A Multimethodological Geophysical Survey of New House Long Barrow

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Monument number -
MG285

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Chapter One - Introduction

1.0 Project Summary

The purpose of this research into New House long barrow has been to map the extent of this monument whilst creating an understanding of this monument within its landscape.

1.1 Research questions

There is a gap in knowledge regarding New House long barrow so detailed geophysical analysis of this site is needed. A series of geophysical techniques will be employed to research these sites and test certain geophysical methods to fill a number of lacunas, these being:

- Can geophysics be used to correctly define New House long barrow?

1.2 Aim

The aim of the research is to create a further understanding of New House long barrow through the use of geophysical methods whilst analysing the data responses received from each geophysical method.

1.3 Objectives

To achieve the aim of this research geophysical survey will be undertaken over all three sites where the following will be studied:

- Assess the change in response by changing the direction of survey of the Wenner array in relation to the monument.

Chapter 2 – Background

2.0 Long Barrows

Long barrows, visible within the landscape as mounds of earth of anything up to about 100m in length, 4m high and 35m wide, dating to the early Neolithic period and began to be built in the British Isles around 3800 BC (Darvill 2004: 67) are among the best known and easily recognised archaeological monuments in the landscape (Field 2006: 21). These monuments are relatively simple earthworks and there is much scope for misidentification, especially when any subtle ledges and breaks of slope, or the ditches that might assist identification, have been obscured by episodes of cultivation (Field 2006: 23). They are rectangular or trapezoidal earth mounds traditionally interpreted as collective tombs. They usually measure from approximately 100ft (30.48m) to 300ft (91.44m) and from 9.144m to 30.48m rising to a height measuring between 4ft (1.2192m) to 12ft (3.6576m). They are usually wider and higher at one end – this is usually towards the eastern end – and this end usually contains the interments (Wood 1967: 151, Hawkes 1957: 149). In shape they must present the features of the angular (usually trapezoidal) mound, defined by a peristalith or dry walling in stone country and by palisades (Piggott 1937: 444).

2.1 Location

Located in the Parish of Churchstoke on the border between the counties of Powys, Wales and Shropshire, England, these three sites lie east of the village of Priest Weston in the near vicinity of Corndon Hill. These three monuments are positioned in close proximity to one another with New House long barrow (Figure 1) being 582m southwest of the Whetstones at a bearing of 249° and Mitchell's Fold stone circle being 707m north of the Whetstones at a bearing of 345° (Figure 2 and 3).

Figure 5 – Aerial view of New House long barrow.

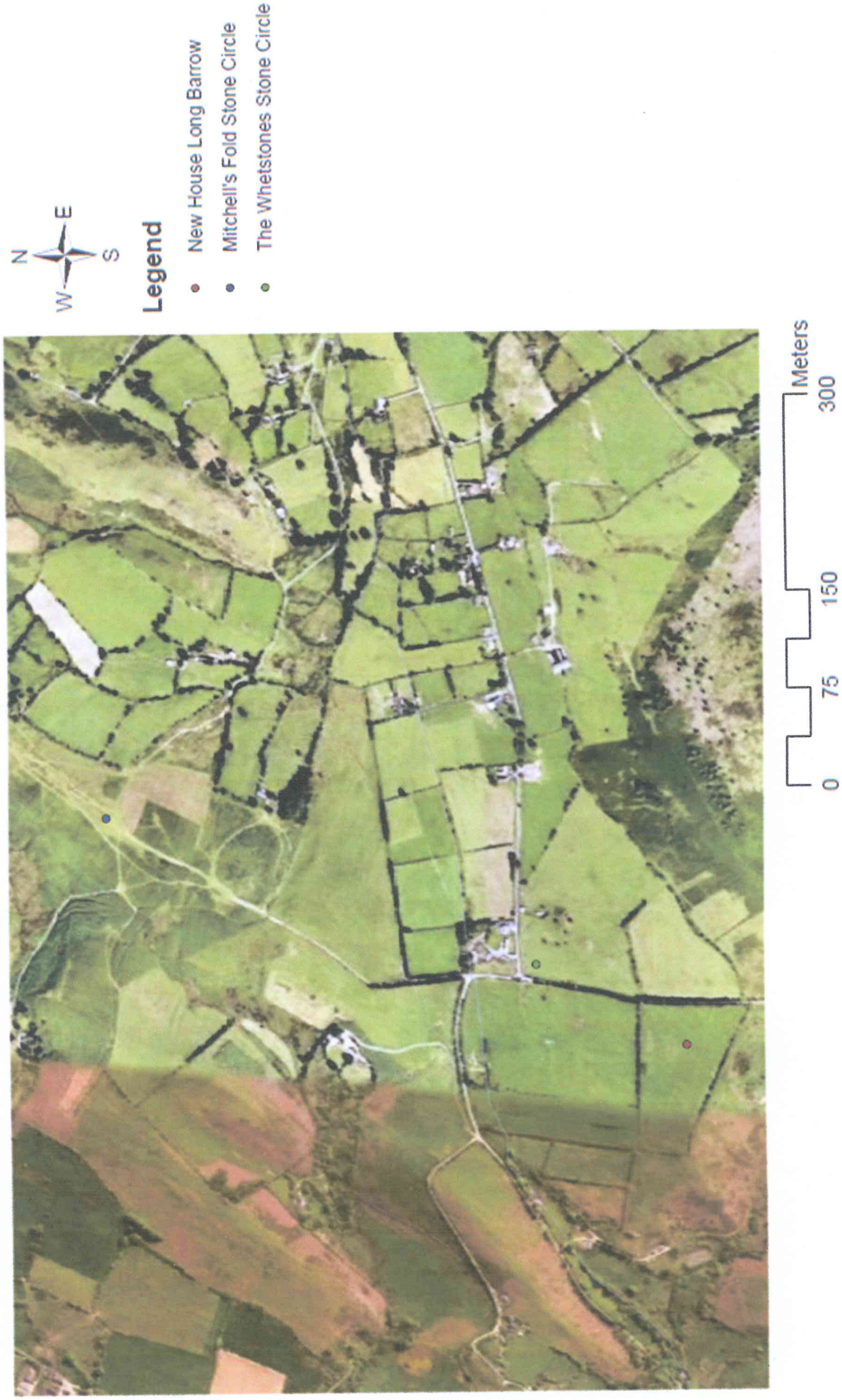

Figure 6 – Aerial view of New House long barrow, Mitchell's fold stone circle and the suggested location of the Whetstones stone circle by English Heritage.

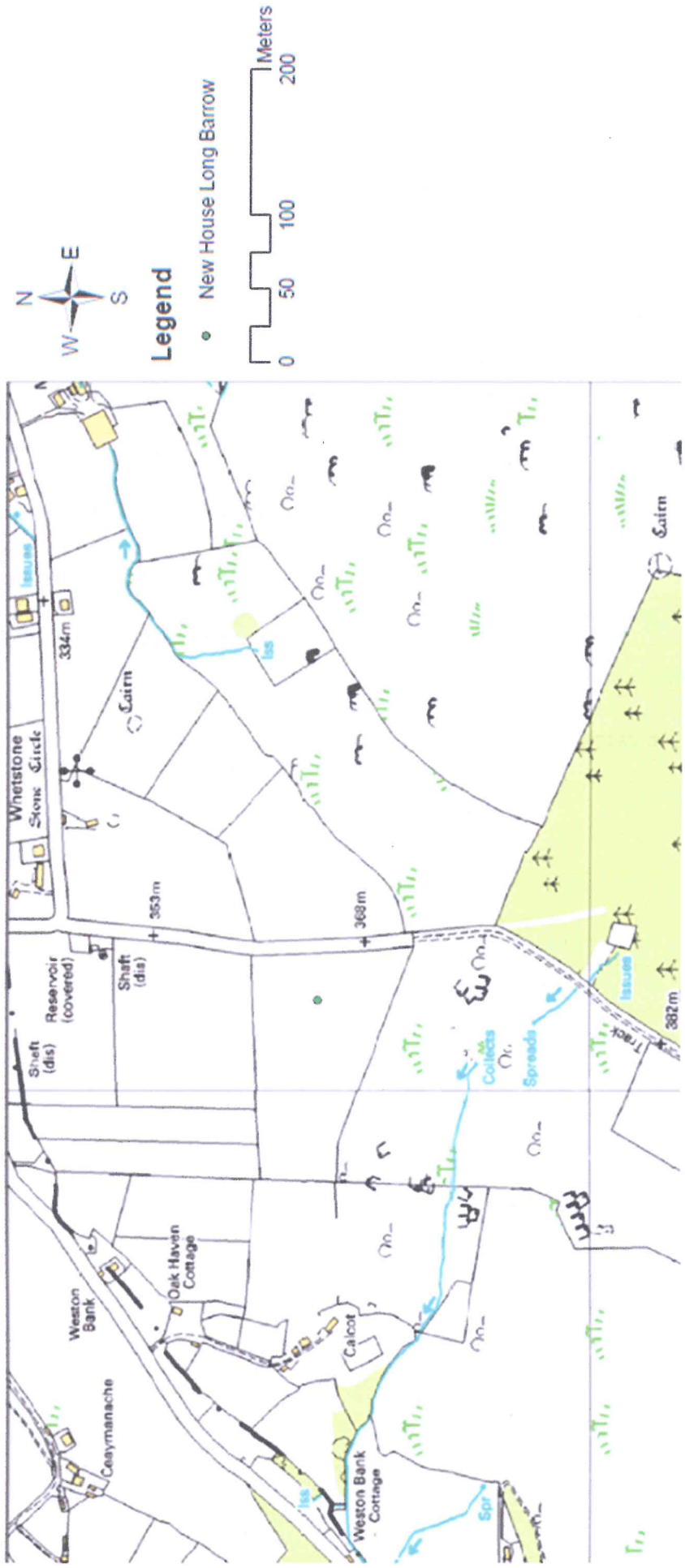

Figure 7 – Location map of the surrounding area of New House long barrow.

2.2 Geology

The geology of the area in question is a mix of caradoc sandstone, limestone, mudstones and Gwern-y-Brain Shale (Cherns *et al* 2006: 80, Brenchley *et al* 2006: 30, Bassett *et al* 1992: 106, BGS 2010). Sedimentary rocks such as limestone provides good magnetic responses whilst using gradiometers (Clark 1986: 1407, Foster 1991: 41), as they provide low levels of noise so good contrast between archaeology and geology is possible (Figure 4).

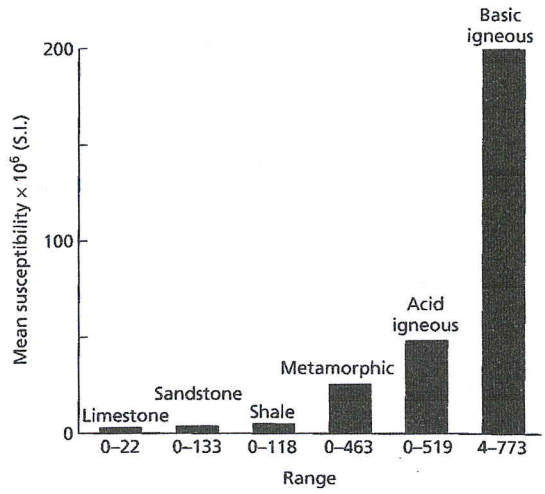

Figure 4 – Histogram showing the mean values and ranges in susceptibility of common rock types (Kearey *et al* 2002: 159).

2.3 New House Long Barrow (SO300973) Monument number - MG285

Defined as an oval mound, measuring 30m by 18m in length is orientated south-west to north-east (Figure 5). This barrow may fall into the category of a trapezoidal earthen long barrow (Ashbee 1984: 88 – 91, Field 2006: 57 – 58). The proximal end rises 0.3 - 0.4m above the surrounding field surface upon a false crest and faces unusually towards the south-west (Figures 24 and 28). This is unusual for long barrows that normally have their proximal ends to the east. Possible kerb stones are located around its north-east perimeter. A modern clearance cairn occupies the proximal end (Gibson 1997: 62, Gibson 1998: 1 – 7, 109). Field visits in 1997 and 1998 have aided in defining this monument (CPAT site visit 1997a, CPAT site visit 1998). Located to just west of the ridge upon which New House long barrow is situated New House cairn I classified as a small burial cairn (CPAT site visit 1997a) holds a diameter of 7.0m and stands to a height of 0.3m – 0.4m.

There are a number of stones protruding through the north-eastern edge of the barrow (Figure 4) which may suggest the presence the remains of a buried cairn.

Figure 5 – A south easterly view of New House long barrow showing its position upon a ridge, thus providing a panoramic view of the landscape to the east. This barrow is difficult to visualise within the landscape as it has nearly been completely flattened standing at its highest point to approximately 0.30m (Author 2011).

2.4 Within a Wider Archaeological Context

There is a wider archaeological context within the surrounding landscape. At Mitchell's Fold stone circle a small standing stone and a burial cairn approximately 80 metres south of the circle is located. At the Whetstones stone circle in close proximity to the suggested location of the stone circle is the Whetstones cairn (SO30409753), this cairn is now much reduced in size and the exposed area holds a diameter of approximately 5m with the original dimensions of the cairn 22m northwest - southwest by 16m transversely (Gibson 2002). Finally at New House long barrow, a clearance cairn (New House cairn 1 - SO29959729) is located to the southwest holding a diameter of 7m and a height of 0.3m – 0.5m. Loose stone on top of cairn attest relatively recent field clearance, but earth-set stones below these suggest an antiquity, probably a small burial cairn. To the southeast of New House long barrow is situated a second barrow, Pant Brwynog barrow (SO29999670). This round barrow discovered in 1953 is partially despoiled holding a diameter of 15m northeast – southwest by 12.5m with a height of 1.5m. There are no signs of a surrounding ditch. One large stone just southwest of centre and a second to the southwest may be cist covers or clearance (Gibson 2002).

Three cairns of significant interest are situated within the area, these being Lan Fawr Cairn I, (SO295896680) of unknown date, Lan Fawr Cairn II (SO29819681) a clearance cairn dating to the Post-Medieval period and Lan Fawr cairn III (SO297965) a Bronze Age cairn. Lan Fawr Cairn I is Natural outcrop (partly dug into) topped by an irregular stone block. This site was formerly noted as cairn (CPAT site visit, 1978a). Lan Fawr Cairn II a Post-Medieval clearance cairn defined as an earth and stone mound some 10m northwest - southeast by 6m wide and at a height of 0.8m (CPAT site visit, 1978b). A small scale excavation at Lan Fawr cairn II in October 1986 was undertaken following the discovery of a collared urn and

cremation (Britnell 1988, CPAT site visit 1997a). The cairn holds a diameter of 0.5m with a height 0f 0.5m.

There are two cairns within the vicinity of Corndon Hill which hold significance to the local area these are the Bronze Age Corndon Hill ring cairn (SO30459665) and the Bronze Age Corndon Hill cairn (SO30449667). Corndon Hill ring cairn is a Probable circular ring cairn defined by a bank 1.5m wide and 0.2m high with an overall diameter of 6.0m. Corndon Hill cairn is a circular mound of turf-covered stone, 5.5m in diameter and 0.3m high. The cairn adjoins a redundant field boundary bank on its NW side

Located around Corndon Hill is the Corndon Hill round barrow group, this group consists of seven Bronze Age round barrows.

Corndon Hill Barrow I (SO30449666) holds a diameter of 22m and a maximum height of 0.8m with poorly defined limits and the eastern half is hidden by turf (CPAT site visit 1978c). The surviving structure consists of a low spread of stone with a high point in the centre where a modern cairn has been built. Stone was probably also removed from the cairn to build the square structure As with two of the other cairn on Corndon Hill (Corndon Hill Barrow V and VI) there appears to be a semi–circular addition, on the south-western side in this case, which may define a secondary burial. The addition measures 6.0m northwest/southeast by 3.0m and is 0.3m high.

Corndon Hill Barrow II (SO30609693) a scheduled monument is located on the highest point of Corndon Hill holding a diameter of 30m and a height of 1.0m. This monument has poorly defined limits and is largely concealed by turf with an OS Trig pillar in the northwestern quadrant. Most of the stone has been removed some of it to form a conical modern cairn (CPAT site visit 1978d, CPAT site visit 1997b). There are some suggestions of

structure around the centre and its southern side, in the form of edge-set stones, but these may be fortuitous and there is no visible evidence of a cist.

Corndon Hill Barrow III (SO30909676), also a scheduled ancient monument holds a diameter of 23m and a height of 1.8m at its central point and now has a single oval-shaped shelter. Present is a central hollow where a shelter has been made, but there are now three similar adjoining hollows extending almost to the northeastern edge of the cairn. Additionally, there are two further isolated disturbance hollows, in the north and western halves of the cairn (CPAT site visit 1978e, CPAT site visit 1997c).

Corndon Hill Barrow IV (SO30949680), another scheduled ancient monument holds a diameter of 10m with a height of 0.6m at its centre, approximately 40m from Corndon Hill Barrow III. Located at its centre is a cist measuring 1.3m in length and 0.6m in width with a 0.8m square capstone (CPAT site visit 1978f, CPAT site visit 1997d).

Corndon Hill Barrow V (SO30869632) is also a scheduled ancient monument holding a diameter of 22m and a height of 2m at its centre. An approximately circular cairn on the crest of the NE/SW ridge to the S of the summit of Corndon Hill there are a total of seven hollows dug in the top for shelters, though these are mainly of limited size (maximum diameter of 2m) in comparison with those in Corndon Hill Barrow III (CPAT site visit 1978g, CPAT site visit 1997e).

Corndon Hill Barrow VI (SO30539608) is also a scheduled ancient monument holding a diameter of 20m and a height at its centre of 1.9m where there are several boulders of up to 1.3m in size. An approximately circular cairn situated at the south-western end of a northeast/southwest ridge, on a local summit. The structure is mostly composed of bare stone, though there is some turf covering in the centre and around the edges. There are

four randomly placed shelters created by hollowing out cairn material in the north, southwest and southern sectors (CPAT site visit 1978h, CPAT site visit 1997f).

Corndon Hill Barrow VII (SO30009679) is an unrecorded barrow in the angle of a triangle of paths (Gibson 2002).

Two further stone circles are located within the immediate landscape of Mitchell's Fold stone circle, the Whetstones stone circle and New House long barrow, these sites being the Hoarstones stone circle (SO324999) and Druid's Castle stone circle (sometimes referred to as Mitchell's Fold Tenement), (SO309981).

The Hoarstones is a stone circle in the civil parish of Chirbury. It has 38 stones holding a diameter of 22m constructed of dolerite. The stones range in height from just protruding through the turf to 0.9m high. A single large boulder 1.2m high stands in the centre of the circle surrounded by a slight hollow 2m in diameter and 0.lm deep. The interior of the circle appears to be raised slightly, up to 0.1m, above the surrounding natural ground level. There are two small mounds in the north-west of the circle that may be the remnants of barrows. There are holes drilled in some of the stones, but these date from a much later period, when local miners would use the stones during wedding celebrations by filling the holes with gunpowder and setting it off. The Hoarstones may have a connection to the similar circle nearby at Mitchell's Fold, and a third circle formerly to the south known as the Whetstones. A *'hoar stone'* is described as an ancient, single, upright and unhewen stone of memorial erected to define the limits of territory (Anderson 1864: 467).

The Druid's Castle is a destroyed site not far from Mitchell's Fold; described as a group of three standing stones in contemporary records, but may well have been part of a circle according to some.

The Cow Stone or "Dead Cow" (SO308988) is situated approximately 400 yards northeast of Mitchell's Fold stone circle, beside the path leading from the circle to Stapeley Hill (Chitty 1930, Chitty 1961). In the 1920s, chippings were analysed from this stone, one from Mitchell's Fold and four from the Hoarstones stone circle, which lies just over one mile away to the northeast. They were all found to be of dolerite, a vein of which runs through the area. The naming of this standing stone aids in the understanding of the local folklore regarding cows.

Cwm Mawr Stone Axe Factory (SO3053095108) Hill of distinctive picrite rock, identified as the probable source of stone for the Group XII Bronze Age battle axes and axe hammers (CPAT 2009).

As previously defined there was a substantial Bronze Age ceremonial presence within the Priest Weston landscape. Mitchell's Fold stone circle, the Whetstones stone circle and New House long barrow represent three distinctive monuments within the landscape and the impact of their study through the use of geophysical study.

The Whetstones stone circle, geographically closer to the village of Priest Weston, this site — when still in standing — in the parish of Churchstoke. To be found a half-mile west of White Grit (near the famous Mitchell's Fold stone circle), the Welsh Royal Commission report (1911) told that its position was, "at the foot of the northern slope of Corndon Hill, and close to a stile on the south side of the road near the turning to Cliffdale Mine, located upon a sort of plateau overlooking a valley to the north-west.

The Rev. C. Hartshorne's account of this circle in *Salopia Antiqua*, (1841: 33), gives an account of the stones. He observes that, "these three stones (the Whetstones) were formerly placed upright though they now lean, owing to the soft and boggy nature of the

soil. This may provide partial reasoning for why the stones were finally removed in conjunction with the enclosure of the land.

The Whetstones stone circle is the last in a line of a series of stone circles positioned within the landscape in a curved or sinuous line (Bathurst-Deane 1834: 190). In 1860, the antiquarian Robert William Eyton still referred to the Whetstones as a "remarkable monument", (Eyton 1860a: 159, Eyton 1860b: 211) but were later stated to have been dug up, and incorporated into a boundary wall, around 1870 (MacLeod 1906: 231). This circle is said to have been demolished between 1860 and 1870 (Burl 2000: 96), with suggestions that the circle was blown up (Burl 1976: 265). The remaining stones are said to have been removed when the land was enclosed by the Royal Commission for Archaeological and Historic Monuments in Wales (RCAHMW 1911: 23, Burl 1976: 265). It has been suggested that the stone circle was located 100 yards (91.44m) from the Whetstones cairn (RCAHMW 1911: 23) which would also position within the field. This field is also known as the 'Whetstones field' providing further evidence that the Whetstones stone circle is located within this area.

'An intelligent man, named John Jones, aged 74 years and a resident in the vicinity since his youth, remembers four stones arranged as though forming parts of a circle, with an appendage in a curve like a hook' (RCAHMW 1911: 23). The final three stones were described as being equidistant from one another and assuming a circular position. The highest of these is four feet above the surface; 1 foot 6 inches in thickness; and 3 feet in width, though this does not provide dimensions of the circle itself it aids in understanding the dimensions of the stone circle. It is suggested that there were once eight or nine stones making up this stone circle (RCAHMW 1911: 23), positioned in a hook shape. Vulgar tradition has provided this circle with its present title, though without any apparent reason,

as the standing stones were constructed from basalt, as basalt is ill adapted to use as the common acceptance of which their name implies. Perhaps the name may relate to some form of sacrificial activity and as suggested by the Rev. C. Hartshorne (1841: 33) '...may be derived from the C. Brit. gwaed vaen, or blood-stone?'

During the enclosure of the land, a bronze dagger was discovered as well as '...a mass of black....human bones.' (Burl 1976: 265). The bronze dagger (or as described by LF Chitty as a bronze dirk) was presented to Shrewsbury Museum on the 14th August 1907 by the Rev. W Brewster, of Fitz (formerly Vicar of Middleton-in-Chirbury). It was inaccurately described as being "found near Mitchell's Fold (ancient stone circles)" though Mitchell's fold is a little over 1/5 mile from to the north of the find spot (Chitty 1926: 27). Measuring 391mm in length and 37mm across the hilt, the sides slope in and taper gradually down to a fine point (Chitty 1926: 28). The thickness of the blade is uneven reaching a maximum of 3.5mm near and below the centre (Chitty 1926: 28).

WF Grimes (1963: 124 – 125) draws upon reports of the site from the 1800's and early 1900's which describe three standing stones one on a tilt due to the boggy nature of the ground. The description of these final three stones aids in the understanding of the environment they stood in. The boggy nature of the soil is described further by LF Chitty, defining how this monument is located near to marshland and a spring

Perched on a flat shelf between Corndon Hill and Stapeley Hill (Hartshorne 1841: 33, Lewis 1882: 3 – 7) Mitchell's Fold was most probably built by local Bronze Age communities approximately 3000 years ago (Figure 3), (Blore 1995: 10). Today there are 15 stones with some of these only just protruding through the top soil. The name *Mitchell's Fold* has been current since 1840 (Hartshorne 1841: 30), but the site was recorded by Edward Lhuyd in 1698 as *Medgley's Fold*, a spelling followed by James Ducarel in 1752, Francis Wise in 1753,

and Stukeley the same year (Lukis 1887: 178 – 179). Other variants include *Madge's Pinfold* and *Milking Fold* (Lewis 1893: 79 – 81). The term *'fold'* in Shropshire means farmyard (Grinsell 1980: 5). An outlier is located south east of the circle. Previous surveys have noted as many as 16 stones within the circle (Buteux and Moss 1988, Anon 1990, Dyer 2001: 150), forming a rough circle (Tyler 1978, Blore 1995: 14, 17 – 18, Stoertz 2004: 25), Appendix 1.

There is an extensive ridge and furrow system running northwest – southeast through the circle (Burl 2000: 95 – 97, Blore 1995: 6). It may be inferred that this ridge and furrow may be evidence of Bronze Age ridge and furrow. Ridge and furrow would usually end when they come to a monument or constructed around the monument. The magnetic data provides a few of the ridge and furrow across the site. It is possible that the ridge and furrow has caused disturbance to this monument, a number of the stones stand on ridges of this field system.

In June 1994 stones 1 and 8 (Appendix 1), were affected by damage, both stones had been pushed over and lay recumbent upon the ground beside their respective sockets. As a result undertaken by Blore (1995) it was discovered that within the stone and soil packing of Stone 11 (Appendix 1), two pieces of pottery were discovered. After examination a piece of black glazed pottery was identified as of a type made in Stoke on Trent from the late 18th century and throughout the 19th century. A white 'china' fragment is obviously later in date, 19th or 20th century. The association of the two fragments indicates that they were probably deposited in the 19th century, and it is possibly more likely that they were deposited in the second half of the 19th century (Blore 1995: 15). During the excavation to replace stones 1 and 8 (Appendix 1) it became apparent that there was still a clear impression of the base of each stone in each socket hole. It was decided to retain 10-20cm of the base of the stone impressions to enable accurate re-positioning of the stones (Blore 1995: 11). In the base of

stone 1 (Appendix 1) a sprig of rosehip, a 10p coin dated 1992 and a 20p coin dated 1982 were found on the surface of the soil (Blore 1995: 14). In the base of stone 8 (Appendix 1), sprigs of rosehip and rosemary, and a 10p coin dated 1992 were found on the surface of the soil. A number of shards of modern glass were found within the soil (Blore 1995: 12). This shows that this stone circle is not as it once stood.

It is thought to have once have had a circle containing 32 stones and holding a diameter of 31m (Hartshorne 1841: 33). The tallest stone was once one of a pair, and these would have formed an impressive entrance into the circle (positioned on the eastern section of the circle), with the stones reaching a maximum height of 1.8m in height (Castleden 1992: 164). The circle probably provided a focus point for ceremonial and ritual activities. There is a large amount of local legend in regards to this circle (Dickens 1993, Grinsell 1980, Burne 1883: 39 – 40, R.U.S 1930: 75, Burne 1883: 39 – 40), the tale named "Mitchell's Fold", near Corndon, provides a description through the folklore of this monument.

"…..And by this means the spell was loosed, the white cow sank away

Down through the ground, but in the stones the witch was forced to stay;

And when the throunging people came they found the woman there,

With her false pail; the much-loved cow they saw not anywhere.

They saw the wasted milk, and then knew what the witch had done,

So welled her up and left her in that living tomb of stone.

The famine passed: but still this tale is in the country told,

Of how the witch was starved to death, walled up in Mitchell's Fold."

(Owen 1884 172 – 173)

Images of this legend are depicted at the capital of two column's at the Middleton-in-Chirbury church (Grinsell 1980: 9). The folklore suggests strong cattle customs for the communities within these areas and among pastoral peoples the welfare of the herds constitutes the main interest of the community (RUS 1930: 73).

Suggested by JB Williams, Mitchell's Fold is '...one of the most important prehistoric remains in the district, and the legend connected with it is but second to the Bagbury Bull' (1910: 184 – 185). The outline of the folklore for Mitchell's Fold provided by LV Grinsell (1980) with the *'witch'* forming the central stone and the stone circle enclosing the *'witch'* can be compared with what is defined by the Reverend John Bathurst Deane (1834: 190 – 191). The suggestions of a central stone may not hold true as when William Stukeley's 1753 sketch and JB Williams 1910 sketch show no evidence for a central stone. William Stukeley produced a sketch of the circle in 1753, which depicts the circle very much as it stands today and may be comparable to J.B. Williams's 1910 sketch of this circle. In the 1750's letters between Dr Francis Drake and Dr Ducarel were exchanged providing a representation of the stone circle in the mid-17th century, providing details on the orientation and dimensions of the circle (Nichols 1822: 621).

It may be mentioned that Mitchell's Fold stone circle has provided the British Society of Dowsers much interest. Their results and discussions draw upon visible features relating to the stone circle and references made by such archaeologists as A Burl (1976 and 2000) regarding the structure of the stone circle, alignments and age, though these results hold no scientific fact. It is generally accepted that the divining rod is controlled subconsciously by the operator, who is responding to sensed changes in signal by converting them into movements of the rod (Locock 1995: 15) which suggests that with prior study of a site

dowsers can make their results look like this method of survey works, which is not to be proven.

Chapter Three – Geophysical Theory

3.0 Directional variations of the Wenner Array

In electrical methods relating to the Wenner array a current (***IAB***) is transmitted through the ground with two electrodes (***A***, ***B***), while the difference of potential (***VMN***) produced by the circulation of this current is measured with two other electrodes (***M***, ***N***), (Geoscan Research 2005a). The apparent resistivity (***rho***) of the ground is defined by the relation **rho = K x VMN / IAB**, where ***K*** is a geometrical coefficient which is dependent upon the separations between the ***A, B, M, N*** electrodes.

The apparent resistivity for the Wenner array must be determined to create a mathematical understanding for rotating the array. To determine the apparent resistivity for the Wenner array the following is applied:

Equation 1.0

$$\rho_a = 2\pi aR$$

(Reynolds 1997: 429)

Azimuthal apparent resistivity measurements are made by rotating an electrode array through 90°, 180° or 360° (Busby 2000: 677 – 678, Conolly and Lake 2006: 18 – 19) and azimuthal Inhomogeneity Ratio (A.I.R) is used to express the orientational variation of current flow into the subsurface.

When using any array the orientation of the features present can have a large effect on the values recorded at the surface, often preferentially in one measurement direction but

not in another (Habberjam and Watkins 1967: 445, Watson and Baker 1999: 740).By using two measurements perpendicular to each other, it is possible to obtain a mean resistance ($\overline{R}$) or mean apparent resistivity ($\overline{\rho A}$) which should remove these directional variations (Habberjam and Watkins 1967: 446, Habberjam 1972: 250, Habberjam 1975: 14). For example, in Wenner or Twin-probe array area survey, measurement are first taken with the array orientated east-west and then repeated with it orientated north-south (Tsokas *et al* 1997: 427, Lynam 1970: 71 – 101), (Figure 6). These two sets of reading would then be used to obtain average values for each measurement point:

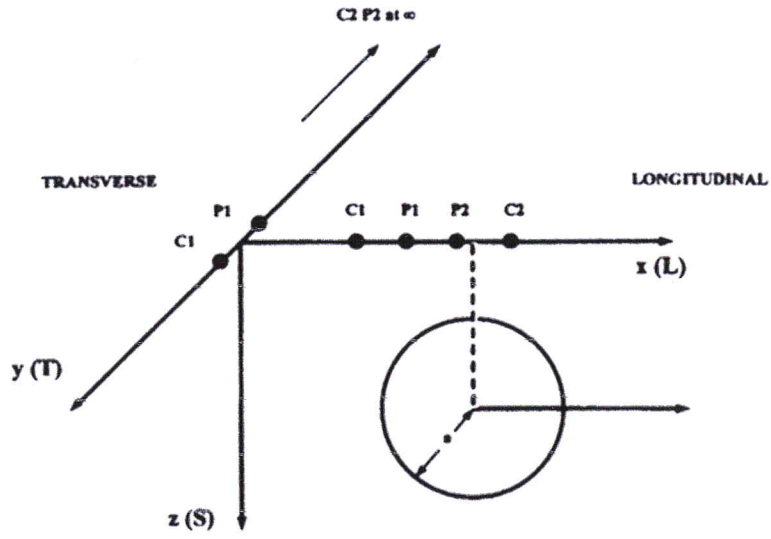

Figure 6 – Coordinate system for the passage of a sphere directly (y, T = 0) beneath a Wenner array (broadside/longitudinal traverse) and Twin-probe array (transverse traverse). In the broadside traverse all electrodes lie on the x(L) axis. In the transverse traverse 'mobile' electrodes are symmetrically disposed about the origin of the T-axis (Aspinall and Crummit 1997: 38).

Equation 1.1

$$\bar{R} = \frac{R_a + R_b}{2}$$

Or

Equation 1.2

$$\bar{\rho}A = \frac{\rho A_a + \rho A_b}{2}$$

where R_a is the first measurement and R_b that made perpendicular to it (Saunders 2002: 19).

In the near-surface the positive and negative signal cancels each other out and the main response, which originates from depth is largely flat (Reynolds 1997: 431). This is may be expressed the geometric factor (*K*):

Equation 1.3

$$K = 2\pi \left[\frac{1}{a} - \frac{1}{2a} - \frac{1}{2a} + \frac{1}{a}\right]^{-1} = 2\pi \left[\frac{2}{a} - \frac{2}{2a}\right]^{-1}$$

$$= 2\pi a$$

Hence, as $\rho_a = KR$, $\rho_a = 2\pi aR$ (Reynolds 1997: 430). The importance of gaining an understanding of these signals as this may influence the interpretations of anomalies seen within the field.

There remains the problem of azimuthal variations in apparent resistivity produced by the presence of dipping stratigraphy and other lateral changes in formation resistivity (Watson and Baker 1999: 739). Though it is difficult to detect this geological effect and in

some cases it is not possible to detect this type of anisotropy from field methods with a linear array (Telford *et al* 1990: 532, Nishimura 2001: 544 – 546).

From a theoretical point of view, the depth of investigation of a measurement depends upon the length of the transmitting line ***AB*** and on the separation between the transmitting ***AB*** line and the receiving ***MN*** line. Various types of electrode combinations can be used (Schlumberger, Wenner, dipole, pole, gradient arrays), each having various benefits and limitations in terms of vertical penetration, lateral resolutions, field set-up, but all having the same general rules:

- the larger the length between the ***A*** and ***B*** probes, the deeper the penetration of the current,
- the further the ***M, N*** electrodes from the ***A, B*** electrodes, the more representative the potential measured on the surface of the ground, of the resistivity of deep layers.

(Bernard 2003: 3)

In a practical point of view, the depth of investigation also depends on the measurability of the ***VMN*** potential which can be expressed as **VMN = rho x IAB / K**. For increased depth investigation, the electrodes have to be at larger distance from each other, the ***'K'*** coefficient has thus an significant value, therefore the ***VMN*** signal becomes smaller, and of greater difficultly to measure. Factors which facilitate a good measurement at large investigation depth being:

- ***A high ground resistivity 'ρ':*** hard rock geology produces a ***VMN*** signal ten times greater than sedimentary rock geology and a hundred times greater than a clayey formation. The resistivity parameter, linked to the nature of the rocks, is of course

out of the control of the operator *a high intensity of the current* **IAB = VAB / RAB,**

which means:

- ***A low ground resistance RAB:*** if the surface layer is dry sand (which has a very high resistivity), the ground resistance of the ***A*** and ***B*** electrodes are higher than if it is a clayey soil (which has a very low resistivity).

(Bernard 2003: 3)

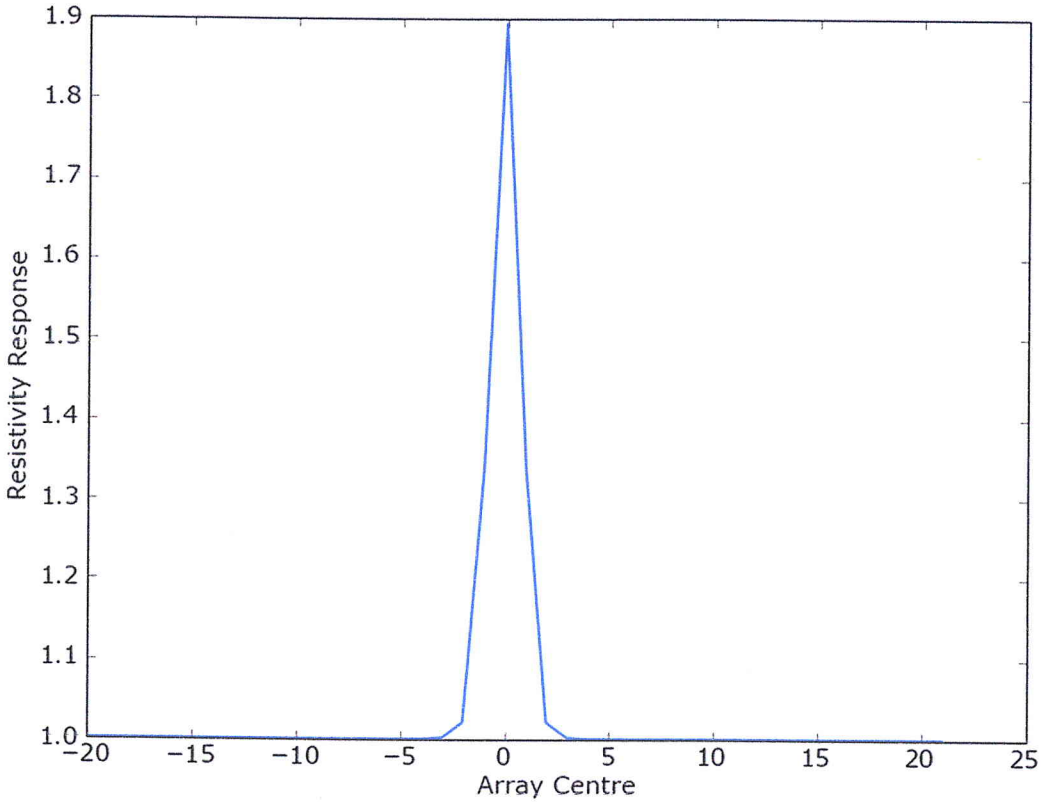

Figure 7 – This Wenner trace represents a Wenner broadside reading undertaken over an insulating sphere holding a central depth of 1.00m. The electrode separation was set to 0.5m, the traverse interval set to 1.00m, the traverse length set to 20.00m and the sample interval set to 0.50m.

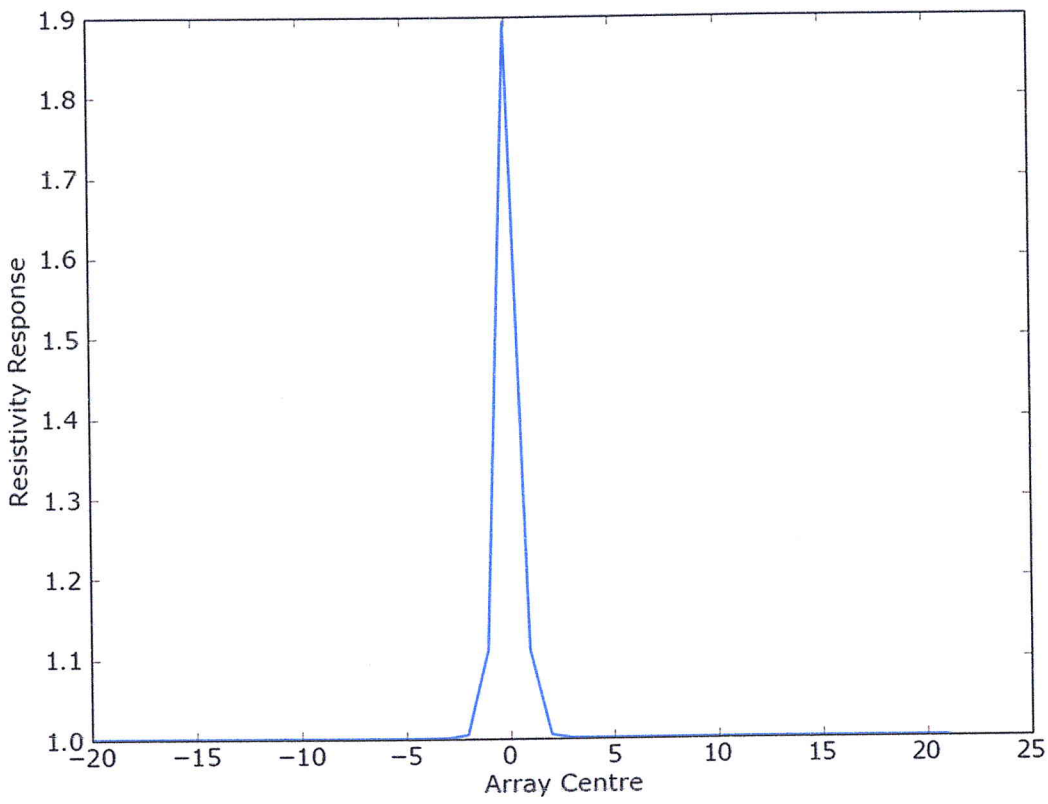

Figure 8 – This Wenner trace represents a Wenner transverse reading undertaken over an insulating sphere holding a central depth of 1.00m. The electrode separation was set to 0.5m, the traverse interval set to 1.00m, the traverse length set to 20.00m and the sample interval set to 0.50m.

By using the modelling programme Resdata 3 comparative information can be gained regarding the responses gained with the Wenner array. Figure 7 represents a response of the Wenner array of an anomaly in a Broadside manor. This compares with the response gained in a transverse manner in figure 8 in the sense that when the array passes over the anomaly in a Broadside manor there is a slight inward movement towards the array centre at a distance of 1.9m either side, this is seen by the response at 1.03 Ohm-meters, whereas this change in resistivity occurs at 1.11 Ohm-meters when the array is passed over the anomaly in a transverse manor and is seen at a much closer proximity to the array centre 0.935m either side. The reading gained from the transverse reading is much narrower in comparison to the Broadside response, (Figure 9). By combining the two responses a greater representation of the anomalies position can be achieved (Aspinall and Crummett 1997: 38 – 39, Lynam 1970: 71 – 101).

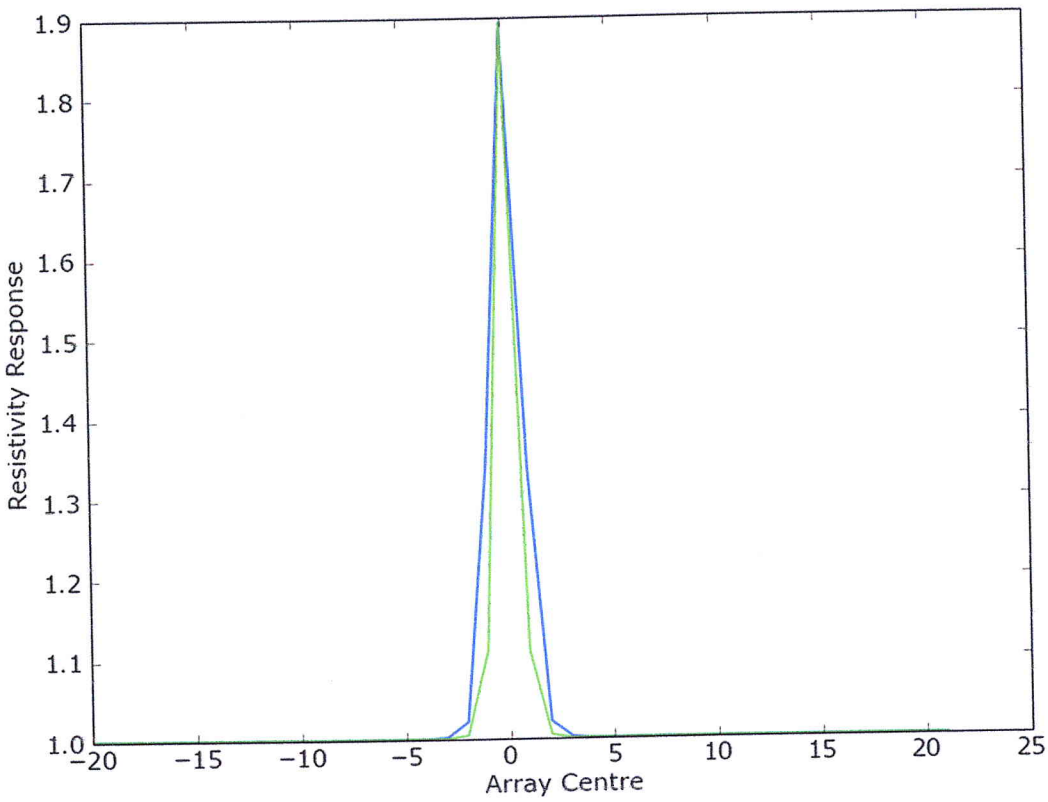

Figure 9 – Broadside = Blue, Transverse = green reading undertaken over an insulating sphere holding a central depth of 1.00m. The electrode separation was set to 0.5m, the traverse interval set to 1.00m, the traverse length set to 20.00m and the sample interval set to 0.50m.

3.1 The Expanding Twin-Probe Array

In creating Pseudo-sections using the Twin-probe array there are associated problems such as what is termed as the 'topographic effect' (Sutherland *et al* 1998: 229). Within electrical imaging, pseudo-section or tomography, the general aim of the survey is to provide a vertical section/slice through the ground in order to obtain an estimation of the depth of features or to investigate stratigraphic sequences such as seen in Noel and Xu (1991). These may, in theory, be combined if a series of vertical slices are combined and analysed in a similar way to radar data to obtain a 3D picture, (Gaffney and Gater 2003: 60).

Table 2 – Geometry factors for three arrays needed to convert resistance data into resistivity.

Array	*n*
Twin-probe	0.5
Wenner	1
Equidistant Double-Dipole	3

To apply this geometry factor (Table 1) for the Wenner array the following equation is used:

Equation 1.4

$$\rho_A = \pi \times \rho_r \times 1$$

$$= 3.1415$$

The separations for the mobile were set at 0.5m, 1.0m and 1.5m and the remote probes were set to infinity. By expanding out the mobile probes greater depth penetration can be achieved (Papadopoulos *et al* 2006: 89 – 90, Noel 1992: 90).

With increased probe separation and inhomogeneity Ohms Law must be modified to use the current density, ***i***, rather than the current, ***I***, and this current density varies with the position of the object and the electrode separation:

Equation 1.5

$$R = \frac{V}{i}$$

It is possible to predict the current density for a given electrode separation by having a knowledge of the current injected, ***I***, into the ground, (Witten 2006: 305, Geoscan Research 2005a, Geoscan Research 2005c, Neighbour *et al* 2001).

3.2 The FM256 Magnetometer

To achieve accurate compensation of the earth's magnetic field (flux density B) in the gradiometer ($\vec{B}_{lower} - \vec{B}_{upper}$), the electronics have to be set up identically for both sensors within the instrument, (Geoscan Research 2005b, Aspinall *et al* 2009: 105, Parasnis 1997: 14–15, Nishimura 2001: 546–547), it is suggested that the north-south and east-west readings are each within 1nT.

The cores are then in a virtually zero field, resulting in a high sensitivity to changes within the ambient field. The steady magnetizing field is provided by the earth's magnetic flux density, ***B***, which is directed along the axes of the cores therefore the output is highly sensitive to the sensor orientation. If a sensor is orientated at an angle of ϑ to the total flux direction, the component along its axis will be:

Equation 1.6

$$\mathbf{B_\theta = B \cdot \cos\theta}$$

(Aspinall *et al* 2009: 36).

It is the changing difference in flux density between the two sensors $\vec{B}_{lower} - \vec{B}_{upper}$. In the case of Neolithic/Bronze Age a magnetic survey is of great importance as 'negative' archaeology meaning that a large number of the features/anomalies were dug into the ground and the filling process produces a distinctive change.

3.3 The MSP40 Carted Square Array

The MSP40 (Multi Sensor Platform) comprises a wheeled resistance array (Geoscan Research 2009: 2). The structure of the MSP40 allows for three resistivity samples to be taken these being; R_α, R_β and R_γ:

Alpha - $\begin{matrix} A & & B \\ & \rightarrow & \\ M & & N \end{matrix}$ Beta - $\begin{matrix} B & & N \\ & \rightarrow & \\ A & & M \end{matrix}$ Gamma - $\begin{matrix} A & & M \\ & \rightarrow & \\ N & & B \end{matrix}$

(Aspinall and Saunders 2005: 116, Walker 2005: 134, Ermokhin *et al* 1998: 54)

In a homogeneous earth, of resistivity ρ_0, there is complete symmetry such that:

Equation 1.7

$$R_\alpha = R_\beta \; and \; R_\gamma = 0$$

This may be represented as:

Equation 1.8

$$R_\alpha = (2 - \sqrt{2})\, \rho_0 / 2\pi d$$

where d is the interprobe spacing along the side of the square.

Though for a medium containing discontinuities, R_α and R_β, are not, in general, equal and:

Equation 1.9

$$R_\gamma = R_\alpha - R_\beta$$

Although the individual alpha and beta data sets are valuable, the asymmetry that exists between them can be minimized by taking the mean value, R_{av}, of R_{α} and R_{β} from which a mean value of the apparent resistivity, ρ_A, can be deduced from Equation 1.7.

Sample R_{γ} can be regarded as a measure of the inhomogeneity of the subsurface and of its variation around zero. This leads to the concept of azimuthal inhomogeneity ratio (AIR) defined as (Tsokas et al 1997: 426):

Equation 2.0

$$AIR = R_{\gamma}/R_{av}$$

This allows for a greater understanding of the effects of survey direction of survey using electrical techniques.

Chapter Four - Methodology

4.0 Data Collection

Targeted geophysical analyses at the Whetstones stone circle was undertaken within 10m by 10m grids (0.01ha). Further mapping of the sites will be undertaken within 20m by 20m grids (0.04ha) (Clark 1990: 158 – 164, Gibson 2000: 5, Aspinall *et al* 2009: 110 – 111). All data collection was undertaken following English Heritage guidelines (Lee 2006: 15). A total area of 2.02ha has been surveyed over the three sites. All resistance surveys will be undertaken in a zigzag traverse configuration. The frame will be kept in the same direction throughout the resistance survey. Both the Wenner array and the Expanding Twin-Probe array will have a multiplexer attached taking multiple readings at varying depths to which pseudo-sections can be produced (Figure 10). The magnetic surveys will be undertaken in a parallel traverse configuration.

With regards to the Wenner array data will be collected in both Broadside and transverse methods to provide an understanding of how the readings of an anomaly changes depending upon the direction of which it is recorded, (Aspinall and Crummett 1997: 38 – 39, Lynam 1970: 71 – 101). Figure 6 represents a number of probe arrangements which a number of have been selected to undertake a number of the resistance surveys.

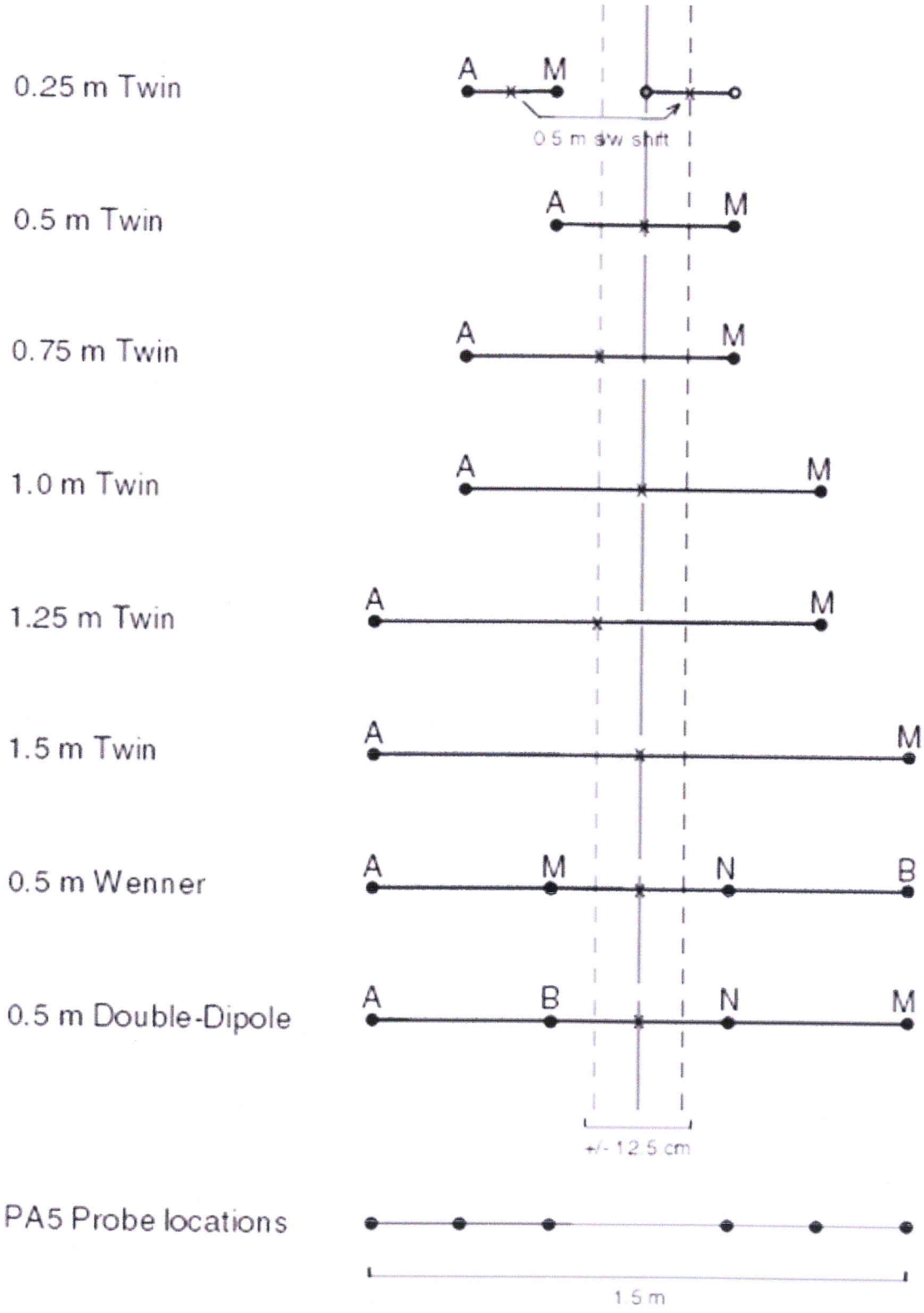

Figure 10 – Probe positions on the PA5 frame. The centre of each array is identified by a cross, and with the exception of the 0.25 m twin, all lie within an error band of ±12.5cm. When shifted by 0.5m using software, the 0.25m twin also then lies within the error band (Walker 2000: 121).

4.1 Sample Densities

The magnetic survey was undertaken with a sample interval of 0.25m and a traverse interval of 0.5m which falls into the recommended sample/traverse density for characterisation suggested by English Heritage (Table 2). The earth resistance surveys were undertaken with a sample interval of 0.5m and traverse interval of 1.0m.

Table 2 – English Heritage sample and traverse intervals (adapted from Jones 2008: 8).

Technique	Evaluation (reading x traverse)	Characterisation (reading x traverse)
Magnetometer	0.25m x 1.0m	0.25m x 0.50m
Earth Resistance	1.0m x 1.0m	0.5m x 1.0m or 0.5m x 0.5m
GPR*	0.05m x 1.0m	0.05 x 0.5m
Electromagnetic (EM)	1.0m x 1.0m	0.5m x 1.0m or 0.5m x 0.5m
EM for geomorphology	5.0m x 5.0m	-
Topsoil Magnetic Susceptibility	10.0m x 10.0m	-

The choice to gain a higher density of readings across the sites was made to give greater definition of the monuments themselves and any features which may be associated with them. This would therefore aid in the interpretation of the sites and allow the surveys to fall within English Heritage guidelines (Jones 2008, O'Rourke and Gibson 2009: 67).

4.2 New House Long Barrow

A 60m baseline (Figure 11) was established through the centre of this monument on an east – west alignment due. A series of 6, 20m by 20m grids were established over the monument

The magnetometer survey was undertaken in an attempt to determine the extent of this monument and map the remains of this monument.

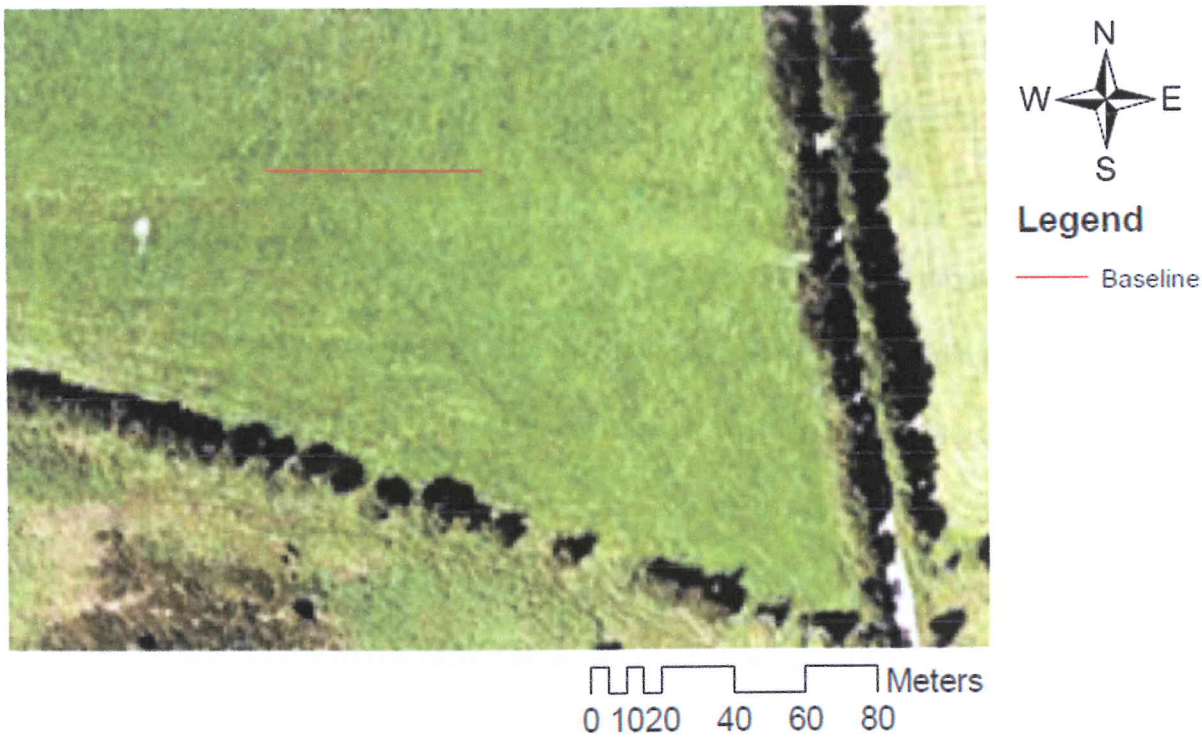

Figure 11 – The baseline for the geophysical surveys of New House long barrow.

A targeted Expanding Twin-probe survey was undertaken using electrode separations of 0.5m, 1.0m and 1.5m to assess the possibility of creating Twin-probe pseudo-sections, and may provide greater clarity of possible anomalies determined within the magnetometer survey (Walker 2000: 122). An additional Wenner survey will be undertaken in transverse and broadside directions across the long barrow to provide a greater transparency of results already gained. By undertaking the Wenner survey in both broadside and transverse

directions would make it possible to compare these two data sets to determine whether greater detail can be gained.

Table 3 – A breakdown of the survey area for New House long Barrow.

Survey Type	Grids type (m)	Grids surveyed	Survey area (ha)
FM256	20 by 20	6	0.24
Expanding Twin-Probe	20 by 20	4	0.16
Wenner broadside	20 by 20	6	0.24
Wenner Transverse	20 by 20	2	0.08
Carted square array	20 by 40	2	0.16
			Total – 0.88 ha

The purpose for undertaking a square array with the MSP40 was to provide comparable data to the Wenner surveys and the Expanding Twin-probe survey providing the gamma (γ) reading as an additional data set. The reasoning for positioning the MSP40 survey at location it was due to the terrain of the barrow and as a result of the data gained from the other methods of geophysics it was of greater interest. 20m by 40m grids were used due to increasing the ease of use of the carted array. A sample interval of 0.5m and a traverse interval of 0.5m were implemented on the eastern and central areas of the long barrow to provide greater detail (Table 3).

The importance of this survey is the determination of general layout and structure of the mound and ditches to provide a basic ground plan within which to fit further more detailed work and perhaps excavation; assessment of the extent to which additional structure.

Chapter Five – Results

5.0 New House long Barrow

The geophysical data gained over this site provided and insight into the complete form of the long barrow and the resistance and magnetic surveys provide an intricate view of this monument. The baseline has been set across the long barrow on an east – west alignment figure 11.

5.1 Magnetic Survey

The magnetic data has provided a large amount of detail of the long barrow and has defined the extent of the long barrow (Figure 12 and 13).

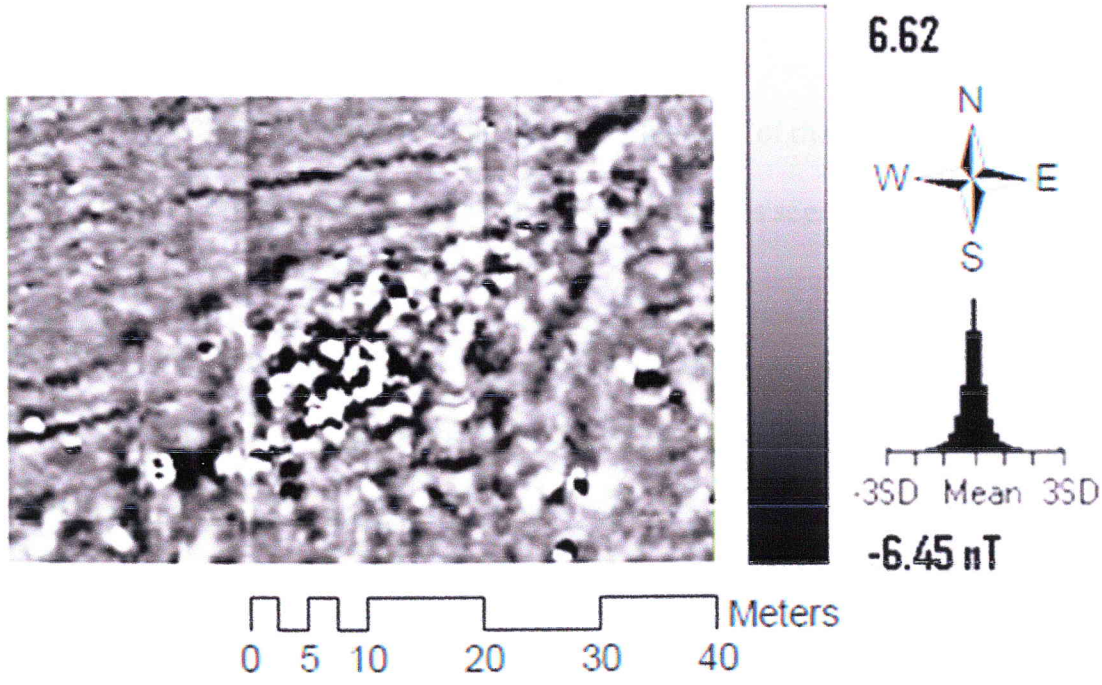

Figure 12 – The magnetic results gained over New House long barrow using the FM256 magnetometer.

A – There are a number of ferrous anomalies spread across the survey holding high dipolar readings which may well relate to modern activity over the site. They seem different in nature in comparison to the dipolar anomalies located to the centre of the long barrow (E) as they do not seem to have any relation to one another

B – A number of linear anomalies within the northern sector of the survey area which may be related to possible agricultural activity suggesting that ploughing have occurred on the site. These negative linear anomalies exhibit a lower magnetic signal than the surrounding background being less magnetic than the surrounding soil.

C – There are a number of anomalies which may represent archaeological significance in relation to the long barrow itself or to previous agricultural activity upon the site. A number of the linear anomalies here seem to coincide with the possible ditches of the long barrow and may well be negative ditches in nature.

D – These anomalies seem to relate to the boundary features of the long barrow defining the shape of the barrow as trapezoidal in shape. These anomalies seem to be negative in nature.

E – This area of anomalous readings represents a region of dipolar readings central in their location to the barrow. These anomalies may relate to the magnetic effects of buried stone within the central area of the barrow.

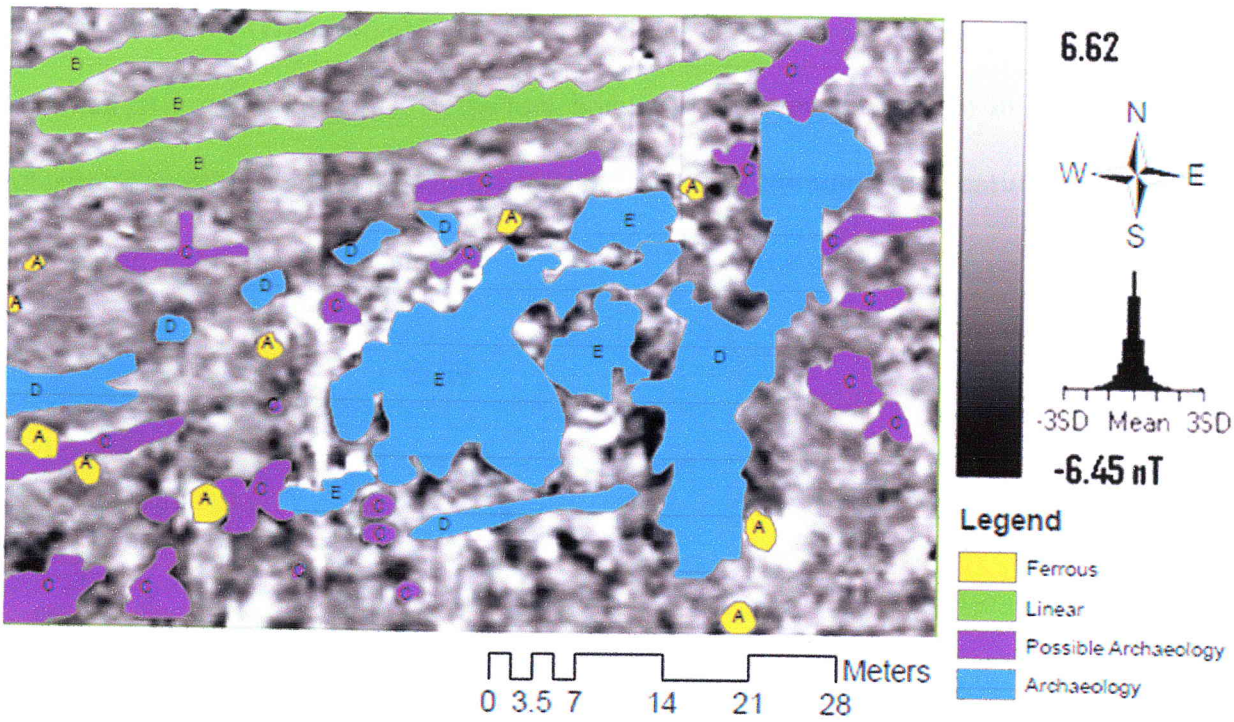

Figure 13 – Interpretations made from the FM256 magnetic survey.

5.2 Wenner Survey (Transverse)

A small area across the centre of the long barrow was surveyed to create an understanding of the central area of the long barrow, with the suggested features represented within figures 14 and 15.

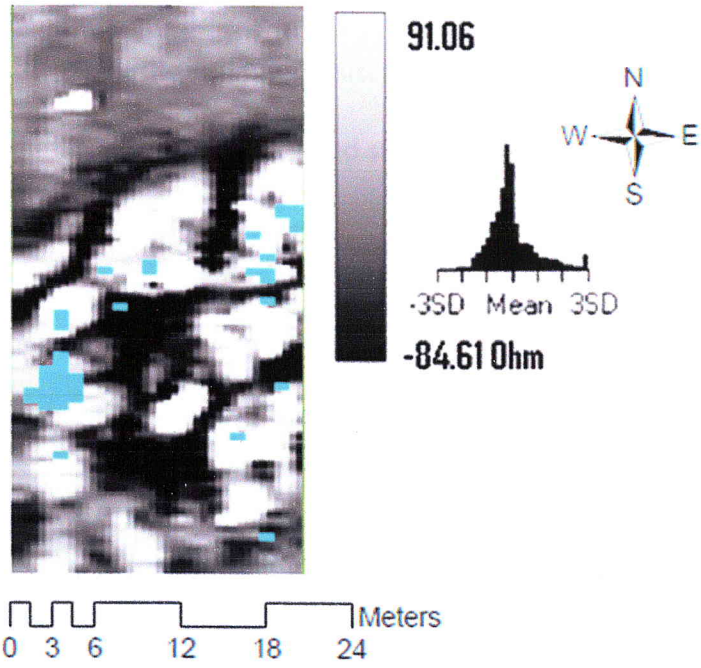

Figure 14 – A 20x40m strip across the centre of the long barrow was studied using the Wenner array. This resistance survey was undertaken in a transverse survey direction in relation to the orientation of the long barrow.

A – This area of low resistance is located central to the barrow complex and may represent an area of earth undisturbed from possible locations of stones used to create the barrow itself. The monument is not as prominent within its landscape though the northern extent is more greatly defined.

B – These anomalies represent areas of possible archaeological interest. Their proximity to the barrow would suggest that they hold some significance to the construction of the

barrow itself though their sporadic positioning, size, shape and resistance values do not seem to suggest a form of distinctive feature.

C – A possible ditch is visible along the northern edge of the long barrow and is represented by a low resistance linear anomaly and provides a view of the possible extent of the barrow upon the northern extent of the long barrow.

D – A number of high resistance anomalies are positioned central to the stone circle relating most likely to buried stones. This may be deduced as there are a number of stones protruding from the long barrow on its norther edge. This would therefore suggest that there would be a number of buried stones within the barrow.

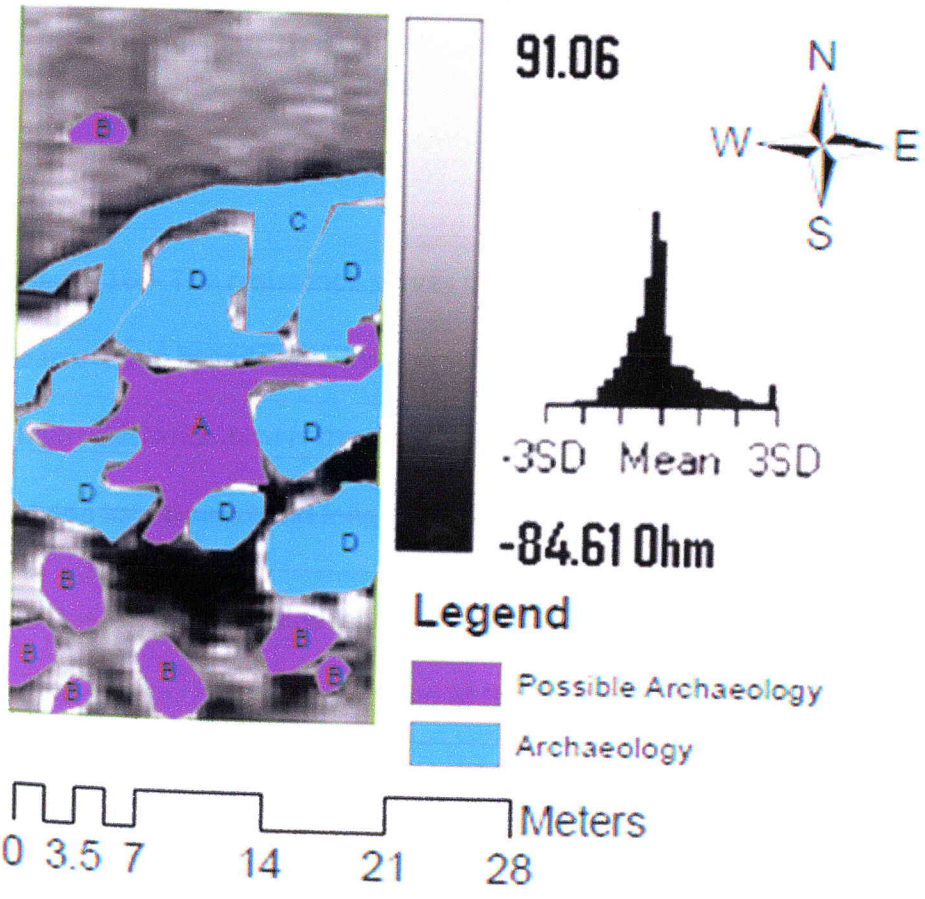

Figure 15 – The interpretations made from the Wenner transverse survey over the centre of New House long barrow.

5.3 Wenner Survey (Broadside)

The area covered with this method covered the extent of the long barrow to create an understanding of the long barrow (Figures 16 and 17).

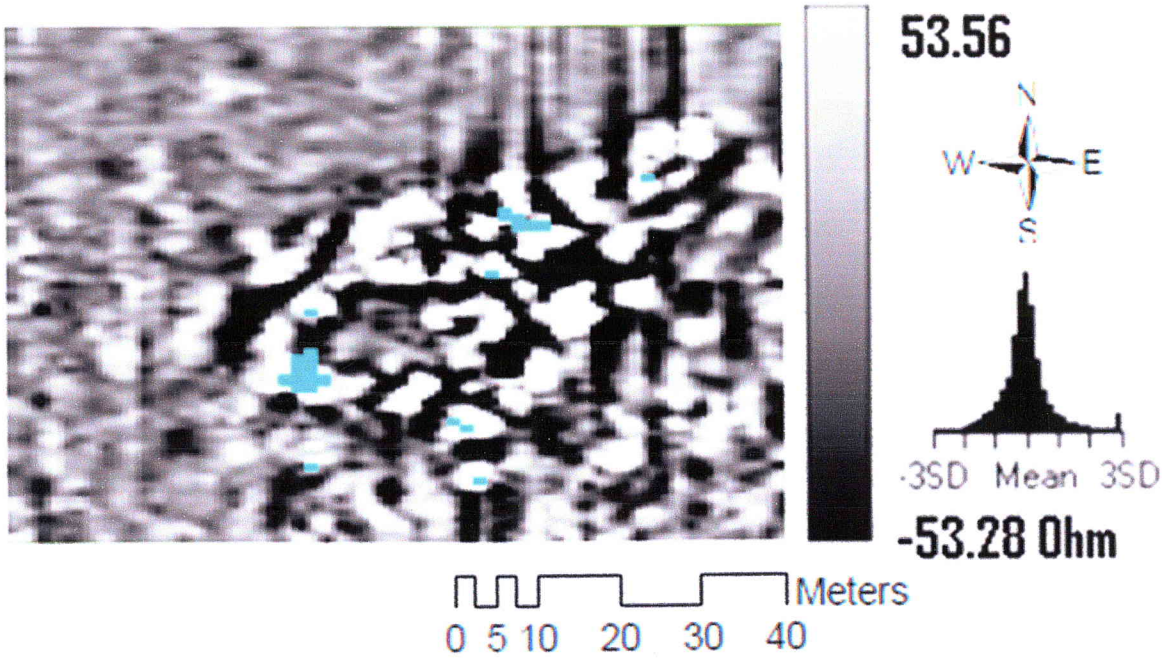

Figure 16 – The resistance survey undertaken over the full extent of New House long barrow in a broadside survey direction in relation to the long barrow defines an area of high resistance across the central and eastern areas of the long barrow and also defines its shape as a trapezoidal long barrow.

A – These anomalies represent areas of low resistance across the long barrow. Within the close vicinity of the western end of the long barrow, set upon a north-northwest to south-southeast alignment is a large U-shaped anomaly which would seem to hold archaeological significance.

B – These anomalies hold high resistance readings and are concentrated within the central area of the long barrow. They compare to the area of magnetic disturbance seen

within magnetic survey. This area of high resistance may suggest buried stones like those seen protruding from the northern side of the long barrow.

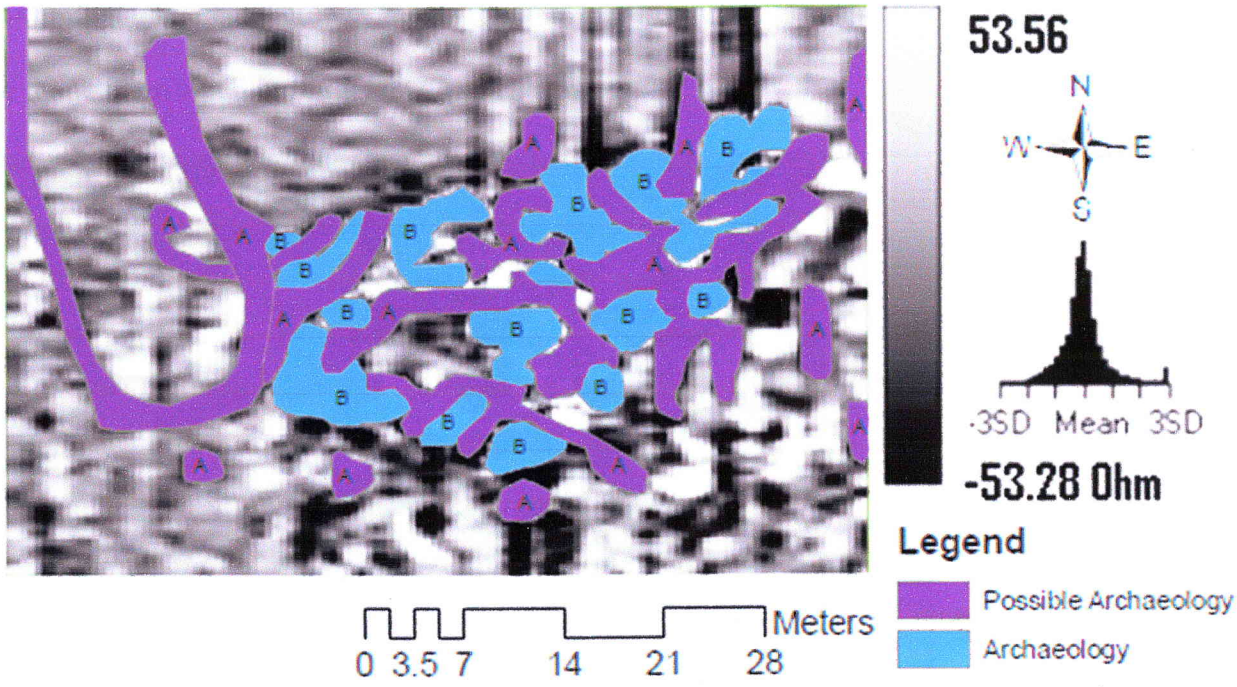

Figure 17 – The interpretations made from the Wenner broadside resistance survey undertaken over the long barrow.

5.4 Wenner Transverse Data Overlain Upon the FM256 Data

The Wenner Transverse survey has been overlain upon the magnetic data to aid in comparing the central area of the long barrow and to further the interpretations which may be made from these data sets (Figures 18 and 19).

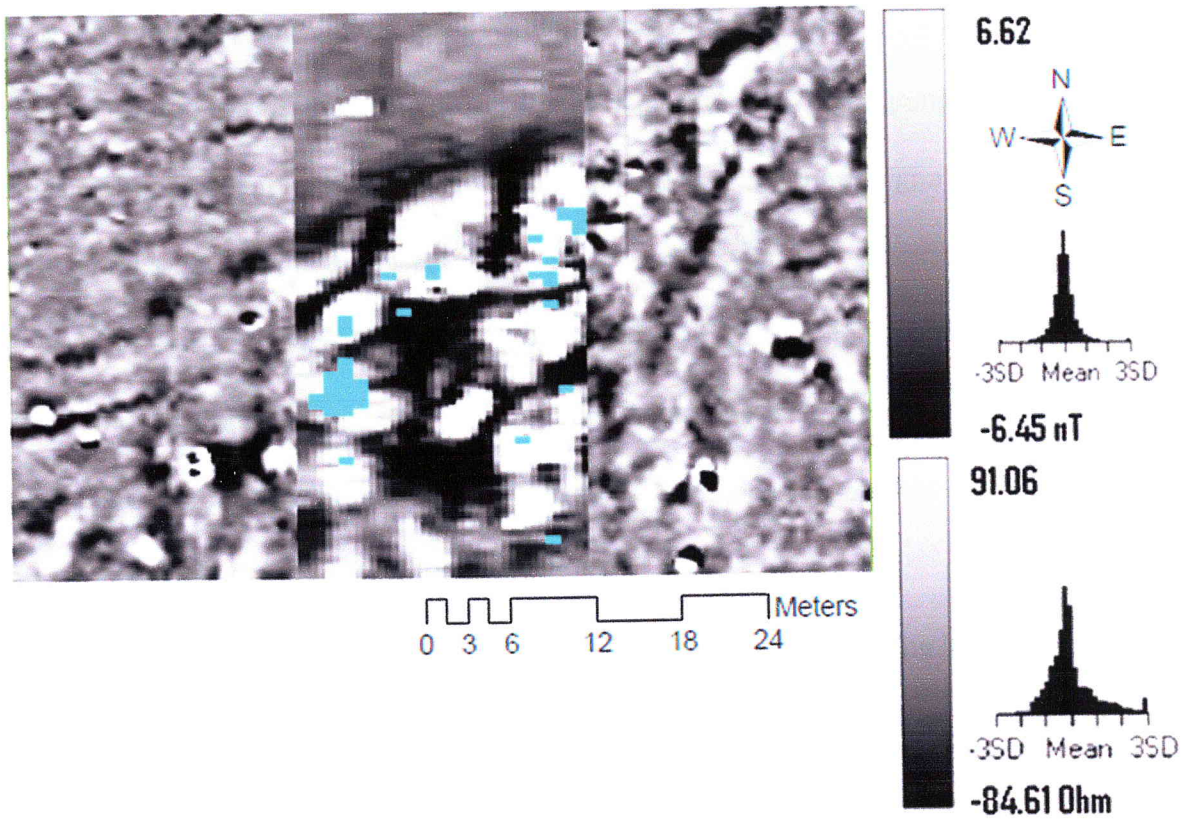

Figure 18 – By overlaying the Wenner transvers data over the magnetic survey it is possible to see the relationship between the resistance survey undertaken over the centre of the long barrow to the rest of the eastern and western extents of the long barrow visible within the magnetic data.

A – There are a number of ferrous anomalies spread across the survey holding high dipolar readings which may well relate to modern activity over the site. They seem different in nature in comparison to the dipolar anomalies located to the centre of the long barrow (E).

B – A number of linear anomalies within the northern sector of the survey area which may be related to possible agricultural activity suggesting that ploughing have occurred on the site. These negative linear anomalies exhibit a lower magnetic signal than the surrounding background being less magnetic than the surrounding soil.

C – There are a number of anomalies which may represent archaeological significance in relation to the long barrow itself or to previous agricultural activity upon the site. A number of the linear anomalies here seem to coincide with the possible ditches of the long barrow and may well be negative ditches in nature.

D – These anomalies seem to relate to the boundary features of the long barrow defining the shape of the barrow as trapezoidal in shape. These anomalies seem to be negative in nature.

E – This area of anomalous readings represents a region of dipolar readings central in their location to the barrow. These anomalies may relate to the magnetic effects of buried stone within the central area of the barrow. These anomalies seem to relate an area within the Wenner transvers data.

F – This area of low resistance is located central to the barrow complex. The monument is not as prominent within its landscape though the northern extent is of greater definition.

G – A possible ditch is visible along the northern edge of the barrow and is represented by a low resistance linear anomaly and provides a view of the possible extent of the barrow.

A number of high resistance anomalies are positioned central to the stone circle relating most likely to buried stones.

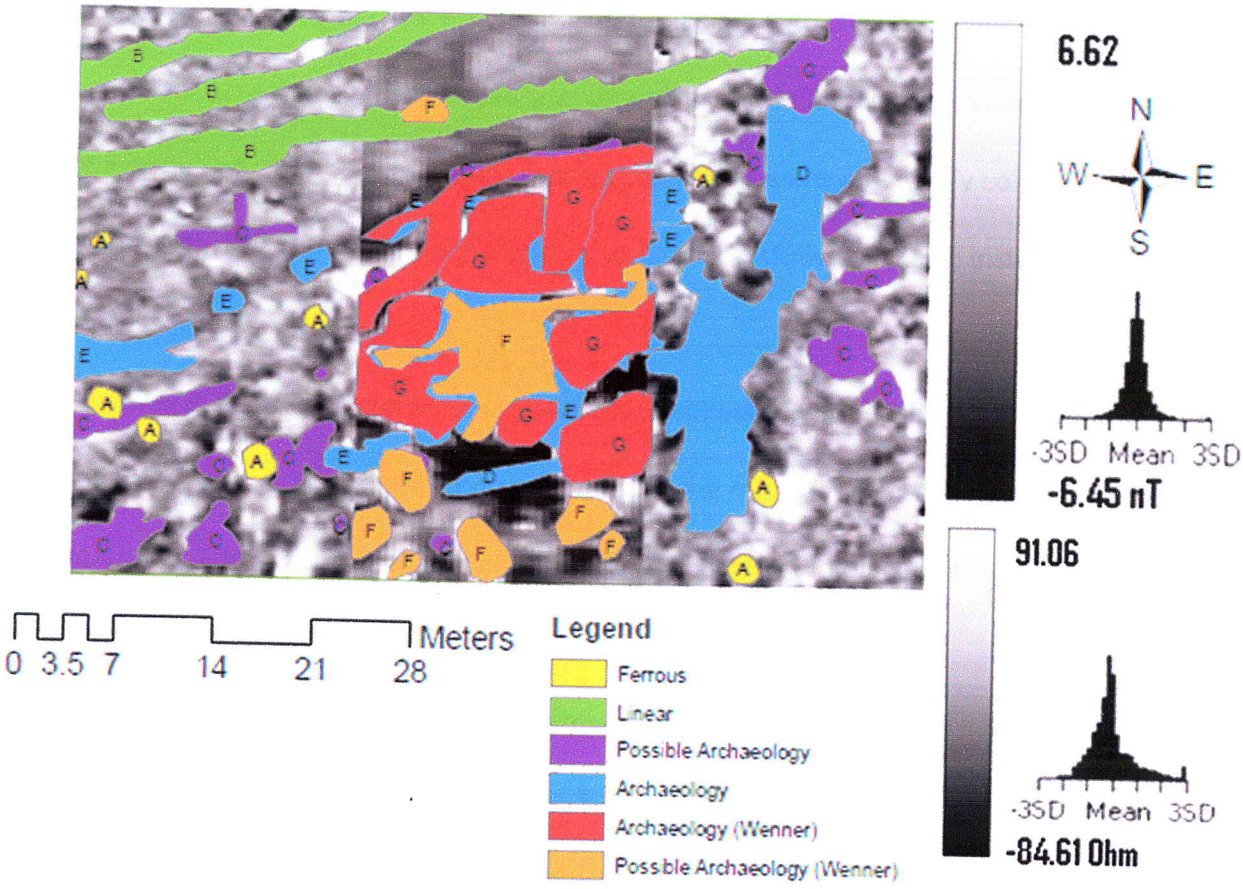

Figure 19 – By overlaying the interpretations of each survey upon this data set it has been possible to see how the anomalies within the two data sets relate to each other allowing for greater understanding of the anomalies seen.

5.5 Expanding Twin-Probe Survey

The Expanding Twin-Probe array has provided an intriguing insight into the eastern and central areas of the long barrow providing greater insight into the anomalies seen within the Wenner Transverse and Wenner broadside, as well as the MSP40 survey. Due to problems with the array only the 0.5m and 1.0m probe separations were effectively collected over the site (Figure 20). The 1.5m probe separation was unsuccessfully collected; instead the 0.5m reading was repeated.

By analysing each Twin-probe separations, data collected with each probe separation can be analysed, (Figures 20 and 21). The separation of the remote probes was kept at 0.5m during survey. The dummy readings have been purposely left in place as they represent the positions of protruding stones from the long barrow.

A – These high resistance anomalies represent areas of archaeological interest within the central and eastern end of the long barrow. These areas may well represent areas where there are concentrations of buried stone which may relate to an earlier cairn.

B – These low resistance anomalies seem to hold archaeological significance towards the eastern end of the long barrow. These distinctive anomalies may well represent the earthen components of the long barrow.

C – These areas of anomalous noise seem may relate to areas of archaeological noise or possibly relate to areas of modern disturbance caused by farming practises undertaken upon the site.

D – These anomalies hold possible archaeological significance due to their relationship with the long barrow. Although outside of the barrow itself there have been a number of anomalies which may hold archaeological significance within the other data sets collected over the long barrow

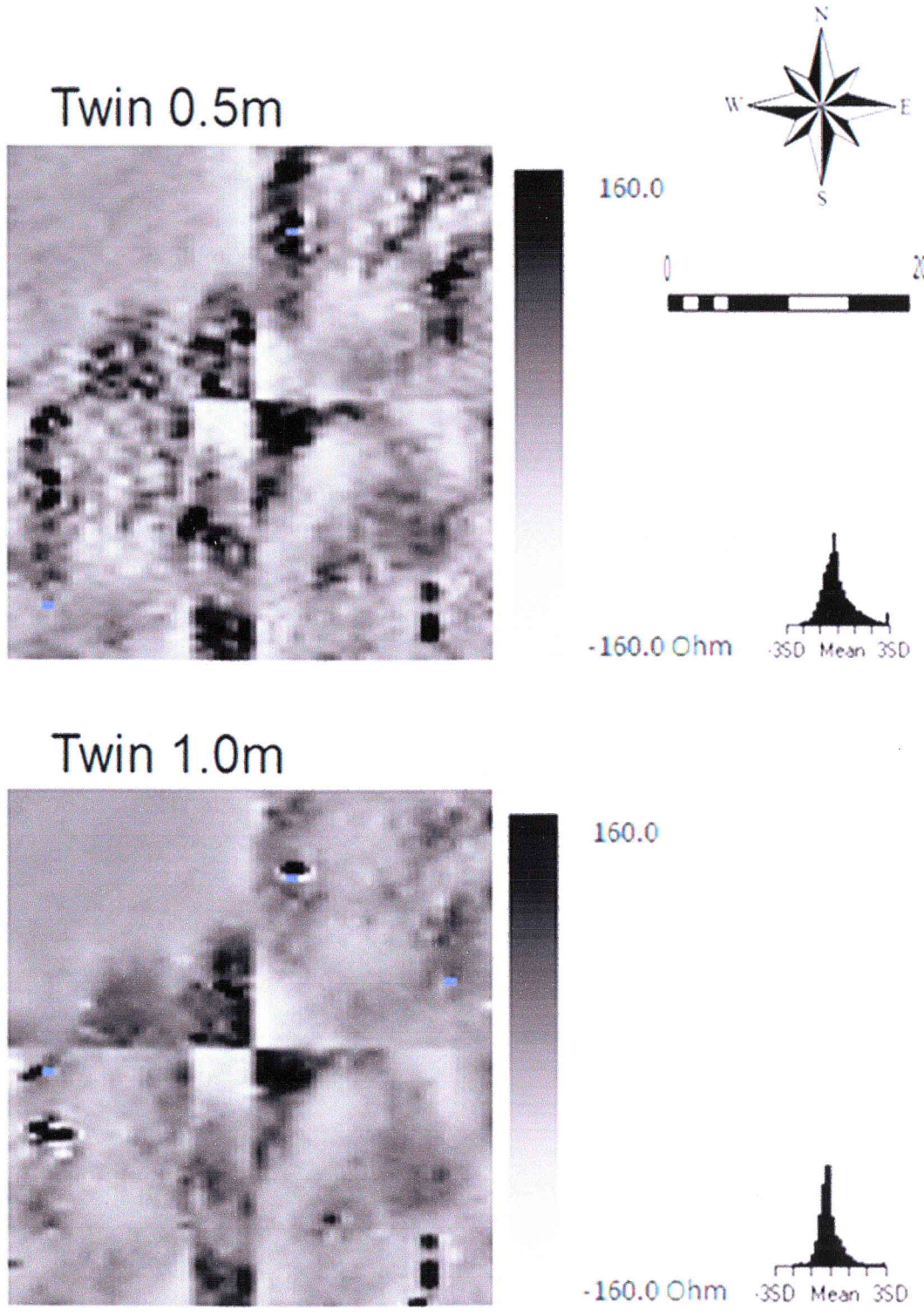

Figure 20 – These data sets collected over the central and eastern sectors of the long barrow demonstrate the use of the MPX15 multiplexer in conjunction with the Twin-Probe array in the collection of data using differing probe separations, therefore allowing for the study of anomalies at differing depths.

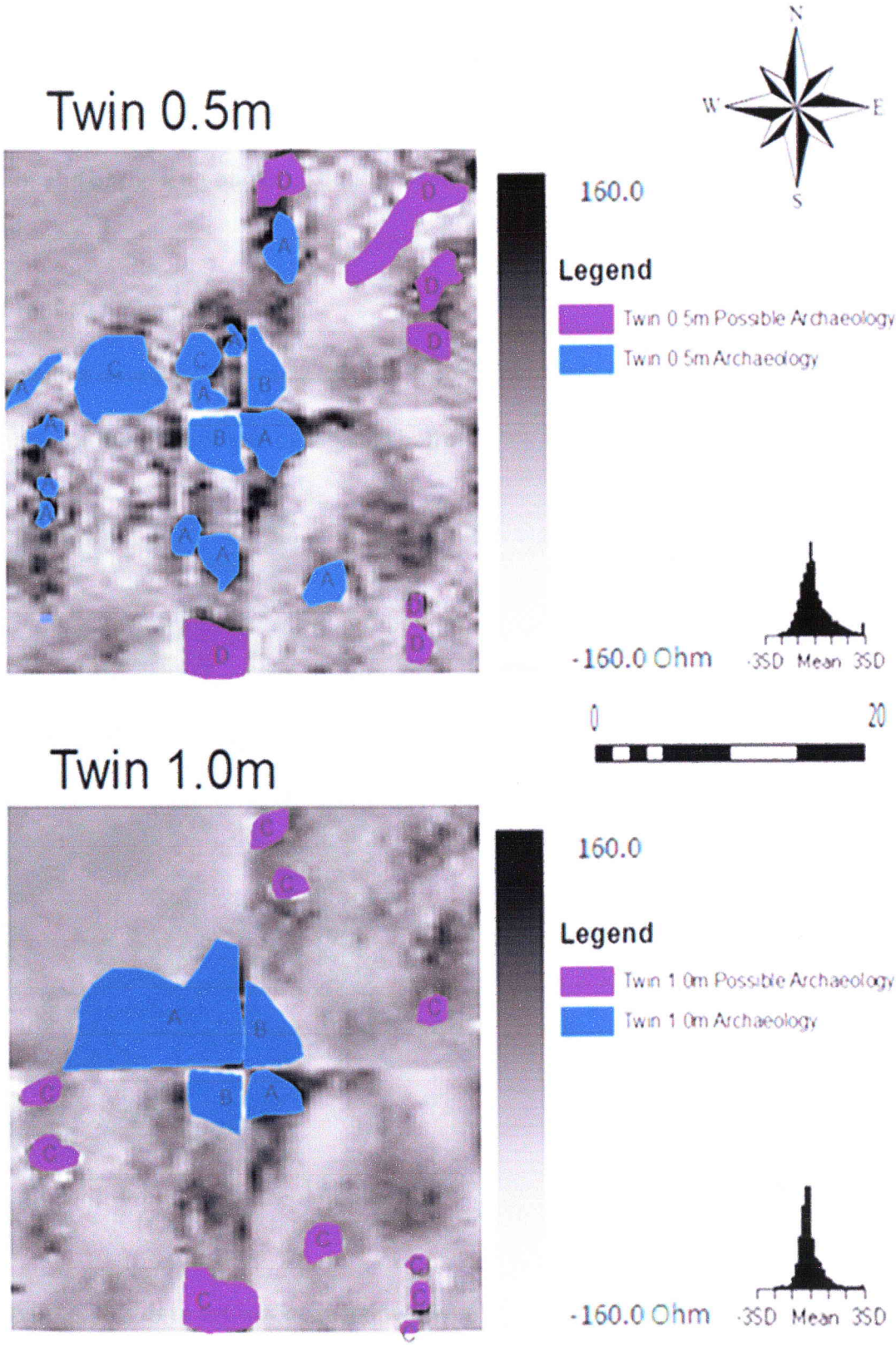

Figure 21 – The extracted Twin-Probe data sets from the Expanding Twin-Probe survey from the New House Long Barrow, providing a comparison between the interpretations of each probe separations.

5.6 MSP40 Survey

The MSP40 survey was undertaken to provide further information and insight into the eastern end of the long barrow.

5.6.1 MSP40 Alpha Data

The alpha data set (Figures 22 and 23) shows a number of anomalies which aid in the definition of the eastern end of the long barrow.

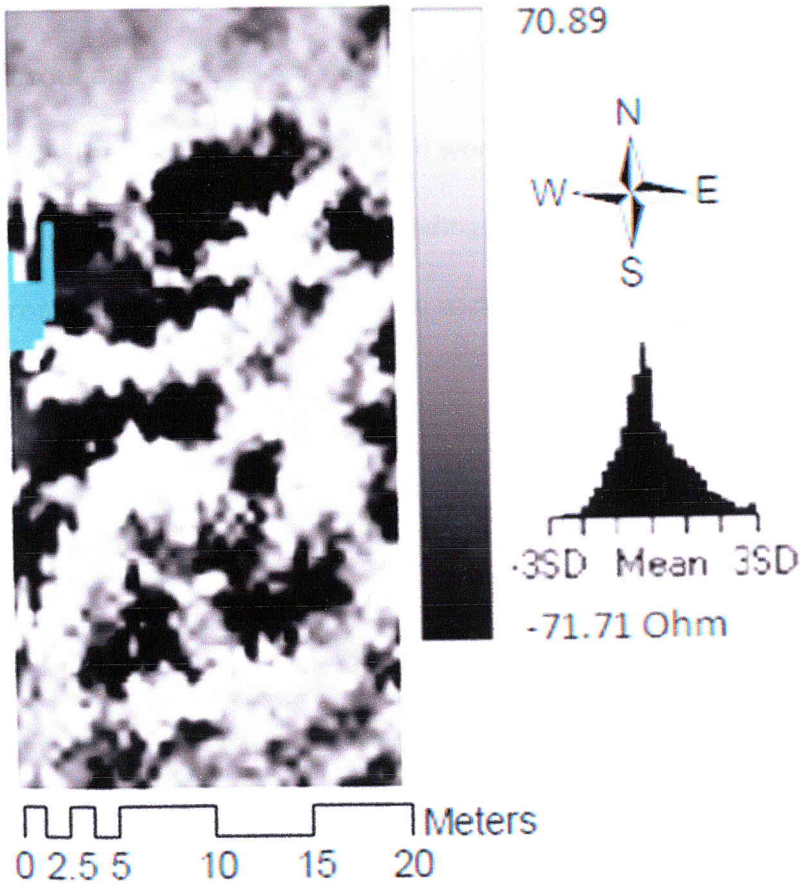

Figure 22 – This data set has been gained over the eastern end of the long barrow using the carted square array and represents the alpha data set (see section 3.3).

A – There are a number of low resistance relate to possible archaeology features located to the eastern end of the survey area. These anomalies may hold a relation to the long barrow and present activity occurring outside the long barrow.

B – These high resistance anomalies seem to represent archaeological features defining the eastern extent of the long barrow.

C – These low resistance anomalies relate to a number of possible archaeological features relating to the central area of the long barrow. These distinctive anomalies may well represent the earthen components of the long barrow which are less compact than the surrounding area.

D - The dummy readings which were inserted into this data set have purposely been left in place as a number of these readings relate to an area of the barrow which was to prominent to successfully use the cart.

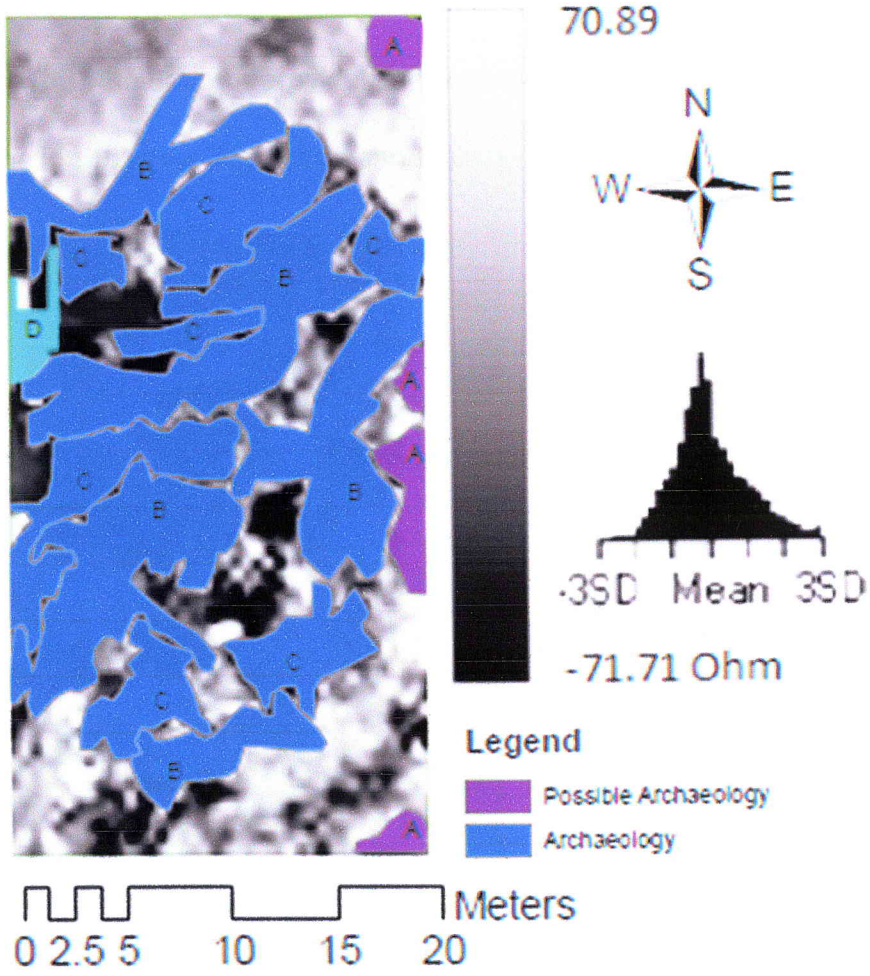

Figure 23 – This represents the interpretations of the alpha data set (section 3.3) gained with the carted square array.

5.6.2 MSP40 Beta Data

The beta data set provides further insight into the anomalies visible at the eastern end of the long barrow (Figures 24 and 25).

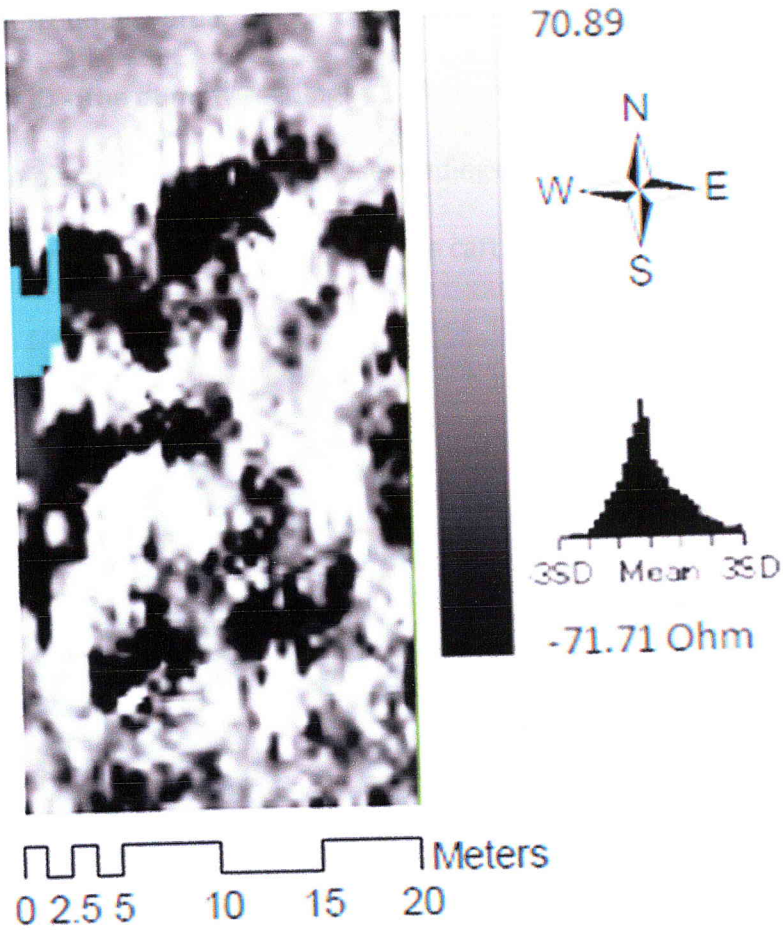

Figure 24 – This data set has been gained over the eastern end of the long barrow using the carted square array and represents the beta data set (see section 3.3).

A – There are a number of low resistance relate to possible archaeology features located to the eastern end of the survey area. These anomalies may hold a relation to the long barrow and present activity occurring outside the long barrow.

B – These high resistance anomalies seem to represent archaeological features defining the eastern extent of the long barrow. This may be caused by increased compaction of the soil.

C – These low resistance anomalies relate to a number of possible archaeological features relating to the central area of the long barrow. These distinctive anomalies may well represent the earthen components of the long barrow which are less compact than the surrounding area.

D - The dummy readings which were inserted into this data set have purposely been left in place as a number of these readings relate to an area of the barrow which was to prominent to successfully use the cart.

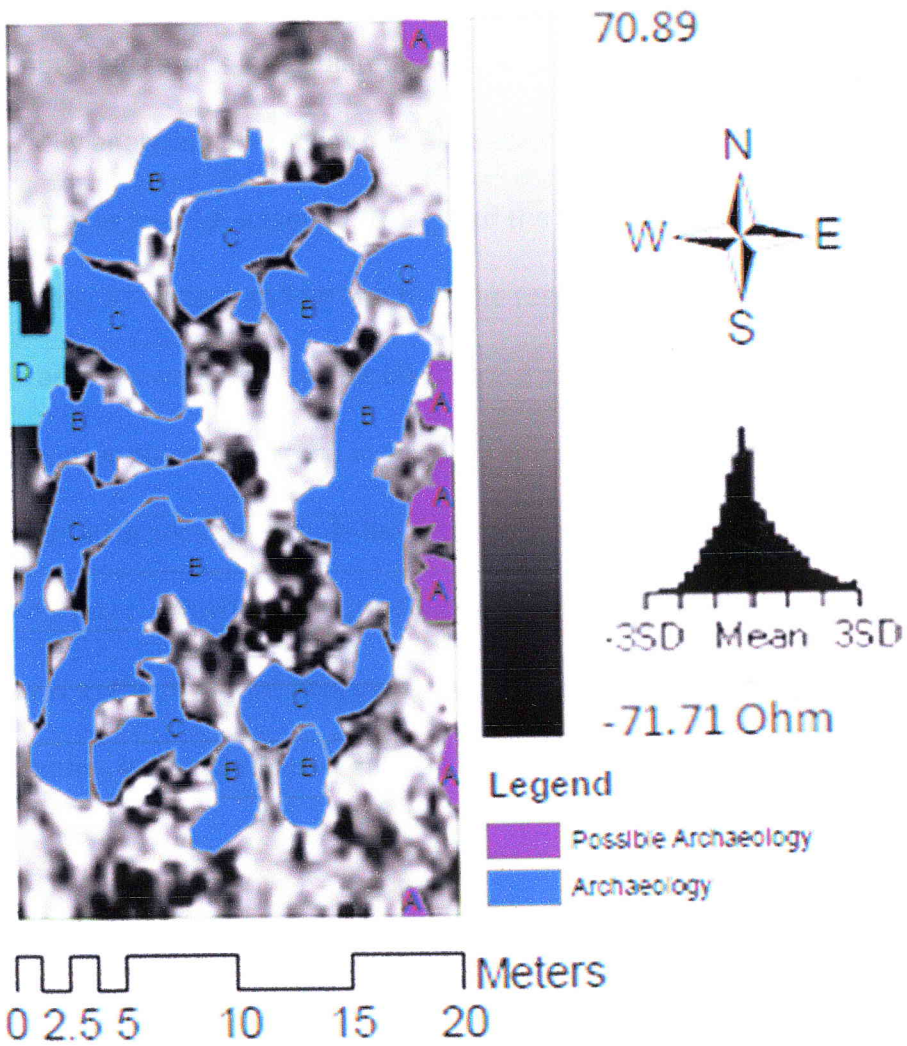

Figure 25 – This represents the interpretations of the beta data set (section 3.3) gained with the carted square array.

Discussion

The use of a multimethodological geophysical survey has aided in the successful mapping of New House long barrow.

The Wenner array is subject to an undesirable measurement feature called the anisotropy. This means that the sensitivity of the installation to the soil conductivity is different in directions perpendicular to sides (A, M) and (A, B). Re-measurement on the same electrode grid but with the array turned by 90 degrees after this the arithmetic mean of obtained results is calculated.

By analysing anomalies over a number of depths, greater information about these anomalies may be achieved. The use of the Twin-probe array has been used to aid in creating an understanding into how the responses of the current is effected with greater distance between the two mobile current and potential probes. By analysing each layer the responses gained decrease in strength due to the greater distance between the current and potential probes. This study has also allowed for a standard 0.5m Twin-probe to be undertaken according to English Heritage standards. It must be understood that in broad terms as the probe separation becomes larger less detail is seen as the probe separation becomes larger (Gaffney and Gater 2003: 60).

The use of a carted square array has allowed for comparative data with the Wenner array. The square array data has provided similar data to the Wenner array in defining the eastern end of the long barrow providing an intricate view of the shape of this monument at its widest extent. By examining the differences between the alpha and beta data sets it is possible to understand the monument and how the differences between the alpha and data sets map the long barrow (Figure 26).

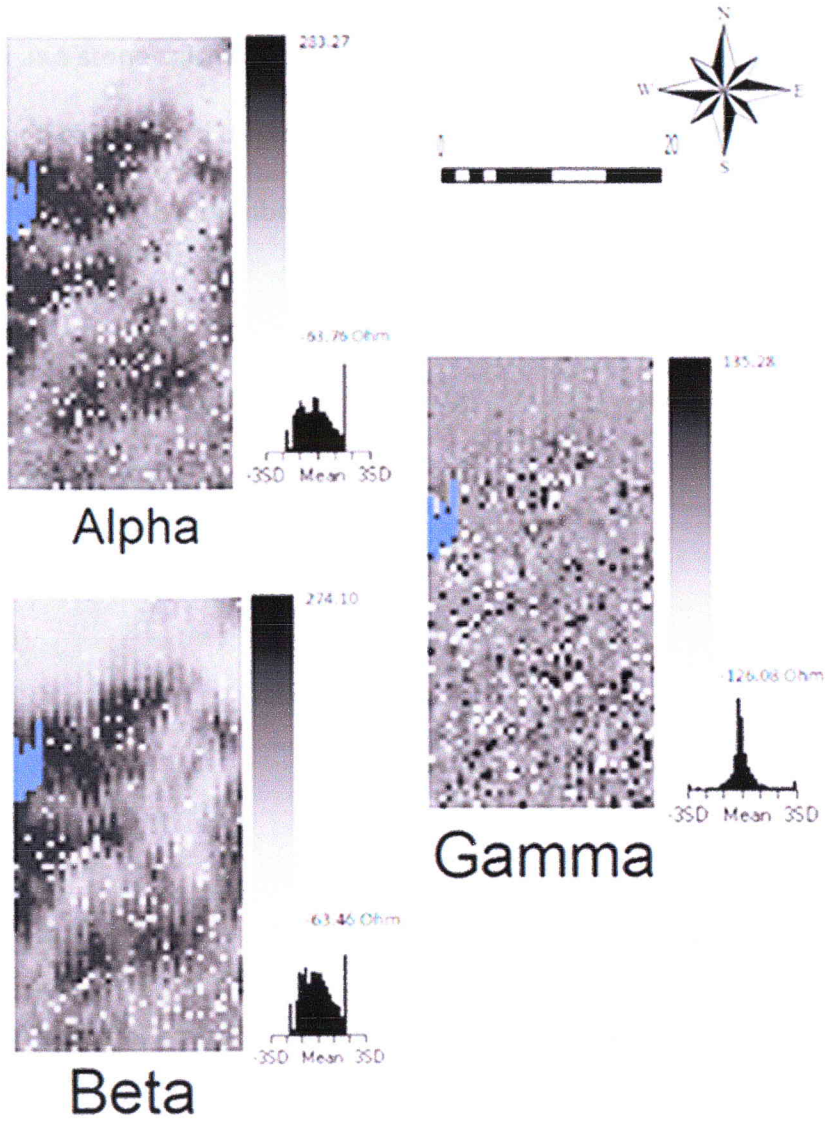

Figure 26 - These data sets collected from the New House long barrow site, demonstrate the use of the MSP40 carted square array and the production of the gamma data by subtracting the beta data from the alpha data. This allows for the differences between the alpha and beta data sets to be examined. The data has been left in its raw state to provide an image of the true difference between the alpha and beta data sets.

The geophysical mapping of New House long barrow has allowed for the extent of the long barrow to be seen. The data received has allowed for the understanding that this monument may have once stood as a stone cairn which at a later period was developed into a long barrow by covering the stone cairn with a trapezoidal earthen long barrow. Evidence of this cairn may be seen within figure 5 with a number of dolerite rocks protruding from the northeastern edge of the long barrow.

Conclusions

The aim of this research has been to create a further understanding of New House long barrow, situated on the Powys – Shropshire border using various geophysical techniques. This was successful in the definition of the barrows shape and construction and the analysis of the geophysical methods used has allowed for a greater understanding of the methods of geophysics which may be applied to this site. It may be inferred from the geophysical data that this monument has at some point in its development stood within the landscape as a cairn before its development into a long barrow. The presence of a number of stones protruding from the barrow itself would suggest that there was a possible cairn. The size, shape and orientation of the long barrow fits in with the common definition of long barrows (see section 2.0).

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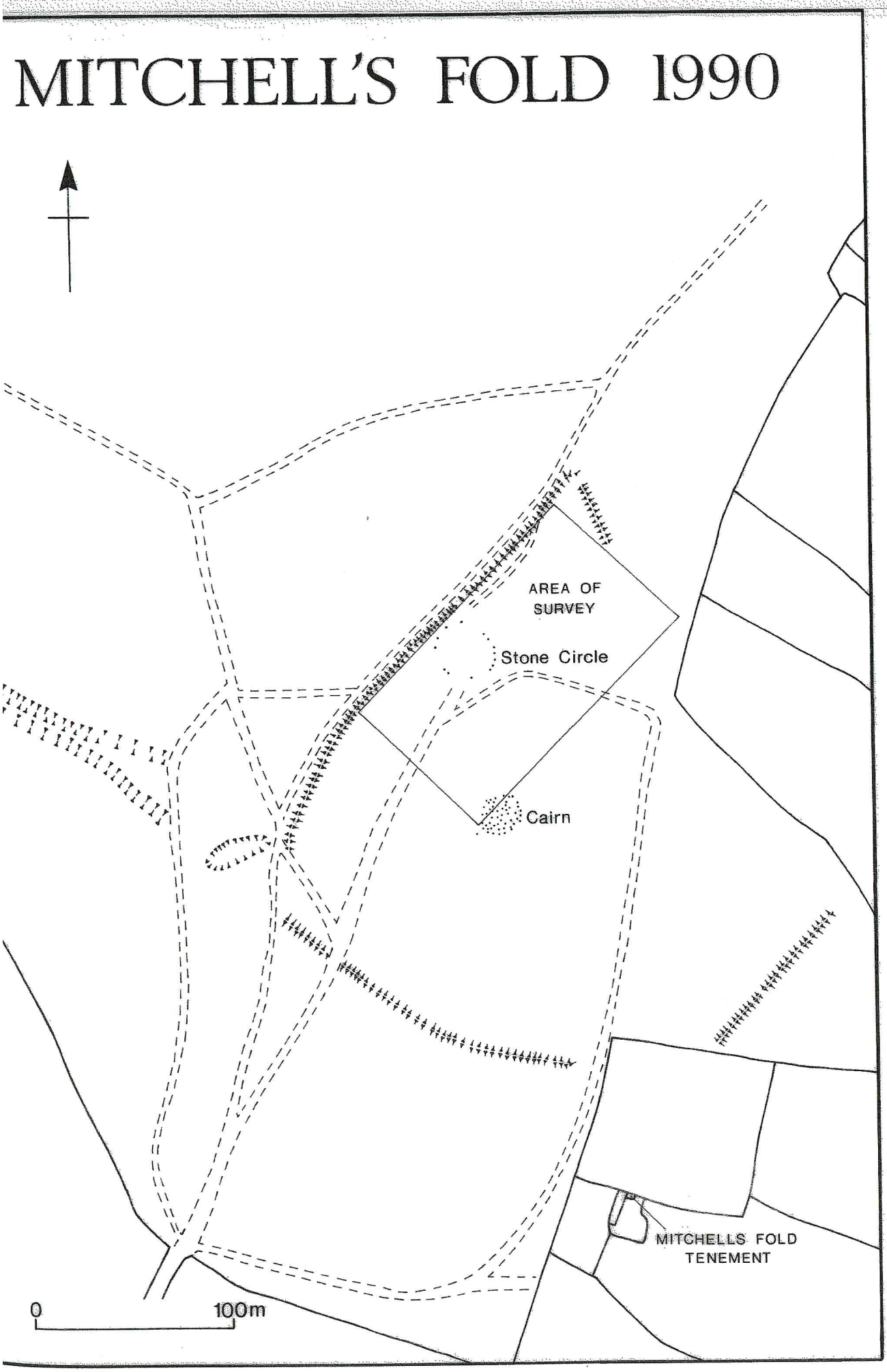
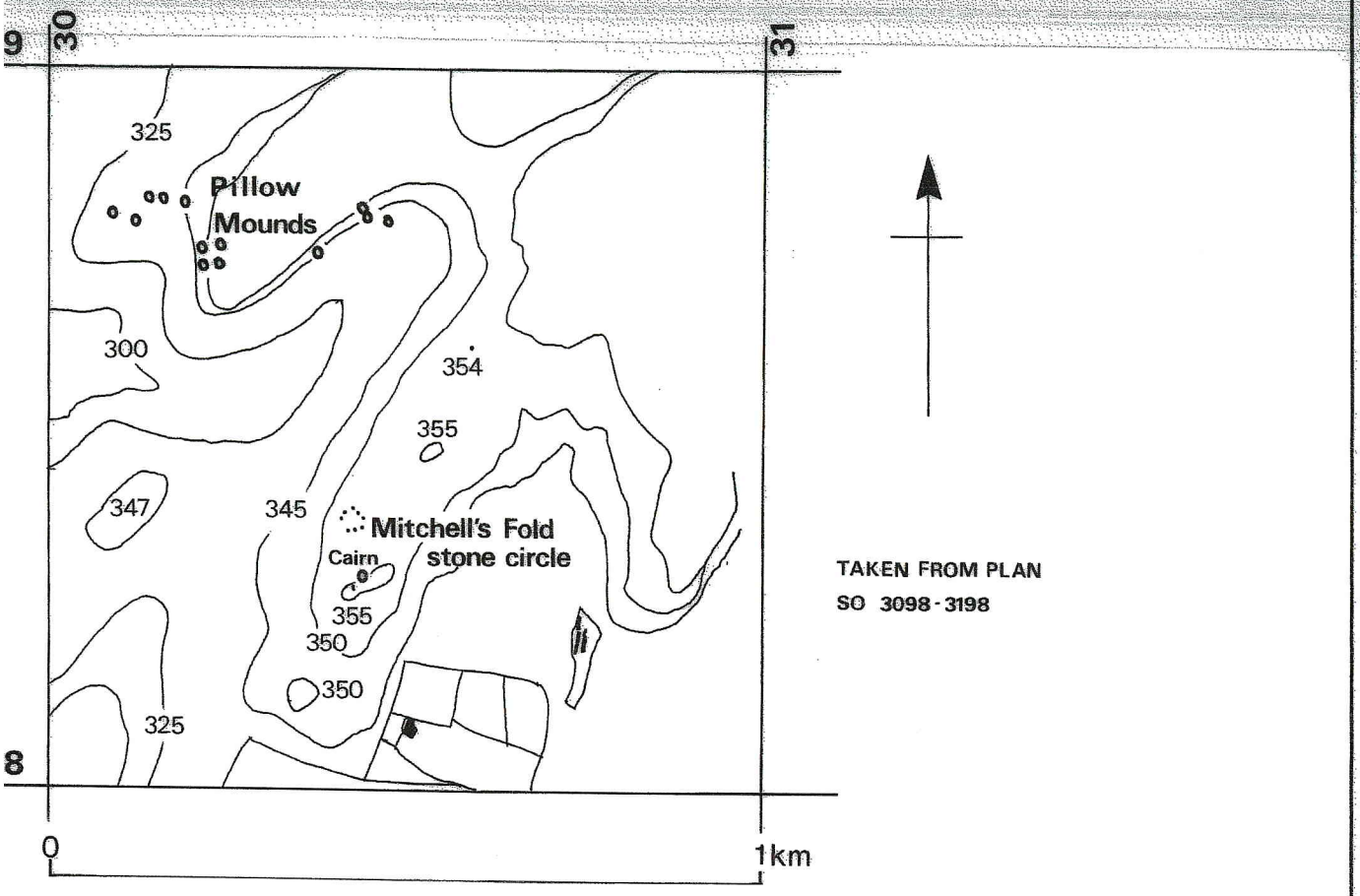
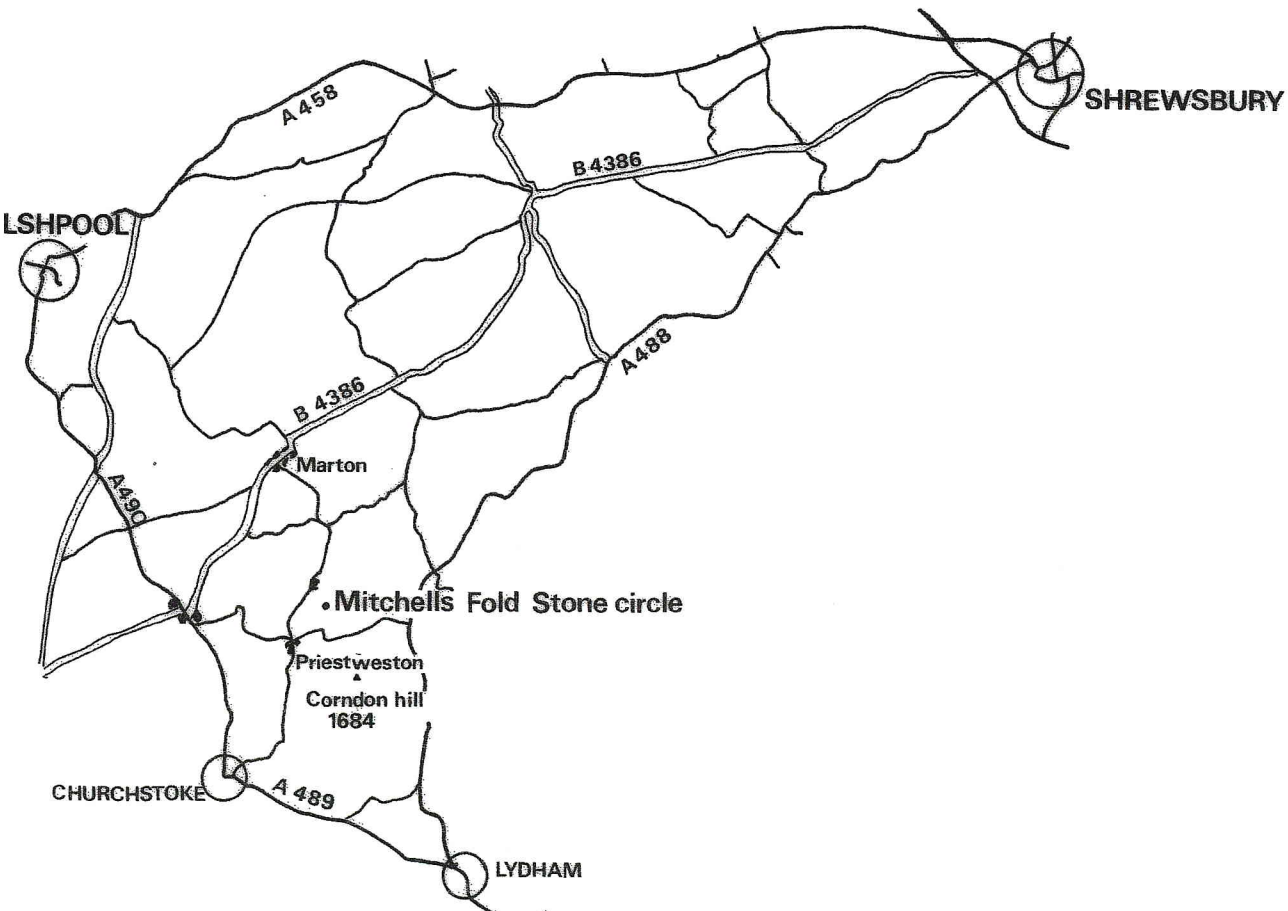
Appendix 1 – Plans of Mitchell's Fold

Undertaken by Birmingham Archaeological Unit

MITCHELL'S FOLD 1990

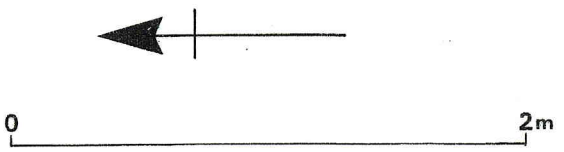


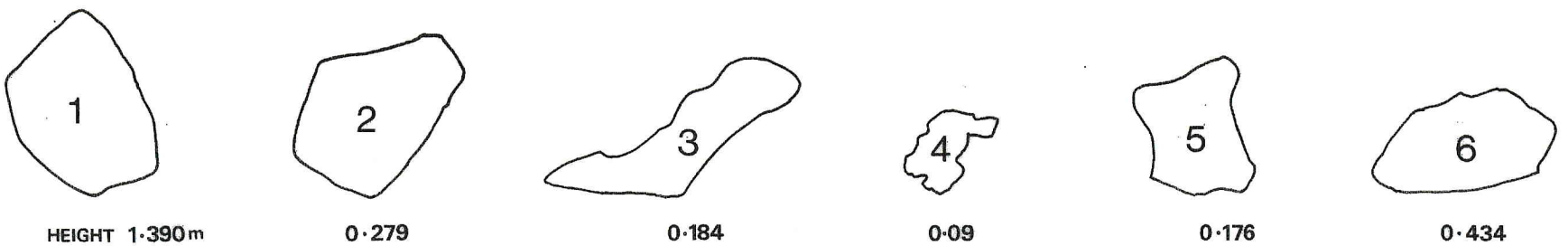




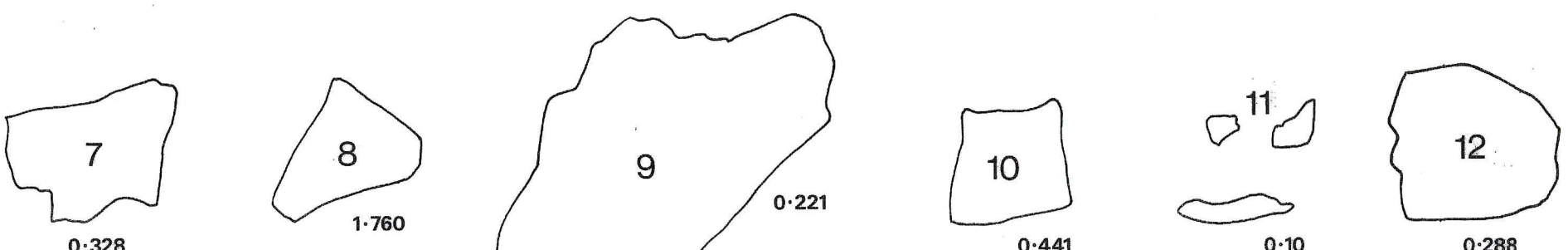
MITCHELL'S FOLD
LOCATION PLAN

MITCHELL'S FOLD
PLAN OF STONES





HEIGHT 1·390m | 0·279 | 0·184 | 0·09 | 0·176 | 0·434



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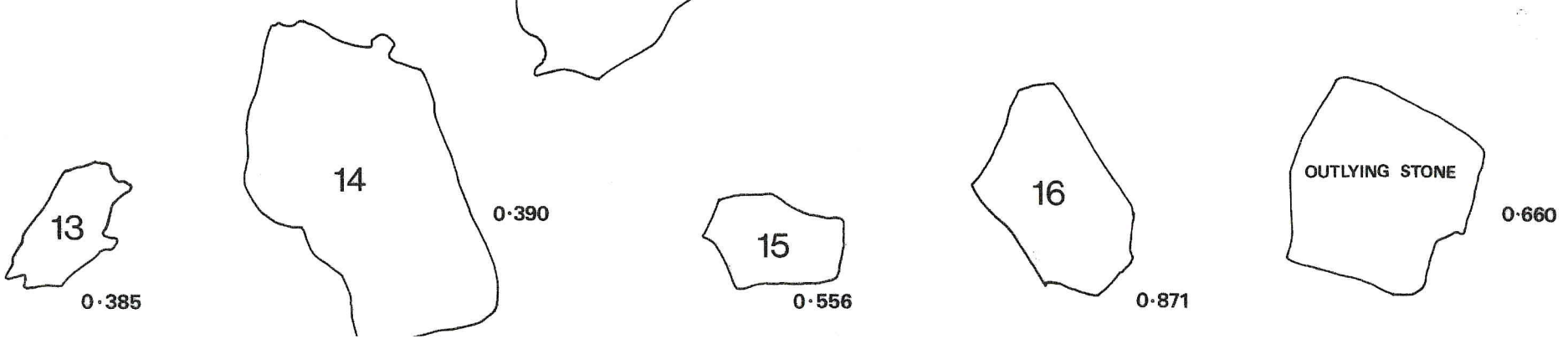

0·385 | 0·390 | 0·556 | 0·871 | 0·660

MITCHELL'S FOLD COMPARATIVE PLANS OF STONE CIRCLE