

***Iron Age and Roman square enclosures  
near Venta Icenorum: Roman changes in a prehistoric  
ritual landscape***

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**Summary**

Eight square enclosures near *Venta Icenorum* can, in most cases, be measured using a Roman unit of length. This, and their close association with the axes of a Roman cadastre, suggests that some of them are Roman. The enclosures form two groups, one of which lies at the centre of a large group of Bronze Age barrows. Such a coincidence of a supposedly Roman feature with an earlier monument is known to occur at only one other site in this prehistoric ritual landscape; this is the Neolithic Arminghall Henge, whose centre also lies on a cadastral axis. The axis of the Henge, as it probably appeared in the first century AD, joins these two sites. This correspondence between Roman and earlier features, and the angular relationship between the cadastre and the Henge axis, suggests that the Roman surveyors deliberately created harmony between their cadastral layout and the prehistoric landscape. Convergence of Icenian and Roman norms may also be evident, in a different form, in the square enclosures.

**Outline of the argument**

Excavations in 1989-91 in the area immediately north of the Roman town of *Venta Icenorum* (figure 1) revealed, among other monuments, eight square-ditched enclosures of a type previously unknown in Norfolk. The excavation report (Ashwin and Bates 2000) suggests that they are ritual/funerary monuments of Caesarean or early Roman date and, after comparing them with similar Iron Age and Romano-Celtic monuments from other parts of Britain, concludes that they are most likely to date from the late Iron Age.

Measurement of the monuments using the *passus* of 1.479m, five Roman feet, makes it arguable that some of them are Roman. Their relationship to a Roman cadastre, South Norfolk A, supports this idea. The monuments form two groups which lie on its axes. This coincidence is unlikely on the basis of chance but is typical of Roman tombs and other ritual monuments in other cadastres.

These enclosures lie within an earlier ritual landscape of the Neolithic and Bronze Age (figure 2). One group seems unrelated to any earlier monument, but the other lies at the centre of the largest group of barrows, which thus seems to have influenced its location and the location of a cadastral axis. The same can be said of the Arminghall Henge, the landscape's initial focus; it shows signs of Roman activity and it is also bisected by a cadastral axis. These are the only places where this is known to happen.

It is at first sight very surprising to find Roman cadastral axes passing through significant features of the prehistoric ritual landscape. However, statistical evidence shows that, in all probability, this coincidence was planned. This view is supported by another relationship between cadastre and Henge. It is likely that in Roman times the south-west orientation of the Henge was clear. The value of the tangent of the angle between this orientation and that of the cadastre (which is 4:3), suggests that the two were deliberately put in harmony.

Roman cadastres sometimes have planned harmonic relationships to earlier Roman landscapes so it should not really surprise us that this cadastre appears to be deliberately linked in the same way to the visible orientation established by pre-Roman monuments. Whatever the origin of the earlier landscape, the Roman surveyors are likely to have used the same principles to choose points of coincidence and relative orientations. From what we know of these principles we can develop a model to explain how these relationships could have been achieved in this case.

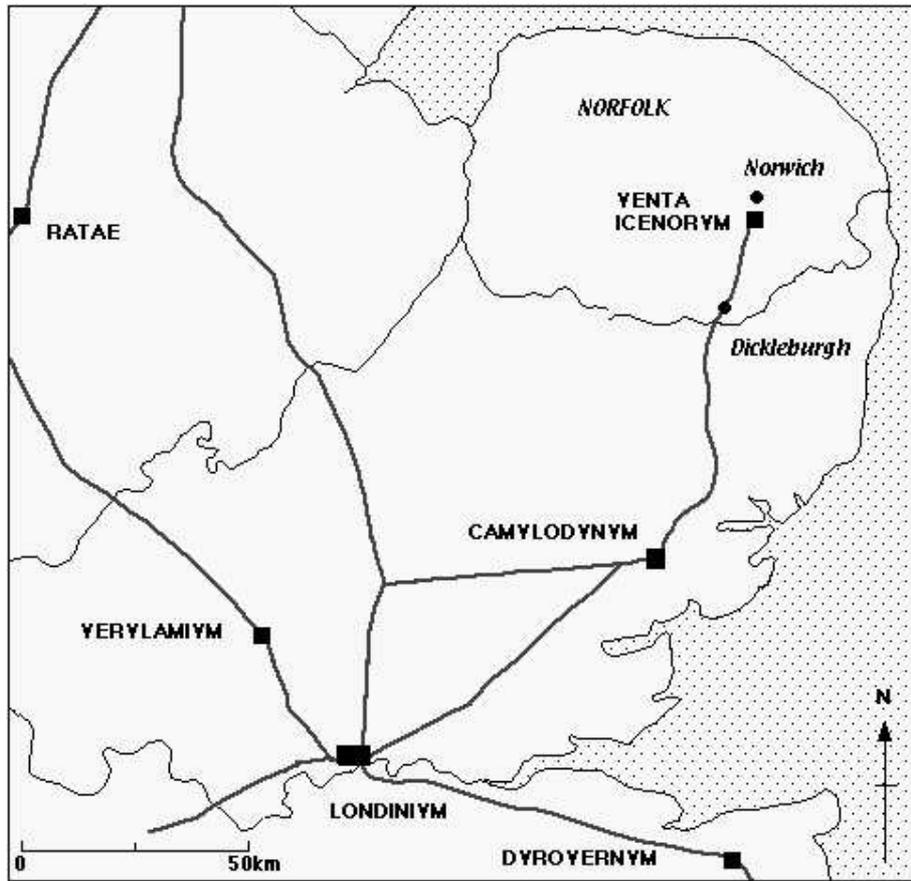


Figure 1. Location of *Venta Icenorum*, with other principal Roman towns and roads

The cadastral system was surveyed as an act of the Roman state and a reason needs to be found for the apparent wish of the Roman surveyors to incorporate earlier landmarks within it. One reason could be that they recognised the need to define the system by substantial landscape features, so that it could easily be redefined when it broke down. It is also possible that this is a case of syncretism, whereby the links to the earlier cultural landscape legitimated the Roman land survey.

The differences which can be seen in the square enclosures may also reflect, in a contrasting form, this convergence of Icenian and Roman norms. It is possible that over time the Iceni voluntarily made each successive monument more Roman.

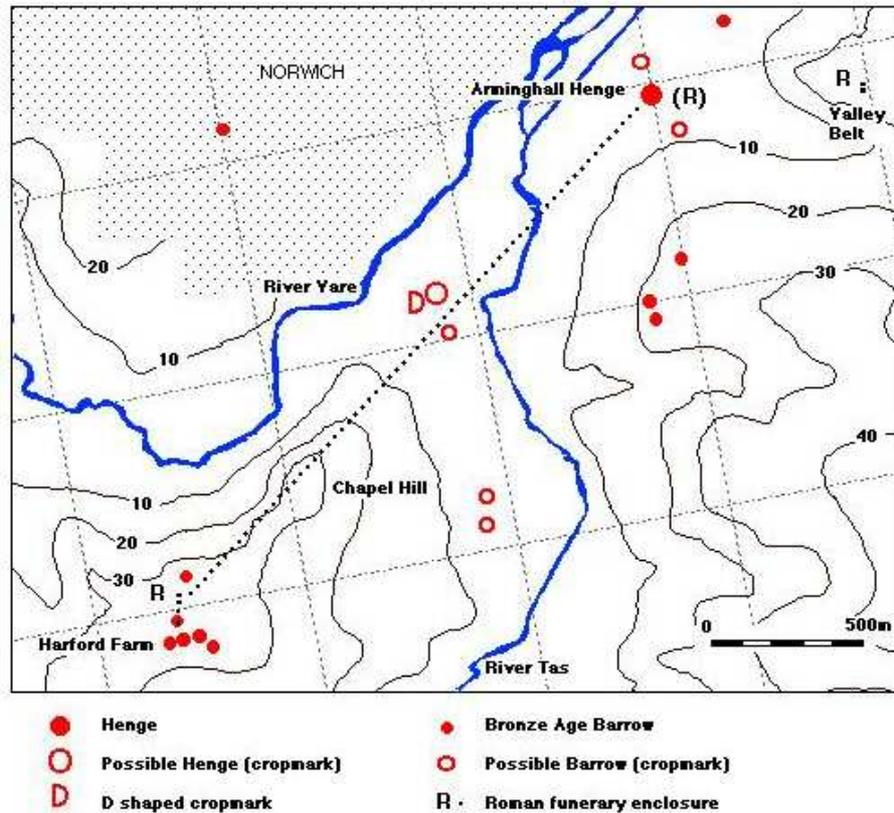


Figure 2. Prehistoric and Roman landscape features of the Yare/Tas confluence (thin broken lines represent the axes of the hypothetical South Norfolk A cadastre)

### Measurement of the square enclosures

The eight square enclosures have orientations close to north-south. They are in two groups, each with a clear north-south alignment, whose location in relation to the prehistoric landscape is shown in figure 2. For the purposes of this article they will be referred to by the numbers used in the excavation report with the prefix HF for those on the Harford Farm site (figure 2, bottom left) and VB for the Valley Belt site (figure 2, top right). Seven of the enclosures have single ditches which appear to have been used to construct banks on their inner edges. The remaining enclosure has an additional outer trench which contains groups of post holes in a broken line. This is evidence for a post-in-trench wall or fence.

### Histoire, Espaces et Marges de l'Antiquité, 1

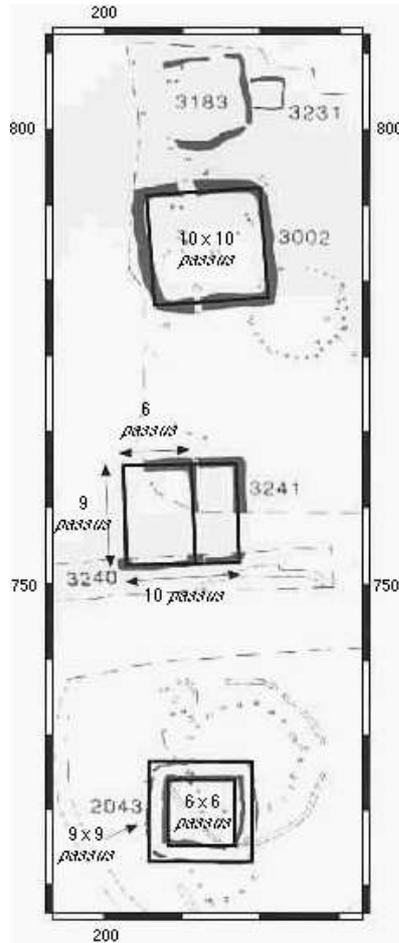


Figure 3. Harford Farm enclosures

Although the enclosures cannot be satisfactorily dated by artefacts or stratigraphy, a Romano-British date is not ruled out. Hence, despite the fact that any irregularities in their original outlines may have been emphasised by erosion, their measurement in Roman units of length may be revealing. If the monuments are Roman, a Roman unit could have been used to lay them out. The Roman foot (*pes monetalis* = 0.296m) is an obvious candidate, but it is too small to allow us to judge if measures using it do or do not fit. For this reason we use the next larger unit of measurement, the *passus* of 1.479m. It is more likely to be recognisable, if present<sup>1</sup>.

The layout of the ditches can be related to multiples of the *passus*, as shown in figures 3 and 4. These results are summarised in a table (figure 5) which also includes an estimate of their quality. Irregular outlines are regarded as low (one smile) and near-perfect squares or rectangles would be considered high quality (five smiles).

The quality assessment is inevitably subjective and the data set is small and needs to be treated with caution. Erosion, perhaps of 30 - 40cm at both sites, will have modified the original outlines. This will not have a severe effect on attempts to fit squares or rectangles of whole numbers of *passus* to the centre line of the ditches, but could have distorted the measurement

<sup>1</sup> There has been a debate on the recognition of two different foot measures which may have been used in British town planning, see Duncan-Jones (1980), responded to by Millett (1982). Given the few data available here, it would not be sensible to join in.

of VB1802, whose ditch centre line will not fit a *passus* multiple, but whose edges apparently will. It is, however, difficult to tell precisely what has been the effect of erosion. It may have made the ditch appear narrower than it was originally, but it has probably not been uniform. This may account for the thinning of the ditch of VB1802 at its north - west corner. If so, the outer edge of this may have once fitted the 6 *passus* square better. Also, the excavation of the ditch produced a bank (or possibly a mound) inside it, so erosion may have done no more than reduce the surface at the inner ditch edge to its original level. This would account for the extremely good fit of the inner 5 *passus* square.

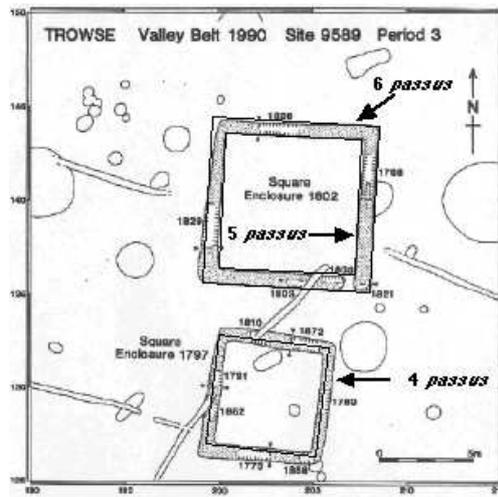


Figure 4. Valley Belt enclosures

Despite these uncertainties, there seems to be a relationship between the apparent skill with which the enclosures were laid out and the way in which they can be measured in *passus*.

The impression of quality increases as the *passus* is more obviously being used. The two low quality enclosures cannot be measured in *passus*, whereas the single high quality example can. If these results were due to chance we would not expect to see this; the monuments which are better defined should be harder to measure in *passus*.

The relative dimensions of the monuments may also indicate a Roman origin. In most cases the ratio of their sides seems intended to be in 1:1 (square), but there is another ratio, 3:2, used in two of them. HF 3240 appears to be 9 x 6 *passus* and HF 2043 approximates 9 *passus* for the outer trench and 6 *passus* for the inner ditch. This ratio is typically (although not exclusively) Roman. It is specified by Vitruvius (*On Architecture*, V 1.1) for the ideal forum<sup>2</sup>.

<sup>2</sup> "Now let the breadth be so determined that when the length is divided into three parts, two are assigned to the breadth".

## Histoire, Espaces et Marges de l'Antiquité, 1

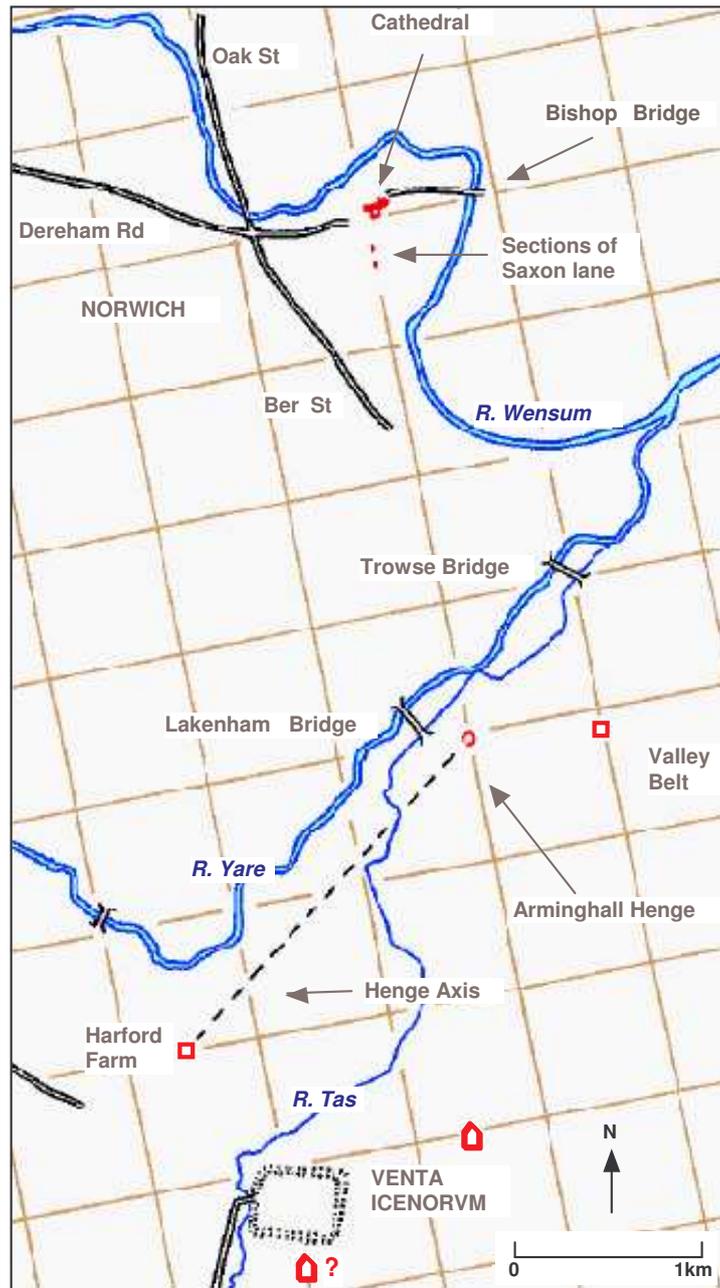
Enclosure	Quality	Dimensions (whole <i>passus</i> = 1.479m)
HF 3183	☺	Not clear
HF 3231	☺	Not clear
HF 3002	☺☺	10 (centre line of E-W ditches only)
HF 3240	☺☺☺	9 x 6 (centre line of ditches)
HF 3241	☺☺	9 x ? (centre line of ditches)
HF 2043 (Inner Ditch)	☺☺	6 x 6 (approx. centre line of ditches)
HF 2043 (Outer Trench)	☺☺	9 x 9 (approx. centre line of ditches)
VB 1797	☺☺☺	4 x 4 (centre line of ditches)
VB 1802	☺☺☺☺	5 x 5 (inner) 6 x 6 (outer) ditch edges

Figure 5. Quality and dimensions of square enclosures

### Spatial relationship of the square funerary enclosures to the South Norfolk A cadastre

In figure 2 the grid of dashed lines at a spacing of 710m represents the axes of the South Norfolk A cadastre. This system was proposed (Peterson 1988) as an explanation for the regularity and the typically Roman spacing of the axes of a supposed late Iron Age field system in the Dickleburgh area of south Norfolk (figure 1). There have been other arguments for its reality (Peterson 1993) and this has subsequently been enhanced by better knowledge of the topography of Saxon Norwich, which seems to have derived from it (figure 6). An east - west Roman road (which corresponds to a cadastral axis) has long been held to run under the Norman cathedral, crossing the river Wensum at Bishop Bridge. Now, Oak Street, a north-south road leading to an early river crossing, is put in the same category (Ayers 2000). The northern part of this road also fits the grid and the southern part, now represented by Ber Street, approximates a diagonal of 2 squares of the cadastre (a 1:2 relationship). If the road south beyond Ber Street continues and crosses the Yare at the same point as any existing bridge then, according to this map, Trowse seems the more likely<sup>3</sup>. This would also accord well with the cadastral hypothesis, since the south-east end of the bridge is at an intersection of axes.

<sup>3</sup> Brian Ayer's view (pers. comm.) is that the road is more likely to turn southwards to Lakenham Bridge and thence to Venta. This requires a turn of at least 39° to the west, whereas the shift required to cross Trowse bridges is a much smaller 11° to the east. The smaller change in direction seems more likely.



■ Group of square enclosures
 
🏠 Temple

Derived from Ordnance Survey 1:25,000 mapping. © Crown Copyright Ordnance Survey. All rights reserved.

Figure 6. Features between Norwich and Venta Icenorum

### Histoire, Espaces et Marges de l'Antiquité, 1

Furthermore, two segments of a late Saxon north-south lane, the only excavated (and hence definite) component of the street grid, coincide with an axis. According to Emery (2000), "Projected northwards, the excavated lane passes in front of the west end of the cathedral." The cadastral axis does the same.

This lane is a very minor part of the pattern of the 11th-century town, but it gives a clear indication of the orientation of the street grid, parallel and at right angles to the Roman road leading west from the Cathedral, on a cadastral axis. By the 11th century there were probably much more important streets parallel to it, but this does not rule out the possibility that the lane represents an earlier boundary. Judging from the ways in which known Roman cadastral systems have degraded, we should not expect that the relative importance of the original boundaries of any associated land division would necessarily be reflected in a later organisation derived from it.

The position of the hypothetical cadastre was fixed before any of the features shown in figure 2 were considered. This is emphatically the case for the square enclosures, which were not known when the hypothesis was first stated. They are truly independent of it, and we would therefore expect that, if it had no reality, they would have only a random association with it. In fact we see from figure 6 that they lie near the axes, in positions generally typical of tombs and other ritual monuments in Roman cadastres.

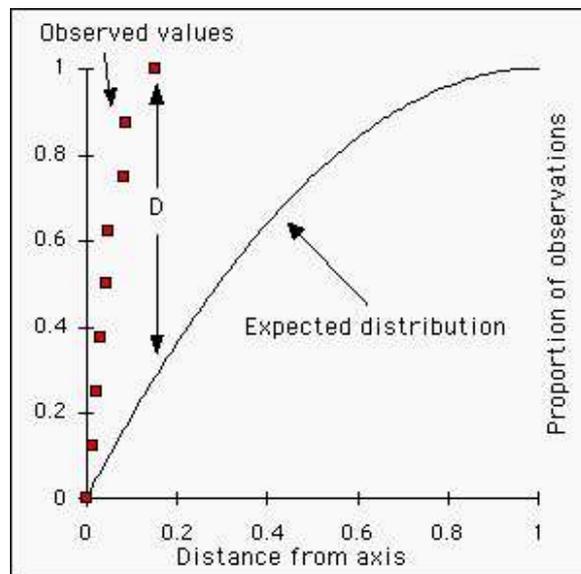


Figure 7. Distribution of Square Tombs

The appearance of association on the map can be tested numerically, using the following procedure. The distances from the nearest axis are arranged in order (figure 7, 'observed values'). For each of these distances, starting at the smallest, we compare the number of enclosures seen at that distance with the number which we would expect to see at random (figure 7, 'expected distribution'). The enclosures have a bias towards the axes, which is measured by the largest value of the gap between what is observed and what would be expected on a random basis. This is the Kolmogorov-Smirnov D value. Tables, or calculation, tell us how unlikely the D value is for any given number of observations.

Kolmogorov-Smirnov Test								
No. 1								
<u>South Norfolk 'A' against Norwich southern bypass square enclosures</u>								
<b>Origin</b>	<b>Module</b>	709.5	<b>Sites</b>	8				
62482								
30912	<b>Angle</b>	-11.077	<b>Max. D</b>	0.7130				
<u>KS calculations* give critical value for p of 0.0002 as 0.6674</u>								
Site	X	Y	Dist.	Cumulative		D	Intermediate	
				Observations	Expected		Calculations	(e-w) (n-s)
				Actual				
				0				
VB 1797	62470	30607	0.0162	0.13	0.032	0.093	704	577
VB 1802	62470	30608	0.0216	0.25	0.043	0.207	702	587
HF 3002	62245	30433	0.0326	0.38	0.064	0.311	408	12
HF 3240	62244	30430	0.0449	0.50	0.088	0.412	424	694
HF 3241	62245	30430	0.0503	0.63	0.098	0.527	414	692
HF 3231	62246	30435	0.0826	0.75	0.158	0.592	394	29
HF 3183	62245	30435	0.0880	0.88	0.168	0.707	404	31
HF 2043	62244	30426	0.1556	1.00	0.287	0.713	431	654

Figure 8. Kolmogorov-Smirnov test for all eight square enclosures

The graph presented in figure 7 is derived from the data for all eight square enclosures (figure 8), using the 'Dist' and 'Cumulative Observations' columns. Values of the distance range from 5.5m to 30.5m (see 'Intermediate Calculations'). The largest D value is 0.7130 times the largest possible distance (354.75m). There is a chance of less than one in five thousand that this would be seen at random.

## Histoire, Espaces et Marges de l'Antiquité, 1

This treatment of the data appears to have the merit of simplicity, but it is defective. Statistical tests of this sort rely on the observations being independent. In this case they are not, since the tombs form two groups whose members appear to be associated. A fair measure should use independent data. In fact we can have only two items, which are the positions of the two groups. Coordinates for these can be obtained objectively by calculating an average (the mean) of the coordinates of group members, irrespective of size.

The D value produced by these inputs (figure 9), while higher, is less significant because of the reduction in the number of observations. Even so the chances of this being a random event are less than one in five hundred. The figures also show that the 'centre' of the Harford Farm group (the point with the mean of its x, y coordinates) lies a notional 2.5m (709.5 - 707) from the east-west axis. The figure is notional because the mathematical model of the cadastral survey has a precision of only 10m in its x and y coordinates. Within the accuracy of the model the central point of the Harford Farm group and the axis coincide, as can be seen in figure 2.

Kolmogorov-Smirnov Tests								
No. 2								
<u>South Norfolk 'A' against groups of Norwich southern bypass square enclosures</u>								
	<b>Origin</b>		<b>Module</b>	709.5		<b>Sites</b>	2	
	62482							
	30912		<b>Angle</b>	-11.077		<b>Max. D</b>	0.963	
<u>KS calculations* give critical value for p of 0.002 as 0.9548</u>								
Site	X	Y	Dist.	Cumulative		D	Intermediate	
				Observations	Expected		Calculations	(e-w) (n-s)
				Actual				
				0				
Harford Farm	62245	30432	0.0079	0.50	0.016	0.484	413	707
Valley Belt	62470	30608	0.0189	1.00	0.037	0.963	703	582

Figure 9. Kolmogorov-Smirnov test for groups of square enclosures

### Critical assessment of the test results for the square enclosures

If the square enclosures are so closely associated with the cadastral axes, why don't their alignments correspond? Could this discrepancy be used to argue against the cadastral hypothesis?

The grounds for this objection are weak. Within areas of Roman land survey different alignments can coexist. Florence is a good example (Watts 2000). The city is oriented north-south, east-west. The land division has another orientation, at 3:5. In any case it will be argued below that the alignment of one group of square enclosures was probably determined in the late Iron Age, and hence could not be influenced by the alignment of the cadastre.

Another objection might be that the statistical test results are too good to be true. They depend on the way in which the data are selected. Hence suspicion might arise that they had been specially chosen, and those that did not fit the cadastral hypothesis were excluded. It might also be asked if the claim that tombs are generally associated with cadastral axes had been invented, after the event, to fit the observations.

This is not so. All eight monuments from this area are included in the tests. There was no unwarranted selection. It is well known that tombs, and other ritual sites such as temples, are associated with cadastral axes.

It can also be observed that the results are in agreement with what was already known of the relationship between the cadastre and Roman ritual sites in the neighbourhood of *Venta Icenorum*. The Romano-Celtic temple to the east of the town (figure 10) lies to one side of its *temenos*, but on an axis (note the distance of 3m, indicating coincidence, in figure 11). Another possible temple seen in aerial photography, and recently accurately located by geophysical survey<sup>4</sup>, lies to the south, near another axis. If we choose to include all known Roman ritual monuments (in this area) in a single class of objects, then the Kolmogorov-Smirnov calculations give us only a small probability (less than one chance in two thousand) that they are distributed randomly (figure 11).

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<sup>4</sup> A resistivity survey was carried out in 2001 by a team lead by Malcom Davies.

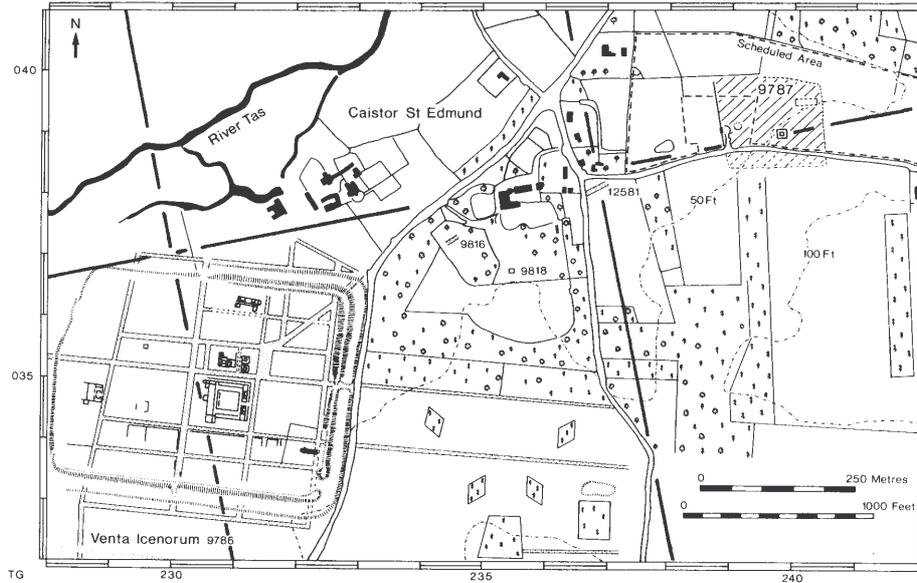


Figure 10. *Venta Icenorum* and its eastern Romano-celtic temple, after Gurney (1986).

<b>South Norfolk 'A' against Norwich southern bypass tombs and Venta temples</b>									
Origin	Module	709.5	Sites	4					
62482									
30912	Angle	-11.077	Max. D	0.857					
KS calculations* give critical value for p of 0.0005 as 0.8475									
Site	X	Y	Dist.	Cumulative		D	Intermediate		
				Observations	Dist.		Calculations	Calculations	
				Actual	Expected		(e-w)	(n-s)	
				0					
Harford Fm Tombs	62245	30432	0.0079	0.25	0.016	0.234	413	707	
Venta E. Temple	62399	30390	0.0091	0.50	0.018	0.482	398	3	
Valley Belt Tombs	62470	30608	0.0189	0.75	0.037	0.713	703	582	
Venta S. ?Temple	62307	30315	0.0744	1.00	0.143	0.857	26	153	
Arminghall Henge	62398	30601	0.0081				3	657	

\* <http://www.ciphersbyritter.com/JAVASCRIP/NORMCHIK.HTM#KolSmir>

Figure 11. Kolmogorov-Smirnov test for Roman ritual sites

Figure 11 also gives the distance calculations for the Arminghall Henge (shown in figures 2 and 6). The Henge was not used for this Kolmogorov-Smirnov test, but it could have been. Excavation revealed Roman material - pottery and tile fragments, nails and coins - in its inner ditch (Clark 1936). Despite Dark's (1993) view that there is no demonstrable evidence of a Roman temple at any British henge, this may point to the demolition of a Roman building in the late Roman period, and hence earlier Roman, possibly ritual, re-use of this site. The figures also show that the Henge is at 3m from an axis, which thus bisects it. In fact all Roman ritual monuments in the neighbourhood – be they a genuine temple, a possible temple, groups of ritual/funerary enclosures or a possibly re-used prehistoric ritual monument – lie on or near a cadastral axis. We could select any subset of them and the statistics would show that they had an almost entirely non-random relationship to the Roman cadastre.

### **The definition of the South Norfolk A cadastre**

It is necessary at this stage to distinguish between the two groups of square enclosures. The enclosures on the Valley Belt site are well laid out and can clearly be measured in *passus*, although in different ways. On this basis they are probably Roman and their position near an axis of the Roman cadastre is not surprising. They could have been positioned after it was surveyed and after its axes had been marked.<sup>5</sup>

The other group, at Harford Farm, is more complex. The enclosures vary in quality and some are difficult to measure in *passus*. This leads to suspicion that some may be more Iron Age than Roman. It is suggested by Ashwin and Bates (2000:138), that the enclosures are "another exemplar of a tradition in the ritual and funerary re-use of earlier prehistoric monuments" and it is understandable that both the late Iron Age and Roman inhabitants would have chosen to use the site in this way, since it contains the most numerous group of Bronze Age barrows. These were still significant upstanding features in the Anglo-Saxon period, when they were again chosen for the same purpose. So, unlike the Valley Belt enclosures, these square enclosures cannot be seen as features whose position was determined in relation to the Roman cadastre. They occupy a site whose position was fixed about two thousand years earlier.

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<sup>5</sup> This could have been done in many ways, ranging from surfaced roads to lines determined by the positions of survey markers, but physically invisible between them.

Much the same can be said of the Arminghall Henge. The Henge is even more important than the Harford Farm barrows. It is seen as "one of East Anglia's most significant prehistoric field monuments" (Ashwin and Bates 2000: 230) and it is taken to be the focus of the Arminghall group of monuments. A cadastral axis runs through its centre, where there are the signs of Roman activity. The penannular bank can still be seen on the ground, although it now has subdued relief. This suggests that the axis of the Roman cadastre was again coinciding with a pre-existing and visible feature which, according to Healy (1982:27), "must have been a major landmark 2000 years ago".

It is at first sight very surprising, and perhaps unprecedented<sup>6</sup>, to find that these two significant features of the prehistoric ritual landscape coincide with the axes of a hypothetical planned landscape of much later date. However, it is hard to dismiss the statistics, whose significance is reinforced by the uniqueness of this pair of sites. They are the only two sites in the Arminghall group of prehistoric monuments which give any indication of Roman re-use. It is therefore likely that the double coincidence was planned, that the cadastral grid was deliberately positioned so that its axes would intersect these older monuments. The question is how, and why?

Ashwin suggests (Ashwin and Bates 2000: 233) that the alignment of the Henge, which is supposedly oriented towards midwinter sunset<sup>7</sup>,

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<sup>6</sup> It seems to be common sense that Roman surveyors would use existing prominent features as landmarks, but there is little solid archaeological evidence that any Roman cadastral system was based on prehistoric features. Compatangelo's (1989:99) claim of association between cadastral axes and menhirs in southern Italy is not entirely convincing. Nearer home, in north Norwich, Bown (1986: 64) suggests that a Bronze Age round barrow "was used as a boundary marker in a Romano-British field system." However, given that the boundary in question is dated by an iron brooch made in the first half of the first century AD (before the Roman take-over of Icen territory), any possible associated field system is more likely to be Iron Age than Roman.

<sup>7</sup> The Henge has within its inner ditch and bank a setting of posts in a horseshoe, also opening towards the south west. In North's (1996: fig. 154) reconstruction, a vertical plane of mirror symmetry is evident, which is essentially defined by the horseshoe and the gap in the inner ditch. Study of a rectified aerial photograph by the author, and independently by Martin Horlock, indicates that the Henge axis, as defined by the mirror symmetry, is at about 40.5° to OS north (to the nearest 0.5°). Since true north is 2.63° west of OS north at the Henge, this is equivalent to an azimuth of about 223° in relation to true north.

The orientation of the axis defined by sites of Roman activity can be calculated using the mean of the extreme values given in figure 12, plus the same 2.63°, plus

might also be directed towards the summit of Chapel Hill (see figure 2). It is therefore clear that a contemporary archaeologist recognises the appearance of this alignment in the prehistoric landscape and that a Roman land surveyor, faced with the monument in a less degraded state, would have been likely to have come to the same conclusion. Even if, as seems likely, the central setting of timber posts had left no trace, an axis towards the south west would still be indicated by the gap in the penannular inner ditch and bank. The latter, estimated to have been up to three metres high when built, would have given a very clear indication that an alignment existed. As shown in figure 2, the summit of Chapel Hill is viewed end on from the Henge. Hence the orientation of an alignment aiming for the hill would lie in a narrow range, and the alignment would, when projected over Chapel Hill to the Harford Farm site, intersect the line of Harford Farm square enclosures. Such an alignment thus joins the Henge to the major barrow group, which was later marked by the Iron Age and Roman square ritual/funerary enclosures.

It therefore seems reasonable to suppose that in the Roman period this axis, as then perceived, was defined by these two sites of possible Roman activity. Accordingly, we can calculate its orientation from the x, y coordinates of the centre of the Henge, at one end, and the Harford Farm square features, at the other, using the figures given in figure 11.

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180°. To the nearest degree this is 225°, i. e. true south-west. Given the 1:1 relationship of this orientation to north, this tends to support the proposal that this is the "Roman" orientation.

Again to the nearest degree, the direction (azimuth) of midwinter sunset (last flash) in 3,000 BC, at the latitude of Arminghall, with an allowance for the altitude of the horizon, is 228°. This figure is calculated using standard formulae. North gives 41° south of West, i.e. 229°, but this is the figure obtained for sunset over flat ground.

From these results it appears that the axis of the Henge does not point at midwinter sunset, and that it is closer to the "Roman" orientation adopted in this article.

## **Histoire, Espaces et Marges de l'Antiquité, 1**

Extreme	Tan (x/y)	Angle to OS north	Angle to Cadastre
A	0.894	41.80	52.88
B	0.917	42.51	53.59

Figure 12. Orientation of Henge Axis, as apparent in the Roman period

The differences in coordinates are 1,530m for x and 1,690m for y. These are, however, notional figures, since the parameters of the cadastre were specified to ± 5m. The differences are therefore inaccurate by up to ±10m. Using extreme values of the differences, the extreme values of the orientation, A and B, may be calculated. In the

table of results (figure 12) the angle to the cadastre is obtained by adding 11.08° (the cadastral orientation).

These values are significant. Their mean is 53.24° and their range includes the angle whose tangent is 4/3, which has a value of 53.13°. Roman land surveyors seem frequently to have defined relative orientations using a limited number of ratios, one of which is 3:4 (see below). However, we should not be entirely carried away by the coincidence. Given the precision of the model there is, for end points so close together, an uncertainty of about 0.7° in the measurement of the orientation of the line joining them. We therefore need to calculate the chance that any equally imprecise relative orientation could be considered significant in Roman terms.

Ratio	Angle
1:5	11.31
1:4	14.04
1:3	18.43
2:5	21.80
1:2	26.57
3:5	30.96
2:3	33.69
3:4	36.87
4:5	38.66
1:1	45.00

Figure 13.

The definition of the varatioscope<sup>8</sup> allows for ten significant angles between 0° and 45° (figure 13); it would be pointless to allow for many more, since the measurement of significant orientation would then lack discrimination. Adopting the inverse of the same ratios for angles in the range 45° to 90° we can tabulate those which give the angles nearest to the orientation of the Henge axis relative to the cadastre (figure 14).

Ratio	Angle
1:1	45.00
5:4	51.34
4:3	53.13
3:2	56.31
5:3	59.04

Figure 14.

<sup>8</sup> The varatioscope is a computational tool for detecting or confirming the existence of oblique planning in orthogonal cadastral systems, see Peterson (2001).

The four intervals between these ratios cover just under 14°. Hence, given the uncertainty of about 0.7° in the determination of orientation, there is a chance of about 0.2 (1 in 5) that a random orientation will match one of them. On the basis of probabilities, we cannot reject the proposition that this may be a chance coincidence, but nevertheless it encourages the idea that there is a planned relationship. Each new observation which is against the odds but is consistent with a given hypothesis increases the chance that it is true.

Whether by chance or not, there is a Pythagorean harmonic relationship, at 3:4, between the orientation of the Henge and that of the cadastre. This can be explained if the Roman surveyor, having chosen pre-existing fixed points on two axes, deliberately chose this relative orientation<sup>9</sup>.

Roman cadastres sometimes have such planned relationships with earlier Roman landscapes. The relationships between the three cadastres of Béziers are a notable case of this; and it has been suggested that they are a deliberate manifestation of harmony (Clavel-Lévêque 1992). Another example occurs in the multiple 1:4 relationships between neighbouring grids at Corinth (Romano and Tolba 1996).

Despite our knowledge of these examples of harmony, which create between Roman systems of land division those simple mathematical relationships fundamental to the Pythagorean world view, we may be surprised to see such a relationship between a Roman cadastre and an axis indicated by prehistoric structures. But perhaps our surprise is due principally to our own lack of imagination. According to the Roman land surveyors, pre-existing features, although they were mainly trees, were used as landmarks and there is no reason why pre-Roman artificial landscape features should not have been so used. Hence, using the principles of oblique design which seem to hold in Roman cadastres (Peterson 1992; Roth Congés 1996), we can develop a model explaining the origin of the relationships that we see.

Once the existence and orientation of the pre-Roman axis was acknowledged, the next task would be to choose an orientation of the cadastral axes in relation to it. The lowest part of the Tas valley could perhaps have been a natural landscape feature to which the surveyor

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<sup>9</sup> Given that the module of the grid (2,400 Roman feet) was pre-specified and that two pre-existing fixed points were to lie on its axes, the surveyor had only one more freedom – the choice of orientation.

wished to conform, as in other cases<sup>10</sup>. The 3:4 relationship with the Henge axis meets this need. It also has the advantage over its neighbouring angles, 2:3 and 4:5, that it can be used to construct right angles without using the *groma*.

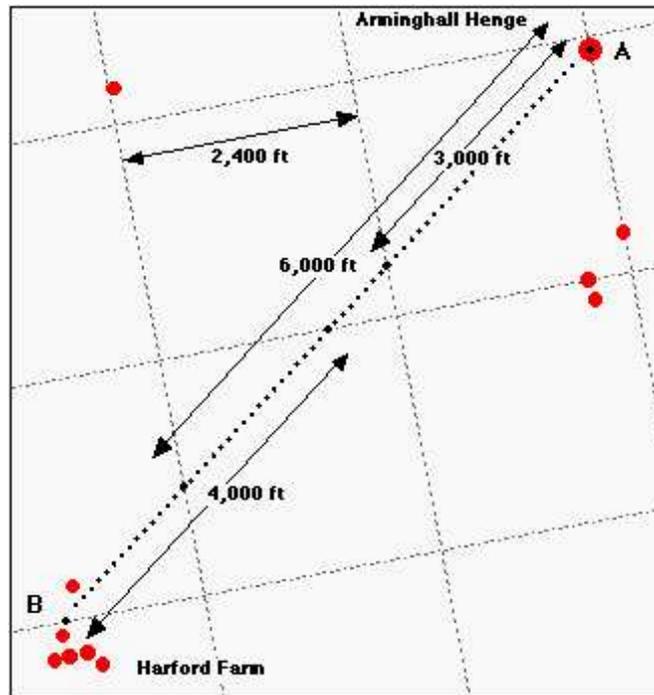


Figure 15. Model for layout of the cadastre

So, according to the model, a line was laid from the centre of the Henge (figure 15, point A), on its presumed axis. This was then projected, by the normal method using aligned stakes (*metae*) over Chapel Hill until it reached the centre of the Harford Farm site. As suggested above, and as will be discussed further below, some of the square enclosures may already have been in place (perhaps all of those categorised as 'two star' or worse in figure 5). If so, their north-south line would intersect the projection of the Henge axis at a point, B. If not, the same point would be defined by the intersection of the Henge axis with the line connecting the centres of the two barrows immediately each side.

<sup>10</sup> Several systems of the Po valley conform to the direction of drainage. Another good example is Florence, where the rural land division is aligned with the Florence-Pistoia basin.

In principle a 3:4:5 triangle could then be constructed at both points A and B, using the two acute angles to direct the axes of the cadastre. In practice, if the Henge banks were still high enough to get in the way, this may have been difficult at point A. However, the sight lines are unimpeded at the Harford Farm site, so from here an east-west axis could be laid out and the *groma* used to define the axes at right angles to it. Another possibility arises from the special property of the 3:4 right angled triangle. For any other ratio used by the land surveyors the hypotenuse of the triangle can only be approximated by a whole number of feet; but for the ratio 3:4 it is not necessary to approximate. The intersection points of cadastral axes parallel to those through A and B can be measured out exactly along the Henge axis, using intervals of 3,000 and 4,000 feet (see figure 15). A cadastral axis could then be laid out from any of these points, if more convenient.

### Roman changes in the prehistoric ritual landscape

The initial survey for cadastral systems was normally conducted by the army. This was an act of state, even if private civilian surveyors were employed to settle disputes at a later stage – when the system began to break down. Why should these Roman surveyors, who we might be tempted to see as the embodiment of bureaucratic and arbitrary imperialism<sup>11</sup>, wish to incorporate features of an earlier ritual landscape in their system? One reason is suggested by their testimony that they assiduously created landmarks, including temples, and were also prepared to use some pre-existing landscape features as points of reference. If these were substantial, recognisable and permanent there would be a clear benefit in administrative terms. The original boundaries could be more easily redefined after the system had partially broken down.

It is also possible that this was a deliberate effort by the surveyors to tie together two ritual landscape systems. This may seem a strange notion, but in some ways – as shown by the sacrifices performed at the intersection of the cadastral axes – the Roman landscape systems were just as ritual as we imagine those of prehistory to be. This coincidence of features in both systems could thus be a case of syncretism. As in the realm of general religion, where the identification of an indigenous with a Roman god was

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<sup>11</sup> For example see Oliver Rackham's (1986: 159) caricature of centuriation.

presumably intended to strengthen the links between the corresponding social groups, the links to the earlier cultural landscape could have made the Roman action, establishing new administrative norms by way of the Roman land survey, more legitimate.

Whatever the explanation, it was probably Roman initiative which established the links between the Roman ritual/administrative landscape and its predecessor. This may not be so for the square enclosures. For them there may have been a voluntary shift from Icenian to Roman norms.

It has been observed above that the information given in figure 5 seems to reflect a correspondence, for each enclosure, between its apparent quality of design and its ability to be measured in *passus*. The two at Valley Belt are assigned (in this article) to the Roman period because of their good performance on both these scores. It therefore seems reasonable to ask if the differences of design may reflect an historical process. Could it be that the enclosures which are least regular and least capable of being measured in *passus* are the earliest? If so they could date to the late Iron Age, and may be measurable in a non-Roman foot. This idea could be supported by measurement of the two northernmost Harford Farm enclosures in 'Drusian' feet<sup>12</sup> (each of 1.33m), in multiples of five. HF 3231 could be 15 of these feet east-west (if we assume that its western ditch was destroyed by its neighbour, HF 3183). HF 3183 itself approximates 30 feet north-south.

The volume of available data is small, so the proposition is tenuous, but we could make sense of the variety of design of these monuments if we assume they were not all of the same period. It could be that there is a progression of the following types, corresponding to periods:

- non-Roman (or only slightly Roman) monuments, laid out rather irregularly in 'Drusian' feet, or, more likely, units of five feet.

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<sup>12</sup> According to Hyginus 1, this foot "has a *pes monetalis* and an inch and a half", i.e. 9/8 of *pes monetalis*. He says that this was known to the Tungri, in what is now Belgium. Brian Campbell suggests that it was named after Drusus, perhaps indicating his ambitions for land division and settlement in this area - he had organised the census in the three Gauls in 13BC (Campbell 2000: 90/91, note 32). The foot was a local unit which the Roman surveyors adopted. There is some evidence that it was also used in Britain (Green 1978).

- early Romanising monuments in which the *passus* is employed to lay out the centre lines of the ditches, but which are still rather irregular.
- late Romanising monuments which are laid out in the same way but more regularly.
- the almost completely regular square monument, VB 1802, in which a multiple of the *passus* determines both the inner and outer edge of the ditch.

The time when Roman influence was felt in the Icenian client kingdom could be the early Romanising period. The earliest years of Roman take-over would then be the later Romanising period. For the last period we take into account the skill shown in the layout of VB 1802, which looks like the product of a trained building worker. We could therefore place it in or after the later first century, by which time an Icenian labour force would, with the construction of *Venta Icenorum*, have acquired the necessary expertise in simple surveying and became accustomed to working to Roman standards.

If this model is anything like reality, it portrays a convergence of Icenian and Roman norms. Each new monument was, like its precursors, an essentially Icenian square enclosure, but the Icenian builders of each new monument voluntarily made it more Roman.

#### **Epilogue: transmission of ritual orientation**

If the cadastral hypothesis is true it takes away from the prehistorians the supposedly late Iron Age landscape of Dickleburgh – the landscape is Roman and probably not earlier than the Roman road passing through it.

However, it offers something in exchange.

We can see in figure 6 that an axis of the cadastre which passes the west door of Norwich Cathedral also passes through the centre of the Arminghall Henge. This emphasises, by chance, the link between these two monuments, and gives a striking example of the persistence of prehistoric ritual orientation, transformed by a Greco-Roman philosophical system.

The Norman Cathedral finds itself at right angles to an axis of the Roman ritual land division. This, in its turn, has its orientation derived by Roman surveyors according to the rules of Pythagorean harmony from the axis of the Henge monument – as they saw it. Thus an orientation established about 3,000 years BC, at what was then one of the most important ritual sites in eastern England, is

#### **Histoire, Espaces et Marges de l'Antiquité, 1**

expressed in a new form in one of the area's most magnificent medieval ritual structures.

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### Bibliography

- Ashwin, T., and Bates, S. 2000. *Excavations on the Norwich Southern Bypass, 1989, Part 1*. East Anglian Archaeology 91. Norfolk Museums Service, Gressenhall.
- Ayers, B. 2000. How Norwich began. *Current Archaeology* XV.2 : 48-51.
- Bown, J. E. 1986. The Excavation of a Ring-Ditch on Sweetbriar Road, Norwich, 1982. In *Barrow Excavations in Norfolk, 1950-82*. East Anglian Archaeology 29. edited by Lawson, A. J. pp. 59-64. Norfolk Museums Service, Gressenhall.
- Campbell, B. 2000. *The Writings of the Roman Land Surveyors*. Journal of Roman Studies Monograph 9. The Society for the Promotion of Roman Studies, London.
- Clark, J. D. G. 1936. The Timber Monument at Arminghall and its Affinities. *Proceedings of the Prehistoric Society* 2 : 1-51.
- Clavel-Lévêque, M. 1992. Centuriation, géométrie et harmonie: le cas du Biterrois. In *Mathématiques dans l'Antiquité*. Centre Jean-Palmerie: Mémoires 11. edited by Guillaumin, J.-Y. pp. 161-184. Université de St-Étienne, St-Étienne.
- Compatangelo, R. 1989. *Un cadastre de pierre: le Salento romain*. Les Belles Lettres, Paris.
- Dark, K. R. 1993. Roman-Period Activity at Prehistoric Ritual Monuments in Britain and the Armorican Peninsula. In *Theoretical Roman Archaeology: First Conference Proceedings*. edited by Scott, E. pp. 133-146. Avebury, Aldershot.
- Duncan-Jones, R. P. 1980. Length-units in Roman Town Planning: the Pes Monetalis and the Pes Drusianus. *Britannia* 11 : 127-134.
- Emery, P. 2000. The Franciscan Friary. *Current Archaeology* XV.2 : 72-78.

- Green, H. J. M. 1978. A villa estate at Godmanchester. In *Studies in the Romano-British Villa*. edited by Todd, M. pp. 103-116. Leicester University Press, Leicester.
- Gurney, D. 1986. A Romano-Celtic Temple Site at Caistor St. Edmund. In *East Anglian Archaeology Report No. 30*. edited by Wade-Martins, P. pp. 37-60. The Norfolk Archaeological Unit, Gressenhall.
- Healy, F. 1982. A Round Barrow at Trowse: Early Bronze Age Burials and Medieval Occupation. In *Norfolk: Trowse, Horning, Deserted Medieval Villages, King's Lynn*. East Anglian Archaeology 14. edited by Wade-Martins, P. pp. 1-34. Norfolk Archaeological Unit, Gressenhall.
- Millett, M. 1982. Distinguishing between the Pes Monetalis and the Pes Drusianus: some problems. *Britannia* 13 : 315-320.
- North, John. 1996. *Stonehenge: Neolithic Man and the Cosmos*. HarperCollins, London.
- Peterson, J. W. M. 1988. Roman cadastres in Britain: I - South Norfolk A. *Dialogues d'histoire ancienne* 14 : 167-199.
- Peterson, J. W. M. 1992. Trigonometry in Roman cadastres. In *Mathématiques dans l'Antiquité*. Centre Jean-Palmerie: Mémoires 11. edited by Guillaumin, J.-Y. pp. 185-203. Université de St-Étienne, St-Étienne.
- Peterson, J. W. M. 1993. *Computer-aided investigation of ancient cadastres*. PhD Thesis. University of East Anglia.
- Peterson, J. W. M. 2001. Design and Performance of the Varatioscope. In *Computing Archaeology for Understanding the Past: CAA 2000*. edited by Stancic, Z. and Veljanovski, T. pp. 269-272. Archeopress, Oxford.
- Rackham, O. 1986. *The history of the countryside*. Dent, London.
- Romano, D. G., and Tolba, O. 1996. Remote Sensing and GIS in the Study of Roman Centuriation in the Corinthia, Greece. In *Interfacing the Past: Computer Applications and quantitative Methods in Archaeology CAA95*. *Analecta Praehistorica Leidensia* 28 II. edited by Kamermans, H and Fennema, K. pp. 457-463. University of Leiden, Leiden.
- Roth Congés, A. 1996. Modalités pratiques d'implantation des cadastres romains: quelques aspects. *Mélanges de l'école française de Rome* 108 : 299-422.
- Watts, C. M. 2000. The Geometry of the Master Plan of Roman Florence and its Surroundings. *Nexus Network Journal* 2.3 (July 2000) : <http://www.nexusjournal.com/N2000-Watts.html>.