Society of Antiquaries of Scotland

The Traprain Law Environs Project

Fieldwork and Excavations 2000-2004

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Chapter 2

Survey in the Traprain Law Environs Project area

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INTRODUCTION

This chapter contains an overview of the survey work lying behind the excavations undertaken in the TLEP study area. The overview is primarily based on the aerial survey and mapping of plough-levelled sites recorded as cropmarks undertaken by RCAHMS and the geophysical surveys carried out by the TLEP, but consideration is also given to the results of arable fieldwalking. The present study has provided an opportunity to compare the information on sites generated by the methods outlined above in a region where often-complex geology has a direct impact on the character of sites revealed as cropmarks and through geophysics. The subsequent excavation programme has provided further depth to

Figure 2.1
Aerial view looking north-east over the central part of the TLEP study area, with Traprain Law in the foreground (DP026198, Crown copyright: RCAHMS)

the comparison of results. The chapter begins with general summaries of the character of the area, its geology and land use, as they inform the interpretation of the survey results.

THE TLEP STUDY AREA – LANDSCAPE AND THE CHARACTER OF THE ARCHAEOLOGICAL RECORD

The TLEP study area is an arbitrary block of ground, roughly centred on Traprain Law, and defined by the simple expedient of Ordnance Survey grid lines. The greater part of the study area comprises a gently-undulating coastal plain, rarely above 120m OD, but in places broken by low hills, such as the Garleton Hills and Traprain Law, which rise up to about 200m in height (Figure 2.1). The ground generally rises to the south and, at the south-east corner, includes the Lothian Edge at some 350m OD. The major river draining the area is the River Tyne, which trends from west-south-west to east-north-east, and is predominantly fed by tributaries draining the Lammermuirs to the south, which are typically deeply incised (e.g. Tipping 2007). The other significant catchment is that of the Whittingehame Water in the south-east. Arable land use dominates the area, although there are increasing proportions of pasture as the ground rises to the foothills of the Lammermuirs and unimproved moorland on the hills themselves. There are intermittent blocks of woodland scattered across the plain, mainly taking the form of discrete shelter-belts, but including some more extensive coniferous plantations. Built-up areas are fairly discrete, with Haddington the only significant urban area.

The pattern of land use has had a direct impact on the character of the archaeological record. The vast majority of recorded sites have been levelled by the plough and are only known as cropmarks on aerial photographs. The surviving earthwork sites lie in small patches of unimproved ground, for example, on the rocky outcrops of the Garleton Hills or in shelter-belts and plantations. Artefact recovery through arable fieldwalking has not contributed much material to the record, but some success in this area (see below) suggests that it is an underused technique that would repay further attention. The broader context of the TLEP in East Lothian will be expanded on in Chapter 10 but, for the purposes of the following discussion, it is noteworthy that the study area is broadly representative of this part of south-eastern Scotland, which is roughly coterminous with the administrative area of East Lothian.

THE GEOLOGY AND SOILS OF THE TLEP STUDY AREA

The geology of the TLEP study area is complex and merits description as it bears on the interpretation of the geophysical survey results (below). Two faults cross the south-eastern quarter of the study area, namely the Dunbar-Gifford Fault and the Lammermuir Fault, both aligned broadly north-east to south-west (Lelong and MacGregor 2007, fig 1.4). The rock types all belong to the Carboniferous era with the exception of the Devono-Carboniferous Upper Old Red Sandstone, which occurs exclusively between these two faults. The Garleton Hills Volcanic Rocks lie within the Calciferous Sandstone Measures, which between them occupy most of the study area. Traprain Law itself is a phonolite laccolith, a mass of igneous rock that rose in a molten condition and pushed up the overlying strata to form a dome (McAdam and Tulloch 1985). Erosion has subsequently revealed the original form of the laccolith by stripping away the soft sedimentary cover.

The most recent glaciation, the Devensian, deposited an extensive till (boulder clay) across much of the study area, mantling most of the low-lying areas north of the Lammermuir Fault in a deposit up to 10m in thickness. In the areas of volcanic rock, however, the till is thinner and less widespread. During the late-glacial period raised beaches of sand and gravel were deposited to the north and east of East Linton. Subsequent Flandrian deposits include river-terrace and floodplain alluvium, with limited peat and lake deposits. The alluvial deposits consist of interbedded gravels, sands, silts and clays, in constantly varying proportions (McAdam and Tulloch 1985).

The soils of East Lothian are dominated by Brown Forest and, to a lesser degree, Brown Calcareous Soils. The Brown Forest Soils are generally imperfectly drained, and have a tendency to gleying. Soil depth varies considerably, and there are large areas, especially in soils of the Kilmarnock and Winton Associations, where the bedrock is near the surface. The areas of well-drained soils are relatively discrete and include the Brown Calcareous Soils of the Fraserburgh Association on the coast around Gullane (Ragg and Futty 1967). These latter are some of the better quality agricultural land in present-day Scotland, which allied to the relatively dry climate that the east coast enjoys, has helped to make East Lothian a prolific county for cropmark formation (Cowley 2007).

AERIAL SURVEY AND MAPPING IN THE TLEP STUDY AREA

Prospective aerial survey has revolutionised the distribution of known sites in the Scottish lowlands (e.g. Maxwell 1983; Cowley and Brophy 2001) – as it has done elsewhere in Britain and beyond. East Lothian is no exception (Cowley 2007; Cowley and Dickson 2007). It has benefited from being close to the main base for aerial survey in Edinburgh, and has been overflown by RCAHMS during almost all summers since 1976, and intermittently by others back to the 1920s. It continues to be flown and, apart from the most dismal of summers, each year brings new discoveries.

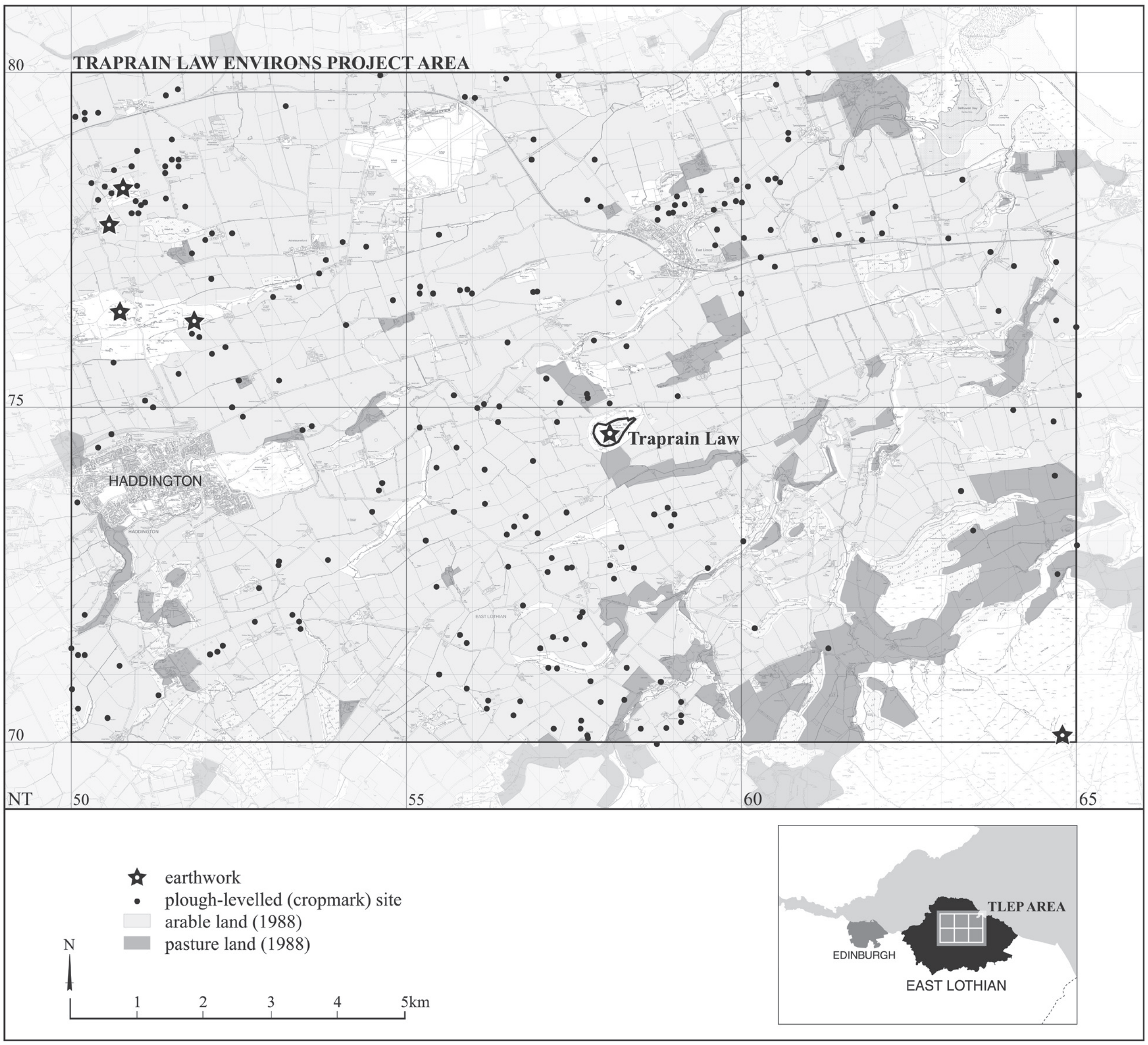

Figure 2.2
Map of the TLEP study area showing the distribution of plough-levelled monuments and earthworks against the extent of arable, pasture and woodland (Crown copyright: RCAHMS, GV004467. Extent of arable, pasture and woodland derived from MLURI mapping, based on 1988 aerial photography)

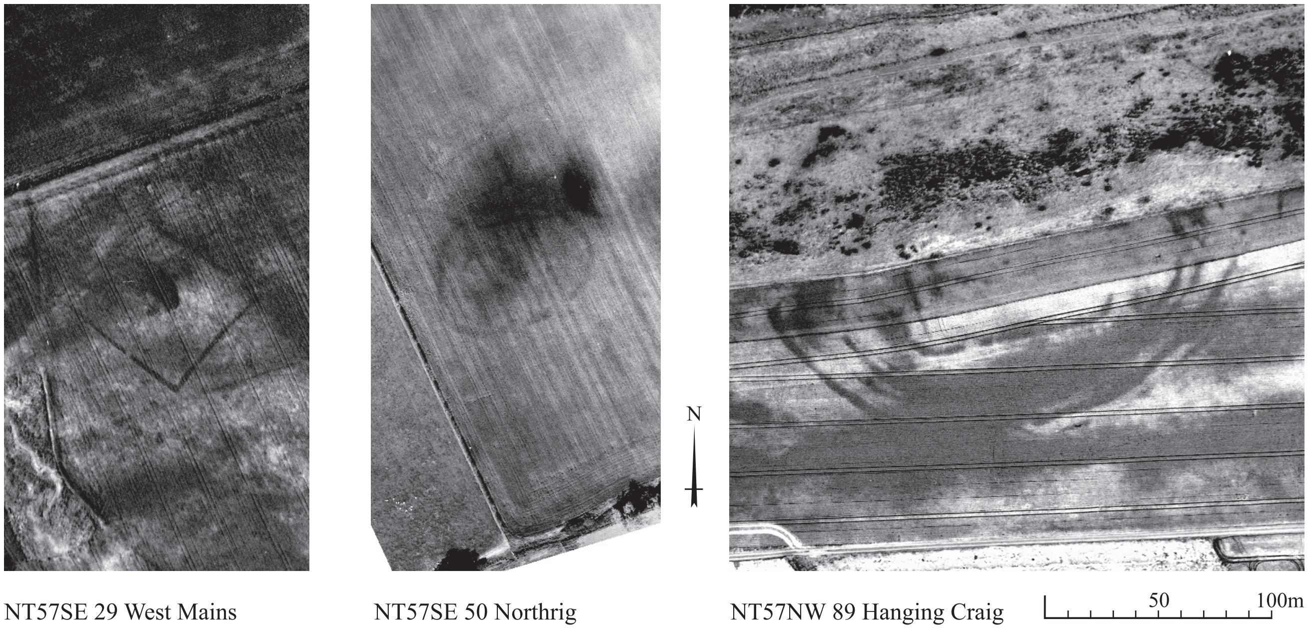

Figure 2.3
Rectified aerial photographs of representative rectilinear and curvilinear settlement enclosures and a fort (rectified versions of EL4136, EL3632 and C52630 respectively, Crown copyright: RCAHMS, GV004468)

The ongoing aerial survey of the TLEP study area has recorded some 190 cropmark sites of all periods. In addition, as part of a contribution to the TLEP and an ongoing programme to map all known plough-levelled sites in Scotland, all the sites have been mapped. The distribution (Figure 2.2) is one of dense clusters of archaeological monuments recorded as cropmarks, interspersed by both thinner scatters of sites and complete blanks in the distribution. The dense clusters of monuments tend to coincide with well-drained soils, or with patches of thinner imperfectly drained soils. More dispersed distributions occur on the thin imperfectly drained soils, while blank areas on the maps tend to be broadly coterminous with deep and imperfectly drained soils, which also have a tendency to be set to pasture (Cowley and Dickson 2007; Ragg and Futty 1967).

An overall consideration of the record of plough-levelled sites in East Lothian is presented in Chapter 10, exploring the basic morphology and distributions of sites, but in general terms the 190 cropmark sites of all periods recorded in the TLEP study area include a figure of about 120 that may be characterised as later prehistoric in date. Settlement enclosures predominate, of which 32 are rectilinear in form, 68 are curvilinear, 10 incorporate a palisade in their circuit (though two of these were revealed by excavation), 10 have been placed with clear defensive intent (including four earthwork sites of which Traprain Law is one), while at least six can be characterised as 'open' or unenclosed settlements (Figure 2.3). The character of this distribution confirms how representative, in general terms, the TLEP is of the wider East Lothian plain (Chapter 10). It also underlines that aerial survey remains the only effective means of discovering plough-levelled sites in the area. Equally, those areas that have remained stubbornly blank, of which the area to the south-east of East Linton is a good example, present a challenge to survey methodologies to explore effectively all parts of the landscape (see below; Cowley and Dickson 2007).

Aerial mapping

The mapping of plough-levelled sites in support of the TLEP has been based predominantly on the collection of oblique aerial photographs held in the archive of RCAHMS. Reference has also been made to vertical coverage, also held in RCAHMS, dating from the period since 1946. In order to locate sites accurately to the UK National Grid and to rectify the oblique view to a true plan, the *Aerial 5* software programme has been used (Macleod 2006).

The mapping begins with the assessment of a suite of aerial photographs, taken over a number of years, to identify those images with the best representation of the archaeological features. The identification of good quality control-points visible on the aerial photographs and represented on the Ordnance Survey (OS) map is vital. Mapping is undertaken against a digital OS map background, and makes use of the OS Profile Digital terrain Model (5m interval), incorporating the height value at each digitised point. The process produces a geo-referenced rectified version of the oblique aerial photograph, which is then used as a basis for on-screen digitising of the archaeology in 3D. All line work is coded with the reference of the source photography and a simple classification system containing both morphological attributes (e.g. 'rectilinear') and interpretation (e.g. 'roundhouse') that allow efficient searching and retrieval. The rectified and geo-referenced aerial photograph and the line work can then be viewed together in a Geographical Information System, presenting both interpretation and source imagery. In addition, the 3D data can be used to generate visualisations of sites where the topography is otherwise flattened out in the aerial photography (Figure 2.4).

GEOPHYSICAL SURVEY

A sample of 30 sites was chosen for detailed geophysical survey from roughly 120 plough-levelled later prehistoric sites recorded and mapped in the TLEP study area. The sample aimed to reflect both the broad proportions in which the main types of enclosure appear in the record and the overall distribution of plough-levelled sites across the study area. The focus on plough-levelled sites has inevitably informed the distribution of the geophysical surveys (Figure 2.5),

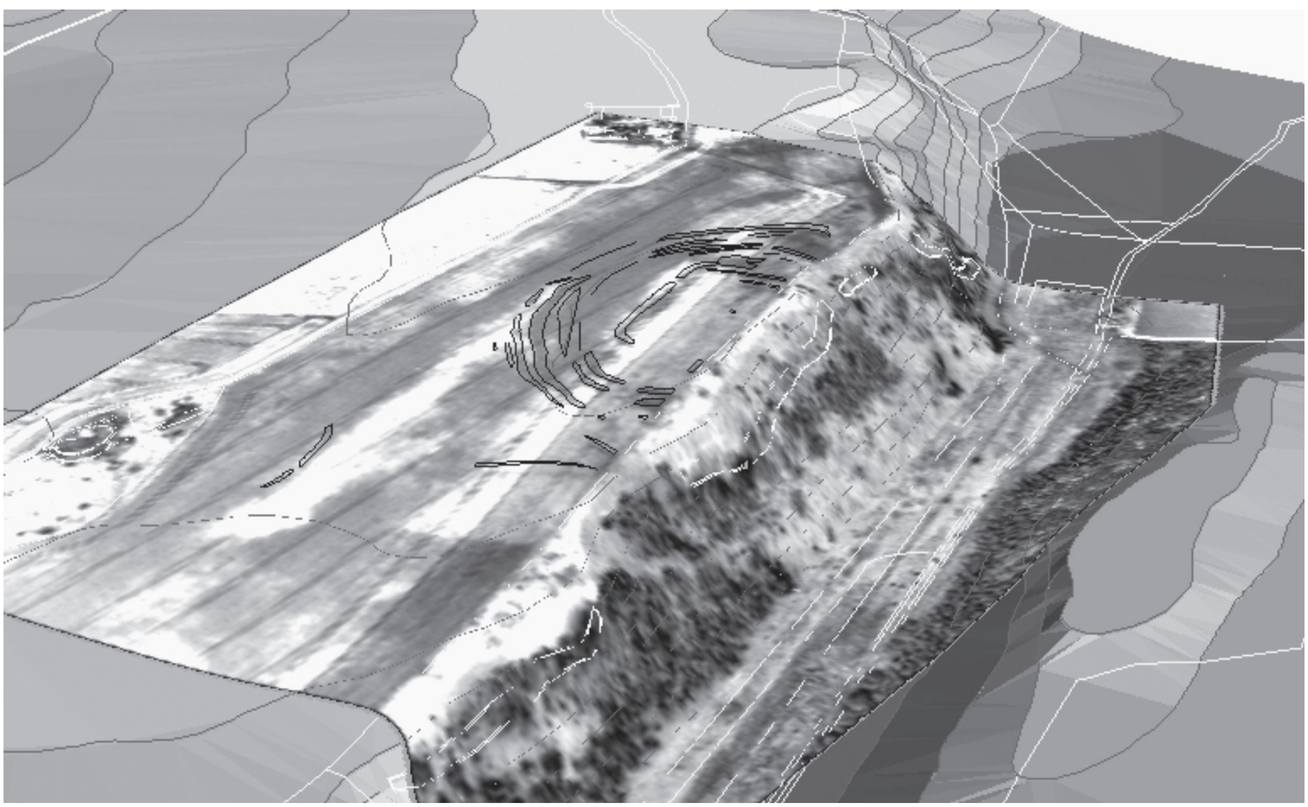

Figure 2.4
3D visualisation of the plough-levelled fort at Hanging Craig (NT57NW 89) constructed digitally in ArcScene over the OS profile model surface (Crown copyright: RCAHMS, GV004469)

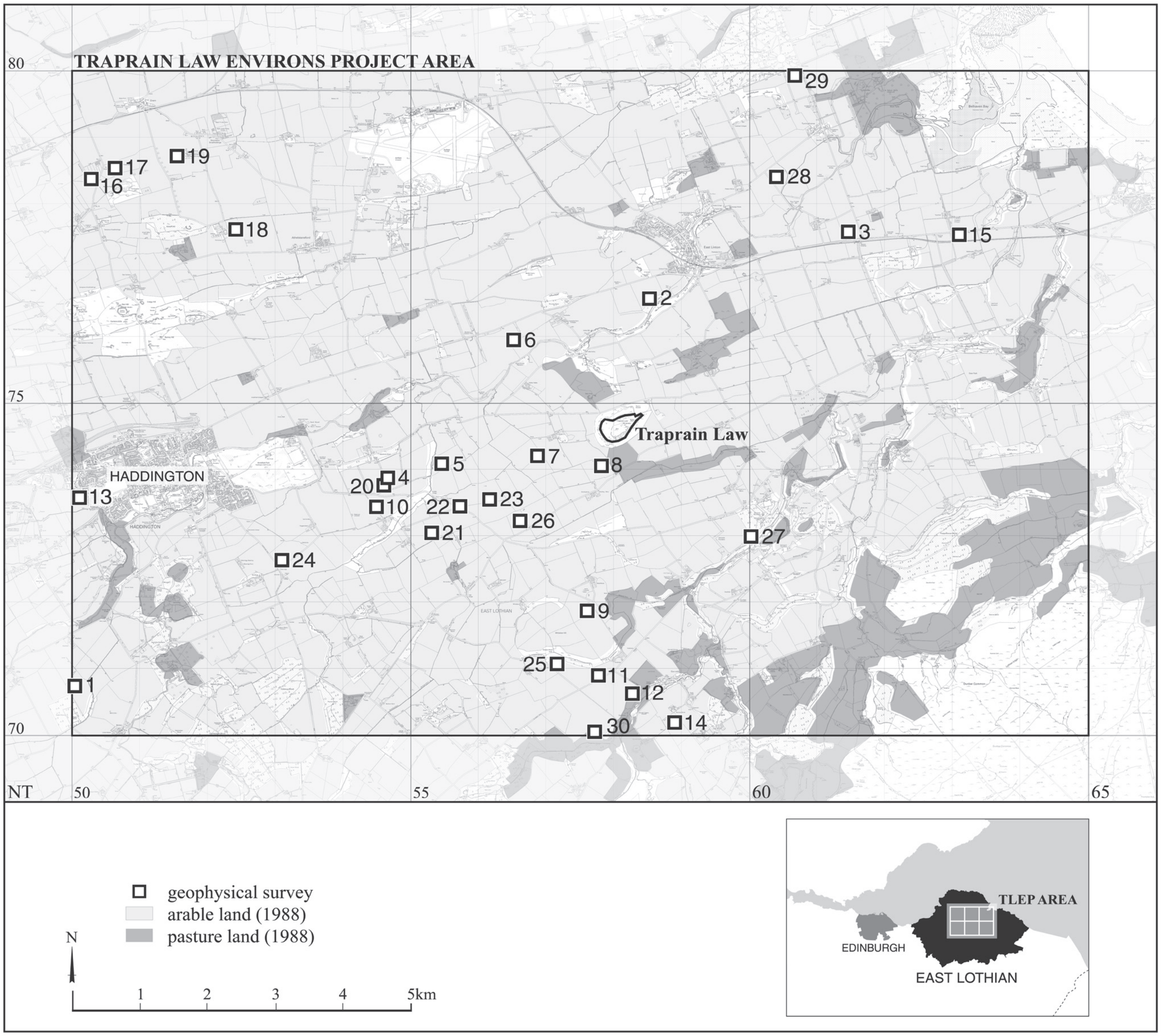

Figure 2.5
Map of the TLEP study area showing the distribution of sites chosen for geophysical survey, against the general distribution of arable, pasture and woodland (Crown copyright: RCAHMS, GV004470. Extent of arable, pasture and woodland derived from MLURI mapping based on 1988 aerial photography)

concentrating as they do into the predominantly arable and cropmark-rich parts of the study area.

The specific aims of the geophysical survey programme were to assess the nature, extent and potential degree of preservation of the 30 sites, comparing cropmark information with the geophysics and using both data sources to inform further phases of work, such as the excavation of selected sites. A further question was to investigate whether geophysical survey could identify small features, such as ring-ditches, which did not appear as cropmarks. A subsidiary objective was to establish whether the effectiveness of the geophysical surveys differed significantly over different rock types.

The sites selected for geophysical survey comprised two multivallate 'forts', 12 rectilinear and 13 curvilinear

Table 2.1

Geophysical site surveys (Geological information from Davies *et al.* 1986; McAdam & Clarkson 1986; McAdam & Tulloch 1985). Site types: M = multivallate, R = rectilinear, C = curvilinear, U = unenclosed, B = building. Numbers refer to Figure 2.5

	NMRS	*Site name*	*Site type*	*Survey area (ha)*	*NGR*	*Geology (GHVR: Garleton Hills Volcanic Rocks)*	*Igneous*	*Geophysics results*	*Geophysics unique features?*
1	NT57SW 31	Begbie	M	3.08	NT 5001 7079	Calciferous Sandstone Measures		Good	Yes
2	NT57NE 17	East Linton	M	2.40	NT 5851 7655	Extrusive basalts and tuffs GHVR	✓	Good	Yes
3	NT67NW 19	Knowes	R	2.56	NT 6140 7755	Calciferous Sandstone Measures		Good	Yes
4	NT57SW 46	Stevenson Mains	R	0.36	NT 5465 7385	Calciferous Sandstone Measures		Poor	No
5	NT57SE 16	East Bearford	R	1.16	NT 5545 7410	Extrusive trachyte GHVR	✓	Good	Yes
6	NT57NE 16	Overhailes	R	1.68	NT 5651 7597	Extrusive basalts and tuffs GHVR	✓	Mixed	No
7	NT57SE 37	Cairndinnis	R	0.96	NT 5689 7420	Extrusive trachyte GHVR	✓	Poor	No
8	NT57SE 79	Standingstone	R	1.40	NT 5788 7402	Extrusive basalts and tuffs GHVR	✓	Poor	Possibly
9	NT57SE 36	West Mains	R	1.00	NT 5763 7194	Extrusive trachyte GHVR	✓	Good	Possibly
10	NT57SW 95	West Bearford	R	0.72	NT 5449 7344	Calciferous Sandstone Measures		Mixed	No
11	NT57SE 41	Tanderlane	R	2.76	NT 5775 7091	Upper Old Red Sandstone		Mixed	No
12	NT57SE 39	Garvald	R	1.56	NT 5825 7063	Intrusive dolerite and basanite	✓	Poor	No
13	NT57SW 77	Haddington	R	0.80	NT 5009 7358	Calciferous Sandstone Measures		Good	Yes
14	NT57SE 104	Nunraw Barns	R	0.48	NT 5888 7021	Upper Old Red Sandstone		Good	No
15	NT67NW 20	Hedderwick	C	1.36	NT 6309 7752	Calciferous Sandstone Measures		Good	Yes
16	NT57 NW 30	Sixpence Strip	C	1.44	NT 5030 7835	Extrusive trachyte GHVR	✓	Good	No
17	NT57NW 41	Foster Law	C	2.40	NT 5063 7854	Extrusive trachyte GHVR	✓	Good	No
18	NT57NW 35	Kilduff	C	1.20	NT 5236 7760	Extrusive trachyte GHVR	✓	Very poor	No
19	NT57NW 38	Newmains	C	1.00	NT 5157 7870	Extrusive trachyte GHVR	✓	Poor	Possibly
20	NT57SW 47	Stevenson Mains	C	0.48	NT 5459 7376	Calciferous Sandstone Measures		Good	Yes
21	NT57SE 50	Northrig	C	0.96	NT 5526 7301	Calciferous Sandstone Measures		Good	No
22	NT57SE 91	Coldale	C	0.88	NT 5571 7344	Extrusive trachyte GHVR	✓	Poor	Possibly
23	NT57SE 56	Coldale	C	0.76	NT 5617 7356	Extrusive trachyte GHVR	✓	Good	Possibly
24	NT57SW 50	Mitchell Hall	C	0.48	NT 5309 7264	Calciferous Sandstone Measures		Very poor	No
25	NT57SE 27	Chesters Quarry	C	0.80	NT 5712 7111	Intrusive dolerite and basanite	✓	Good	No
26	NT57SE 45	Standingstone	C	0.60	NT 5661 7322	Extrusive trachyte GHVR	✓	Good	No
27	NT67SW 15	Whittingehame Tower	C	0.84	NT 6003 7300	Upper Old Red Sandstone		Poor	Yes
28	NT67NW 18	Preston Mains	U	0.60	NT 6040 7840	Extrusive basalts and tuffs	✓	Mixed	Yes
29	NT67NW 16	Tyninghame	U	0.80	NT 6058 7991	Extrusive basalts and tuffs	✓	Mixed	Possibly
30	NT57SE 103	Sled Hill	B	0.36	NT 5771 7006	Upper Old Red Sandstone		Mixed	No

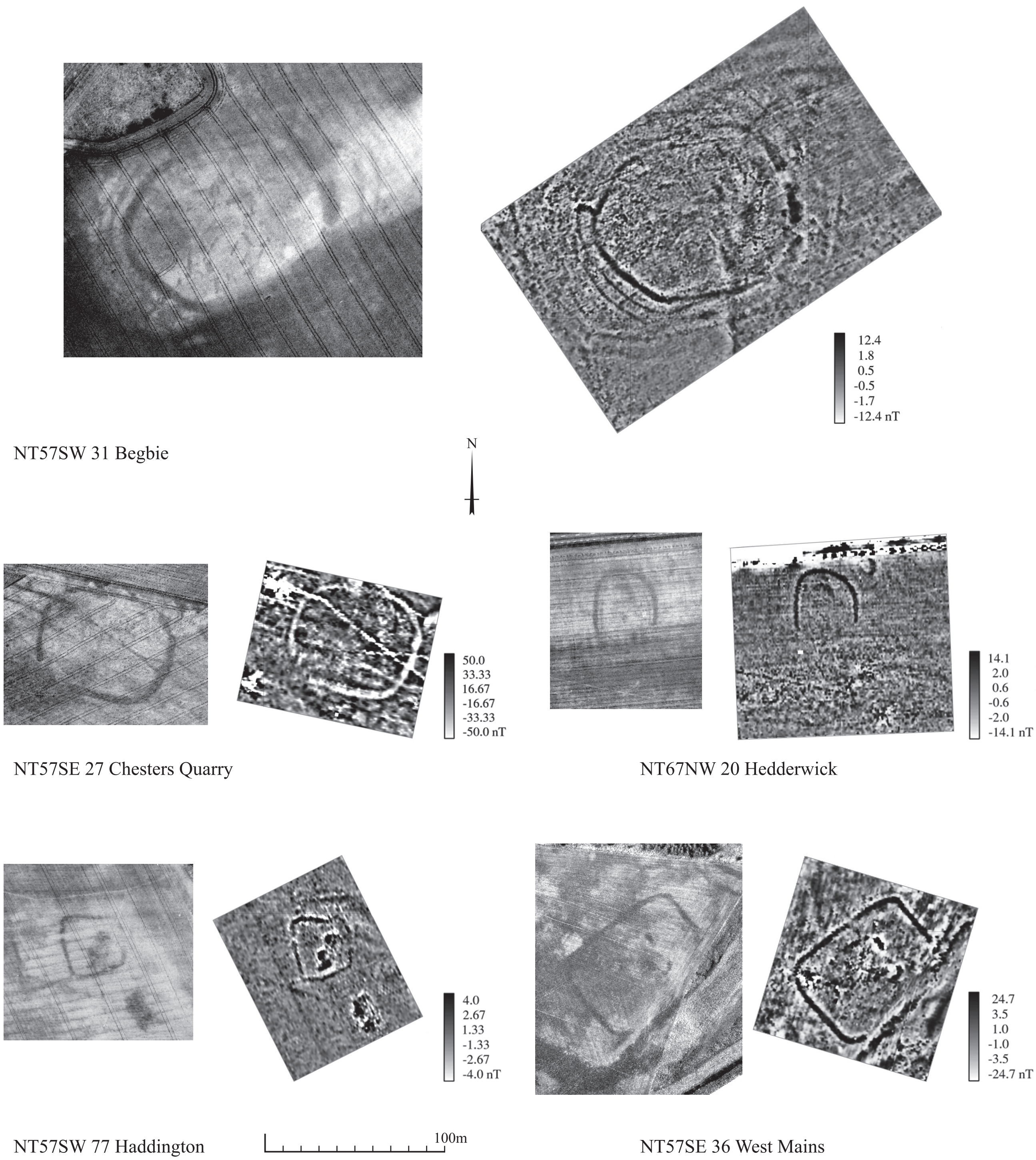

Figure 2.6
Selected sites with rectified aerial photographs of the cropmarks set beside the TLEP geomagnetic survey plots (rectified versions of A29865, EL3032, A22255, B05135 and B24406 respectively, Crown copyright: RCAHMS, GV004471)

enclosures, as well as parts of two unenclosed settlements and a possible rectangular building (Table 2.1). The proportion of rectilinear enclosures selected was slightly higher than numbers alone merited, on the grounds that hardly any have been excavated in southern Scotland. With the exception of Sled Hill, each of the surveys was undertaken with Scheduled Monument Consent granted by the Scottish Ministers under Section 42 of the Ancient Monuments and Archaeological Areas Act 1979. The geophysical surveys were undertaken by ASUD between August and November 2000 and then, following the 2001 outbreak of Foot and Mouth Disease, between October 2001 and January 2002.

Geophysical survey: fieldwork and data processing

In order to assess the suitability of a geomagnetic survey technique in this complex and part-igneous geological environment, small trial areas were initially surveyed by fluxgate gradiometry. This demonstrated that significant magnetic susceptibility contrasts could be recorded over both the igneous and sedimentary strata, and that some of the geomagnetic anomalies almost certainly reflected archaeological features. This technique was therefore employed at all of the 30 selected sites.

Each survey was undertaken on a 20m grid, which was tied-in to known Ordnance Survey points using a total station survey instrument and datalogger. Measurements of geomagnetic field gradient were determined using Geoscan FM36 fluxgate gradiometers with automatic datalogging. A zig-zag traverse scheme was employed. The instrument sensitivity was set to 0.1nT and measurements were logged at 0.5m intervals along traverses spaced 1m apart, thus providing 800 sample measurements per 20m grid unit. Data were downloaded into laptop computers on-site for initial processing and interpretation.

The geophysical data presented as greyscale images have basic data processing functions applied. Geoplot and InSite software was used where necessary to correct for spikes, striping, shear and instrument drift. Data have been interpolated to 0.25m intervals. In each greyscale image, positive magnetic anomalies are shown as dark grey and negative magnetic anomalies as light grey; palette bars relate the greyscale shades to values in nanoTesla. A number of interim reports have been published (Hale *et al.* 2001; 2003; 2006) and Data Structure Reports are lodged with Historic Scotland (ASUD 2001; 2002).

Geophysical survey: results

Despite the complex and often igneous geology – situations where a geomagnetic technique might not traditionally have been used – good overall results have been obtained adding value to existing knowledge derived from cropmarks (Figure 2.6). Indeed, several of the surveys indicated the presence of previously unrecorded features, both internal and external to enclosures, such as probable roundhouses, palisades and annexes, and in some cases it has been possible to distinguish more than one phase of occupation. In only seven of the 30 cases were the features recorded as cropmarks not readily identified in the geophysics. This appears to be due to a range of factors, with the underlying igneous geology apparently to blame in only a single case. The current plough regime is typically apparent on the geophysical surveys as a uni-axial 'texture'.

The basic results of the geophysical survey are presented (Table 2.1) with a subjective assessment of the quality or significance of the results, mainly in terms of a value judgement of the information return. A similar subjective assessment of the information return from the aerial photography is also presented, alongside the background geology.

In the majority of cases (23 out of 30), the geophysical surveys replicated the expression of the features recorded as cropmarks on aerial photography, often with very clear results. This alone is a valuable outcome in providing a group of sites where the differing forms of registration – cropmarking and geophysics – can be compared. A second encouraging result is that at a number of locations, the geophysics produced evidence of probable internal and/or external features, which were not immediately visible on the aerial photography. These included the three sites subsequently selected for large-scale excavation at Whittingehame, Standingstone and Knowes (Chapters 3–5) and two selected for smaller scale evaluations (Chapter 6). At all these sites, the excavations subsequently confirmed the presence of many of these additional features. Finally, it is notable that many of the useful geophysical surveys were carried out over igneous bedrock, giving good results in less than auspicious conditions, a factor that should encourage the more widespread application of such surveys in Scotland.

In the seven surveys where the cropmarked features were not readily identified, a number of factors appear to be responsible. In only one instance (Kilduff) does the underlying igneous geology appear to be the main factor in the lack of resolution of features.

Further commentary of the geophysical results on the unexcavated sites is found in Appendix 1.

Geophysical survey: questions and issues

A number of questions have inevitably arisen from the geophysical survey results, largely concerning the effect of the underlying geology. Marked variations are evident where surveys have been conducted over the same general rock type. Over igneous trachyte, the East Bearford and Foster Law surveys provided much more archaeological information than the Kilduff survey, although the explanation for this is not clear. Similarly, while the surveys at Standingstone and Overhailes provided useful plans of the enclosures, the nature of some of the anomalies is not fully understood. There are of course a number of other factors besides solid geology that will determine the effectiveness of one technique over another at any given location. These include the depth to rock head, the nature of overlying soft sedimentary cover, the composition of boulder clay, the nature and depth of likely targets, ground conditions and the proximity of buildings, fences or services.

MAKING SURVEY COUNT – INTEGRATING METHODOLOGIES

Few archaeological distributions can be taken to reflect past activity in any meaningful manner, more often being the product of variation in land use, bias in survey methodology, variation in survival and the influence of soil types, amongst many other factors. The broad pattern of sites in the TLEP study area illustrates how effective a prospective survey methodology aerial survey is, but even here there are stubbornly blank areas, generally on poorly drained soils, that are unresponsive. Indeed, the large number of previously unknown sites discovered during the works in advance of the A1 road upgrade (Lelong and MacGregor 2007) are another indication of the limitations of traditional aerial survey, relying as it does on the formation of cropmarks over buried features. These are a clear challenge to develop approaches to explore the wider landscape more effectively, drawing on other forms of remote sensing.

Such problems in defining the wider landscape are emphasised by other East Lothian discoveries. There is, for instance, a series of cave sites with Iron Age activity (Chapter 7), which need to be incorporated into the settlement pattern. While these could at least be prospected for, other components are more problematic. East Lothian is a high-spot of Iron Age burials, but this is entirely due to accidental discoveries and the character of the known distribution is difficult to assess. There is more hope in prospecting for other types of site via an often-undervalued avenue – the finds. A number of East Lothian excavations have been stimulated by casual finds, such as the midden at Muirfield (Younger 1936) and the settlement at New Mains (Stevenson 1966; Clarke 1969; 1970), while antiquarian casual finds from a midden at Pincod, Dunbar can also be identified as Iron Age (*PSAS* 1910, 102). These examples are unlikely to have been discovered from the air, and may represent further facets of the unenclosed settlement pattern of the Iron Age, complementing that emerging from the analysis of the aerial photographic record (Chapter 10).

Developing an approach from a response to serendipitous discoveries into a prospecting tool is rather more problematic. Yet fieldwalking should not be dismissed as futile for later prehistory. Recent experience on Traprain, where a wealth of material was gathered after a fire, is perhaps exceptional, but the unpublished New Mains collection includes a significant quantity of Iron Age finds (mostly pottery and stone tools) recovered by fieldwalking. Stray finds of querns in particular are likely to be revealing, as these are unlikely to have moved far from their original settlement, yet they are rarely if ever incorporated in considerations of Iron Age settlement distributions north of the border, despite the rich insights that comparable exercises have produced in north-east England (Hayes *et al.* 1980; Heslop 2008).

Recent work at Gilmerton House, Athelstaneford (Appendix 2), while less finds-rich than New Mains, has shown that fieldwalking can produce useful results – especially in combination with metal-detecting. This latter method is the great under-used tool for later prehistoric sites, especially those with a Late Iron Age phase when non-ferrous ornamental material becomes more common. At Gilmerton House, the metal-detected discovery of four Roman brooches on a known cropmark site marks it as unusual. At Aberlady the thin scatter of Roman Iron Age material in an Early Historic and medieval metal-detected assemblage shows that there is an earlier phase to this important 'productive site'.

Fieldwalking can undoubtedly be soul-destroying; several days of walking and trial-trenching in the field immediately south of Traprain produced only a single, early prehistoric find (M Cook, pers. comm.), and no finds were made in the course of the TLEP geophysical surveys. However, when tied in with metal detecting it becomes a valuable prospecting strategy for unknown sites and for investigation of known ones (as Gilmerton House suggests). Yet for this, detecting and fieldwalking must be sustained and intensive, not a once-over scan; it is clear that persistence over a period of time is necessary to extract the best results. So, while perhaps less widely-recognised than other survey techniques in Scotland, this brief review does suggest that strategies targeted to artefacts have more to offer studies of later prehistory than current practice allows. In developing future practice, however, the emphasis on the recovery of artefacts from the ploughsoil must be maintained, a process that does not further disturb stratified contexts.

The same is true of geophysical survey. At present geophysical survey in Scotland has not been trialled as a tool to prospect the landscape at a regional level, but the good results obtained from the TLEP study area should encourage its use and highlight its potential value in exploring areas where cropmark formation is rare. The widespread application of geophysical survey in Scotland still suffers from a perception that it is not effective (Jones and Sharpe 2006), but these results weaken that position. The interpretation of both cropmark evidence and geophysical surveys has benefited from a symbiosis between the results, each feeding off the other, and in the cases of the excavated sites benefiting from corroboration through excavation. Overall, the approach of the TLEP in drawing on the coarse grain, but extensive, relatively inexpensive and non-destructive survey data in tandem with the detailed, but expensive and destructive, view from selected excavations provides a solid model for exploring relatively unknown landscapes.