# Druminnor Castle: Report on the Geophysical Survey, 2019

Colin Shepherd and Emil Tanasie[1]

## Introduction

As part of the ongoing excavations at Druminnor Castle - now in their eighth season - a programme of geophysical survey was undertaken in order to help understand the site better and to aid future excavation strategies. This work was generously sponsored by the Castle Studies Trust and undertaken by Alpha Geosurvey at the beginning of April, 2019. 2,500 square metres were surveyed using Ground Penetrating Radar (GPR) across a total length of five and a half kilometres. In all, 286 transects were recorded to a depth of just over four metres. 'Time slices', each of approximately 100mm depth, were compiled from these data to provide a view of the site through time. Two transects were also carried out using Electrical Resistivity Tomography (ERT). These were laid out on roughly north-south and east-west orientations and intersected between formerly excavated trenches. One ERT transect was 70 metres in length whilst the second was a little over 90 metres.

The Druminnor Castle excavations form part of the Bennachie Landscapes Project, run jointly by the Bailies of Bennachie - a local community-led conservation and research group - and the University of Aberdeen. Druminnor Castle is home to Alexander Forbes who is to be warmly thanked for all his help, support and important historical knowledge. All those working on the site are volunteers.

## Historical Background

Druminnor Castle was the caput of the Lordship of Forbes. It sits within Kearn parish which, along with the parish of Forbes, formed the Barony of Forbes as recorded in a charter of 1271/2 (Ant. A&B, iv, 372) (Figure 1). Though the Forbeses are known to have been at Druminnor from this time, it is possible that they were associated with the site prior to this - the 1271/2 charter simply recording an earlier state of affairs. A grain-drying kiln, dated to the second half of the 12th century (Shepherd, 2018) indicates that the site was settled, probably in a 'manorial-like' fashion, at that earlier time.

1 Alpha Geosurvey, info@alpha-geosurvey.co.uk.

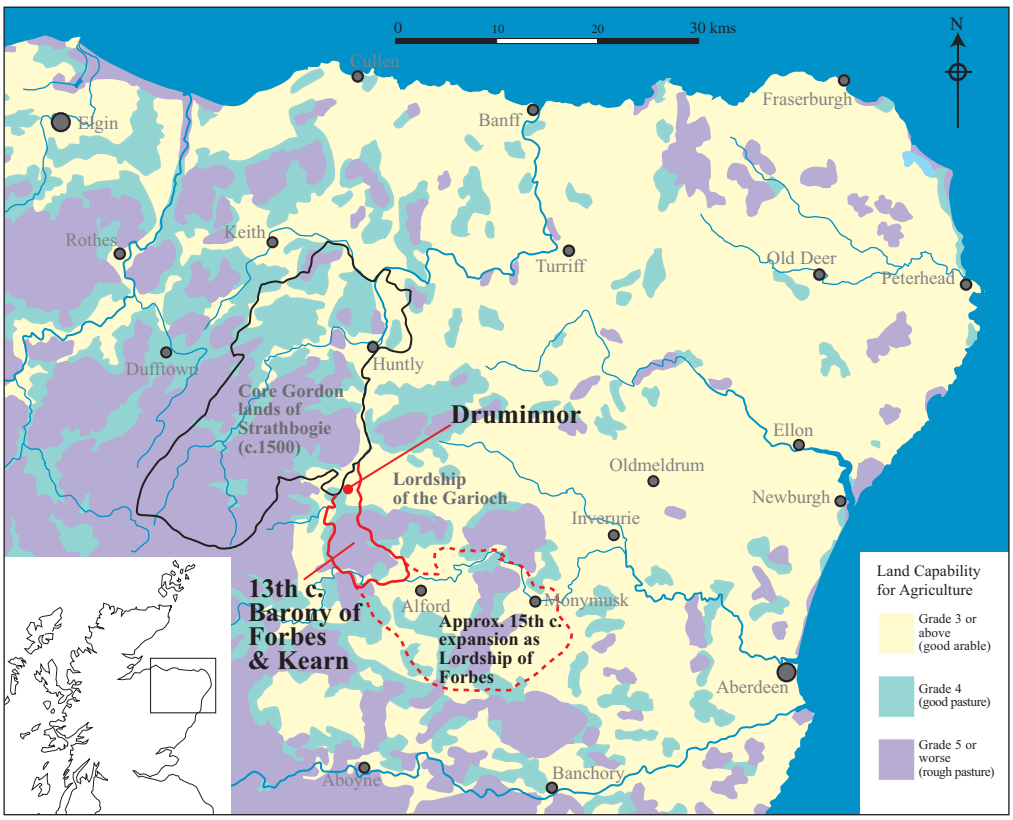


*Figure 1. Lordship of Forbes and associated familial lands in the 13th and 15th centuries with land capability for agriculture (based upon Macaulay Institute, 1982).*

Documentary study carried out for the Bailies of Bennachie in 2010 (Shepherd, 2011) revealed the hitherto overlooked survival of two 18th-century estate plans (RHP 260/1a; RHP 44705) detailing the plan of the castle (Figure 2). Prior to this, it had been considered that the castle had consisted simply of the present hall block with an attached tower on its north-west corner (Slade, 1967). This can now be shown to have been a completely erroneous view. Subsequent excavation as part of this project (Shepherd *et al*, 2015; in prep.) has demonstrated that the 18th-century plans are fairly accurate in their depiction of the castle with a main courtyard and appended, secondary court. The latter appears to have been added in the early 16th century, with the main courtyard being a product of the mid 15th century. A ditch-like feature underlying the buildings in the lower courtyard may well be related to the 1456 licence to fortify that notes permission *"to fortify the same with walls and circumvallate it with ditches..."* (Forbes, 2011, 1 ; Ant. A&B, iv, 400) (Figure 3). The upper courtyard appears to have been built upon a platform created by dumping a vast quantity of quarried sandstone to the

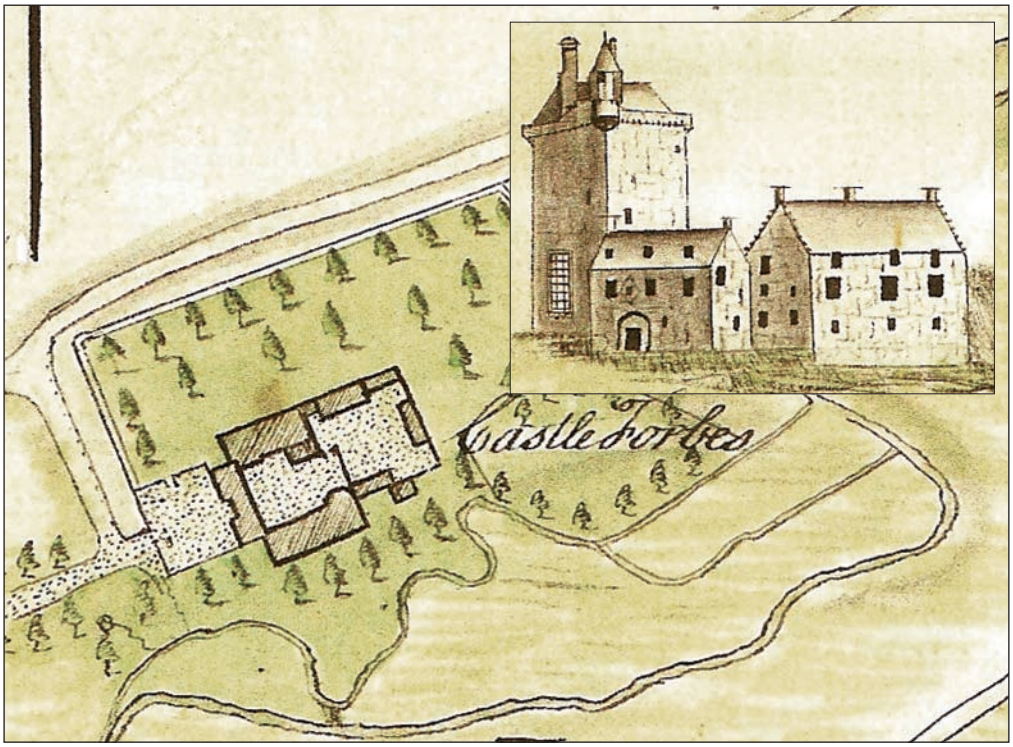


*Figure 2. Two sections of one of the 18th c. estate plans (RHP 44705) showing castle plan and inset sketch of the standing buildings. Note the three courtyards and outer garden enclosure. Also, the interesting irrigation pattern below the castle.*

height of a geological basalt dyke. This latter feature may have had a bearing on the siting of the castle. At least some of the platform material may have originated from the ditch beneath the later lower courtyard buildings.

Other features (apart from the kiln), lying to the north of the tower, have been revealed by the excavations and do not form part of the 18th-century plan. They appear to be earlier in date. These may relate to the 15th-century build or to a former plan associated with the tower, prior to the 15th-century work. During the 1600s, Druminnor was again refurbished, possibly resultant upon damage inflicted in 1571 by the neighbouring Gordons of Strathbogie, with whom the Forbeses were in an almost perpetual state of conflict. From the early 1700s, parts of Druminnor again lay in a state of disrepair as economic stress and other factors forced the then Lord Forbes and family to live elsewhere. The present hall block was probably tenanted and the other castle buildings are presumed to have fallen into decay (Wright, 2003, 28). Druminnor was sold to the Grant family who demolished the buildings and tower in 1800 (Leyden, 1903, 229). The hall block remained in residential use and, between 1841 and 1843, a Victorian 'mansion

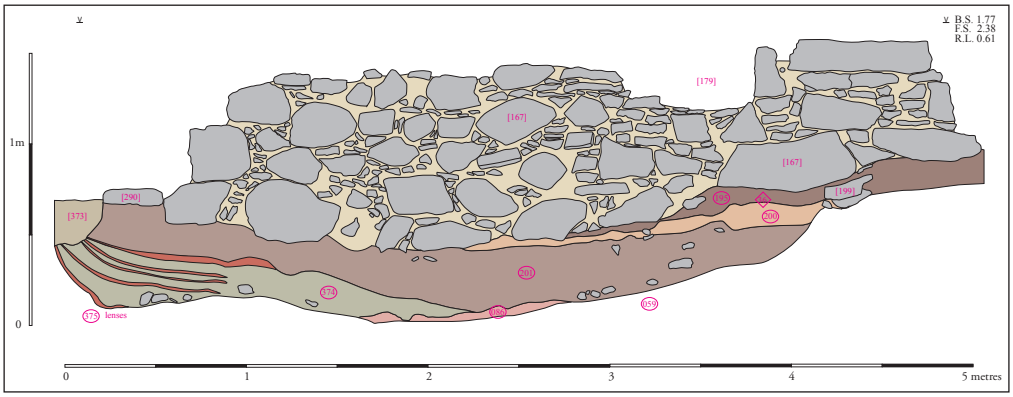


*Figure 3. Section 94 showing later extended north barmkin wall with cut of ditch beneath.*

house' was constructed against the north-west corner of the hall block. (This, along with other architectural evidence of a former adjoining structure, presumably led to the supposition that the tower had formerly occupied that spot.) This 19th-century addition was itself removed in the 1960s.

## Aims of the Geophysical Survey

The work reported upon here sought to address a range of concerns. Most were resultant upon previous excavation work that posed new questions and possibilites that, prior to those interventions, could not have been foreseen. Generally, these revolved around the fact that the site turned out to be far more complicated than first imagined. Another problem encountered was the intractable nature of the dense overburden of material comprising the present car parking area. In particular, help was required to help in deciding which parts of the car park showed the greatest archaeological potential. The tower is known to have stood on the site of the car park and former trial trenches had already demonstrated the difficulties involved in working in this location.

Previous work that revealed the kiln also raised the possibility that further remains may have been sealed beneath an area of lawn to the west of the castle. However, the overburden appeared to be almost two metres deep in places and a historically-important sycamore limits the potential for archaeological investigation in that area. Consequently, geophysical survey seemed to offer the only approach viable in such a sensitive area. This was also, as shown by the estate plans, the area of the 18th-century entrance to the castle and it was hoped that evidence may be found relating to that.

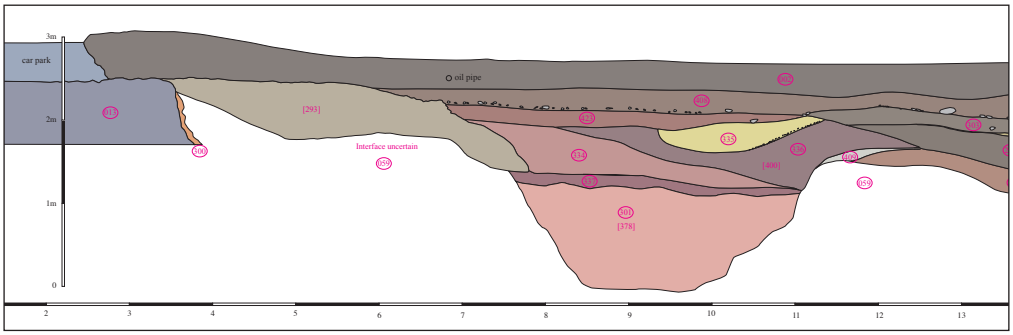


*Figure 4. Part of Section 98 showing deeply cut feature of unknown origin partly overlain by platform comprising quarried and rammed sandstone.*

Earlier excavations, as noted above, had also demonstrated the existence of a ditch-like feature that, it was hoped, might be traced by GPR as well as a much deeper cut feature (see Figure 4). The latter may be either archaeological or geological and the merits of both suggestions have resulted in hours of contentious wrangling between professional geologists involved with the project. (It was hoped that geophysics might sort the question before blows were dealt!)

Finally, the 18th-century plans depict an outer enclosure wall surrounding what may once have been formal gardens associated with the castle. It was hoped that GPR might pinpoint that feature in order that it might be sectioned.

## Geophysical Survey Methodology

### Ground Penetrating Radar (GPR)

The GPR technique uses high-frequency electromagnetic (EM) waves (from 10 to 3000 MHz) to acquire subsurface information (Figure 5). GPR detects sharp changes in dielectric uniformities in the different materials in the subsurface. These uniformities, in a geological setting, being a soil and rock material, water content, and bulk density. Data are normally acquired using antennas placed on the ground surface or in boreholes. The transmitting antenna radiates EM waves that propagate in the subsurface and reflect from boundaries at which there are EM property contrasts. The receiving GPR antenna records the reflected waves over a selectable time range. The depths to the reflecting interfaces are calculated from the arrival times in the GPR data if the EM waves propagation velocity in the subsurface can be estimated or measured. Equipment used was a Mala GX with 450MHz (approx. 150 - 900MHz) antenna.

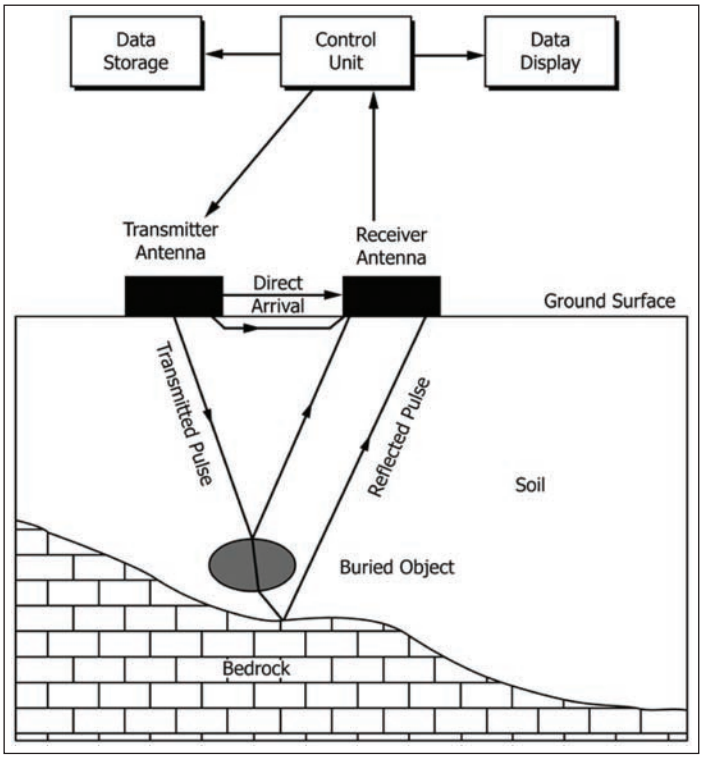


*Figure 5. The basic concept of a GPR system.*

**Electrical Resistivity Tomography (ERT)**

(Also known as Electrical Resistivity Imaging - ERI)

Metal electrodes are used to inject an electric current and then measure that current. This determines the distribution of electrical resistivity in the ground and is closely linked to the nature of the ground material (Figure 6). Equipment used was an Ares utilising 48 electrodes.

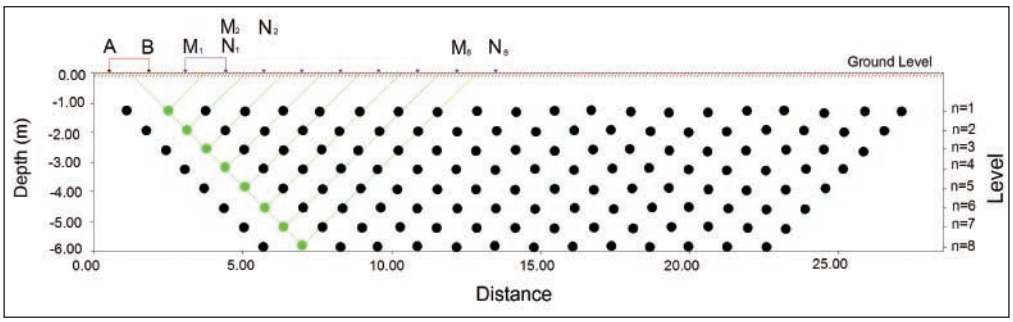


*Figure 6. Typical data point distribution of an ERT profile using a Dipole-Dipole array.*

## GPR Data Coverage

The GPR data was acquired in grid patterns. In total there were 286 individual lines collected. The data was subsequently processed as a single data set to create time/depth amplitude slices - 'time-slices' (Figure 7).


*Figure 7. GPR data coverage at Druminnor Castle.*

### ERT Data Coverage

The ERT data has been acquired as 2 intersecting profiles (Figure 7):

ERT1, 94m length, 48 electrodes at 2m spacing. Maximum estimated investigation depth: 18.8m

ERT2, 70.5m length, 48 electrodes at 1.5m spacing. Maximum estimated investigation depth: 14.1

## Results and Archaeological Contextualisation of the Geophysical Survey

Of particular relevance for the present work at Druminnor are the results from the GPR survey. The 75 'time-slices' covering 2,500 square metres of the site of Druminnor have added greatly to its interpretation based upon known data as well as presenting foreknowledge for the planning of further interventions. These are now underway, informed by the GPR data.

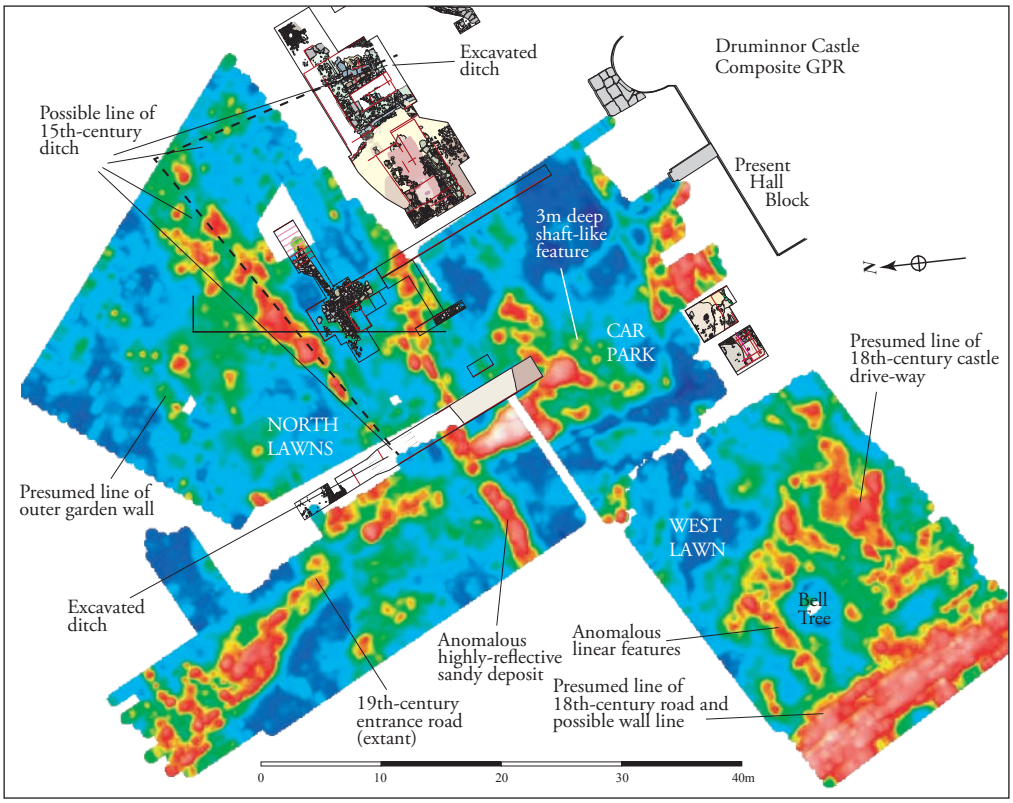


*Figure 8. Composite view of all 0.5-1.8m time-slices showing major features.*

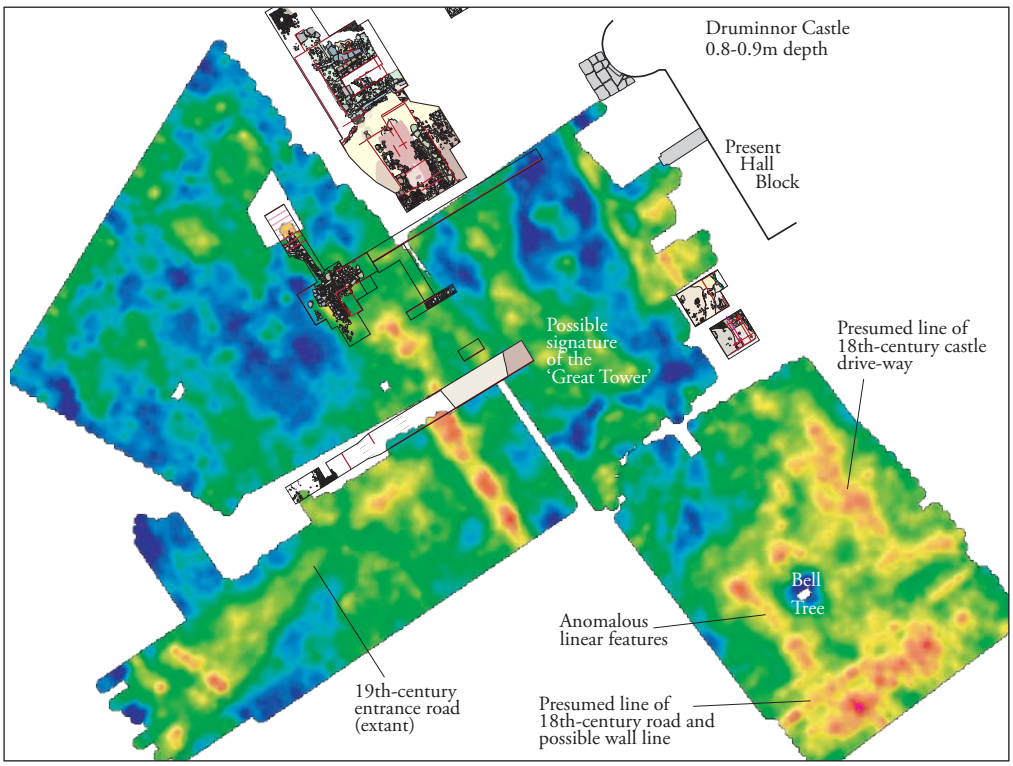


*Figure 9. Reflective surfaces at estimated depth of between 0.8m and 0.9m.*

Figure 8 shows a composite view of 0.5-1.8m time-slices, compressed onto a single dimension. In general terms, the red areas are the most highly reflective planes with respect to providing a contrasting interface between one surface and those above and below it. Three areas - the North Lawns, West Lawn and Car Park - have been indicated and will be referred to in the following assessment. Excavation trenches have been shown superimposed onto the GPR results.

Figure 9 shows reflective surfaces estimated to be between 0.8m and 0.9m in depth. In the North Lawns, the 19th-century entrance to the 'mansion' can be seen. This trackway still survives in a fairly grass-grown state. Its great depth, as shown by the GPR, is quite surprising but a consideration of the topography indicates that it was built up in order to maintain an even and level approach to the house. The natural ground level would have resulted in the road needing to dip before rising again to approach the house. Clearly, it was considered more appropriate to offer a level approach.

Within the Car Park area are a range of reflections that, it is hoped, indicate the presence of stone related to the tower. The difficulty of deciphering geology

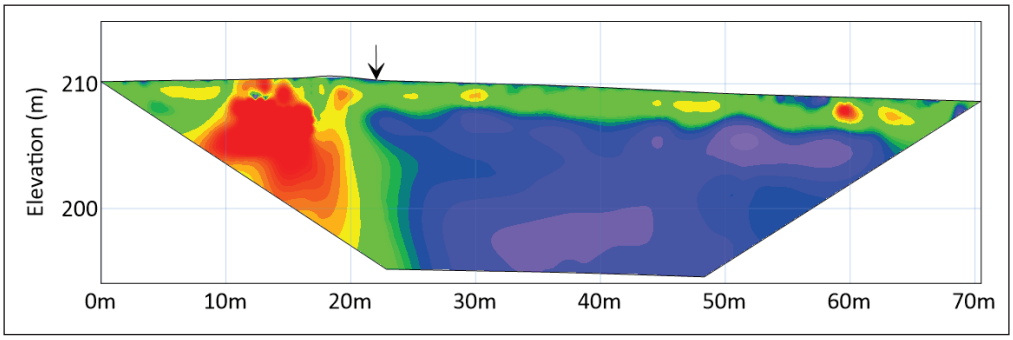


*Figure 10. ERT North-South section showing basalt dyke on left of image.*

from archaeology in this part of the site is hampered by the igneous intrusion that created the basalt geological dyke. This shows up as the large red expanse to the left on the ERT section shown in Figure 10.

The West Lawn shows a range of fascinating features. The linear features at the extreme west appear to relate to the known 18th-century entrance track to the castle. This appears to have been bounded to the east by a wall, as shown on the

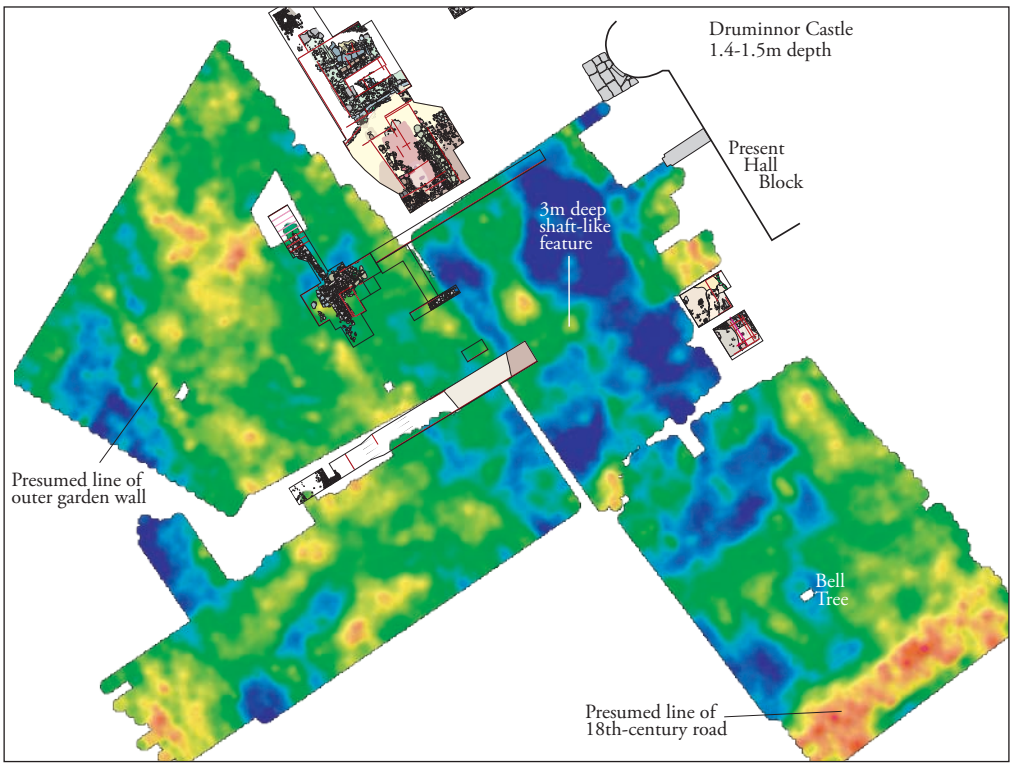


*Figure 11. Reflective surfaces at estimated depth of between 1.4m and 1.5m.*

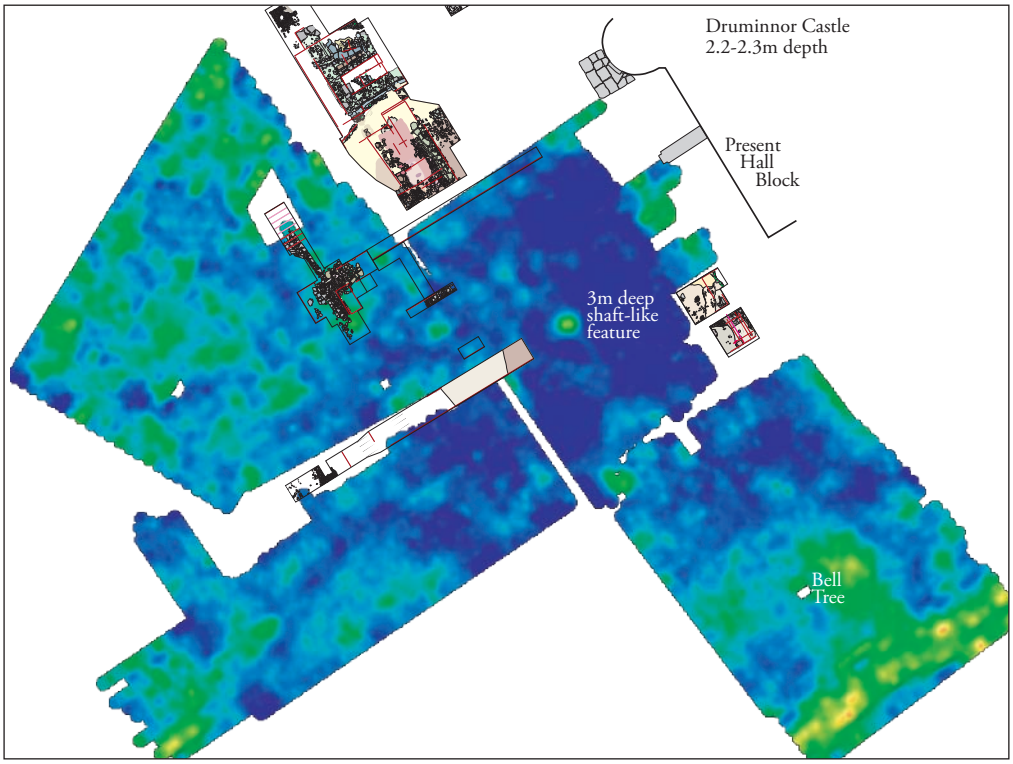


*Figure 12. Reflective surfaces at estimated depth of between 2.2m and 2.3m.*

GPR. There was a ninety degree turn into the castle approach and this also appears to be shown on the time-slices. These features appear to confirm the reasonable accuracy of the18th-century plans discussed above. Most intriguing, however, is the linear feature north of the Bell Tree. This may well be the northern boundary wall of the entrance court shown on the estate plan and might suggest that the Bell Tree was situated within this court.

The Bell Tree is an ancient sycamore and one of only a handful of 'named' trees recorded on the 1st edition Ordnance Survey maps. The reason for its name is lost to time, though a range of suggestions have been made. A late 19th-century photograph shows it looking fairly similar to how it does now and subsequent photos demonstrate that the present tree is, indeed, the same one photographed at that time. This would indicate that it was very old even then and it may be suggested that a 16th- or 17th-century planting date may be considered possible. The historical nature of this tree, therefore, militates against any archaeological work that would impinge upon its root system. Geophysical survey is, consequently, the only means available of assessing the below ground evidence here.

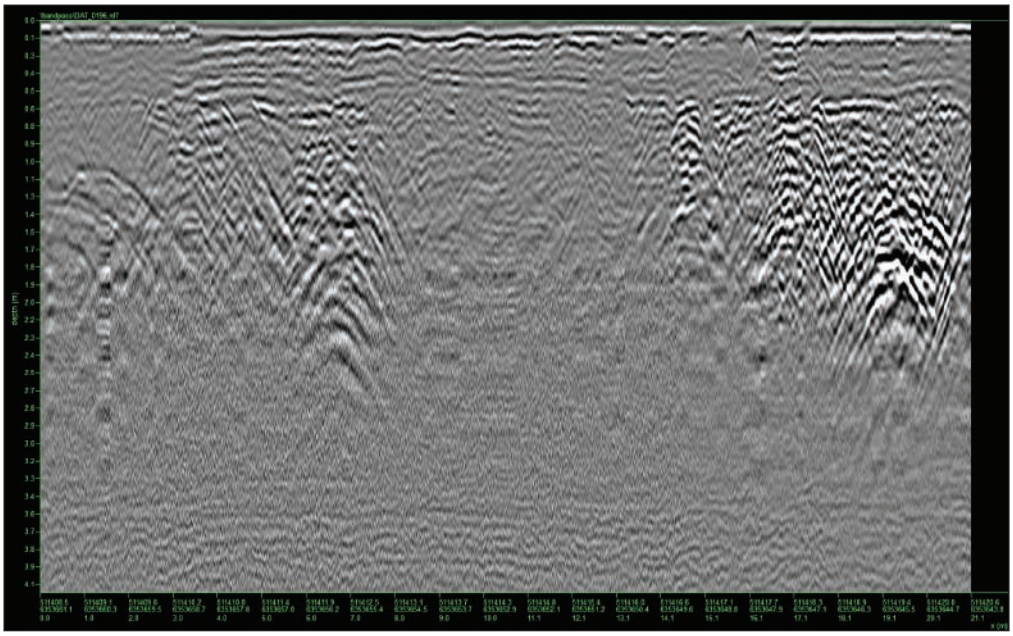

*Figure 13. Radargram from transect 196 showing deep, circular shaft to the left of the central 'quiet' zone.*

Figure 11 shows the time-slice at approximately 1.4-1.5m deep. The 18th-century entrance road is still clear and suggests that it was metalled to a substantial depth. In the North Lawns, a linear feature is likely to be the sought-after, northern enclosure wall as depicted on the 18th-century estate plan. Again, this demonstrates that the plan was fairly accurate in its depiction of the castle and its surroundings. In the Car Park is a circular feature within the footprint of the known location of the tower. Figure 12, at between 2.2 and 2.3m depth shows this feature continuing. In fact, it can still be seen at a depth of between 2.8 and 2.9m and seems to be about 2m in diameter. It appears to be a circular shaft filled with highly reflective material that extends downwards for almost 3 metres. It can be seen clearly on the radargram 196 (Figure 13) and it is hoped excavation will confirm what this interesting feature is. One obvious suggestion may be a well. However, its positioning in relation to the basalt dyke makes this an intriguing prospect and it may lay alongside the dyke within sandstone.

Finally, Figure 14 shows a time-slice at between 3.2 and 3.3m deep.Whilst most of the site is, at this depth, devoid of interest, the area around the Bell Tree still contains some highly reflective surfaces. In fact, this is the only part of the surveyed area that demonstrates features in all time-slices. It might also be noted that the present tree sits on a slight mound. Considering the depth of the 18th-century

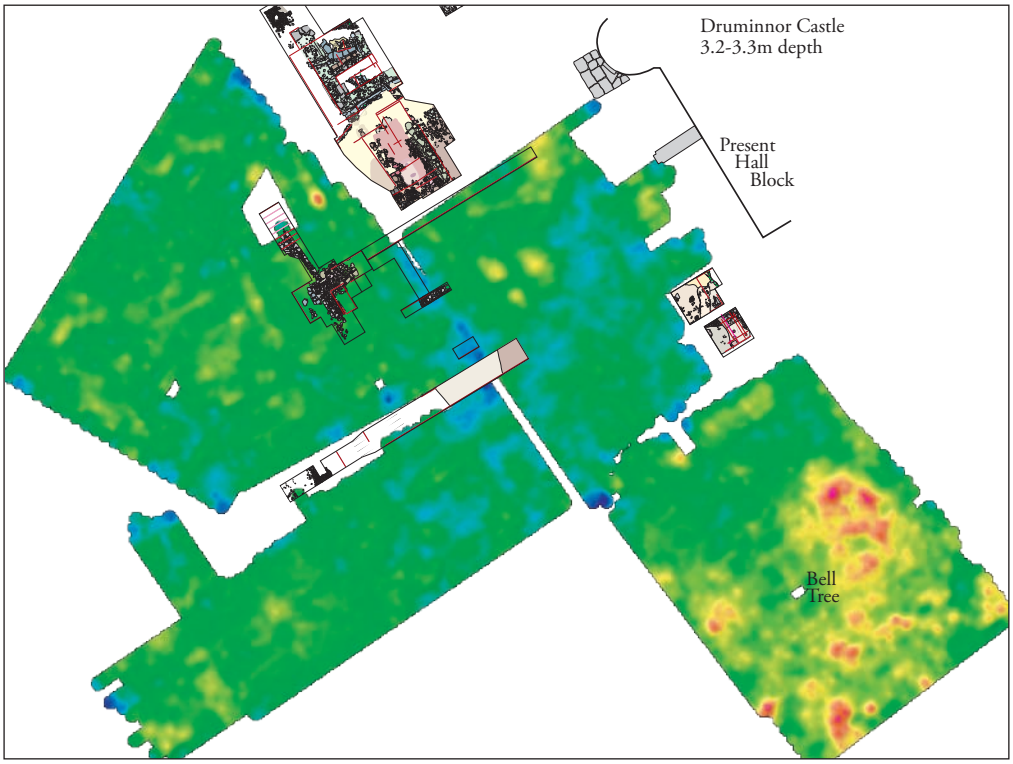


*Figure 14. Reflective surfaces at estimated depth of between 3.2m and 3.3m.*

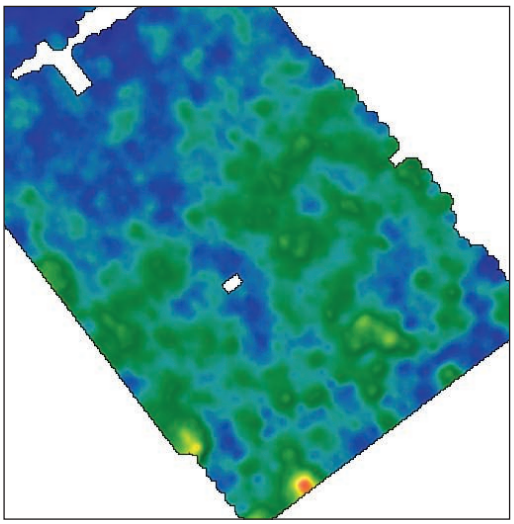

*Figure 15. Area of the Bell Tree at the lowest time-slice of 4.1m.*

road indicated by GPR, the tree must have loomed over the entrance track. Furthermore, if reflective surfaces survive at over 3 metres deep, it might be suggested that some stony structure may have been set upon the natural ground surface. This, presumably, has been subsequently added to by later deposits. Clearly, excavation is impossible because of the tree but the evidence to hand indicates that a historic, named tree sits in the middle of and above a pile of reflective deposits that are roughly circular and extend down for 3 metres. Even on the lowest time-slice at 4.1m, this feature is still evident (Figure 15).

## Conclusion

Geophysical survey at Druminnor, as well as guiding future endeavours, has been used as a means of attempting to understand certain problems defined by excavation. This contrasts with how it is more commonly used when forming a predictive stage in site analysis, frequently culminating in excavation.

With respect to the aims of the geophysical survey, most have been achieved. The car park area has produced a range of disturbances that, it is hoped, relate to the former tower. Of particular interest is the deep, circular feature sited within the assumed footprint of that tower. Owing to the dense matrix forming the surface of the car park - accumulated over the last 150 years - this insight into the underground features is very important for increasing the viability of excavation in this area.

The West Lawn is virtually 'off-limits' with regard to excavation owing to the presence of the historically-important and aesthetically-beautiful ancient sycamore - the Bell Tree. GPR has been able to distinguish features recognisable from the 18th-century estate plan and to provide exact locations in order to plot these features accurately. Of particular interest has been the recognition that much of this ground has been substantially raised through time. The Bell Tree still sits on a slight, raised mound and when this is related to the 18th-century entrance track level as determined by GPR, can be seen to have towered over that feature. That further 'reflective' anomalies persist down to even lower depths raises the interesting possibility that this tree marks what was once a significant topographical, raised - possibly circular - feature.

On the North Lawns, the outer enclosure wall appears to have been recognised and can be targetted for excavation. It is hoped that dating evidence may be found in order to try to ascertain the date of this feature. More problematic has been the recognition of the ditches or 'cut' features recognised in previous excavation trenches. It is possible that the reflective anomalies seen on Figure 8 indicate stone 'backfill', thrown into the ditch after it had gone out of use. This theory will be tested by excavation. Finally, the very deep and equally puzzling cut feature shown in the section drawing (Figure 4) cannot be seen on the time-slices so far produced. It is presumed that the highly geologically-weathered sandstone is almost indistinguishable, in terms of reflective properties, from the fine sandstone-derived fill. Further analysis of the 2D radargrams is being pursued in the hope that more can eventually be gleaned from the data. It should be stressed that the analysis of the results is still ongoing. The data gathered in this survey can be sorted and ordered almost inifinitely to permit ever-closer refining of the results.

*Figure 16. GPR survey on the West Lawn beneath the Bell Tree with surviving hall range in the background.*

It is hoped that, in time, it will be possible to clarify the nature of that deeply-cut feature. But, with the exception of that outstanding 'work in progress', the geophysical analyses undertaken here have succeeded in achieving the aims set out and have provided important new data with which to develop further excavation strategies. Furthermore, a more accurate delineation of the castle plan has also been made possible by these results.

## Acknowledgements

As noted at the beginning, this geophysical survey has been made possible through the generous funding provided by the Castle Studies Trust. As ever, grateful thanks are owing to Alex Forbes for his forbearance in the face of the ravages to his lawns and for his insightful historical advice. Bruce Mann of Aberdeenshire Council has, as ever, been a great source of support and advice as has Penny Dransart. Finally, were it not for the stout-hearted and highly-skilled volunteers of the Bennachie Landscapes Fieldwork Group who have been turning up for years to interrogate this site, its secrets would have remained hidden.

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