and enclosures (1533133) are visible as earthworks on air photographs, centred at NY 7910 4883 (Fig 22c). The larger enclosure is curvilinear in plan and has banked and ditched elements. The features lie adjacent to a modern building at Farney Shield, but again are potentially associated with an earlier farmstead in this location.

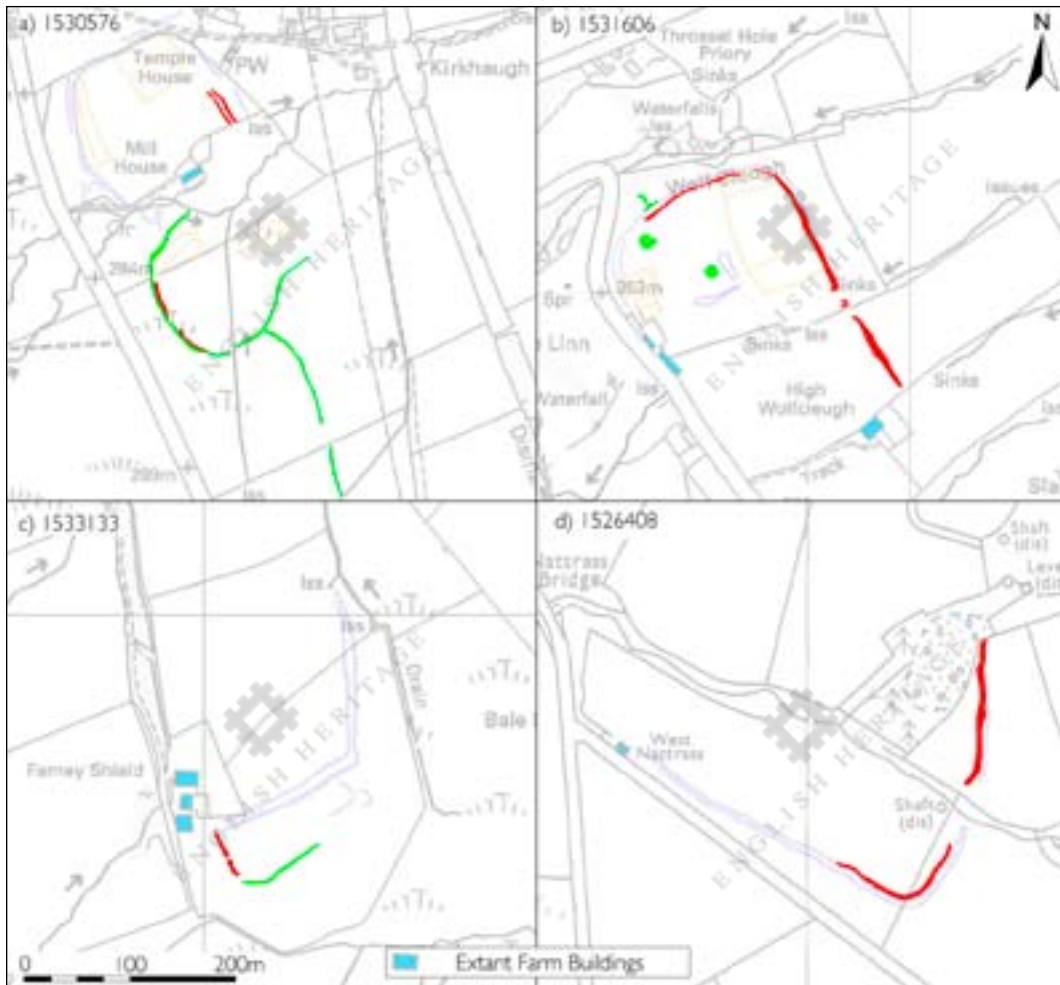


Fig 22: Ditched and banked enclosures, dating to the medieval and medieval/post medieval period, encompassing upstanding farm buildings (marked in turquoise). ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

A similar form can be seen at West Nattrass, NY 7306 4463. Here a larger banked and ditched boundary of potential medieval date is visible as an earthwork (1526408) (Fig 22d). The boundary encloses, on the southern and eastern sides, a rectilinear area of land bordering Nattrass Gill. The enclosure is substantial with the ditch measuring up to

7m across and the bank approximately 5m. The ditch, which extends beyond the flanking ditch on the southern side, appears to append to a modern farmhouse.

It is both the form and the substantial nature of these enclosures that make them distinctive. The large banked and ditched enclosures appear to be too broad to function as simple field boundaries. As discussed earlier, their association with extant farm buildings is noteworthy, though unfortunately none of the four farm buildings were within the scope of the architectural survey research (Module 2.6) to confirm their age or form. Nevertheless, the likelihood exists that some or all of the farms are early post medieval in origin. As there are a significant number of bastles in the vicinity, their origins as this early form of farmstead cannot be discounted. The bastle is a building type found on both sides of the Anglo-Scottish border, constructed between the late 16th century and the early decades of the 17th centuries. It is generally thought to be a response to the insecurity of the area, where reiving (the thieving of livestock, particularly cattle) was rife (Jessop and Whitfield 2010, 7). If the early phases of the extant farms were bastles, then it is reasonable to suggest that the enclosed areas represent a medieval or early post medieval response to reiving. Perhaps further archaeological and architectural research at these farmsteads could support this.

MEDIEVAL/POST MEDIEVAL

A medieval/post medieval date was commonly attributed to features when their form or phasing with other monuments was not clearly diagnostic of a medieval or post medieval date. Features dated to the medieval/post medieval period predominantly relate to the agricultural landscape and include field systems and structures relating to livestock management.

Shielings

One of the most distinctive forms of upland settlement was the seasonally occupied shieling and many have left archaeological traces (Newman 2006, 124). A shieling served as temporary, summer, accommodation for people involved in transhumance, that is the movement of stock (generally, but not exclusively, cattle) to exploit areas of summer pasture (Young 2011, 2).

A cluster of ruined buildings and associated enclosures, known as the Whitley Shielings (958983), are situated on the north bank of the Gilderdale Burn at an elevation of between 335m and 380m OD. The buildings are largely rectilinear in plan, with some showing evidence of internal divisions. At least four have abutting curvilinear enclosures (Fig 23).



Fig 23: The Whitley Shielings, consisting of numerous small buildings and associated enclosures, overlooking Gilderdale Burn (north is to the top of the image). Miner-Farmer Imagery NY6846 12-APR-2009.

A medieval/post medieval date is suggested by the ruling, taken from the Alston Moor Paine Roll, which orders stock farmers to go to the shielings over the summer months.

'2.22 Item that everie tenant that have used to goe to the sheles to goe to the same within one monethe after St Helen daie and there to staie till St Peter daie sub pena xii^d for everie defalt.' (Winchester 2000, 163).

Interestingly the clause relating to transhumance was withdrawn in the 1597 version of the Paine Roll suggesting that shieling activities were in decline by this date in the North Pennines. This theory is supported by Fairbairn and Robertson (2007), who undertook an archaeological field survey of the Whitley Sheilings. They noted that the shielings levels of preservation vary greatly, suggesting abandonment was phased and that some were used as sheep huts in the post medieval period. Winchester (2000, 99) suggests that the reasons for the abandonment of sheiling practices are complex but that increasingly intensive pastoral systems were enabled by the use of enclosed pastures. By creating these pastures, stock could be milked closer to home, grass growth was better managed and stock carrying capacity was enhanced. Additionally, improved stock-proof field boundaries lessened the risks to crops from livestock and reduced the need for their isolation during the summer months.

Field systems

A number of medieval/post medieval ditched field boundaries forming substantial field systems have been recorded. These are unusual as most boundaries within the project area tend to be bank defined. The location of these field systems is interesting; situated in relatively flat positions, upon BRICKFIELD 3 (713g) soils. This is a drift deposit which is slowly permeable and liable to be seasonally waterlogged.

One example east of High Galligill, centred at NY 7586 4514, consists of a number of primarily ditched field boundaries forming an extensive system (1539079 & 1520799). Some of the ditches are sinuous and appear to pre-date the post medieval field boundaries. It is likely that the boundaries were cut in order to facilitate land improvement, by increasing drainage and some do feed into small burns. A similar situation can be found west of Alston at NY 7062 4672 (1537207) where the ditch defined field system is overlain by the current enclosure walls. Again it is likely that the boundaries also served as drainage. One of the ditched boundaries appears to cut through the Walnewood park pale (1537195, described above) at NY 6955 4842.

Settlement

The remains of a possible medieval/post medieval settlement (1531093) are visible at NY 6949 4846, the only example of this site type recorded by the project (Fig 24). The settlement is situated adjacent to the farmstead at Holymire, which appears to be the only extant feature in what was a larger settlement. Identifiable earthwork elements include hollow ways, platforms, rectilinear enclosures, trackways, ditches, a field boundary and a curvilinear enclosure. The settlement is situated close to the south corner of Whitley Castle Roman fort (13725) and it may be that some elements date to the Roman period. In particular, a linear earthwork, heading north towards the fort appears to underlie medieval ridge and furrow (1530694).

The majority of the ridge and furrow adjacent to the settlement has a form suggesting a medieval date (1530694 & 1530851), being both wide and sinuous. One field, at NY 6951 4856, appears to have been reworked during the post medieval period as the ridge and furrow is narrowed, yet still sinuous. This ploughing and re-ploughing is likely associated with the continued settlement of Holymire through the medieval and post medieval periods.

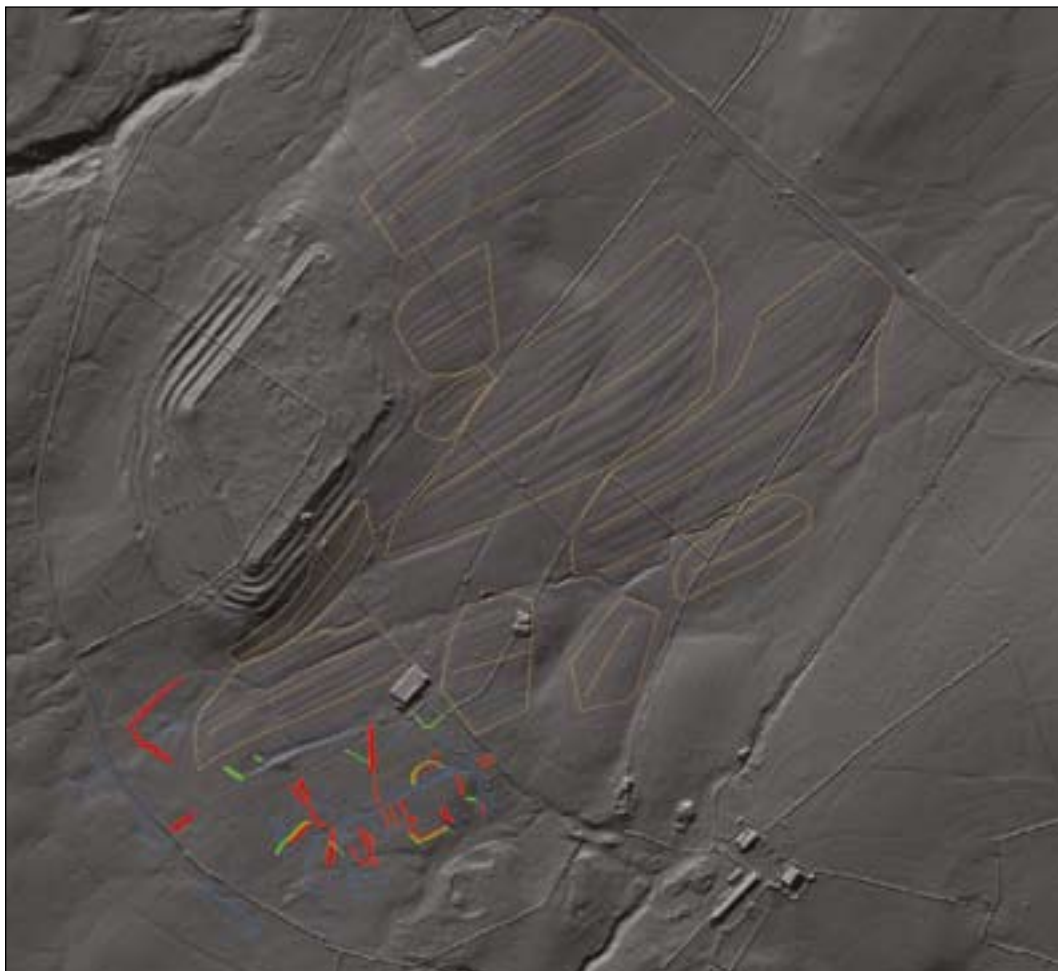


Fig 24: NMP plot of the medieval/post medieval settlement adjacent to the farmstead at Holymire. Extensive ridge and furrow lies to the north and east (north is to the top of the image). LIDAR NY6948 DSM 01-APR-2009.

POST MEDIEVAL NON-INDUSTRIAL

Although many elements of the 18th and 19th century agricultural landscape persist to this day, several areas of post medieval field system were identified that appeared to predate the parliamentary enclosure walls. These sometimes incorporated enclosures, presumably for the management of stock. Other features recorded include remnants of designed landscapes and a previously unknown racecourse.

Sheep folds

Post medieval sheep fold and biolds are ubiquitous in the North Pennines landscape with the majority surviving as structures and ruined structures, those visible as earthworks were likely originally stone built. Interestingly there are no apparent trends as to their location, with both upland and lowland environments favoured. Associated shepherds huts and sheep dips have also been recorded. The sheep folds vary in form, size and complexity, with rectilinear and curvilinear prevalent. The biolds are mostly T shaped or L shaped. Those sheep folds located on the lower valley slopes of the River South Tyne are largely defined by earthworks, rather than structures. This is exemplified by sheep folds located to the north of Middle Craig (1523171), at NY 7315 4279 where medieval origins appear likely due to their poor state of preservation and their apparent association with medieval/post medieval field boundaries. A number of sheep folds are not recorded on first edition Ordnance Survey mapping, in which case a 20th century date is appropriate. The typical form of these later sheep folds is a circular stone built enclosure (sometimes called a stell), with a diameter of approximately 9m as seen on Whitley Common, at NY 6927 4782 (1530470).

Field systems

Ridge and furrow forms the most common monument type dating to the post medieval period. The location of the post medieval ridge and furrow largely follows that seen in the medieval period, focussing on the lower valley slopes of the River South Tyne, River Nent, Ayle Burn, Gilderdale Burn, Black Burn. Additionally, small amounts are located on the valley sides of Mohope Burn and the River West Allen. The form of the ridge and furrow varies, being either very narrow (1–2m), very straight, or both. It is uncertain whether this post medieval ridge and furrow relates to arable agriculture or, more likely, is an attempt at land improvements during this period.

A number of banked and ditched field systems predating the extant stonewalled field pattern are visible on lidar. Three field systems exemplify this site type and are located on the north facing slopes of the River Nent, River South Tyne and Ayle Burn (Fig 25). At NY 7084 4787, above Wanwood House, is a field system predominantly on a north-west south-east alignment and defined by narrow parallel ditches, partially flanked by a narrow bank (1536427) (Fig 25a). The boundaries lie in an area that is heavily drained and it is probable that the ditches also acted as drainage. Elements of the system are fossilised in the pattern of the later enclosure walls and are depicted on the Ordnance Survey first edition map but most of the walls overlie the field boundaries. At least four small enclosures are also visible, commonly sub-circular with diameters of around 10m. These

are likely to have been stock enclosures and all but one are aligned on field boundaries.

A similar pattern is visible at High Skelgill, NY 7361 4669, (1536847) where three parallel ditched boundaries can be seen running along a gentle slope (Fig 25b). Two other ditches cross these. A broader ditch runs towards the River Nent and has two ditch and banked enclosures, presumably for stock management, aligned on it. The first, at NY 7345 4671, measures 9m by 19.5m whilst the second, at NY 7349 4679, measures 10m by 6m.

At NY 7212 4901, south-west of Clarghyll Hall, the fragmentary field boundaries are defined by narrow banks, sometimes with a ditch on the upslope side (1536169) (Fig 25c). Other ditches that were interpreted as later drains and therefore not mapped appear to incorporate elements of the earlier system. The current enclosure walls overlie the field boundaries but in places the walls appear to follow the course of the older boundaries. A possible stock enclosure at NY7235 4921 is aligned on one boundary.

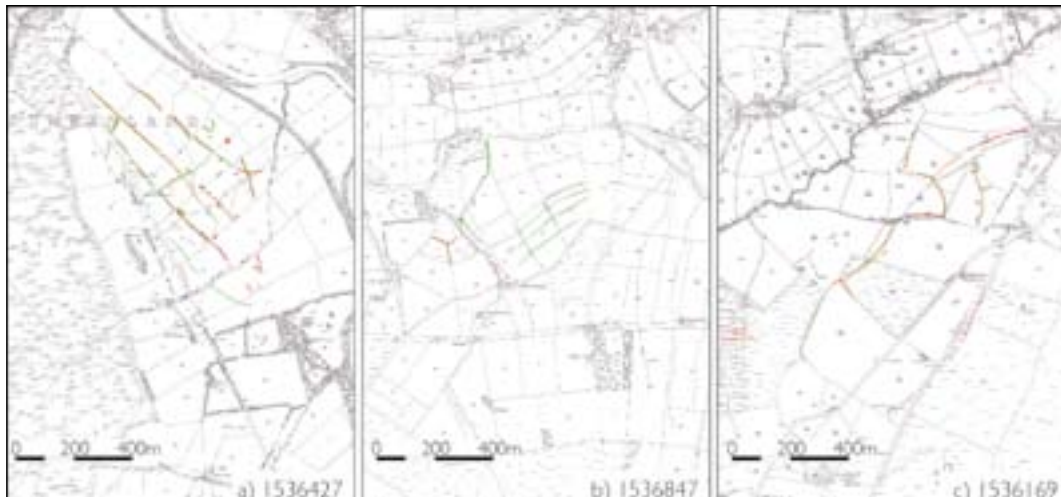


Fig 25: Post medieval ditched field systems and associated enclosures. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

Racecourse

Perhaps the most unusual discovery is that of an undocumented racecourse on Alston Common (1535904), the highest point of the course lying at nearly 370m above sea level (Oakey 2010). Two sections of parallel linear ditches, 11m (12 yards) apart were intermittently visible on the lidar imagery, one section describing a gentle curve and the other partially terraced into a slope. These formed part of an irregular circuit measuring 1605m in length, equating to eight furlongs or one mile, one of the standard distances for a horserace. It included several steep climbs and descents as well as a stream crossing and would have proved a very challenging ride.

The racecourse lies immediately to the south-east of an area historically called Fair Hill and the 1861 Ordnance Survey first edition map notes 'Fair held annually here'. As in many other instances, this fair may well have provided a context for race meetings.

Although an entry in the 1829 trade directory does make reference to fairs, racing and wrestling at Fair Hill, it is not clear whether this is horse racing and the archaeological evidence suggests that the course had fallen out of use by then anyway.

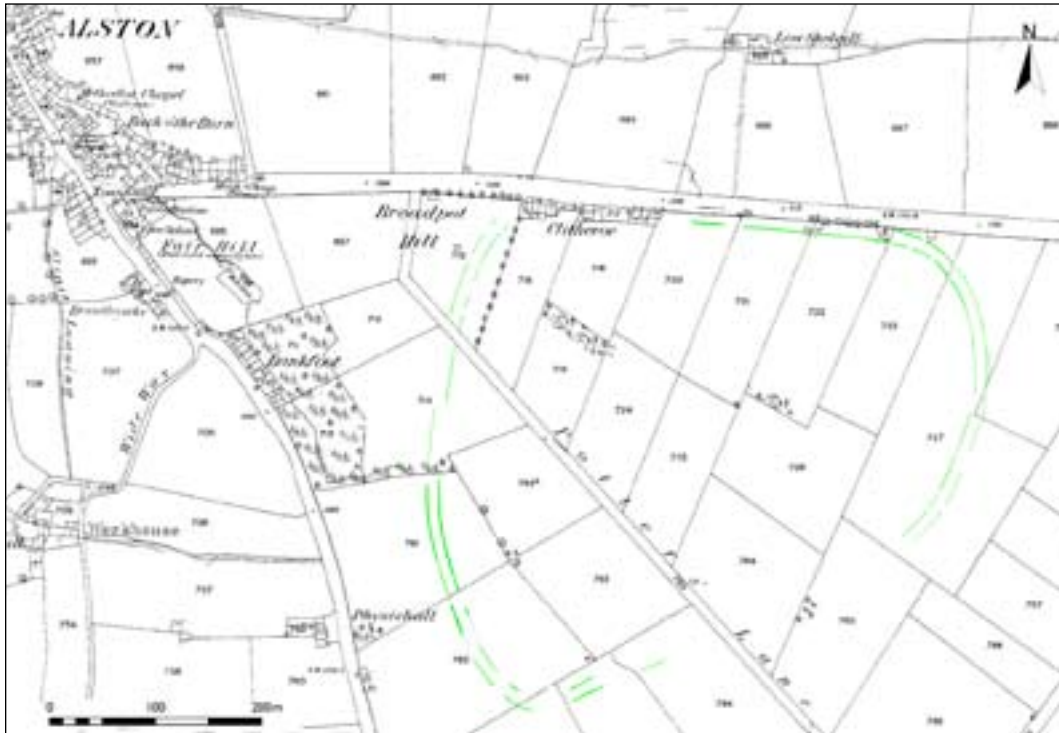


Fig 26: The Alston racecourse, against first edition Ordnance Survey mapping. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

The precise date of the racecourse remains conjectural. No elements of it are depicted on the 1861 Ordnance Survey first edition map, which shows that the former common land has been enclosed by this date, criss-crossing the course with drystone walls (Fig 26). It is known that the date of the Act of Parliament for enclosure of Alston Moor was 1803 although the actual enclosure of lands is attested into the 1880s. The course clearly predates a small quarry which itself underlies the field walls shown on the first edition map. Part of the northern straight underlies a row of houses, also depicted on the Ordnance Survey map. Initial work by English Heritage's Architectural Investigation team has dated some of these properties to the late 18th or early 19th century (M Whitfield, pers comm) which must indicate that the racecourse was out of use by around the start of the 19th century. In turn, the northern side appears to respect, and therefore post-date, a toll road which is thought to be of mid-18th century date. This evidence narrows down the existence of the course to a few decades in the mid- to late-18th century, coincident with an increase in prosperity and the rapid development of the lead mining industry of Alston Moor.

Garden features

Remnants of designed landscapes relating to two small estates were noted at Raise and Harbut Lodge. Earthwork elements of garden features at Raise are limited to two tree mounds (1536064). The better preserved of the two consists of an external ditch with an internal raised platform, measuring 8m in diameter, at NY 7144 4630. The second tree mound is less clearly defined approximately 41m to the south. Ordnance Survey first edition mapping of the area, dating to 1859, reveals further elements of a designed landscape adjacent to a range of buildings. These include a possible formal garden, formal curvilinear trackways and additional designed tree planting.

Harbut Lodge is a grade II listed detached house, built in 1838. A number of earthwork features, relating to the associated garden, were mapped on the eastern side of the house (1536806). One identifiable element is a curvilinear ditched feature visible for 111m and interpreted as a ha ha. The ha ha would have acted as a barrier to livestock, restricting their access to the formal garden, without the need for obtrusive fencing. Other amorphous banked features, possibly representing enclosures are visible abutting the ha ha to the north.

POST MEDIEVAL INDUSTRIAL

The majority of sites recorded by this project relate to post medieval or later industrial activity. Of some 2,370 AMIE records nearly 68% relate to industrial activity. Alston Moor forms one of several mining fields in the North Pennines, covering the drainage area of the River South Tyne and its tributaries (Raistrick and Jennings 1989, xvi–xvii) with an ore-rich landscape consisting of mainly lead, with some iron, copper and silver. Gangue minerals such as fluorite, barytes, witherite and zinc were also exploited, often by the reworking of earlier spoil heaps in the late nineteenth and twentieth centuries. Other extractive industries recorded include coal mining, peat cutting and quarrying, mainly for limestone and sandstone.

A number of mineral-rich upland areas of northern England have been studied using aerial photographs mapping features to varying levels of detail and adjusting the NMP specification as appropriate. Geographically similar contexts are the Yorkshire Dales (Horne and MacLeod 1995) with post-analysis on the industrial activity (White 1991), and Warcop (Boutwood 2002); the latter was subsequently enhanced by photogrammetric and field survey in the Scordale valley (Hunt and Ainsworth 2010). The Derbyshire and Peak District Aggregates Assessment highlighted the complexity of lead mining in the South Pennines mining fields (Bacilieri and Knight 2010). The use of the commissioned datasets (see SOURCES) for the current project has enabled a far more detailed and comprehensive interpretation than has previously been achieved by NMP mapping.

From an aerial survey perspective, forms of extraction are rarely diagnostic of medieval or earlier industrial workings, therefore the term of post medieval was used with the exception of where there was documentary or other supporting evidence suggesting an earlier date. Consequently, a detailed overview of the historic development of the industry of Alston Moor is not attempted here. The earliest evidence for lead working is tentatively dated to the Roman period, (see ROMAN (1543372)). Aspects of the industry dating to the medieval period were previously recorded in some AMIE records and the Ordnance Survey maps also provided evidence of sites which continued into the 20th century.

Lead extraction and processing

Of the 1,596 AMIE industrial records that were mapped as part of this study, over 61% relate to lead mining or associated activity. The extraction of lead was noted across almost the entire mapping area, with the most intensive extraction concentrated east of Alston, along the Nent Valley to Nenthead, and over Middle Fell. More localised sporadic areas of mining extend south to Rotherhope Fell and into the River Tees Valley. This distribution pattern largely mirrors that of the mineral veins depicted by the British Geological Survey, though some veins were not exploited. This variable concentration of sites is potentially indicative of the relative quality and accessibility of the ore resources.

Lead mining can essentially be broken down in to three main components or activities (Fig 27):

- Ore extraction

- Water supply and drainage
- Ore processing, storage and transport

Prospection for lead ores was evident across the project area, particularly along the valleys of the South Tyne and Nent. Although indexed as 'prospecting pits' these are mostly narrow trenches, some extending up to 60m in length. The other method of revealing mineral veins was by hushing. Successful prospection, by either technique, was presumably superseded and the physical traces engulfed by subsequent mining and workings.

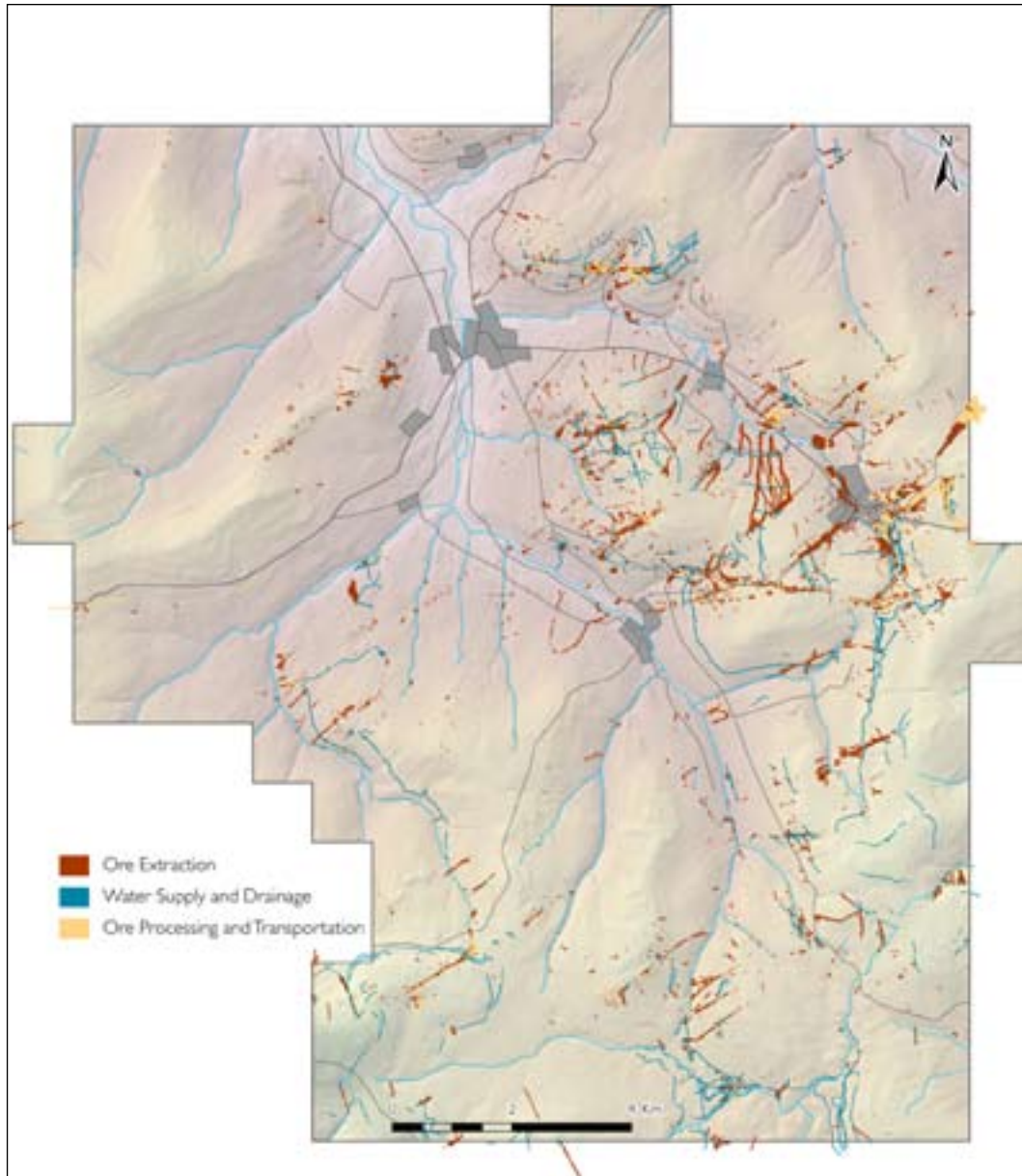


Fig 27: Extent of lead mining and associated activity in the in the project area. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.



Fig 28: Fletcheras Rake Lead Mine: illustrating varying forms of extraction from prospection, hushing and rakes, to opencast and shafts (looking south). NMR NY 7443/2 NMR 17212/34 11-JAN-1999. ©Crown copyright. NMR.

Lead extraction is characterised by a number of forms (Fig 28). Major concentrations of hushes are located along the south bank of the River Nent, between Nentberry and Nenthead (960074) (Fig 29). A more dispersed pattern was noted to the south, utilising both the watersheds of the Rivers South Tyne (1522718) and Tees (963654). Most examples appear to follow river tributaries and take advantage of the natural slope of watercourses, but where these did not exist a linear trench was constructed to act as the channel for hushing, a method noted in Teesdale by Beadle (1980, 3). This method may have been employed at Hard Hill (960881 and 1531369) and Crowdundle Head (960211). The constructed dams and leat systems associated with hushes are discussed below.

Opencast lead workings, with extractive pits and spoil heaps, target easily accessible ore deposits. These are primarily located along the Nent Valley working along tributaries and gills, such as at Long Cleugh Burn (1521912). Other larger areas of opencast workings extend across the valley benches as seen east of Blagill (957785). Smaller areas of extraction recorded as lead workings, are dispersed amongst the lead mines and shafts.

Most extraction appears along mineral veins, sometimes in the form of a series of pits, often merging into a continuous trench, and the term rake was used for these. Good examples are seen north-east of Nentsberry (1539363 and 1538764) and at Tyne Head (1531868). Single or groups of trenches were described as opencuts and examples are seen along the Nent Valley (1535990).

The most common form of extraction is shafts, which number over 3,000. The shafts tend to occur as distinctive linear distributions following the ore veins, though some have a more dispersed pattern. As with most aspects of extraction the chronology and dating is problematic. Raistrick and Jennings (1989, 66) state that by the 18th century this method of extraction was becoming less common in the Pennines, only occurring in a few fringe regions. Many shafts in our study area were marked on early edition Ordnance Survey maps but it remains difficult to confirm whether they were disused or not.

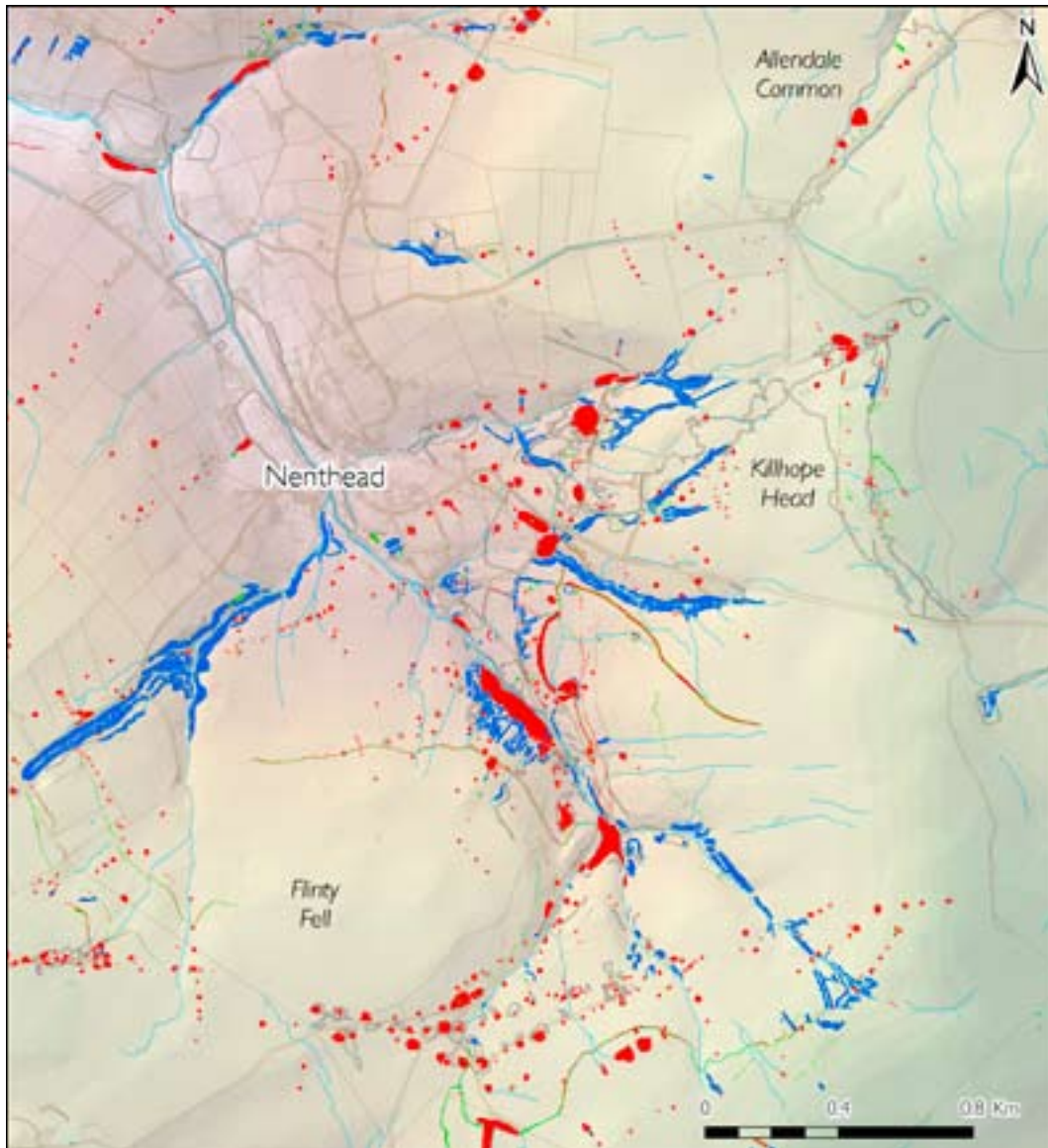


Fig 29: Extensive lead mining, workings and processing at Nenthead utilising the natural water catchment. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

Lead mines are also accessed via adits, these are broadly distributed along the river valley bottoms and their tributaries, or higher up along the benches of the valley sides.

Two ventilation shafts, labelled by the Ordnance Survey, are visible on air photographs near Trout Beck (1531376 and 960874), located 160m and 655m from the nearest adit, reflecting the wide extent of the underground network of mine tunnels.

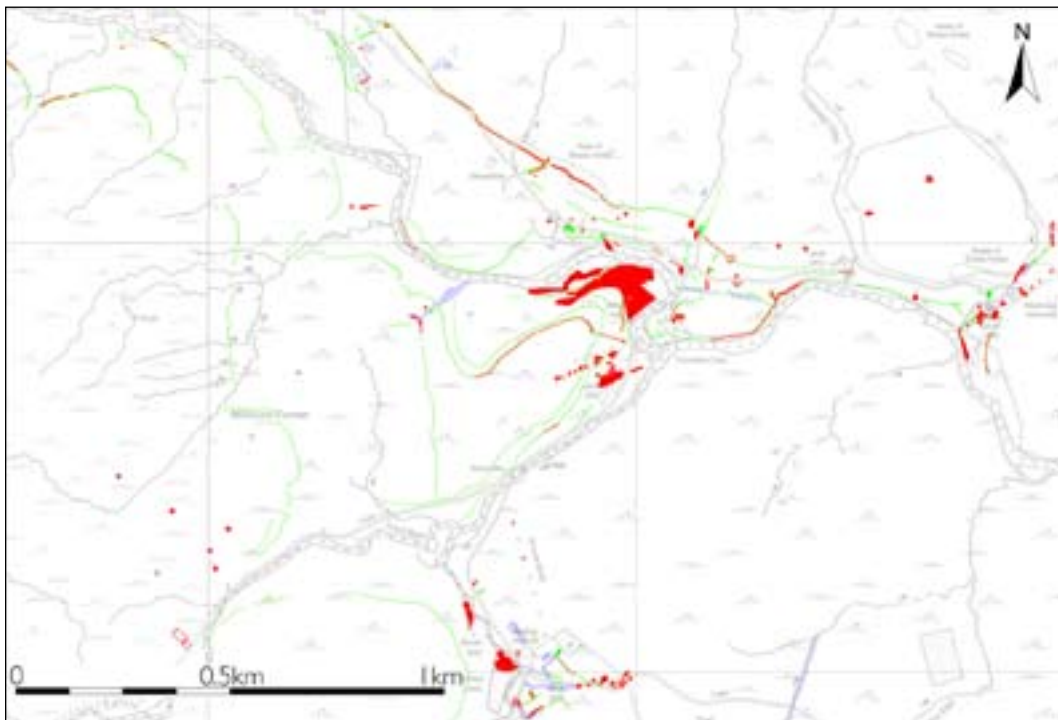


Fig 30: Extensive leat and water management complex on the slopes above Teeside Mine. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

Extensive water management systems of leats, dams and reservoirs were mapped. Networks of leats, both supplying and draining water, were recorded across the area, sometimes extending for over 7km in length, as seen along Backstone Edge and beneath Cross Fell (1525351 and 1530974). Leats commonly followed contours, singly or as arrays, collecting and transferring natural water sources as part of a controlled network, supplying water to dams for hushing, or ore processing. Several instances of complex leat systems were mapped, such as above Teeside Mine (1532370) (Fig 30). Other examples, such as at Tynehead may have functioned as drains for mines (960110). Some of the leats appear to have been re-cut in more recent times and incorporated into the modern drainage systems.

Upland watercourses were dammed to create reservoirs and numerous examples extend across the mining areas. These are generally relatively small, embanked constructions, sometimes feeding directly into hushes. Dams were also noted at intervals along some leats creating 'top-up' reservoirs (1521091). Larger dams were noted, for example Perry's Dam at the head of the River Nent, which supplied water to the mines and processing areas by a high pressure pipe and conduit, and at Rotherhope Fell (1462201) where the mines remained active into the 20th century. Greencastle Tarn at

the head of Middle Gill was modified to function as a reservoir by constructing a dam wall and leats (1530490).

Several ore processing sites were identified during the survey. The colour balanced commissioned orthophotography, covering the core area, enabled the identification of widespread areas of dressing waste, typically characterised by those seen at Nenthead (1522772). Other smaller structures were also evident, such as buddles, aerial ropeways (visible as lines of stanchions), winding circles and bouse teams for the storage of ores.

Over 130 mine buildings were recorded, most of which could not be placed to a particular function from the aerial photography. Others were identified primarily through historic Ordnance Survey maps and ranged from a blacksmith's workshop at Teeside Mine (960164); a mine pumping works at Garrigill (960050); to powder magazines on Skirwith Fell (960225), by Teeside Mine (960165), and at Nenthead (964302). Larger complexes of buildings were also recorded, such as Rotherhope Fell Dressing Mill, Sir John's Mine crushing mill, and the two smelting mills at Nenthead and Crossfell. Although often extant on historical photography many of the mine buildings were either ruined or demolished on later photography.

A good infrastructure was vital for the lead industry for the movement of the ores and refined smelted material, as well as easier access to the mines themselves over difficult terrain. Numerous trackways were mapped and when closely associated with the lead mines they were included in the AMIE record. They form a network throughout the valleys of the rivers South Tyne, Nent and along Shield Water. Parts of the modern road network was originally constructed by the London Lead Company (Mitchell 1979, 10), and continued in use after the decline of the lead industry. Other mining roads survive as earthworks and one extends for 4km from Hartside Cross to join the A686 (1529474).

A number of tramways were recorded and many were in close proximity to lead mines. One extends from a number of lead mining adits along Aglionby Beck for nearly 3km to the north where it appears to terminate at Hartside Cross on the present A686.

Zinc mining

With the decline of the lead mines in the late 19th century most of the mines appear to have closed or been taken over with an emphasis towards extracting zinc ores (Raistrick and Jennings 1989, 328–30). A well documented example is the workings at Nenthead (502426) which were sold to the Nenthead and Tynedale Lead and Zinc Company before passing to the Vieille Montagne Zinc Company in 1896. The company maintained the larger operating mines with some success, branching to others such as Rotherhope Fell Mine (1462201 and 1167794). By the 1920s this company had ceased working in the area and only a few small-scale operations survived on Alston Moor (Fairbairn 1993, 16). Although zinc extraction may have occurred at many of the mines mapped by this project this was not possible to identify through aerial photographs and lidar, and therefore were recorded for the primary extraction as lead mining. Only one site was recorded as a zinc works: Wellgill Spelter Works (958002), though this site presumably concentrated on the purification of zinc alloys to produce spelter, rather than extraction.

Ironstone mining

The mining for ironstone is spatially isolated and never reached the scale of lead or coal extraction. Four records were made, all within 2km from Alston: High Nest Mine (957982), Park Grove (959955), Park Mines (959957) and Manor House Mine (957775). The extraction method appears to have been very much the same as lead in that shafts and adits were dug. The identification of these sites was predominantly through historical sources such as early Ordnance Survey maps, rather than by their physical form.

Barytes and other gangue minerals

Although barytes, fluorite and witherite are known to have been extracted in the area, this cannot be distinguished on air photographs. Hence any identification of the exploitation of these gangue minerals comes from documentary evidence in existing AMIE records, such as at Woodlands Level near Alston (964341) and at Hartside Mines on Haresceugh Fell (964329).

Coal mining

After lead, coal appears to have been the most sought after natural resource in this area. As with lead, several different forms of extraction were noted: opencast workings, collieries, shafts and adits. The densest concentration lies in the north-east around the South Tyne and Nent rivers (Fig 31), and no sites were identified along the Tees or south of Tynehead. With the exception of five collieries of post medieval or 20th century date all the coal sites were placed under the bracket of 'coal workings' according to the preferred AMIE term, resulting in 88 records. Most of the coal workings on the east side of the River South Tyne and north of the Nent occur as small adits and extractive pits along the geological benches, following the contours of the hillside, just above the pastoral farmland limit. On Newshield Moss an extensive tract of coal workings extends for over 3km (1536271), running parallel to the present B6294 and along Garrigill Burn (960035) (Fig 31b). The latter site is defined by very small adits with a series of finger-dumps of spoil. Opencast coal workings were also mapped in the higher areas of Coalcleugh Moor (959161), Allendale Common (959132) and along Deadman's Cleugh (1535272).

The other major concentration of coal workings occurs in the western part of the study area where shafts and shaft mounds are clustered along Coal Cleugh on Haresceugh Fell (1529489) (Fig 31a). Minor isolated areas are noted at Whitley Castle (1530221) and on the lower slopes of Gilderdale Forest (1528303).

Most of the larger coal mining complexes or collieries, with their buildings, tramways and other features, appear to have been in use into the 20th century and were all located in the north of the study area surrounding Ayle: Clarghyll (Clargill) Colliery (957929 and 1535886), and the Ayle Collieries (1538174, 1536443, and 1535835).

Peat cutting

Peat cutting is widespread across the project area, particularly on the fells above the

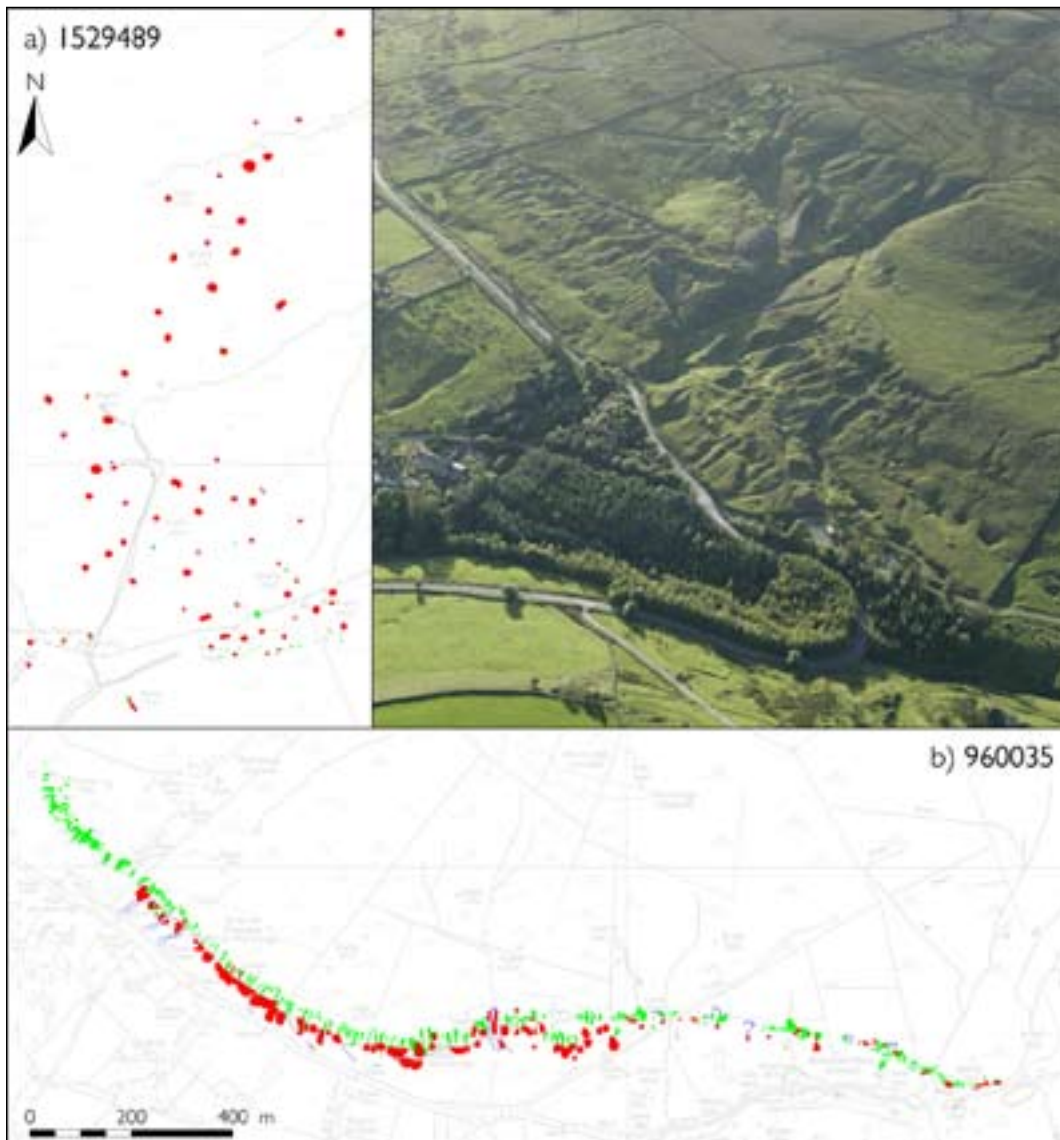


Fig 31: Variations in form of coal extraction. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088. NMR NY 7347/5 20679/47 10-SEP-2007 ©English Heritage. NMR.

Nent Valley, on Alston, Hesleywell and Wellhope Moors. Smaller areas were recorded for the South Tyne Valley, mainly on Rotherhope Fell (Fig 32), but notably extending down to the lower slopes of the valley side, as seen at Tynehead (1531500). Some of the peat cutting areas are located in close proximity to lead mining and processing areas, for example on Smallburns Moor (1520454). Recent recollections state that coal was expensive and peat was used as the fuel in the ore hearth (Mitchell 1979, 15) allowing a direct link between the two industries.

The form of extraction is typically seen as hollows with peat banks, or baulks. As there was no clear chronological development all peat cutting was dated as post medieval. Initially the peat banks were mapped using a T hachure symbol, to identify the cut face,

but this methodology was reviewed and an extent of area around the denser concentrations was used instead.

Quarrying and lime kilns

The Carboniferous rocks provide a range of stone resources for quarrying, which is extensive throughout the project area, spread along the valleys of the Rivers Nent and South Tyne. It was only possible to identify the explicit type of resource, as limestone, sandstone or ironstone, if noted on Ordnance Survey maps or from other documentary evidence. Where there was a close association with a lime kiln, quarries were recorded as limestone. The 1:50,000 scale digital geological maps made available to the project, suggested a broad pattern of limestone on the lower valley benches and sandstone on the higher slopes, but they did not provide sufficient detail to reliably distinguish between these inter-bedded rocks.

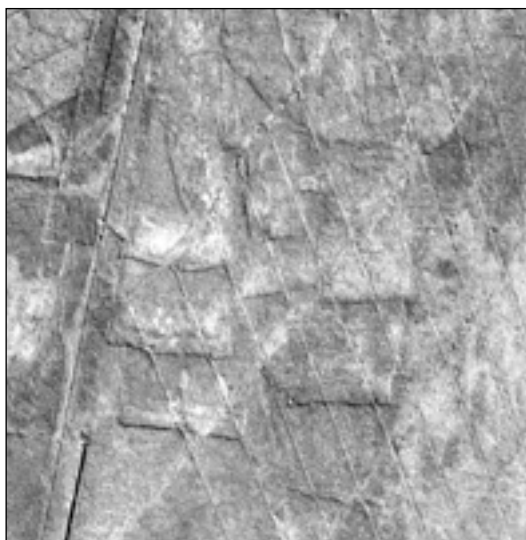


Fig 32: Peat cutting on Rotherhope Fell (looking north). NMR OS/77163 216 18-SEP-1977 © Crown copyright. Ordnance Survey.

Many of the limestone quarries were principally used to produce lime for local use as fertiliser and for mortar. The outcrops of sandstone provided stone for the construction of farm and domestic buildings, field walls, stone floors and roofing flags and in more recent times as a source of stone for building restorations (Clarke 2008, 44–5). Hence most quarries in the project area are recorded as post medieval, with a few potentially having medieval origins. There is some evidence for more recent re-use of spoil heaps in quarries, possibly for local use as hardcore (1513127).

The size of limestone quarries varies from the frequent scoops and small quarries to the rarer large scale quarries, as seen at New Shield (1536397) and Coatleyhill (957769 and 1536008). These quarries operated into the 20th century and the latter has a complex of lime kilns, indicative of commercial scale production. A network of tramways (1536388 and 1536370) links them to the South Tyneside railway, facilitating the transportation of products.

There are numerous single lime kilns scattered throughout the project area. Of these 121 AMIE records, 78% were previously recorded from data derived from the North Pennines AONB Lime Kiln Survey, which examined the form and condition of the lime kilns. Not all the lime kilns recorded by that survey were visible on air photographs and lidar, but an additional 26 lime kilns were recorded.

20TH-CENTURY MILITARY

Just two sites relating to 20th-century military activity were recorded by the project. The site of a Royal Observer Corps (ROC) monitoring post (1413069) was noted by the Defence of Britain survey on Potters Lane. The structure was recorded as having been destroyed at the time of survey but was found to be visible on 1978 Ordnance Survey vertical photography by the current project. In addition to this, two further structures were identified on 1948 RAF vertical photography at the same location. These predated the construction of the ROC post and have been interpreted as a World War II Observer Corps post and later orlit post. A similar sequence of structures was noted at Haydon Bridge, Northumberland during the Hadrian's Wall NMP project (Oakey 2009, 24). The Observer Corps are known to have met in the Turk's Head Hotel in Alston from 1943–1945 (Robertson 2002, 85).

To the east of Alston was a small military camp (1535796) (Fig 33). It is understood that this is the location of an Italian prisoner of war camp (A Robertson, pers comm). The buildings are extant on the 1948 RAF vertical photography but all that now remains are a series of low earthwork platforms.



Fig 33: An Italian prisoner of war camp east of Alston (north is to the top of the image). RAF 5411A/439 3241 29-JUL-1948 English Heritage (NMR) RAF Photography.

ARCHAEOLOGICAL DISCUSSION

The analysis of the aerial survey mapping results has sought to examine the character, diversity, distribution and associations of archaeological features within the historic manor of Alston. It has become clear that the mapping has made a significant contribution to our understanding of the archaeological landscapes of Alston Moor, particularly those relating to settlement and farming in the later prehistoric to medieval periods.

The distribution of settlement and agricultural remains is confined to a relatively narrow band following the river valleys. From the surviving evidence it seems that there has been continuity in the pattern of the settlement from prehistory to the medieval and post medieval periods. This reflects the relatively marginal upland situation of Alston Moor where soils, topography and climate have restricted the use of the landscape for several millennia.

Agriculture

The earliest evidence for cultivation appears to date from the Iron Age or Romano-British periods but could have origins in the Bronze Age. Unlike other upland locations such as Hadrian's Wall, no evidence had been found for cord rig cultivation; instead the evidence for ploughing takes the form of lynched field systems, occasionally with associated clearance cairns. Arable cultivation continues into the medieval period and is also evidenced by lyncheds as well as ridge and furrow. Some of the medieval lyncheds and boundaries are likely to represent a continuity of use from the pre-Roman period. Other features include hollow ways, stock enclosures and boundary banks. The evidence for farming from prehistory into the medieval period is indicative of a mixed economy with features relating to arable cultivation and the movement and management of livestock.

At some point in the post medieval period there was a transition to an entirely pastoral farming regime which remains to this day. Much of the ridge and furrow in this period appears to be for land improvement rather than arable cultivation and is commonly confined by the 19th-century enclosure walls. Further evidence for improvement of pasture is provided by numerous small quarries with related lime kilns, used to burn limestone which was then spread on the fields to alter the soil's pH and increase fertility. The predominance of sheep farming is attested by numerous sheep folds located throughout the survey area.

Settlement

Firmly dated evidence for Bronze Age activity is restricted to funerary monuments but it is considered highly probable that elements of the settlements and field systems will have originated in this period. Few morphologically distinct forms of enclosure can be identified and the lack of rectilinear settlements contrasts with other areas mapped by the NMP such as Hadrian's Wall and Till-Tweed. There is also no observable 'evolution' in the form of the enclosures although the contrast between discrete settlements and larger villages such as Gossipgate may indicate a nucleation of settlement. Without excavation

it is not possible to establish to what degree the settlements are contemporary but it is likely that the lack of morphological variation reflects the continuity of Iron Age traditions into the Roman period rather than a narrow period of construction.

In contrast to neighbouring areas of Northumberland and Cumbria there are no hillforts located within the project area. Furthermore, none of the settlements appear to have defensive features such as ditches or multiple banks. This may indicate that there was relatively little pressure on the landscape in this region.

There is no clear evidence for continued occupation at any of the settlement sites beyond the Roman period but it remains a possibility that some did continue in use into the early medieval period. Similarly little evidence exists for later medieval settlement but its presence can be inferred from the evidence for arable cultivation. It is probable that, in several instances, the present farms are successors to medieval ones at the same location and have either destroyed any trace of their precursors or incorporated elements of them into their fabric. The identification of ditched enclosures around four farms lends further weight to this argument and additional investigation into these features and the vernacular architecture of the farmsteads would be valuable.

Industry

The exploitation of Alston Moor's rich mineral resources, particularly from the 1700s onwards, has helped to shape the landscape and the development of the built environment. Abundant industrial remains are testament to the dominance of the lead industry in the area and include related infrastructure for transport and water management. Although mining is documented in the medieval period, and may even have begun under the Roman occupation, this could not be readily distinguished in the form of the remains. Extraction of coal, peat and stone were also prevalent and even after the decline of the lead industry in the 19th century, extraction of other minerals continued.

METHODOLOGICAL DISCUSSION

In addition to the vertical and oblique photographs commonly used in air photograph mapping projects (see SOURCES), three further datasets were made available to the project.

- 25cm resolution orthophotography supplied by Next Perspectives™ through the PGA.
- 25cm resolution orthophotography commissioned for the project (100sq km).
- 50cm resolution lidar (DSM and DTM) commissioned for the project (100sq km).

The following discussion is an attempt to assess the impact of these commissioned datasets, principally the lidar, on the air photograph mapping.

Orthophotography

The primary advantage of using orthophotography in AutoCAD was that it provided an accurate and georeferenced set of photography that reduced the need for rectification of other photography. It was of particular value where archaeological features were defined by tonal differences such as exposed stonework or dressing waste (Fig 34). The commissioned orthophotography was also valuable for verifying features on the lidar by providing a 'real world' view of the landscape and aiding filtering of non-archaeological anomalies. A relatively small gap of a few months between the lidar and photography being flown meant that any changes in the landscape were minimal. The ability to easily switch between the orthophotography and lidar in AutoCAD helped to inform the interpretation of the lidar data and clarify misleading non-archaeological features.

The decision was taken to use orthophotography rather than Ordnance Survey mapping for control in AERIAL. The rationale for this was that the orthophotography would be a common base between teams and would also afford greater accuracy than the Ordnance Survey mapping. It would also provide control in upland areas where the lack of mapped features can be problematic.

The findings of the project were that the orthophotography provided very good accuracy for rectification. The calculated error values in AERIAL were consistently low and were often lower than those achieved by other projects in comparable landscapes using Ordnance Survey mapping. One disadvantage noted was the inability to visually check the fit of the rectification in AERIAL. Vector or raster mapping can be superimposed on the rectified image within AERIAL to assess the accuracy of the rectification but this is not possible with orthophotography. This visual check was instead carried out in AutoCAD but the accuracy of the rectifications was such that there were few instances where control points had to be altered.



Fig 34: Lead mining remains at Nenthead highlighting the tonal differences of the lead dressing waste and spoil. Miner-Farmer Imagery NY7843 12-APR-2009

Lidar

Although lidar derived imagery has been used in several NMP projects such as Marden Henge and Beachy Head, its use has tended to be confined to 2D jpeg images. These are raster images, lit from a single source and the data contained within them cannot be manipulated, so are analogous to a vertical photograph. Where raster surface data were used, the geographical area covered tended to be limited to a relatively small area (eg Savernake Forest) or was site-specific (eg Wrest Park and Audley End). The North Pennines project has been the first to systematically use raster surface data over such a wide area. It is also the first time that the technique has been applied to a northern upland landscape by English Heritage apart from a small swathe of Hadrian's Wall that was assessed as part of the Hadrian's Wall NMP project.

It can be difficult to evaluate the impact that lidar has had on a project. Savernake Forest NMP (Crutchley *et al* 2009) took the approach of using lidar and air photographs independently of one another and having duplicated layers in AutoCAD. This enabled an empirical comparison of what features were visible from the different sources of imagery and their relative locational accuracy.

It was decided that for the North Pennines project the lidar data would be fully integrated with air photographs at the analysis, interpretation and mapping stages. While this method would not allow for a quantitative analysis of which features were visible on each source, it was anticipated that the mapping flow line that evolved would provide a qualitative indication of how useful the lidar had been relative to the air photography. This would also help to inform the future use of lidar data.

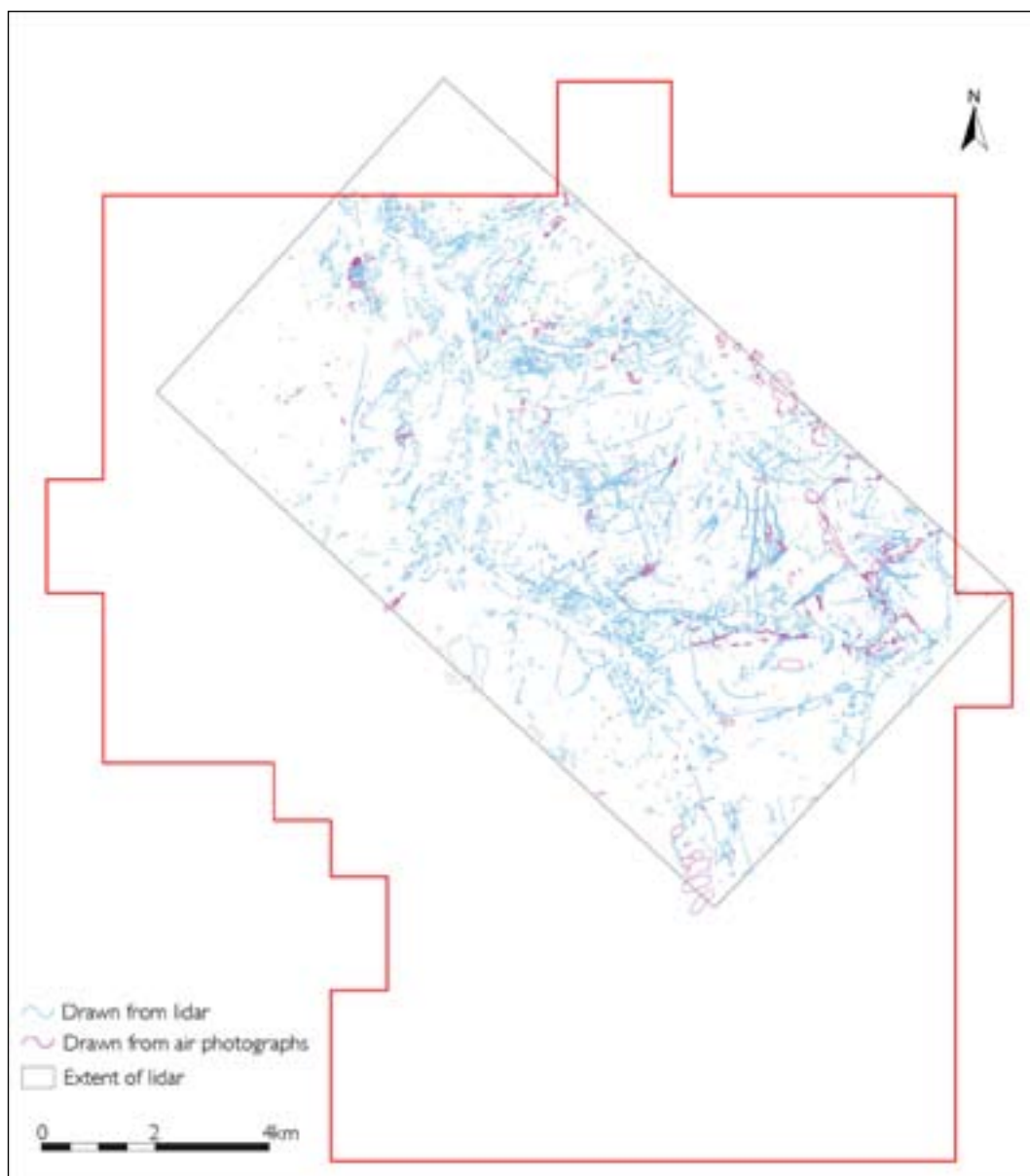


Fig 35: Comparison of features drawn from lidar and air photographs.

Because of the nature of the mapping data produced, it is very difficult to get quantitative analyses of the impact of lidar on the mapping. One approach is to calculate the number of objects that were drawn from each source by querying the object data table within the AutoCAD drawing (in AutoCAD terms, an 'object' is a single entity within the drawing such as a line or polygon). The problem with this approach is that one archaeological feature may be drawn with a single object while another might be drawn from multiple objects.

An alternative approach is to determine the number of AMIE UIDs that these objects relate to. However, this method is again only of limited value as the number of archaeological features that are recorded within a single AMIE record can vary considerably. There will also be a degree of overlap where features within a single UID have been mapped from a combination of lidar and air photographs.

Within the area covered by the lidar, a total of approximately 167,500 objects (excluding hatches) were drawn from lidar but only around 7,340 from air photographs, equating to around 4%. This compares with around 1,490 UIDs that were drawn from lidar compared to 319 from air photographs, or approximately 21%. The reality is probably somewhere between these two figures but the results can be most readily understood visually and Figure 35 demonstrates that the significant majority of features were mapped from the lidar. The fact that a feature was mapped from lidar does not necessarily indicate that it was not visible on other sources. What it does suggest, though, is that the lidar was considered to be the source on which the feature showed most clearly.

Case studies

The following case studies are intended to demonstrate the relative merits of lidar and air photographs under different circumstances.

Tynedale

The lynched field system and settlements at Tynedale are only covered by four vertical runs, two of which were the PGA and commissioned orthophotography; no oblique photography had been taken at this location. It can be seen from Figure 36 that very few of the archaeological features were visible on the vertical collections held by the NMR. On both the Ordnance Survey and RAF photographs the direction of the sun is aligned along the lynchets so no highlights or shadows are present.

Features are better represented on the PGA and commissioned orthophotography. The lynchets happen to lie perpendicular to the sun in this instance, giving strong shadows and highlights. Lynchets aligned along the direction of the sun are not visible though.

There is better definition of the earthworks on the lidar and the ability to light the lynchets from the north-west made identification of their south-eastern sides easier. The lidar also highlighted additional features when lit from the north-east and it was this angle that also gave better definition to the settlements. Additional detail of the settlements that was not visible on the air photographs could also be picked out on the lidar and

subtleties of the relationships between features are also better represented.

Ayle

The settlement at Ayle (Fig 37) represents one of the best preserved examples within the survey area. It is covered by a total of five vertical runs and, unlike many other sites, was also photographed obliquely in 1979 and 2007. The general form of the enclosure can be made out in all of the vertical sorties apart from the PGA but the 1977 Ordnance Survey and 2009 commissioned orthophotography also give indications of internal structures.

Cambridge University photographs from 1979 (not illustrated) were taken in snow covered conditions and pick out better internal detail. Additional details can be identified on the 2007 oblique photograph (Fig 8) although some areas are obscured by heavy shadow. While it is evident that the lidar gives the clearest view of the settlement, this does demonstrate that further targeted photography of other sites would have yielded good results.

Mounthooley and High Spencycroft Plantations

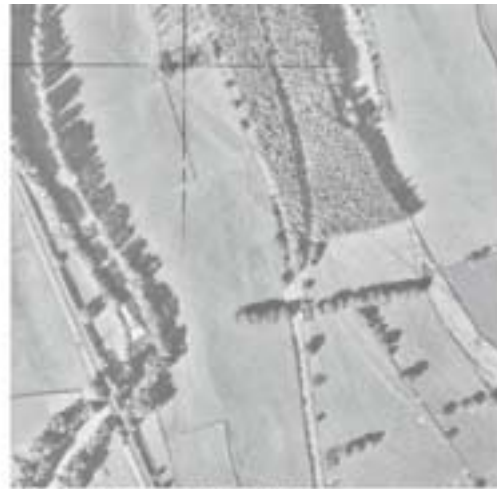
The results of lidar survey in areas of woodland were variable and produced DTMs of differing quality. At Mounthooley and High Spencycroft Plantations (Fig 38) there is a mix of woodland types including coniferous plantations of different ages which serve to illustrate the range of findings more generally. The limitations of lidar in woodland have been noted in other studies (Crutchley and Crow 2009, 33–7) but within the North Pennines survey area woodland is very restricted in its extent so the impact was small. Observations on the main tree species in the woodlands, which is generally coniferous plantation, were recorded as part of Module 2.2, the field survey by English Heritage's Archaeological Survey and Investigation team.

Areas A and B are planted with Norway Spruce, an evergreen conifer, with a fringe of deciduous woodland towards the road. On the 2002 PGA photography area B appears to be the younger woodland. The results from the lidar are quite good within the area of older, taller trees but poor in area B where the trees are shorter and younger. This tallies with the findings of Crutchley and Crow (2009) who suggest that lidar penetration can be poorer in areas of dense, young woodland. In this instance, mapping of features within Mounthooley Plantation was aided by historic photography from the 1950s to 1970s.

Area C is planted with Japanese Larch, a deciduous conifer, which sheds its needles in the autumn. Lidar has been very effective here as it was flown in late October when the trees will have largely been bare. Equally good results can be observed in area D, a mix of Japanese Larch and Silver Birch representing early experimental planting so sparser than the later plantations. The Birch trees have also largely died, apparently due to the lead waste in this area.



RAF/541/A/439 3067 29-JUL-1948 English Heritage (NMR) Photography



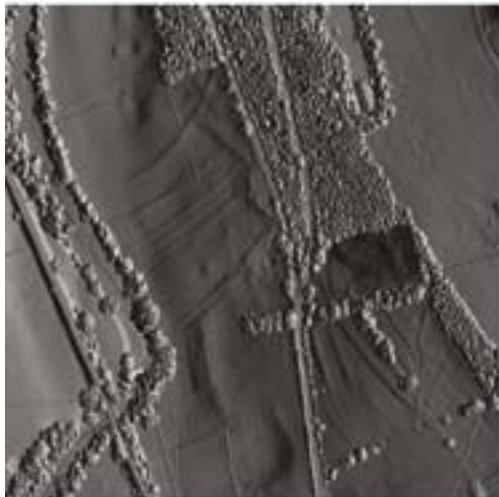
OS/77163 0226 18-SEP-1977 © Crown copyright, Ordnance Survey



PGA Imagery NY7147 Aerial Photography; Licensed to English Heritage for PGA, through Next Perspectives™

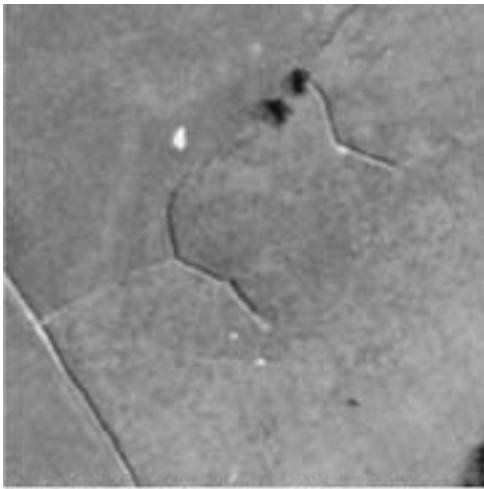


Miner-Farmer Imagery NY7147 12-APR-2009 ©English Heritage

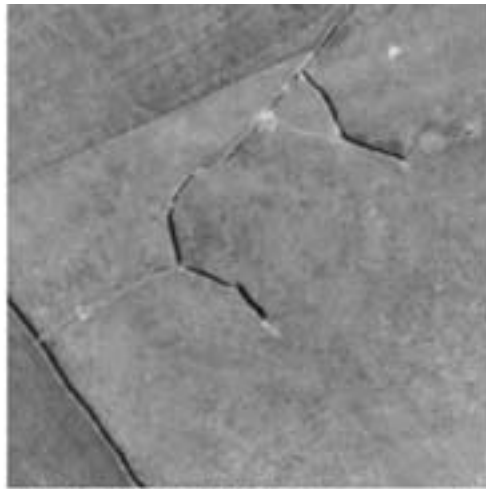


LIDAR NY7147 DSM 01-APR-2009 ©English Heritage

Fig 36: Field system and settlements at Tynedale.



RAF/541/A/439 3192 29-JUL-1948 English Heritage (NMR) Photography



OS/69243 0158 10-JUN-1969 © Crown copyright, Ordnance Survey



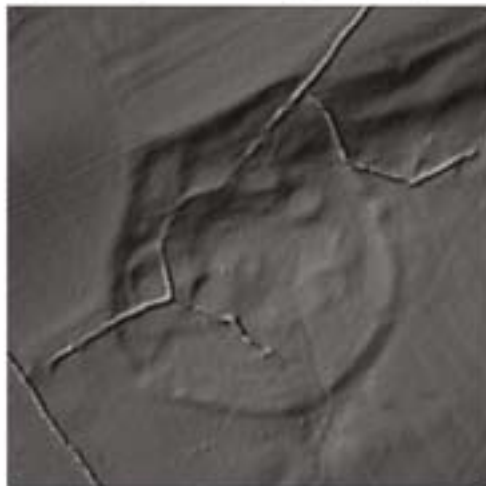
OS/77163 0229 18-SEP-1977 © Crown copyright, Ordnance Survey



PGA Imagery NY7149 Aerial Photography: Licensed to English Heritage for PGA, through Next Perspectives™



Miner-Farmer Imagery NY7149 12-APR-2009 ©English Heritage



LIDAR NY7149 DSM 01-APR-2009 ©English Heritage

Fig 37: The Iron Age/Roman settlement at Ayle.

Conclusions

The findings from the analysis of the lidar data have highlighted that features were often quite poorly represented on vertical photography. While elements of sites were visible, their full extent and complexity was rarely clear. The general consensus of opinion is that where earthwork remains were visible on lidar and air photographs, they were more clearly visible on the lidar. Assuming that if the level of detail or visibility had been better on an air photograph this would have been used for mapping, this is borne out by the statistical data. One notable exception to this is at Whitley Castle where a number of features were mapped from a CUCAP oblique.

One of the factors that has led to the relatively poor representation of features on air photography is the lack of targeted reconnaissance, especially prior to the 2007 flight undertaken in advance of the project. Undoubtedly more oblique photography taken under the right conditions would have yielded better results but a number of sorties at different times of the day and year would have been needed to achieve similar results to the lidar.

The circumstances in which air photographs were used in preference to lidar can broadly be summarised as when:

- Features had been levelled or altered since the date of the air photograph
- Features were defined by tonal or colour differences
- Features were visible before woodland plantations were established

Perhaps the greatest strength of lidar is the ability to move the light source and exaggerate heights. Features were often most clearly visible when lit from angles and directions that they would not be naturally. Another factor influencing the predominant use of lidar for mapping is that it is a georeferenced dataset. This has reduced the need to rectify photographs and increased the positional accuracy of mapped features when compared to rectified images.

Analysis of the lidar data does indicate that a greater level of detail, particularly subtleties of phasing, can be achieved by lidar compared to conventional photography. In the North Pennines this has also been influenced by the steep topography which can result in short shadows on slopes facing the sun and deep shadows on slopes away from the sun which obscure sites.

Lidar has also proved valuable in assessing the current survival of earthworks. Previously, the most recent available photography was used to assess whether a feature was still extant or levelled. This was always done with the caveat that the most recent photography may not have been taken at a time conducive to highlighting earthworks. Lidar gives the ability to provide a more definitive statement on the state of preservation of earthworks.

The presence of lidar artefacts, misleading patterns in the data caused by data collection

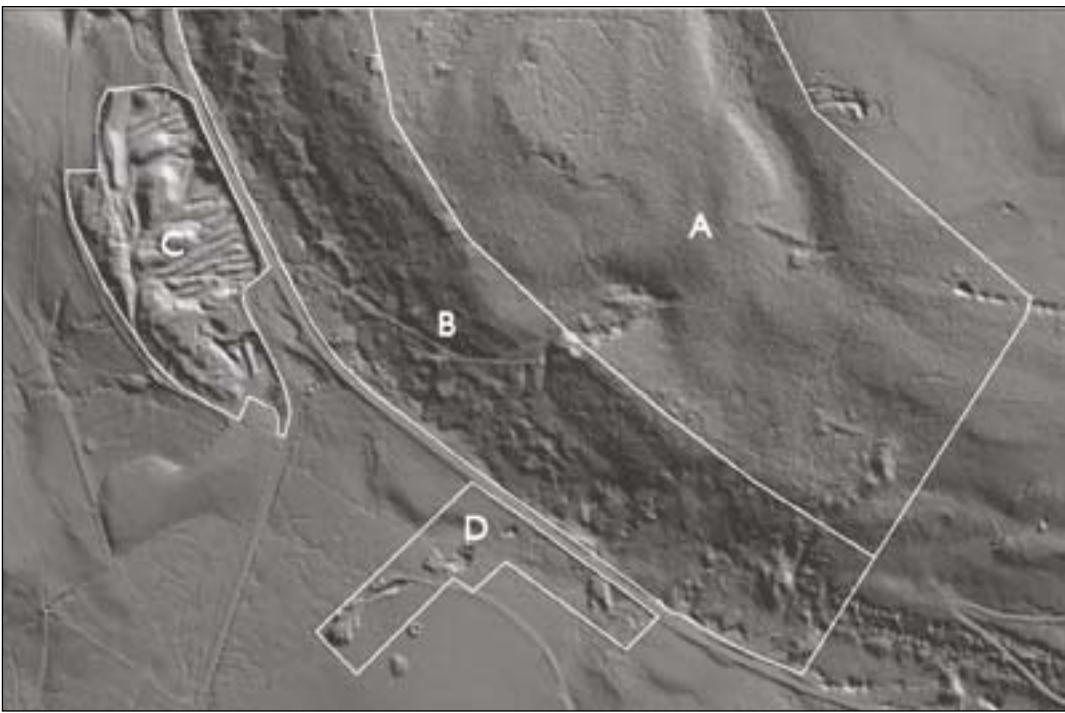


Fig 38: Orthophotography and lidar DTM of Mounthooley and High Spencycroft plantations demonstrating the relative visibility of archaeological features on the lidar DTM in different types of woodland.

and processing, are an acknowledged pitfall when interpreting lidar data. Artefacts encountered included parallel lines, swathes of coarse data and rectangular areas of polygonised data. Instances were also noted where the processing of the data to produce the DTM had a softening effect on features (Fig 39).

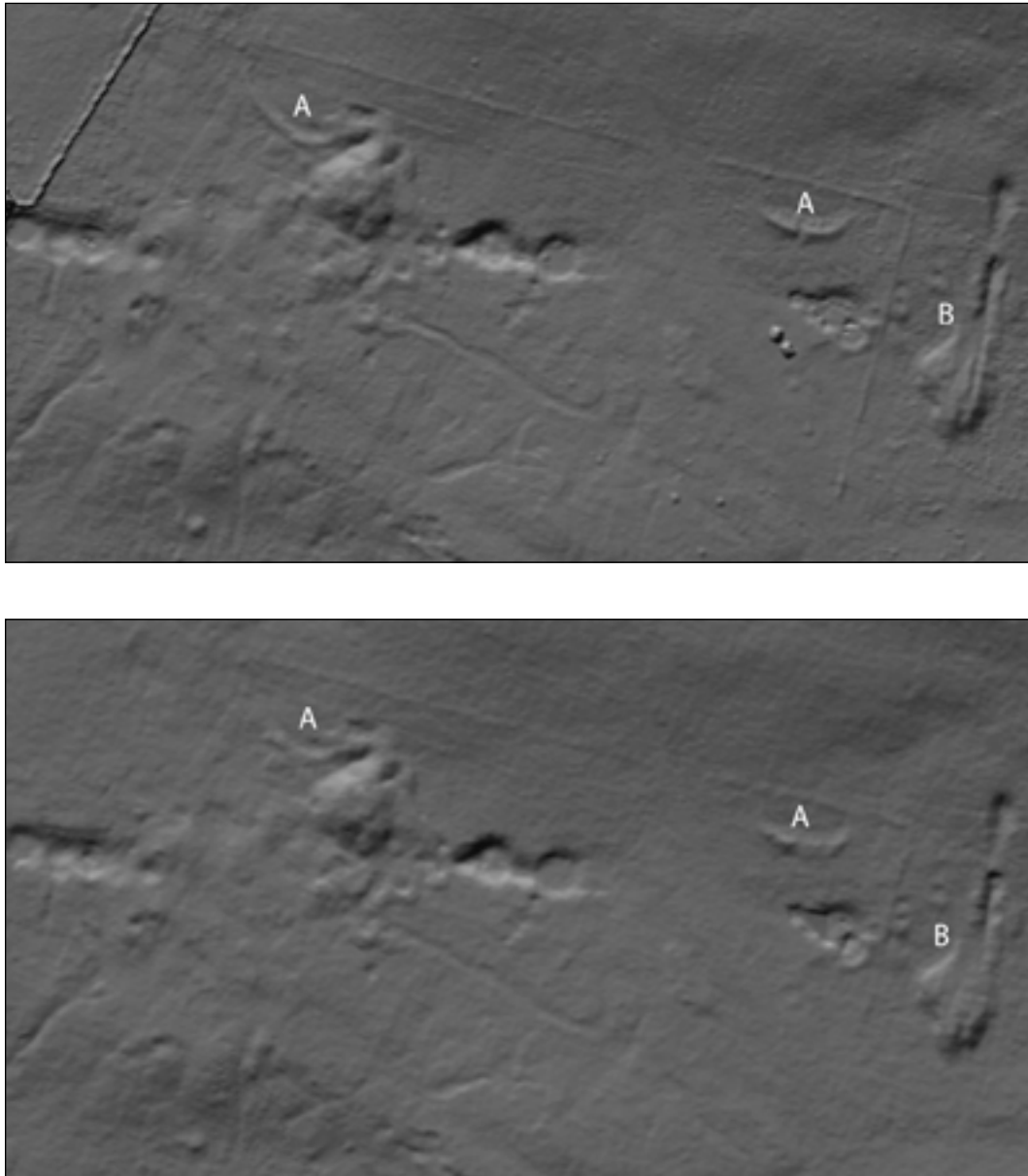


Fig 39: Earthworks visible on the DSM (top) and DTM (bottom) demonstrating the softening effect of the DTM algorithm on archaeological features. Of particular note are the two dams (A) and spoil heap (B).

From a methodological point of view, it is interesting to observe how lidar has been used when it is not treated as a standalone dataset. Use of lidar data radically altered the approach to mapping compared to previous projects undertaken by the team. For the reasons outlined above, it became the primary source for mapping and interpretation

with air photographs used alongside the lidar to inform interpretation and check for additional detail. It must be emphasised, however, that oblique and vertical air photographs remained an intrinsic part of the interpretation process and were essential to the understanding of the lidar data.

The interpretation processes developed further those used when analysing air photographs. The ability to move around the digital model in a 3D environment and 'virtually' observe features from ground level enhanced the interpretation of earthworks, especially when looking at subtle phasing within a site. Field visits with members of the Archaeological Survey and Investigation team were a valuable aid to developing interpretation skills with lidar.

Time impact

It has been difficult to assess the implications that the lidar has had on the time spent mapping features. This is partly because the density of the archaeology has been considerably greater than encountered in other projects. A valid question would, of course, be whether the number of identified features would have been so great were it not for the lidar. Undoubtedly, one of the time impacts has been the greater number of features that were visible on the lidar when compared to conventional photography. Although a large number of these features fell outside of NMP specifications, such as extensive drains, (see SCOPE OF THE SURVEY) and were therefore not mapped, they still had to be interpreted and assessed.

This was also the first time that the members of the team had used lidar in this way. Initially learning how to interpret and use the lidar data increased the time taken to complete a 1:10,000 map sheet. Additional time was also required to establish how to incorporate lidar data into the flow line of interpretation and mapping. These are, however, valuable skills that will be carried forward to subsequent projects.

Digitisation from the lidar data in AutoCAD was found to be more time consuming. During mapping the lidar model was re-lit from a number of different angles as different elements were drawn. However, this must be balanced against the potential time that would have needed to rectify several air photographs lit from different angles to achieve similar results.

Practical issues associated with the use of raster surfaces in AutoCAD Map 3D 2008 were encountered. If raster surfaces were left connected to the drawing when AutoCAD was closed this produced a 'phantom' image that could not be detached. The need to connect and disconnect lidar tiles every day did have a small time implication. It was also necessary to resample the data when panning and zooming.

Recommendations

The findings of this report largely support the recommendations made in *The Light Fantastic* (Crutchley and Crow 2009) but specific recommendations are:

- Before taking the decision to use lidar for an archaeological survey project, an attempt should be made to assess the number and quality of air photographs. This may give an indication of the potential returns that will be achieved with lidar.
- The type of landscape (eg topography, vegetation) should be carefully considered before lidar is used. The returns from lidar in other areas may be far lower than those achieved in the North Pennines.
- A resolution of at least 1m is necessary for archaeological survey but 0.5m is much better for assessing fine detail. The value of higher resolutions needs to be carefully considered against cost and unwieldiness of the data.
- The blanket use of raster surfaces has been time consuming but this must be balanced against the returns that it has given. Use of lidar data in future projects should be considered carefully and ways to find a compromise between using 2D jpegs and raster surfaces, such as Principal Component Analysis, should be explored.
- While it is possible to undertake interpretation and mapping from lidar alone, the use of air photographs alongside lidar is highly recommended. Although air photographs may be unlikely to reveal many additional features in areas not conducive to cropmark formation, they do provide a qualitative enhancement to aid interpretation.
- Contemporary or near contemporary air photographic coverage should be used to aid the interpretation of archaeological and non-archaeological features seen on lidar, especially where there are colour or tonal differences. It also provides a 'real world' view of the landscape that can be more intuitively understood than a digital model, enhancing the interpretation of lidar.
- Historical air photographs should be used to provide a time-depth that can improve understanding of features visible on lidar as well as showing features that have since been levelled.

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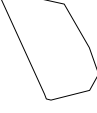

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APPENDIX I. QUARTER SHEETS

Map	NMR Collection Number	Author(s)	Date of completion
NY 63 NE	MD002635	David Knight	14 January 2011
NY 63 SE	MD002636	David Knight	20 January 2011
NY 64 NE	MD002637	Sally Radford	21 January 2011
NY 64 SE	MD002638	David Knight	22 December 2010
NY 64 SW	MD002639	David Knight	23 December 2010
NY 73 NW	MD002640	Sally Radford	7 October 2010
NY 73 NE	MD002641	David Knight, Jane Monk, Sally Radford	25 February 2011
NY 73 SW	MD002642	David Knight	27 January 2011
NY 73 SE	MD002643	Sally Radford	17 February 2011
NY 74 NW	MD002644	Matthew Oakey, Sally Radford	13 May 2011
NY 74 NE	MD002645	Yvonne Boutwood	1 June 2011
NY 74 SW	MD002646	David Knight, Jane Monk	27 October 2010
NY 74 SE	MD002647	Sally Radford	17 August 2010
NY 75 SW	MD002648	Tara-Jane Sutcliffe, Sally Radford	10 May 2011
NY 84 SW	MD002649	Sally Radford	8 July 2010

APPENDIX 2. AUTOCAD MAP LAYER CONTENT AND DRAWING CONVENTIONS

Layer Name	Layer content	Attached data table	Layer colour	Linetype	
0	None	NONE	7 (white)	CONTINUOUS	
BANK	Closed polygons for features such as banks, platforms, mounds and spoil heaps	MONARCH	1 (red)	CONTINUOUS	
BANKFILL	Solid fill for BANK layer polygons	MONARCH	1 (red)		
DITCH	Closed polygons for cut features such as ditches, ponds, pits or hollow ways	MONARCH	3 (green)	CONTINUOUS	
DITCHFILL	Solid fill for DITCH layer polygons	MONARCH	3 (green)		
EXTENT_OF_AREA	Closed polygons outlining complex or extensive remains such as industrial complexes	MONARCH	8 (grey)	DASHEDX2	
GRID	Grid lines at 1km intervals	NONE	7 (white)	CONTINUOUS	
MONUMENT_POLYGON	Closed polygons encompassing all the features comprised within a single AMIE record	MONARCH	7 (white)	CONTINUOUS	
RIG_ARROW	Polyline showing the direction of ploughing in outlines of ridge and furrow	MONARCH	40 (orange)	CONTINUOUS	

RIG_OUTLINE	Closed polygon defining the extent of ridge and furrow	MONARCH	40 (orange)	DOTX2	
STRUCTURE	Closed polygon for built features including stone, concrete, metal and timber constructions	MONARCH	9 (grey)	CONTINUOUS	
STRUCTUREFILL	Solid fill for STRUCTURE layer polygons	MONARCH	9 (grey)	CONTINUOUS	
THACHURE	Polyline t-hachure convention to schematise sloped features indicating the top of slope and direction of slope	MONARCH	5 (blue)	CONTINUOUS	

APPENDIX 3. AUTOCAD MAP ATTACHED DATA TABLE

The attached object data table MONARCH* consists of eight fields that were input directly through AutoCAD Map. The object data were exported with the shapefiles as attribute data. The content of these fields broadly duplicates those that are entered in the National Monuments database, AMIE.

Attribute	Description	Sample data
MONARCH*	AMIE Unique Identifier (UID)	957978
PERIOD	Date of feature (EH Thesaurus). Single or dual indexed terms	POST MEDIEVAL
NARROW_TYPE	Monument Type (EH Thesaurus). Specific monument type for individual features	DAM
BROAD_TYPE	Monument Type (EH Thesaurus). Broader monument type to enable grouping of individual features	LEAD MINE
EVIDENCE_1	Form of remains (EH Thesaurus) as seen on PHOTO_1	EARTHWORK
PHOTO_1†	Source feature was mapped from (air photograph or lidar)	NMR RAF/58/2655 F22 0017 09-DEC-1958
EVIDENCE_2	Form of remains (EH Thesaurus) as seen on PHOTO_2	LEVELLED EARTHWORK
PHOTO_2†	Latest available source (air photograph or lidar)	LIDAR NY7445 DSM 01-APR-2009

*MONARCH is a former name of the National Monuments database re-named AMIE. The table retains the former name to facilitate download into the English Heritage GIS.

† The commissioned orthophotography is referred to as 'Miner-Farmer Imagery'.

APPENDIX 4. MONUMENT TYPES

ADIT
AERIAL ROPEWAY
AQUEDUCT
BANK (EARTHWORK)
BARYTES MINE
BATH HOUSE
BIELD
BLACKSMITHS WORKSHOP
BOUNDARY
BOUNDARY BANK
BOUNDARY DITCH
BOUSE TEAM
BRICK KILN
BUDDLE
BUILDING
BUILDING PLATFORM
CAIRN
CHIMNEY
CIRCULAR ENCLOSURE
CISTERN
CLAY PIT
CLEARANCE CAIRN
COAL WORKINGS
COLLIERY
CONDENSING CHIMNEY
CONDENSING FLUE
CONDUIT
COPPER MINE
COPPER WORKINGS
CRUSHING MILL
CULTIVATION TERRACE
CURVILINEAR ENCLOSURE
DAM
DEWPOND
DITCH
DRAIN
DRAINAGE DITCH
DRAINAGE SYSTEM
DRESSING FLOOR
DRESSING MILL
DRESSING WASTE
DROVE ROAD
ENCLOSED SETTLEMENT
ENCLOSURE
EXTRACTIVE PIT
FARM
FIELD BOUNDARY
FIELD SYSTEM
FLUE
FOOTBRIDGE
FORT
GARDEN FEATURE
HA HA
HEADLAND
HOLLOW WAY
HUSH
HUT CIRCLE
HUT PLATFORM
HYDRAULIC PIPEWORK
IRONSTONE MINE
LANDSCAPE PARK
LEAD MINE
LEAD MINE/IRONSTONE MINE
LEAD WORKINGS
LEAT
LIME KILN
LIMESTONE QUARRY
LYNCHET
MILITARY CAMP
MILL POND
MILL RACE
MINE
MINE BUILDING
MINE PUMPING WORKS
MOAT
MOUND
NARROW RIDGE AND FURROW
OBSERVATION POST
OPENCUT
ORLIT POST
PARK PALE
PEAT CUTTING
PIT
PLATFORM
PLOUGH HEADLAND
POWDER MAGAZINE
PROSPECTING PIT
QUARRY
RACECOURSE
RAKE

RAMP
RECTANGULAR ENCLOSURE
RECTILINEAR ENCLOSURE
RESERVOIR
REVETMENT
RIDGE AND FURROW
ROAD
ROUND CAIRN
SANDSTONE QUARRY
SETTLEMENT
SHAFT
SHAFT MOUND
SHEEP DIP
SHEEP FOLD
SHEPHERDS HUT
SHIELING
SLUICE GATE
SMELT MILL
SPOIL HEAP
SQUARE ENCLOSURE
STACK STAND
STOCK ENCLOSURE
STRUCTURE
TERRACED GROUND
TRACKWAY
TRAMWAY
TREE MOUND
UNDERGROUND MONITORING POST
VENTILATION SHAFT
VICUS
WALL
WATER CHANNEL
WATERCOURSE
WHEEL PIT
WINDING CIRCLE
ZINC WORKS

APPENDIX 5. AIMS AND OBJECTIVES ACHIEVED BY AERIAL SURVEY MAPPING

The aerial survey mapping has created a comprehensive record of archaeological features across the project area encompassing the historic manor of Alston. It has enhanced elements of previously known archaeological sites, but also significantly increased our knowledge, by adding new sites to the national archaeological record. The digital data format has enabled analysis of features ranging potentially from the Neolithic to the 20th century. This data is complementary to other components of the project, particularly in providing a wider context to the ground survey within the core research area (Modules 2.2 and 2.3). The contribution the aerial survey mapping has made to explicit project aims and objectives (Ainsworth 2008) are identified below, where these additionally contribute to English Heritage’s Research Agenda or AONB Management Plan Objectives, they are noted.

Miner-Farmer project aims and objectives:

<p><i>Miner-Farmer Project Aim 1. Increase the understanding and record of the historic environment.</i></p> <p>Objective 1. Undertake systematic survey of areas and sites representative of an historic environment dominated by lead-mining and associated remains.</p> <p>Objective 3. Develop compatible GIS datasets for exchange of heritage information between public bodies with an interest in the historic environment of the AONB.</p>
<p><i>AONB Management Plan Objective 15. To increase the range and quality of data available to support the conservation of the natural and historic environment.</i></p>
<p><i>English Heritage Research Agenda Theme A. Discovering, studying and defining historic assets and their significance.</i></p> <p>A1 What’s out there? Defining characterising and analysing the historic environment.</p> <p>A2 Spotting the gaps: Analysing poorly understood landscapes, areas and monuments.</p>

- Archaeology within the 234sq km of the historic manor of Alston was interpreted and recorded using air photographs and lidar.
- Air photographs in accessible archives were examined as well as lidar and orthophotography.
- Georeferenced digital maps were created to the NMP specification and methodologies.
- Use of commissioned datasets (lidar and orthophotography) increased locational and morphological accuracy and aided interpretation.

- Archaeology from Bronze Age burial cairns through to 20th-century military and industrial remains was mapped and recorded.
- New AMIE records were created for 1865 sites and a further 505 existing records were enhanced.
- The prehistoric to Roman period were previously very under represented in the existing records; the project has enhanced the understanding of this landscape.
- The digital mapping was exported from AutoCAD Map in ESRI Shapefile format (with attribute data) to increase functionality and usability for project partners.
- Data exchange of digital maps and AMIE records will be undertaken with Cumbria, Northumberland and Durham HER's and the North Pennines AONB partnership.

Miner-Farmer Project Aim 2. Contribute to conservation and management of the historic environment.

Objective 1. Inform future monument and land management strategy and identify priorities for action within the study areas.

AONB Management Plan Objective 15. To increase the range and quality of data available to support the conservation of the natural and historic environment.

AONB Management Plan Objective 16. To ensure increased research and survey of the historic environment and identify priorities for action.

English Heritage Research Agenda Theme D. Studying and assessing the risks to historic assets and devising responses.

DI Heritage at risk: quantifying and analysing the historic environment.

English Heritage Research Agenda Theme E. Studying historic assets and improving their presentation and interpretation.

EI Presenting the past: research to inform the presentation to the public of historic places.

- Identified and recommended sites and themes for level 3 survey by English Heritage's Archaeological Survey and Investigation.
- When successfully integrated with HER datasets, NMP mapping is a key tool for heritage management.
- Provides a comprehensive map of archaeology over a landscape setting.
- Can be used as a tool for management strategies and to aid development control

decision making.

- Latest available photographs and lidar images were examined to assess the latest known condition of each monument.

Miner-Farmer Project Aim 3. Development of new research methodologies applicable to upland lead-mining landscapes.

Objective 1. Investigate new and innovative methods of research into lead-mining landscapes in partnership with other agencies and academic establishments. Research methodologies will be explored for discovery and analysis of early lead-mining remains including terrestrial geophysics, lidar, geo-landscape modelling and remote sensing.

AONB Management Plan Objective 15. To increase the range and quality of data available to support the conservation of the natural and historic environment.

AONB Management Plan Objective 16. To ensure increased research and survey of the historic environment and identify priorities for action.

English Heritage Research Agenda Theme G. Studying and devising ways of making English Heritage and the sector more effective.

G1 Sharpening the tools: developing new techniques of analysis and understanding.

- First fully integrated use of raster surface lidar data for NMP.
- Enhanced detail of NMP mapping as a consequence of commissioned datasets.
- Increased understanding of methodologies required for working with lidar and its efficient use; contributing towards standard setting for the professional sector.

Miner-Farmer Project Aim 6. Contribute to a programme of capacity building, community and public awareness.

Objective 1. Actively engage local communities in the project through the agencies of the North Pennines AONB Staff Unit, the Living North Pennines Project, and the North Pennines Heritage Trust.

AONB Management Plan Objective 35. To develop and increase participation in educational and lifelong learning opportunities in and about the North Pennines AONB.

English Heritage Research Agenda Theme C. Engaging and developing diverse audiences.

C2 Making friends: building understanding and appreciation through education and outreach.

- Undertook two air photo interpretation workshops as part of the AONB's 'Altogether Archaeology' initiative, designed for community groups interested in

their local heritage.

- Participants received training in aspects of air photo interpretation and mapping, so that they may undertake future original research, thus developing skills.
- Two articles in *Research News* (English Heritage's newsletter of historic environment research) highlighting some of the findings from the project.
- Web page produced highlighting the project.
- Dissemination of AMIE records to the public and professionals via PastScape.
- Fostering increased understanding and appreciation of historic environment.
- Providing community groups increased accessibility to professional expertise and knowledge.



ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to <http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/>.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

- * Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
- * Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
- * Imaging and Visualisation (including Technical Survey, Graphics and Photography)
- * Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

