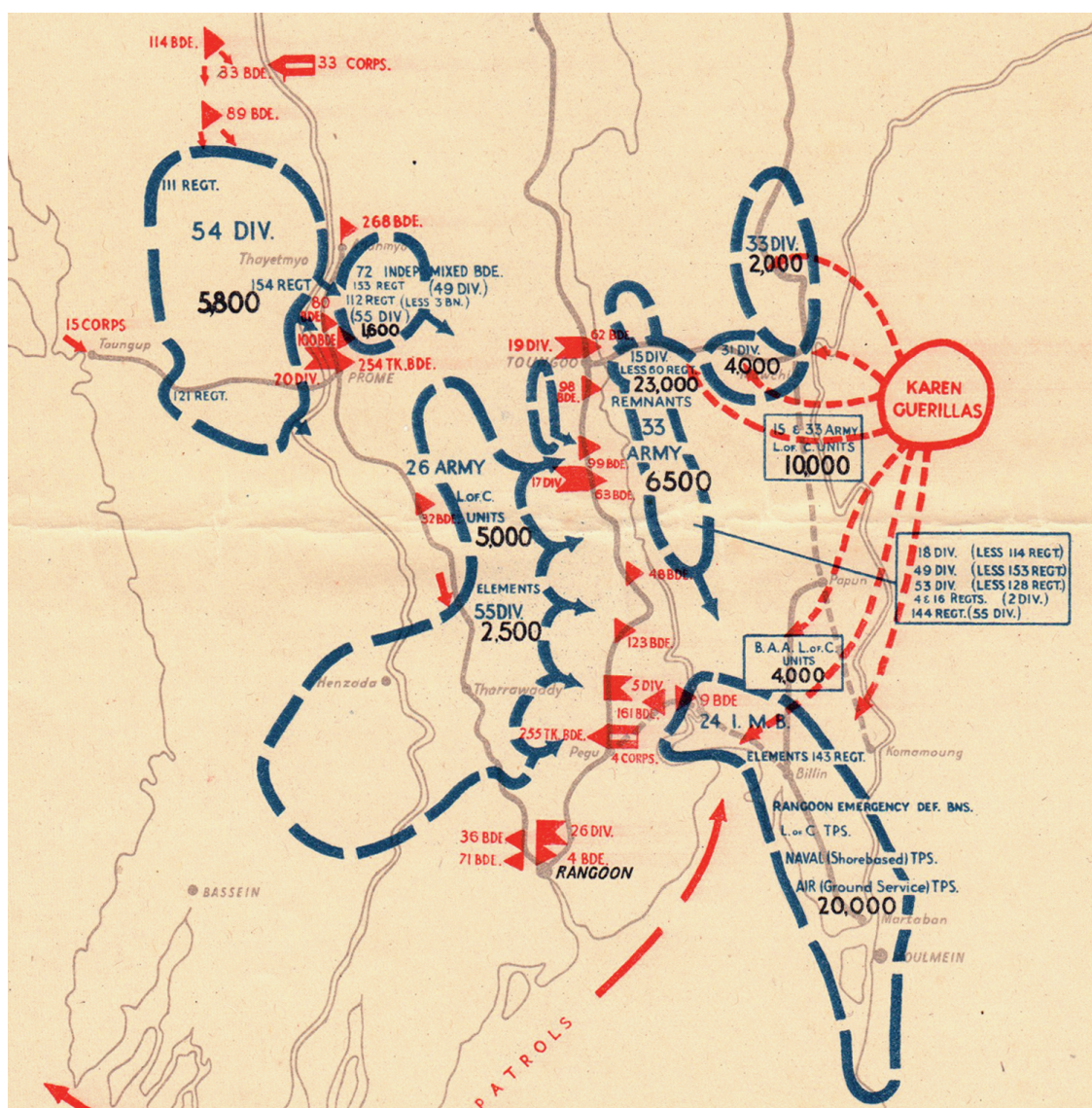


The Journal of
THE CHARLES CLOSE SOCIETY
 for the Study of Ordnance Survey Maps

August 2021



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Sheetlines

Number 121

August 2021

The Society's AGM will be held via Zoom on Saturday 14 August, since the continuing uncertainty about the status of the Covid pandemic has made planning for a physical meeting impossible. The papers for the meeting, together with the information needed for joining the AGM, accompany this edition of *Sheetlines*.

The meeting will begin at 10.30am, and at the conclusion of business David L Walker will give a talk on *The Ordnance and the Hydrographic Service 1811-1843*. The starting time has been chosen so that everything can be completed by 12.30.

As will be seen from the Chairman's report included with the AGM papers, the Society continues to flourish despite the constraints imposed as a result of the pandemic. Increasing numbers of members have attended online map meetings held during the past twelve months. The CCS Committee has recently agreed cooperation with the British Cartographic Society, with the aim of ensuring that both our major societies exploit all possible opportunities for enhancing our respective members' enjoyment, entertainment, and education. This arrangement begins on 8 September, with two presentations by CCS members to a joint seminar to be held online with the BCS's Historic Military Mapping Group.

Members may recall being invited in December to participate in a survey designed to establish what the CCS was doing right, and anything it might be doing wrong, in its members' eyes. Two hundred and seventy four members responded, for which we are extremely grateful. Highlights of the responses:

I am a member of the Charles Close Society because

- it helps me to better understand my collection – **54%**
- it helps me to use maps to see what particular places were like in the past – **57%**
- I am interested in how the modern OS handles its digital data and prints its maps – **27%**
- I am interested in how maps used to be made and printed – **55%**
- I am interested in cartography generally – **82%**

The primary means by which the CCS assists me with this is

- through *Sheetlines* – **95%**
- by the books CCS publishes – **61%**
- by the meetings and visits CCS arranges – **28%**
- through the material CCS makes available on its website – **53%**
- through the CCS Facebook group – **8%**
- by the contacts the CCS enables me to form with those of similar interests – **16%**
- by the advice and assistance I have received from other CCS members – **18%**

Is there ideal basic content for a topographic map?

Richard Oliver

In *Sheetlines* 109 I discussed a possible ideal sheet and paper size for topographic mapping, on the premise that for some users paper mapping continues to have greater functionality than do on-screen displays.¹ I concluded that the optimum size was B1 (100 × 71 centimetres), folded 8 × 4 to 12.5 × 17.75 cm. This entailed an integral cover, and a maximum legend area of 12.5 × 35.5 cm, though in practice this would be reduced by up to 1 cm on each side by a ‘handling edge’. I noted that ‘This ... would impose some constraint on the content of the legend, which in turn raises the question of whether there is optimum map content. This can be addressed on another occasion.’ Somewhat delayed, the present is that occasion.

The ideal sheet size was based on mathematical and ergonomic considerations, which were intended to be as ‘objective’ as seems attainable in a relativistic age. ‘Ideal content’ is much harder to define in ‘objective’ terms, and it would probably have been elusive even before the revolution in cartographic theory and study from the 1980s onwards associated with Brian Harley and his followers. ‘Ideal content’ implies ‘one size fits all’, and whilst it may have been the case in an earlier age that, as General Sir Redvers Buller observed in 1894, ‘the requirements of military purposes & of the practical traveller are identical’, the content of the 1:50,000 *Landranger* series, configured since the 1980s to be the ‘standard map of the country’ for both civilians and soldiers, perhaps calls this into question.² Up to then civil maps rarely carried grid figures on the map face – though they are certainly a convenience – and if ever the military needed ‘tourist information’ (a somewhat fluid category), their requests appear to have been ‘not selected for retention’ in the Ordnance Survey files preserved in The National Archives at Kew. As it is, the *Landranger* is a strange fusion of consumerism and militarism; paradoxically, the 1:25,000 *Explorer* series, though traceable to wholly military origins in the early twentieth century and with much of its style in common with the *Landranger*, is an entirely civil production.

Economies of scale and costs of renewing cartographic material seem to have made for an inertia in Ordnance Survey cartography that is an uneasy compromise between the two distinct groups of military and civil users, and of numerous constituencies within the latter. This results in a mixture of visible, ‘physical’, information, and that which is ‘invisible’ and is essentially administrative or ‘legal’. This is well demonstrated by the mapping of roads or ways: the higher categories are based on administration, the lower on physical characteristics, except that the lowest are either overlaid or replaced by the depictions of public rights of way, the status of which is not necessarily related to their physical characteristics. Or rather, this applies in England and Wales: in Scotland, as in both parts of Ireland, there is no officially recorded public rights of

¹ Richard Oliver, ‘Is there an optimum size for topographic maps?’, *Sheetlines* 109, 42-52.

² Buller to Harcourt, 11 May 1894, in group 10077/94 in The National Archives T1/8834C.

way network, and the specifications of both *Explorer* and *Landranger* have to accommodate two different legal, highway and tenorial systems. Economics of production and distribution have hitherto ensured the paper maps embody a one-size-fits-all approach; the alternative, of producing mapping in several versions, with the cartography and content adjusted to suit particular user groups, has not been pursued, but would seem ideal for basically digital production and distribution, with print-on-demand as necessary.

There are four basic scale-groups for topographic mapping suitable for countries such as Britain and Ireland: 1:25,000, 1:50,000, 1:100,000 and 1:250,000. Variations of scale of about 25 per cent larger or smaller (e.g. 1:63,360 *versus* 1:50,000) do not greatly affect the basic type of detail appropriate to the scale; some detail cannot be shown conveniently at much smaller than 1:25,000, whereas other is suitable for, indeed expected by users on, all four. On the basis of an average pace for walking of 4-5 km/h, for cycling of 15-20 km/h and for motoring of 50 km/h or more, an approximate equation of purpose of 1:25,000, 1:100,000 and 1:250,000 to these three modes of movement may be suggested, but in practice in Britain the 'one-inch habit' seems so ingrained that the 1:50,000 needs to be added, as a scale that seems a compromise between 1:25,000 and 1:100,000, but has neither the detail of the former nor the compactness of the latter. Indeed, there is at present no national 1:100,000 in either Britain or either part of Ireland; the apparent dominance of the half-inch scale in the latter for much of the twentieth century appears to have been an episode, not an indication of a change of direction.

'Ideal content' and 'softening up'

A characteristic of the development of Ordnance Survey and other mass-market mapping in Britain from the early 1960s was the increased prominence of 'soft' information: that is, information that, often, describes and enhances that which is already shown and which can come or go without significant effect on the built environment. Another way of defining it is that the absence of this information would produce a basic content generally very similar to that of an Ordnance Survey topographic map – in practice the one-inch – of the middle quarters of the nineteenth century, or indeed of six-inch or larger scale mapping produced at any time over the past two centuries.³ The first signs of the rise of 'soft' content came on one-inch mapping published from the early 1880s, mainly in the form of noting some inns, smithies and post offices; this was adding descriptions to buildings that had hitherto been mapped anyway. This was followed a decade later by implementing the recommendations of a War Office committee, which led to the rapid and comprehensive appearance of post and telegraph offices, letter boxes, inns, smithies, light houses and beacons, coastguard stations, windmills and mile markers, the last indicated selectively by road mileages. The military did not have it all their own way; they would have preferred to do without parish boundaries, which had a civil administrative function. Such

³ A substantial difference would be in road classification; administrative road classification tends to be reflected in physical characteristics, although the correlation is certainly not absolute.

boundaries are ‘soft’ and, particularly in Britain, have been subject to considerable change since the later nineteenth century. The inclusion of parliamentary constituency boundaries on the 1:25,000 *Explorer* series seems far more indicative of production economics than it does of utility to the great majority of users, added to which it tends to ‘clutter’.

The windmills and lighthouses were shown by symbol, as landmarks; other types of tower were much more discreetly mapped. This basic approach lasted through various generations of one-inch map into the 1960s; after 1914 smithies and letter boxes disappeared, but in due course symbols were introduced for communications masts – those not omitted on security grounds, anyway – and public and motoring organisation telephones.

Whilst the designation ‘Tourist Map’ developed around 1919-20, such maps were initially standard one-inch mapping with enhanced relief treatment. From 1964 they started to carry a limited range of ‘tourist information’ not to be found on the parent mapping, mostly shown by symbols that needed explaining in the legend. Market research in 1970 indicated that ‘tourist information’ would be a worthwhile addition to the 1:50,000 series then being developed; the extra cost of collection would be more than offset by increased sales. A design that had its roots in the age of the horse and the bicycle would be revolutionised for that of mass motoring, prosperity and consumerism. The example set in Britain was quickly emulated in Ireland, and by commercial mapmakers.

Collection of the information lagged a little behind the publication of the first group of 1:50,000 maps, in 1974. These sheets were unusual for an Ordnance Survey small-scale series in having a national sheet-index in the legend, thus duplicating information on the back cover of the folded copies that represented the majority of sales. This might be thought to aid the transition from the layout of the one-inch predecessor, but in fact seems to have been to ‘fill in’ the space to be occupied by the tourist symbols, which were added to these sheets at the first convenient reprint.⁴ As on the one-inch ‘tourist maps’, some of the information was conveyed by symbol and some by a form of highlighting.

‘Tourist information’ appeared on the restyled 1:250,000 mapping of Britain that appeared in 1978-9, relying heavily on symbol, and then on the redrawn 1:250,000 of Ireland of 1981-2. On the 1:25,000 the information was at first confined to what in concept was a parallel series of ‘Outdoor Leisure Maps’, but which developed in the mid 1990s into a national series of ‘Explorer’ maps. The *Explorers* mimicked the 1:50,000 and 1:250,000 in including ‘tourist information’, but resembled the smaller scale rather than the larger in relying heavily on symbols, despite the apparently greater room for text. Whilst the 1:250,000 had always been oriented to the motorist, the addition of the tourist information to the 1:50,000 and 1:25,000 seemed to tilt these scales towards a motorised, consumer market. This development coincided with – indeed, was in counterpoint to – the

⁴ This applies to the 99 First Series sheets issued in March 1974; the three Second Series sheets issued at the same time incorporated the tourist symbols from the start, and had a differently arranged legend.

growth of 'environmental awareness' and a questioning of the ubiquity and net benefit of consumerism generally and the motor-car in particular. In that respect the *Landranger* and the *Explorer* seem to embody a view of things that is under challenge.

The rise of the tourist information was accompanied by other specification changes, some of which added information – including a distinction of lighthouses in use and disused – and others of which reduced it, including omitting the distinction of uncultivated land from the 1:50,000 and a simplification of classification for public roads without sealed surface, so that the 'white roads' now varied from private drives with a surface superior to many publicly-maintained highways that were colour-infilled, to those that were traversable only by four-wheel-drive or farm vehicles. The derivation of the 1:25,000 Second Series from drawings also used for the 1:10,560/10,000 series resulted in the former gaining some detail, particularly administrative boundaries and boundary markers, hitherto only shown on the latter.

In both Britain and both parts of Ireland the various topographic scales have been initiated at different times and have developed independently, so that there tends to be a lack of the evident 'family relationship' and sense of conscious relationship between scales that is characteristic of, for example, the French and Swiss equivalents. Design has apparently taken place in a vacuum, with inconsistent symbolisation, and historical anomalies persisting: in Britain and Northern Ireland the explicit distinction of 'Park or ornamental ground' on the 1:50,000 but not on the 1:25,000 is a striking example.

Basic content

The assumption made here is that whatever symbols and conventions appear on the map should be explained on the map, rather than in a separate document.

The fundamental consideration is: what is of use for planning travel, and for finding one's way on the ground? The following is based on a combination of what is visible with what is 'accessible', and includes some detail more appropriate to larger rather than smaller scales. To avoid a sense of hierarchy, classes of information are given in alphabetical order.

'Access' land, including danger areas

Administrative boundaries

Bridges and level crossings

Buildings: those of wide interest (*e.g.* schools, hospitals) being emphasised

Electricity lines

Ferries

Field boundaries, including hedges, fences and walls

Heighting (contours and spot heights)

High and low water mark

'Landmarks', defined as (1) structures with a vertical emphasis (church steeples, communication masts, etc), and (2) visible 'antiquities'

Railways, including stations

Roads and ways: to include road numbers and indications of public rights of way

Surface cover, including woodland and uncultivated ground

Water, including foreshore

Table 1 indicates what would be shown at each scale: numbers indicate categories, and a blank indicates that a feature is omitted at that scale: for example, field boundaries would not be shown at smaller than 1:25,000. Also, some generalisation would be necessary: for example, only major road bridges could be shown at 1:250,000. Note that certain features frequently repeated in legends, *e.g.* bridges, are listed only once.

Table 1 – Basic content: numbers of categories at different scales

Feature	1:25,000	1:50,000	1:100,000	1:250,000
'Access land'	3	2	1	
Administrative boundaries	4	3	2	1
Airports				1
Bridges, level crossings, earthworks	5	5	3	3
Buildings	4	4	1	1
Electricity supply	2	2	1	
Ferries	2	2	1	1
Field and road boundaries	2	1		
Heighting (contour interval in metres)	2 (5)	2 (10)	2 (20)	2 (50)
High/low water mark	2	2	2	2
Landmarks	8	8	6	4
Railways	4	3	3	3
Roads & public rights of way: classifications	7 + 8	7 + 8	6 + 6	7
Roads & ways: physical characteristics	4	4	3	2
Surface cover	9	8	5	5
Water	6	6	3	2
<i>Total number of symbols</i>	<i>70</i>	<i>67</i>	<i>45</i>	<i>34</i>

This gives a maximum of 70 symbols to be explained in a legend, compared with over 150 on the current *Landranger*. This is achieved partly by a reduction in features shown, but also by rationalising symbols used in multiple contents, such as bridges.

Table 2 expands on features to be included, in order of elimination as the scale of the map reduces.

Table 2 – Details of features to be included within categories

'Access land'	Public parks, cemeteries and sports grounds; 'Access land' designated under CRow Act 2000; 'Danger areas'	'Access land' inapplicable in Scotland
Administrative boundaries	Parish; district; county; nation	
Airfields and airports	Military and private airfields (to be shown by name) Airports (to be shown by symbol at 1:250,000, otherwise by name)	Only airports at 1:250,000
Bridges, etc	Foot bridges; road, railway and other earthworks; road bridges; level crossings; tunnels	Viaducts and aqueducts treated as 'bridges'
Buildings	Buildings of public interest, e.g. schools, hospitals, places of worship without 'steeples'; ruins; glasshouses; buildings generally	Retain 'landmark' ruins, e.g. abbeys, at smaller scales
Electricity supply	Solar farms; electricity lines	
Ferries	Foot; vehicular	
Field and road boundaries	Field boundaries (hedges, fences, walls); indication of fenced/unfenced roads and woodland	
Landmarks	Beacons; trig pillars; windmills; obelisks and towers; lighthouses; church steeples; wind farms; communication masts	
Railways	Single/multiple track distinction; sidings; narrow gauge; stations	
Roads and ways: [A] roads; [B] public rights of way	[A] Untarred and other 'white' or minor roads; tarred rural roads; B-road; A-road; Motorway; [primary routes] [B] Footpath (ordinary/permissive); Bridleway (ordinary/permissive); off-road cycle route; Restricted Byway; Byway Open to All Traffic; 'Other route with public access';	Primary routes on 1:250,000 only Public rights of way at present inapplicable in Scotland
Roads & public rights of way: physical characteristics	Fenced/unfenced; dual carriageway; car parks (rural); over/under two-way width	Two-way width threshold to be 5 metres
Surface cover	Uncultivated ground; rocky surface; mud; orchard; coniferous/non-coniferous woodland; quarries, pits and tips; marsh; sand; woodland	Distinction of coniferous and non-coniferous woodland only at 1:25,000 and 1:50,000
Water	Springs; weirs; locks; ponds; canals; streams/rivers	Larger waterbodies will appear by default

Names, when ‘given’ or descriptive, have not been discussed, as these usually do not feature in legends, and their gradual exclusion as the scale of mapping diminishes is in inverse ratio to the assumed importance of the feature or place. Criteria for inclusion or exclusion at particular scales need a more thorough discussion than is possible here, and in any case does not affect the content of legends, except if there are abbreviations to be explained, which are themselves a form of symbol. However, a useful improvement would be to have ‘cultural names’ in upright or ‘Roman’ and ‘physical’ names in italics, and ‘given’ names with an initial capital and descriptive names entirely in lower case.

Whilst detail redesign is not for discussion here, *Figure 1* (page 12) shows some suggested symbols. For some, alternatives are suggested. The fundamental approach has been to make these ‘planimetric’ rather than ‘pictorial’ in style.

Comments, including exclusions

Certain features are either excluded entirely from the ideal, seem questionable, or need further discussion. Discussion is not exhaustive, and more detailed studies might follow on certain aspects, for example the classification of roads and ways, and landmarks.

Administrative boundaries and markers

Administrative boundaries are ‘invisible’; roadside signs indicating a change of local authority are often placed some distance from the actual boundary; boundary stones, posts and other markers are frequently inconspicuous and hard to find. The occasional showing of tree types along boundaries, taken over from the 1:10,000, is selective and of doubtful wayfinding use. Such detailed ‘mereing’ is surely the function of larger-scale and more specialised mapping, and seems quite inappropriate to topographic mapping.

Aerodromes, airfields and airports

These are best shown by name at the three larger scales; only airports would be shown at 1:250,000, by symbol.

‘Antiquities’ and ‘heritage’

Sites of antiquities of which there are no obvious remains on the ground, which include battlefields not commemorated by obelisks, etc, are of limited wayfinding use.⁵ Discoveries by remote sensing methods over the past century mean that any

⁵ The showing of battlefields in Britain seems to be an interesting consequence of the adoption of ‘civil-oriented’ six-inch survey after 1840, and perhaps reflects practices developed in the ‘encyclopaedic’ and ‘antiquarian’ elements of the 1:10,560 survey of Ireland of 1825-42: one notes that one-inch Old Series sheet 93, compiled from six-inch survey of c.1844-50, shows the battlefield at Towton, but not at Marston Moor. Earlier one-inch Old Series sheets, despite their ‘military’ origins, seem to ignore battlefields completely, with the exception of the French landing at Carregwastad Point in Pembrokeshire in 1797, which has never been shown by the ‘battlefield’ symbol. There is a certain logic to this as, even assuming that the site of the battle is accurately known, battles would take place over a much wider area than the symbol and date on topographic maps immediately suggest.

Otherwise the latest battle shown is that of Culloden, of 1746. The writer has seen tourist mapping of Czechoslovakia of the late 1950s which includes the sites of ‘workers’ uprisings’, with dates, but no such indications of ‘left’-‘right’, ‘worker’-‘capitalist’ confrontation have ever

comprehensive attempt to show the ‘invisible’ archaeological record is properly the function of thematic rather than of general mapping. The depiction of Roman roads, whilst long-standing, in practice excludes a large number of known or inferred routes, and entails the showing of often invisible courses across land that is not publicly accessible. Similar considerations apply to the treatment of former railways, the courses of which are far more certain than those of many Roman roads. The threshold for treating a building as an ‘antiquity’ has been progressively brought forward well into the nineteenth century; it seems anomalous that twentieth century military remains, for example, continue to be shown in ‘ordinary’ lettering. Or does ‘living memory’ have something to do with it?

Any ‘antiquities’ would seem better treated like other features, as roofed buildings that continue in use, ‘ruins’ or ‘earthworks’, and left at that. Possibly the largest class of ‘historic’ or ‘heritage’ building is parish churches, which are only treated as antiquities if in ruins.

Bridges, viaducts and aqueducts

An aqueduct or viaduct is simply a long bridge, and it seems strange that a distinctive symbol has continued to be used for these by Ordnance Survey, all the more so because the symbol used on the 1:50,000 *Landranger* has ‘cutwaters’, which is at odds with the reality of elevated sections of motorway and other major road and railway viaducts and aqueducts.

Landmarks

Those listed are useful for wayfinding and for locating oneself in the landscape. Church steeples are useful for locating road junctions in villages. It is difficult to see what practical use is served by the distinction of lighthouses in use and disused, or of showing chimneys in large industrial complexes. A purist might argue that windmills, obelisks lighthouses and towers, and possibly church steeples, should all be categorised as ‘tower-like structures’, and beacons, windfarms and telecommunications masts as ‘mast-like structures’. This is certainly worth further study.

The usual Ordnance Survey practice (some chimneys and towers excepted) has been to show these by either a geometrical or a pictorial symbol that, though the significance of the feature in the landscape is vertical, have nonetheless been horizontal and ‘flat on the ground’. Churches with steeples are effectively shown oriented north and thus at right angles to the prevailing eastwards orientation, and parallel with the ground rather than perpendicular to it.⁶

appeared on British maps, which no doubt indicates that, though ‘history in cartography’ is ‘inscribed by the victors’, the conflict actually commemorated is of a limited nature; there is no indication of the blitz of 1940-1, for example, to say nothing of numerous aircraft crash sites. The showing of mediaeval and early modern battlefields therefore perhaps says as much about a habit of mind as it does about ‘history’ or the landscape. In summary: the showing of battle sites seems inconsistent and anomalous.

⁶ Fortunately for the various Ordnance Surveys, none of them have to map the Leaning Tower of Pisa.

Post and telecommunications

There has been a considerable reduction in both post offices and in telephone boxes in recent years, and these must now be regarded as ‘soft’ data, and hence impermanent.⁷ An ‘ideal’ specification needs to recognise the rise of the cellphone.

Railways

The distinction of Light Rapid Transit (LRT) systems and stations seems an unnecessary elaboration; most of these systems run over, or even sometimes share, former ‘heavy’ rail routes and stations, and there is no substantial difference in physical appearance, as there is with narrow gauge lines. The distinction of sidings as a separate category seems unnecessary.

Roads and ‘ways’

The use of superimposed symbols for public rights of way and for cycle routes obscures underlying detail and sometimes the physical characteristics of the route: the most clearly depicted rights of way can be those which follow no obvious feature on the ground.⁸ The current threshold for indicating a ‘wider’ and a ‘narrower’ ‘unclassified’ public road is 4 metres, or 13 feet. The War Office committee of 1892 recommended 14 feet (4.3 metres), evidently as the minimum width suitable for two-way horse-drawn military convoy traffic. Metrication and a simplification in lower road classification in the early 1970s led to the adoption of the 4-metre standard, perhaps because it was easy to effect without extensive fieldwork or redrawing of road casings on published mapping, but in practice this now seems too low, and a threshold of 5 metres, or 16 feet, seems more appropriate at present.

‘Roadside furniture’ and ‘minor obstructions’

This includes cattle grids, gates, gradient arrows, and mile stones and posts. Cattle grids are not mapped completely at present; gates across roads are highly unusual; gradient arrows – a souvenir of a War Office committee of 1912, and of the limitations of early mechanised military transport – do not indicate the length of steep gradient, and in any case difficult gradients of any significance should be apparent from the contours; mile stones and posts are often hard to find, are illegible when found, and survive fragmentarily, added to which the mapping of them is at present incomplete, and not subject to maintenance.

⁷ There were 28 post offices within the Exeter city boundary in 1999-2000 and 13 in April 2021: *AZ Street Plan Exeter*, Borough Green: Geographers’ A-Z, edition 6A, 2000, and survey of city postal facilities by writer, April 2021. In 3 of 4 villages included in the 1999-2000 map, but outside the city boundary, the post office continued open in 2021.

⁸ The showing of bridleways, which are legally usable by cyclists, was discussed in Richard Oliver, ‘The later Ordnance Survey half-inch maps: some points of detail’, *Sheetlines* 92 (2011), 23-8, pp25-7; their inclusion on 1:100,000 or similar scale mapping, for which a significant constituency would be cyclists, presents problems.

Surface cover

The persistence of pictorial rather than abstract depictions seems to complicate map production and design, and has the disadvantage that, as with landmarks, symbols are often shown at right angles to how what they appear in actuality, save briefly when tree-felling is in progress. Pictorial depictions of slopes and associated features, for example rocks, derive from a time when topographic mapping relied wholly on pictorial relief – hachures in OS practice – before the advent of contours. It follows that steep slopes should be depicted by continuous contouring, even if it ‘fuses’, rather than pictorially. A single symbol seems appropriate for rock, sand and shingle that affect ‘going’ and can appear both above and below high water mark.⁹ Ordnance Survey practice in distinguishing, or not distinguishing, coniferous and non-coniferous woodland has varied from time to time, and this would seem worth further study.

‘Tourist information’

Most of this is ‘soft’ information, which can change without significant structural change on the ground, and is essentially enhancement of information already provided, for example indications of ‘viewpoints’ and highlighting of names that the scale of mapping would favour the inclusion of anyway.

Conclusion: less is better – and greener

The outline of map content given here provides the basis, duly adapted according to scale, for four types of topographic mapping. It seeks to balance what can be fitted into a legend of a certain size on the one hand with information considered to be of practical use for journey planning and wayfinding on the ground on the other, and minimises the showing of ‘soft’ information that is liable to change, and therefore affect map maintenance costs. Mapping produced to this specification should be rather clearer than that at present on offer from Ordnance Survey.

See figure 1, p12.

⁹ It follows that the writer would prefer a ‘physical’ depiction of high water, based on spring tides, rather than the ‘administrative’ one, of ‘mean tides’, that is used in England, Wales and Ireland: see Richard Oliver, ‘The Ordnance Survey Act, tidelines and the growth of a myth’, *Sheetlines* 90 (2011), 36-51, esp. p.49.

Communications

Railway: multiple,
single track



Road; dual carriageway
'ordinary', narrow



Landmarks

Church with steeple



Windmill



Tower, obelisk



Communications mast



Wind turbine



Communications
mast (alternatives)



Lighthouse



Tower (alternatives)



Quarries and tips

Quarry or pit

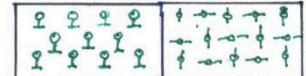


Tip, spoil heap

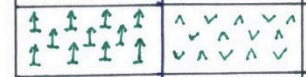


Surface Cover

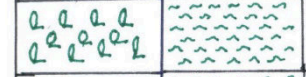
Woodland - non-
coniferous



Woodland -
coniferous



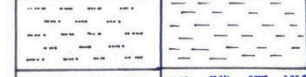
Woodland -
unclassified



Orchard



Uncultivated
ground



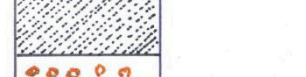
Marsh/'wetland'



Sand



Mud



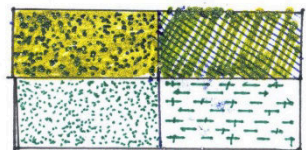
Shingle, gravel



Rocky ground



Woodland,
unclassified: four
alternative
treatments



Lettering

TOWNS

Villages, Settlements

Physical Names

sluice, memorial

fp mm bm ph

Figure 1. Some suggested non-pictorial signs for topographic maps, with some alternatives. Note: these are basic designs, and are not necessarily at the size at which any of them would appear on a printed map.

The 1st edition of the 1:2500 in Suffolk

R C Wheeler

Introduction

The first edition of the OS 1:2500 is perhaps the source most widely used by those investigating the history of a site: an accurate depiction at a known date from which they can work backwards. Unlike (say) the earlier six-inch surveys, the source is largely free from pitfalls, offering a snapshot of what there was at a particular survey date that is (latterly, at least) stated on the map. In 99 per cent of cases, that - and the *Concise Guide*¹ for an account of survey practices - is all the user needs. This article is intended to address the other 1% of cases, and also for those who believe that one should engage with so important a source, even if it does appear to be altogether straightforward.

My intention was to deal with the first edition after 1880. Practices before that date were somewhat different, and specimens from that era are rarer. Even for the period after 1880 there are over ten thousand sheets to consider; and, while a general development took place across all counties, for certain aspects uniformity across a county was preferred to synchronicity across the country. I chose therefore to focus on a single county in the expectation that my more important conclusions will be applicable across the whole country.

I chose Suffolk because publication of the main series there started in 1881. The NLS site has a large collection of Suffolk 1st editions that come from the OS Record Map Library. Above all, I had the assistance of Dave King, who was able to go through a collection of sheets that had been sold in the normal way (hereafter called the *Sales collection*) at a time when access to archives and libraries has been difficult or impossible: I am extremely grateful for his help and observations.

An earlier Suffolk survey had started, using the meridian of Otley church tower; only a few sheets were produced and it falls outside the period addressed. The main survey shared a new meridian (Danbury church) with Essex, Norfolk, Cambridgeshire and Huntingdonshire. It also enjoyed common sheet-lines with these counties, so that a sheet that straddles a county boundary appears as a single version only, bearing multiple sheet numbers - eg Suffolk 88.9 / Essex 20.9. Like so many 'obvious' improvements of these years, there were complications. Sheets that contained any part of Essex seem to have been surveyed as part of the Essex survey and appeared in that county's format, where the marginalia give the names of the superintending officers but not the date of publication. Once the survey of Suffolk was under way, those sheets that contained more of Suffolk than of Essex seem to have been 'taken over' by Suffolk and if they had to be re-issued they appeared with Suffolk-type marginalia. So there is, perhaps, a rationalised county boundary that runs along sheet edges. This is not a subject I intend to cover; I mention it because statements made about Suffolk may not apply to some sheets straddling borders - particularly the Essex border.

¹ Richard Oliver, *Ordnance Survey Maps - a concise guide for historians*, 2013.

Zincography

The process of survey produced five classes of documents: the surveyors' notebooks (1) were used to plot a diagram of chain lines (2). These were pricked through to drawing paper on which the linework of the map was added (3). A tracing of this was taken into the field by the *field examiner*, who checked it for errors and added names and information on land use. This trace (4) was then used to correct and augment item 3 into a fair drawing (5). To produce a printing plate, a tracing of the linework was made from (5). To this, names and ornament were added by stamping. The area men defined and numbered their parcels; from 1884 or 85, the areas themselves were typed² on the map. Altitudes and bench marks were added. All this was done (or in the case of the linework perhaps 'gone over') in lithographic ink, so that the paper could be laid face down on a zinc plate to produce a (mirror) image which could then be used to run off the requisite number of copies.

The cost of holding zinc plates against the contingency that further printings might be required was considered excessive, except for urban areas. The zinc plate was therefore cleaned off for use with another sheet. Nor was there any satisfactory way of preserving the tracing for re-use. Thus, if it turned out that more copies did need to be printed, the sheet was *re-zincographed*: basically the whole process was repeated, going back to the fair drawing.

The greatest weakness of this process was the need for tracing. If the tracer draws a line that is displaced by as little as 1/8 of a millimetre, that corresponds to a foot on the ground. This may be one of the causes of the inaccuracy in building dimensions noted by Paul Bishop.³ It certainly leads to noticeable changes in the length-to-width ratio of small buildings. There are signs that the OS was aware of the problem: they seem to have tried to avoid tracings of tracings - as would happen, for example, if an existing printed map were used as the basis for a subsequent re-zincographing.

The whole process was also subject to errors of omission, which are seen most easily when different printings of a sheet are compared. I drew attention in Sheetlines 119 to the omission of outbuildings or internal divisions on Leics 37.11; but one encounters more serious errors than this. *Figure 1* shows an extract from Suffolk 83.14 as published; *Figure 2* shows it as re-zincographed in 1900. The outbuilding marked 'kiln' in *Figure 1* is probably a malt-kiln, in which case it is a remarkably late survival: malt-kilns on individual farms in Lincolnshire generally vanished in the 18th century, being superseded by maltings operating on an industrial scale. So the omission of the name in 1900 is regrettable. Note also the rectangular pond south of the garden, which has become trapedzoidal in 1900 - as tracing errors go, this one is quite gross. But there is a bigger change still: "Kirton" has become "Kirkton". In this case, the 1900 version gets it right. To eliminate, so far as we can, the possibility that the Name Book was in error rather

² *Typed* in this context means that a block was made up from moveable type and the name was stamped on the map.

³ Paul Bishop, "The Internal divisions and size of buildings", *Sheetlines*, 105 (2016), 27-33.

than the draughtsman typing the name, *Figure 3* shows the contemporary six-inch. In this period, the six-inch was produced from a photographic reduction of the 1:2500 fair drawing. One can see this by looking at the SW corner of the RH yard of the farm buildings (WNW from the 'P') where there is a small enclosure, perhaps a pig-sty, which does not appear on either zincographing.

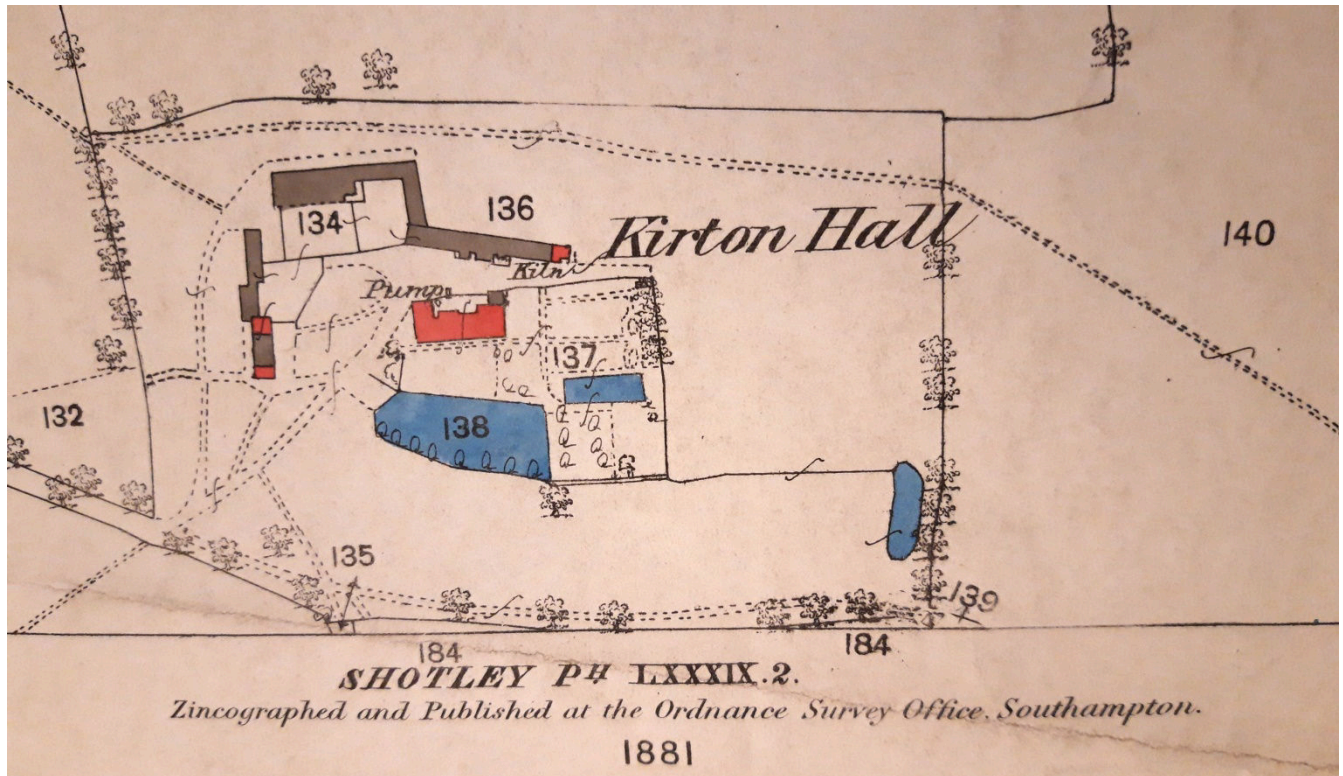


Figure 1 Kirton Hall on sheet 83.14 as published

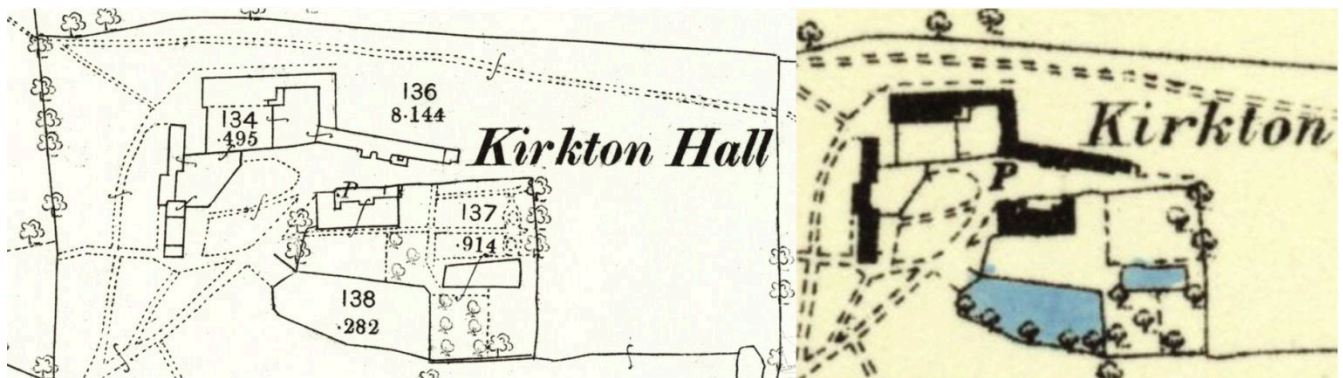


Figure 2 Kirkton Hall on 1900 reprint.

Figure 3 Kirkton Hall on six-inch.

Figure 4 shows an error of a more useful kind. Shepherd & Chilton have shown that in this era Martello towers were considered as fortification works that needed to be deleted from the published maps.⁴ As first published, Sheet 84.7 has three such towers; by the reprint of 1895, all have vanished. That this was an error rather than a change of policy can be seen from sheet 90.1 where a Martello

⁴ Ifan DH Shepherd & Steve Chilton, "Where have all the (Martello) towers gone?", *Sheetlines*, 103 (2015), 7-30.

tower is absent when first published (1881), is present on a re-zincograph of c1885-6, and vanishes again from the NLS reprint of 1899. What seems to have happened is that the sheet as zincographed each time included everything; any unredacted copies required were printed off, the offending detail was then deleted directly on the plate, and the ordinary sales copies were then printed. But evidently the need to check whether there was anything that ought to be deleted was sometimes overlooked.

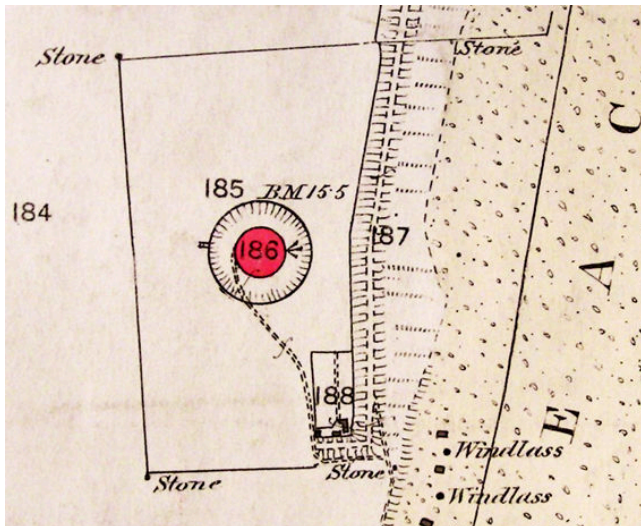


Figure 4 Martello Tower on Sheet 84.7 as published.

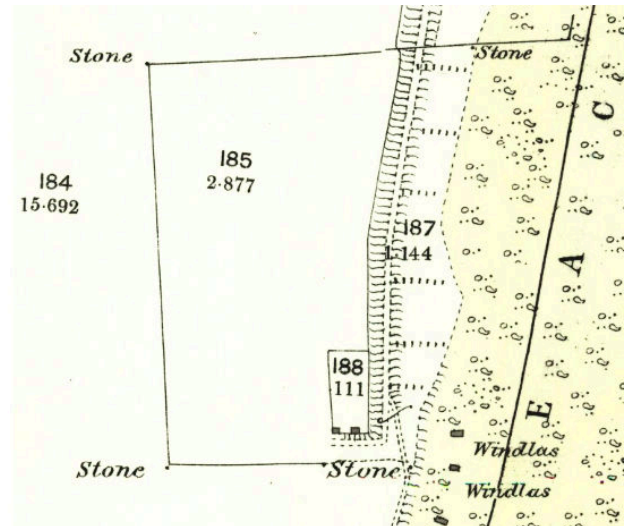


Figure 5 Sheet 84.7 as reprinted 1895

The deletion made for the 1895 reprint of 84.7 (*Figure 5*) includes the track leading to the tower and the parcel number 186. That much is unsurprising. That the southern slope of the embankment south of the huts or cottages has also gone can be attributed to the difficulties in deleting detail on the zinc plate. But the disappearance of the largest of the huts seems more likely to be attributable to careless tracing, because it survives on the six-inch. The disappearance of the path within parcel 188 may be excused by the directive of 1893 that paths in gardens were no longer to be shown; but the disappearance of the two windlasses seems to be another tracing error. As for the truncation of the name to “Windlas”, one wonders how this could have got through the checking process. There seems little doubt that re-zincographing grew more sloppy as the years passed.

Another example of an error providing extra information occurs on the 1888 state of Suffolk 84.10 (available on the NLS site) and concerns foreshore areas. OS practice was that areas of foreshore in each parish should be computed so that the totals could appear on the table of parishes on the county index sheet; but they were not printed on the individual sheets, nor were parcel numbers allocated for anything below the High Water Mark. On this sheet, the individual areas have been stamped as though they were normal parcels, so one can learn the exact area of The Horse Sands, a sandbank in the middle of the River Deben. Curiously, there is nothing on the map to indicate whether it belonged to Felixstowe or to Bawdsey: one needs to look at the next edition to learn that.

Perhaps it is not the most exciting of errors, but it does cast a little light on area-computation practice.

Were there undated reprints?

During the decade around 1890, changes to marginalia, and in particular to headings, came every couple of years. They are listed at Appendix 1. There were changes on the face of the map too: in particular, there were four generations of stamp employed for isolated deciduous trees - the type of tree most easily checked.

The addition of areas to the face of the map comes mostly in 1885, with a very few sheets receiving them in 1884 and the sheets around Bury St Edmunds still lacking them in 1886. Initially they are not given when the parcel number is in the margin. (The area of a parcel straddling a sheet edge only appears on the face of the map on the sheet deemed to contain the middle of the parcel.) That at least was the intention: but if area computation had not started on an adjoining sheet, parcels extending into that sheet could not have their area given, regardless of where their centre lay. In such cases, a note to this effect was inserted bottom-left and the areas were stated in the margin of that adjoining sheet when it was published. It was all a bit messy, and was made more so by the note sometimes being omitted when it was required and sometimes appearing when it was unnecessary.

No sheets were found bearing dates 1889 or 1890: publication was complete and there are hints that the few reprints required had been brought forward to clear the decks for the Lancashire and Yorkshire replots. By 1892, it is clear that policy had changed, so that areas were given under all parcel numbers, whether on the map or in the margin.⁵

If a sheet was re-zincographed, the draughtsmen followed the conventions current at the time. Thus, with so many changes in such a short period, one can date a sheet to within a year or two on its style alone. This is quite useful when cataloguing sheets in poor condition when the part of the margin bearing the key dates may have been lost. It also means that any re-zincographed sheet that did not bear a reprint date would stand out as anomalous - unless it was re-zincographed within a year or two of first publication, something that would only happen if the OS had massively underestimated the demand. Accordingly, we can be fairly confident that all re-zincographed sheets do bear a reprint date.

Urban sheets and Heliozincography

As mentioned earlier, for urban areas the zinc plates were retained, so a reprint only required the normal process of preparing an existing plate for printing. Marginalia were updated to reflect new current standards, at least partially; but no changes were made within the neatline. In consequence, reprints can appear anomalous, for example because the tree stamps had been superseded by the date of the reprint; indeed for Suffolk such anomalies may be the only evidence

⁵ With one minor exception: if a parcel whose centre was deemed to lie on another sheet crossed the sheet edge in multiple places, its number was given in the margin at each place but the area was only given once.

we have that the plate was retained. It is of course perfectly possible that there are facsimile reprints with no (or no new) reprint date, though it seems more likely that the practice of dating reprints that had been adopted for re-zincographed sheets was used likewise for the relatively few urban sheets. Actually it does not matter greatly: whereas identifying re-zincographed sheets is important, identifying such facsimile reprints is of little significance.



Figure 6 Sheet 10.4 - reprint of 1898

Figure 6 shows an urban-type reprint of part of Lowestoft, made in 1898. The quality of the printing leaves a lot to be desired: note the blotches on the lettering of OLD MARKET PLAIN and the frightful smudge by the tree in the NE part of the churchyard. It is hardly as though the plate had seen much use, compared to the massive print-runs for the Popular Edition one-inch in the next century; perhaps the Survey was still developing its skills in lithography.

It seems that the superintending officer recognised that he had a problem with this plate because, when a further reprint was needed in 1904, 50 copies were printed by heliozincography. This had new marginalia but in other respects the image was transferred to a new plate photographically from a previous printing. The sheet can be seen on the NLS website; it still lacks areas, so the books of reference for Lowestoft and at least one of the surrounding parishes must have been kept on sale.

This is the only instance I have found within a sample of 216 NLS sheets, of one described as a “reprint by heliozincography” but there were six reprints by “Direct Helio”.⁶ *Figure 7* shows the imprint on one such sheet. The ‘Direct Helio’ line is distinctly blacker than the rest, and the lettering is quite elegant: note the curved serif to the ‘1’ and the curlicue to the ‘2’. The line would appear to have

⁶ The essential difference between photozincography and heliozincography was not so much the (optional) use of sunlight for the latter, but rather that the former process formed an image on transfer paper, the latter on the sensitized plate itself. See WA Seymour, *A History of the Ordnance Survey*, 1980, 200.

been added to a printed sheet which was then photographically transferred to zinc, the rest of the marginalia being undisturbed. All six Direct Helio reprints have marginalia of the form that had been standard since 1896; presumably what we have in each case is a photographic reproduction of a post-1896 re-zincograph.

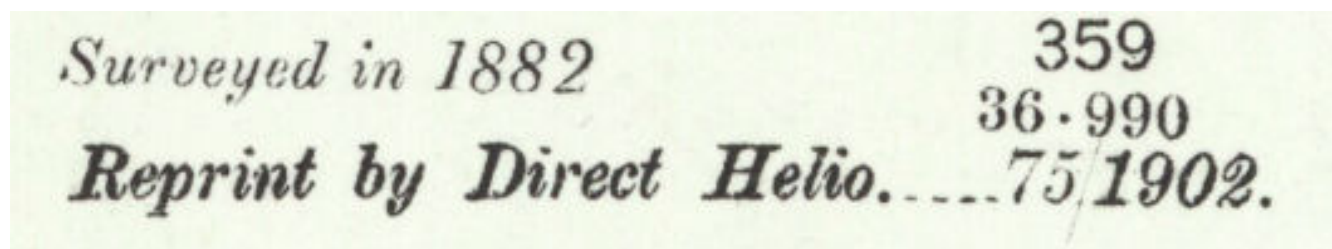


Figure 7 Direct Helio imprint on sheet 10.7.

A decision is recorded, apparently from soon after 1886,⁷ that any plan that would cost more than £2 to trace for a new edition by zincography should instead be reproduced photographically from an existing impression. Nevertheless, in Suffolk one finds re-zincographed sheets as late as 1893. After that date, the method of reproduction is not stated, but most of the reprints until the end of the century seem likely to be by re-zincographing.

Colouring

Most maps were sold after hand-colouring. Indeed, of the Sales collection of some 300 sheets only 15 (5%) were uncoloured. None of these fifteen sheets bore a stamp. In contrast, 83% of the coloured sheets bore a stamp. Four stamps are found:

- (a) Office of Works embossed date stamp: the same stamp that is found on engraved maps, the date always being in the range April 1881- Sep 1882.
- (b) Office of Works 'Coloured' stamp in black ink, with a number and letter.
- (c) Board of Agriculture embossed date stamp: the same stamp found on engraved maps, the date always being in 1890.
- (d) Board of Agriculture embossed 'Coloured' stamp, with a letter and number.

(a) and (c) are illustrated elsewhere.⁸ (b) and (d) are shown in Figures 8 & 9. What is perhaps surprising is that, on these maps, the standard embossed date stamps appear to be used in exactly the same way as the 'Coloured' stamps, but only within limited date-ranges.

To understand this better, the Sales collection was grouped according to the year of publication, and the stamps found in each group were compared. It is easiest to give the conclusions first and then to set out the data that support them.

Thus it appears that, initially, stamp (a) was applied after colouring. In September 1882, concern perhaps arose that this practice would lead to an

⁷ WA Seymour, *A History of the Ordnance Survey*, 1980, 185.

⁸ R Hellyer & R Oliver, *The First Ordnance Survey Map*, 2015, 105.

unacceptable divergence from the customary use of the stamp to indicate the date of *printing*; a different form of stamp should therefore be used. Until this stamp was ready, sheets went out (or went into stock) unstamped.

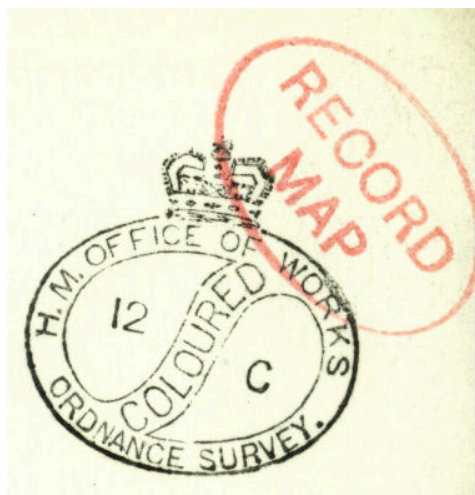


Figure 8 Office of Works 'Coloured' stamp along with 'Record Map' stamp.



Figure 9 Board of Agriculture 'Coloured' stamp.

By October 1883, the new stamp had arrived. The numbers indicated the month, the letter the year, following a simple code in which 1883 was A and so forth – see Appendix 2. This continued until 1890, when the Survey's sponsoring department changed to the Board of Agriculture. There is no evidence this time for a halt to stamping; but this was a period of little activity on Suffolk - I have already suggested the decks were cleared for Lancs & Yorks. Once again, the new 'Coloured' stamps took longer to arrive and use was made, briefly, of the ordinary date stamp, notwithstanding the fact that it was being applied to sheets *printed* several years earlier. The sequence of year codes continued unchanged, despite the switch to placing the letter before the numbers. The system then remained unchanged until at least 1904.

The strongest evidence for this comes from the practice of colouring a large proportion of the print run shortly after publication. Thus, of the maps published in 1881, 70% of specimens bear an embossed date, and were coloured before July 1882. Consequently, on the maps published in a particular year, the forms of stamp used in that year and the following tend to predominate. After 1887, there are at most a handful of reprints in any particular year, even including the NLS sample, which has a higher proportion of late reprints. Hence one cannot argue directly that (say) J was the letter code for 1892. One can nevertheless observe the absence of letter codes provisionally assigned to dates prior to the printing date;⁹ by the time we reach 1904 (V), this is quite a telling argument.

⁹ Actually, the occasional instance has been noted of sheets coloured late in the year before publication. This might represent the building of stock prior to launch. But there was also a degree of vagueness about publication year: for 75.16, a publication date of 1884 was given initially, 1885 at the 1891 reprint, 1884 again at the 1895 reprint.

On this basis, I have estimated the proportion of the print run that was coloured in the year of printing or the following year, for each of the years 1881 to 1886. To do this, I have shared out the unstamped copies between 1882 and 1883 in the ratio 1:3 to reflect the gap in dates, and I have apportioned Office of Works 'Coloured' stamps with illegible letters in proportion to the stamps with legible letters. Results are given below.

Date	1881	1882	1883	1884	1885	1886
%	74	81	63	81	100	78

In effect, we can say that four-fifths of the print run was coloured soon after printing, any variation from year to year being merely a fluke of what specimens found their way into the Sales collection. The consistency of these results also serves to confirm the correctness of the decodes given in Appendix 2.

For later years, the number of reprints in the Sales collection was too small to form a useful sample. Accordingly, the NLS sample of Record Maps was used to examine the years 1892-99. For this period, 63% of the coloured sheets (17/27) were coloured within a year of the reprint date. Given that Record Maps represent the stock remaining when the sheet was superseded, we expect a higher proportion of top-up colourings. Thus this is consistent with about four-fifths of the print run continuing to be coloured more or less immediately. From 1900 onwards, data are limited but there does seem to be an increase in the proportion of uncoloured states among the Record Maps. There is little evidence of top-up colouring - but the remaining life of the edition was so short that this is to be expected. The increase in the proportion of uncoloured maps may suggest a revised policy of colouring only one or two copies when needed, in order to avoid wasting effort on copies that would never be sold.

The ability to date the colouring was useful in investigating the bands of colour used to delineate 'town areas' within which separate parcel numbers are not given. The Concise Guide notes an instruction of 1889 that these bands were to be in yellow; but an example had turned up of a town band drawn in carmine. Further investigations produced more carmine bands.¹⁰ Bands in yellow, or rather the yellowish brown used for roads, were also found. By knowing the year codes, it was possible to say that the sheets with carmine bands were coloured in 1885 or 1886, with one having an illegible Office of Works stamp, so only dateable to 1883-90. The sheets with the yellow bands were coloured 1895-1902. Thus the instruction of 1889 needs to be understood as 'use yellow *henceforth*'.

Town bands may be something where individual counties show a degree of divergence. A cursory examination of some Norfolk towns threw up three sheets¹¹ coloured in 1900-2 where the band was missing altogether, although other Norfolk sheets were found with a yellow-brown band. The number lacking bands seems too high to be explained by casual error.

¹⁰ Suffolk 13.12, 48.16, 74.14, 81.12.

¹¹ Norfolk 5.8, 63.10, 78.3.

The FIRST EDITION stamping

The new marginalia introduced 1896 included a very prominent 'FIRST EDITION' top-centre with the date of original publication. It can hardly have helped sales to emphasize that the maps were now over ten years old and to imply they were about to be superseded (though that was almost ten years away in most cases). What lay behind it may perhaps be the suggestion made before the Hayes-Fisher Committee that Stanford preferred to sell purchasers an outdated hand-coloured plan when a new (but of course uncoloured) edition was available, because of the greater price of the former.¹² This FIRST EDITION heading seems to have been considered sufficiently important to be applied to some existing stock, apparently by stamp. The quality of the stamping is often very good, so it is worth noting the three ways this stamp can be recognised as such.

1. The map will not have a Legend box bottom left.
2. Between 'EDITION' and the date is (usually) a comma instead of a space.
3. The date given is that of survey rather than publication.

Going through the sample of NLS Record Maps, it appeared that about 8% of the pre-1896 maps were stamped in this way. This is something of a mystery: what determined the favoured (or disfavoured) 8%? It has nothing to do with sheet number, which one could understand if someone had started working through the maps in stock and then the order had been rescinded.

All the sheets seen with this stamp had been coloured no later than 1895. More significantly, there were maps in the Sales collection with Coloured stamps of 1899 and 1901 but lacking 'FIRST EDITION' (in any form). So whatever was being done was abandoned within a couple of years. We still have the challenge of explaining how the great majority of maps in stock in 1896 (and still unsold a decade later) escaped being stamped. The most likely explanation is to suppose that the Survey maintained a bulk-stock store, separate from the store ready for distribution. A typical print run, by the time these were recorded, was 30; print runs on first publication were probably larger. Hence the initial batch of coloured maps might number 25. One can conceive of arrangements for the ready-to-issue store which could hold 2 or 3 copies of each sheet but not 25. When the ready-to-issue store ran out, another handful would be fetched from the bulk store where access was rather less convenient; if this exhausted the bulk-store stock, that would be the time to initiate a new order for another batch to be coloured. I hypothesize that in 1896 the maps in the ready-to-issue store were given the FIRST EDITION stamp, but the idea of stamping this was abandoned not long after. That would certainly explain how it came about that a relatively small proportion of the maps in stock at that date received a stamp.

¹² Seymour, 1980, 196.

Record Maps

The manner in which the OS ran its map store may at first sight seem uninteresting but it is actually very pertinent to understanding Record Maps. When a sheet was superseded, a certain number of specimens¹³ were kept as Record Maps for sale at an elevated price to purchasers who particularly wanted the old edition. It is commonly assumed that these must necessarily have been of the final printing. That assumes that the OS rotated stock in the same way that a supermarket does. But maps do not go off; and it is somewhat easier to add a new batch to the top of a pile than to insert it at the bottom. The arrangements hypothesized in the previous paragraph have the merit that stock is rotated automatically.

A comparison was made between sheets in the Sales collection and the Record Maps on the NLS website to check that the Sales maps were not only of no later a printing than the Record Maps but also of no later a colouring batch. Because there were relatively few reprints among the Sales collection, the first check was undemanding. The second check threw up a single counter-example, a copy of 67.11 coloured in Jan 1895. The NLS specimen was published in 1882 but bore no colouring stamp so was presumed to have been coloured in the period 1882-3. However, the NLS copy also bore an embossed stamp from the Ancient House Bookshop, Ipswich; a couple of sheets had already been noted bearing this stamp (*Figure 10, below*).

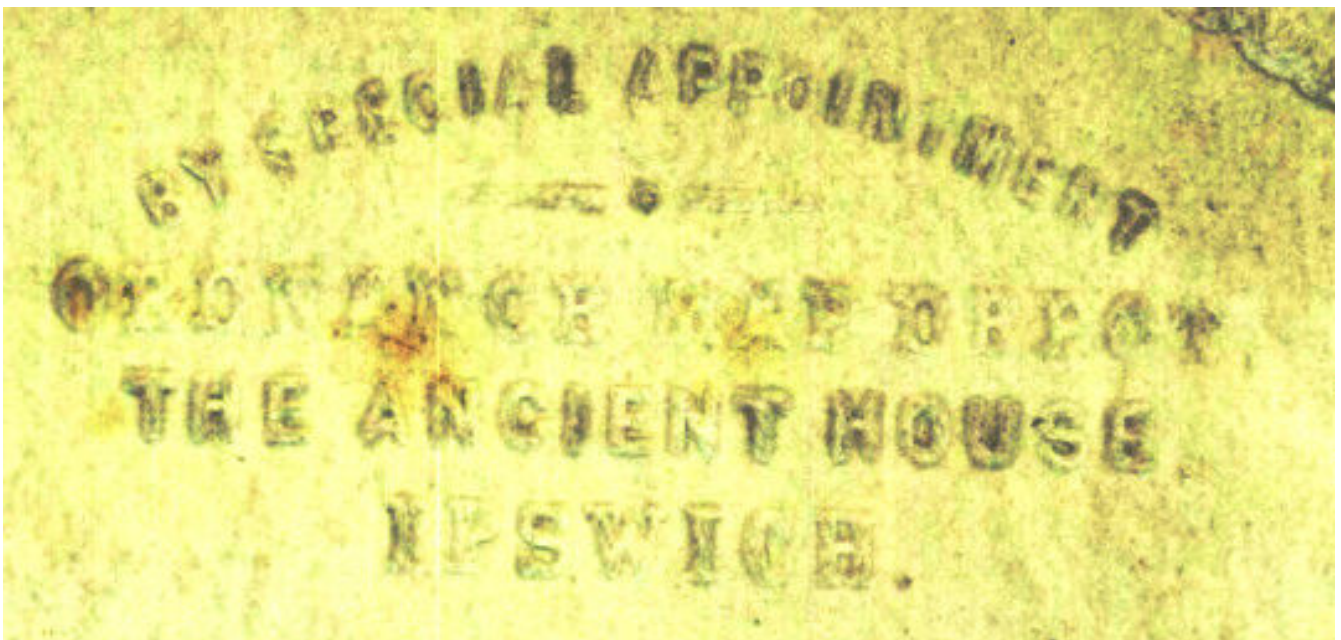


Figure 10 Bookshop embossed stamp.

So what we have here is a bookshop return that has been taken in to the Record Map store; it might well have been sitting on the shelves in Ipswich from 1883

¹³ The 'Dublin Instructions' in the CCS Archive say just one, but Record Maps seem too numerous for this to have been the normal rule.

until 1906.¹⁴ This is in the nature of an exception that proves the rule. It is probably safe to assume in 99% of cases that a Record Map is the latest printing (and the latest batch to be coloured) but not all bookshops were so free with their embossed stamp as the Ancient House, so we should be alert to the possibility that an older state somehow found its way to the Record Map store. We should also be alert to the possibility that the stock of uncoloured sheets might be exhausted and require a reprint while coloured sheets of the older printing remained; no evidence has been found that this ever occurred, but without a thorough cartobibliography such evidence is unlikely to appear.

On the assumption that the 216 Record Maps examined are representative of the Suffolk sheets at the end of their life, we find that 71% of sheets did not need a reprint. Furthermore, of the coloured sheets that did not go to a reprint, 49% had been coloured within 2 years of their publication date, the other 51% having being coloured later. It was suggested earlier that about 80% of the initial print run was coloured within the first year or two. It follows that $0.71 \times 0.51 = 36\%$ of sheets achieved lifetime sales of more than 80% of their initial print run but managed to avoid the need for a reprint. Given the massive uncertainties in demand for this series, that indicates an outstandingly good process for setting print runs.

The Six-inch

Until 1880 the six-inch had mostly been engraved, with a degree of generalisation especially on the early sheets, where small buildings are frequently omitted. The six-inch is still worth inspecting, because generic garden ornament is used more widely than the surveyed garden detail on the 25", giving a more complete picture of that category of land use. The early sheets use a double line for watercourses, even where the 25" has a single line, and this can sometimes resolve ambiguity about whether a line represents a stream or a fence. Minor features may be copied 'by eye', and their exact orientation can be untrustworthy.

From 1881 to 1889, the six-inch was generally¹⁵ produced by photographic reduction of the 25" fair drawings. Initially, this required names, in particular, to be excessively large on the 25" drawing so that they would be legible on the six-inch, but from mid-1882 names on the drawing, along with tree-ornament, were in cobalt so that they would not photograph.¹⁶ This is the period when almost all the Suffolk six-inch sheets were drawn. From 1889, the six-inch was drawn on blues of a photographic reduction, but generalisation was introduced once again. Thus, for an eight-year period, the six-inch allows us to see the fair drawing of which the 25" is merely a tracing. It will not show us interior subdivisions of buildings because buildings were filled in black; nor will it show us the detailed trackwork on railways, as this was redrawn; but for everything else it offers a

¹⁴ That superseded maps should be returnable was a recommendation of the Olivier Committee in 1914; so perhaps these sheets were actually on the shelves at Ipswich until after 1914.

¹⁵ A desire to keep adjacent sheets in the same style caused the continuation of engraving beyond 1880.

¹⁶ Seymour, 1980, 178.

check on the accuracy of the 25-inch tracing. Of course, from a four-fold reduction printed by lithography, it can be difficult to make out the finest detail. Nevertheless the clarity of image one needs to decide whether a particular 25-inch tracing is an accurate copy of the original is less than if one is trying to interpret a blurred six-inch image by itself.

To illustrate the process, Figure 11 a & b show part of 74SW, (a) being the 'First Edition Without Contours' (1884) and (b) the normal edition (1889). In addition to acquiring contours (though there are none on this small extract) the latter has acquired rouletting on Holbecks Park (in the western part of the extract) and a name, "Tinker's Lane" which was perhaps left off in error in 1884. In other respects the matter within the neat lines is exactly the same. (The building above 'Corn' of 'Corn Mill' has acquired a white spot in its building fill, but I regard this as a printing imperfection rather than a change in drawing.) Every name is in exactly the same place; every tree symbol is exactly the same. Clearly the two maps are based on the same photographic image.¹⁷ Figure 11 c & d show 74.14, as issued in 1885¹⁸ and as re-zincographed in a reprint of 1900. The observant may note that, in addition to areas and new tree stamps, (d) has acquired a superfluous 'i' to Toppesfield Bridge. (c) has a carmine band around the town area of Hadleigh; on (d) it is yellow-brown.

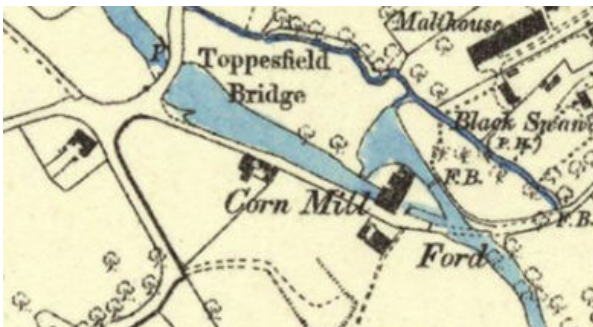


Figure 11a Six-inch without contours



Figure 11b Six-inch with Contours



Figure 11c 74.14 as published

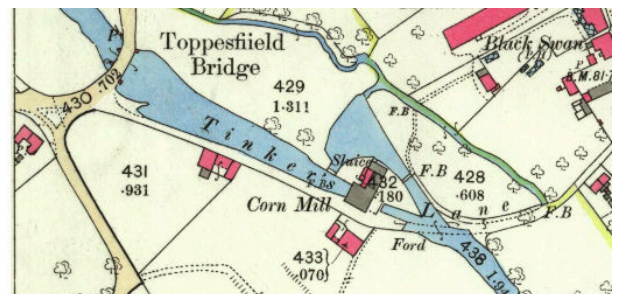


Figure 11d 74.14 re-zincographed

¹⁷ Capt Sankey refers to contours being cut on the negatives.

¹⁸ It is striking that the six-inch could appear a year in advance of the 25-inch on which it was based. This was perhaps caused by delay with area-calculation.

Whereas solid lines on the six-inch appear to be used unaltered from the 25-inch, broken lines were widely subject to deletion. Looking at the road junction SW of Toppesfield Bridge, one sees that the broken lines bounding the carriageway have been deleted; this was general practice. In contrast, the broken line separating the carriageway from the little tongue of land that projects into the river has been retained. Broken lines of paths often have alternate dashes deleted (or perhaps appeared on the fair drawing with much larger gaps than when they were traced); minor paths in gardens are sometimes deleted altogether. There is, however, no sign of complete redrawing; even though the width of a narrow path may, when photographically reduced, be so small that the separate sides are barely discernible, this is not interfered with.

Names have been typed on the six-inch with occasional omissions where the detail would be too congested: for example the 'Sluice' by the mill, or the 'P' behind the cottages that face Toppesfield Bridge. Tree symbols are stamped, so far as possible in exactly the same position as the tree symbols on the 25-inch. Indeed, close inspection is necessary to see that they are not a photographic reduction from the 25-inch.

The positioning of the six-inch's trees in the field between "Toppesfield" and "Malthouse" is particularly interesting. They appear to be a copy of those on the 1900 version of the 25-inch, despite being stamped sixteen years earlier! What seems to have happened is that in 1885 names were typed in advance of ornament, and "Toppesfield Bridge" on 74.14 was extended into that field, so that there was no room for the trees in its eastern part. In contrast, the six-inch kept the name south of the minor watercourse, so there was space for the trees. Evidently the man doing the stamping for the six-inch (and likewise the man stamping the re-zincographed version of the 25-inch) was working from the fair drawing - the document numbered (5) at the very start.

If one examines the building immediately to the right of the 'n' of 'Black Swan' one sees a very small outhouse at its rear, coloured carmine on Fig 11c and uncoloured on Fig 11d. (The reader may wish to check the image on the NLS site to confirm the latter statement.) This is par for the course: the colouring of small outhouses can be a bit erratic. The user who is particularly concerned to establish whether such an enclosure was roofed should consult multiple copies, ideally copies with different colouring dates.

Summary

It may be useful to set out what has been learned for the benefit of the map user who is not interested in the minutiae of how these maps were drawn.

First, in the great majority of cases, it is sufficient to look at the survey date bottom left and treat the map as a snapshot of what was on the ground at about that date.¹⁹ Only if the user is determined to extract every scintilla of available information or if he suspects a minor drawing error need he read further.

¹⁹ "about" because a year might elapse between field examination and the final signing-off of the survey and, whilst some changes might be incorporated through having been spotted at that final stage, others might not.

In that last case, if the map he is consulting is a reprint, he should seek a different zincographing; the easiest option will be to consult a copyright-deposit copy, which will normally be of the initial print run. If the map he is consulting has no reprint date, so is of the initial printing, he should check the NLS website to see whether they have a reprint. Further search is quite likely to be fruitless: 70% or so of maps were never reprinted. And if the NLS has an original printing with Record Map stamped top-right, he can be almost certain that there were no reprints. But he can still look at the six-inch (which is worth doing even if he has located multiple zincographs). Although photographic reduction will have led to some blurring of detail, and the blacking-in of buildings will have destroyed other detail, the original image photographed may have been superior to what he sees on the 1:2500.

Other Counties

I believe that most of the conclusions reached in this paper will be applicable to other counties commenced after 1880 - but not to the 'replotted' counties, for which photozincography was introduced. The main exception concerns the six-inch, whose utility is much reduced after 1889, when it was wholly redrawn. It is, however, incumbent on the reader who is interested in other counties to check his material. No doubt sundry oddities will emerge. At the very least, this article has, I hope, demonstrated that the 1:2500 is by no means as straightforward as has sometimes been assumed.

Before 1880

Early sheets were subject to railway revision and, in some cases non-railway revision. This is not always mentioned in marginal notes.²⁰ Embossed date stamps do at least help in dating copies. The observation of a map bearing an 1879 embossed date *and* an Office of Works 'Coloured' stamp has led me to suppose that the date stamps were applied immediately after *printing* right up to 1879; but more evidence is needed to confirm this.²¹

What is apparent is that none of the conclusions reached about practices after 1880 can be assumed to apply before that date.

See appendices overleaf, p28.

²⁰ See the summary of Alan Godfrey's talk, 17 March 1990, in *Sheetlines*, 27, 17.

²¹ The NLS site has a copy of Peebles-shire 18.10 with an embossed printing date of 1858 and a Nov 1883 Coloured stamp, demonstrating that the application of Coloured stamps when colouring pre-1880 stock that had originally been left uncoloured seems to have been standard practice.

Appendix 1 - Changes to Marginalia 1884-96

1884: names of parishes were dropped from the heading, and the county moved across to replace them, in the form **Suffolk** (Eastern Division).

1886: new Divisions briefly appear in the title, following the 1885 Representation of the People Act.

1886: Divisions dropped from title entirely.

1886: **Suffolk** moved to top-right

1887: note explaining areas appears bottom right.

1888: Prices moved to bottom right, replaced bottom-centre by “All rights of reproduction reserved”; area note moved to top left.

By 1892: ‘Suffolk’ and ‘Sheet’ in capitals.

1894-5: area note dropped

1896: redesigned bottom margin with Legend box; FIRST EDITION with publication date appears top centre - but this might also be stamped on earlier sheets.

After this date there were no more changes.

Appendix 2 – Year codes on ‘Coloured’ stamps

A 1883	F 1888	K 1893	P 1898	U 1903
B 1884	G 1889	L 1894	Q 1899	V 1904
C 1885	H 1890	M 1895	R 1900	
D 1886	I 1891	N 1896	S 1901	
E 1887	J 1892	O 1897	T 1902	

Illustration credits: John King for figures 1, 4, 9, 11c; CCS website for 11b; National Library of Scotland, the remainder.

Recovering the 1798 Sedgemoor Baseline

Edwin Danson¹

In 1798, the seventh year of the Principal Triangulation of Britain, Captain William Mudge of the Board of Ordnance and head of the Trigonometrical Survey, writing of the need for a base of verification in the southwest of Britain, recollected that it was “necessity that compelled us to think of measuring a base on Sedgemoor”²; a necessity made even more imperative “in consequence of resolutions taken to inclose (sic) Sedgemoor: an act for which purpose was passed a few years ago, and partly carried into execution in 1797”. Fortunately for Captain Mudge, the parliamentary enclose of the area of the Somerset Levels known as King’s Sedgemoor, had progressed only as far as marking out the parochial allotments.

Mudge and his assistant, the geodesist and mathematician Isaac Dalby, arrived in the Somerset market town of Somerton in June 1798 from the wilds of South Wales where they had searched fruitlessly for an alternative to the extensive but marshy land of the Somerset Levels. After a reconnaissance of the moor, in hopes of finding the firmest ground, it was decided to run the five and a quarter mile baseline as near as possible alongside the recently completed King’s Sedgemoor Drain. “The ditches” wrote Mudge, “were generally ten feet broad, and five feet deep; but the principal and secondary drains were much wider, the first being thirty, and the last twenty-five, feet in breadth.”

Their choice of control stations for integrating the baseline into the surrounding network was limited to just two trig points; Moor Lynch windmill (now lost) and Dundon Beacon, a Bronze age barrow at the southeast corner of an ancient hill fort; an unsatisfactory situation that Mudge was obliged to accept.

Measuring equipment

In early July “The apparatus for the measurement, consisting of the tressels (sic) belonging to the Royal Society, pickets, iron heads, and a new set of coffers” along with a contingent of artillerymen, arrived in Somerton. For the baseline measure, Mudge chose a pair of 50-foot steel chains fabricated at the London workshops of the illustrious Jesse Ramsden. The triangulation would be performed with the Royal Society’s 36-inch theodolite commissioned of Ramsden by General William Roy for the Anglo-French survey during the years 1784-1790.

The baseline measurement commenced on 11 July and proceeded uninterrupted until field work completion on 16 August, after which the chains were recalibrated against the Royal Society’s 5-foot brass standard, corrected for temperature, wear, and stretch, to deliver a final result for the baseline’s length of

¹ Edwin Danson began his career in Ordnance Survey before moving into private practice and an international career in the land and offshore geospatial sciences. He is a Fellow of the Royal Institution of Chartered Surveyors and a Fellow and past-president of the Chartered Institution of Civil Engineering Surveyors.

² W Mudge and I Dalby, ‘An Account of the Trigonometrical Survey, carried on in the years 1797, 1798, and 1799 &c’. *Philosophical Transactions of the Royal Society*, 1800, 556-563.

27,680.1447 feet. The measuring process had not been without its challenges, including the need to introduce two right-angled deviations around the excavations for the Eighteen Feet Rhyne (drain), the soft nature of the ground occasioning movement of the pickets, and crossing no less than fifty-seven ditches and rhynes³. Mudge, confident that under normal circumstances he could achieve a linear accuracy less than 3 inches in 5 miles, “in this occasion” he wrote, “I should not suppose the error can be less than six, nor more than nine inches”.

The measurement done, all that remained was observing the rounds of angles at the Lugshorn Corner and Greylock Foss terminals points with “the great theodolite”. Observations at Moor Lynch windmill and Dundon Beacon included the two terminal stations in the rounds to the principal trig stations at Mendips Hills two miles north of Shepton Mallet, Ash Beacon, Pilsden Hill, Quantock Hills, Brent Knoll, and Bleak Downs.



The Somerset Levels from Collard Hill, with Dundon Beacon prominent in the landscape
(© Pam Goodey - geograph.org.uk/p/2267037)

Locating the terminals

When William Roy ran his famous five-mile baseline across the wilderness of Hounslow Heath in 1784, he had the terminal points permanently marked with the barrels of upturned cannon. Both marks are still in place; one beside a

³ Somerset term for a wetlands drainage ditch

parking lot on the north side of Heathrow Airport, (TQ07714 76789) the other set in the grass of Roy Grove, a suburban street in Hampton (TQ13720 70985). The King's Sedgemoor baseline, being a base of verification, was not grand enough to warrant a piece of artillery.

Mudge was known to mark his stations with a slab of dressed stone with a one inch hole drilled through the middle and buried a foot or so into the ground; if this was the means employed at Sedgemoor, or something more permanent, it was not recorded. The fact that both terminals stood on agricultural land, prone to flooding and the trampling of cattle, would have limited the endurance of any ground marker to a few years at most. And so it was that the baseline of verification, so critical to maintaining the exactness of the great triangulation project and the first accurate maps of Britain, passed into uncertain memory and eventually became forgotten.

None of the original trig points in the area used by Mudge remain. However, Dundon Beacon, a prominent point, offered some hope as a starting point for the recovery exercise, from Mudge's contemporary description:

Dundon Beacon. This is an insulated hill, at the eastern extremity of King's Sedgemoor; upon it are the remains of a barrow, probably the site of the ancient beacon. The station is about 4 feet eastward of the small cavity in the centre of it.

Dundon Beacon, the remains of a Bronze Age barrow, is a conspicuous mound at the southeast end of Dundon Hill, standing some three metres high and 15 metres across. Since Mudge's visit, the beacon has been enthusiastically excavated and all signs of "the small cavity" have disappeared. However, as fortune would have it, the old trig point appears on the OS 1st Series 25-inch plan. Mudge's two terminal locations were also described:

"Lugshorn Corner, the eastern extremity of King's Sedgemoor. There is a small rivulet, which separates the moor from the cultivated ground on the Somerton side, and, close to a particular part of it, is a passage called Somerton Gate. About a quarter of a mile eastward of this entrance, and in the second field, north of the stream, is the station called Lugshorn Corner, one of the ends of the base. The spot is 5 feet from the ditch, and 9 from the gateway. There were but three fields in this part of the moor, at the time the base was measured."

The 1840 tithe map of the moor and the Ordnance Survey's 25-inch plan identified the position of Somerton Gate and the contemporary field patterns. However, Captain Mudge, or more probably one of his assistants, caused much puzzlement in this writer's mind by confusing east with south! Nevertheless, the general form of the field is much as it was when Mudge visited.

"Greylock's Foss. This is towards the western extremity of the moor: a causeway leads from Middlezoy to Greinton over it. In the second field from the bridge, near the latter, is the other extremity of the base. The station is about 10 feet from the ditch, running parallel to the Foss, and is in the angle

formed by the ditch contiguous to the road and a second ditch north of the drain."

The bridge was the newly built one spanning the King's Sedgemoor Drain and again the tithe map and First Series 25-inch plan quickly identified the field with its odd 'angle'. However, the current bridge lies west of the original structure creating a shallow bend in what was once a straight stretch of causeway, and the position of the original ditch of 1798 was in doubt.

From the station descriptions it was possible to box the probable locations for the terminals within 10m squares.

Recourse to calculation

Mudge's 1800 publication of *An Account of the Trigonometrical Survey*, provides a wealth of information and clues that can be used to re-create the spatial geometry of the day. The first wave of inebriated joy was to discover that many of the surrounding church steeples had been intersected and their geographical coordinates computed. Sobriety returned with the realisation that the two reference meridians – Greenwich and Black Down – were still in their early evolution and the longitudes therefore too inexact to be useful. For example, Mudge quotes Dundon as 02° 43' 33.1" west of Greenwich observatory, whereas in reality it was a further 29.5" west.⁴

Resorting to the Ordnance Survey's now-obsolete list of trig points,⁵ only two 'up stations' could be reliably identified as being coincident with both sets of coordinates – High Ham and Glastonbury Tor. The other steeples' positions were derived from Google Earth (which is surprisingly accurate in the area) and adjusted for the 5.3" Greenwich longitude offset,⁶ but even so the table of differences was just too inconsistent to use as reliable indicators of position, and the quest was abandoned. Fortunately, Mudge's *Account* also includes all the triangulation's observed angles and (calculated) distances.

The solution therefore lay in a complete re-computation of Mudge's triangulation scheme that included the narrow triangle comprising Dundon Beacon and the baseline terminals at Lugshorn Corner and Greylake Fosse, all the angles of which were measured with Ramsden's 36-inch theodolite. The other 'fixed' known was the solidity of the 27,680.1447-foot baseline.

As previously noted, none of Mudge's trig points exist today. However, consulting Clarke's *The Account of the Observations and Calculations of the Principal Triangulation of Britain* (1860), it was noted that the Mendips Hills trig

⁴ From the start, the prime meridian was Greenwich. However, because there were still uncertainties over the amplitudes of vertical deflection and other geodetic issues, it was necessary in the early stages of the work to observe a series of meridian arcs, each approximately 60 miles apart.

⁵ <https://www.ordnancesurvey.co.uk/gps/legacy-control-information/triangulation-stations>

⁶ E Danson, 'When Greenwich Moved East', Letters, *CES*, 2012. For a more thoroughly mathematical explanation see Malys S, Seago JH, Pavlis NK et al. 'Why the Greenwich meridian moved'. *J Geod* 89, 1263–1272 (2015). <https://doi.org/10.1007/s00190-015-0844-y>

was occupied in 1797 and in 1844. Consulting the excellent National Grid geo-referenced set of 25-inch historic Ordnance plans in the Somerset Historic Environment Record (HER), the coordinates for Mendips Hill and Dundon Beacon were recovered – a check on their veracity was shown by comparing the HER's coordinates for Ash Beacon with the OS list of trig points for Corton Hill (the modern name for the beacon) which agreed within 2mE, 1mN.

The next task was to confirm that Mudge's calculated distances between Greylake Foss, Dundon Beacon and Lugshorn Corner and the triangle's internal angles satisfied the sine rule (not doubting Captain Mudge's maths for one second but being wary of the presence of typographical errors in his paper).

That done, it was a matter of determining the modern National Grid bearings from Mendips Hill to Dundon Beacon and Moor Lynch and then calculating the bearings of all the other lines. Mudge's calculated line length Mendip to Dundon Beacon was compared with the National Grid (projection) distance to derive a local line scale factor of 0.999763 which compared reasonably well the official OS Transform and Projection software's scale factor of 0.999640.

The following summarises the National Grid coordinate results:

From	To	NG grid brgs	Distances corrected for SF (m)	E	N
Moor Lynch	Mendips Hills	66.48570°	24035.95	362046.50	146732.00
Mendips Hills	Dundon				
	Beacon	222.51431°	19997.06	348533.00	131992.00
Moor Lynch	Dundon				
	Beacon	121.13293°	9961.15	348532.93	131992.02
Moor Lynch	Beacon	121.13254°	9961.15	348532.97	131992.08
Mendips Hills	Moor Lynch	246.48570°	24035.95	340006.48	137142.19
Dundon					
Beacon	Moor Lynch	301.13251°	9961.15	340006.51	137142.11
Greylake Foss	Moor Lynch	01.10307°	2566.36	340006.48	137142.19
Moor Lynch	Greylake Foss	181.10307°	2566.36	339957.08	134576.31
Dundon					
Beacon	Greylake Foss	286.77001°	8956.86	339957.07	134576.33
	Lugshorn				
Moor Lynch	Corner	129.13557°	9769.97	347584.60	130975.80
Dundon	Lugshorn				
Beacon	Corner	223.01196°	1390.02	347584.80	130975.60

The calculations were done without adjustment because to have done so would have been meaningless and a travesty of history. That said, those points derived from different directions matched well. The final results for the terminals being:

Greylake (Greylock) Foss:

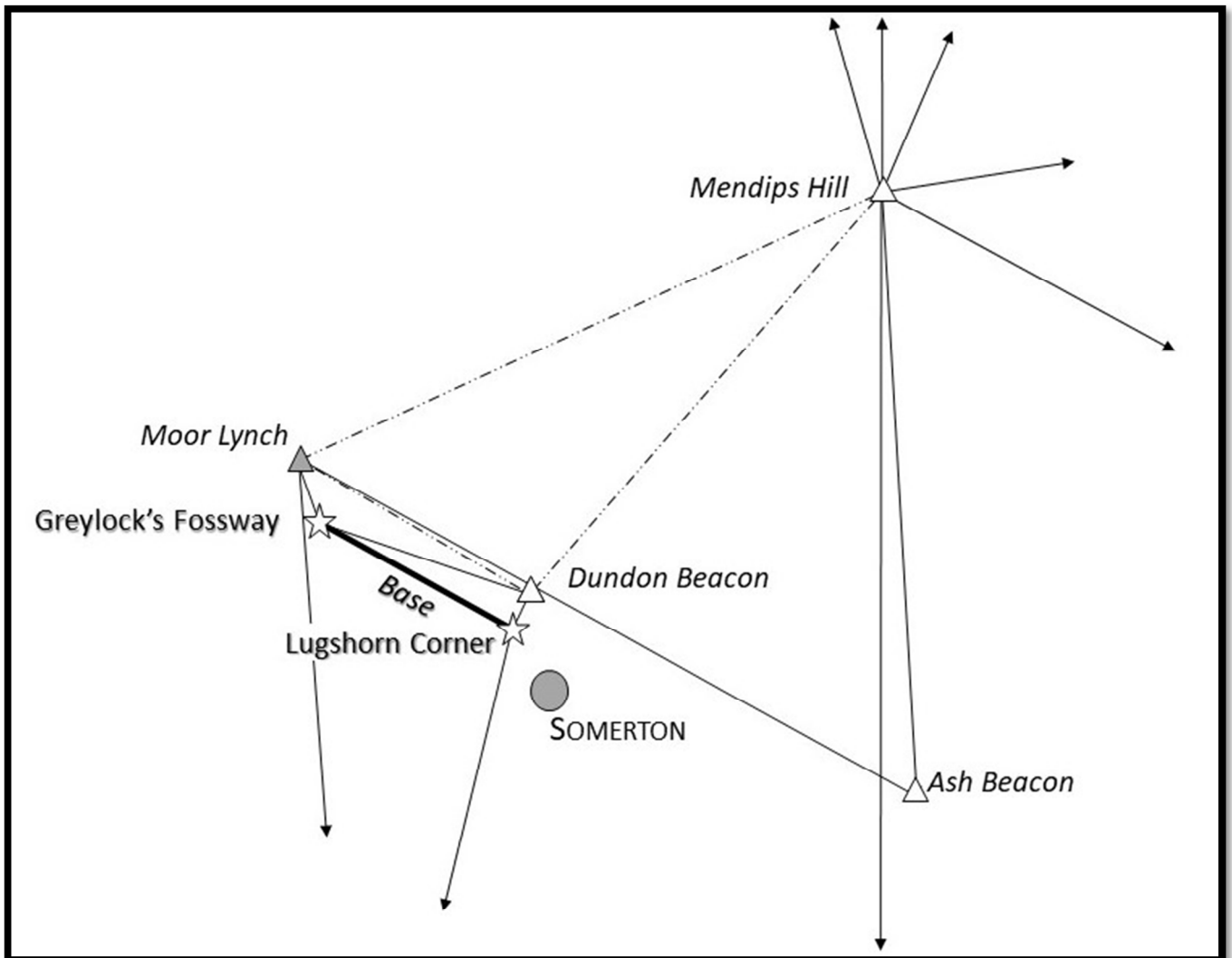
National Grid 339 957mE, 134 576mN (ST39957 34576)

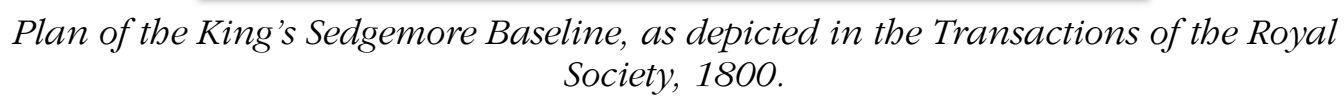
ETRS89: 51° 06' 26.3"N, 02° 51' 32.5"W (GoogleEarth compatible, $\pm 0.5\text{m}$)

Lugshorn Corner:

National Grid 347 585mE. 130 976mN (ST47585 30976)

ETRS89: 51° 04' 32.5"N, 02° 44' 58.4"W





Brian Adams (breviter) Redux

Michael Spencer

Introduction

In 2006 the Society published *Projections and Origins: collected writings of Brian Adams*, edited by Roger Hellyer and Chris Higley. Adams (1924 – 2005) was a hydrographic cartographer with a particular interest in the mathematical underpinnings of mapmaking, and he was a frequent contributor to *Sheetlines* in this general field, in which “he was not just one expert, he was the expert” (from the Preface to *Projections and Origins*, unsigned but presumably written by one of the editors thereof). He also contributed an Appendix to Roger Hellyer, *The ‘ten-mile’ maps of the Ordnance Survey*, published by the Society in 1992; this Appendix is reproduced in *Projections and Origins*.

These writings of Adams were designed of course to clarify his somewhat difficult professional ideas to those members of the Society who were interested in but not entirely comfortable with them. None the less, it seems to me that he omitted to explain in any degree at all two concepts mentioned in the course of the Appendix to *Hellyer*, in the sentence:

“The projections of all Ordnance Survey maps of Great Britain, of regular series commenced after 1830 and on scales of 1:633,600 and larger, are calculated on the Airy spheroid (Airy’s figure of the earth) defined in terms of the foot of Bar O_1 .”¹

The concepts of the Airy spheroid and the foot of Bar O_1 are not defined anywhere by Adams, no doubt because these are fundamental ideas in the field of mathematical cartography and were as familiar to Adams as the concepts of Boolean logic used to be to me. It is the purpose of this paper to put some flesh on those bones; and, in particular, the Lemma to the discussion of the “Bar of O_1 ” raises an important question that does not seem to have previously been addressed.

Some further questions arising from Adams’ work will be examined in a forthcoming article.

The Airy Spheroid

The Ancient Greeks were aware that the Earth is a spherical body rotating slowly about its polar axis, and they developed map projections designed to allow the depiction of the surface of such a body on a flat sheet of paper. It took more than two thousand years for mathematical physics to develop to the point where it could be understood why such a large body was necessarily spherical, and why and by how much its slow rotation distorted it so that the equatorial diameter was larger than the polar diameter. A sphere distorted in such a way is called a *spheroid*. The nineteenth-century science of *geodesy* was able to determine the real size of the spheroid and to encase it in a mathematical straitjacket that allowed the conversion of geographical (spheroidal) co-ordinates of points on its surface to rectangular (map) coordinates of points on paper. Any formula to do this is called a *projection*. Spheroidal co-ordinates are called *latitude* and *longitude*; map co-ordinates are called *eastings* and *northings*.

¹ Roger Hellyer, op. cit, (1992), p. 176; Roger Hellyer and Chris Higley (eds), op.cit. (2006), 5

George Biddell Airy (1801-92, Astronomer Royal 1835-81) was an early geodesist. In 1830, he calculated the lengths of the polar radius and equatorial radius of the earth using measurements taken in the UK and France. He gave these dimensions² as:

a – the equatorial radius = 20,923,713 feet

b – the polar radius = 20,853,810 feet

To bring both the Imperial and the metric measures into a unified document, a conversion between feet and metres was required. This had been obtained in 1817 by Capt. Henry Kater, comparing the Imperial standard used by Airy with a platinum copy of the Archived Metre whose length had been determined in 1799 by François Arago, the leading French geodesist. Kater found that

Foot/metre = 0.3048007491

At the time Airy's results were taken as state-of-the-art. Although his measurements were superseded by more accurate radius figures (such as those used for WGS84, the modern world geodetic system used by the Global Positioning System), his *Airy spheroid* is still used by the Ordnance Survey for the mapping of Great Britain because it better fits the local sea level (about 80 cm below world average). Those parts of the Airy spheroid that do not lie under Great Britain are of no value and have never been used.

The spheroid is also called the *ellipsoid*: the two terms are interchangeable, and choice of which to employ seems to be related to date. When the Ordnance Survey was young, the term *spheroid* was more usual, and so the phrase *the Airy spheroid* comes naturally to mind. In modern writing, the term *ellipsoid* seems to be preferred. Personally, I would tend to deprecate this usage, because it tends to hide the fact that even with the distortion, the earth is still fundamentally spherical. On the Airy spheroid, using the values for the diameters rather than the radii, because this simplifies the mental arithmetic, in round numbers the difference between the equatorial and the polar diameters is 140 thousand feet, while the equatorial diameter is 42 million feet: the ratio between these numbers, and so the magnitude of the distortion, technically called the *flattening*, is 0.3 per cent.

Lemma: Mapmaking before Airy

There was plenty of mapmaking in Britain before 1830. One thinks in particular of Saxton (1570s), Speed (1611) and Ogilby (1670) in England, Roy (1750s) in Scotland, and of course the early Ordnance Survey (by 1805) in Essex and Kent. All these people published maps for public consumption, and one has to ask, what did they think they were maps of and what projections did they use? In the particular case of the early Ordnance Survey, these maps were clearly *not* calculated on the 1830 Airy spheroid defined in terms of the foot of Bar O₁. So what did they use for their standard of length?

The foot of Bar O₁

The practice of triangulation enables the relative positions of points on the surface of the earth to be established with remarkable accuracy, but to find the actual distances between points requires the use of an immutable standard of length to which

² GB Airy, Figure of the Earth (1830), in Encyclopedia Metropolitana, Vol. V, 165-239.

measurements can be referred. Four such standard bars are relevant to our story: Roy's 42-inch scale, the Shuckburgh scale and the wrought iron bars described as O_1 and O_2 .

Major-General William Roy (1726-90) came to prominence after his success in mapping Scotland, completed in 1755, and was invited to lead the triangulation operations starting in 1784 to connect the positions of the observatories at Paris and Greenwich. His standard of reference was a 42-inch brass scale made in 1742, which he checked by microscopic observations against the National Standard held by the Royal Society. He used this to determine the length of a baseline he had set up on Hounslow Heath, to an precision of about 3 inches in 5 miles, or 1:100,000. This was a precision far exceeding any previous measurement, and Roy was recognised by the award of the Royal Society's prestigious Copley Medal in 1785.

The triangulation itself was delayed until 1787, awaiting the design and construction of an improved theodolite, and was completed in 1790. This theodolite was described by Sir Charles Close³ as "the first in the world capable of detecting the spherical excess," that is the amount by which the angles of a triangle on a sphere or a spheroid exceed 180° . The calculations to convert the measured positions on the ground to rectangular co-ordinates for drawing the map were to some degree deficient. Seymour's *History* does nothing to reduce confusion here, stating⁴ that Roy's calculations of latitude depended on Bouguer's spheroid (calculated in 1749 after observations made in Lapland, in France and in what is now Ecuador), and a few lines lower down that the calculations assumed that the surface of the earth was in fact plane, not spheroidal at all!

After Roy's death, the triangulation was extended (1791-1822) to cover the whole of Great Britain: this operation is known as the Principal Triangulation. The baseline on Hounslow Heath was re-measured, using 100-foot steel chains supplied by Jesse Ramsden. These were calibrated against his prismatic bar, which had in turn been compared carefully with the bar belonging to the Royal Society. When the calculations of the Principal Triangulation to determine the rectangular co-ordinates were to begin, it was felt that a new reference standard was required. In 1827 the instrument makers Troughton & Simms supplied two ten-foot bars of wrought iron, designated O_1 and O_2 , each of dimensions 122.15 by 1.45 by 2.5 inches. They were brought to the temperature of 62°F , and dots were then engraved on them to mark the ten-foot standard, from which the length of one foot could be easily obtained – the "foot of bar O_1 ." The calculations were then carried out on the Airy spheroid, with the assumption that Airy's figures for the radii of the spheroid were in fact feet of O_1 , which may have led Adams into his suggestion⁵ that Airy based his results on such feet.

However, it is clear from Airy's own article in the *Encyclopedia Metropolitana* that his reference was the Shuckburgh foot. Sir George Shuckburgh (1751 –1804) was a British politician, mathematician and astronomer. The Shuckburgh scale was a five-foot brass bar made by Troughton in 1796, originally for use in Shuckburgh's

³ CF Close, *The Early Years of the Ordnance Survey* (1926), p.15 (reprinted Newton Abbott: David & Charles, 1969).

⁴ WA Seymour (ed), *A History of the Ordnance Survey* (Folkestone: Dawson, 1980), 36.

⁵ In the extract from the Appendix to Hellyer, quoted at the start of this paper.

researches into metrology, engraved along its length in tenths of an inch. It was this Shuckburgh foot that Kater compared with the Archived Metre to find his conversion value.

Important conversion values

The Ordnance Survey made extensive comparisons between the O_1 bar and various other standard bars, of which the most important were:

- (made in 1742) Roy's Scale, a brass scale 42.8 inches long, divided by lines into inches and tenths of an inch;
- (1791) Ramsden's Prismatic Bar, a cast-iron bar 21 feet long of equilateral triangular section, 1.25 inches on each side, divided at 54°F into 40-inch parts marked off by dots engraved on brass pins let into the bar;
- (1796) the Shuckburgh scale: Edward Troughton's brass scale 66 inches long, divided by lines on silver into inches and tenths, and also divided into inches by dots on silver pins let into the brass.

From these comparisons, a conversion figure between each of these scales and the mean foot length of the O_1 bar was found, which became the standard of length for all activities of the Ordnance Survey until the advent of metric standards and the National Grid following the recommendations of the Davidson Committee⁶⁶ in 1938. (The use of the designations O_1 and O_2 may have simply been Troughton & Simms' codes to show that the bars were made for the Ordnance Survey; but they may also lead to confusion with tool steel of those grades, which were not available in the early nineteenth century. There is thus no need for doubt that the Ordnance Survey's bars O_1 and O_2 were made of wrought iron.)

For our present purposes, the ratio between the O_1 foot and the Shuckburgh foot is important, because it enables us to see how far the Ordnance Survey's use of the former led to a compromise of the actual size of the Airy spheroid. Any direct comparison between these two values is hidden in the hundreds of pages of mathematics available on the Internet, but fortunately both have been given in terms of the metre, from which their mutual ratio can be found. Thompson (1952)⁷⁷ gives both, and also gives a brief survey of the method of finding the ratio between the foot of O_1 and the metre, which involved comparison of the O_2 bar with the Standard Metre held in France, and then the comparison of the O_1 bar with O_2 , followed by temperature corrections. In 1906 the method gave the result:

Foot of O_1 at 62°F = 0.304800756 metres.

Taking this together with Kater's result, we see that

Foot of O_1 /foot of Shuckburgh = $0.304800756/0.3048007491 = 1.0000000023$

or, the increase in the equatorial radius of the spheroid using the O_1 foot is insignificant (less than one foot in 20,923,713).

These days physical objects are no longer used to define the "truth": for example, the metre is now defined as the *length of the path travelled by light in a vacuum in 1/299792458 of a second*. This is just as well, because the present location of the Ordnance Survey bars is sadly not now known.

⁶ Seymour, op. cit., 257-266.

⁷ Lieut.-Col. E.H. Thompson, RE: *The Ordnance Survey Foot/Metre Conversion Ratio* (1952), in *Empire Survey Review*, Vol.11, No. 84, 280-281.

***From Ruabon to Rangoon:
The 61 Indian Reproduction Group IE
Ian Jacobs***

In early September 1942 his captain asked Gunner Ronald Waddams whether he would like to draw a cartoon. Ron explained to his parents that "A.A. Command were asking for specimens of drawing. Apparently they were looking for a draughtsman. The chance of doing a job connected with drawing, of course appealed to me, so I drew the cartoon and it was submitted. The result of this little drawing has just come through. On Tuesday of next week I am to be at Wrexham in Wales, for an interview with the view of me becoming a Lithographic draughtsman in the Royal Engineers."¹ Ron had spent a year at Ealing School of Art and had then worked for a sign company and a lettering studio in London², so his records told his captain that he might be just the kind of man who was needed. Ron's cartoon turned out to be his ticket to Ruabon and on to South Africa, India and Burma.

Ron arrived at Wynnstay Hall,³ Ruabon, north Wales on 22 September. He wrote home: "Tomorrow I am having a drawing test, if I do not pass this, I shall be returned to my unit. As the test consists of a little lettering, I have every hope of succeeding. On passing, I shall be trained as a Litho draughtsman, this will be entirely connected with map work; everything points to an interesting job. ... I have made several pals already. They all seem excellent fellows, and all connected with painting and art. I should be very happy."⁴

Ron passed the test and was now Sapper Waddams. On 30 September he started a course which "normally takes nine weeks to complete, though now it is being crammed into about a month. This means quite a lot of hard work and studying. Consequently, every night after tea we have gone back to the class room and done an extra hour and a half's work."⁵ The course began with "a lecture this morning on the principles of lithography. After this we were given a [zinc] plate each to practice on. I should like to know why they put Gum Arabic on the plate when the drawing is finished. We were given a reason but it was not very clear. The book Dad gave me on survey will be most useful, even the instructor has borrowed it."⁶ His father responded "Gum Arabic is used because it can hold moisture. If it happens to dry, the plate can easily be sponged all over (with a gummy sponge) without injuring the work."⁷

¹ RH Waddams, Fort William, 18 Sept 1942.

² RH Waddams, biographical notes.

³ For the history of map training at Wynnstay Hall see WN Saunders, 'Wynnstay Hall and the School of Military Survey', *Sheetlines*, 106, 21-23.

⁴ RH Waddams, Survey Training Centre, Ruabon, 22 Sept 1942.

⁵ RH Waddams, Survey Training Centre, Ruabon, 16 Oct 1942.

⁶ RH Waddams, Survey Training Centre, Ruabon, 30 Sept 1942. Ron's father, Bert Waddams was a draughtsman at the well-known Arts and Crafts printer Emery Walker Ltd. One of his specialities was drawing maps. Several of Ron's letters ask his father to explain something he had not fully understood in class.

⁷ HC Waddams, *Lithography*, October 1942.

By 5 October the trainee mapmakers had “completed the map [they were] working on, it has turned out quite successfully. Much of our time has been taken with the study of scales and their construction; these have given us severe headaches. To achieve this end we have been delving into the forgotten mysteries of decimals and geometry. For Dad’s technical ear, I can now reduce the Representative Fraction to a graphic scale or to a written scale. At first I found it a little difficult to grasp the figures, but I have soon picked it up again.”⁸ A week later, while continuing to practice on plates, the class was learning “about grids. This meant more headaches, but through a mass of information, daylight is dawning. Our work is restricted to army grids or the Modified British Grid System. During this coming week we are going to draw some grids for ourselves. Last week we had a little test. We had to construct a map from instructions given, showing necessary contours and conventional signs. My drawing was correct in all ways.”⁹

By 16 October the class had progressed to “working on a very fine map. The work on this is extremely delicate and calls for much painstaking. The lettering too, calls for the utmost skill, it is tiny stuff mostly Bodoni italic; you can imagine it is very tiring to do, especially after so long a time without practice. Working on a zinc plate adds more difficulties, the main one being the correcting of mistakes. Later on, I may be able to have a proof taken of my work, so that I shall be able to show you.” The study of grids had “progressed to the construction of a sloping grid.” One class “dealt with the permanent offset on the plate, that makes it possible to draw each colour separately on each plate. To do this they have a special process, which has not yet been released for general use. As Dad knows, the offset that is usually obtained is not permanent. I will explain this new idea when I see him. Another lecture was on the Helio[typ]e process, and the Gum reversal or Vandyke process.”¹⁰

The following week, “We have passed quickly onto the study of projections in their various forms and complexities. A brief outline of latitudes and longitudes has been given to us; with an even briefer description of grid north, magnetic north and true north; to say nothing of all the little odds and ends that have been thrown at us. The trainee mapmakers also visited the presses of “the mobile printing unit, I had better not say anything about them here, as they are pretty secret. But you can take it from me that it is a most excellent outfit. I also watched a Crabtree Rotary machine working. The opportunity was also given me of following the gum reversal process through its various stages.”¹¹ In early November the students were sent “into the grounds, with paper; scales;

⁸ RH Waddams, Survey Training Centre, Ruabon, 5 Oct 1942.

⁹ RH Waddams, Survey Training Centre, Ruabon, 11 Oct 1942.

¹⁰ RH Waddams, Survey Training Centre, Ruabon, 16 Oct 1942. The Vandyke process, invented by Ordnance Survey, involved a light-sensitive layer on the zinc plate. ‘Gumming out’ was used on zinc plates to achieve effects such as stipple: personal communications Rob Wheeler 06 April 2021 and Richard Oliver 9 April 2021.

¹¹ RH Waddams, Survey Training Centre, Ruabon, 24 Oct 1942.

protractor; and prismatic compass; and have surveyed and constructed a map of the lake here.”¹²

Outside the classroom the men at Ruabon had plenty of activities to fill their days. Army duties included fire picket, 15 minutes of PT each morning, and every Tuesday there was bath parade. The troops took the train eight miles to the Whitehaven colliery baths. They were also prepared for combat: a week of gun drill and a week of firing. In November they were taught battle tactics, “showing how we should defend ourselves if ever the need arose”, and staged an attack on the railway station. The week ended with manoeuvres with the Home Guard. The lorry transporting Ron and his colleagues broke down, obliging them to walk. At Greenfield, on the estuary of the River Dee, the cartographers found themselves under attack. “[A] lorry load of Home Guards came streaming across a field towards us. We immediately scattered and went to ground. We had some little crackers to give the effect of fire, but this did not impress the guardsmen, who came pouring down and captured us, although we tried to explain that we had shot them, but they would not have it.”¹³ Free time was spent at dances, in the camp or in the village, the chief attraction being the local girls, or at the cinema in Wrexham.

Ron’s training finished at the end of November and by 3 December he had been “mustered as an A2 tradesman, and my total wage is five and three a day.” “The No 1. Reproduction Group, is a small company just being formed, and it is this my pal and I have joined. Until it has been properly formed and equipt (I think that word is misspelled) we are attached to another company ... Our quarters are in the house of the Duke of Bedford, in Ampthill Park. It is quite a large house from what I have seen of it. I am sleeping in a room that must once have been one of the servants’ rooms at the top of the house.”¹⁴

A few days later Ron was able to tell his parents more about his unit: “I can now define my position more clearly. The No.1. group to which I belong, comprises of about thirty men, printers and draughtsmen. This is a complete little production unit, or one little firm, if you like. And when we have the necessary equipment, we shall be drawing and producing maps. This is about one of the best jobs I could get into. For unlike the ordinary field survey units, we are not mobile. Our job will be to produce stock maps, so if ever we go abroad we will be stationed at some base or depot. You may remember me explaining the work of men in the field survey, who print new information on maps, that is obtained from the Topo. Surveyors or from air survey. When I was with you I knew nothing of the Reproduction Group idea, as it is quite a new thing. Imagine how

¹² RH Waddams, Survey Training Centre, Ruabon, 3 Nov 1942.

¹³ RH Waddams, Survey Training Centre, Ruabon, 29 Nov 1942.

¹⁴ RH Waddams, No.1 Reproduction Group, Att. 14th CFS Company R.E., Ampthill, Bedfordshire, 3 Dec 1942.

cushy and enjoyable it is going to be, just working with a few men. I am certainly in luck again.”¹⁵



Ron Waddams (1920-2010), Self-Portrait, oil on canvas, probably painted in Rangoon in 1946. He wears the army glasses issued to him at the Survey Training Centre in Ruabon in October 1942, and the Australian style hat issued to the 61 Group in January 1945 before entering Burma.

By 18 February 1943, Ron knew that his unit was to be sent overseas. “Naturally, I am very excited with the prospect of my future, for I can see extremely good and interesting times ahead of me. When I return I shall never regret going. I expect to go to one of two places, and neither of these is an active front. Judging by the nearness of the end of war, I should not be away for longer than a year.”¹⁶ The fortunes of war proved Ron to be much too optimistic. He would not see home for three and a half years. As he prepared for his departure, the commanders of allied forces that had suffered a disastrous defeat at the hands of the Japanese and their Thai and Burmese allies in 1942 were preparing the Burma campaign. His unit, now the 61 Reproduction Group IE (Indian Engineers), would be called upon to produce the maps used to

plan battles in Burma. Ron was to be in Rangoon Friday 10 August 1945 when news of the Japanese surrender arrived. On 26 August he witnessed Spitfires escorting two Japanese planes carrying Lieutenant General Takazo Numata to the formal ceremony of surrender of Japanese forces in Burma. Ron’s unit printed a leaflet in Japanese to be distributed to enemy troops still in Burma to encourage them to stop fighting: “Special Notice. Lieutenant General Numata, Chief of Staff of the Southern Expeditionary Army General Headquarters, arrived in Rangoon on August 26 to discuss the withdrawal of the Japanese Army from Burma. The photo on the reverse side is of Lieutenant General Numata signing the treaty in the presence of the Chiefs of Staff of the Allied Forces.”¹⁷

At the time of the surrender, Ron was busy designing a booklet, *Finale*, published by his unit in September 1945 to record their “travels & trials”.¹⁸ They had sailed from Greenock in February 1943 and after brief stops at Dakar, Sierra Leone and Capetown, reached Durban, where they waited in Clarewood Camp

¹⁵ RH Waddams, No.1 Reproduction Group, Att. 14th CFS Company R.E., Ampthill, Bedfordshire, 7 Dec 1942.

¹⁶ RH Waddams, No.1 Reproduction Group R.E., 18 Feb 1943.

¹⁷ The leaflet is in one of Ron’s photo albums.

¹⁸ *Finale*, Rangoon, 1945. The centre spread is a map of the 61 Group’s travels.

for a ship to take them on to Bombay. They arrived in India on 11 June. From June 1943 to January 1944 they were stationed at the headquarters of the Indian Survey in Dehra Dun, in the Himalayas. February to August 1944 found them in Thondebavi, just north of Bangalore. In August a long journey by train and river boat took them closer to the front line at the 14th Army HQ in Comilla. In February 1945 they arrived at Imphal on the Burmese border, where until late April they worked 24 hours a day to produce the maps used by commanders to direct the successful campaign to defeat the Japanese in Burma. On 28 April 1945 they entered Burma. In *Finale*, Colonel C. A. K. Wilson of the 14th Army noted: "When we heard that 61 Rep Group was coming to join Fourteenth Army in August 1944 we made a few discreet enquiries and were told that it was a first class, efficient unit. It has certainly lived up to its reputation. It stepped straight into high production, and maintained it until the end of the campaign. The first rate standard of quality has never been lowered. With the other Rep Groups, it efficiently defeated the prognostications of our pessimists by successfully taking its heavy equipment and plant 1500 miles overland from Comilla to Rangoon."

The histories of the Burma campaign do not mention the part played in victory by the cartographers of the Rep Groups, but the first thing General "Uncle Bill" Slim did when he was appointed to command Allied forces in Burma in 1942 was to take a map of Burma and reduce it in his mind "to a rough diagram with the distances between the main places marked". A map of the current situation was permanently available in the War Room of his HQ and Slim's "practice [was] to visit my War Room every night before going to bed, to see the latest situation map". Maps captured from Japanese units were a valuable source of intelligence concerning enemy intentions.¹⁹

Ron Waddams preserved 19 maps from his years in the 61 Rep Group. For example, *Situation Sep. 1944*, was printed in Comilla, shortly before the beginning of the offensive that would lead to the defeat of the Japanese army in Burma (*figure 1, pxx*). It showed the positions and numbers of enemy troops (principally Japanese, but also the Burma National Army led by Aung San). Notes provided commanders with additional information, for example: "2 Div[ision] moved to Salween Front end Aug 44 for counter offensive ordered by Gen. Kimura on Kawabe's relief by Gen. Kimura in Sep 44. This operation was cancelled, and main body 2 Div moved to reserve in Lower Central Burma." Another note stated that the "Japanese Air Force [had] 80 aircraft in Burma. Total 450 aircraft in S.E. Asia. Total fighting T[roops] 78,000 replacements coming in at rate 7,000 per month. L[ines] of C[ommunications] T[roops]. 100,000".

Another map (*figure 2, pxx*), *Enemy Situation Immediately After Crossings (by 20 Div., 7 Div. & 2 Div.) of Irrawaddy: - 20 Feb '45*, printed in Imphal, documents a critical point in the Burma campaign. Slim's plan was to convince General Kimura that his main objective was Mandalay, while in fact he intended to direct his principal attack to capture Meiktila to the south. This involved perilous

¹⁹ Field Marshal Viscount Slim, *Defeat into Victory*, London, Pan Books, 2009, pp.25-26, 161, 396, 478-479

multiple crossings of the great Irrawaddy River.²⁰ This map shows the various bridgeheads established by 14th Army troops despite the opposition of the Japanese forces waiting for them. Flags mark the various headquarters: Slim's 14th Army HQ in Monywa, 33 Corps HQ directing the feint to attack Mandalay. 4 Corps had its headquarters at Myitche for the critical crossings to the south to advance on Meiktila. As the map shows, 48 and 63 Brigades and the 255 Tank Brigade had already broken out from the bridgehead at Nyaungu to seize the Myingyan-Meiktila railway line.

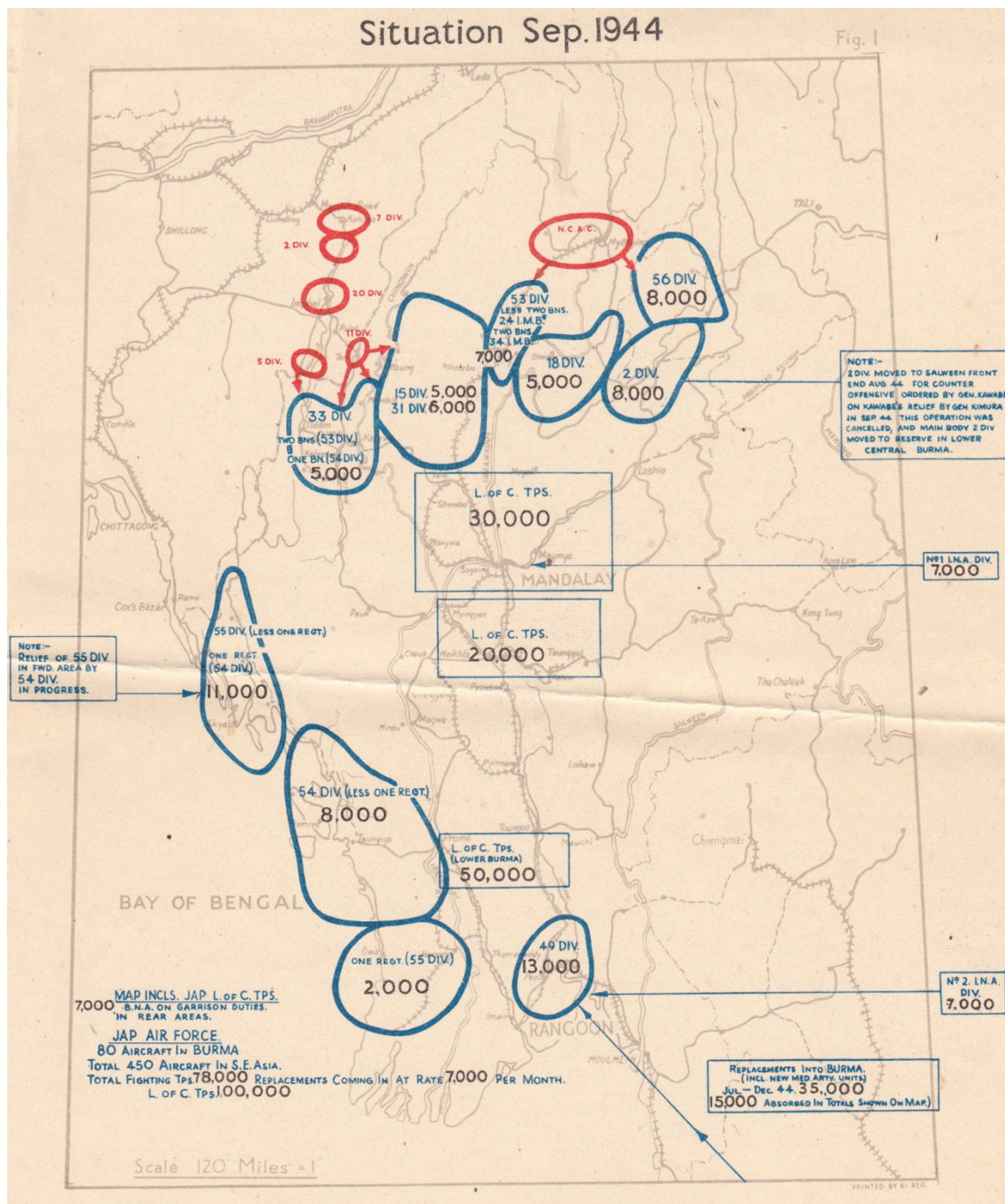


Figure 1

²⁰ Slim, pp.469-470, 472-473, 476

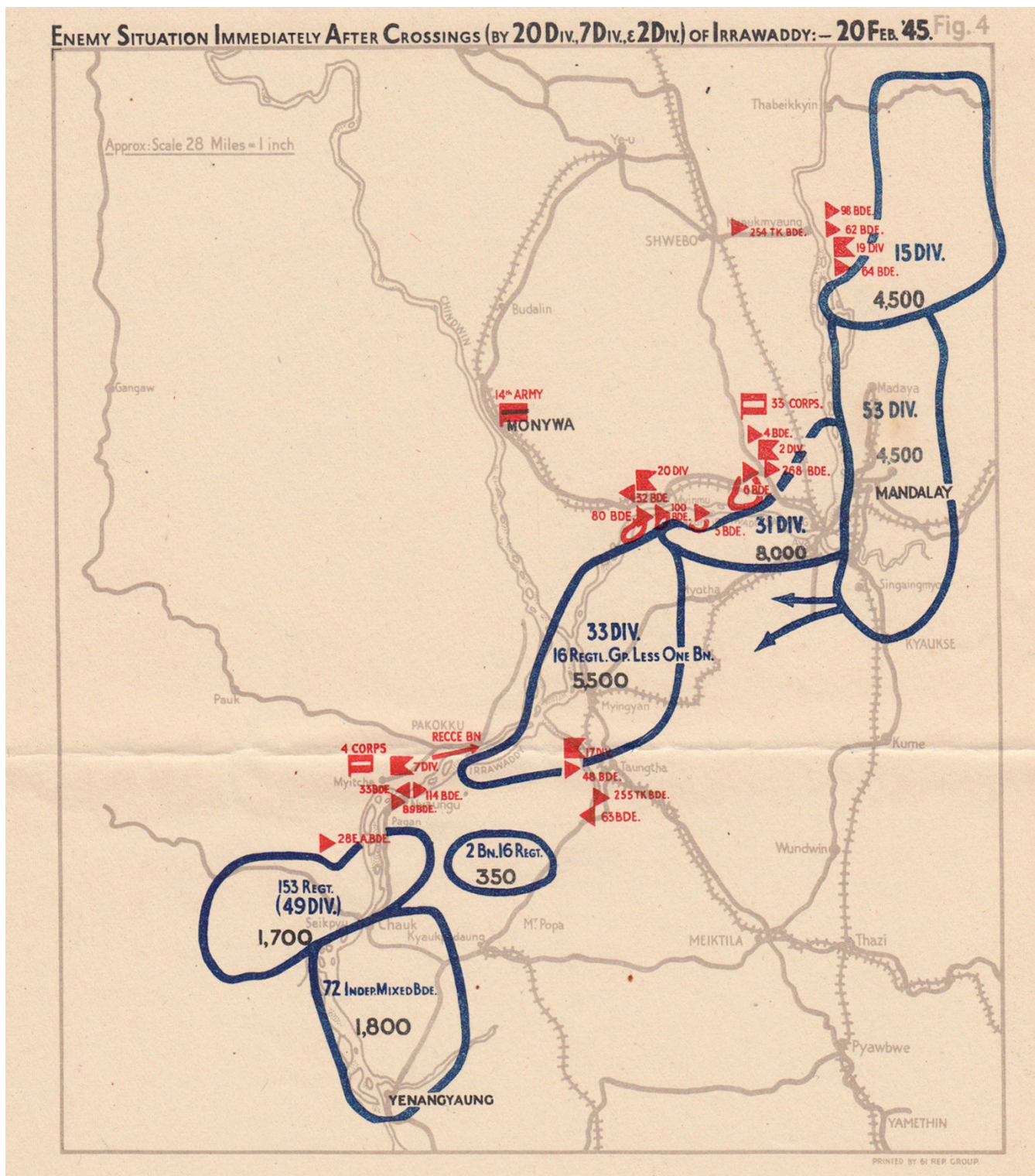


Figure 2

In the river port of Kalewa, during a halt in their journey to Rangoon, the 61 Group printed *Japanese Dispositions 10 May '45 After Capture Rangoon* (figure 3, pxxx). The Japanese had been roundly defeated after the crossings of the Irrawaddy, and 15 Corps had occupied Rangoon on 3 May. But the imperative of racing to Rangoon to beat the monsoon rains left substantial numbers of Japanese troops at large in several parts of Burma. As Herbert Holland observed in *Finale*,

the 61 Group passed through Toungoo on 29 May and “from then on we had to be on the alert, as the Japs were still operating either side of the road”. The map makes the risks that Herbert referred to graphically clear. Between Toungoo and Pegu 5,000 lines of communications and 2,500 fighting Japanese troops were to the west of the road to Rangoon. To the east were 29,500 remnants of the 33 Army, and to the south of those elements were a further 20,000 Japanese army, air and naval troops.

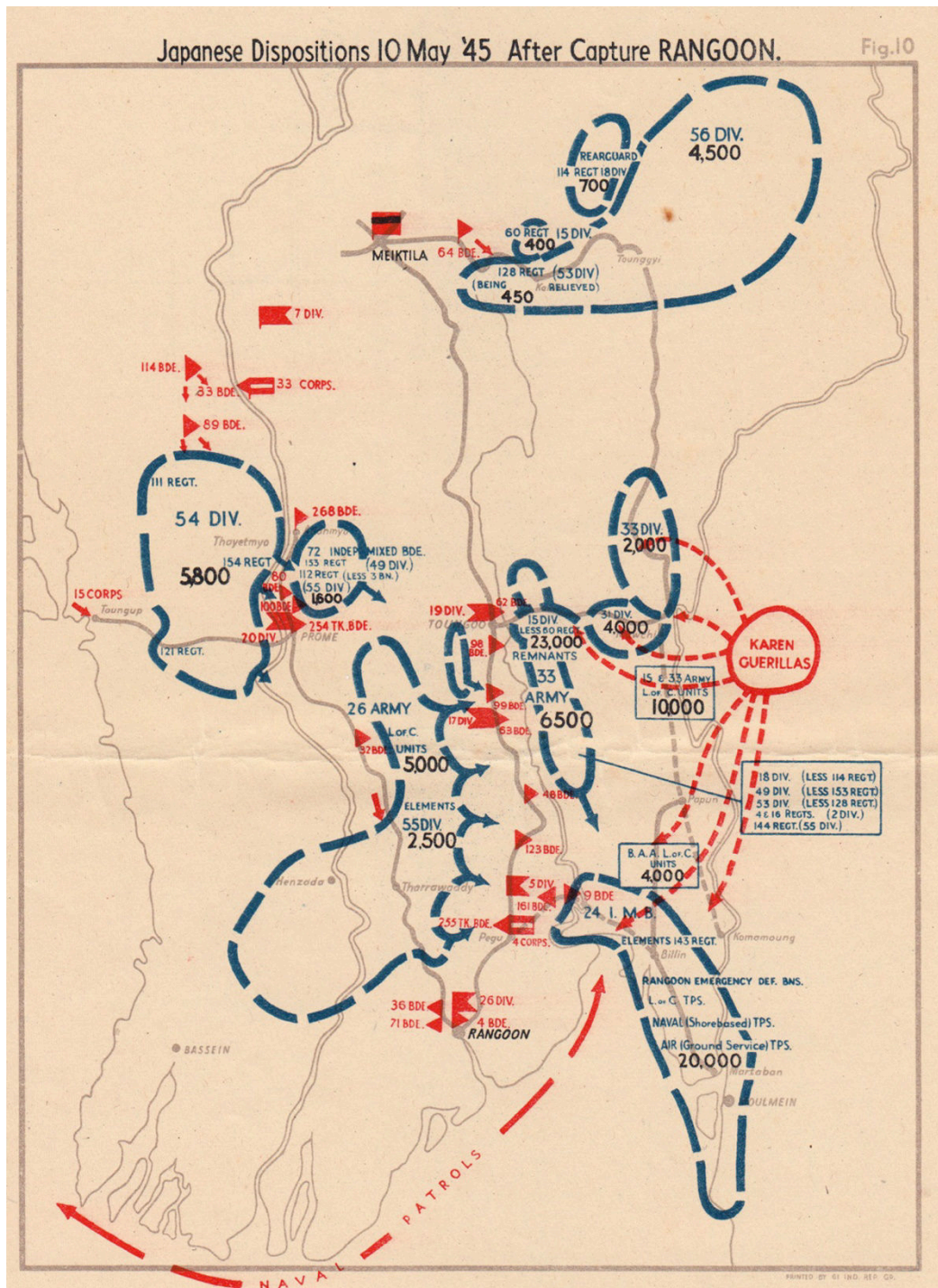


Figure 3

Ron also brought home four large detailed maps of Burma and the wider area; India, Siam, French Indo China and China, presumably used as reference maps. There is also a map of Burma printed on red silk, because, Ron explained to me, paper maps disintegrated in the monsoon season.

A photo of the Group, taken in Rangoon, shows 64 men, British and Indian.²¹ The programme printed for Christmas celebrations in 1944 and *Finale* identify 37 British members of the Group.²² The non-combatant Indians included tradesmen, while others took care of “the common fatigues of ordinary army life”, such as washing and sweeping, and drove the trucks.²³ Some of the British contingent had been with the Group since Ruabon, others had replaced those who had been promoted to other duties. A humorous piece in the Christmas 1944 programme, when the Group was working in Comilla in the hot lowlands of East Bengal, indicates how the unit was organized. The commanding officer, was Captain Edward (‘Eddie’) Baker. The orderly Les Wilde started the day with First Parade, and, with Stan Ward, managed the office. Jobs arrived as base maps on Kodatrace produced by Indian colleagues, which were passed to the Photo Department, manned by Jack Charlesworth and ‘Tookey’, operating in a trailer. Here faults (“pin-holes”) in the negative were corrected with ‘semi-opaque’. In a *basha*, a large thatched bamboo hut, where the negative was examined with a ‘shiner’, or light box, some nine draughtsmen worked. One of them was “young Wads”, Ron Waddams. The *basha* also housed the generators. Plates were made and scrubbed with sulphuric acid for reuse in the trailer where about seven platemakers worked. There were ten printers working on at least two machines. Andy Howe was the maintenance man of the printing department, always ready with his “hammer, wire and pliers”. Ted Carigeit was the senior of the four men who ran the stores.

These men made maps in the cool of Dehra Dun in the Himalayas, the tropical savannah climate of Thondebavi, the intense heat and humidity of Comilla, humid subtropical Imphal, where production ran 24 hours a day²⁴, and tropical Kalewa. In Comilla, the men lived in a *basha* roofed with thatch where rats made comfortable homes and would descend at night to gnaw the clothing of anyone careless enough not to keep his clothes in bed under the mosquito net.²⁵ To produce accurate maps in these conditions, in less than luxurious accommodation, under the pressure of deadlines imposed by military exigencies, required team work and considerable professional skills. Clearly, the Ruabon course had trained the 61 Group to a very high standard.

²¹ In one of Ron’s photo albums.

²² *Christmas Programme 1944 Souvenir*, Comilla. *Finale*.

²³ *Christmas Programme 1944 Souvenir*. RH Waddams, 61 Ind. Reproduction Group, 31 July 1944; 31 June 1945.

²⁴ *Finale*

²⁵ *Finale*

Miltonhead (site of)
Humphrey Welfare

Absolutes and superlatives are full of problems for the writer, risking the likelihood of instant contradiction by the knowledgeable. Saying that something is unique only serves to set the hounds running to test if the assertion is true. In one of the final footnotes to my draft text of a biography of General William Roy¹ I comment on one of his many unusual memorials: the label that appears on OS Maps at the site of his birthplace, Miltonhead, in Clydesdale (NS 82554952). This usage began after the construction there of an operational 4th-order trig pillar, bearing a simple commemorative inscription, in April 1956. Readers may be able to correct me, but I think that the first publication of the label was on the 1:2500 plan NS 8249-8349, revised in 1963 and published in 1965. The legend there is 'Miltonhead (Site of the birthplace of General Roy),' next to the symbol for the trig pillar and the height of the benchmark: 510.09 feet. At about the same time the label also appeared on the One-inch Seventh Series, sheet 61, Falkirk and Lanark, revised 1954-5 and published c1966. On this sheet the wording is different: 'Birthplace of General Roy (site of)' and it is accompanied, most unusually, by a small square uncoloured symbol. This same wording is also used on the current digital edition of the Landranger map, but in other editions there has been little consistency: we have 'Site of the birthplace of General Roy' on the 1:10,000 NS 84 NW (surveyed/revised in 1963-8 and published in 1969), and on the 1:25,000 digital edition (perhaps more correctly) 'Monument (site of the birthplace of General Roy).'

One of the engaging aspects of all this is that the map-user is - of course - expected to know who General Roy was; in the space available no explanation can be offered. I have always supposed that this label was unique on later twentieth century small-scale maps, but is that true? Earlier, large-scale maps were more didactic and chatty and, especially in rural areas, had the space to project what was essentially local historical information onto this national platform. JB Harley illustrated² a good example, near Welshpool in Powys, which bears the label 'Cobham's Garden (Field in which Lord Cobham was arrested).' Again, there is no explanation, just the expectation that the cultured map-user will instantly appreciate that this refers to an event in 1417 and to Sir John Oldcastle, a model for Falstaff and a Lollard who had been on the run after rebelling against Henry V. William Roy himself probably contributed at least one such Delphic label on his long walk around the coastline of Scotland for the Military Survey of 1747-55. On the western shore of the Kyle of Tongue, in Sutherland, a label on the manuscript Fair Copy reads: 'Here the Hazard sloop was run ashore.' The ship, captured by the French and renamed *Le Prince Charles*, was driven onto the sands by a British frigate in April 1746; it was carrying nearly 170 men and five chests of gold, all destined for the Jacobite army which was then, shortly before

¹ *General William Roy, Father of the Ordnance Survey*, to be published by Edinburgh University Press in 2022.

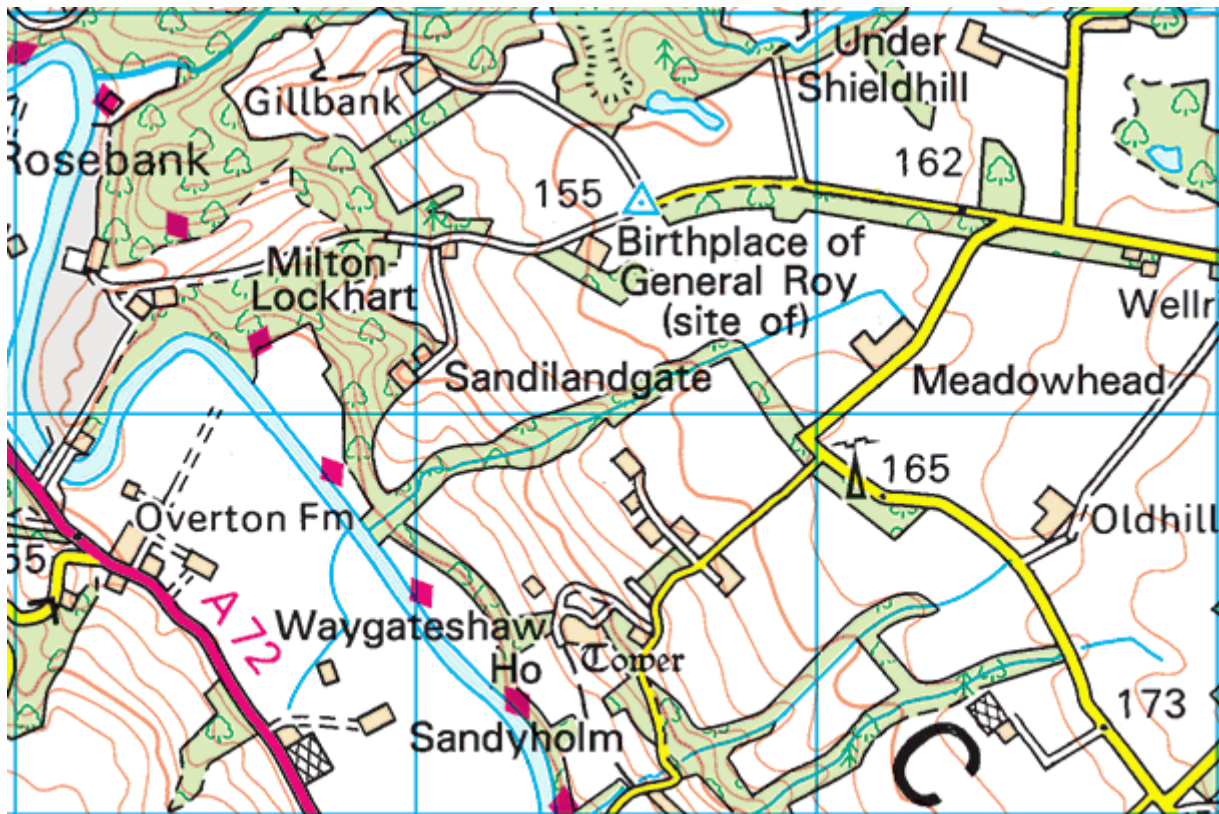
² JB Harley, *Ordnance Survey Maps, a Descriptive Manual*, Southampton: Ordnance Survey, 1975, plate 3: an extract from 1:2500 County Series, Montgomeryshire sheet XV.13. Llanfyllin, 1902.

Culloden, close to Inverness. Men and money were all taken.³ In the early 1750s this was a very modern, raw piece of history.

Although they had appeared on earlier cartography, part of the more direct ancestry of the 'site of' labels lies in the inclusion of (some) battles on the sheets of the Military Survey: intangible recent 'antiquities' that were inserted because of the lessons that they might offer for contemporary military tactics. The incidence of such things proliferated in the 19th century during the survey of rural areas for the 1:2500 County Series. There they usually refer to levelled 'tumuli,' to 'urns', or to hoards of metalwork or coins: interesting snippets, noted in the Name Books, but unusual in being of no navigational value. Before the arrival of OGS Crawford as Archaeology Officer in 1920 there was no professional appraisal of their accuracy.⁴

Returning to Miltonhead, where the house that the Roy family had lived in was swept away between 1816 and 1855, the label may be a throwback to this earlier practice on large-scale sheets, but are there any other examples on small-scale maps where a birthplace, or similar, is commemorated by a label for a building that has disappeared? Or is it, indeed, a unique act of pietas on the part of the OS to the man so often regarded as its founding father?

Readers who may have information on this topic are invited to contact the author by email at dykesfield@icloud.com.



³ *London Gazette*, 12 April 1746.

⁴ CW Phillips, *Archaeology in the Ordnance Survey 1791-1965*, London: Council for British Archaeology, 1980, pp. 19-20.

Sheetlines 117 & 120 : some observations

Richard Oliver

Burghfield and mapping secrecy (Sheetlines 120)

John Ambler's article in *Sheetlines* 120 illustrates an interesting series of varying treatments of the Burghfield ordnance factory suggesting either landscape change when there was none, or else denying change when in fact it had taken place! There are ten files at The National Archives at Kew dealing with Ordnance Survey security treatment between 1928 and 1979.¹ Chris Board used the earliest of these for some publications in the early 1990s, but otherwise they are unexploited; I hope to remedy this before too long.² In short, there were three basic categories: (1) 'S', or secret, where the installation was omitted completely, and its site was shown as far as possible as it had been before it was built; (2) 'U', or undescribed, where buildings and associated roads were shown, but no descriptive or given name was given; and (3) where it was mapped without any security treatment. There was – perhaps still is? – a 'security section' at OS that scrutinised all new mapping at proof stage, and was responsible for ensuring that any treatments requested by defence or other departments were carried out. In practice these seem to have varied between departments: the Royal Air Force seem to have been particularly keen in the early postwar years on the maximum secrecy, notwithstanding that the 'land take' of aerodromes was often very considerable! It is possible that the later files at TNA might explain why the Burghfield factory was still given 'S' treatment when part of it appeared on the edge of one-inch Seventh Series sheet 158 when it was republished in 1967, but did not even need 'U' treatment when sheets 168 and 169 were republished fully revised in 1971.

Michael Meacher's airing on 29 April 1982 of the omission of the factory from the 1:50,000 Second Series was not the first mention in public of the matter, and I am wondering whether its timing may have been affected by the outbreak of the Falklands War, which had begun on 2 April. On 20 February the Guardian had carried a short article, without attribution, 'Arms factory left off the map'. 'Some of the 700 people who work at the factory, which makes nuclear weapons, are baffled. It is one of the area's biggest employers and the one square mile factory is clearly signposted.' OS were reported as saying: "In 1976 we were told that there had been a change in the classification." The MoD justified the omission on the grounds that "It could have been helpful to international terrorists who might have wanted to break in."³ Three letters were published in the wake of this:

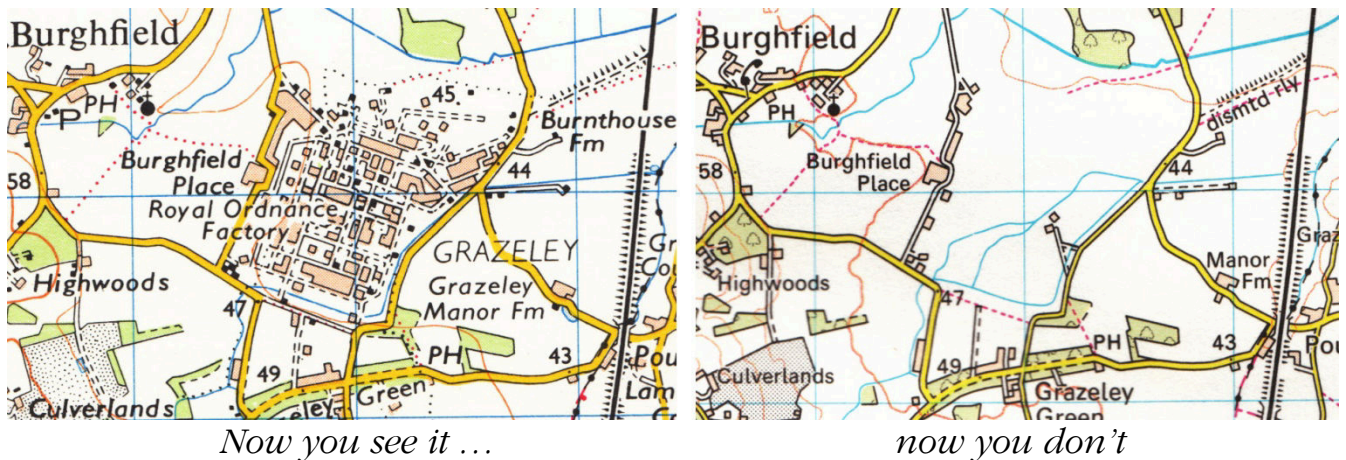
¹ These are: OS 1/251 (covering 1928-39); OS 1/524; OS 1/525; OS 1/526; OS 1/1286; OS 1/1287; OS 1/1288; OS 1/1472; OS 1/1479; OS 1/1624.

² Christopher Board, 'Things maps won't show us: reflections on the impact of security issues on map design', *Mapping the nations*, Proceedings, Vol I, London: ICA Ltd, 1991, 136-48; Christopher Board, 'Falsification and security', in Peter Barber & Christopher Board, *Tales from the Map Room*, London: BBC Books, 1993, 106-7; see also report of his talk, 'Not to be shown...', at the CCS AGM in May 1992 in *Sheetlines* 34, 22-3.

³ 'Arms factory left off the map', *The Guardian*, 20 February 1982, p.2, cc 4-6.

David Walsh of Saltburn drew attention to the omission of the early warning station at Fylingdales, notwithstanding its conspicuousness and the availability of picture postcards; PJ Mountain of Norwich drew attention to the armaments depot at Caerwent, likewise omitted; and I drew attention to the use of the generic description since 1957 of ‘works’ for industrial sites, and to Aldermaston being only about four miles from a blank space in the Aldermaston area. This was accompanied by a Hector Breeze cartoon.⁴

The effective abandoning of such censorship probably owe less to the sort of ridicule expressed in the *Guardian* correspondence, and more to the collapse of the communist bloc and the subsequent cartographic revelations.



Acres, roods and perches (Sheetlines 120)

In *Sheetlines* 120 Chris Higley provided invaluable descriptions and illustrations of computing scales for measuring areas. In its ‘six-inch period’, of the Irish townland survey and then of two northern English and seven Scottish counties, the OS published its acreages in acres, roods and perches; the acres-and-three-decimal-places style was introduced in 1855 with the adoption of the 1:2500 scale. I suspect that this was a matter of show rather than of substance, and may even have been a small economy, as it is highly probable that acreages had always been calculated in decimals, and only converted to roods and perches for publication. In this the OS was simply following long-standing land-survey practice, as is evident from a few surviving draft enclosure maps, and some Kendal tithe maps.⁵ However, what was well-known to land surveyors was still

⁴ *The Guardian*, 23 February 1982, p.10, c.6; 25 February 1982, p.12, c.4; ‘How we disorientate the world’s terrorists’, 27 February 1982, p.10, cc 2-4.

⁵ Enclosure maps: Alkerton (Oxon: draft, 1777), Oxfordshire Record Office Stilgoe 53 [Exeter number 14242]; Aynho (Northants: 1793), Northamptonshire Record Office Enclosure plan no.3 [Exeter number 14716]; Roade & Ashton (Northants: draft, c.1819), Northamptonshire Record Office Map 2932 [Exeter number 14724]. An example of a Kendal (Westmorland) tithe map using decimals is Lambrigg (1835), Cumbria Record Office (Kendal) WQ/R/C 10 [Exeter number 15648]. As the Exeter parish map project (1993-97) was mainly concerned with fair-copy tithe maps, it is highly likely that more examples of acreages in decimals will be found in draft maps that were not examined, even though the proportion of surviving draft maps is modest.

probably much less familiar to the ordinary public, and tables for converting decimals of acres to roods and perches were a standard component of the ‘area books’ that were published by parishes up to the mid 1880s.

In 1912 1:2500 procedures were reviewed, evidently as part of ‘streamlining’ with a view to cost-saving where possible, and Colonel Charles Close, Director-General, ruled that decimals should continue to be given to three places.⁶

Access for surveyors in Scotland (Sheetlines 117)

An article by Peter Haigh in *Sheetlines* 117 suggested that deficiencies noted in mapping more remote parts of Scotland may be attributable to problems of access by surveyors.⁷ Whilst I don’t want to dispute that the deficiencies are indeed there, they may be attributable rather to nineteenth century OS cost-cutting. Under the Ordnance Survey Act of 1841 the surveyors have a right of access to property. Two constraints in Scotland were the restricted season when the weather was suitable for surveying work, and the hunting season. For this reason, between about 1861 and 1874 it was the practice to move a large proportion of the field staff from southern Britain to the Scottish highlands for two or three months around May to July: legal rights of entry were presumably trumped by diplomatic relations with lairds.⁸ I have not heard of such movements of field staff for subsequent revision work, so perhaps it was possible to ‘work round’ these constraints, and for small-scale revision, in particular, surveillance with field-glasses may have been a substitute for thorough perambulation of the ground.

The deficiencies that Peter describes are mainly to do with contouring, and here initial economy is definitely the explanation. Up to about 1855 contouring in Great Britain was at 25 or 50 feet intervals, with a mixture of rigorously-mapped contours surveyed by spirit-levelling, and less rigorously mapped ones using the faster and cheaper process of water-levelling.⁹ As a consequence of the ‘battle of the scales’, from 1854 to the completion of the initial survey in 1890, all further contouring below 1000 feet in Britain, outside the Scottish highlands and islands, was by spirit-levelling, and there were no intermediate water-levelled contours. Accuracy was therefore secured at the expense of wide intervals. Above 1000 feet, and in the Scottish highlands and islands, water-levelling was used exclusively (except in Lewis, complete by 1853, and the apparent extravagance of contouring which helped bring about the change of policy). The water-levelled contours were only considered accurate enough for publication at the one-inch scale, and the interpolated contours added to the one-inch Scotland Popular and Seventh Series had a rather dubious basis. This was fully recognised by the 1950s, and the six-inch resurvey of the Scottish highlands and islands was an integrated

⁶ Southampton Circulars, Book 2, p.86: copy in Charles Close Society Archive, IM 402/1.

⁷ Peter Haigh, ‘The mountains of the Fisherfield Forest’, *Sheetlines* 117 (2020), 23-26.

⁸ Richard Oliver, *The Ordnance Survey in the nineteenth century*, London: Charles Close Society, 2014, 273, 277.

⁹ Richard Oliver, *Ordnance Survey maps: a concise guide for historians*, third edition, London: Charles Close Society, 2013, 94-95 has some further detail: details of contouring by county will be found on pp 229-81.

operation, with both detail and contours plotted from air photographs onto the same document. This operation was only completed in the late 1970s, and when an article on Scottish contouring was published in the *Cartographic Journal* in 1972, which drew attention to planimetric inaccuracies in the water-levelling, all the water-levelled contouring remained on the one-inch.¹⁰

‘Life on the Ordnance Survey’ and Royal Engineer Survey Sections (Sheetlines 120)

The two brief articles from *The Sapper* of 1895 and 1901 reprinted in *Sheetlines* 120 are useful additions to the exiguous ‘worms’ eye views’ of rank-and-file work on the nineteenth century Ordnance Survey, and I wish I had known about them ten years ago. The accompanying illustration of the RE 1st Field Survey Section is indeed of Sappers who had been posted to the Ordnance Survey, but atypical in that they are not on routine domestic topographic survey. In 1889 the then Director-General, Colonel Sir Charles Wilson, obtained approval for the creation of three military survey sections within the Ordnance Survey, for overseas use if needed. Each would consist of one officer and six non-commissioned officers, who would annually perform fourteen days reconnaissance training, chargeable to the Survey Vote. The existence of the sections was advertised repeatedly in the Survey’s annual reports, but it was 1900 and the South African War before their services were called on. The first section left Southampton on 15 January 1900, under Captain Charles Close: he commanded eight RE surveyors and two drivers. They ‘had a very good send off, as we were the first unit sent to any war by the Survey’.¹¹

Water mills and water supply (Sheetlines 120)

Paul Bishop’s excellent article in *Sheetlines* 120 mentions the use in Scotland of ‘lade’ for the channel leading to the mill. In Devon ‘leat’ is encountered, for a variety artificial watercourses: Exwick Leat, originally from SX 90559505 to SX 90959319 seems to have been constructed for the benefit of Exwick Mill (SX 90809400), but the Devonport Leat (easily traceable from SX 582750 to SX 550680), was built around 1794 to supply what was then Plymouth Dock with drinking water. The *Shorter Oxford English Dictionary* defines ‘leat’ as ‘An open water-course to conduct water for mills, mining works, etc’, and gives the earliest use as 1642; ‘race’, defined as ‘running or rushing of water’, is first recorded in 1670.

¹⁰ Heloise Collier, ‘A short history of Ordnance Survey contouring, with particular reference to Scotland’, *Cartographic Journal* 9 (1972), 55-58.

¹¹ Col Sir Charles Close, ‘A fifty-years retrospect’ [contd], *Empire Survey Review* II (1933), 2-6, p.3; Richard Oliver, *The Ordnance Survey in the nineteenth century*, London: Charles Close Society, 2014, 344-5, 419.

IFOR, but what for?

John Davies

Although it's a bit of a stretch from OS, I have recently acquired a map which brings together two topics aired in *Sheetlines*: John Cruickshank's description of the Soviet 'rectangular' topographic maps ¹ and the personal stories behind hand-annotated maps related by Michael Richardson and Andrew Darling.²

My new acquisition is 1:500,000 rectangular topographic sheet 59-00-59-11, published by the Military Topographic Unit of the Soviet General Staff in 1985. Measuring a huge 1030mm by 860mm, it is titled *Sarajevo*, labelled Secret, and neatly covers the whole of Bosnia-Herzegovina and the Adriatic coast.

This copy, which has come from an unknown source in Latvia, has been covered with a clear plastic laminate and has been folded many times in different ways, such that almost any panel can be viewed in a confined space.

The map has been annotated in blue and red ink over the laminate. At Sarajevo is a large flag labelled IFOR, with bold blue lines radiating from here to the border, dividing the country into three sectors, with other flags elsewhere, each having a two- or three-letter code and other symbology.

IFOR, (Implementation Force), was the NATO-led multinational peace-keeping force here from December 1995 to December 1996. The country was divided into the three sectors depicted; American, British and French. The native Serbian area is as shown by the red line drawn on the map.

As well as NATO member states, 19 other nations contributed forces, including Latvia. The symbols used on the map are the NATO Joint Military symbol set,³ which identify the name, size and capability of bases. The American

base north-east of the capital is labelled ASV, the Latvian for USA.

It would seem, therefore, that my map was annotated by a Latvian serving with IFOR and its durability would suggest it was used in the field, rather than hung on the wall in HQ.

But who knows? That's the intriguing thing about annotated maps!



¹ *Sheetlines* 89,5

² *Sheetlines* 112,46 and 115,33 respectively. Archive copies of back numbers are available at <https://www.charlesclosesociety.org/Sheetlinesarchive>

³ See https://commons.wikimedia.org/wiki/NATO_Military_Map_Symbols

Ordnance Survey covers and titles update

Derek Deadman

Introduction (adapted from Sheetlines 111)

For John Paddy Browne's *Map Cover Art*, Roger Hellyer devised a numbering system to identify OS cover types. This book, and his *Ordnance Survey Small-scale Maps Indexes 1801-1998* give much invaluable information. What seems to be lacking in both, however, is a list of which covers may be found on which maps within series. Based on Hellyer's numbers I am compiling a list of cover titles (not map titles, which may differ from cover titles). Previous updates to the list were published in *Sheetlines* 111, 114 & 118.

1.1 Textured red cloth. Title label, book-fold.

Add known district maps: Isle of Wight;

8.1.a.1 "Official" Royal arms. Single lineation on buff. One-inch. Black arms and red. Location map.

Add known sheets: Ipswich & Felixstowe; Corrected cover title: Weston super Mare and District (covers with and without compass on front cover map).

8.1.a.2 "Official" Royal arms. Single lineation on buff. Black arms and red. No location map.

Add O.S. Leaflet No. 49/35 lists a half-inch scale District Map of Birmingham printed on Place's Waterproof Paper as available remaindered, presumably from this category.

10.1 Royal arms with mantling. One-inch. Black cover with red sheet name. England & Wales Third Edition, Large Sheet Series sheets/district maps.

Add Book-fold covers. Known LSS sheets (Hellyer & Oliver: Third Edition Maps, in colour. p.81, note 173): 95, 97, 98, 115, 125

10.2 Royal arms with mantling. Dark red and brown cover. One-inch. England & Wales Third Edition, Large Sheet Series. Coloured edition. Series sheets/district maps. Scotland Third Edition/Ireland Series sheets/district maps.

Add known district maps: England; Ilkley District (map reverse orientation); Staffordshire Potteries & District (map reverse orientation); Worcester District (map reverse orientation).

Scotland. Add known district maps: Third edition, Coloured edition. Loch Lomond District.

Ireland: Add known District maps. Belfast and District; Cork and District;

11.1.c Popular Edition. One-inch. England & Wales. Place's Paper legend. Series sheets on Place's Waterproof Paper.

Add known sheets 11, 13, 14, 15, 24, 25, 91, 100, 118, 122, 131, 134, 140 and 141.

11.2.a Popular Edition. One-inch. England & Wales. Dark red and black. Location map. Series sheets except sheet 17 (pictorial cover) and 140 (place-name list). All other 144 numbered series sheets known in this cover.

Book-fold covers ('wrap round'). From the large number of different sheets that have now been identified with these covers, it seems likely that all sheets were available in this form. Add known sheets: 2, 3, 6, 13, 19, 20, 21, 22, 30, 44, 47, 59,

60, 63, 65, 71, 73, 74, 75, 84, 86, 90, 95, 96, 97, 102, 103, 106, 107, 108, 112, 114, 115, 117, 121, 124, 125, 137, 138, 140, 144.

On Place's Waterproof Paper. Sheet 117 (East Kent) 1929. No Place's markings but Price 3/6. (Not on a mounted/dissected map for which the price of 3/6 seems to have been generally reserved); Sheet 83 (Northampton and District). Two labels affixed to front cover, viz "Printed on Washable Paper" and 'Note to the Purchaser'. Illustrated at H.295 in image library.

11.2.d Popular Edition. One-inch. England & Wales. Black sheet name. Series sheets 1939. Covers with sheet names in black may be found on Bender covers or on maps mounted in sections..

Add known in Bender covers: Sheet 34.

12.1.a Car passing signpost. Half-inch layered/hill-shaded Editions. Recorded only with book-fold covers. Black, full red title. England & Wales series sheets. 1919.

Add known book-fold sheets: 29.

12.1.b Car passing signpost. Half-inch, black, red sheet name. England and Wales series sheets, 1919.

Probably all 40 numbered sheets were printed with this cover.

Known sheets: 1-32, 34, 36-39.

12.2. a Car passing signpost. Half-inch, green and brown. England & Wales (40 numbered sheets)/Scotland (34 numbered sheets)/Ireland (25 numbered sheets) series sheets. G.R. arms. All numbered series sheets are known for each country with these arms. Covers with E.R. arms are also known to exist for maps of England & Wales and of Scotland.

Add known sheets E.R. arms: 1, 35.

Book-fold covers for England and Wales. G.R. arms. Add known sheets: 3, 10, 11, 15, 19, 22, 25, 26, 30, 34, 40.

Book-fold covers for Scotland. G.R. arms. Known : Sheets 8, 33.

England and Wales. District maps: Add Country Round Aldershot; Loch Fyne and Loch Lomond.

13.1.b Motor cyclist at signpost. Quarter-inch, black sheet name. Third Edition (New Series). England and Wales (12 sheets)/Scotland (10 sheets) series sheets. c1932. It is presumed that all covers were printed with black sheet names.

Book-fold. England & Wales. Add known sheets: 9A.

On Place's Waterproof Paper. No Places markings (but signs of removal of labels) but price Four Shillings Net. Sheets known: 8A; 10, 12A.

16.2.b Scottish lion rampant. Standard format. One-inch. Scotland Popular Edition. Maps on Place's waterproof paper with 'Printed on Place's Waterproof Paper' at foot of cover.

Add O.S. Leaflet No. 49/35 lists the following other maps on Place's Waterproof Paper as available as remaindered stock but they may not have been issued in covers: 1 – 11, 15, 22, 25, 32, 35, 52, 61, 74, 86.

One-inch Scotland Popular Edition. Standard format (not waterproof). Red sheet name.

Add Book-fold covers. Known sheets: 25, 35, 36, 37, 41, 54, 60, 63, 65, 69, 83, 84, 85.

16.2.c Scottish lion rampant. One-inch. Scotland Popular Edition. Black sheet name. 1939.

Add known hinged sheets: 12, 41, 43, 45, 47, 51, 67, 68, 73, 76, 80.

Bender covers. 1939-40. Add known sheets: 43, 47.

18.2.b Quarter-inch Aviation maps. Civil Air Edition. Scotland. No location maps. Add known sheets: 2.

23.2.a One-inch England & Wales Fifth Edition. Blue and black covers. Blue sheet names. With location map.

Book-fold covers. Add known sheets: 106, 111, 112, 127.

27.1 A51 signpost. Quarter-inch Fourth Edition. Series sheets. 1934.

Add O.S. Leaflet No. 49/35 lists the following sheets printed on Place's Waterproof Paper as available as remaindered sheets but they may not have been in covers: Sheets 7, 10, 11. A Glasgow District quarter-inch map was also listed available on Places's Waterproof Paper (H.13.2?).

29 Black Car in Profile. England and Wales Popular Edition district/tourist maps. England & Wales/Scotland Third Edition district maps.

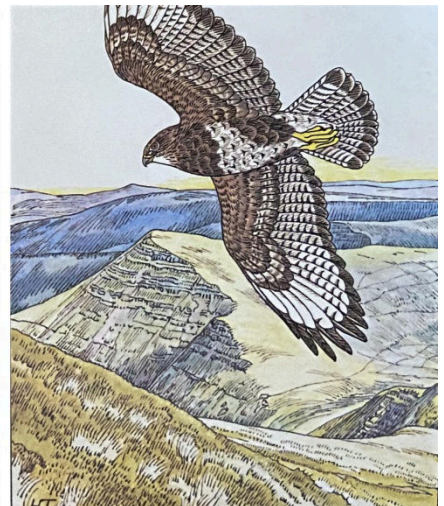
Add known: Exmouth; Pwllheli;

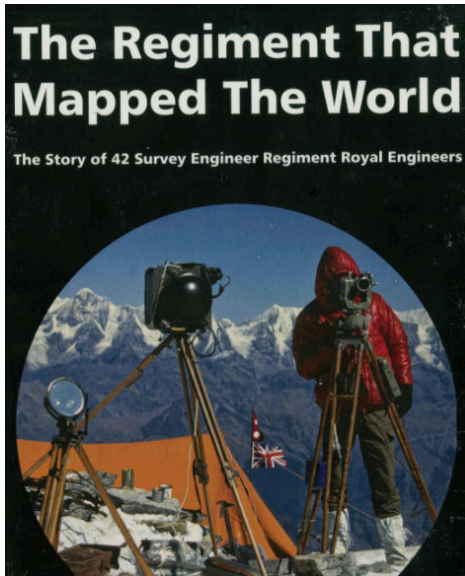
30. Hiker at Stile. England & Wales Third/Popular Edition district maps; England & Wales/Scotland Popular Edition tourist maps.

Add known sheets: Blackpool & District (via an adhesive label and printed label); Hastings & Bexhill; Huddersfield (corrected title); Weston super Mare and District (On Place's Waterproof Paper); York District.

Bender covers. Add known sheets: Birmingham & Wolverhampton; Blackpool & District; Derby & District; Dorking & Leith Hill; Hastings & Bexhill; Leicester District; Leicester District (different layout for title), Manchester District.

Thanks to David Archer, Chris Bull, Graham Cornell, Brian Garvan and Peter Gibson for their help in the preparation of this article. Remaining errors are those of the author.





The Regiment That Mapped The World: The Story of 42 Survey Engineer Regiment Royal Engineers, Alan Gordon, RE Corps Enterprises. A4, hardback, 236pp.¹

Let me begin on a melancholy note: this book was a labour of love by its author to tell the story of the unit to which he belonged, and, sadly, he died as the book was going to press. But we can congratulate him, posthumously, for a work that will delight many, if not most, of the people who find *Sheetlines* of interest. As I read its pages – I was sent a proof-copy for the purposes of this review – I realised that one could not view this as a book dedicated to

a single theme or readership, but rather one has to approach it as something more complex and enjoyable that weaves together five themes. The most obvious strand is that this is a regimental history – a well-established genre among military historians. This unit was formed after the Second World War and changed personnel, structure, locations, tasks, and kit until it was disbanded in 1985 – and yet it continues in another form beyond the end of this narrative (see a ‘map’ of its history on pp. 2-3). So we follow the human beings that were its life blood at work (surveying and producing maps – its main task, being deployed as infantry in Northern Ireland and as replacement fire-fighters in the 1970s), at play, and in all the formalities (and informalities such as a visit from Miss GG Barton Stacey of The Sun on p. 158) of army life.

Having met the people, the book is a quick guide to how military survey has evolved over the period since the Second World War. The book’s story is set in context in that it presents the work of this regiment in a longer time frame that begins with Roy’s survey in 1747 – and points out, something I had never noticed before, that General Roy began his work in Scotland as a civilian and it was while the mapping was in progress that he received his commission. Across Europe most, if not all, the national mapping agencies began life as military endeavours which, as with the Ordnance Survey, gradually migrated into the civilian sphere to a greater or lesser degree. Then, when their histories came to be written it was usually done by civilian historians who had a greater familiarity with the civilian rather than the military dimension of their subject. This book is the exact opposite and it provides, therefore, a very welcome balance. Time and again as I read its pages, little bits of information fell into place simply because Gordon thinks of the history of survey from the viewpoint of the military unit that did the work. While we expect that viewpoint in the history of survey during wartime (one finds it so well done in Peter Chasseaud’s work), when we see it applied to the mapping of Ceredigion (pp. 159-60) one gets a fresh insight the dynamics of survey and the competing demands that underlie every map.

¹ Price at time of writing £30 + UK p&p £2. Order via info@reahq.org.uk, or REA HQ, Brompton Barracks, Chatham, ME4 4UG.

The third level of interest is linked to the notion of ‘the regiment that mapped the world.’ This unit was based in many places in the UK and abroad – it spent nearly a decade in Cyprus – but while one might expect to learn of the maps it produced for places where there were deployments (Cyprus and Aden in the 50s and 60s and then the Falklands – there is a fascinating section of a ‘Minefield Map’ on p. 180) or manoeuvres (Norway), one also sees maps produced in more exotic places such as Nepal. The authors presents this activity within the long traditions of the RE working on maps of British interests abroad such as the surveying the border between the USA and Canada along the 49th parallel. It might be more accurate to say that Gordon has given the military survey dimension that parallels the work of the Directorate of Overseas Surveys. That organisation had almost the exact same lifespan (1946-1985) as 42 Regiment, it produced maps that were very similar in style and appearance, covered some of the same regions, probably its Director, Brig. Martin Hotine, knew many people in the regiment, and lastly, the histories of the two organisations have almost identical titles – see Alastair Macdonald, *Mapping the World* (London 1996). Each book throws light on the other.

The fourth stream is that by looking at this very specific kind of survey, done by one small and very focussed group, one senses that mapping is always to be located in terms of a larger society and in league with other players – in this case, in a particular way, with the Ordnance Survey. It is perhaps this element of the book that is more interesting for members of the CCS – and, yes, our inspiration, as ‘Captain Charles Close, commanding Number 1 Survey Section,’ get a mention on p. 13. The book allows us to see how the historic link between the OS and the RE, both in pursuit of the government of the day’s agenda, continued to touch, depart from, and overlap each other until the 1980s.

The last stream within this book is that it is micro-study, in its photographs as in its text, of the greatest revolution in cartography since the Renaissance. In the sections on the late 1940s we see methods of survey and instruments that would have been familiar to Close, Kitchener, Colby, or even Cassini. There is a picture of a plane table set up with clinometer, a signal lamp descended from that designed by Colby, and an officer looking through a theodolite (p. 45). No doubt there was a slide-rule and log-tables nearby and they could do the trig with pencil and paper. Likewise, on p. 108 is a marker for a trig station (labelled ‘A Norwegian Trig Point’) that is identical in shape with the ‘Trigonometrical Pole’ pictured in Close’s *Topographical and Geographical Surveying* (London 1905), p. 10. By the book’s end we have laser measuring instruments and satellite location – and in the pages between we can track the evolution in survey and map production – which, while ever more accurate, seem far less fun to use! I suspect that this is a book that members of the society will really enjoy having.

Thomas O’Loughlin

Letters

John Ambler in *Sheetlines* 120, demonstrates the difficulties that arise in deciding whether a pair of lines on a map indicate a narrow road, a wide ditch, or a ditch and a hedge. In his case, the double line separates two fields in Sulham Bannister Lower End parish, having parcel numbers 2 and 4 on the 25-inch edition of 1877, 61 and 62 on the edition of 1899, the map in both cases being Berks 37.13 .

It is worth observing that the Field Examination Trace will have distinguished a water-bearing ditch by colour, so draftsmen had access to the information. Because the Field Examination Traces no longer survive, our challenge is to find clues to that information from what the draftsmen drew.

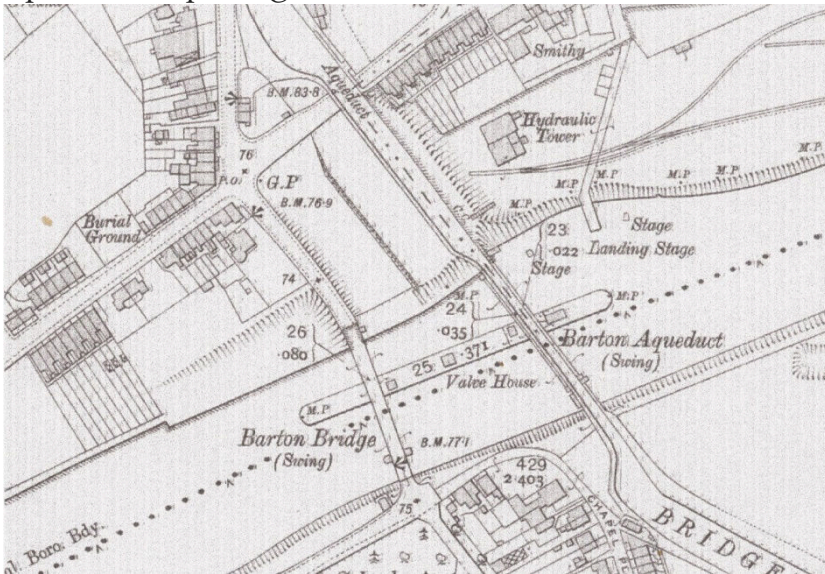
One useful clue comes from the definition of parcels. A double-line ditch will normally be shared between parcels; but where a single-line ditch accompanies a hedge, the hedge will be taken as the boundary between the parcels. On the 1899 edition, the area between the two lines is braced with parcel 61. This is strong evidence for the westerly line being a ditch and the eastern one a hedge. The 1877 edition has a brace in much the same position but badly drawn: it is unclear whether the brace is intended to extend as far as the space between the two lines or merely indicates the belt of trees (which is delineated by a pecked line so needs to be braced to something else or to be computed separately). The NLS copy is a rezincograph of 1892; it would be worth finding an earlier state in which the brace might have been stamped more precisely. Nevertheless, the fact that the two lines appear to have been a ditch and hedge respectively in 1898 seems to indicate that the two lines should be interpreted the same way on the first edition.

We now come to the direction of flow in that ditch. The arrow on the 1898 map indicates that water flowed south to 'Broad Street' (see Sheet 45.1) and continued across that feature to its southern edge. Already in 1898 there was a watercourse corresponding to that shown by John on his 1:25,000 extracts, which is visible within Grazely Green on the 1898 map and seems to run between parcels 54 and 51 to reach Broad Street. (Note the jink in the hedge where it appears to cross from one side of this ditch to the other.) Are we to believe that this also flowed in a southerly direction? Or did both streams flow towards Broad Street, where they merged and flowed westwards? The line of the stream as it crosses Broad Street seems inconsistent with the latter hypothesis. And the general lie of the land seems to argue against the former. I therefore believe that in 1898 the flow throughout was northwards and that beyond parcels 61 and 62 the ditch was too close to an accompanying hedge to be distinguished from it on the map. In short, that this stream in 1871 and 1898 flowed in the manner shown on the Pathfinder extract. In a dry spell, it can be very difficult to establish which way water flows, especially when a breeze is disturbing the surface. This seems to be a case where the 1898 surveyor got it wrong.

Rob Wheeler

Since we seem to be initiating a new section of the Society (CCSSUUB – Charles Close Society Subsection for the Unearthing of Unusual Bridges), please allow me to suggest the inclusion of the Barton Aqueduct (a weird word: I always look at it and think it should have acquired an earlier “c”. Like that). The aqueduct is situated at the western edge of Salford, at SJ767976, and carries the Bridgwater Canal over the Manchester Ship Canal (which was of course built later). The water surfaces of the two canals differ in height at this point by only about fifteen feet, and nothing using the Ship Canal could squeeze underneath. It was obviously necessary to get the Bridgwater out of the way so that the ships on their Canal could proceed unimpeded.

It was at first suggested that this might be achieved by the incorporation into the Bridgwater of two sets of locks, one on each side of the Ship Canal, so that barges laden with coal could float down to the ship canal surface and then stagger up the other side. This plan was rejected, it is said because of the need to conserve water, although it seems likely that the bargemen were not keen on the idea of paddling their ten-ton barges across a two-hundred-foot wide canal, with their horses doubtless swimming steadfastly alongside, and meanwhile avoiding the attentions of the five-thousand-ton monsters rip-roaring up and down between Manchester and the sea. And so the engineers of the Ship Canal came up with a spiffing wheeze.



They built a 330-foot cast-iron trough to the dimensions of the Bridgwater canal with watertight gates at both ends, and mounted it on a swivelling pivot. As you might expect, there were watertight gates at the ends of the fixed parts of the canal as well. The gates on the trough held back about 800 tons of water, and the total swivelling weight was well over two thousand tons.

Being a Victorian engineering achievement, it was of course swivelled by steam. The bridge opened to commercial traffic in 1894, but the rollers supporting the framework, having been designed on the nineteenth-century principle that cast iron was good enough for anything, had to be replaced by steel rollers in the 1920s.

This was when built, and still is, the only swinging aqueduct in the world. It's now a Grade II* listed building. Take your narrowboat across it, when you can, and enjoy a most unusual thrill. The map extract is from the 25-inch sheet Lancaster CIII.II, revised 1905 and published in 1908, courtesy of the NLS website. It doesn't show the gates; but they are still there, and still in use.

Michael Spencer

Kerry musings

David Archer

A lot of readers will know the very funny recording of Gerard Hoffnung at the Oxford Union in 1958.¹ Although the Bricklayer's Story is probably the most famous excerpt, he also recalled being employed during the Festival of Britain to give advice to visiting tourists : zebra parking places are everywhere, ignore all left and right signs, these are merely political slogans, have you tried the famous echo in the reading room of the British Museum, and so on. All very mischievous, and far funnier when listened to. But supposing he had been a cartographer at the Ordnance Survey, what might have resulted?

In an idle moment, might Hoffnung have reversed the contour figures on Brent Knoll so that it became a depression rather than a hill, he might have been very tempted to reverse the direction of the small black arrow heads showing gradient steepness, or to join two such symbols point to point, egg-timer fashion, and to place them on Romney Marsh. Long blue drainage channels in East Anglia just call for the addition of motorway service area symbols, or failing that, he might have shown ski lifts linking the summits of several Munros. The mind boggles at the possibilities of complex motorway junctions with many slip roads, or having a legend only in an obscure language. I am sure that changing the direction of a couple of arrows could turn many one-way systems shown on maps into something one could only ever drive in to, not out of. But transposing the signs for picnic areas and re-cycling centres would be more than cruel and anti-social. Readers can supply other, far better, examples themselves, but please keep them plausible, so no London to Edinburgh ferry via Manchester.

That few map users are ever on the alert for such things surely shows just how much we trust the accuracy of OS maps. Indeed, when a howler is spotted, it usually merits a note in *Sheetlines*, which is not over full with them. So, why do most map users never spot a mistake on a map, given that many must exist? I would suggest that part of the answer is because most people only ever use a few maps, despite many members owning hundreds, if not thousands of the things. And when using them, most of the time, the user only glances at the map, and seldom studies it. They wish to confirm something, not test the accuracy of the map. A route or walk is wanted, with the focus on a very limited area of any sheet, and as the detail shown gets smaller along with the scale, so one accepts less accuracy. Or rather, one does not really question the accuracy, indeed, how would one begin to check a 1:1,000,000 sheet?

Let me explain what I mean. When standing on the edge of a very large field, with the destination stile hidden in distant bushes, a 1:25,000 map will hopefully show whether one needs walk towards the corner of the field, or a short distance from it. Here, one wishes for accuracy. However, with a 1:250,000 map, if a motorway is shown 3mm off course in open countryside, it will not matter and most people will not notice. The important point here is that such poor cartography will not upset many of us, and if spotted will just be shrugged off and accepted, with no letter to *Sheetlines*. Why? Because it all depends on what we are using the map for.

¹And anyone who has not heard it, should do so : <https://www.youtube.com/watch?v=OOGfg1B3ZMw>

Surely the need for accuracy depends on who is using a map and for what purpose? As I suggest, a walker will be quite particular, whilst a motorist is pretty blasé, as might be the good old general public.

A proposition : the 1:50,000 First Series maps were riddled with poor cartography and few noticed, or if they did, no outcry ensued. In 1993, the society visited Taylor Data Graphics who were under contract to the Ordnance Survey to convert scanned one-inch Seventh Series maps to the temporary 1:50,000 First Series products. One of the problems they were finding, was that when two Seventh Series scans were butted together, features sometimes failed to meet. Their instructions were to ease the two together if the difference was small, my memory is less than 5mm, but that anything over this had to be referred to the Ordnance Survey. The visit report notes that not everything was corrected : 'Edge-matching includes principal communications, but not B- or lesser-class roads or contours, for example'.² As the First Series was temporary, it seems that such easing, and the resulting poor cartography were acceptable. I have never tried to replicate this by butting two Seventh Series maps together, and seeing whether all roads do meet, and if they do not, then take out the resulting 1:50,000 First Series for comparison, and if easing has occurred, then checking the First with the Second Series 1:50,000 sheet. Did the Ordnance Survey really publish maps where contours and minor roads are not continuous, or is my memory at fault?

A few years ago, we decided to have our house registered, rather than rely on a fat bundle of deeds to prove ownership. We have a portacabin tucked into a corner of the garden, on the very edge of one boundary, but leaving a small triangle of land beyond it along the adjoining shorter side. When the plan came back from the Land Registry, it showed the boundary going at right angles around the portacabin and the triangle as being part of the neighbouring property. The man from the Ordnance Survey duly came out, agreed at once that the triangle was ours and spent a couple of hours doing a full survey. When he showed me what he had produced, the triangle had been joined to the portacabin, giving a strange shaped building. I was told that the OS merged such small areas into a larger one in certain circumstances. Meaning, the map, newly drawn was inaccurate. Deliberately so. Thus, Ordnance Survey maps at all scales have quite a lot of inaccuracies in them, some sanctioned by the OS. If we are willing to accept such inaccuracies, the question is, what degree of inaccuracy is acceptable? Or is it acceptable if it goes without being noticed?

The early Stingemore London underground maps, had the various coloured lines wiggling across a standard street map, just as motorways wind all over the place on current OS topographical maps. But do they need to, when people only want to know which towns they connect, where the services and junctions are and distances? In which case, why go to all the bother of accurately surveying motorways? Why not have some features shown almost diagrammatically? Mr Beck's diagram replaced the Stingemore maps and London Transport never looked back. If the Beck diagram suits people who just want to know which stations are on which lines, surely this equates with which towns are on which motorways, and if we accept symbols for churches and Youth Hostels, why not have motorways shown as elongated symbols? Something along the lines of the 1:50,000s powerline overprints. If this means

²*Sheetlines* 35, 32. <https://www.charlesclosesociety.org/SheetlinesArchive>

showing a motorway and the relevant junction at a distance from a named town, rather than passing through it, so what? It should be perfectly clear what is happening.

Therefore, I suggest, the Ordnance Survey should consider a more diagrammatic approach to depicting certain features on their maps. There is nothing wrong with diagrams, or even maps so vague that they might almost be classed as diagrams. We are all familiar with them, even if they are only in our heads. Listen to the morning weather forecast on the radio, and you have to imagine the areas they mention; ‘the south-west, all of Wales and the north west’. When I hear that, I cannot help but imagine the outline of Cornwall and Devon sticking out to my left, Wales above and then a wiggly coastline heading northwards, with whatever weather is over it, and no thought of the Midlands, or the east coast. But later, if they mention East Anglia, I see a great curve sticking out into the German Ocean. I only see shapes defined by a single coastal outline, no relief, no towns rivers or roads. Sometimes, the M4 corridor comes into a weather forecast, and here my mind sees two parallel lines running east-west, with land rising either side of them, what is more, this high land is a grey-green colour with the texture of cotton wool. Must be something in the marmalade, or that it is usually mentioned along with fog.

For those of you still reading, might we pass the substantive motion and agree that there are lots of small inaccuracies in Ordnance Survey maps, known and unknown? Indeed, there always have been, witness the Replotted Counties, for example. And being in agreement, perhaps we should ponder whether this matters by asking ‘How accurate do we want our maps to be?’, which is a very different question from ‘How accurate do our maps need to be?’ Ignoring fractals. My reply would be that I do not necessarily want them one hundred per cent accurate, and have no need for them to be so. I would go further and suggest that most map users would agree with me. Inaccurate maps are fine by most people.

In his talk to the 1994 AGM,³ Brian Adams drew a very clear distinction between a map and a sea chart. A map is generally useable if some features are out of date or even wrong, because we can see what it shows, but a sea chart needs to be fully up to date for safety reasons, because it shows what *cannot* be seen below the surface. Looking for a church wrongly shown on a map as on the left of the road, rather than on the right, would present no problem, but the absence of a recent wreck from a sea chart could prove fatal.

Despite it being more up to date than the map they own, very few members rush out and buy the latest state of their local map when issued. They know what the old map shows, and are aware of most major and probably many minor changes not shown. They have no need for complete accuracy, and do not want it enough to fork out.

A superseded map might in other circumstances be termed a ‘second’, in the same way a map with known inaccuracies might be. Yet we continue to use them, showing that we do not mind the inaccuracies, so why should the OS worry unduly about them? After all, the Charles Close Society exists because our main interest is out of date maps. Maps which are now inaccurate, and have been superseded. Such maps are a different beast from those which were inaccurate when current.

³*Sheetlines* 40, 7. <https://www.charlesclosesociety.org/SheetlinesArchive>

Ordnance Survey outspells Harry Potter

Nevis Hulme

Harry Potter draws us into a world of intrigue and magic. Such wizardry, however, can rarely be replicated despite the progress of science and technology. The Ordnance Survey, on the other hand, has the power to entrance and amaze without resorting to fiction.

Some fifty years ago, when I was about ten years old, my father was given a number of cloth-bound One-inch Seventh Series maps of various part of Great Britain. Unlike the other maps in the house, of which there were many, these were not required for any serious purpose. They could be given to me to peruse as I desired. I remember spreading them out over the living room floor and finding mysterious places and curious features that, in those days, were difficult to explain with only a gazetteer to help. There was a fascinating world within the covers of these publications.

We lived in the north of Scotland but motored once a year to visit relatives in the Midlands. This journey, before the construction of motorways, took some seventeen hours from early morning to late in the evening. My brothers and I whiled away our time playing games and observing the changes from previous years. It was during this period that the M6 was under construction and the A9 was being upgraded. Each trip would allow us to experience a new stretch of road with the fun of picking out where we used to travel. Another favourite pastime of mine was to follow the journey with either a road atlas (the 1966 AA Book of the Road with its folded page edges was particularly useful) or, if available, an OS map, either the Quarter-inch or, rarely and briefly, the One-inch. I became adept at recognising the remains of old railways: their embankments, cuttings, old bridges or parallel fences were easy to spot. More satisfying to identify were the inconspicuous features: the field boundary curving as had the track previously or a rail-related relic amidst modern developments, for example.

Our modern equivalents of the One-inch still provide opportunity to explore these railways even although the service has long since ceased. In many cases, the track has gone and is now represented by a pecked line and the occasional 'dismtd rly' label. Here and there, this pecked line ends where the track-bed has been integrated with surrounding fields; it may be found some distance further on where the landscape has deterred landowners from subsuming the route. In built-up areas, the street pattern may give a clue as to where the trains once ran. Unlike when the track was clearly shown on the old maps, the puzzle presented can be a challenge to solve especially when development has obscured all traces.

Nowadays, we also have Google Earth and its new means of exploration. It is, however, the incredible website of the National Library of Scotland that is my destination for entering what could be termed a magical world. The ability to view maps, for example, the First and Second Edition 1:10,560 OS maps and charts from earlier times, linked to the modern image either in map or satellite form using the 'side by side' option, permits places to be interrogated to appraise how they have changed. Railways are still a favoured choice: choose a line on the map and often, unless you are in a remote spot, you will be following a disused line and seeing what remains or how the line has been built over or repurposed. The thrill of this adventure to unknown locations still entices me to take another virtual trip.

The title of this article, hopefully, no longer requires an explanation and it can be seen that, with the help of the OS, it is possible to enjoy a venture more fulfilling than make-believe.



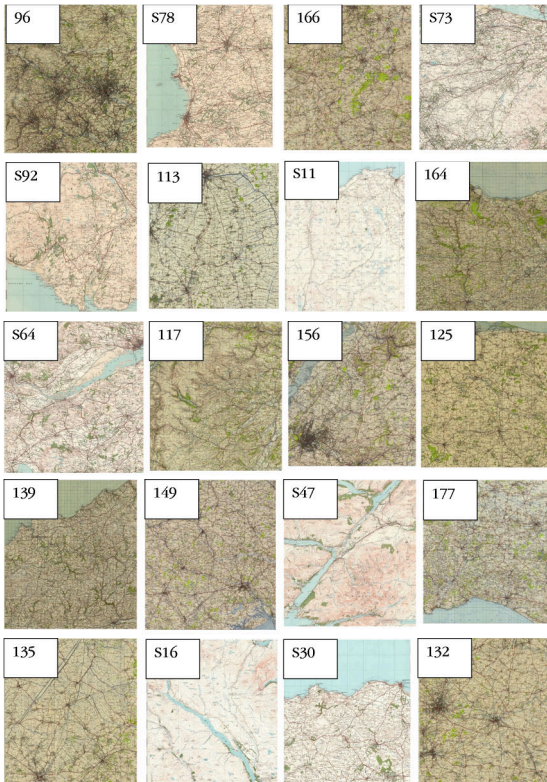
A field boundary follows the line of the former Fort George Branch of the Highland Railway closed in 1958. From Inverness-shire (Mainland) sheet I (includes: Ardersier; Nairn; Petty). OS Six-inch Second Edition, revised 1903, published 1906 with Bing satellite image. (Courtesy NLS)

Solution and Solvers

The New Popular (N) and Scottish Popular (S) sheets depicted in the *Sheetlines* 120 puzzle were: N96, S78, N166, S73, S92, N113, S11, N164, S64, N117, N156, N125, N139, N149, S47, N177, N135, S16, S30, N132.

Congratulations to the winner, Peter Strugnell and to the other successful (or very nearly so) solvers: Peter Addiscott, Chris Board, Roger Holden, Geoff Kent, John Wilson Parker, Michael Spencer, Malcolm Stacey, Dave Vaughan, Peter Wilkinson, Anthony Wood and Caroline Wood (with a little help from above-mentioned brother Anthony).

The editor thanks the Puzzlemeister for his contributions over the years. A seasonal offering from his successor will be found overleaf.



It's bucket and spade time. Identify the locations of these beaches and resorts (they are in alphabetical order), as depicted on 7th Series sheets. A 99 or a Strawberry Mivvi may assist deduction.

