News from the archives  Anne Taylor  3
The initial triangulation of Scotland from 1809 until 1822  David L Walker  5
Revision points revisited  John Cole, Paul W Sowan
                    Geoffrey Spencer-Smith  16
How OS depicted limekilns in Scotland’s Central Belt  Paul Bishop and Gavin Thomson  19
OS County Series - NLS records listing project  Chris Fleet  32
Grid colours on military maps  Mike Nolan  34
Masked balls  Rob Wheeler  38
Colby’s grave  42
Nigel James (1953-2013)  Nick Millea  43
Mapping the Olympic park  John Davies  44
CCS visits Liverpool  John Henry  46
British Library visit  John Henry  50
The introduction of the UTM grid  Mike Nolan  52
Irish postcodes  53
Irish historic towns atlas – latest developments  Rodney O’Leary  54
Dealing with awkward extrusions  Rob Wheeler  56
An anthropologist investigates the wives of the surveyors of
Directorate of Overseas Surveys  Shelley Savage  57
Bridges patent mounting  58
Recent additions to NLS online OS map series  Chris Fleet  59
Kerry musings  David Archer  60
Letters  Paul Bishop, David Archer, John Cole, Iain Thornber  63
Book review - Mapping the roads  John Davies  64
We are pleased to announce that the third edition of Richard Oliver’s established and essential handbook for users of ‘non-current’ Ordnance Survey mapping, *Ordnance Survey maps: a concise guide for historians* is now available. This fully revised and updated edition includes a greatly expanded list of towns with their mapping dates, improved data on the early 1:2500 mapping of counties, and further minutiae on ‘points of detail’, as well as an updated bibliography. Special introductory price for CCS members is £12.50 for orders placed with publications manager (contact details opposite) before 28 February.

Due to a production error, for which we apologise, the index included in the 2013 Almanack was incomplete. An up-to-date version is supplied with this issue. In future years the Almanack will appear with the December, rather than August, *Sheetlines*.

The virtual museum, proposed by Rob Wheeler\(^1\) now has a collection of images and instruction manuals of surveying equipment and ancillary items. Further contributions are welcomed. See [www.charlesclosesociety.org/virtualmuseum](http://www.charlesclosesociety.org/virtualmuseum)

Also on the website is a new facility invaluable for those wishing to create a visual catalogue or index diagrams for their map collection. This is a shapefile which can be loaded into Google Earth and GIS software. It has the sheet line definitions of all series of one-inch and 1:50,000 British and Irish Ordnance Survey maps and 1:25,000 Provisional series of UK, together with their names and numbers. It is free to download and can be modified to include whatever additional information is required. Our thanks are due to Alastair Davies for creating this. See [www.charlesclosesociety.org/kmlfile](http://www.charlesclosesociety.org/kmlfile)

To encourage more members to share their research or observations with a wider audience, David Archer and Alison Brown are offering a biennial *Rowley Award* of £50 for a contribution to *Sheetlines* that ‘appeals to a judging panel for its freshness, content and promise for the future’. Eligible authors will not have had more than one previous contribution published. Any piece, long or short will be considered. Brief notes or letters will not count as a previous contribution. A panel of members will make the final decision, which will be announced at the AGM held on even years. The first recipient will be announced at the 2014 AGM.

The limited edition OS/ICE *Queen Elizabeth Olympic park map* featured on page 44 is not generally available, but *Sheetlines* has a few copies to give away in return for a short (preferably relevant) contribution to the next issue. If you are interested, contact the editors without delay!

---

\(^1\) *Sheetlines* 97, 3.
The 2013 programme of CCS outings, which included Explorer House Southampton, Geological Society London, Defence Geographic Centre Feltham, various locations in Liverpool and the British Library, concluded with the November visit to see Ordnance Survey maps being printed at the Butler, Tanner and Dennis works in Frome (to be reported in Sheetlines 99).

The 2014 programme has not been finalised at the time of closing for press. However, it is hoped that visits will include the British Geological Survey at Keyworth (Notts), the Network Rail archive in York and the offices of Ordnance Survey Northern Ireland in Belfast, as well as other venues. Please keep an eye on the events page on the website www.charlesclosesociety.org/forthcoming or contact Bernard Anderson on visits@CharlesCloseSociety.org or 1 Pulpitfield Close, Walton-on-Naze, Essex CO14 8RS.

The 2014 Annual General Meeting will be at Ordnance Survey head office at Explorer House Southampton on Saturday 17 May from 10.30. Full details will be sent to members with April Sheetlines.

CCS members assembled in front of Thomas Colby’s memorial in St James’ graveyard, Liverpool cathedral in July, with chairman Gerry Zierler seated front left and our guide Tinho da Cruz front right. Read more on pages 42 and 46.

[photo Roy Beacham]
News from the Archives

As promised in the Archives subcommittee report presented at the AGM, here is some more information about two new additions to the CCS Archives.

Seven issues of ‘On the Map’ have been kindly donated to the Archive by Iain Taylor of Halifax, Nova Scotia. These were formerly the property of Mr Barnes, a surveyor, and later his son, Dave Barnes of Rugeley, Staffordshire.

Although the main title stays the same throughout, the two earliest issues (September and December 1941) describe themselves as the journal, or official journal, of the Ordnance Survey Technical Officers Association, whilst the later issues (March, April and May 1946 and March-April 1947) are subtitled “The Official Journal of the Association of Government Geographers and Allied Technicians” (classmarks CCS_OS_415/1 and 415/2 respectively).

All are slim publications of about twelve pages, 25cm by 19cm in size and printed in black and white, with the covers of all but the earliest also printed in red.

The September 1941 issue states: “contributions of an informative, instructive or humorous nature (stories of persons and events in the annals of O.S.O. or of survey work abroad especially welcome) and cartoons are invited from members and other interested persons”.

And the contents are very much a hotch-potch. The more serious articles include those on triangulation and levelling, desert navigation, the origins and history of GSGS and the new (in March-April 1947) medium and small scale maps of Ordnance Survey. In the 1946 and 1947 issues the emphasis of much of the remaining material is on Union business. However, the two earliest ‘Ordnance Survey’ issues contain a much broader range of material and include, for example, announcements of births, marriages and deaths and, inevitably given the date, a roll of honour ‘in proud and grateful remembrance’ and a list of prisoners of war and those reported missing. Interesting insights into war-time life at Ordnance Survey include a short article on the tardiness with which the expenses claims of those on fire-watching duties are being met and the difficulties encountered in getting home by those who live some distance away (September 1941 p.7). The December 1941 issue (pages 4-5) then has an article about a Mr Jim Reed who had been injured whilst acting as one of the Ordnance Survey A.R.P. Fire Superintendents and on whose behalf colleagues had been asked to contribute a penny a week. The article’s final paragraph states that now that Mr Reed had been awarded a disablement allowance by the Civil Service War Service Distress Fund of 23/- per week for the period covering treatment, the voluntary levy was being discontinued.
So, plenty of different types of information, ripe for someone to come and investigate further!

The second acquisition is something of a mystery and your help is sought. Acquired from a gentleman whose father worked for Ordnance Survey in both Chessington and Southampton are four six-inch County Series sheets of three discrete areas in the vicinity of Plymouth printed in 1941, 1944 or 1945 (classmark CCS_OS_L130). So far, not unusual! However, all have (mostly) blue stencilled and hand drawn annotations the most obvious of which is the National Grid. In addition, dashed lines in red or blue follow some roads, and green solid lines follow some boundaries. All of the maps have the word 'TRAVELLER' stencilled in blue at the top.

It has been suggested that the marks along the roads might indicate a scheme for re-levelling and that ‘Traveller’ might indicate a sheet to be taken out on the ground rather than kept in the office as a record copy.

What do you think? Write or email me and I will put a summary of the replies in a future issue of Sheetlines.

Anne Taylor
Cambridge University Library
West Road, Cambridge CB3 9DR Tel: 01223-333041. email: aemt2@cam.ac.uk
The initial triangulation of Scotland from 1809 until 1822

David L Walker

Introduction

Whereas detailed progress reports were published on the first Trigonometrical Survey of England and Wales, including its extension into the Scottish Borders in 1809, little more was published on the triangulation of Scotland until the substantial report on the principal triangulation of Great Britain and Ireland published in 1858. From this report it emerges that many of the observations made before 1823 were superseded in the 1840s or discarded by 1858. Surprisingly, the diagram of the principal triangulation shows very few of the stations adopted as county meridians for the first topographical surveys of Scotland.

A history of the Ordnance Survey observes that ‘there is little detailed information about the work between 1810 and 1822’ (after which survey work was diverted into Ireland until 1838) and that ‘a complete list of the stations does not exist’ – although it does provide a provisional list of trigonometrical stations occupied in Scotland between 1813 and 1822.

This article draws upon a little noticed ‘sketch diagram’ in the National Archives at Kew to complete this list and (on pages 14-15) to illustrate these trigonometrical stations, and to explore aspects of the initial triangulation of Scotland by reference to official reports and to the illuminating but fragmented information available from other sources.

The triangulation of Scotland

After 1809 William Mudge, then Superintendent of the Ordnance Survey, left the Scottish survey in the charge of Thomas Colby, who succeeded him as Superintendent in 1820. After Colby returned from Ireland to Scotland in 1838, the triangulation of Northwest Scotland and the Western Isles was completed within a few years. But Colby had become concerned that the triangulation of Great Britain did not meet geodetic requirements and for the 1840s set in hand a new series of observations from the peaks of Britain and fresh observations from many of the stations occupied previously.

---

1 The author is a retired civil engineer whose family history research has been enriched by the resources of the map library of the National Library of Scotland.
2 William Mudge and Thomas Colby, An account of the trigonometrical survey, carried on by order of the Master-General of his Majesty’s ordnance, in the years 1800-1809, London, 1811.
3 Account of the observations and calculations of the principal triangulation etc, Drawn up by Captain Alexander Ross Clarke under the direction of Lt Col H James etc, Ordnance Survey: London, 1858.
5 The National Archives, MFQ 1/269/13, 1834 (described under footnote 8 below).
6 Seymour defines the fieldwork largely completed by 1841 as ‘the primary triangulation’ and that added in the 1840s and recalculated in the 1850s as ‘the principal triangulation’. This article uses the title ‘initial triangulation’ to describe the work carried out before the long hiatus between 1823 and 1838.
William Yolland became responsible for bringing this work together, but, after Colby retired in March 1847, he failed to get on with Colby’s successor, Lewis Hall, and Yolland was sent to Ireland in November 1852. After a gap of nearly two years, it was fortunate that the talented Alexander Ross Clarke emerged to complete the trigonometrical calculations in impressive style, but only by discarding observations from many of the stations occupied over the previous years. Hence the progress of the initial triangulation can be understood only by reference to a sequence of diagrams (from which extracts are shown opposite):

**Mudge 1811** 7 This diagram, of a very high standard, shows precise triangles extending into the Scottish Borders. It accompanied the 1811 report (footnote 2).

**Colby 1834** 8 Described as a ‘sketch diagram’, this accompanies an internal Board of Ordnance investigation into the progress of the survey in Great Britain.9 As the trigonometrical stations (in Scotland) are annotated upon a much earlier map, it does not pretend to show the triangles accurately.

**Yolland 1852?** 10 This previously undated ‘Diagram showing the Principal Triangulation for the Ordnance Trigonometrical Survey of Great Britain and Ireland’ has the same title and is drawn within the same coastline as Clarke 1858 (below), but at a larger scale (c 13 miles to the inch). Those stations which are shown on both diagrams appear to be plotted in the same position. Although it includes considerably more stations than the 1858 diagram, the undated diagram appears to reflect the position in 1852, as observations made from Goat Fell in 1852 are shown but not additional observations made from Brandon Down in 1853.

The status of this excellent resource apparently remains to be determined. Perhaps it was commissioned by Alexander Ross Clarke after his arrival at Southampton in 1854. But it seems more likely that it was maintained under the direction of William Yolland until his departure in November 1852. It shows stations and observations which were discarded in Clarke’s calculations and it usefully distinguishes observations made in only one direction.

**James 1856** 11 A small scale diagram showing ‘The principal triangulation with adjustment figures’ was first published in 1856 in a paper to the Royal

---

7 *Diagram of the great triangles in the trigonometrical survey of England & Wales, with the heights of the several stations etc*, R Wilkinson, London, 1811, © The British Library Board, Maps 1175(39).


9 For this (and several other corrections) the author thanks Richard Oliver.

10 *Diagram showing the principal triangulation for the Ordnance trigonometrical survey of Great Britain and Ireland*, Southampton [1852], © The British Library Board, Maps 1101(15).

11 *Account of the observations and calculations of the principal triangulation etc*, Drawn up by Captain Alexander Ross Clarke etc, London, 1858, © The British Library Board, Maps 207.b.5, vol 2, plate XVIII.
above: Mudge 1811 (footnote 7)
right: Colby 1834 (footnote 8)
below: Yolland 1852? (footnote 10)
lower right: James 1856 (footnote 11)
Society attributed to Lt Col James12. It was reprinted (slightly amended) as plate XVIII of the 1858 report (footnote 3) and much later as plate 11 of Seymour (ed), A history of the Ordnance Survey, 1980.

Clarke 185813 (extract left)
Of a similar cartographical standard to Mudge 1811, this diagram shows the stations selected by Clarke for his re-calculation of the principal triangulation and the dates they were occupied, but it does not show the many stations which were discarded, even those that are listed in the 1858 report (where it is published as plate XXVIII).

Diagram of the initial triangulation (as now illustrated)
The following rules have been adopted in preparing the diagram on pages 14-15 to illustrate the chronology of the initial triangulation from 1809 until 1822:

1. The ‘great stations’ marked O (already observed) or + (proposed for completion) are exactly those shown on Colby 1834.
2. Sides of triangles shown in full lines are exactly those shown on Colby 1834.
3. The coastline and location of stations shown on Clarke 1858 accords with Clarke 1858.
4. Other relevant stations marked x are added to show links with England and Ireland.
5. Stations ‘proposed for completion’ are named (or not) in accordance with Colby 1834.
6. The names and location of other stations were deduced from the bearings detailed in the Report of 1858, aided by www.trigpointinguk.com website (for the current status of these sites, and for grid references and spot heights, assistance which is gratefully acknowledged).
7. Dates of occupation (by the theodolite) were taken from Seymour (where listed), and from Yolland 1852? and Clarke 1858, and in a few cases deduced as described below.

12 Plate following ‘On the figure, dimensions, and mean specific gravity of the Earth, as derived from the Ordnance trigonometrical survey of Great Britain and Ireland communicated by Lt Col James RE FRS &c Superintendent of the Ordnance Survey’, Phil. Trans. R. Soc. Lond. 1856, vol 146, 607-626.
13 Diagram showing the principal triangulation for the Ordnance trigonometrical survey of Great Britain and Ireland, Southampton, around 1858, © The British Library Board, Maps X.8003.
8. A few ‘sides’, not shown on *Colby 1834*, but found to have been observed by 1817, have been added (in broken lines) to show how some early triangles were completed.

**Colby’s modus operandi**

In 1805 Mudge had instructed Colby ‘Don’t make a practice of going to all three points of every triangle, if observations made at two of them will be sufficient. Work round spires, staffs on mountains or any other proper objects, that the Survey may get on rapidly’\(^{14}\) Thus, in 1808 and 1809, both Skiddaw and the Cheviot provided ‘pivot points’ which were observed from several directions without being occupied by the theodolite. Apparently a single artilleryman had to journey ahead to set up each staff, until in 1818 Colby decided that ‘I have been compelled to send two men together instead of one to erect the objects, and the allowance of 2s 6d each object heretofore granted is become obviously too small. I have, therefore, to request that you will sanction me to raising it to 3s 6d each object.’\(^{15}\)

Dawson\(^{16}\) provides a useful clue to Colby’s reconnaissance of potential survey stations. On the mail coach ‘neither rain nor snow …. would induce him to take an inside seat …. but muffled in a thick box coat [he travelled] with his servant Fraser, an old artilleryman, at his side’. But Colby also travelled astonishing distances on foot, as described below for 1819.

**Trigonometrical survey of Scotland 1809-1814**

From the detailed information in the report of 1811 it is possible step by step to trace and, for those so inclined, to re-calculate the extension of the triangulation from northern England into Scotland in 1809, when observations were made from Criffel, Wisp Hill, Sayrs Law and Lumsdane Hill, reaching as far north as East Lomond and Largo Law beyond the Firth of Forth.

When the Scottish survey was resumed in 1813, Colby was at first mainly pre-occupied with ‘sector observations’ – the measurement of latitude by stellar observations – at Kellie Law, north of the Firth of Forth, and Cowhythe, south of the Moray Firth. In the following year, Colby with James Gardner linked up these stations by triangulation, for which the stations listed by Seymour as observed in 1814 would have been insufficient without the addition of Bruxiehill and The Buck, both shown on *Colby 1834*. Alva (now Hill of Alvah) and Manar Lee (now Hill of Maunderlea) were also occupied in 1814, apparently in support of the sector station at Cowhythe.

**Trigonometrical survey of Scotland 1815-1818**

In 1815, Colby remained in London, putting Gardner in charge of observations which ‘commenced on Bengairn Hill, near Kirkcudbright, and concluded on the Black [sic] Carrick Hill, near Ayr; thus completing the connection between


\(^{15}\) Colby to Mudge, 24 July 1818, quoted in Close, *The early years of the Ordnance Survey*, 86.

\(^{16}\) As reported in JE Portlock, *Memoir of the life of Major-General Colby*, London, 1869, 132.
Cumberland, the Isle of Man, part of the coast of Ireland, and the south-west of Scotland as far as Ayr.'\(^{17}\) As Seymour's list shows only Glasserton and Brown Carrick occupied in 1815, and as Gardner's work provided the basis for the first topographical surveys of Scotland\(^{18}\), the following description is of interest in illustrating the strategic position of Bengairn:

‘The great road from London to Portpatrick runs along the north-western margin of the Carlinwark Loch … with the magnificent background of Dungyle, the Skreel, and Bengairn. ….. From Bengairn, when the state of the atmosphere is favourable, the view is remarkably beautiful and extensive….. the eye naturally rests upon the lofty Cairnsmuir of Carsphairn, overlooking the Kells range of mountains, which separates the stewartry from Ayrshire …. on the east and northeast are seen Criffel and Queensberry Hill …. to the west Cairharra and Cairnsmuir of Fleet and the Isle of Man … and to the south the bold outline of the Cumberland mountains and the towns and villages that adorn the coast of England.’\(^{19}\)

To triangulate Brown Carrick from Glasserton, Gardner needed to occupy intermediate stations (shown on \textit{Colby 1834}) at Mull of Galloway, Carn Piot, Benereard and Saugh, making good use of volcanic outcrops within sight of the coach road, together with more remote stations on the summits of Merrick and Cairnsmore of Deugh (later known as Cairnsmuir of Carsphairn). Whereas Merrick may have been used only as a ‘pivot point’ (until it was occupied for ten weeks in 1852) confirmation that Cairnsmuir of Deugh was in fact occupied in 1815 or thereabouts\(^{20}\) is provided by the report of the Minister for Carsphairn (which incidentally lay on the coach route between Ayr and Dumfries) that:

‘The highest mountain in the parish is Cairnsmuir, which rises to an elevation of about 2696 feet above the level of the sea. It was chosen by Captain Colby as one of his stations for the trigonometrical survey in this part of Scotland, about 1814. From the summit of this mountain, when the atmosphere is clear, a most extensive view is obtained in every direction, except where it is intercepted by a mountain called Carline’s Cairn, on the south-west side of the parish, which is nearly of an equal height.’\(^{21}\)

According to Portlock, Colby in 1816 planned to determine the positions of the observatories of Edinburgh and Glagow and, using Ben Lomond to the north

\(^{17}\) JE Portlock, \textit{Memoir of the life of Major-General Colby}, London, 1869, 61
\(^{18}\) Richard Oliver, Unfinished business: the lost Ordnance Survey two-inch mapping of Scotland 1819-1828 and 1852, \textit{Sheetlines} 78, 9-31 (2007) available online at \url{www.charlesclosesociety.org/SheetlinesArchive}
\(^{19}\) Rev Samuel Cowan, \textit{Parish of Kelton}, Jan 1841, 145 and 147, from Statistical accounts online service © University of Glasgow and University of Edinburgh, available online at \url{http://edina.ac.uk/stat-acc-scot/}
\(^{20}\) A letter from Mudge to Colby dated 10 September 1816 (in Sir Charles Close, \textit{The early years of the Ordnance Survey}, 65) suggests that ‘the conclusion of your operations will be found on Cairnsmuir’.
\(^{21}\) Rev David Welsh, \textit{Parish of Carsphairn, Kirkcudbright}, 1839, 274 and 279, from Statistical accounts online service © University of Glasgow and University of Edinburgh, available as above.
and Dunrick hill to the south, to compute their distance from each other, and during the year visited nine stations in Scotland. Seymour lists seven: from east to west, Calton Hill, Allermuir, Dunrich, Hart Fell, Tinto Hill, Wisp, and Hill of Stake. *Yolland 1852* and *Clarke 1858* show Ben Lomond occupied in 1818 but neither shows the ‘observatory of Glasgow’.

1817 was a busy year for Colby and Gardner, starting with the measurement of the Belhelvie baseline and the extra stations associated with it, and going on to what turned out to be an unhappy visit to the Shetlands. Seymour (with dates confirmed by the 1858 Report) lists visits to Craigowl (just north of Dundee, 5 June–4 July) and Mount Battock, occupied on the way to and from Belhelvie; and Tarbaty (7–30 May), Layton (7–9 June), Dudwick (10–12 June), Over Hill (15 June) and Brimmond (17 June) associated with the new baseline; and Balta (10–27 August) and Saxavord (28 August) in the Shetlands.

Eager to extend their measurement of the meridian, the French *Bureau de Longitudes* in 1817 sent Monsieur Jean Biot to engage in joint observations in the Shetlands, intended to compare measurements of latitude deduced from pendulum frequency, the French ‘repeating circle’, by stellar observations (the sector) and by triangulation. Portlock provides a lively description of the unfortunate tensions arising in the course of this expedition, to which additional perspectives have been added recently by Rachel Hewitt.22

1818 saw observations from Ben Lomond, Ben Cleugh, East Lomond and Largo Law, and from Glashmeal in Perthshire (once again near to the coach route). Colby and Gardner then nicely avoided the challenge of Goat Fell by placing a station (Carn na Leagh) near to the lighthouse track established 30 years earlier across the tip of the Mull of Kintyre. In nine productive days23 they observed ‘backwards’ to their Ayrshire stations and forwards into Northern Ireland, to Islay and Jura, and as far as Mull and Tiree. It is unclear whether the station at Ben Turc, north of Carn na Leagh, was occupied or only a ‘pivot point’.

**Trigonometrical survey of Scotland 1819-1822**

In 1819 Colby’s enthusiasm for fieldwork was demonstrated in his remarkable forays24 on foot in the hazy summer months from Corriehabbie in Banffshire westwards to the Isle of Skye and the Western Highlands and northwards to place observation staffs in the Orkneys, and then under the clearer autumn skies to position these future stations from observations made from Ben Wyvis, Ben Cheilt, Ben Lundie and Balnaskerriish.25

---


23 *Account of the observations and calculations of the principal triangulation etc*, Drawn up by Captain Alexander Ross Clarke etc, Ordnance Survey: London, 1858, 93.

24 Dawson’s first-hand account is in Portlock’s *Memoir* 131-155 and is mentioned in Seymour, 30-31.

25 Seymour’s list shows Ben Hutig occupied in 1819 but *Colby 1834* shows it observed only from afar.
Then in 1820 Colby decided to stay in London, awaiting a decision on the succession to William Mudge as Superintendent of the Ordnance Survey, which Colby duly secured after the Duke of Wellington’s concise consultation\textsuperscript{26} with Professor Charles Hutton.

In April 1821 Colby obtained agreement from the Admiralty\textsuperscript{27} to the use of HM brig \textit{Protector} for the trigonometrical survey of the Orkney and Shetland Islands, for which the ‘great stations’ shown on \textit{Colby 1834} match those listed by Seymour. In support of Colby, Vetch and Drummond, sixteen artillerymen were employed under a sergeant and two bombardiers. The perceived need to ensure that the Admiralty paid victualling money only for days spent on board and the War Office only for days spent in camp means that, using also the ship’s log and muster rolls, this expedition can be reconstructed in some detail.\textsuperscript{28}

On 16 May 1822 the \textit{Caledonian Mercury} reported that Major Colby was embarking from Greenock for Islay on HM cutter \textit{Bat} with two other commissioned officers and a party of 18 artillerymen to commence his survey of the west coast. After assisting Colby at the Oa of Islay, Dawson and Vetch were entrusted to complete observations from Mull, Tiree and Jura. With only Northwest Scotland and the Outer Isles unreached, the 36 inch theodolite was put to work in England in 1823. In 1824 the resources of the trigonometrical survey were removed to Ireland, where revision of the tax base had secured a greater priority than the Scottish survey.

\textbf{Outcomes}

It was not until 1838 that Colby returned to Scotland, where with Robe and Robinson he observed from Ben Hutig in the far North West before handing the next stage of fieldwork over to them. It seems that the nine year old Alexander Ross Clarke was living with his grandmother in the nearby village of Eriboll,\textsuperscript{29} and it is an attractive thought that watching Colby’s survey party at work in 1838 may have inspired the career of the man whose tireless mathematics eventually brought Colby’s work together in 1858.

Colby was more effective in making observations than he was in computing his results. Even Portlock regretted his ‘indisposition to publish the details of the survey, and morbid apprehension of criticism’. \textsuperscript{30} \textit{Yolland 1852}\textsuperscript{p} shows a maze of accumulated observations which it must have proved impossible to reconcile precisely, especially as the ellipsoidal figure of the earth apparently was both an input to and an output of the calculations.

Alexander Clarke in his calculations of the principal triangulation published in 1858 resolved the maze he had inherited by relying mainly upon the long distance observations accumulated in the 1840s and discarding twenty-six of the

\textsuperscript{26} Nicely described by Rachel Hewitt in \textit{Map of a nation}, 235-236.
\textsuperscript{28} OS 3/260, f 431; with ADM 52/3951 \textit{Master’s Log: Protector}; and ADM 37/6466 and 6467 \textit{Muster Books}.
\textsuperscript{29} Actually we can be sure only that Alexander Ross Clarke lived in Eriboll at the time of the 1841 census.
\textsuperscript{30} JE Portlock, \textit{Memoir of the life of Major-General Colby}, London, 1869, 3.
‘great stations’ observed by 1834. Clarke’s calculations, which he published in detail, are enormously impressive and provided new estimates of the figure of the earth – yet any influence of this work in bringing together the ‘county meridians’ adopted by the Ordnance Survey is by no means certain.

To conclude, it is a tribute to Colby’s vision of the initial triangulation that, of the twenty-six of his stations discarded in 1858, no less than eleven were re-adopted as primary stations in the re-triangulation which was put in hand in 1935. It can also be argued that the pattern of medium sized triangles adopted for this work resembles Colby’s initial triangulation of Scotland much more closely than it resembles Clarke’s principal triangulation.

I would like to thank Richard Oliver for reading the draft of this paper and for his many helpful suggestions.

Rob Wheeler points out that Ben Hutig in Sutherland (NC 539 653) appears to be unique in that is labelled on OS First edition and on Bartholomew (Scotland sheet 26) as ‘Great Instrument Station’
Initial Triangulation of Scotland and its Islands
from the 'sketch diagram' completed at the Ordnance Map Office on 9th January 1834
(copied from MFQ 1/269/13 with grateful acknowledgement to the National Archives)

- 'Great Stations already observed'
- 'Great Stations proposed for completion of the Triangulation'
- 'Sides already observed and completed'
- 'Sides observed from one Station'
- 'Great Stations' relevant but not shown on MFQ 1/269/13
- 'Sides observed at some stage but not shown on MFQ 1/269/13'

Scale in miles: 0 5 10 15 20 25 30 35 40 45 50 55
Scale in cm: 0 10 20 30 40 50 60

Fitty Hill 1822
Wart Hill Hoy 1821
South Ronaldsay 1821
Fair Isle 1221
Saxa Island 1821
Balta 1821
Yell 1821
Yell North 1821
Heinisland 1821
Hirta 1821
Barra 1821
Benbecula 1821
Ben Lomond 1819
Knoydart 1814
Rene 1821
Rona 1821
Ben Chie 1819
Ben Hatte 1819
Ben Chriag 1819
Ben Wyvis 1819
Balmacara 1912
Bala 1821
Harris 1813
Gusmorn 1814
Mull 1817
Lorn 1814
The initial triangulation of Scotland from 1809 until 1822

David I Walker

Introduction

Whereas detailed progress reports were published on the first Trigonometrical Survey of England and Wales, including its extension into the Scottish Borders in 1809, little more was published on the triangulation of Scotland until the substantial report on the principal triangulation of Great Britain and Ireland published in 1858. From this report it emerges that many of the observations made before 1823 were superseded in the 1840s or discarded by 1858. Surprisingly, the diagram of the principal triangulation shows very few of the stations adopted as county meridians for the first topographical surveys of Scotland.

A history of the Ordnance Survey observes that ‘there is little detailed information about the work between 1810 and 1822’ (after which survey work was diverted into Ireland until 1838) and that ‘a complete list of the stations does not exist’ – although it does provide a provisional list of trigonometrical stations occupied in Scotland between 1813 and 1822.

This article draws upon a little noticed ‘sketch diagram’ in the National Archives at Kew to complete this list and (on pages 14-15) to illustrate these trigonometrical stations, and to explore aspects of the initial triangulation of Scotland by reference to official reports and to the illuminating but fragmented information available from other sources.

The triangulation of Scotland

After 1809 William Mudge, then Superintendent of the Ordnance Survey, left the Scottish survey in the charge of Thomas Colby, who succeeded him as Superintendent in 1820. After Colby returned from Ireland to Scotland in 1838, the triangulation of Northwest Scotland and the Western Isles was completed within a few years. But Colby had become concerned that the triangulation of Great Britain did not meet geodetic requirements and for the 1840s set in hand a new series of observations from the peaks of Britain and fresh observations from many of the stations occupied previously.

---

1 The author is a retired civil engineer whose family history research has been enriched by the resources of the map library of the National Library of Scotland.
2 William Mudge and Thomas Colby, An account of the trigonometrical survey, carried on by order of the Master-General of his Majesty's ordnance, in the years 1800-1809, London, 1811.
3 Account of the observations and calculations of the principal triangulation etc, Drawn up by Captain Alexander Ross Clarke under the direction of Lt Col H James etc, Ordnance Survey: London, 1858.
5 The National Archives, MFQ 1/269/13, 1834 (described under footnote 8 below).
6 Seymour defines the fieldwork largely completed by 1841 as ‘the primary triangulation’ and that added in the 1840s and recalculated in the 1850s as ‘the principal triangulation’. This article uses the title ‘initial triangulation’ to describe the work carried out before the long hiatus between 1823 and 1838.
William Yolland became responsible for bringing this work together, but, after Colby retired in March 1847, he failed to get on with Colby’s successor, Lewis Hall, and Yolland was sent to Ireland in November 1852. After a gap of nearly two years, it was fortunate that the talented Alexander Ross Clarke emerged to complete the trigonometrical calculations in impressive style, but only by discarding observations from many of the stations occupied over the previous years. Hence the progress of the initial triangulation can be understood only by reference to a sequence of diagrams (from which extracts are shown opposite):

**Mudge 1811**

This diagram, of a very high standard, shows precise triangles extending into the Scottish Borders. It accompanied the 1811 report (footnote 2).

**Colby 1834**

Described as a ‘sketch diagram’, this accompanies an internal Board of Ordnance investigation into the progress of the survey in Great Britain. As the trigonometrical stations (in Scotland) are annotated upon a much earlier map, it does not pretend to show the triangles accurately.

**Yolland 1852?**

This previously undated ‘Diagram showing the Principal Triangulation for the Ordnance Trigonometrical Survey of Great Britain and Ireland’ has the same title and is drawn within the same coastline as Clarke 1858 (below), but at a larger scale (c 13 miles to the inch). Those stations which are shown on both diagrams appear to be plotted in the same position. Although it includes considerably more stations than the 1858 diagram, the undated diagram appears to reflect the position in 1852, as observations made from Goat Fell in 1852 are shown but not additional observations made from Brandon Down in 1853.

The status of this excellent resource apparently remains to be determined. Perhaps it was commissioned by Alexander Ross Clarke after his arrival at Southampton in 1854. But it seems more likely that it was maintained under the direction of William Yolland until his departure in November 1852. It shows stations and observations which were discarded in Clarke’s calculations and it usefully distinguishes observations made in only one direction.

**James 1856**

A small scale diagram showing ‘The principal triangulation with adjustment figures’ was first published in 1856 in a paper to the Royal

---

7 Diagram of the great triangles in the trigonometrical survey of England & Wales, with the heights of the several stations etc, R Wilkinson, London, 1811, © The British Library Board, Maps 1175(39).


9 For this (and several other corrections) the author thanks Richard Oliver.

10 Diagram showing the principal triangulation for the Ordnance trigonometrical survey of Great Britain and Ireland, Southampton [1852], © The British Library Board, Maps 1101(15).

11 Account of the observations and calculations of the principal triangulation etc, Drawn up by Captain Alexander Ross Clarke etc, London, 1858, © The British Library Board, Maps 207.b.5, vol 2, plate XVIII.
above: Mudge 1811 (footnote 7)
right: Colby 1834 (footnote 8)
below: Yolland 1852? (footnote 10)
lower right: James 1856 (footnote 11)
Society attributed to Lt Col James\textsuperscript{12}. It was reprinted (slightly amended) as plate XVIII of the 1858 report (footnote 3) and much later as plate 11 of Seymour (ed), \textit{A history of the Ordnance Survey}, 1980.

\textbf{Clarke 1858} \textsuperscript{13} (extract left)

Of a similar cartographical standard to \textit{Mudge 1811}, this diagram shows the stations selected by Clarke for his re-calculation of the principal triangulation and the dates they were occupied, but it does not show the many stations which were discarded, even those that are listed in the 1858 report (where it is published as plate XXVIII)..

\textbf{Diagram of the initial triangulation (as now illustrated)}

The following rules have been adopted in preparing the diagram on pages 14-15 to illustrate the chronology of the initial triangulation from 1809 until 1822:

1. The ‘great stations’ marked $\mathbf{O}$ (already observed) or $\mathbf{+}$ (proposed for completion) are exactly those shown on MFQ 1/269/13 (described here as \textit{Colby 1834}).

2. Sides of triangles shown in full lines are exactly those shown on \textit{Colby 1834}.

3. The coastline and location of stations shown on \textit{Clarke 1858} accords with \textit{Clarke 1858}.

4. Other relevant stations marked $\mathbf{x}$ are added to show links with England and Ireland.

5. Stations ‘proposed for completion’ are named (or not) in accordance with \textit{Colby 1834}.

6. The names and location of other stations were deduced from the bearings detailed in the Report of 1858, aided by \texttt{www.trigpointinguk.com} website (for the current status of these sites, and for grid references and spot heights, assistance which is gratefully acknowledged).

7. Dates of occupation (by the theodolite) were taken from Seymour (where listed), and from \textit{Yolland 1852?} and \textit{Clarke 1858}, and in a few cases deduced as described below.

\textsuperscript{12} Plate following ‘On the figure, dimensions, and mean specific gravity of the Earth, as derived from the Ordnance trigonometrical survey of Great Britain and Ireland communicated by Lt Col James RE FRS \&c Superintendent of the Ordnance Survey’, \textit{Phil. Trans. R. Soc. Lond.} 1856, vol 146, 607-626.

\textsuperscript{13} \textit{Diagram showing the principal triangulation for the Ordnance trigonometrical survey of Great Britain and Ireland}, Southampton, around 1858, © The British Library Board, Maps X.8003.
8. A few ‘sides’, not shown on Colby 1834, but found to have been observed by 1817, have been added (in broken lines) to show how some early triangles were completed.

Colby’s modus operandi
In 1805 Mudge had instructed Colby ‘Don’t make a practice of going to all three points of every triangle, if observations made at two of them will be sufficient. Work round spires, staffs on mountains or any other proper objects, that the Survey may get on rapidly’

Thus, in 1808 and 1809, both Skiddaw and the Cheviot provided ‘pivot points’ which were observed from several directions without being occupied by the theodolite. Apparently a single artilleryman had to journey ahead to set up each staff, until in 1818 Colby decided that ‘I have been compelled to send two men together instead of one to erect the objects, and the allowance of 2s 6d each object heretofore granted is become obviously too small. I have, therefore, to request that you will sanction me to raising it to 3s 6d each object.’

Dawson provides a useful clue to Colby’s reconnaissance of potential survey stations. On the mail coach ‘neither rain nor snow …. would induce him to take an inside seat …. but muffled in a thick box coat [he travelled] with his servant Fraser, an old artilleryman, at his side’. But Colby also travelled astonishing distances on foot, as described below for 1819.

Trigonometrical survey of Scotland 1809-1814
From the detailed information in the report of 1811 it is possible step by step to trace and, for those so inclined, to re-calculate the extension of the triangulation from northern England into Scotland in 1809, when observations were made from Criffel, Wisp Hill, Sayrs Law and Lumsdane Hill, reaching as far north as East Lomond and Largo Law beyond the Firth of Forth.

When the Scottish survey was resumed in 1813, Colby was at first mainly pre-occupied with ‘sector observations’ – the measurement of latitude by stellar observations – at Kellie Law, north of the Firth of Forth, and Cowhythe, south of the Moray Firth. In the following year, Colby with James Gardner linked up these stations by triangulation, for which the stations listed by Seymour as observed in 1814 would have been insufficient without the addition of Bruxiehill and The Buck, both shown on Colby 1834. Alva (now Hill of Alvah) and Manar Lee (now Hill of Maunderlea) were also occupied in 1814, apparently in support of the sector station at Cowhythe.

Trigonometrical survey of Scotland 1815-1818
In 1815, Colby remained in London, putting Gardner in charge of observations which ‘commenced on Bengairn Hill, near Kirkcudbright, and concluded on the Black [sic] Carrick Hill, near Ayr; thus completing the connection between

---

15 Colby to Mudge, 24 July 1818, quoted in Close, The early years of the Ordnance Survey, 86.
16 As reported in JE Portlock, Memoir of the life of Major-General Colby, London, 1869, 132.
Cumberland, the Isle of Man, part of the coast of Ireland, and the south-west of Scotland as far as Ayr.' As Seymour's list shows only Glasserton and Brown Carrick occupied in 1815, and as Gardner's work provided the basis for the first topographical surveys of Scotland, the following description is of interest in illustrating the strategic position of Bengairn:

‘The great road from London to Portpatrick runs along the north-western margin of the Carlinwark Loch ... with the magnificent background of Dungyle, the Skreel, and Bengairn. ... From Bengairn, when the state of the atmosphere is favourable, the view is remarkably beautiful and extensive ... the eye naturally rests upon the lofty Cairnsmuir of Carsphairn, overlooking the Kells range of mountains, which separates the stewartry from Ayrshire ... on the east and northeast are seen Criffel and Queensberry Hill ... to the west Cairnharra and Cairnsmuir of Fleet and the Isle of Man ... and to the south the bold outline of the Cumberland mountains and the towns and villages that adorn the coast of England.’

To triangulate Brown Carrick from Glasserton, Gardner needed to occupy intermediate stations (shown on Colby 1834) at Mull of Galloway, Carn Piot, Benereard and Saugh, making good use of volcanic outcrops within sight of the coach road, together with more remote stations on the summits of Merrick and Cairnsmore of Deugh (later known as Cairnsmuir of Carsphairn). Whereas Merrick may have been used only as a ‘pivot point’ (until it was occupied for ten weeks in 1852) confirmation that Cairnsmuir of Deugh was in fact occupied in 1815 or thereabouts is provided by the report of the Minister for Carsphairn (which incidentally lay on the coach route between Ayr and Dumfries) that:

‘The highest mountain in the parish is Cairnsmuir, which rises to an elevation of about 2696 feet above the level of the sea. It was chosen by Captain Colby as one of his stations for the trigonometrical survey in this part of Scotland, about 1814. From the summit of this mountain, when the atmosphere is clear, a most extensive view is obtained in every direction, except where it is intercepted by a mountain called Carline’s Cairn, on the south-west side of the parish, which is nearly of an equal height.’

According to Portlock, Colby in 1816 planned to determine the positions of the observatories of Edinburgh and Glasgow and, using Ben Lomond to the north

---

19 Rev Samuel Cowan, *Parish of Kelton*, Jan 1841, 145 and 147, from Statistical accounts online service © University of Glasgow and University of Edinburgh, available online at [http://edina.ac.uk/stat-acc-scot/](http://edina.ac.uk/stat-acc-scot/)
20 A letter from Mudge to Colby dated 10 September 1816 (in Sir Charles Close, *The early years of the Ordnance Survey*, 65) suggests that ‘the conclusion of your operations will be found on Cairnsmuir’.
and Dunrick hill to the south, to compute their distance from each other, and during the year visited nine stations in Scotland. Seymour lists seven: from east to west, Calton Hill, Allermuir, Dunrich, Hart Fell, Tinto Hill, Wisp, and Hill of Stake. Yolland 1852 and Clarke 1858 show Ben Lomond occupied in 1818 but neither shows the ‘observatory of Glasgow’.

1817 was a busy year for Colby and Gardner, starting with the measurement of the Belhelvie baseline and the extra stations associated with it, and going on to what turned out to be an unhappy visit to the Shetlands. Seymour (with dates confirmed by the 1858 Report) lists visits to Craigowl (just north of Dundee, 5 June-4 July) and Mount Battock, occupied on the way to and from Belhelvie; and Tarbaty (7-30 May), Layton (7-9 June), Dudwick (10-12 June), Over Hill (15 June) and Brimmond (17 June) associated with the new baseline; and Balta (10-27 August) and Saxavord (28 August) in the Shetlands.

Eager to extend their measurement of the meridian, the French Bureau de Longitudes in 1817 sent Monsieur Jean Biot to engage in joint observations in the Shetlands, intended to compare measurements of latitude deduced from pendulum frequency, the French ‘repeating circle’, by stellar observations (the sector) and by triangulation. Portlock provides a lively description of the unfortunate tensions arising in the course of this expedition, to which additional perspectives have been added recently by Rachel Hewitt.22

1818 saw observations from Ben Lomond, Ben Cleugh, East Lomond and Largo Law, and from Glashmeal in Perthshire (once again near to the coach route). Colby and Gardner then nicely avoided the challenge of Goat Fell by placing a station (Carn na Leagh) near to the lighthouse track established 30 years earlier across the tip of the Mull of Kintyre. In nine productive days23 they observed ‘backwards’ to their Ayrshire stations and forwards into Northern Ireland, to Islay and Jura, and as far as Mull and Tiree. It is unclear whether the station at Ben Turc, north of Carn na Leagh, was occupied or only a ‘pivot point’.

**Trigonometrical survey of Scotland 1819-1822**

In 1819 Colby’s enthusiasm for fieldwork was demonstrated in his remarkable forays24 on foot in the hazy summer months from Corriehabbie in Banffshire westwards to the Isle of Skye and the Western Highlands and northwards to place observation staffs in the Orkneys, and then under the clearer autumn skies to position these future stations from observations made from Ben Wyvis, Ben Cheilt, Ben Lundie and Balnaskerrish.25

---


23 *Account of the observations and calculations of the principal triangulation etc*, Drawn up by Captain Alexander Ross Clarke etc, Ordnance Survey: London, 1858, 93.

24 Dawson’s first-hand account is in Portlock’s *Memoir* 131-155 and is mentioned in Seymour, 30-31.

25 Seymour’s list shows Ben Hutig occupied in 1819 but *Colby 1834* shows it observed only from afar.
Then in 1820 Colby decided to stay in London, awaiting a decision on the succession to William Mudge as Superintendent of the Ordnance Survey, which Colby duly secured after the Duke of Wellington's concise consultation\textsuperscript{26} with Professor Charles Hutton.

In April 1821 Colby obtained agreement from the Admiralty\textsuperscript{27} to the use of HM brig \textit{Protector} for the trigonometrical survey of the Orkney and Shetland Islands, for which the ‘great stations’ shown on \textit{Colby 1834} match those listed by Seymour. In support of Colby, Vetch and Drummond, sixteen artillermen were employed under a sergeant and two bombardiers. The perceived need to ensure that the Admiralty paid victualling money only for days spent on board and the War Office only for days spent in camp means that, using also the ship’s log and muster rolls, this expedition can be reconstructed in some detail.\textsuperscript{28}

On 16 May 1822 the \textit{Caledonian Mercury} reported that Major Colby was embarking from Greenock for Islay on HM cutter \textit{Bat} with two other commissioned officers and a party of 18 artillermen to commence his survey of the west coast. After assisting Colby at the Oa of Islay, Dawson and Vetch were entrusted to complete observations from Mull, Tiree and Jura. With only Northwest Scotland and the Outer Isles unreached, the 36 inch theodolite was put to work in England in 1823. In 1824 the resources of the trigonometrical survey were removed to Ireland, where revision of the tax base had secured a greater priority than the Scottish survey.

\textbf{Outcomes}

It was not until 1838 that Colby returned to Scotland, where with Robe and Robinson he observed from Ben Hutig in the far North West before handing the next stage of fieldwork over to them. It seems that the nine year old Alexander Ross Clarke was living with his grandmother in the nearby village of Eriboll,\textsuperscript{29} and it is an attractive thought that watching Colby’s survey party at work in 1838 may have inspired the career of the man whose tireless mathematics eventually brought Colby’s work together in 1858.

Colby was more effective in making observations than he was in computing his results. Even Portlock regretted his ‘indisposition to publish the details of the survey, and morbid apprehension of criticism’. \textsuperscript{30} Yolland 1852\textsuperscript{2} shows a maze of accumulated observations which it must have proved impossible to reconcile precisely, especially as the ellipsoidal figure of the earth apparently was both an input to and an output of the calculations.

Alexander Clarke in his calculations of the principal triangulation published in 1858 resolved the maze he had inherited by relying mainly upon the long distance observations accumulated in the 1840s and discarding twenty-six of the

\textsuperscript{26} Nicely described by Rachel Hewitt in \textit{Map of a nation}, 235-236.
\textsuperscript{28} OS 3/260, f 431; with ADM 52/3951 \textit{Master’s Log: Protector}, and ADM 37/6466 and 6467 \textit{Muster Books}.
\textsuperscript{29} Actually we can be sure only that Alexander Ross Clarke lived in Eriboll at the time of the 1841 census.
\textsuperscript{30} JE Portlock, \textit{Memoir of the life of Major-General Colby}, London, 1869, 3.
‘great stations’ observed by 1834. Clarke’s calculations, which he published in
detail, are enormously impressive and provided new estimates of the figure of the
earth – yet any influence of this work in bringing together the ‘county meridians’
adopted by the Ordnance Survey is by no means certain.

To conclude, it is a tribute to Colby’s vision of the initial triangulation that, of
the twenty-six of his stations discarded in 1858, no less than eleven were re-
adopted as primary stations in the re-triangulation which was put in hand in 1935.
It can also be argued that the pattern of medium sized triangles adopted for this
work resembles Colby’s initial triangulation of Scotland much more closely than it
resembles Clarke’s principal triangulation.

I would like to thank Richard Oliver for reading the draft of this paper and for
his many helpful suggestions.

Rob Wheeler points out that Ben Hutig in Sutherland (NC 539 653)
appears to be unique in that is labelled on OS First edition and on
Bartholomew (Scotland sheet 26) as ‘Great Instrument Station’
Initial Triangulation of Scotland and its Islands
from the 'sketch diagram' completed at the Ordnance Map Office on 9th January 1834
(copied from MFQ 1/269/13 with grateful acknowledgement to the National Archives)

○ 'Great Stations already observed'
+ 'Great Stations proposed for completion of the Triangulation'
○-----○ 'Sides already observed and completed'
+○ ○ 'Sides observed from one Station'
× 'Great Stations' relevant but not shown on MFQ 1/269/13
○-----○ ○ Sides observed at some stage but not shown on MFQ 1/269/13

Scale in miles
Scale in cm
Revision points revisited

The story of the Swindon revision points (RPs) in Sheetlines 97\(^1\) attracted several responses.

**From John Cole:** Health and safety experts may have palpitations over the railway RPs, with not a hi-vis jacket to be seen and (possibly) not even a railway employee look-out. A train is signalled from Swindon Town station – unless it has just passed – on photo 22A. I have copies of RPs of the 1950s of Brixham (where I did the 1:2500 revision in 1979-81) and ‘railway’ RPs for several other Devon locations. At Exeter Central in 1947 a pair of brand new ‘West Country’ Pacific locos are blowing off steam in a siding next to the RP.

OS were clearly behind the times in persevering with such a large scale survey method due to timidity over air survey and tachometry even in the early fifties. The mind boggles at the cost – over 100,000 RPs must have been established in London alone. The Annual Report of 1963 indicates that for England, Scotland and Wales there were over 600,000 RPs during the period 1943-63.

The fear is that the vast majority of RP albums were wantonly destroyed; I’m not too sure about the ‘manuscript’ copies kept at Southampton or Division offices, but at least having the Swindon set on-line helps to fill a gap.

The reference to my Sheetlines 67 article in the Swindon story prompts me to add corrections and additions to that and draw attention to several others.\(^2\) Further justification is that I did not enlarge on the nature of actual revision points. The Swindon collection indeed gives a very clear selection including developing estates and rural locations. The majority were permanent buildings or other objects of apparent permanence, features thereon if an actual corner wasn’t convenient (as per 77A on the Goddard Arms Hotel) and as last resorts, nails or rivets in concrete blocks, walls, pavements or similar. It will be seen from the photographs that even with this aid, finding them at later dates was far from easy, even with a measurement quoted (as 73K).

The OS 1948 ‘Biscuit book’\(^3\) contained seventeen pages on reconnaissance, selection, marking and recording RPs; as for selection the only taboos were telegraph poles, Post Office concrete posts or trees. The last rule was being broken according to some maps, whilst one of the Swindon RPs was in a tree stump.

The functions of RPs, fixed to an accuracy of 0.1 metres\(^4\) at both 1:1250 and 1:2500 scales, were [a] to anchor the skeleton chain or air survey to the National Grid (later, Detail Points, accurate to 0.25 metres and not appearing on published mapping (unlike RPs), were used for the 1:2500); [b] to facilitate continuous revision, especially in developing housing or industrial estates; [c] to enable those who required surveys of their own (eg at 1:500) to have usable control points.

---

\(^1\) Surveying in Swindon 1953, Sheetlines 97, 44-45.

\(^2\) Sheetlines 67, 26-31, Sheetlines 64, 19-25, Sheetlines 68, 48-49, Sheetlines 80, 58-60, Sheetlines 81, 36-39. All are available online at [www.charlesclosesociety.org/SheetlinesArchive](http://www.charlesclosesociety.org/SheetlinesArchive)

\(^3\) Instructions for detail (chain) survey described in Sheetlines 81, page 36.

\(^4\) Machine plotted by a rectangular co-ordinatograph to a precision of 0.1 mm.
The absence of RPs on maps of central London was explained in the Sheetlines 81 article in that flat roof control points, many of which already existed, saved a lot of money on traverses to fix RPs. Sadly, this was offset by sub-standard photography which may have caused difficulties elsewhere. One such location quoted in the Sheetlines 67 article was Bath, but it transpired that the southern half of the city was chain surveyed. Banstead was incorrectly identified as the first ‘tachy’ town – effectively it was chain survey with tachometric experimental surveys probably using RPs as control.

Sheetlines 68 carried a list of survey methods from 1955 to 1965. As with the Sheetlines 67 list, there were numerous date and method corrections. The most significant were Harwich (probably air graphic), Aldershot and Bolton-upon-Dearne (both tachy). Thus chain survey from RPs probably ended with Maldon in 1957, though the method would have been much used for continuous revision into the 1960s until more tachy sets became available.

A list of counties where RPs were established for basic 1:2500 scale work appeared in Sheetlines 67 and to this list should be added Essex (Brantree), Staffs (Alsager and Biddulph) and West Lothian (Bo’ness, Broxburn/Uphall and Linlithgow). A rural strip from Bradford to Wakefield should also be added. Incidentally, there were some remarkable RP tallies in the Lancashire and Yorkshire cases; for example, whilst the general rural average was about thirty RPs per square kilometre, Delph and Dobcross (near Oldham) sported 113 and 109 respectively.

Averages for 1:1250 locations were tolerably consistent – the ideal for a map being twenty (80 for the four quadrants making up a square kilometre). With about fifty maps each, Birmingham, Bolton, Liverpool, Manchester, Sheffield, Swansea and Edinburgh all average 18 to 24 RPs per map. Exceptions include Bournemouth (45), Exeter (51 – but only 18 maps), Leeds (37 – only a few maps), Plymouth (36), Torquay (44).

For air graphic the average seems to have been about 14, but as quoted in Sheetlines 68, exceptions including Bradford, Dover, Deal, Canterbury, Crewe, Folkestone/Hythe, Littlehampton. Shrewsbury and Stafford averaged just four.

Apart from Swindon (and possible Lowestoft) the only collection I’m aware of is at Plymouth Archives, where RP albums for the city, as well as Launceston, Saltash, Torpoint, Tavistock, Okehampton, Totnes, Salcombe, Kingsbridge, Dartmouth and Kingswear are to be found.

Should you wish to know if your property appeared on an RP photograph, the Historic Maps website\(^5\) will give you a clue as the vast majority of the first edition 1:1250 (reduced to 1:2500) and 1:2500 are viewable. You may also find out the hard way by damaging a garden spade on a long-forgotten and partially-buried six-inch square concrete block like this:

![OS R55B rivet or nail](http://www.old-maps.co.uk)
From Paul W Sowan: Readers may like to know that there is a substantially complete set (63) of RP albums for the former County Borough of Croydon in the town’s Local Studies library. These cover the northern part of the present London Borough, but not the area of the former Coulsdon & Purley UDC. Details and a list of these were published in our Croydon bibliographies for regional survey 108 (2004). Apart from the interest in the dated photographs of parts of Croydon rarely or never otherwise recorded, the RP data is most helpful in exactly locating archaeological features in woodland.

From Geoffrey Spencer-Smith: I was a member of one of two teams of surveyors employed on RP fixation in Swindon in 1953. Our office was at 45 Regent Street. Each team consisted of three surveyors and two field assistants. The three were observer, booker and one who positioned the tripods over the traverse station. These consisted of a pipe nail marked with a rawlplug or a wooden peg. Permanent stations were brass rivets set in kerbs or chisel cuts on drains, manhole covers and the like. For measuring the legs of the traverse one surveyor held on the backmark and guided the one at the front who marked the tape end; one booked (the measurement was to one mm) and the field assistants stood on the forward and back stations. Observations also had to be made for change of slope. We used a Cooke Troughton and Sims 3½ inch theodolite for normal work and a Tavistock geodetic theodolite for working off trig stations and for observing bases where the trig point was a roof station.

RPs were plotted on plates after their National Grid position had been calculated. The surveyors had to do an office check on accuracy by measuring to check-points. We had an enamelled zinc sheet about five feet square called a ‘crown quad’ on which was printed a 360° protractor with a cross in the centre and using a 4H pencil and straight-edge we would plot RPs and checkpoints and do a graphic check. If this did not agree with the check measurements we had to re-observe and re-measure before sending off to Traverse Computations dept in Chessington.

Left: Geoffrey Spencer-Smith observing and his brother booking in Marlborough Road, Swindon.

More photographs of revision points appear on page 63.

---

6 The writer is librarian, archivist and vice president of the Croydon Natural History & Scientific Society.
How OS depicted limekilns in Scotland’s Central Belt
Paul Bishop and Gavin Thomson 1

Introduction
Richard Oliver’s recent short review2 of Bill Bignell’s new book on OS mapping of windmills3 highlighted the fact that there has been relatively little discussion of the ways in which OS mapping symbols depict the object that is being mapped, and the ‘veracity’/accuracy of that mapping. Bignell developed that theme at some length, and Oliver also noted that a recent Sheetlines piece in that same vein concerned the mapping of ha-has,4 which discussed the conventions, or lack thereof, associated with representing ha-has; that discussion continued in follow-up exchanges.5 Oliver likewise explored the mapping and representation of churches in an earlier Sheetlines.6

This note discusses the mapping of limekilns on OS first and second edition maps of the Central Belt of Scotland, with an emphasis on the first edition six-inch maps. We explore the ways in which the mapped symbols represent the ‘true’ situation ‘on the ground’, both in terms of the type of kiln being represented, and in terms of how many limekilns are actually mapped. We undertook this survey as background to a new project on the early lime industry in Scotland. The focus is on Scotland because the lime industry here is distinctive in several ways and the literature on lime-burning is generally dominated by reports of lime-burning in England.7 Moreover, the literature that is Scotland-

---

1 Paul Bishop is a Professor in the School of Geographical and Earth Sciences at the University of Glasgow, and Gavin Thomson graduated from the University of Glasgow in summer 2013 with a Honours BSc degree in Geography. We sincerely thank Mr John Moore of the University’s Library, and the staff of the Library’s Maps, Official Publications and Statistics Unit, for kindly providing access to the maps. All OS map extracts are reproduced by permission of the National Library of Scotland. John Harrison, Richard Oliver and David Andrews provided helpful comments on an earlier draft.
7 Lest there be concerns that the treatment here is overly influenced by considerations of Scotland’s separateness (against a background of a referendum that is looming in 2014), let us reassure readers that the lime industry in Scotland does appear to be locally distinctive. It is often characterised by a particular geological setting, which, unlike in many other parts of Britain, provides both limestone and coal together in the same rock sequence. In addition, the acidic soils of Scotland are particularly needy of ‘sweetening’ by lime, reflecting Scotland’s
focused is itself dominated by discussion of masonry-built draw kilns for producing lime, largely ignoring, save for a few notable and important exceptions, the widespread use of clamp kilns (see below for an explanation of these two types of kilns).

**Background on lime**

Multiple uses for lime – for bleaching, tanning, mortar, sugar production, plaster, medicines, corpse disposal, ‘sweetening’ acid soils, and so on – have been known since antiquity,\(^8\) and lime industrial archaeology/history is extensively documented. Agriculture in northern Britain depends critically on liming because of higher rainfalls and acidic, often poorly structured, heavy soils that are significantly improved for agriculture by the addition of lime or by ‘liming’.

Lime is produced by burning (calcining) limestone (CaCO\(_3\)) to a temperature of at least 900°C in a kiln, using coal, wood or even peat as fuel. This burning drives off CO\(_2\) leaving CaO, or quick lime, to which water may be added to form slaked lime (i.e. Ca(OH)\(_2\)). The kilns used to calcine the limestone in Scotland may be relatively simple clamp kilns: three-sided U-shaped or rectangular pits or embayments *(figure 1)* that were packed (‘charged’) with inter-layered limestone and fuel, and fired by igniting the fuel and covering or ‘clamping’ the kiln charge. More elaborate draw kilns were also used, consisting of substantial, masonry-built structures enclosing an internal kiln ‘pot’ or pots where the limestone and fuel were loaded from the top and burned as the charge moved down through the pot, until the lime was drawn off from a draw hole at the base of the pot *(figure 2)*. Agricultural liming in Scotland dates from at least the early seventeenth century,\(^9\) but, unlike for Yorkshire,\(^10\) the relative numbers and spatial distribution of kiln types in Scotland’s lime production are essentially unknown, except for a few areas covered in a range of crucial but rather obscurely published works.\(^11\) Nonetheless, recent literature, drawing heavily on Skinner’s work on draw kilns in the Lothians,\(^12\) continues to emphasise large masonry-built draw kilns as the

---


Figure 1 (above):

Left: Nisbet’s sketch of a clamp kiln (U-shaped embayment) [Redrawn by PB from figure 1 in S Nisbet, ‘The 18th century lime industry in Scotland’, Scottish Local History 58 (2003), 8-13]
Right: U-shaped symbols labelled ‘Kill’ (common Scots word for kiln) at Langfauld, west of Scotland, on an ?1805 farm plan for ‘Long Fauld’, part of the Dougalston Estate [National Records of Scotland, RHP 05302-00020]

The towering infernos at Charlestown

The five (5x) high kilns were open at the top. The draw holes at the bottom varied in size to control the rate of burning, and allowed gas to escape at the drawn end.

A large clamp at Charlestown, superimposed on the cliff face within the original 14th century site (as drawn above).

The kilns were built directly into the cliff face within the original 14th century site to avoid any demand note.

The view of the kilns from miles around.
pre-eminent and dominant technology,\textsuperscript{13} to the unhelpful and inappropriate extent that the Lothians is thought of as “somehow the ‘cradle of the industry’ in Scotland”\textsuperscript{14} This view was at odds with PB’s reconnaissance observations that lime manufacture in clamp kilns was widespread in Scotland’s Central Belt and in many dispersed localities elsewhere.

**First edition six-inch mapping of lime works**

We documented every mapped occurrence of limekilns or limeworks on the mid-nineteenth century OS 1st edition six-inch maps of the Central Belt of Scotland, covering, broadly from west to east (and using the mid-nineteenth century county names), the Counties of Ayrshire, Renfrewshire, Dunbartonshire, Lanarkshire, Stirlingshire, Linlithgowshire (West Lothian), Edinburghshire (Midlothian), Haddingtonshire (East Lothian), Berwickshire, Perthshire & Clackmannanshire, and Fifeshire & Kinross-shire. One of us (GT) examined the 487 sheets that make up this coverage, systematically moving an A4-sized ‘window’ west to east across each sheet, on successive lines down the sheet. Each lime kiln or limeworks was noted within that ‘window’, assisted by a magnifying glass as necessary. GT recorded the mapped kiln symbol(s) as well as the location of each limekiln or limeworks to 5 inch accuracy using the latitude and longitude on the map sheets margins; all data were compiled in an Excel spreadsheet. Other information related to the industrial activity, but of less relevance to the present note, was also recorded, including the presence of quarries, mines, tramways, train lines, and so on. We then worked our way through all 487 sheets a second time, with one of us reading out the locational and other information from the spreadsheet and the other checking the map for the accuracy of that information as well as ‘mopping up’ any limekilns or limeworks that had been missed in the first pass. We are confident that we have located virtually all of the lime-related features mapped on these 487 sheets.

**The mapping symbols**

We located a total of 1608 kilns, which had been mapped using more than 30 symbols (figure 3). For several reasons we are satisfied that all of these symbols are meant to represent limekilns. These reasons include, firstly, the close relationship between the mapped symbol and the technology ‘on the ground’. Thus, U-shaped clamp kilns are mapped by a U symbol and less frequently a three-sided open rectangle, and draw kilns by a circle that we interpret to represent the pot of a draw kiln, with the black dot on the circumference representing the draw hole (e.g., the various symbols in group 5, figure 3). When that symbol is surrounded by a square, which we take to represent the stonework of the draw kiln, the match between mapped symbol and object is even closer (see below).


\textsuperscript{14} Nisbet, 2005, *op.cit.*, p. 51.
Figure 3. Symbols used on OS first edition (mid-nineteenth Century) six-inch maps of the Central Belt of Scotland to map limekilns (as indicated by the label ‘Limekiln’ or ‘Old Limekiln’ being beside the symbol recorded here). The symbols are hand-drawn by us here for clarity and some examples from maps are given below. Our original classification of these symbols included more symbols than are given here, some of which were subsequently deleted and others moved into other symbol groups. We retain the original numbering here, however, for consistency with our Excel spreadsheet data and to avoid potential errors arising in re-numbering those spreadsheet data.
Secondly, some of the symbols, particularly those for masonry-built draw kilns, correspond to those used for limekilns on the one-inch Old Series maps, as re-drawn by Rodney Fry for the Margary volumes, *The Old Series Ordnance Survey maps of England and Wales* (figure 4). Interestingly, the symbols for clamp kilns on the first edition six-inch maps (i.e., figure 3 symbols 1, 2 and 3) are not as clearly represented among the Old Series symbols, although it is possible to interpret some of the Old Series symbols as perhaps representing U-shaped clamp kilns (e.g., some symbols in figures 4A, 4B, 4C, and 4D).

Selected mine, quarry and kiln symbols redrawn by Fry from the Old Series one-inch maps (from the Margary volumes as indicated).

Figure 4A. Limekiln symbols from Margary Vol II. Note the possible similarity between these two symbols and that in figure 3.1f. However, we are unclear as to what the filled black squares represent here, as we are similarly unclear as to what is represented by the dot in figures 3.1f and g.

Figure 4B. Various minerals-related symbols from the legends given in Margary Vol IV. The U-shaped symbol at the far left of those labelled “Lime” may represent a clamp kiln, with the others representing draw kilns, the circles evoking the pots of draw kilns. The symbols labelled “Kilns” at the bottom of this group are enigmatic (and perhaps include a U-shaped clamp kiln?)

Figure 4C. Various kiln symbols from the legends given in Margary Vol V. Once again, the meaning of all the limekiln symbols is not immediately obvious. We interpret those incorporating small circles as indicating draw kilns, and perhaps the more-U-shaped symbols represent clamp kilns (e.g., third from the left) but the right-hand symbol is enigmatic.

Figure 4D. Symbols for ‘Limestone pits and quarries’ from Margary Vol VII. Although explicitly labelled as related to pits and quarries, it might be argued that symbols at bottom left, incorporating circles, might indicate draw kilns (see next set of symbols - E).

E. Lime kiln symbols from Margary Vol VII, which almost certainly represent draw kilns.

F. Lime kiln symbols from Margary Vol VIII. All but the extreme right-hand symbol probably represent draw kilns, and it is noteworthy that the bottom left symbol is the same as the symbol we take to represent a draw kiln on the six-inch first edition maps being studied here (i.e., symbol 5, and particularly 5a, in figure 3).
In other words, the facts that the symbols in figure 3 lie adjacent to ‘Limekiln’ or ‘Old Limekiln’ labels, and that precursor limekiln symbols are used on the Old Series maps (figure 4), give us confidence that the symbols in figure 3 do indeed represent limekilns. We are essentially certain that symbol groups 1 to 6, 12, 21 to 25 in figure 3 do represent limekilns, with one set of symbols corresponding to clamp kilns (groups 1-3, 21) and one set to draw kilns (groups 4-6, 12, 25).

Returning to the issues that motivated this examination of limekiln symbols, namely, the extent to which the first edition six-inch mapping captures essential aspects of the lime-burning industry, we can ask several questions.

**Does map symbol mirror form and therefore function?**

Evidently, yes: in PB’s local area of Baldernock Parish (East Dunbartonshire; formerly Stirlingshire), for example, all lime kilns ‘on the ground’ are U-shaped clamp kilns or, in some cases, more circular, horseshoe-shaped clamp kilns. In almost all cases, the orientations of the mapped U-shapes match the orientations of the embayments on the ground. In other areas, U-shaped embayments and rectangular embayments are mapped side-by-side, clearly differentiating these two clamp kiln sub-types (figure 5A), but in other examples, a clamp kiln mapped as an open (three-sided) rectangle on the first edition may have become a closed rectangle by the second edition (e.g., figure 5B and 5C). Notwithstanding that uncertainty (which, incidentally, we think cannot be interpreted to represent a change in kiln type between the first and second editions, because the kiln is already defunct ['Old'] when mapped for the first edition), we judge that a map symbol for a clamp kiln generally means that a clamp kiln was there. The 25-inch may give more detail than the corresponding six-inch map (figure 5D).

Likewise for draw kilns: the number of pots generally seems to have been faithfully recorded (figure 6). Symbol 5a (figure 3) is very commonly used for mapping a draw kiln and it is clear that the circle represents the kiln pot (e.g., figure 6B and 6C); we speculate that the dot on the circumference locates the draw hole. Evidence for this conclusion includes the following: the dot is not always in the same position each time the symbol is used for a bank of draw kilns, and superimposing semi-transparent OS first-edition six inch on Google Earth imagery, via the excellent National Library of Scotland mapping website, indicates that the location of the circumferential dot is consistent with its marking a draw hole or at least the tunnel that provides access to the draw hole. We commented above that the mapped orientation of a clamp kiln generally matches the kiln’s orientation on the ground, and it is noteworthy that many clamp kilns, certainly in Baldernock Parish where we have seen all mapped kilns on the ground, have their open ends towards the prevailing wind that blows in an arc ranging from the west through the south to the south-east. Likewise, the dot on map symbol 5 is very commonly located on the western to south-eastern part of its circle’s circumference, which we speculate indicates draw holes facing the dominant wind direction. Such speculation needs careful testing, however, not least because clamp kilns functioned by being ‘clamped’ (i.e., the charge was covered over) so as to control the burn. So, limeburners would certainly have needed to control the draft provided by prevailing winds, but clamp kilns did
need draft, not least because the product of the burning – CO₂ – extinguishes a fire. Clamp kilns excavated by David Johnson in Yorkshire incorporate quite sophisticated plumbing for draft.¹⁵

Figure 5A (top left): Types 1A and 2A clamp kilns at Gartincaber [first edition six-inch Stirlingshire, Sheet XIV]

Figure 5B (top right): Unlabelled (and presumably defunct) clamp limekiln at Baldernock Linn on first edition six-inch mapping (Stirlingshire, Sheet XXVII), represented by symbol 2a (figure 3). We know that this is an ‘Old Limekiln’ as it is labelled as such on the corresponding first edition 25-inch sheet. An abandoned quarry, a larger U-shaped symbol outline by slope hachures, lies immediately to the north of the kiln.

Figure 5C (lower left): The same defunct (‘Old’) Baldernock Linn clamp kiln as in B, but here labelled and represented on the second edition six-inch by symbol 3a (figure 3) [Stirlingshire Sheet XXVII.SE]

Figure 5D (lower right): Clamp kiln near Meiklemire (Ayrshire) on first edition six-inch map (left; Ayrshire sheet VII) and on first edition 25-inch map (right; Ayr Sheet VII.15 (Dalry)). We wonder if the dotted stipple pattern around the kiln on the 25-inch mapping indicates ground sloping away from the top of the U-shaped embayment.

In some localities both clamp and draw kilns are mapped (figure 6B), with the map representation faithfully recording the draw kiln’s situation and the meaning of its mapping symbol (figure 6C). Draw kilns and clamp kilns also may be distinguished in the same map (figure 6B), and there may be further information on different kilns’ relative ages (figure 6D).

Figure 6A (top left): OS first edition 25-inch mapped symbol for the Johnshaven (East Mathers) draw kiln, showing the single pot that is still clear ‘on the ground’ and from which quick lime would have been drawn in the two arched draw holes shown in figure 2 right. The eroded pots of two earlier draw limekilns still visible to the immediate west of this kiln are not mapped (Kincardineshire, Sheet XXVII.4 (St Cyrus)).

Figure 6B (top right): The single-pot draw kiln at the Cults Lime Works, Pitlessie (Fife, Sheet 17), which is still clearly visible on modern Google earth imagery in C. Adjacent to the draw kiln are banks of operating clamp kilns, here mapped with symbols 2a (figure 3).

Figure 6C (centre left): Google Earth image of the draw kiln (upper centre) mapped at Cults Lime Works in B. [©Google. ©Getmapping plc]

Figure 6D (lower left): Draw kiln and abandoned clamp kiln at Nobleston (Dumbartonshire, Sheet XVIII). Note how the ‘Old Limekiln’ label is attached to a degraded clamp kiln (approximately represented by symbol 1d (figure 3), and that a quarry is evidently represented to the northeast of the abandoned clamp kiln.
An intriguing question is prompted by the detail implied by the symbols 4 to 6 in figure 3: in those symbols in which the circular pot symbol is surrounded by a geometrical figure, does the geometrical figure indicate the form of the kiln’s masonry surrounds? Symbol 5e presumably indicates a kiln pot supported at its sides by embankments, with a wall at its front where the draw hole is located. It is less clear what we are to interpret of the kiln form that is mapped by more elaborate representations, such as at Auchencloigh (Ayrshire) (figure 7).

Figure 7. Draw kiln at Auchencloigh Farm, Ayrshire, showing an oval kiln pot apparently in a masonry structure, with a sloping southern side. We presume that the ‘wings’ at the kiln front, either side of the ‘LimeKiln’ label, represent projections on either side of the draw hole. [Ayr Sheet VII.08 (Kilbirnie)]. This kiln is not mapped on the corresponding first edition six-inch map.

Are all kilns mapped?
No. In Baldernock Parish, there are 35 clamp kilns mapped and at least double that number extant on the ground. In upper Bannock Burn (Stirlingshire), not one of an extensive field of 45 horseshoe-shaped clamp kilns is mapped on OS first edition six-inch maps. Nor is there any mention on this site of limeworks, which is sometimes OS practice when many kilns are present. The latter situation is found around Braehead in Lanarkshire where Ward has identified and georeferenced more than 140 clamp kilns. In some but by no means all of these Braehead settings, the first edition six-inch maps simply record Limeworks, with no indication as to numbers or types of kilns, whereas for other Braehead localities kilns are indicated, generally as clamp kilns. This lack of information on kiln typology and numbers in OS first edition six-inch maps of some localities diminishes the utility of these maps in mapping the industry.

The reasons for only partial mapping of limekilns remain unclear, but may simply come down to the surveyors’ unwillingness or lack of time to record every individual structure. The failure to map kilns when adjacent and equally obvious kilns are mapped, as is the case in the ~50% under-mapping of clamp kilns in

---

16 Mackay, op. cit.
17 The lack of mapping of the upper Bannock Burn clamp kilns almost certainly reflects the fact that they were long-abandoned by 1860 (J. Harrison, pers. comm., 11 July 2013; see also Harrison, op. cit.).
18 Ward, op. cit.
Baldernock Parish noted above, is noteworthy in this regard. In the Baldernock case, one kiln in a pair or triplet of side-by-side kilns will be mapped and the other(s) not. It is possible that the surveyors had neither the time nor the motivation to record every last kiln. In some cases in Baldernock, groups of up 12 or 15 kilns went unmapped, whereas other groups were meticulously recorded. Perhaps it came down simply to the numbers that had to be mapped to record every kiln in a locality versus the pressure to complete ‘the job’ and move on, perhaps along with an outcome of different surveyors working in adjacent areas. Another possibility is that some kilns were more degraded (and hence less obvious) than others and were not recognised as kilns, but we think that this is not an explanation for the partial mapping, as the degree of degradation of mapped kilns and adjacent unmapped ones is quite uniform.

The situation in this regard is different from the case of windmills examined by Bignell,19 where failure to map a windmill, or failure to map the type of windmill correctly, probably cannot be attributed to the sheer number of windmills. In the case of clamp kilns, many tens of which occur in some localities, there may have been ‘information overload’ for the surveyors (or perhaps, indeed, for the engravers?).

Are the mapped representations of kilns accurate, both temporally and in terms of kiln type?

It is clear from the preceding point that there are slight differences between the six-inch and 25-inch scales, the origin(s) of which we cannot explain at this stage and which are worthy of further investigation. As well, old limekilns will sometimes appear on the second edition six-inch maps (late nineteenth century) when they were not mapped on the first edition. There is no reason to think that these kilns were built, operated, and then abandoned to become ‘old’ between the mid-nineteenth century first edition mapping and that of the late nineteenth century second edition. No, they were simply missed or ignored in the first edition mapping. Notwithstanding these uncertainties and anomalies, we think it likely that kilns mapped as ‘Old Limekilns’ on the six- and 25-inch first editions were abandoned at the time of mapping. We see no reason to record something as ‘Old’ and, we interpret, abandoned when it is still operating, and the current degree of degradation of these kiln remains is consistent with their considerable antiquity. As well, we speculate, but cannot so far demonstrate, that the non-inclusion of ‘Old’ in the labelling means that the kiln was still functioning at the time of mapping. It is clear that at least some of the clamp kilns that do not include ‘Old’ in their label are today considerably less degraded (‘sharper’ in appearance) than those mapped as ‘Old’ on the first edition mapping. It is entirely possible, however, that practice varied throughout OS and that abandoned limekilns might have been mapped without the ‘Old’ label. A definitive answer on this matter awaits the fuller development of the project to which this map work is the precursor.

19 Bignell, op.cit.
So, the temporal dimension of the mapping has to be treated with caution, especially in terms of the comings and goings of the industry. Nonetheless, there are many examples of kilns appearing on the second edition of the six-inch mapping in situations in which we can be reasonably confident that the change is ‘real’. One example from Campsie Parish in the western Central Belt illustrates such a change (figure 8).

clamp kilns (‘Limekilns’; symbol 1a) at upper left of centre and the eight defunct limekilns (‘Old Limekilns’; symbol 1a) at upper right.

Figure 8. The Derry Coal and Lime works, near Milton of Campsie, Stirlingshire (left), which had become the Glorat Lime Works by the end of the nineteenth century (right).

Left: The Derry Coal and Lime Works on the first edition six-inch map (Stirlingshire, Sheet XXVIII). Note the two small operating kilns at upper right.

Right: The Glorat Lime Works and the Works’ connectedness to the railway network point to major investment at this locality, presumably between the mid-nineteenth century (first edition) and the late nineteenth century (second edition). Unless the first edition maps are incorrect and have not mapped the lime works and kilns correctly, and are somehow mapping a previous form of the Works, then we take the changes from first edition to second to be ‘real’. Bignell [op cit] highlighted the ways in which mapping of windmills may have suffered from failures to update earlier mapping, but it must be remembered for this Milton of Campsie case that it is logically impossible to judge the first edition mapping as incorrect because of a failure to update earlier mapping.
Concluding points

This note is concerned with OS mapping of limekilns, and the degree to which form and function can be interpreted from the mapping symbol. These issues are similar to some of those addressed by Bignell in his recent *Mapping the windmill*. Bignell notes that there is evidence that OS surveyors tried “to do more than simply signify the presence of ‘a windmill’, whether through the use of nuanced symbols or of ground plans”. (p. 59) It is easy to see how this issue applies also to the mapping of limekilns, particularly to distinguishing clamp kilns and draw kilns, and perhaps to the elaboration of the varied morphologies of draw kilns. Regarding the apparent mismatch between the mapped symbol for a windmill and the actual type of windmill, Bignell noted: “The much more likely explanation is that the surveyors were simply not sufficiently determined in their resolve to get this distinction between post mills and tower mills correct … and that this issue continued to be unaddressed, even under the strictures of Colby’s new regime of better fieldwork.” (p. 88) Similar conclusions might be drawn about the mapping of limekilns in Scotland, especially where there were many tens to be mapped in a relatively small area. In other words, mapping is difficult and time-consuming, and especially so when there are more-or-less subtle differences between distinctive types of the object to be mapped (e.g., post mill vs. tower mill, or different types of clamp kilns).

Despite these cautionary notes, it does seem that OS first edition six-inch mapping forms a useful basis for understanding the mid-nineteenth century distribution of limekilns, with the following caveats. Clamp kilns are almost certainly under-represented in the mapping, especially where there are many kilns in a small area. The forms of clamp kilns and draw kilns are distinctive (unlike, perhaps, the more similar forms of the post windmills and tower windmills that Bignell examined, and which he shows are often substituted for each other in the mapping). So, we feel confident in using the mapping to provide an overview, at least, of the lime industry in the Central Belt of Scotland in the nineteenth century.

It seems likely that the variations in map symbols for draw kilns (symbols 4-6 and 12) represent variations in the built masonry that surrounds and supports the kiln pot. We remain uncertain, however, about the subtleties of form implied by the various symbols for clamp kilns (symbols 1-3), especially when different symbols are used within a bank of side-by-side clamp kilns (*figure 5A*). These variations might be recording real variations in kiln morphology apparent at the time of mapping (e.g., square-ended kiln embayments vs. more rounded embayment ends, in the case of *figure 5A*) but other obvious variations in clamp kiln morphology have not been mapped (e.g., keyhole-shaped clamp kilns [plan-view] we have observed at the Cults Lime Works). Elaboration of the meaning(s) of all of these symbols awaits further fieldwork.
**OS County Series – NLS records listing project**

Over the last year, the National Library of Scotland has recorded sheet level records for the first time of all of our six-inch and 25 inch County Series maps of England and Wales. The work was part-funded by EDINA, to whom we are sincerely grateful for providing the impetus and rationale for the project.

The rationale for the project was actually the deficiencies of date information within the Landmark historic mapping that forms the basis of Historic Digimap. The original scanned images of sheets were cropped at their neatlines and seamed together into geo-referenced tiles, then grouped into epochs of time, usually about 20-30 years apart, from the 1840s to the 1980s. It is therefore not possible to date a specific map to a specific year.

In 2009, EDINA were able to fund the recording of sheet-level information for all Scottish OS six-inch and 25 inch County Series sheets. This facilitated the subsequent scanning of all these maps, as well as their online availability,¹ and formed a useful pilot project for marching south of the Border to list maps of England and Wales in 2012-13. We recorded 152,332 maps in eight months, using two full-time and three part-time staff.

The sheet lines defined in CCS *Sheetfinder* and associated shapefiles² were of great value, and we are very grateful to CCS. These cover the theoretical possibilities of the County Series, rather than actual sheets published, and so we needed to link them to real sheet information. The shapefiles allowed a unique polygon ID to be created for every possible sheet at both scales. This was used to create sheet records in a master spreadsheet, including the sheet polygon ID, County, and sheet number in Roman and numerical forms. As sheets were listed, records from the master spreadsheet could be copied and pasted into individual county spreadsheets, recording the specific date information for each sheet. This both saved time and reduced chances of mis-transcription. But most important, it also allowed the completed county spreadsheets to be merged back with the shapefile via the polygon ID, creating a geographic index to the records.³

We had to aim for a high throughput recording just basic date information; the priority was to record survey/revision and publication dates for every sheet, not record all the possible marginalia. We aimed to record all published sheets, and although we skipped duplicates, our definition of these was very specific. Any differences in printed information was treated as a new edition, and where all printed information was the same, but stamping dates of accession in NLS or reprint dates were different, we recorded these as additional sheets with different ‘probable’ dates of publication.

What can we say about completeness? The Advocates Library that acted as the

---

¹ All NLS OS maps are available at [http://maps.nls.uk/os](http://maps.nls.uk/os) and via a graphic index at [http://maps.nls.uk/geo/find](http://maps.nls.uk/geo/find)

² www.charlesclosesociety.org/CCS-sheefinder and www.charlesclosesociety.org/kmlfile

³ We used Michael Minn’s *Attributes Join from CSV file* QGIS plugin for this ([http://michaelminn.com/linux/mmqgis](http://michaelminn.com/linux/mmqgis)), which helpfully matched our spreadsheets on the sheet polygon ID to create large shapefiles of 150,000 records, also saving any mismatched records in a specified CSV file.
forerunner to the National Library of Scotland before 1925, only obtained legal deposit status from 1911, and we knew that our earlier sheet coverage was likely to be patchy, in spite of the significant donations of OS mapping to NLS in the 20th century. We aimed to record sheets that were published, whether or not they were held by NLS, by using OS County Series graphic indexes and publication records, as well as the records of later editions (recording survey dates of the first edition), and we clearly recorded whether the sheet records were in NLS as real paper items, or not in NLS. As CCS members will know only too well, there are numerous idiosyncrasies to OS mapping with non-standard sheets, and no library can therefore claim completeness on any grounds. NLS also only received very occasional Inland Revenue sheets published ca. 1911, and none of the Special Emergency Edition / Air Raid Precaution sheets of 1939. At least for the initial comprehensive revisions of counties in the 19th century, the ability to check editions spatially within ArcGIS/QGIS was very helpful, allowing us to spot graphically any missing sheets, especially at county boundaries.

We have made all the information available in our OS sheet records viewer at http://maps.nls.uk/geo/records. It is possible to summarise statistics for numbers of published sheets for Scotland, England and Wales at these scales over time (below). These should be treated with caution, given the caveats mentioned above, but show interesting troughs and peaks. For example, according to our figures, OS published 7467 sheets at these two scales in 1900 but the peaks in the 1880s and 1940s-1950s are significant too.

Chris Fleet

![Six-inch maps per year 1846 to 1959. Total of 43,895, peak is about 2500 in 1900.](image)

![25 inch maps per year 1847 to 1953. Total of 145,529, peak is about 5000 in 1900.](image)
Grid colours on military maps

Mike Nolan

On the Series M726 1:50,000 map series of Great Britain, a variant of the Ordnance Survey 1:50,000 series, the grid lines and the kilometre values of grid lines around the neat line are shown in blue. In earlier times both elements would probably have been on the black detail plate. It is believed also that at one time the grid lines may have been ‘rouletted’, or drawn as a series of faint dots with a small wheeled instrument in order to make the grid less obtrusive on the map face. The reason why blue is used is not known and the author would be pleased to hear from anyone who may know the background to this practice. An enquiry to the Ordnance Survey has not resulted in any positive information but perhaps members of the Society may have some information.

What is known is something of the background to the use of grid colours on military maps and it may well be that the use of blue is an offshoot of military practice.

Surprisingly, perhaps, there is little mention of ‘grid colours’ in Brigadier Clough’s monograph on Military survey in World War Two, Maps and survey, HMSO 1952. The only index entry of note refers to the use of the Egyptian ‘red’ and ‘purple’ grids in the Middle East.

However, a letter has been found introducing a policy for the depiction of grid colours on British military maps. This predates the entry into the war of the USA and it is thought likely that the policy would have been immediately adopted by the Americans when they entered the war. The policy letter, found in PRO WO 193/202 & 203, is reproduced in full below:

TECHNICAL INSTRUCTION No. 1 – COLOURS OF GRIDS ON MAPS.

It is considered desirable that the colours of grid overprints should be standardised to call attention to a change in the grid system and to familiarise users with a particular colour for each grid.

Standard colours when they differ from those already used will be introduced only when a reprint is required in order to avoid cancellation of existing stocks.

It is not proposed, however, to insist on coloured overprinted grids where the grid is or will be put on the black outline plate, but standard colours should be used for the grid figures on the sheet margins.

In certain cases it is appreciated that the proposal cannot be rigorously adopted but the principle of one grid one colour should be followed as far as is practicable.

The attached chart shows the colours to be used on reprint for overprinted grids and/or grid figures on the majority of grid systems now in use.

(Signed) J. Calder Wood

13th November, 1941.

For Colonel, G.S.
The graphic illustrating this policy produced originally as a spirit-duplicated or Gestetner printed diagram is reproduced below as a modern Autocad drawing as faithfully as possible. It will be noted that the policy as illustrated in the graphic was confined to the European Theatre of Operations but doubtless the policy was extended to cover the Far East and the South West Pacific Area theatres of operations as well after the entry of Japan into the war.

In the post-war period, guidance on the system has been found in Military Engineering:

**Grid Colours**

24. To assist the user in recognizing the grid in use on a particular map, a system of colour codes has been introduced. Colour codes are particularly useful in the complex situations which can sometimes arise at junctions between UTM/UPS and
British Grids. In the case of operational grids, the grid colour is always used for the figures defining the easting and northing values but not necessarily for the lines themselves. When only one grid appears on a sheet, the lines are printed in the grid colour but, when a grid junction occurs, all lines take the colour of the grid covering the larger part of the sheet to ensure accurate registration between both grids. The treatment of overlapping and secondary grid values and ticks varies from scale to scale and reference should be made to current instructions for full details. In such cases, the standard grid colour may not be used where it would entail an additional printing. Generally, either brown or blue, each a colour which will already occur on the sheet, is substituted and the printing combined with either the contours or the drainage as appropriate.

25. Occasionally grids of the same colour abut. In such cases, an extension of the grid across the junction to form an overlapping grid could cause ambiguity. To overcome this, the overlapping grid values and ticks are shown in a different colour.


Shortly after, the above was repeated with minor amendment in the Manual of graticules and grids on Military maps and air charts, GSGS 5191 Edition 1, GSGS, September 1973, pages 3-5):

Grid Colours

19. To assist the user in recognizing the grid in use on a particular map, a system of colour codes has been introduced (See Appendices 2 – 43 at Annex C). Colour codes are particularly useful in the complex situations which can sometimes arise at junctions between UTM/UPS and British Grids. In the case of operational grids, the grid colour is always used for the figures defining the easting and northing values but not necessarily for the lines themselves. When only one grid appears on a sheet, the lines are printed in the grid colour but, when a grid junction occurs (paras 16a, b), all lines take the colour of the grid covering the larger part of the sheet to ensure accurate registration between both grids. The treatment of overlapping and secondary grid values and ticks varies from scale to scale and reference should be made to Chapter 4 for full details. In these cases, the standard grid colour may not be used where it would entail an additional printing. Generally, either brown or blue, each a colour which will already occur on the sheet, is substituted and the printing combined with either the contours or the drainage as appropriate.

20. Unfortunately, grids of the same colour do occasionally abut. In such cases, an extension of the grid across the junction to form an overlapping grid (see para 17) would cause a colour problem. To cater for this, the overlapping grid values and ticks are shown in a substitute colour (see Chapter 4).

The author would be pleased to hear from anyone who may have further information on this subject.
Diagram illustrating British grid systems in the Balkans in World War Two and also the colours used for the various grids. 
Taken from Notes on maps of the Balkans, July 1944.
**Masked Balls**

**Rob Wheeler**

Figure 1 (below left) shows an extract of an engraved map of 1796, before the Ordnance Survey had produced its first map. It shows detail – roads and rivers – and names. The engraver has tried to position names where they are clear of detail, but he hasn’t tried all that hard and, if the two intersect, neither gives ground to the other.

Figure 2 (above right) shows an extract from OS Revised New Series sheet 184. The engraving is far superior but the same principle is followed. A fairly superficial inspection of different series suggests that the first systematic departure from this came with the introduction of the Revised New Series in colour. For this edition, multiple-track railways were redrawn in solid black. Carrying such a railway over a name was liable to render it illegible, and because the line was being drawn afresh in litho it was no trouble to stop it short of the name. Figure 3 (below left) shows the ‘Second Coloured’ sheet 287; figure 4 (below right) shows the same extract from the Third Edition, which retained the old engraved detail. Normally the new railway symbol would simply obliterate the old, but where it was broken – as for the name *Shrubhurst* – it would have been necessary to clean off the old detail, a fiddly job but one that was being done elsewhere. More interestingly, this cleaning off was not limited to railways. The removal of the casing of roads where they cross a name is not so easy to spot, but *Grants Fm* on the same extract provides an example. Note particularly the way the road borders to the north of the name come right up to the letters on the 3rd edition; note also the eastern border visible between the two minims of the ‘n’ – as a result of a kink in the road it is parallel to them. In contrast, on the second edition the road casing stops well clear of the lettering, while the sienna road fill carries on uninterrupted.
The next development came with the use of dimensionally-stable film for scribing, a technique still being used on the CCS’s early visits to OS. Different films were used, not just for the different colours but for different types of information within a colour. In particular, (black) lettering was normally on a different film from detail, even though it would in due course be combined with it to produce a single plate for printing.

Combining two films could be done simply by placing them in coincidence and re-photographing, and this can be thought of as the logical operation OR. Taking a negative corresponds to the logical operation NOT. The operation AND can be derived from these, since \( A \land B = \neg(\neg(A) \lor \neg(B)) \).

By photographing out-of-focus and with a degree of under-exposure, an image could be coarsened, so that lines became wider while the overall scale remained unchanged; let us call this operation BLOAT. If one now replaced the detail film by Detail AND NOT(BLOAT (Lettering)) that automatically created a ‘hold-out mask’, removing just as much detail as was necessary to create a white halo around the lettering.

This technique was used when the Second Series 1:50,000 was drawn in the mid 1970s. Figure 5 (left) shows an extract from Sheet 115(A). Note the way that the road border reappears as a mere dot in the middle of the ‘b’ of Rachub: this is something that would never have happened with manually broken detail and it tends to improve its legibility. Note also the way the wood boundary is broken for the ‘O’ of Ogwen. Masks were produced from black, blue and red lettering. Note also the ‘+’ symbols for chapels: detail is broken around these too, whereas the ‘b’ of Rachub is allowed to run into a ‘+’ without any break. It would appear that some black symbols (churches, position of antiquity, public telephones) were treated as lettering rather than detail so far as masking was concerned. The masks (or probably a single composite mask) were applied to black detail only; other colours were unaffected.

So far, so good. The story now moves on to the late 1970s, a time – viewed in retrospect – when new ideas at OS were greeted with uncritical enthusiasm. The Routemaster 1:250,000 was born in this era and was an early application of 4-colour printing. One of the new ideas was for a themed series of photographic covers: nine different road bridges were selected, one lying within the coverage of each sheet; the back cover carried a paragraph explaining the engineering or historical significance of the selected bridge. Historical engineering structures tend to appeal to CCS members so it is perhaps surprising that this aspect of the series has never attracted attention in Sheetlines. The appeal of such photographs to casual map purchasers was perhaps more muted, and the pictures were replaced
about 1985\(^1\) by picture-postcard scenes of more general interest.

But the development of relevance to this article was the extension of masking beyond black detail. The table below lists for black, red and blue lettering respectively, which films were masked in respect of that colour lettering.\(^2\) (Ignore the entries in blue for the present.) Thus enough black detail was omitted to give lettering in all three colours the desired halo; for other films the treatment varied according to the colour of lettering. The question mark in respect of magenta appears because its use as solid colour is so sparse. Thus I could find no instances on the maps which would show whether masking was used, although it is difficult to see why the extra work should have been undertaken to so little purpose.

<table>
<thead>
<tr>
<th></th>
<th>Black L</th>
<th>Magenta L</th>
<th>Blue L</th>
<th>Blue screen, dense</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black detail</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Black screen</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Magenta detail</td>
<td>N</td>
<td>?</td>
<td>N</td>
<td>?</td>
</tr>
<tr>
<td>Magenta screen</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Yellow</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Blue detail</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Blue screen, faint</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Blue screen, medium</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Blue screen, dense</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>-</td>
</tr>
</tbody>
</table>

Actually, it is difficult enough to see what purpose was served by masking anything other than the black detail: the Landranger series manages perfectly well without it. The added complication may seem harmless enough. The problem is that tidy masking depends on exact registration during the masking process, and registration in preparing the Routemasters left a lot to be desired, though few maps were as bad as my B edition of Sheet 9, of which an extract appears at figure 6 (left). There is a vertical misalignment here of about 1.5mm with the consequence that the masking of both blue screen (for sea) and of the black grid-line comes well below the road number. Road numbers superimposed on woodland could look odder still. Recall that road numbers at

---

\(^1\) Pencilled date on cover cards in CCS Archives, OS 255.

\(^2\) Based on inspection of ‘B’ editions.
this date were to appear red, so are magenta with yellow; the green of woods is blue screen with yellow. Thus there was no reason to mask yellow. Figure 7 (below left) shows a road number near Lyndhurst on this same sheet. The clearing in the wood produced by the mask is consequently filled in yellow. Note that the masking of solid blue did not suffer this alignment problem. These two examples also serve to demonstrate that road numbers stand out perfectly well against sea or wood without any masking.

All this may seem bad enough, but worse was to come. The ‘C’ edition of this sheet introduced a green rectangle to highlight Primary Town names - ie those that would be signposted as destinations of Primary Roads. Primary Town green was a bluer shade than wood-green, involving a denser screen of blue overlain on yellow. What was to be done if this rectangle intersected a wood? The answer, probably inevitable, was that the rectangle should take priority over the wood tint. This was achieved by preparing the denser blue screen on a separate film and masking the other blue-screen films with it. The black screen was also masked. This is shown by the entries in blue in the table above.

For this, a tidy result depended on much more precise registration than was needed for a halo. This was rarely achieved. Figure 8 (above right) shows the effect where the rectangle overlays sea. In this case we have a white fringe to the rectangle on the top and right-hand sides, a dark fringe on the other two sides where medium and dense blue screens coincide.

This was not the only problem introduced by revision. If a few new road numbers were introduced, did all the masks need to be re-done? Looking at the ‘B4096’ that appears at SU0168. I think the answer must have been ‘yes’. The ‘C’ edition also introduced an Old English ‘M’ for ancient monuments. This appears to mask the medium-blue screen but nothing else. Moreover the masking is odd – see Figure 9 (left) – in that the space between the legs of the ‘M’ is wholly white but there is little or no white to either side. This applies consistently across the sheet. I believe that this represents a rectangular mask applied manually.

To continue the history of Routemaster masking through the numerous successive editions would be as tedious for the reader as it would be laborious for the author. More interesting is the question of how things went astray. A couple of ‘Sixth Series’ proof sheets in the CCS archives\(^3\) throw some light on this.

The first is stamped with the date 3 October 1977 and is a traditional 7-colour

---

\(^3\) OS 211 16 & 17. Evidently the Routemaster name had yet to be devised.
sheet broadly similar to the previous series. The ‘2nd Proof’ is dated 6 December 1977, introduces yellow for built-up areas and drops the boundaries for woods. Brown has been replaced by screened red on yellow but green appears to be retained as a separate colour with a series of screens used both for hypsometric tinting and for woods. The red lettering is masked on various films, including the blue screen used for sea; no masking for blue lettering is being done yet. The result looks most unsatisfactory, the principal problem being confusion between woods and the hypsometric tinting. I suspect that dealing with this and eliminating the green plate took everyone’s attention; minor difficulties with masking were, shall we say, masked.

Colby’s grave

Below is the inscription on Colby’s memorial in St James’ cemetery, Liverpool Cathedral, visited by the Society in July.

Sacred to the memory of Major General Colby RE of Pant Y Deri Pembrokeshire.

His powerful mind and superior scientific achievements were devoted to that great work with which his name will ever be associated, the Ordnance Survey of Great Britain and Ireland, the charge of which was confided to him by the Duke of Wellington. Nor was it by this illustrious individual alone his abilities were acknowledged. He was known and valued by most of the distinguished men of his time, was a member of the Royal Societies of London and Edinburgh, of the Royal Irish Academy and of other learned bodies. Knight of Denmark and an honorary LLD of the University of Aberdeen.

Born at Rochester September 1st 1784, he died suddenly at New Brighton near Liverpool October 2nd 1852 leaving a widow and seven children who mourn their irreparable loss.

Too bad the stonemason didn’t have auto-correct turned on
Nigel James (1953-2013)

CCS members who frequented the Bodleian Library map room will be saddened by the death of Nigel James, the Assistant Map Librarian, who retired in October 2010, after 32 years in post.

Nigel joined the map room team in September 1978, transferring across Broad Street from Parkers (now Blackwell’s art shop) where he had been responsible for the Ordnance Survey agency operation, so arrived in the Library with an impeccable mapping pedigree.

In 1993 Nigel produced two valuable OS-related compilations, Maplists 1 and 2, respectively: *A list of Ordnance Survey district, special and tourist maps 1861-1939* and *A list of Ordnance Survey catalogues, publication reports and other publications 1862-1993* [in the Bodleian Library].

Nigel’s long-standing expertise in matters concerning Ordnance Survey were greatly enhanced as he enthusiastically took on responsibility to become the map room’s specialist in digital cartographic data, mirroring Ordnance Survey’s conversion to a fully digital operation. The Maps team were fortunate to have Nigel on board as the internet arrived on the scene. He was quickly off on a course, and before we knew it, the first Library website had been launched in Oxford, when the award-winning map room site went live in early 1996.

Nigel’s talent on the digital mapping front saw him gain an MSc in Geographical Information Science from Manchester Metropolitan University (2003), and in 2006 he won an Oxford Learning Institute Teaching Award in recognition for giving lectures, seminars and providing individual teaching support in digital mapping techniques and Geographic Information Systems. Two years later he successfully completed his Post-Graduate Certificate in Archaeology and GIS from the University of Leicester.

Beyond the University, Nigel has contributed much to the British cartographic community, with the creation of his *Scalefinder* software, which still enables map librarians to calculate scales on maps which might not at first be obvious to determine. Where else can measurements in Chilean *vara* be easily converted into a representative fraction?

Nigel had been battling with mantle cell lymphoma since 2009, and during his retirement decided to take flying lessons. Nigel fought his illness hard, always positive and always believing there would be a combination of better health and good weather conditions that would permit him to fly again.

Nigel was supported during his illness by his wife, Jill, daughter, Clare and son, Ross. He was a devoted family man and good friend to many. He will be much missed.

Nick Millea
photo: Ann Sutherland
Mapping the Olympic park

In December 2010 we mentioned an unusual OS map depicting the Olympic park in east London at a scale of 1:4000. Produced jointly with the Institute of Civil Engineers (ICE), its purpose was to promote civil engineering as a career choice for young people and to celebrate the work of the Olympic Delivery Authority in preparing the site for the 2012 Games.

Now a new one-off version entitled The future Queen Elizabeth Olympic park has been issued, again jointly with ICE and again printed on both sides with integral covers. The plan of the park itself occupies about half of one side, alongside a timeline from 2005 to 2030 (when 9.3 million visitors are expected) and an overview map locating Stratford. On the reverse, developments (achieved and proposed) are described under topic headings such as Transformation, Transport, Venues, Energy, Water and Waste.

Ordnance Survey are evidently pleased with the map, as they displayed it at the International Conference on Cartography in Dresden in August this year, using it (rather than their standard products) as the case study to demonstrate their ‘Cartographic design principles’.

The map is indeed attractive and easy to read with the choice of muted colours depicting the different land use, for example.

However, closer inspection leads one to suspect that style has taken precedence over substance. There are several errors and omissions in the case of railways (ironically, as one of the purposes of the production is to promote the development of the urban transport infrastructure). Also, whilst the title on the front cover is as shown above, on the map itself it appears as the highly-misleading Queen Elizabeth Olympic park 2030.

1 Engineering the Olympic park, Sheetlines 89, 4.

John Davies
Applying our cartographic design principles

* User requirements – the map had to show the importance of civil engineering in developing and creating the Olympic park
* Display format – This was a paper map and the colour palette was developed to ensure maximum clarity
* Visual hierarchy – The main focus was the Olympic park. To allow park data to stand out we chose a colour palette that was bold but aesthetically pleasing
* Simplicity – We depicted only the key information required. The park features shown were boundary, rail lines, venues, utilities, pedestrian concourse and roads, general surface, green space, water and facilities / buildings
* Legibility – All the map features were coloured to make them instantly recognisable. Text was positioned to make it as legible as possible and halos applied to make it clear amongst surrounding detail
* Consistency – We kept both maps [2010 and 2013 versions] similar in terms of design but tweaked the colour palette enough so each map would stand out on their own
* Accessibility – We tried to make the map as intuitive and easy-to-use as possible
* Composition – Being a folded map it was designed with fold lines in mind. For example the overview map and legend occupy one panel each. Borders were used to separate the different elements but the overall impression is one of balance and harmony, helped by the fact that the main map bleeds into the other panels.

A slightly abridged version of the OS presentation at ICC Dresden, with thanks to Christopher Wesson, OS Cartographic design consultant.

Above and top right: Some of the errors on the map. Jubilee line Stratford depot is wrongly labelled Abbey Road station; Bow Road station (District line) is labelled Bow Church, a non-existent station is labelled Bow Road and the DLR Bow Church station (on the easternmost line shown) is omitted. Other errors include the omission of Stratford High Street station (DLR) and the anachronistic labelling of the London Overground as the North London line.

The Overview map (above) is rather odd in that two short spurs of the DLR are depicted, but not the sections serving Stratford. High Speed 1, two detached sections of London Overground and an unidentifiable line north of Tower Pier all appear, but no National Rail or London Underground lines.
Liverpool is a vibrant and attractive port city, a revelation to this first-time visitor whose only previous impressions were from the depressing news of the 1980s. For our visit in glorious sun on 5 and 6 July, CCS member Tinho da Cruz, map curator at University of Liverpool (and a transplant from the Southeast), guided us through the mapping and architectural history of his adopted city.

We began on a surveyor’s traverse to the location of the Liverpool Datum locating bench marks. Prior to 1840, there was no established datum for OS maps. Why Liverpool? The OS surveyors had progressed as far north as Liverpool before this bizarre omission was addressed by Col. Thomas Colby, director of the OS. Liverpool was not only convenient to the work flow, but also central in England and Wales and its largest port. The sill of the tidal lock gate into the Victoria Dock, then the most seaward of Liverpool’s numerous harbours, was chosen for eight days of hourly readings of the tide to establish an average mean tide level, which became the datum for all subsequent levelling in GB. The site area today is an exposed and nearly featureless wasteland of infilled docks, lorry parks and disused or converted Victorian warehouses. Tinho located the Liverpool Datum point by superimposing a modern plan on the old. Nice on a sunny windless day to imagine the invisible past and watch the ships go by. Liverpool’s docklands have moved nearer to the sea as ships have become larger.

The datum itself was also abandoned. The second geodetic levelling, carried out between 1912 and 1921 and tied to Newlyn, compared the new benchmark readings to the ‘Old values of benchmark’ and expressed them as contours of error. Relative to Newlyn datum, the Liverpool datum was inclined and had an undulating surface. Rather than re-levelling from Liverpool, a new location was selected in Cornwall after taking geological advice. (Newlyn Datum was established in 1925 based on six years of automatic hourly gauging of the tide. A more precise levelling established a system of primary or fundamental bench marks, fixed on solid rock, from which secondary and tertiary circuits were precisely levelled. Now thanks to GPS, these levelling networks based on Newlyn are also history. For levelling histories in areas of subsidence, see my article The ups and downs of benchmarks).1

On our way to and from the site of the Liverpool Datum, we spotted the characteristic OS benchmarks and Tinho showed us Liverpool’s architectural heritage, beginning with the Albion building from whose balcony the losses of the Titanic, staffed largely by Liverpudlians, were announced. The most iconic buildings of Liverpool are the ‘Three Graces’ of which the Liver Building crowned by its distinctive liver birds is the best known. Moving inland from the waterfront, Oriel Chambers was a very early (1864) example of steel-framed construction which permitted large windows. Many grand buildings testified to the great wealth of Liverpool in the eighteenth and nineteenth centuries. At Haymarket we

1 Sheetlines 69, 35-36 (available to download at www.charlesclosesociety.org/Sheetlinesarchive).
visited St. John’s Gardens where St John’s church had stood; its tower was the location of the provisional datum for Liverpool but was abandoned in favour of the sea-level datum discussed above – another invisible fragment of the past.

Images of Liverpool:
Top row: Tinbo locating the Ordnance datum; Colby’s memorial
Middle row: Picton library; at the site of the datum
Left: the three graces reflected in the ultra-modern Museum of Liverpool Life.

[photos John Henry, Ken Hollamby, John Davies]
Facing the gardens, the highly visible St George’s Hall was a massive monument to civic glory housing criminal and civil courts, cells and a vast banqueting hall, all in flamboyant High Victorian style.

After lunch, we visited the recently-opened new Liverpool Central Library. It is a light and airy five storey modern building with mezzanine floors arranged around a large ovoidal atrium criss-crossed by apparently unsupported staircases. The original Picton Library, accessed from the second mezzanine level, has been retained and restored to its former magnificence. Its high circular dome grandly illuminates bookcases and alcoves arranged around the perimeter on three levels. Both modern and restored libraries were clearly being used and loved by their public. Proceeding to the fourth floor, we found the Liverpool Record Office where librarian Margaret Daley had spread examples of maps to show us the expansion of Liverpool over three centuries. It was a good opportunity to appreciate Liverpool’s cartographic heritage and consolidate the morning’s observations.

Tearing ourselves away, we took taxis to Liverpool Cathedral on St James Mount. It towers over St James Cemetery where we had come to pay our respects to Major General Colby. The cemetery is sheltered on the floor of a quarry descended into by a winding footpath through a short tunnel – a more dramatic entrance than your average cemetery’s. The obelisk marking Colby’s grave lists his achievements and honours and we were impressed (see page 42).

Ascending from the graveyard, we entered the Cathedral, the second longest and fifth largest in the world. It is a masonry Gothic Revival edifice built between 1904 and 1974. Its huge interior was filled with the sound of rehearsing children’s choirs as we had tea on a terrace outside the refectory. From the cathedral it was a short walk to the University of Liverpool and Tinho’s library in the School of Environmental Sciences. Formerly the Geography Department, the School was the home of eminent geographers FJ Monkhouse and Brian Harley. The library holds about 100,000 maps and Tinho had laid out a selection of OS and other maps of Liverpool. John Booth, he of the cholera and crime maps of Victorian London, was a native of Liverpool and similar maps of Liverpool by Hume showed Booth’s influence. I was pleased to find a geological map of Liverpool by Morton, previously unknown to me.

We closed the afternoon by a visit to the Philharmonic Dining Rooms, a grand gin palace, all dark mahogany and etched glass, opposite the home of the eponymous orchestra. Tinho advised us to visit the gents for its fine porcelain and shining copper. It was impressive, and startling to find a woman tourist there taking photographs – of the exuberant architecture. She ‘had to see it, it’s in my guidebook’.

On Saturday morning, we reassembled near the waterfront before another tall building, which was in fact a vast ventilation stack of Portland Stone in an art nouveau style over the Queensway tunnel. We joined a tour of the stack and the shaft down to the road tunnels. The two mile Queensway tunnel under the River Mersey was the longest vehicular tunnel in the world in its day. Excavated and constructed between 1925 and 1934 by a labour force of 1700, its 46’ diameter
bore was intended to accommodate the roadway in the top half and an electric tram in the lower half. On our tour we visited the control room where today’s computers and monitoring screens occupy a small space beside the massive control panels of the thirties. We then descended to the fan rooms where the original huge 28’ diameter fans that draw air into the tunnels were started to give us a blast. Moving laterally we entered an empty room where we could see the walls of the original St George’s Dock which the ventilation stack occupied. We then descended to the road level where we ventured onto a narrow platform to watch the cars whizz by and startled a few drivers. Finally we went deeper to one of several recently constructed refuges for travellers to evacuate to in the event of an accident or fire. The refuges are in the lower half of the tunnel where the intended trams never ran. Today, a second, larger tunnel, the Kingsway, complements the Queensway. The profit from tunnel tolls subsidises the much-loved ferries across the Mersey.

Emerging from the Tunnel, we proceeded to the futuristic Museum of Liverpool Life right beside the Mersey. With much to see and little time, we opted to view the long model of the Port of Liverpool as it was in the early twentieth century when the docks were full of shipping and workers. Beside it we just had to sit in a passenger carriage that had run on eight miles of the Overhead Railway before the track was dismantled in 1957. There appears, within CCS, to be a strong correlation between cartoholism and railway-ism; maintaining this connection we found a stained glass map near a 1:1 model of the liver bird.

After lunch we passed the Canning Dock basins thronged by sun-seekers to reach the Merseyside Maritime Museum housed in warehouse D on the north side of Albert Dock. For Londoners who may know St. Katherine’s Dock by the Tower, Liverpool’s remaining historic Docklands at the heart of the waterfront easily triples London’s in size. From the MMM we were guided by two enthusiastic young archaeologists past the Salthouse Docks and back into town, apparently. Entering a new urban park, part of Liverpool One, a 42 acre mixed-use redevelopment by the Grosvenor Estate, we left the sunshine via an indoor mall to an anonymous door and stairway to a large cavern housing the northeast corner of Liverpool’s original wet dock, the first commercial wet-dock in the world. Wet docks revolutionised ports around the world. Simple in concept, a lock gate holds the dock water at high tide level so that unloading and loading can take place at all hours. Designed and built by Thomas Steers between 1709 and 1715, his dock could hold a hundred ships and reduced turnaround times for ships from two weeks to four days. Soon augmented by more docks as Liverpool boomed, it was known as the Old Dock.

Ascending into the sun again, our two days in Liverpool were over. We headed home, having had an active and extremely interesting tour of things one can no longer see as well as map collections and Liverpool’s marvellous architectural treasures – historic and modern. We thank Tinho da Cruz, for this well-conceived and organized visit and his kind courtesy and thoughtfulness throughout. After this introduction, Liverpool is on my list for a longer visit.
British Library visit

A dozen CCSers gathered in the vast foyer of the British Library on 11 September to visit the map library and in particular to view maps from the George III collection, known in the BL as ‘K-top’. Tom Harper, Curator of Antiquarian Mapping, and map specialist Magdalena Peszko were our hosts. Tom met and guided us past an innocuous ‘staff only’ door from the atrium, up one of the BL’s 28 lifts, and through a maze of corridors to a meeting room. Tom, in his welcoming remarks, was very complementary about Sheetlines, which is a frequent reference for his staff. Tom, in consultation with Peter Barber who could not attend, had laid out a selection of maps for our inspection. The maps were either by surveyors of the Board of Ordnance, made prior to the founding of the OS, or maps by OS surveyors in preparation for the engraver.

It is easy to forget that maps, plans and sections were vital to the Board of Ordnance for the planning and maintenance of fortifications for centuries before the Ordnance Trigonometrical Survey was formally established. These documents are included in the BL’s OS collection.

The earliest maps were bound in a thick volume, ‘The present state of Guernsey, with a short account of Jersey and forts belonging to the said islands, by Col George Legge, Lieutenant Generall [sic] of bis Majesties [sic] Ordnance, anno Domini 1680’. It combined details of fortifications in section and plan, ‘birds-eye’ views of harbours and estuaries, and various elevations (in the architectural sense), all immaculately coloured in water colours. By chance, years ago, I had used this volume when researching various piers that required remedial work in Jersey; the plans I found in this volume were accurate and I was able to tie them in with later conventional OS plans. The volume also included contemporary accounts of material costs and labour.

Nearer in time, other Channel Island maps included a ‘Copy of a Survey of the Island of Jersey, taken by order of his Grace the Duke of Richmond, Master-General of the Ordnance (1783-1795)’ and ‘An Accurate Survey and Measurement of the Island of ... Guernsey. Surveyed by W.Gardner. J.Warner Sculpsit, 1787’ both at six inches to the mile. These were rigorous triangulated surveys which resemble the OS maps we are more familiar with.

On the mainland, a folio ‘Collection of plans and profiles, and accompanying report, for fortifications on the south coast, Board of Ordnance Drawing Office, 1750-53’ included several in the vicinity of Portsmouth and one fort of which none of us had heard. Dear reader, if you know of Sandford Fort, please reply. Another fascinating folio of Plymouth included several large-scale plans that portrayed at close intervals the growth of Plymouth from 1725 to 1756.

Moving north, ‘A very coloured military survey of the kingdom of Scotland undertaken by order of William Augustus, Duke of Cumberland’ (by) William Roy, Paul Sandby 1747-1755, sheet 7 covered Edinburgh and environs in great detail. At a scale of one inch to 1000 yards (1:36,000) it was exceptionally detailed. Never coordinated with latitude and longitude, Roy wrote that it was rather a ‘magnificent military sketch, than a very accurate map of the country’ in which
‘no geometrical exactness is to be expected, the sole object in view being, to shew remarkable things, or such as constitute the great outlines of the Country’.1

The other category of maps displayed for us, were maps used to prepare for published maps. These included a surveyor’s diary, survey compilation maps, revision maps, fair drawn maps and contour/hill-form sheets.

A truly unique item was a notebook executed between 1812 and 1813 by surveyor Edmund Crocker whose meticulous daily entries incorporated clear sketch maps along lanes and traverses of surveyed lines and angles. All in neat italic script in sepia, free from blots, errors and revisions. Another Crocker item from 1808 was a two inch to the mile manuscript survey map of the area around Frome, again immaculate.

Similar but later was a set of two inch revision maps of Old Series sheets 7 to 34, dated 1826.

There were fair drawn and printed forms of Old Series sheet 19, published in 1817. The fair drawn map was prepared for the engraver to copy and so neat that it was difficult to imagine that it was a manuscript.

Tom had brought out boxes of, as yet, uncatalogued six inch maps with manuscript additions of hill forms drawn as contours and intervening form lines. We were examining the ‘Y-W’ box with maps of Yorkshire, Westmorland and Wiltshire. An interesting feature was that each manuscript was signed by the draftsman including the start and end dates and the number of days taken – usually 19 or 20 – to add the hill forms.

These maps and other uncatalogued maps have been discovered as part of a major new programme to recatalogue and digitise the BL’s maps. Some four million maps are involved with an estimated cost of £1,500,000 for digitisation. Many of the maps will be difficult to digitise due to their large size, fragility and, in some cases, faintness of pencilled detail. We all agreed that there was nothing like examination of an original manuscript to appreciate a map. The two inch fair drawn and revision maps of the Old Series have already been scanned with intention of registering them on Google Earth.

The two hours passed quickly. We thank Tom and Magdalena for fascinating insights into pre-OS Ordnance maps and the compilation maps leading to the published Old Series maps.

---

The introduction of the Universal Transverse Mercator (UTM) grid

Mike Nolan

Sheetlines 96 included a short note on the introduction of the UTM Grid on British military mapping,¹ a programme which commenced in 1952. In that note was a list of ACIs (Army Council Instructions) which introduced the use of the UTM grid on maps of various parts of the world as the programme progressed. The last entry was in 1963 which was the last year covered by ACIs in the National Archives at Kew. Missing from that list was a related ACI, No. 156/1963, which introduced the RSO (Rectified Skew Orthomorphic) Grid in Malaya and Singapore, but that is another story!

By a coincidence, at the Defence Surveyors’ Association’s Maps & Surveys seminar at the Royal School of Military Survey in June 2013 the DSA presented one of its annual prizes to Paul Butterfield of the Defence Geographic Centre, Feltham for his work in compiling a new manual of graticules and grids.

Conversation with Mr. Butterfield resulted in an application to DGC under the terms of the Freedom of Information Act as a result of which the following information relating to the introduction of the UTM Grid has been provided:

<table>
<thead>
<tr>
<th>Army Council Instruction etc.</th>
<th>Part of the World</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI 447/1953</td>
<td>Europe (Priority 3) Denmark</td>
</tr>
<tr>
<td>ACI 725/1953</td>
<td>Iceland</td>
</tr>
<tr>
<td>ACI 540/1954</td>
<td>Danube</td>
</tr>
<tr>
<td>ACI 69/1958</td>
<td>South Arabia (Aden Protectorate)</td>
</tr>
<tr>
<td>ACI 431/1960</td>
<td>Thailand</td>
</tr>
<tr>
<td>ACI 128/1962</td>
<td>Burma, Thailand, Laos border</td>
</tr>
<tr>
<td>DCI (Army) 6/1965</td>
<td>Zanzibar</td>
</tr>
<tr>
<td>DCI (Army) 30/1965</td>
<td>Bechuanaland, S.W. Africa, Angola</td>
</tr>
<tr>
<td>DCI (Army) 58/1965</td>
<td>Basutoland, Swaziland, Southern Africa</td>
</tr>
<tr>
<td>DCI (Army) 238/1966</td>
<td>Burma/Thailand</td>
</tr>
<tr>
<td>DCI (Army) 52/1967</td>
<td>East Africa</td>
</tr>
<tr>
<td>DCI (Army) 99/1967</td>
<td>La Reunion and the Seychelles</td>
</tr>
<tr>
<td>DCI (Army) 225/1967</td>
<td>Java and Christmas Island</td>
</tr>
<tr>
<td>DCI (Army) 424/1967</td>
<td>Kelulauan and Bunguran (Natunas)</td>
</tr>
<tr>
<td>DCI (Army) 425/1967</td>
<td>Somalia, French territory of Afars and Issas (Formerly French Somaliland and Eastern Ethiopia)</td>
</tr>
<tr>
<td>DCI (Army) 426/1967</td>
<td>Southern Borneo and Part of Celebes</td>
</tr>
<tr>
<td>DCI (General) 38/1968</td>
<td>N. Sumatra (North of the Equator)</td>
</tr>
<tr>
<td>DCI (General) 100/1968</td>
<td>Cyprus</td>
</tr>
<tr>
<td>DCI (General) 119/1968</td>
<td>Eastern Indonesia</td>
</tr>
<tr>
<td>DCI (General) 170/1969</td>
<td>Spain and Portugal</td>
</tr>
</tbody>
</table>

¹ Mike Nolan, The introduction of UTM grid on military maps; a sixty year retrospective, Sheetlines 96, 20-29.
<table>
<thead>
<tr>
<th>DCI (General) 171/1969</th>
<th>Southern Sumatra</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCI (General) 9/1970</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>DCI (General) 58/1970</td>
<td>Kra Isthmus</td>
</tr>
<tr>
<td>DCI (General) 211/1970</td>
<td>Greece</td>
</tr>
<tr>
<td>DCI (General) 12/1971</td>
<td>Maldives Islands and Chagos Archipelago</td>
</tr>
<tr>
<td>DCI (General) 66/1971</td>
<td>Western Central Africa</td>
</tr>
<tr>
<td>DCI (General) T1/1972</td>
<td>Southern Italy</td>
</tr>
<tr>
<td>DCI (General) T18/1972</td>
<td>Comoro Archipelago</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RN J105/82</th>
<th>Afghanistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army J58/82</td>
<td></td>
</tr>
<tr>
<td>RAF J57/82</td>
<td></td>
</tr>
<tr>
<td>(DCI Joint Service)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RN J106/82</th>
<th>Part of North East Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army J59/82</td>
<td></td>
</tr>
<tr>
<td>RAF J58/82</td>
<td></td>
</tr>
<tr>
<td>(DCI Joint Service)</td>
<td></td>
</tr>
</tbody>
</table>

**Paul Butterfield (on the right) and Alastair Macdonald examining each other’s work at the DSA’s seminar in June 2013. Alastair Macdonald was the compiler of Manual of Graticules and Grids on Military Maps and Air Charts published by the Directorate of Military Survey in 1973.**

---

**Irish postcodes**

Further to the stories about Irish postcodes in recent *Sheetlines*, The Irish Times of 8 October 2013, under the headline *Every address to have postcode by 2015* carries the news that a consortium led by Capita Ireland has been awarded a contract to introduce a new postcode system. This, it is claimed, goes beyond the usual area codes in most developed countries. The new postcode will comprise seven digits providing a unique identification for every letter box in the State. The ‘unit specific’ code will be in the format A65 B2CD with the first three digits relating to the postal district. A spokesman said important knowledge of locations will be retained in the new addresses. For example Dublin 4 will still be identifiable in the first three digits of the new code, D04.

---

**Irish historic towns atlas – latest developments**

Irish historic towns atlas (IHTA) is part of a Europe-wide project whose aim is to publish a series of national historic towns atlases. They trace the topographical development of towns and cities, each atlas consisting of an essay with thematic maps, a topographical gazetteer and a series of loose sheet facsimiles.

Ireland has so far published 25 town atlases. The principal maps in each fascicle are either Ordnance Survey or based on them.

**Two new books that help you to explore the atlases**

IHTA has now published two books to enable users of these atlases to make better use and understanding of the material they contain.

**Reading the Maps** *A guide to the Irish historic towns atlas by Jacinta Prunty and HB Clarke, Dublin: The Royal Irish Academy, ISBN 978-1-904890-70-6*

*Reading the Maps* is intended to serve all users of the Irish historic towns atlas, samples from the first twenty-two atlases are used to illustrate comparative, thematic and case studies of Irish urban history. Various town-types, from monastic to modern, show the origins of urban culture portraying similarities and differences across the island of Ireland. The book is heavily illustrated with maps and views taken from the IHTA series along with sets of questions and observations that can be drawn from the detailed information. *Reading the Maps* is geared towards teachers and users of the atlas from primary through to postgraduate students, but do not let that put you off this very helpful book.

**Maps and texts** *Exploring the Irish historic towns atlas, edited by HB Clarke and Sarah Gearty, Dublin: The Royal Irish Academy, ISBN 978-1-908996-14-5*

This volume, *Maps and Texts*, is concerned with making comparisons to discover what is unique about Irish towns and what is generic. It considers various categories of urban life, how they interacted and changed over time and why that might be so. Based on three seminars that examined the contents of 25 Irish historic towns atlases, *Maps and Texts* tries to broaden the ways in which historic town atlases might be used and considers the structure of society as a social process in the making of urban Ireland.

*Maps and Texts* comprises twenty individual essays by different contributors offering readers three different perspectives on urban life in Ireland, firstly comparing similar towns, secondly aspects of urban life, finally a broader view into various approaches and tools for understanding towns and their history, shape and diversity. The book is well illustrated with maps, reconstructions, views and photographs.

Whether you are into Irish town maps or not both these books will prompt you to look at our towns and cities in a different way. And if you have any of the Irish historic towns atlases you will be getting them out and looking at them afresh. The Irish historic towns atlas project covers the whole of the island of Ireland. Further information can be found at [www.ihta.ie](http://www.ihta.ie) or [www.ria.ie](http://www.ria.ie)
The Irish historic towns atlas is part of a wider European project, with atlases containing broadly similar information available for a number of countries. For British towns, visit www.historictownsatlas.org.uk

**Digital atlas of Derry~Londonderry, a web-GIS based project**

The city of Derry is ‘UK city of culture’ 2013. To mark this, the Royal Irish Academy is producing a series of online resources based on its atlas of Derry~Londonderry by Avril Thomas, published in 2005. The digital atlas of Derry~Londonderry is a joint collaboration between the Royal Irish Academy, Derry City Council and Queen’s University Belfast.

It is an experimental web-GIS resource that uses content from Irish historic town atlas No15 Derry~Londonderry. A selection of early plans and thematic maps from the atlas are layered and historical details of streets and key sites within the walled city are available in pop-up boxes.

As for all towns in the IHTA series, this contains an essay, an index of topographical information, a bibliography, appendices and a series of thematic maps and historical illustrations. The site went live in September at www.ria.ie/digitalatlasderry

The above project derives from two previous mapping research projects, one is a comparative study of a group of medieval new towns founded in the late thirteenth century in England and Wales under King Edward I, the second is a study of the late medieval urban landscapes of Chester.


*Mapping medieval Chester: place and identity in an English borderland city c. 1200-1500* [www.medievalchester.ac.uk](http://www.medievalchester.ac.uk)

*Rodney O’Leary*
Dealing with awkward extrusions

One of the cartographer’s bugbears is the feature that sits outside the neatline but which really needs to be shown. The normal solution – an extrusion – rarely adds to the appearance of the map.

One solution, which one hopes OS always eschewed, is to change the position of the offending feature so that it lies within the neatline. At first sight Bartholomew appears to have done this to the Eddystone lighthouse, which sits just outside the southern neatline of their 1950s half-inch (sheet 2) (upper) and just inside on their 1960s version (lower). This does not reflect a change in the neatline: measurement suggests a latitude of 50°10.43' N on the 1950s map, 50°10.95' on the 1960s map.

But one would be wrong to accuse them of so cynical an adjustment. According to Trinity House (who presumably can be relied upon) the actual latitude is 50°10.843'. So actually Bartholomew were merely over-correcting an error.

The remaining error on the 1960s edition seems too great to be explained by a difference in the geoid used. Perhaps the Bartholomew archive might throw some light on the matter.

Rob Wheeler
An anthropologist investigates the wives of the surveyors of
Directorate of Overseas Surveys

Shelley Savage

The outside world will be astounded at my discovery. You have heard of the Bushmen of the Kalahari, a very primitive tribe of hunters and gatherers who live in the deserts of Southwest Africa, but have you heard of the Bushwomen of Yemen? The description which follows is as rigorous and scientific as possible and covers the usual topics: habitat, economy, family organisation, politics, ritual and everyday life.

Habitat: These people are transhumant (ie they move according to the time of year) from one part of Yemen to another. Intercontinental migration has also been known. For instance, two of my informants, Rosem-ari and And-roo have lived in six countries in Africa and on two Caribbean islands. In Yemen they move from the Tihama to the Highlands and back to the coastal areas, and have a supply centre in Sana’a.

Economy: How these people gain a livelihood is not yet clear. Although they travel in groups of about 30 people, they do not herd cattle, keep sheep or goats, or even practise agriculture. Perhaps they tend Land Rovers, of which they have many. Their subsistence appears to be closely linked to the men’s ritual activities, see below.

Family Organisation: The name I have given to this tribe is Dossers. The absentee head of the tribe, the Doss Boss, lives abroad, no doubt in great luxury, while the ordinary members of the tribe keep a very modest, if not primitive, standard of living. The tribe is divided into clans, each with their own names. Marriage is exogamous (ie they marry outside the tribe).

Politics: This is a peaceful tribe, with no known acts of aggression against their peaceful neighbours. They never carry arms and only want a peaceful existence. In fact, their rituals are not effective under warlike conditions.

Ritual: This is exclusively the concern of the adult males. The core activity takes place on mountain tops, where they unwrap and erect their sacred equipment and set up mirrors called helios (which they have somehow managed to procure from the British Army who used them in the olden days for Morse Code signalling, an amazing adaptation) and flash them at their colleagues on other mountain tops, simultaneously shouting out magic numbers to a ‘booker’ who writes them down … in a book! This is regularly followed by the whirling of a psychrometer, a kind of bull-roarer (similar to those found in New Guinea tribal religious festival and English football stadiums). Their nocturnal rituals involve one very ancient method of calculating, using the stars, and one very up-to-date

---

1 From Ring Road Rag, No 41, October 1980, published independently in Sana’a, North Yemen, of which Shelley Savage was editor.
2 Theodolites.
3 For recording temperature and humidity.
method using made-made satellites. These magic symbols are then sent to tribal headquarters where maps are drawn of the features significant to the well-being of the people.

*Everyday Life:* At the beginning of a new migration, they load up their Land Rovers and lorry and set off with camping equipment, fill the water-bowser and head off for a new area. Setting up camp is usually a routine matter unless, as Rosem-ari described, it is in the path of stampeding elephants. Food comes mostly from tins, but bread and cakes are sometimes baked in a wood fire, while khubs\(^4\) is cooked in an oil drum, a makeshift tandoor oven. Every Friday, a sheep which has been a camp follower is slaughtered according to religious practice, and consumed. Sanitary arrangements consist of going into the bush with a spade in one hand. This can be a problem in desert country where the men are 80 feet up on Bilby Towers, and there are no bushes! A neat folding wash-basin, made of animal skin or canvas, is used when there is sufficient water. Children thrive on the life, picking up different languages as they play with sand and stones among the tents and campfires.

I discovered that these people have many curious customs of great interest to a folklorist. They claim that a Tilly lamp kept burning all night keeps elephants away, and that pet cat will deter snakes. Enormous quantities of fig-rolls are eaten, but I cannot figure out the significance of that.

It is not an easy life, having to put up with unexpected downpours of rain (Moi-ra and Ter-ri once spent four hours under a canvas sheet shared between 25 people), and wind and dust storms which whip tents down, but they all enjoy the life and are most reluctant to become sedentary and civilised.

---

**Bridges patent mounting**

In the online forum [http://uk.groups.yahoo.com/group/ordnancemaps](http://uk.groups.yahoo.com/group/ordnancemaps) Gordon Watson wrote: I recently acquired a one inch map of London published by Edward Stanford with the Stanford-Bridges patent mounting. Are you able to tell me about the mounting, which I have never come across before?

Richard Oliver replied: The map is the 1921 OS one-inch of London etc. This fits in with the few ‘Bridges’ that I have seen over the past thirty plus years of mapping current in the early to mid 1920s. The system was certainly ingenious, and no doubt very useful in open cars at speed, but it’s impossible to open out the whole map and, unlike the Ansell fold – specimens of which turn up more often (though still hardly common) – one cannot so open out the map as to move seamlessly from section to section. Put another way, Bridges has the disadvantages of a road atlas with no overlaps between pages, and the disadvantage of being relatively expensive to prepare – unsurprising that it didn’t really catch on.

\(^4\) Pitta or flatbread.
**Recent additions to NLS online OS maps series**

**Ordnance Survey One-inch Revised new series, England and Wales (1892-1908)**

Covering all of England and Wales in 346 sheets, this beautifully engraved series presents a clear and attractive general overview of the landscape from a century ago, based on a national revision of 1893-8. We have included the Outline edition (with relief shown by contour lines), as well as the Hills edition (with relief shown by brown hachures), borrowing in places from the Third Edition sheets in the 1900s to provide more complete coverage.


Graphic index for viewing sheets: [http://maps.nls.uk/openlayers.cfm?id=36](http://maps.nls.uk/openlayers.cfm?id=36)

Geo-referenced mosaic (hills): [http://maps.nls.uk/openlayers.cfm?m=1&id=160](http://maps.nls.uk/openlayers.cfm?m=1&id=160)

Geo-referenced mosaic (outline): [http://maps.nls.uk/openlayers.cfm?m=1&id=161](http://maps.nls.uk/openlayers.cfm?m=1&id=161)

**Ordnance Survey Five feet to the mile - London, 1893-1896**

The most detailed mapping of London by Ordnance Survey just over a century ago, the five feet to the mile or 1:1,056 scale covered the capital in 729 zincographed sheets, based on a revision and survey of 1891-5. The maps provide excellent detail of the whole urban infrastructure, including residential and industrial premises, schools, asylums, hospitals, parks, canals, docks and railways, and even the interior layout of public buildings, such as cathedrals, churches, and railway stations.

Home page: [http://maps.nls.uk/os/london-1890s/index.html](http://maps.nls.uk/os/london-1890s/index.html)

Graphic index for viewing sheets: [http://maps.nls.uk/openlayers.cfm?id=38&zoom=11&lat=51.48&lon=-0.12](http://maps.nls.uk/openlayers.cfm?id=38&zoom=11&lat=51.48&lon=-0.12)

Geo-referenced mosaic: [http://maps.nls.uk/openlayers.cfm?m=1&id=163](http://maps.nls.uk/openlayers.cfm?m=1&id=163)
Kerry musings
David Archer

If you could meet someone from the past, who would you choose, and why? Shakespeare perhaps, to hear his strong brummy accent? Nelson, to be certain of his last words? Or a man with a white hard-hat who was a senior project manager during the construction of Stonehenge, and has so many questions to answer? Me? I would choose the person who supervised the numbering of the Ordnance Survey six-inch maps; he would certainly have some serious questions heading his way.

So what’s wrong with the numbering? Nothing really, it works, the sheets have the same numbers as the index diagrams, some diagrams, and that is all that matters. The only problem, no not a problem, a bewildering curiosity, is the question of all the sheets at the edges of counties which have a suffix, usually ‘A’. The only consistent thing about them is that one cannot predict, I cannot predict, where they will occur or the number allocated to them. The six-inch maps for England and Wales continued the young tradition of inconsistent numbering followed by the Ordnance Survey in Ireland at this scale and for the mainland Old Series. Here, sheet 68 sits along the north coast of Norfolk, and to the right of it, floating in the sea are sheets 68 East part 1 and 68 East part 2. Which, I assume were considered preferable to 68 East North and 68 East South. On the Welsh coast, we have sheets 77 NE and 77 SE, with 76 N and 76 S beneath them. No uniformity is achieved by using Part 1, N and NE.

But I digress. Numbering of six-inch sheets. Draw a county boundary on a piece of paper, any county. Across the county, draw a grid of rectangles representing maps measuring 6 by 4 miles within the neat lines. Rub out any rectangle that does not have some part of the county on it, leaving a grid of irregular shape, often with edge sheets having only a small area of the county on them. Number the sheets from left to right, top to bottom, 1 to whatever. Neat. Mission accomplished. Except that it was not so. What I want the man from the past to explain, is why the numbering is from left to right, top to bottom, from sheet 1 to whatever, but with a lot of edge sheets given the same number as another sheet with the addition of a suffix, rather than their own number. Why sheet 198A rather than 199, and why was this sheet chosen to have a suffix in the first place? Put it another way. If one has just one six-inch sheet plotted anywhere on a county outline, one can predict with certainty where the other sheets will fall simply by extending the sheet lines to form a grid. What cannot be predicted is which sheets the Ordnance Survey would have chosen to have a suffix and which sheet number would have been used. I might be wrong and have missed something terribly simple by relying on a visual inspection of index diagrams, but I can see no consistency in the numbering of the six-inch maps. A search of the literature has proven fruitless. Yes, if one had a blank grid, one could make a good guess to identify sheets with a suffix, and what the number will be, but so often one would be wrong. Totally. The big question is why the Ordnance Survey adopted such an inconsistent approach in this matter?
The first ‘A’ sheets that I came across contained a very small bit of land, weeny, the size of a garden jutting out onto an adjoining sheet. A classic case of something missed at the planning stage, and only discovered by a draughtsman who went to his boss and said he thought they needed another sheet. Better call it 198A and press on. No time to go back and re-number everything. So when another was needed, it seemed acceptable to give it an ‘A’ number as well. Maybe the ‘A’ sheets remedy a significant minor error?

At least two things count against this suggestion. Firstly, they are found on maps and index diagrams spanning the whole era of six-inch production, a good chunk of the nineteenth century, in England, Wales, Ireland and Scotland. When a problem was found on the first counties to be mapped, surely they would have initiated extra care and checks in the future and would not have continued as they did? Secondly, numbers with a suffix are given to maps with quite large areas of land, where such sheets could easily have had their own non-suffix number, and would never have been missed at the planning stage. Land within the county boundary occupies seventy five per cent of Northumberland 106A, as much as is shown on the adjoining sheet 106. Thus, one might predict an ‘A’ where a smidgen of land creeps on to a sheet, but would never suggest having one where a sizeable area of land is shown.

Assuming one could predict a sheet bearing a suffix, there is still the problem of predicting what number to put before it. And here things are weird and wonderful, obvious, not so obvious, utterly bewildering and downright confusing. Hold on to your hats. Numbering. We might imagine that the easiest, indeed the only numbers we are able to predict are where the ‘A’ sheet is attached to the grid on one side only, taking the number of the sheet it is attached to. So, if the eastern border of the county is covered by a column of sheets 120, 130, 140 and 150, the sheet jutting out from 130, will be 130A. Similarly on the west, north and south of the county. Here, one might suggest that ‘A’ means additional, annex, appendix, also, and.

But no, even this simplest of assumptions does not work. Consider Northumberland six-inch sheet 8. This shows some mud flats and the northern tip of Holy Island on the north-east coast of England, and has three sheets of solid land to its west and south, with only the deepest blue ocean beyond the other two sides. If there were a sheet 8A, one would expect it to be holding hands with sheet 8, but it isn’t. Look carefully and we find it on the other side of the county, attached to sheet 9, four inches westwards on the quarter-inch index diagram and 16 road miles away from its parent number. Why on earth is it not 9A, acknowledging its neighbour and the bit of land that protrudes onto it from sheet 9? Northumberland sheet 12 is another coastal sheet, with 12A to the right, mapping the Farne Islands, and sheet 12B, again on the other side of the county, snuggling against sheet 13. Again why not call it 13A?

When there are more than two suffixes it does appear that they are kept together. Good. But if there is a gap anywhere, it might or might not be acknowledged in the numbering. Consider the beautiful Pembrokeshire coast, and sheet 31. To the west of this sheet we have 31A with Grassholme Island (OS
six-inch index spelling), and then a space the exact size of a six-inch sheet, and to
the left of this space is sheet 31C with the Smalls. The gap is given the silent number
31B, which does not appear on an index of course. Not so for sheet 9 of County
Galway, where 9A sits above sheet 9, and has 9B to its left. Then a map sized space,
and below it sheet 9C. No silent suffix this time. To the right of 9C is 9D, and then
home to sheet 9 where we started. Consistency my foot. Could anyone predict either of
these? At least the Irish numbering is anti-clockwise, which should keep the witches
away.

The majority of suffix sheets are attached to the main grid by two adjacent sides,
with the possibility of receiving the number of a sheet in line with it either vertically or
horizontally. After a quick look through the indexes, it appears that sheets for England
and Wales always received their number from a sheet to one side, rather than from
above or below, with a similar picture for Scotland, which is what I would have
expected, but Ireland was content to take the middle way and took numbers from either
side or above and below in about the same quantity.

Space is running out and the boredom factor rising, so I think brevity is needed for
further comments on numbering. Why does Yorkshire 164 suddenly have 164W to the
west of it? This being only the second occurrence of a ‘W’ suffix that I am aware of,
whilst County Donegal is not alone in having a sheet bearing two numbers, 32A and
40A in this case.

There are also numbers missing, Northumberland sheet 2 and Galway sheet 3, for
example. Non-sequential numbering is rife, assuming we read left to right and down the
grid. What ‘should’ have been Galway sheet 3 is numbered 15A, giving the first few
sheets as 1, 2, 9B, 9A, 10A, 15A, 4, 5, 6, 7, 8, 9C, 9D, 9, 10, .... Why were numbers
missed?

Did I say that I wanted just five minutes with the man from the past? Five days
might be more profitable. Indexes for Tyrone, Roscommon and Westmeath show the
county boundary extending beyond the sheet lines, with no adjacent sheet. Did the
detail appear as an extrusion on a standard sheet? Or was the Galway example
followed, where miracle upon miracle, we find an index showing what appear to be
extended sheet lines to accommodate islands, but I might be wrong. None of the
nonsense of putting them on an adjacent sheet with an A suffix, just have a larger piece
of paper. When one considers paper size, one remembers that a lot of the very small
detail shown to fall on an adjoining sheet can easily be shown on the ‘parent’ standard
size sheet by breaking the neat line with an extrusion; indeed many sheets were
combined in this way on issue or re-issue. Having suggested it, I do not like different
sized sheets. Anyone who regularly handles sets of flat sheets knows the problems.

It was Richard Oliver who guided me to the most puzzling feature of the six-inch
numbering, when he suggested that I look to the west of Kingston upon Hull. Wait for
it. The sheets concerned, all inland, well within the county border, part of the core
sequence, are in a line, side by side, one next to the other, and numbered 236, 237, 238,
myself. Whyyyyy? When I pass through the pearly gates, as surely I will, who do you
think I will seek out first? No, not him. The question and answer session would take
until eternity, leaving no time to hear Shakespeare.
Letters

Perhaps the final word on the issue of the mapping of ha-has may be found in JRS Booth’s *Public boundaries and Ordnance Survey 1840-1980*, published by Ordnance Survey in 1982 and which I have just discovered. As the preface notes: “This manual endeavours to set out in practical terms the statutory duties and legal requirements, direct and indirect, of Ordnance Survey in regard to public boundaries and their mapping together with general instructions as to how those official duties are to be performed and discharged” (no page number). The manual’s glossary lists ‘HA HA’ and notes: “A sunken fence in a ditch. The boundary would use the mereing description of ‘fence’.” (p.380) ‘Mereing’ is defined thus in the glossary: “The act of surveying, ascertaining and agreeing, on the ground, the true legal boundary line and describing the boundary in relation to the existing physical features by measurement as necessary.” (p.394) The glossary definition makes it clear that a ha-ha is to be treated and mapped in the same way as a fence, and that there is no requirement to map the slope on the opposite side of the ditch to the sunken fence.

Paul Bishop

Aidan de la Mare¹ refers to ‘the sport of hunting with dogs’. I disagree. Fox-hunting is not, never has been and never will be a sport. Unless someone speaks out, future generations of readers will assume that all Charles Close Society members think it is.

David Archer

John Cole sent these pictures of ‘elf’n’n’safety-defying’ revision points. Left: Exeter Central in 1947, a very busy station in those days (note the excess of information on the board). Right: Brixham in 1950. Surprising that this was accepted as such antics were not appreciated at the time and the garage corner could have been used just as well.

Iain Thornber took this picture of the trig point on top of the Dutchman’s Cap, part of the Treshnish Isles, off the west coast of the Island of Mull and writes: It occurred to me that there cannot be many trig points on such a spectacular setting!

¹ *Sheetlines* 97, 38-43.

Hold the Christmas list! Add this title even if you have to knock out two others! Subtitled Building modern Britain, this lavishly-illustrated volume traces the story of road maps from the fourteenth-century Gough map to 21st-century satnavs and Google Street View.

At first, the 256 large-format glossy pages and embossed cover may give the impression of a coffee table book, more for casual browsing than reading. And being published by the AA may suggest a song of praise to the all-pervasive motor car. But no, this is a true Mike Parker book. The maps take pride of place and the story is well researched and excellently told.

And being a Mike Parker book, once we reach the twentieth century, the expected personal stories of bad behaviour make an appearance (‘Leeds to London in well under two hours’, anyone?). In other words, as with his earlier books, we get entertainment to go with the erudition.

Of particular delight is the choice of illustrations (many of them full page or double spread). Not just map extracts and map covers (all fully captioned) but contemporary cartoons, photographs and copious planners’ and architects’ designs for future developments, not all of them fulfilled.

Parker’s commentary sparkles. He notes with amusement, for example, Nikolaus Pevsner’s enchantment with the recently-opened M1 in his 1961 Northamptonshire guide and adds wryly ‘Thirteen years later, Pevsner felt obliged to apologise for his earlier over-enthusiasm’.

On the subject of the M1, one illustration that will be familiar to Sheetlines readers is the OS map extract showing the mislabelling of A45/M45. A similar problem occurs on a 1922 Bartholomew map, on which the A698 is labelled A7.

As a Woodfordian, this reviewer has just one quibble: on page 201, Parker tells us that ‘in Woodford there’s a strange intersection of A406 and M11 ... with abandoned slip roads set in acres of wasteland’. Strange the junction may be, but of slip roads there are just the required number and of wasteland there is none (but there is a pretty cycle track down the Roding valley, below all that concrete). Check it on Google Street View!

John Davies

1 Not the M1, Sheetlines 95, 18-19