

198 years and 153 meridians, 152 defunct

“Most references to county meridians in OS publications for at least 60 years have contained errors.” “Ordnance Survey’s most inaccurate maps.” “My only criticism of Guy Messenger’s book.” These are all matters that I have felt moved to write to *Sheetlines* about in the past year. But they have a common component, Cassini’s projection, and the Editor has suggested that some elucidation of this projection may be desirable for our less technical members. I am therefore putting these items together in a short series. It is hoped that our professional members will bear with the introduction to Cassini’s projection, but the Editor and I both feel it will be welcomed by the wider circle of those who are fascinated by maps, but are not so familiar with the ways they are brought into being.

Part One – Winterbotham, Cassini and Messenger

150 years and 150 meridians was the title of an article contributed to the *Empire Survey Review* by Brigadier H St J L Winterbotham in 1938.¹ The author confessed in his opening paragraph that his title was not a precise statement but an averaged one – in its then 147 years the Ordnance Survey had employed 153 fully authentic meridians in its mapping of Great Britain and the Isle of Man; the former DG excluded the numerous Irish meridians from his arithmetical survey although all had been established long before 1921. Since 1938 no new meridian has been adopted, but several had already been superseded by the time of the Survey’s centenary and many more had gone or were obsolescent by the time of its sesquicentenary. By that time too the die had been cast which was to lead to the one single meridian remaining in use today, longitude 2°W, the central meridian of the National Projection and National Grid, a Transverse Mercator projection on which much has been published in past decades.

Only one other of the 153 was a round figure; longitude 4°W was the central meridian for the first three series of the one-inch maps of Scotland which were drawn on Bonne’s projection, as were smaller scale maps of Scotland of the same period. (Bonne’s is an equal-area pseudo-conical projection on which the scale is preserved along all parallels of latitude but on only the central meridian.) The remaining 151 were central meridians of Cassini projections, two of national extent and many countywide, but the majority serving only the old large scale surveys of single towns. These meridians were drawn through the origins of the projections, which were normally specific topographical features upon which trigonometric stations were sited, and whose geographical positions were calculated through the national survey. Very few of the town surveys were in a position to adopt primary triangulation stations as their origins, but somewhat surprisingly less than half of the county origins were primary stations.

Cassini’s projection was a very basic one in which distances on the ground were plotted true to scale along the central meridian (CM) itself and at right angles to it, along great circles. If one imagines a globe turned on its side with its equator lying along the CM, it can be seen that projection distances parallel to the CM are increasingly greater than true distances on the globe as one moves away from that CM; this distortion is of no noticeable extent in a local survey, and of manageable proportions across the width of a county, but becomes a considerable nuisance over a wider area, where its problems are more

¹ Winterbotham, H St J L, ‘150 years and 150 meridians’, *Empire Survey Review* 4 (1938), 322-326.

conveniently coped with by a more sophisticated projection such as the Transverse Mercator. A short technical description of Cassini's projection and tables for its construction were included in *Methods and Processes*.²

What is not always appreciated by the layman is that in constructing most maps the familiar latitudes and longitudes, properly referred to as geographical co-ordinates, are no use in themselves and have to be converted to x and y rectangular co-ordinates by the projection formulae to enable the map detail to be drawn in. In modern times the projection co-ordinates have a dual purpose, serving also as the basis of a reference system; x and y become easting and northing. Co-ordinate lines are drawn as a grid on the face of the map, and usually form its sheet lines. But this is nothing new; all the sheet lines of the New Series, Third and Popular Edition one-inch maps of England and the Popular of Scotland are actual co-ordinate lines of a national Cassini projection, the obvious difference from today being that they are not numbered. So, too, the system of two-inch squares drawn across the face of a Popular Edition map is in modern terminology an un-numbered grid.

The reason the lines are not numbered will become apparent if we look for example at the fenland city of Ely, situated in square E9 on Popular Edition sheet 75; the co-ordinate lines bounding this square are:-

	278,420 feet south	
651,030 feet east		661,590 feet east
	288,980 feet south	

a far cry from the round thousands of figures of the National Grid squares. The origin of this nationwide Cassini projection was an early primary station in Cheshire, Delamere, situated at an internal point on Popular Edition sheet 44, the unit was the foot (the Ordnance Survey's own 'foot of 0_1 '), and the co-ordinates were measured in four directions therefrom. Delamere was adopted as the origin of the projection and sheet lines of the Old Series maps from the Preston-Hull line northwards and then for their extension south as the New Series, and their conversion in turn to the Third Edition, Small and Large Sheets, and the Popular Edition, and in due course for the extension of the latter edition to Scotland. It was also used for all the smaller scale maps derived from those series.

The position of Delamere was

latitude	53° 13' 17".274 N
longitude	2° 41' 03".562 W

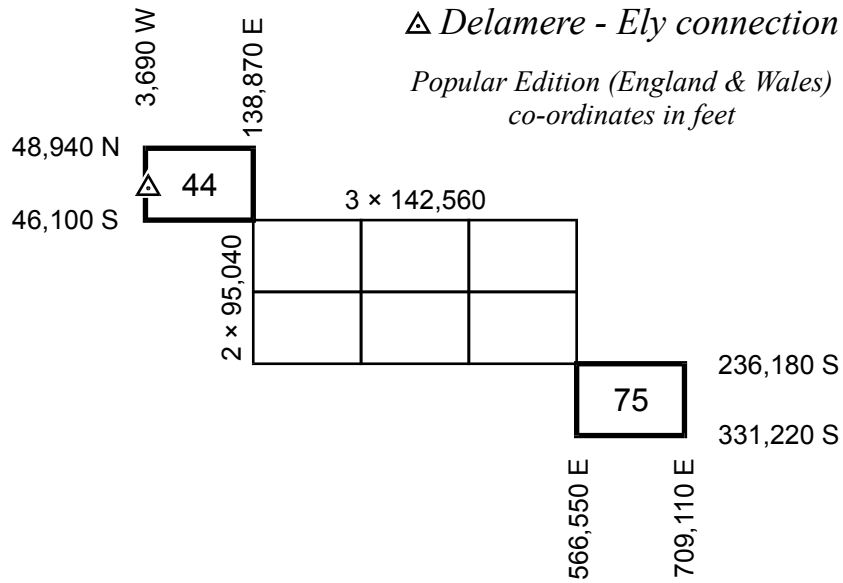
and all the sheet lines of the map series mentioned above are parallel or perpendicular to the latter meridian. The co-ordinate lines bounding Popular sheet 44 are:-

	48,940 feet north	
3,690 feet west		138,870 feet east
	46,100 feet south	

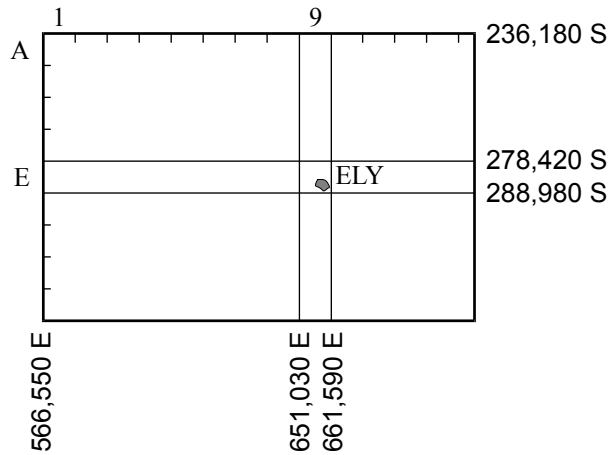
and all standard size sheets are 27 miles \times 18 miles, or 142,560 feet \times 95,040 feet. Hence, using a sheet index, the interested member can amuse him/herself by computing the Cassini co-ordinates on the Delamere origin of, say, his/her local Popular Edition sheet lines and thence his/her home; the diagram illustrates this exercise in relation to the Ely square mentioned above. This type of operation, formerly particularly familiar to the professional

² Ordnance Survey, *Account of the methods and processes adopted for the production of the maps of the Ordnance Survey of the United Kingdom*, second edition, London: HMSO, 1902.

surveyor using the county series plans, is equally applicable to the one-inch and smaller scales, except that direct reference to the maps may be necessary to carry the arithmetic through where non-standard or overlapping sheets are involved. Caution is also required in extending this exercise to Scotland through the common sheets 3 & 86 or 5 & 89, because of the one-mile overlaps introduced on the Scottish Popular Edition as well as its many non-standard sized sheets.



Sheet 75



To complete the picture I give the data for the sheets containing Delamere in the one-inch Third Edition; the co-ordinates are:-

Small sheet 109

17,260 feet north
 51,210 feet west 43,830 feet east
 46,100 feet south

Large sheet 44

	48,940 feet north	
51,210 feet west		91,350 feet east
	46,100 feet south	

Third Edition small sheets are all 18 miles × 12 miles, or 95,040 feet × 63,360 feet, whilst the standard size large sheets have the same dimensions as the standard Popular Edition sheets. Hence we may again trace local Cassini co-ordinates on Delamere through the sheet line systems.

This leads on to the Society's *The Ordnance Survey ... Third Edition (Large Sheet Series)* by Guy Messenger;³ I have but one criticism of this major monograph, and I may say at once that Guy agreed with it fully as soon as I mentioned it to him. It is the absence of any explanation in the opening pages of the items in the Sheet Histories headed 'Coordinates'. It is implicit in what I have said above that the columns of sheets in this series from nos. 3, 5 and 6 through 44 to 142 and 143 run effectively due north-south, but away from the Delamere meridian the lines of latitude and longitude run at a small angle to the sheet lines, gradually increasing to one of 3½° in sheets 68 and 88. This results in a difference of longitude of 2' 25" between the north-east and south-east corners of these vertical sheets.

Thus, strictly speaking, Guy Messenger's 'Coordinates' are the mean values of latitude and longitude along each of the four sides of the respective sheets, but they are in any case approximate, being quoted to the nearest minute only, and are provided basically for location purposes in the absence of any figures on the maps themselves. To be pedantic, it would have been better had they been headed 'Geographicals', for this is the conventional abbreviation for 'geographical co-ordinates' among professionals, whilst 'co-ordinates' unqualified would usually refer to rectangular projection co-ordinates. But this is clearly not a serious criticism, and I can but add at this late stage my congratulations and thanks to Guy Messenger for his monumental work.

Addendum – Towards a National Grid

The choice of a grid for British maps,⁴ reporting a discussion meeting of the Royal Geographical Society in March 1924, records an early use, possibly the first public use, of the expression 'national grid'. But the first stirrings towards a national Ordnance Survey Grid, as distinct from a military grid, had appeared a few years earlier. The one-inch Third Edition (Large Sheet Series) had carried an alpha-numeric reference system marked off by cross-ticks in the borders at two inch, or more correctly two scale mile, intervals. Guy Messenger records that on four of the special district sheets of this series the ticks were joined across the face of the map forming a system of two mile squares. Starting from the north-west corner these were lettered from A southwards (omitting I) and numbered from 1 eastwards, finishing where necessary with intervals of odd lengths adjoining the east and south borders.

This system was then adopted for the Popular Edition maps of England & Wales, forming, as I remarked above, an un-numbered Cassini grid, but one which was individual to the sheet concerned. However, on sheets published from 1920 onwards the system was

³ Messenger, Guy, *The Ordnance Survey one-inch map of England and Wales Third Edition (Large Sheet Series)*, London: Charles Close Society, 1988, ISBN 1 870598 03 2.

⁴ Winterbotham, H St J L, 'The choice of a grid for British maps', *Geographical Journal*, 63 (1924), 491-503.

amended so that the squares formed part of a continuous semi-national two mile grid. Thus standard sheets 35 and 37 conformed to the pattern stated above with one mile wide rectangles numbered 14 at their east ends, but the adjoining sheets 36 and 38 had one mile rectangles numbered 1 at their west ends forming two mile squares with the aforementioned number 14s. The standard sheets were all nine squares deep (A to J), and so the portrait sheets 1 and 2 had rows of one mile rectangles lettered A against their north borders so as to finish with two mile squares (lettered O) against their south borders adjoining the standard sheets 3 and 4. The portrait sheets 8 and 18 had rows of one mile rectangles on both their west and east sides, numbered 1 and 10 respectively, in order to conform to the continuous grid line system.

This semi-national two mile grid was used for sheets 43 to 47, then 35 to 40 and all sheets northward except 17 (Isle of Man), and on the extension of the Popular Edition to Scotland was duly completed across the whole of that country. All these grid lines are co-ordinate lines of the national Cassini projection on the origin of Delamere, and their co-ordinates are all multiples of 10,560 feet added to the particular co-ordinate of the relevant side of the two mile square containing Delamere; the co-ordinates of the sides of this square (which lies half on sheet 43 and half on sheet 44) are:-

	6,700 feet north	
8,970 feet west		1,590 feet east
	3,860 feet south	

Part Two – Confusion worse confounded, the gridded grid

Part One focussed largely on the application of Cassini’s projection to the one-inch map, the favourite of the purchasing public, as Brigadier Winterbotham termed them, but by whom the properties or even the existence of the projection were frequently unappreciated; subsequent parts will feature aspects of the six-inch and larger scale county series maps, wherein the projection often has a greater day-to-day impact on the user who is generally more familiar with its technicalities.

But here is someone else with a furrowed brow; he is, it seems, a Scottish ex-soldier. “You have explained” he says “how the Popular Editions of Scotland and England were constructed on a single Cassini projection, with the sheet lines parallel and perpendicular to the meridian of Delamere. But I defended these lands using these maps printed with a Cassini grid which lay at an angle to the sheet lines, and then after the war the Scottish Popular Edition was reprinted with the National Grid, a Transverse Mercator grid running at another angle to the sheet lines. Can you explain these, please?” Indeed I will try.

My sub-heading may appear over-dramatic, for one grid would not normally be printed over another one, except under the exigencies of wartime operations. But as I have indicated in Part One, grid lines on a basic map are in fact projection co-ordinate lines and are therefore still present as an invisible net even if not ruled on the map. So, to take the example of the Scottish Popular Edition with National Grid, we (apparently) have a Transverse Mercator grid on top of a transparent Cassini grid; not wholly transparent because the sheet lines are Cassini co-ordinate lines. The vital point to grasp is that the map and everything on it are constructed on Cassini’s projection, and the National Grid is present here solely as a reference system. It is perhaps best in this instance to think of the grid lines as lines on the ground, cutting the topographical features exactly as they do on the Seventh Series map; the

lines are then mapped on the Scottish Popular by Cassini's projection along with all other ground detail.

Thus, whilst on the National Projection maps of today the National Grid is an exact system of squares forming both a construction network and a reference system, when printed on any other map it will appear only as a reference grid composed of curvilinear rectangles, although often (as in the present example) they are only very slightly distorted squares. A similar effect occurs on GSGS 3907 and 3908, the military editions of the one-inch recently discussed by Richard Oliver.⁵ As stated thereon these maps carry the War Office Cassini Grid whose origin was Dunnose, a primary triangulation station in the south-east of the Isle of Wight and county origin for fifteen central counties. So even this grid, although a Cassini grid, was not quite an exact square grid when drawn on a map on Cassini's projection with a different central meridian, i.e. Delamere; and with a different central meridian the grid lines lie at an angle to the map sheet lines, technically the convergence of the two meridians. Yet another variation appears on the eleven south-western sheets of the War Revision versions of GSGS 3907, which were Fifth Edition sheets and carried the War Office Cassini Grid over the Fifth Edition Transverse Mercator projection, central meridian 2°W.

The reasons for the choice of Dunnose as the origin of the War Office Cassini Grid have never been published but are clearly connected with its prior status as the county origin for the central counties, especially Hampshire and Wiltshire which included many military establishments for which Dunnose co-ordinates would already have been in existence. The position of Dunnose is latitude 50° 37' 03".748 north, longitude 1° 11' 50".136 west, but the grid has a false origin 500,000 metres west and 100,000 metres south of Dunnose, and co-ordinates thereon are known as WOFO (War Office False Origin) co-ordinates; the grid itself was often familiarly referred to as the WOFO ('Woffo') grid.

To sum up, any grid may appear on any map for reference purposes, the projection of the base map remains paramount, and the quoted projection of the grid only refers in this case to the way it is laid down on the ground and not to its projection on the base map. The way it is laid down on that base map may confidently be left to the mathematical geodesist.

Terminology (applicable to Parts Three and Four)

When referring to the situation in the final stage of county series mapping the present tense is generally used.

'County' means a geographical county as existing prior to 1965, except that in the context of county series, Isle of Lewis, Isle of Skye and Outer Hebrides are equivalent to counties, having separate series of sheet numbers (Outer Hebrides here signifies just the Inverness-shire portion); the Isle of Man, too, is here equivalent to a county.

'Combined counties' means a group of counties, not necessarily contiguous, mapped on the same origin with a single system of sheet lines, though each county usually has its own series of sheet numbers.

'Unified counties' means a pair of combined counties with a single unified series of sheet numbers.

⁵ Oliver, Richard, 'One-inch military maps of Great Britain, 1919-1950: some notes on GSGS 3907 and 3908', *Sheetlines* 20 (December 1987), 9-12.

Part Three – Ordnance Survey’s most inaccurate maps (?)

In 1920 the OS published a booklet *A description of the Ordnance Survey large scale maps*;⁶ running through eight editions, the last published in 1954, it had a total shelf life of some forty years. Most editions contained two maps showing the origins used for the projection co-ordinates of the county series of twentyfive-inch and six-inch maps, which were drawn on Cassini’s projection. Covering respectively England & Wales and Scotland, they depicted the county origins and their meridians in red over black base-maps showing the counties. The same maps were included in Brigadier Winterbotham’s *The National Plans* published in 1934.⁷ Throughout they were entitled ‘Diagram ... showing meridians’, the Ordnance Survey’s usual practice being to describe a map as drawn on the meridian of so-and-so. But every point on a flat surface has to be fixed by two co-ordinates and it is their origin which is the definitive feature. Further, a plot of positions on a geographically true base-map, especially when produced by the OS, would hardly be regarded as a diagram.

However, most people will know that St Paul’s is situated in the centre of London and not in the vicinity of Harrow in Middlesex, where it is marked on the England & Wales map; many will know that Leith Hill is as near the southern boundary of Surrey as it is depicted near the northern. Anyone familiar, if only as a map user, with the peaks which comprise the origins in the Scottish Highlands will realise that several of them are shown miles out of position; indeed Ben Cleugh placed in the middle of Perthshire actually lies in Clackmannanshire. A detailed check, inspired by these evident errors, on all thirty-eight origins suggests that they were thrown at the map from some way off, for their positions are virtually all in error by distance rising to 17 miles, the average error on the Scottish map being 5.6 miles and on the southern map 5.2 miles. A glance at the maps accompanying this article will show that the erroneous positions lie in all directions from their true positions, so that the meridians are as much in error as the origins themselves.

The red plates also carry firm lines enclosing the groups of combined counties, as do black ones on my maps, but in some editions of the OS booklet as well as *The national plans* West Lothian is incorrectly included with the counties drawn on The Buck instead of those on Lanark Church Spire. Several incorrect spellings of the names of the origins also persist through some or all editions of the maps. All these facts lead to the suggestion that these two maps must be among the OS’s most inaccurate, and I find it surprising that such maps, produced for the information of map users and surveyors by the country’s national cartographic authority, continued to be reprinted without major correction for so long. I find it equally surprising that Winterbotham, who one supposes was particularly familiar with the subject, should have included the maps in his Professional Paper without apparently realising the errors they contained, especially the incorrect assignment of West Lothian to the origin of The Buck.

For some reason the four south-western origins in England were not plotted on the maps in the first three editions of the OS booklet, being indicated solely by their names and meridians. In the original edition only, the remaining English and Welsh origins were marked by open circles, and Danbury Church Spire which (as will be explained in Part Four) lay

⁶ *A description of the Ordnance Survey large scale maps*, OSO Southampton, undated (1920); second edition (1922); third edition (1926); fourth edition (1930); fifth edition (1937); sixth edition (1939). *A description of the Ordnance Survey large scale maps*, OS Chessington, unnumbered edition, 1947. *A description of the Ordnance Survey large scale plans*, OS Chessington, unnumbered edition, 1954.

⁷ Winterbotham, H St J L, *The national plans*, Ordnance Survey Professional Papers, New Series 16, HMSO 1934.

outside the combined counties drawn on it, continued to be so marked throughout the life of the map. Otherwise, and on the Scottish map from the start, the origins were indicated by solid dots. There is no official list of the county origins and some of their names will be found in varying forms in OS internal documents and publications. I have examined as many of these sources as possible and drawn up a list of generally accepted forms as given on the page of abbreviations accompanying my two maps. It should be remembered that the names of the origins date from the early days of the Survey, and that the spellings adopted for them at that time remain unchanged in their roles as origins, notwithstanding any changes in their spellings as features. In addition to the definite spelling errors already mentioned, the maps in the OS booklet have some names differing in form from the approved norms, e.g. Brandon instead of Brandon Down.

The red plates were re-prepared for the fourth (1930) edition and it was at this stage that the combined counties' boundary was diverted to the wrong (west) side of West Lothian; it was corrected to run east of this county in the fifth (1937) edition. The sixth (1939) edition contained a single newly-drawn map of Great Britain in black only, but it must be presumed that this was lost in the bombing as the first post-war edition of 1947 reverted to the old pair of two-colour maps and to the erroneous assignment of West Lothian! The latter was re-corrected in the final 1954 edition, which also for the first time correctly spelt Scour-na-Lapich (previously -Lopach) though it included the hyphens not generally used. For this last edition the title of the booklet was altered to *A description of the Ordnance Survey large scale plans*.

Even the black base-maps (excluding the sixth edition) contained some strange features; the old county names of Carnarvon, Edinburgh, Elgin, Forfar, Haddington and Linlithgow appearing in the first edition were all altered to their modern forms in the fourth, but the 'm' in Dumbarton was never corrected to 'n', and the older alternative spelling Argyle was used throughout although this spelling was not otherwise used by the OS as far as I can determine. These two counties were spelt correctly in the sixth edition. But the oddest feature of the base-maps was the remarkably idiosyncratic selection of towns; only one (Aberdeen) appeared on the Scotland map, and none appeared in thirty-six counties of the southern map, whereas, for example, Lincolnshire contained Grimsby and Grantham, and in the East Riding the village of Flamborough was marked together with Hull. In the post-war editions the positional circle at Flamborough was deleted, but although the name might have been regarded as applying to the promontory the word 'Head' was not added; in these editions too an intrusive 'o' appeared in Middlesboro'.

In 1975 a new publication appeared, *Ordnance Survey maps, a descriptive manual* by J B Harley,⁸ replacing the former three booklets on different scales. Unfortunately it includes a single plate of Great Britain combining the material on the pair of maps in the former large scale booklet; the glaring errors in the positions of the origins and meridians (now on a blue plate) are all reproduced, as well as the peculiar selection of towns plus the name Flamborough. Three spellings are corrected and the abbreviation for 'Island' altered, but Argyle and Dumbarton remain, and an additional error is introduced in the boundary of Peebles on the black but not on the blue. These matters can hardly be laid at Brian Harley's door, for the plate is clearly the result of an unthinking exercise by the drawing office in combining the two old maps, but it has to be regarded as a prime contender for the Ordnance Survey's 'most inaccurate map' title.

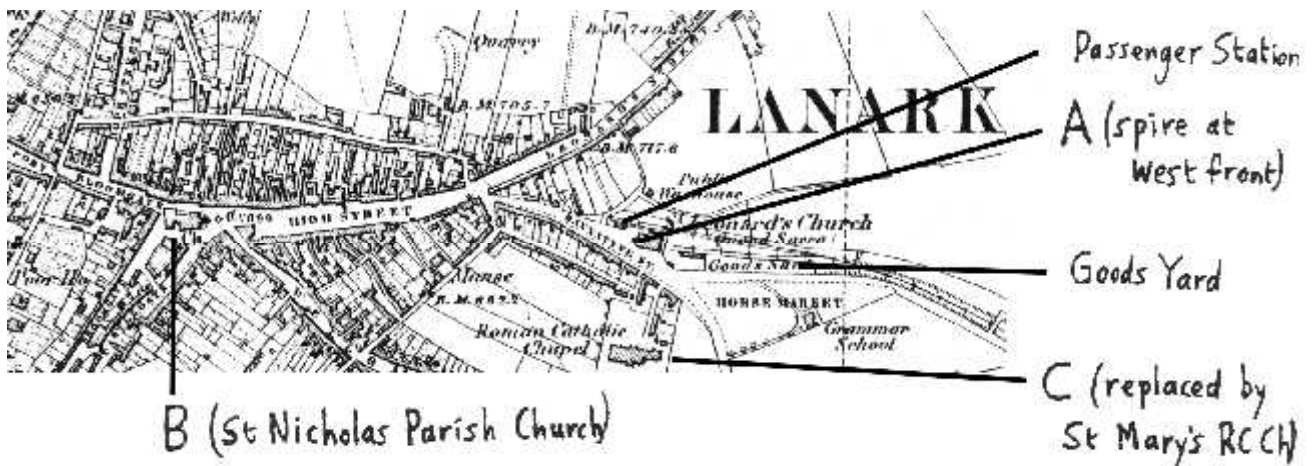
⁸ J B Harley, *Ordnance Survey maps, a descriptive manual*, Southampton: Ordnance Survey, 1975.

I cannot forbear to add that, apart from a small displacement of Lanark, none of the catalogue of errors appears on the maps in a booklet issued by the Hydrographic Department for its surveyors and staff in 1946 (in which a young hydrographic officer named B W Adams had a considerable hand).⁹ On another page this booklet does contain incorrect co-ordinates for the sheet lines of Zetland 54 (Foula), but my research into the present series has confirmed that the erroneous figures were supplied from, and still remain in, the OS records at Southampton and Kew.

Puzzle corner

Which county origin has the same name as a well-known TV presenter whose home is in that county? – see page 00.

Brian went to Lanark in 1995 to investigate the uncertainties surrounding the actual location of the trig. station Lanark Church Spire, generally assumed locally to be the parish church, St Nicholas (B on the plan he drew following his visit). His findings are summarised here.



Brian's first qualm on approaching Lanark from the east was to find the skyline dominated by a spire (C) southward of the expected place; this turned out to be one which had replaced a burnt-down predecessor which itself had only been in the course of construction at the time of the first large scale OS survey, and had therefore not been used as a trig. station. But his main surprise was to find the spot where he had expected to find another church, St Leonard's (A), occupied by a Job Centre. The church had been demolished in 1969.

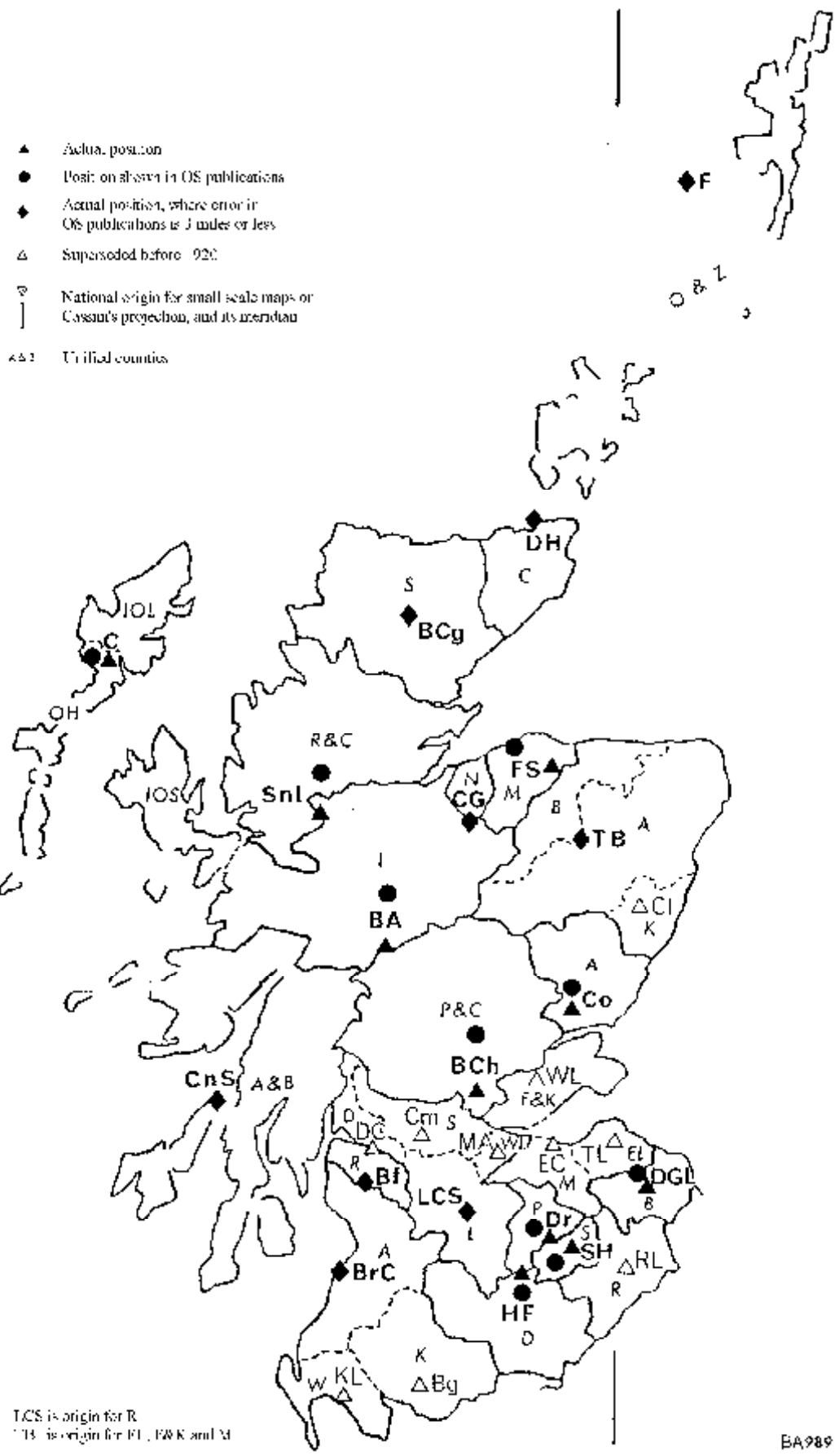
He quoted the fundamental data referring to Lanarkshire from the Ordnance Survey sheet line co-ordinate data referring to the old County Series plans:

Origin: Lanark Church Spire, Lat. 55° 40' 24".170 N., Long. 3° 46' 18".370 W.

		18,120 feet north
<i>Sides of six-inch Lanarks sheet 25:</i>	19,680 feet west	12,000 feet east
		3,000 feet south

By transferring these figures to Lanarks 1:500 sheet XXV.15.13, he confirmed that the origin of the county co-ordinate system is the trig. point shown in the position of St Leonard's Church Spire (C), the trig. point being marked at 672 scale feet from the western neat line and 168 scale feet from the northern neat line of the 1:500 plan.

⁹ HD 364, Ordnance Survey sheet line co-ordinate data for six inch and 1:2,500 sheets, Hydrographic Department of the Admiralty, Restricted Issue 1946.



County origins – Scotland

List of county origins

<i>Code</i>	<i>Name of origin</i>	<i>Latest form</i>	<i>Geographical position</i>		<i>Identification on 1:50,000 map</i>		
			<i>latitude</i>	<i>longitude</i>	<i>N G ref.</i>	<i>m.</i>	<i>Name at point</i>
BA	Ben Auler	Ben Alder	56° 48' 50".431	4° 27' 49".113 W	NN496719	1148	
BCh	Ben Cleugh	Ben Cleuch	P 56 11 08.695	3 46 03.873 W	NN903006	721	
BCg	Ben Clibrig	Ben Kilbreck	P 58 14 07.844	4 24 35.534 W	NC585299	961	Meall nan Con
Bg	Bengray		54 54 51.940	4 08 11.178 W	NX631598	366	
Bd	Blackdown	Black Down	P 50 41 10.287	2 32 52.432 W	SY613876	237	Hardy Monument
Bl	Bleasdale ^a		53 54 55.388	2 37 20.809 W	SD591468	510	Fair Snape Fell
BD	Brandon Down		P 54 45 17.630	1 40 36.632 W	NZ208401	266	
Bf	Broadfield		55 47 59.798	4 32 20.609 W	NS409592	236	
BrC	Brown Carrick	Brown Carrick Hill	55 24 26.531	4 42 41.070 W	NS284160	287	
Cl	Caerloch	Kerloch	56 58 52.543	2 29 56.890 W	NO697879	534	
CG	Cairn Glasher	Carn Glas-choire	57 20 22.829	3 50 30.775 W	NH891292	659	
C	Cleisham	Clisham	P ^m ⁿ 57 57 50.561	6 48 41.648 W	NB155073	799	
			57 57 47.350	6 48 42.073 W			
Cm	Corkmulaw	Cort-ma Law	55 59 36.745	4 09 44.286 W	NS651799	531	
Co	Craigowl		56 32 52.216	3 00 48.599 W	NO377400	455	Craigowl Hill
CnS	Cruach-na-Sleagh	Cruach na Seilcheig	56 07 08.247	5 43 34.944 W	NR684981	296	
CyB	Cyrn-y-Brain	Cyrn y Brain	P 53 02 16.870	3 10 22.300 W	SJ214496	562	^b
DCS	Danbury Church Spire		P 51 42 57.897	0 34 32.746 E	TL779051		
Del	Delamere		P 53 13 17.274	2 41 03.562 W	SJ543696	176	Pale Heights
DGL	Derrington Great Law	Dirrington Great Law	55 47 12.070	2 28 51.930 W	NT698549	398	
Di	Ditchling		P 50 54 04.039	0 06 21.838 W	TQ332131	248	Ditchling Beacon
DC	Dumbarton Castle		55 56 12.478	4 33 46.136 W	NS399745		
DH	Dunnet Head		P 58 40 09.962	3 22 13.056 W	ND205765	127	
Dn	Dunnose		P 50 37 03.748	1 11 50.136 W	SZ568802	235	Shanklin Down
Dr	Dunrich	Dun Rig	P 55 34 19.950	3 11 01.472 W	NT254316	742	
EC	Edinburgh Castle		55 56 54.110	3 11 53.440 W	NT252735		
FS	Findlay Seat	Findlay's Seat	57 34 42.276	3 14 26.599 W	NJ258549	338	Brown Muir
FH	Forest Hill	The Forest	54 25 30.680	2 43 41.580 W	NY528036		
F	Foula		P 60 08 26.609	2 05 38.668 W	HT948395	418	The Sneug
HF	Hart Fell		P 55 24 28.961	3 24 00.212 W	NT114136	808	
He	Hensbarrow	Hensbarrow Downs	P 50 22 58.810	4 49 05.137 W	SW997575	312	
Hg	Highgate		51 39 37.750	4 56 17.995 W	SR968999		

Code	Name of origin	Latest form	Geographical position			Identification on 1:50,000 map		
			latitude	longitude	N G ref.	m.	Name at point	
HP	High Pike		54 42 19.170	3 03 26.600 W	NY319350	658		
Ho	Hollingbourne		51 16 10.380	0 39 55.564 E	TQ859557	197		
KL	Knock of Luce		54 51 58.316	4 43 10.206 W	NX255558	175	Knock Fell	
LCS	Lanark Church Spire		55 40 24.170	3 46 18.370 W	NS886436		^c	
LHT	Leith Hill Tower		51 10 32.887	0 22 11.049 W	TQ139432	294		
LI	Llangeinor	Mynydd Llangeinwyr	51 38 26.680	3 34 17.000 W	SS913948	568	Werfa	
MA	Mount Airy		55 55 22.038	3 37 05.376 W	NS989711	312		
NCT	Nantwich Church Tower		53 04 00.152	2 31 09.186 W	SJ652523			
	Otley Church Tower		52 08 53.789	1 13 17.963 E				
RT	Rippon Tor ^a		50 33 57.034	3 46 12.078 W	SX747756	473		
RL	Rubers Law		55 25 55.971	2 39 48.069 W	NT580156	424		
SP	St. Paul's Cathedral ^d		51 30 47.753	0 05 48.356 W	TQ321811			
SH	Sandhope Heights	Sundhope Height	55 30 10.253	3 02 31.092 W	NT342237	513		
SnI	Scournalapich	Sgurr na Lapaich	57 22 10.334	5 03 31.678 W	NH161351	1150		
Si	Simonside ^a		55 16 50.750	1 57 26.410 W	NZ027985	429		
SB	South Berule	South Barrule	54 08 57.597	4 40 05.328 W	SC258759	483		
	Stafford Castle ^o		52 47 51.000	2 08 44.580 W				
TB	The Buck		57 17 18.978	2 58 11.630 W	NJ415224		Kebbuck Knowe	
TL	Traprean Law	Traprain Law	55 57 48.110	2 40 13.380 W	NT582747	221		
WL	West Lomond		56 14 43.980	3 17 43.583 W	NO197066	522		
			56 14 44.430	3 17 44.146 W				
YM	York Minster		53 57 43.265	1 04 49.752 W	SE603522			

^a properly Bleasdale new, Rippon Tor new, Simonside new (names of trig. points).

^b adjacent to Sir Watkin's Tower.

^c not on map; position of church is just within circle of railway station symbol.

^d conventionally St. Paul's.

^m accepted value.

ⁿ value used originally for sheet graduations.

^o properly Stafford Castle (centre).

P principal triangulation station.

No key is provided to the initials of counties; readers unfamiliar with the British counties prior to 1965 are referred to an appropriate map.

Part Four - The story of the county origins

Most of the textual references to county meridians or county origins in OS publications for at least sixty-five years have contained errors, particularly as to the numbers in use at different times, whilst their graphical depiction was shown in Part Three of this series to be a cartographic disaster area. Yet they were fundamental to much the greater part of OS mapping up to the Second World War. Further words on this wider aspect fail me, but it is the purpose of this present part to record the true numbers involved. *A history of the Ordnance Survey*, Chapter 21,¹⁰ mentions some of the differing arithmetic in previous publications and remarks ‘These discrepancies are not easy to resolve ... it is difficult to establish the initial situation and the subsequent history.’ Frankly, I find this nonsense; the bones of the story are adequately documented even though some of the flesh is missing, and a day-and-a-half at Southampton, two afternoons at Kew, and some hours at Parsons Green on my calculator, sufficed to elicit the relatively few details of the old county origins which I did not know already. Chapter 21 also wrongly assigns the transfer of West Lothian to The Buck, which can only have been suggested by the incorrect editions of the maps described in Part Three. I have to admit here that some of the faulty arithmetic on county meridians is in Brigadier Winterbotham’s 1938 article,¹¹ whilst some of his other figures are rather suspect, and these facts cast doubt on the figures in my series title, though there is no question that they are all defunct but one.

The reasons for the adoption of county series mapping by the OS have been frequently aired and I do not wish to expand on them here; very briefly it was the normal practice at the time of the foundation of the Survey. County-based (large scale) OS mapping in Great Britain started in 1840 with the six-inch surveys of Lancashire and Yorkshire, using the origins of Bleasdale and York Minster; these were followed by seven Scottish counties (see Terminology, page 00), and immediately two anomalies appear. Cleisham, the origin selected for Isle of Lewis, lay three miles outside the county boundary. Although this was unusual for the time, Cleisham was a primary station of the old triangulation, conveniently situated to be on the edge of the Lewis sheet line system. Whether there was any thought that it would be used for the rest of the Outer Hebrides it is impossible to guess. Secondly, Fife and Kinross were published as unified counties on the origin of West Lomond. It seems to have been early recognised that because of the small size of a few Scottish counties, and the strange configurations of some prior to the extensive boundary rationalisations of 1889-91, the adoption of unified sheet line systems for some pairs of counties, one large and one small, was the only reasonable course. In such circumstances both counties were mapped together on the relevant sheets, whereas the early large scale plans were not otherwise filled to the borders with adjoining counties.

Returning to Fife and Kinross, Winterbotham (1938) makes the categorical statement ‘Even Kinross-shire ... had its own meridian’, but had it? The actual survey consisting of angles and chainings had no origin; only when it reached the computer (a human being armed with log tables) had meridian and origin to be selected for the calculation of co-ordinates. There were certainly instances when the origin chosen initially for these calculations was superseded by another before the publication of the relevant maps, and such may have occurred in Kinross. But there is no evidence of it at all in the surviving material I

¹⁰ Seymour, W A (ed.), *A history of the Ordnance Survey*, Folkestone: Dawson, 1980.

¹¹ Winterbotham, H St J L, ‘150 years and 150 meridians’, *Empire Survey Review* 4 (1938), 322-326.

have examined at Southampton and Kew, and it seems just possible that Winterbotham, writing three years after his retirement, was relying on an imperfect memory. The other four counties first surveyed and published at the six-inch scale were Edinburgh (later Midlothian) on the origin of Edinburgh Castle, Haddington (East Lothian) on Traprean Law, Kirkcudbright on Bengray, and Wigtown on Knock of Luce.

Thereafter (glossing over the battle of the scales) the twentyfive-inch took over as the ruling scale, but the same pattern of county mapping continued, with Clackmannan & Perth and Argyll & Bute published as unified counties. The ‘skeleton’ survey of London, undertaken forty years before the creation of the County of London, adopted St Paul’s Cathedral as its origin, and this was followed in 1862 by the full survey, which was in effect the most extensive of the old town surveys. The Middlesex county survey was executed concurrently with this and naturally used the same origin, but the Hertfordshire survey commenced three years later was also published on the meridian of St Paul’s. Although Middlesex and Hertfordshire were drawn on the same origin with a single continuous system of sheet lines, they were not published as unified counties, as defined in my terminology, but formed two separate series of maps, each individually numbered. However the secondary and tertiary surveys were linked across the common boundary and the cross-boundary sheets were joint sheets with dual numbers in both series.

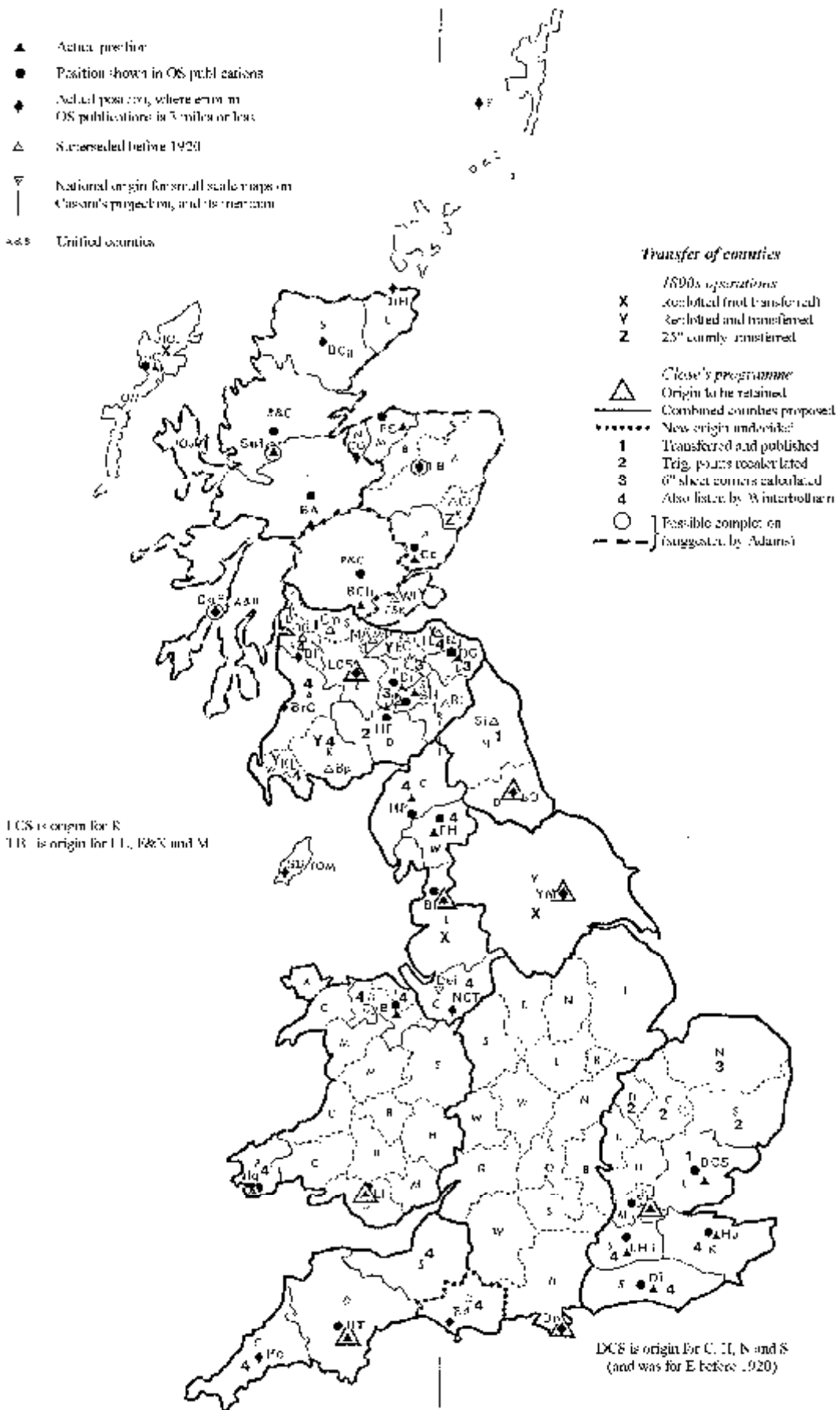
This first publication of combined non-unified counties was tangible recognition of the difficulty caused by adjoining areas having been independently surveyed and mapped and simply not joining properly. It set the pattern for the greater part of the remaining county series mapping with blocks of combined counties of increasing size, culminating in twelve Welsh and Marcher counties on the origin of Llangeinor, and fifteen central English counties on the origin of Dunnose. For some reason, however, combined counties found little early favour in Scotland apart from the unusual case of Aberdeen and Banff, two more pairs of unified counties (Ross & Cromarty – then still separate counties – on Scournalapich and Orkney & Shetland, or Zetland, on Foula), and the special cases of the Inner and Outer Hebrides. The origin selected for Aberdeen was The Buck, which was also well situated to be that for Banff although at that time it was four miles outside the latter county. So the two were mapped as combined counties but with the cross-boundary sheets issued as two individual sheets, neither filled to the border with the other’s ground. Yet these counties were, and always remained, indexed together on the same sheet and I suspect they may have been intended originally to be unified counties, but were numbered separately under the influence of the almost simultaneous publication of Middlesex and Hertfordshire.

This phase of county mapping was completed in 1891, with all but the original nine six-inch counties having been published on both the twentyfive- and six-inch scales, and there was a total of forty-nine county origins in use in Great Britain and the Isle of Man. There followed ‘one of the Ordnance Survey’s worst errors’ (*A history of the OS*), the infamous episode of the Replotted Counties whose twentyfive-inch maps were largely drawn from the old six-inch surveys from 1887 onwards. The only good thing to emerge from this operation was the tardy emergence of two sets of combined counties in Scotland, where the six mainland counties involved were transferred on to two other existing origins, Kirkcudbright and Wigtown being redrawn on the Ayrshire meridian of Brown Carrick, and Edinburgh, Fife & Kinross and Haddington being redrawn on The Buck. It is a pity that this aspect of the Replotted Counties operation is omitted from the Seymour-edited history as it was the first time that the plans of a published county were transferred, that is, redrawn on a new origin

with a new set of sheet lines on a slightly different orientation. But an even more significant operation executed a few years later, over the turn of the century, was the transfer of Kincardine from its first origin of Caerloch also on to The Buck. This was the first transfer of a county which had already been published on the twentyfive-inch scale, predating the next by a dozen years, and yet it seems almost certain that it has never been mentioned in print. It was not described in OS reports of the time, nor in the more recent standard works, and I am indebted to Michael Wood and his colleagues at Aberdeen University for confirmation that it does not seem to have been recorded locally. A glance at the map will suggest that the transfer of the Forthside replotted counties on to The Buck must have been carried out with the eventual transfer of the intervening counties of Forfar (Angus) and Kincardine also in mind, yet the whole process of thought and partial(?) execution appears destined to remain an intriguing mystery.

There were now still forty-three origins in use and the problems of adjoining counties on different origins were becoming more pressing, especially where built-up or industrialised areas crossed the boundaries of non-combined counties. It should also be mentioned that most of the principal estuaries had their opposite shores in different counties, and the hydrographic surveyor, working for example in the Thames Estuary, could fix his position from up stations in Essex or from those in Kent, but he could not obtain a fix from a mix of stations on both sides of the estuary. So it was that Colonel Charles Close decided in 1912 to institute a rolling programme to transfer one-by-one as many counties as possible on to other existing origins, but still recognising that Cassini's projection was not suitable for areas wider than about three average counties at the large scales. The procedure was firstly to compute the co-ordinates of the relevant primary and secondary stations of the new origin, then to re-compute the tertiary points from the old observations on to the new positions, and hence to redraw the plans on the new sheet lines. It has to be said, however, that combining independent surveys on to a single map does not eliminate the intrinsic problems, but merely presents them in a new form.

The programme, commenced in earnest in 1913, was interrupted by the First World War, and had to be abandoned 'temporarily' in the post-war stringencies of 1919, never to be resuscitated. By 1919 six counties had been transferred and five origins, not six as has often been stated, had been eliminated, leaving a total of thirty-eight in use for the final period of county series mapping. In Scotland, Dumbarton (later Dunbarton), Linlithgow (West Lothian), Roxburgh and Stirling were all transferred on to Lanark Church Spire, whilst in England, Northumberland was transferred on to Brandon Down and Essex on to St Paul's. This programme eliminated the old origins of the first five (Dumbarton Castle, Mount Airy, Rubers Law, Corkmulaw, Simonside, respectively) but the former Essex origin, Danbury Church Spire, still remained in service for Cambridge, Huntingdon, Norfolk and Suffolk, although outwith that combined area. When the transfer programme ceased the data had been re-computed for five more counties – Cambridge, Huntingdon and Suffolk to go on to St Paul's, Dumfries and Selkirk on to Lanark Church Spire – and (not previously recorded) the new sheet line patterns had been devised and the latitudes and longitudes of the full six-inch sheet corners calculated for four more – Norfolk (sheet numbering provisional), Berwick, Edinburgh (Midlothian) and Peebles, on to the same two origins.



EA 493

County origins (1920)

Winterbotham (*The national plans*) states in his Chronology, Section 27, but not in the main text of Section 12, that Close intended to reduce the number of meridians to eleven. He also lists in Section 12 what he terms ‘the remainder of Close’s programme’ but which only includes the counties south of the River and Firth of Forth, and shows that these would have been combined into eight blocks. The limits of these blocks, the origins involved, and the stages reached in the different counties are illustrated on the map herewith; it will be noticed that four of the replotted counties were to have been transferred a second time!¹² Looking at the areas north of the Forth and west of Loch Long, I conclude that Close’s supposed target of eleven could only be met if his programme were restricted to the mainland of Great Britain plus the Inner Hebrides, and my map also depicts a purely personal suggestion as to how the programme might have been completed on that basis.

I finish with a table summarising the numbers and changes of county origins in Great Britain and the Isle of Man:-

Origins used for the first county plans either 6-inch or 25-inch		49
Replotted counties:	total	9
Replotted counties transferred:	counties	6
	origins	5
25-inch county transferred 1899+		1
Origins in use 1902-1913		43
Close’s programme:	counties transferred	6
	origins eliminated	5
Origins remaining in use 1919+		38

Part Five - Ireland

I derived my series title from Brigadier Winterbotham’s 1938 article ‘150 years and 150 meridians’ and so far I have followed him in restricting my coverage to Great Britain and the Isle of Man, but I wish to conclude by highlighting the situation in Ireland, one of those select places fashioned by nature to fit neatly on to the page of an atlas and equally neatly bisected by the meridian of longitude 8° west of Greenwich. This meridian has served as the central meridian for all the national OS projections of Ireland, the Bonne’s projection used for the old one-inch and smaller scale maps, the old Irish Grid on Cassini’s projection used for military versions, and the Transverse Mercator projection of Ireland and the new Irish Grid which is its visual manifestation. All these, too, have a common centrally-placed true origin, situated just in the waters of Lough Ree, at latitude 53° 30' N longitude 8° 00' W, forming a distinct contrast to the four national meridians which have been used in Great Britain, Delamere, 4°W, Dunnose, and 2°W.

So, is Ireland then a cartographer’s dream? – for small scales maybe, but for larger scales it has been a cartographer’s nightmare. Winterbotham refers to ‘respectable fully-fledged’ meridians; taking these words out of context it could be said that Ireland had only one such,

¹² Winterbotham, H St J L, *The national plans*, Ordnance Survey Professional Papers, New Series 16, HMSO 1934. *The replotted counties*, supplement to the above, official use only, OSO Southampton, 1934.

8°W as above, for all the others were at best provisional. Under pressure to commence large scale surveying in Ireland, the OS started while the primary triangulation was still being completed and well before it was computed and adjusted. Consequently, only provisional values could be determined for the positions of the thirty-two county origins, and no latitude or longitude figures were provided in the sheet borders. But not just their positions were provisional, so were the corresponding directions of true north, and although each county six-inch series could stand on its own as a separate ungraduated block, something had to be done when the time came to reduce the thirty-two blocks into a cohesive whole to draw the one-inch series. So the computing staff at Southampton carried out an intriguing but completely lost ‘adjustment’ to bring the thirty-two blocks into some sort of sympathy, resulting in another set of provisional geographical positions for the county origins and thirty-two ‘county twists’ or angles of rotation, each applied to the respective county six-inch block in its entirety. The county twists ranged from 32.82 seconds anti-clockwise to 48.34 seconds clockwise, in the sense to bring the county sheet lines on to true north. No suggestion ever appears to have been made to transfer counties and form combined blocks in Ireland.¹³

So far I have omitted reference to the town plans, and it may have been them and the indeterminate nature of much of their surveying backgrounds that decided Winterbotham to omit reference to Ireland altogether; I am indebted to Professor John Andrews for some additional background to his published works on the subject.¹⁴ It is difficult to decide whether the original manuscript plans would have come within the Brigadier’s terms of reference; some fall distinctly short of his requirements whilst the Dublin series was eventually published and would certainly have qualified. Suffice to say here that 125 towns were drawn, probably all on their own meridians, but nineteen of these contained their respective county origins and may therefore be expected to have shared those origins (but I decline to say ‘confidently expected’). Moving forward to the printed town plans: although they were surveyed independently they were tied in, or more probably forced in, to the surrounding smaller scale work and the majority were on the county origins, but further research is needed to ascertain whether some of the earlier printed plans were oriented on local origins. It therefore appears that the total number of origins or meridians used in Ireland was about 140.

I finish with a Government Health Warning for the unwary – Irish large scale plans can seriously damage your calculations. These plans are drawn to a different module from those in Great Britain, for they are related to the Irish full six-inch sheet size which represents 32,000 feet × 21,000 feet, not immediately obviously different from the 31,680 feet × 21,120 feet of the Great Britain plan sheets.

*Sheetlines 25, August 1989; Sheetlines 26, December 1989; Sheetlines 27, April 1990
plus other unpublished material*

Puzzle corner – answer

The reference in Part Two is to Rippon Tor, county origin of Devon, the home county of Angela Rippon.

¹³ Murphy, Thomas, *The latitudes and longitudes of the six-inch sheet maps of Ireland*, Geophysical Bulletin 13, Dublin: Institute for Advanced Studies, 1956.

¹⁴ Andrews, J H, *History in the Ordnance map*, Dublin: OSO Phoenix Park, 1974; *A paper landscape*, OUP, 1975.