

Grange Stone Circles, Lough Gur, Co. Limerick: Geophysical survey at Stone Circles B, C and D and review of dating and phases of monument use of Circle B

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In a major re-interpretation of the archaeological evidence the authors¹ show that the present appearance of the Great Stone Circle at Lough Gur owes much to late-nineteenth-century restoration with more than forty stones added, the height of the bank raised and the interior levelled. The date of the monument is also revised with its construction now shown to be in the later Neolithic period and its continuation as a ritual site into the Bronze Age suggested by the discovery of seven ring ditches within the circle.

Introduction

Three stone circles in Grange townland are located in close proximity on the crest of a low limestone ridge that rises from Lough Gur on the east and slopes downwards to a stream valley to the west (Fig. 1). The stone circles were designated B²–D by Windle (1912) and a 3m high standing stone³ on the west-facing slope of Ardaghlooda Hill was designated site 'A'. Stone Circle B is monumentally the most impressive of the Lough Gur archaeological sites and is recorded as the 'Great Stone Circle' by Windle (1912) and Ó Ríordáin (1951). Stone circles C and D are located to the north of the Great Stone Circle (B). Stone circles B–D are part of a complex of upstanding monuments and details of these were presented in a previous paper in this journal (Cleary and Hogan 2013, 82–84; fig. 2). Medium altitude aerial photography and geophysical survey also confirmed a number of low-visibility and sub-surface sites of archaeological significance immediately south of and to the west of the stone circle complex (*ibid.* 89–93).

Antiquarian accounts provide clues to the original form of the monuments and this is the case for the stone circles at Grange. There are varying accounts of the numbers of original stones at the Great Stone Circle (B); up to 1840, the numbers given varied from 40–65 stones and of these antiquarian accounts, four⁴ indicate the numbers of stones as 60–65. The addition of stones to Circle B has implications for the interpretation of the site given that the stone circle was restored possibly around the 1870s. Subsequent accounts of Stone Circle B may have recorded a monument that was substantially added to and altered. Westropp *et al* (1916) followed Windle's (1912) enumeration of the stones and cited 113. At the time of Ó Ríordáin's excavation (1951, plate II) 113 stones were shown and of these, six numbered stones (72, 77–79, 86 and 94) are indicated as modern insertions giving a number of 107 as original in the circle⁵.

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² B = RMP LI032-004001; C = RMP LI032-006; D = RMP LI032-005.

³ RMP LI032-010002.

⁴ Crofton Croker (1833) specified 63, Lewis (1837) and Fitzgerald/McGregor (1826) recorded 65; Camden (1607) gave 60 as the number. Other antiquarians record lower numbers: Twiss (1775 [Finnegan 2008]) said 40 and Beauford (1828) indicated 43; O'Donovan (1840) recorded 45.

⁵ Seven stones were also indicated as modern in the entrance passage (Ó Ríordáin 1951 plate III).

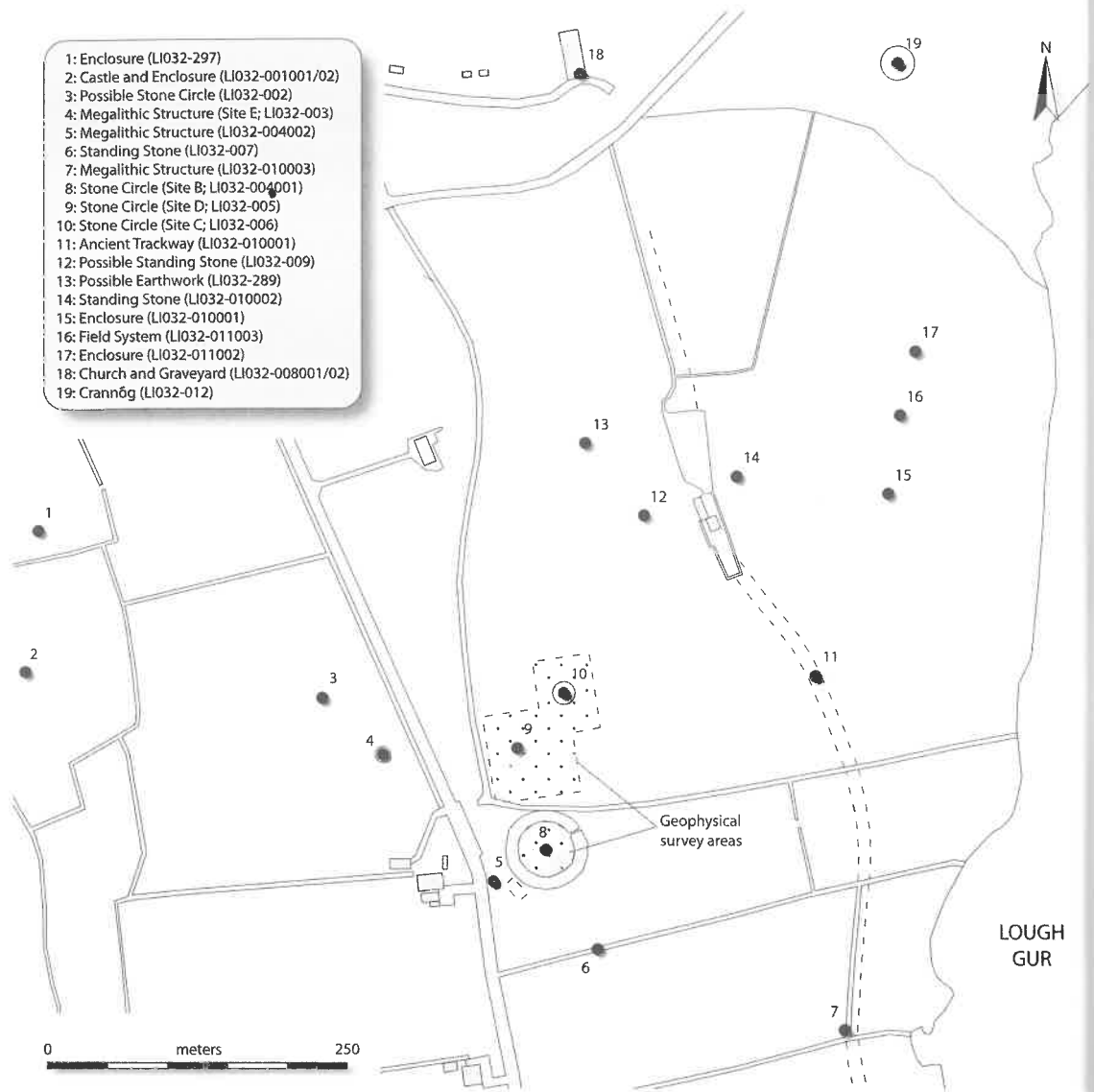
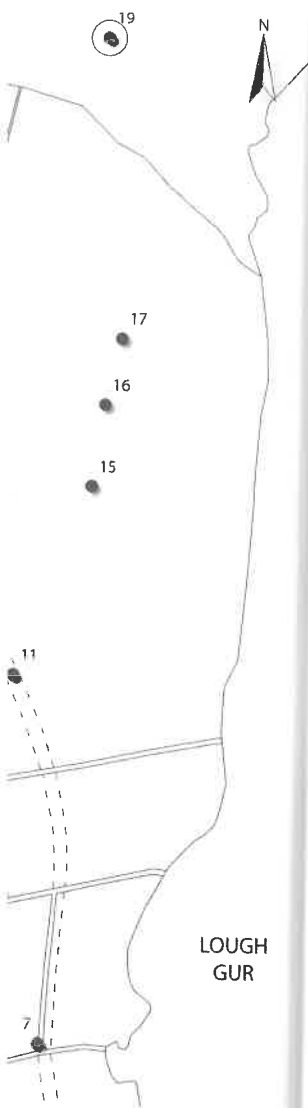


Fig. 1 Site location.

The Ordnance Survey mapped the Lough Gur area in *c.*1840 (published 1844). The accompanying O'Donovan Letters (1840) contained information relative to the antiquities of Co. Limerick collected during the progress of the Ordnance Survey in the early 1840s and provide descriptions on the monuments. O'Donovan's account of Circle B is similar to Beaufort's (1828, 138) description. O'Donovan (1840, 75) stated that 'many of the intermediate stones have been removed and part of the north side of the circumference has been much disturbed by a ditch lately made close to it'. Some of the Ordnance Survey representations of the antiquities may be schematic, illustrated at the three stone circles in Grange townland where Circle B is depicted as fifteen separate stones, Circle C is shown as nine separate stones and Circle D is shown as an embanked stone circle.



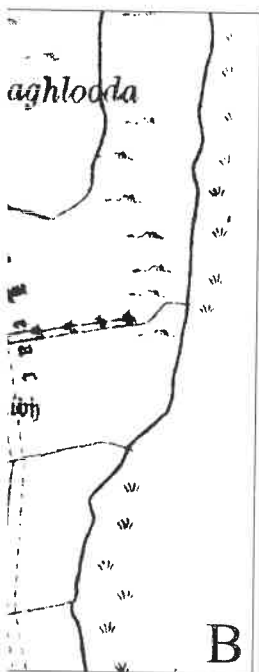
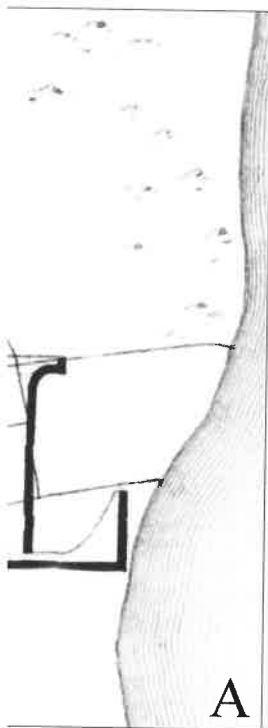
published 1844). The relative to the antiquary Survey in the early account of Circle B is stated that 'many of the circumference of the Ordnance at the three stone circles, Circle C and stone circle.

J. F. Lynch (1895, 292) recorded that 'the chief circle of the Ardagh-lougher group [Grange] is on the farm of Mr. Edward Fitzgerald [of Holy Cross Cottage], and is in a splendid state of preservation, owing to the great care and pains which were bestowed on its restoration, some twenty-five years ago, by the landlord, Count de Salis, the late Mr John Fitzgerald and his brother Mr Edward Fitzgerald'. Lynch (*ibid.*) recorded the number of stones as 120. Lynch (*ibid.*, 294) also noted that Edward Fitzgerald informed him that he and his brother 'only introduced at the time of the restoration, a very few new stones into the circle, and that all the rest belonged to it, but had fallen from the upright positions and been covered by the earth from the surrounding rath'. Lynch (1913, 14) reviewed his original assessment of the amount of restoration and stated 'I have been told since the publication of my article [1895], by old men at Lough Gur that the late Mr. John Fitzgerald introduced very many stones into the circle, which he obtained from the lake, and from other stone monuments in the district and that the mound was deformed by him'. Lynch (1913, 15) also recorded that a megalithic tomb⁶ 'was destroyed by the father of Edward Fitzgerald, as it stood near the gate opening from the public road, and impeded his carts'. The collector Robert Day (1895, 303) visited Lough Gur around 1885 and met John Fitzgerald and recorded that Fitzgerald 'took most particular care of the great stone circle... having restored it with marvellous skill and correct feeling. In doing this he discovered the original entrance on the eastern side... and had prostrate stones set up, and some others that had been removed to a distance brought back to their original place and set up in their old positions'.

The excavation undertaken by Ó Ríordáin (1951) included the entrance area, six trenches across the bank and one tangentially through the bank in the north-west quadrant. The longitudinal section cut through the NW bank quadrant shows considerable disturbance in the northern side (Ó Ríordáin 1951, plate V, section DF), at the back (east) of Circle Stone 1 (*ibid.*, section AB) and at the back (north) of Circle Stone 99–100 (*ibid.*, section MN). Other sections across the bank illustrated by Ó Ríordáin (1951, plate IV) appear to show less disturbance. An excavation trench in 2012 at the back (south side) of Circle Stone 26 showed that the west end of the bank was severely disturbed and the bank immediately behind the Circle Stone 26 (Cleary 2013) was modern. This modern infill was c.0.8m deep and extended southwards from the circle stone across the top of the original bank raising the bank height up to 0.5m particularly behind the stone circle orthostat Circle Stone 26. Overall the evidence from antiquarian accounts and excavation by Ó Ríordáin and in 2012 suggest a considerable amount of restoration possibly including the addition of a minimum of 42 stones to the circle, straightening of *in situ* stones and consequent disturbance of the sockets and bank and raising the bank height.

The other aspect to be considered is the interior which today presents as a level surface that is higher than the surrounding ground. Ó Ríordáin (1951, 43) recorded an introduced gravelly clay spread over the interior which covered the old ground surface and described the layer as 'an average depth of 18" [0.45m], – the actual depth varied between 14" [0.35m] and 34" [0.86m]'. The bases of some circle stones were supported with stone packing and gravel and as some of the smaller stones did not reach the old ground level, packing was used to raise and support these bases (*ibid.*, 45). Ó Ríordáin considered that one reason for the introduced layer was to cover the 'unsightly bank inside the uprights' and the overall conclusion was 'the monument was constructed as a unit – bank, uprights and packing' (*ibid.*). Packing and support stones around stones added to the stone circle in modern times were also covered by the introduced layer. The introduced layer appears to have been sterile of finds and where locations are given in the

⁶ Probably the site recorded as RMP LI 032-004002.



published report all the finds were recovered from bottom of the introduced layer, the gravel layer around the circle stone bases and the old ground surface. The archive⁷ for the ceramic assemblage also supports the absence of finds from the introduced layer. An alternative dating of the introduced layer may be proposed on the basis of stratigraphy and the introduction of new stones during monument restoration and it is suggested that the interior was also levelled up as part of the process of 'restoring' the site. If the introduced layer was part of this process, any feature above the old ground surface can be considered modern and probably post-1870. The enclosure within the interior recorded as 'C' on the excavation (Ó Ríordáin 1951, 44–45) can consequently be considered at the earliest to date to the late nineteenth century. Finding clay pipe fragments in the trench of enclosure B which was dug into the old ground level may be due to modern disturbance undetected by the excavators.

Circle D was depicted as an embanked stone circle on the 1844 edition of the Ordnance Survey map (Fig. 2A) and effaced by the 1902 edition and marked as 'site of' (Fig. 2B). Lynch (1895, 300) recorded Circle D as 'about thirty yards [27m] due north of the chief circle [Circle B] there is another circle with a diameter of one hundred and seventy feet [52m]' and six circle stones remained in place. The absence of a surrounding bank was also noted as 'no rath'. Lynch (*ibid.*) commented that 72 stones were in place in the early 1830s. Croker (1833, 107) recorded 69 and 'many being sunk in the ground, and overgrown with weeds and brambles'. Croker (*ibid.*) also wrote 'that twelve of the largest stones had recently been taken away from the circle, and broken up to road repair'. Lynch (1895, 300) and the antiquarian known as B.R.R. (1865, 242) attribute the destruction of Circle D to 'Mr. Edward Croker, of Grange'. Circle C apparently remains intact and has survived 'restoration' and destruction.

Archaeological excavation and dating

Circle B was excavated by Seán P. Ó Ríordáin in 1939 and the results were published in the *Proceedings of the Royal Irish Academy* (1951). At the time of Ó Ríordáin's excavation dating was based largely on the pottery types recovered from the site. The presence of Beaker pottery within the interior and in the sockets⁸ of the orthostats appeared to confirm dating to the Late Neolithic/Beaker period of c.2500–2200 BC. It is clear however that the site had a longer currency of use than indicated by Beaker pottery. Ó Ríordáin (1951, 53–67) identified a variety of pottery types from the site. A limited amount of Early Neolithic pottery was found under the bank and was likely to be residual from an earlier phase of site use. Pottery originally identified as 'Class II'⁹ ware was found by Ó Ríordáin under and within the bank and in the interior. A residue from one of these vessels¹⁰ returned a 14C date of cal. BC 3020–2888 (UBA-23442) confirming this type of pottery as within the Grooved Ware tradition and Late Neolithic in date. The ornamentation and method of manufacture¹¹ of the 'Class II' ware at Grange also provide a

⁷ Labels accompanying the ceramic finds.

⁸ Re-plotting the pottery on the published excavated plan where the information was available shows a marked absence of Beaker pottery from the stone sockets. As the stratigraphy within the stone sockets was likely disturbed during the 'restoration' any finds from these features may have been *ex-situ*.

⁹ Roche (2004, 115) erroneously identified this part of the Grange Stone Circle (B) pottery assemblage as Late Bronze Age and proposed a construction date for the stone circle in the Late Bronze Age in date.

¹⁰ The sherd was found on the old ground level in the excavation cutting through the bank in the NWQ (Ó Ríordáin 1951, Plate IV; Section DF).

¹¹ Fracture pattern of the coil-built pottery results in a 'false rim' which is a recognised feature in Grooved Ware pottery (Cleary 2010).

strong argument for the identification as Grooved Ware (Brindley 1999, 24). Ó Ríordáin (1951, 62–64) described a 'miscellaneous' type of pottery and identified parallels at the Scottish Grooved Ware sites of Skara Brae and Rinyo on the Orkney Islands. The absence of Beaker pottery from under the bank also suggests that the bank was in place prior to the use of Beaker ceramics. Six radiocarbon determinations from animal bone and ash charcoal from the bank and residues on pottery¹² returned dates of 2950–2850 BC (Cleary 2013) suggesting a period of construction at the beginning of the third millennium. Other pottery from Ó Ríordáin's excavation is identified as Bowl Food Vessels (Ó Ríordáin 1951, fig. 7). These were recovered from near the entrance (NEQ 12) and the interior (NEQ 7 and 15; SWQ 7, 8 and 15). Details of the stratigraphic location¹³ were given only for the Food Vessel pottery recovered from NEQ 12 and were recorded as being under the 'gravel bank'¹⁴ at the base of the uprights¹⁵ (Ó Ríordáin 1951, 61). Where identifiable, the Food Vessel sherds can be assigned to Brindley's Stage 1 of Bowl Food Vessels and dated 2180–2100 BC (Brindley 2007, 241). The pottery from Circle B confirms longevity of use and it may be suggested that the monument was built in the first few centuries of the third millennium, was used by populations who were part of the 'Beaker Culture' and by Early Bronze Age people who used Food Vessels. Geophysical survey on the site has also identified possible ring-ditches which show continued use into the Bronze Age.

Circles C and D at Grange are undated by scientific excavation. Circle C has a low external bank and a low mound inside the circle and morphologically may have been similar to and contemporary with Circle B, albeit on a smaller scale as the internal diameter is only 17m. The largely destroyed Circle D has an estimated diameter in the region of 56m¹⁶ and is of comparable size to Circle B.

Archaeological geophysics

The local geology in the area surveyed around the stone circles is Carboniferous limestone overlain by podzolic soils and this geomorphology is conducive to the application of geophysical techniques. The geology and soil type provide a naturally weak and uniform magnetic background, allowing more faint magnetic features to be detected.

The geophysical survey employed magnetic gradiometry to investigate the interior of Circle B and at the now largely levelled Circle D and electrical resistance was also employed at Circle D. These non-invasive survey techniques measure and record localised physical discontinuities or anomalies indicative of shallow subsurface remains (Gaffney and Gater 2003, 25; Waddell *et al.* 2009, 18). Theoretical and methodological approaches to geophysical survey were presented in this journal for a previous survey at Lough Gur (Cleary and Hogan 1913, 87).

A twin probe array¹⁷ was employed in the electrical resistance survey over Circles C and D and probes were set 0.5m apart. This spacing responds to features at a maximum depth of 0.75m and is usually sufficient for most features in the context of rural

¹² The residues were on pottery recovered during Ó Ríordáin's excavation.

¹³ No details of the location of other Food Vessel pottery were recorded in the site archive.

¹⁴ The gravel bank was within the interior and immediately west of the sockets of orthostats 10–12 (north of entrance) and may have been upcast from digging the sockets or later disturbance during the 'restoration' of the monument in the late nineteenth century.

¹⁵ Orthostats 10–11.

¹⁶ The diameter is based on measurements from the 1st edition Ordnance Survey maps and excludes the possible embankment; if the embankment is included the overall diameter was 78m. Early accounts of Circle D give a larger diameter of 68.5m (Ó Ríordáin (1951, 38).

¹⁷ This was undertaken using a Geoscan RM15 resistance meter.

archaeological sites (Gaffney and Gater 2003, 32), although the size of the target being investigated is also significant in this respect (Walker 2000, 122). The twin probe array has the advantages of good depth penetration and lateral resolution, a relatively good response to archaeological features and easy mobility (Dabas *et al.* 2000, 117). Data was collected at one meter traverse and sample intervals and the recording sensitivity of the meter was set at 1 Ω . A series of 20m by 20m grids were set out and data was collected in a zig-zag pattern. The remote probes were located 15m from the survey area and spaced approximately 1.2m apart.

The magnetic survey employed a gradiometer¹⁸ which comprises two magnetometers separated 1m vertically apart¹⁹. The top sensor measures the earth's magnetic field (Nano Tesla [nT]), while the bottom measures the same field, but is affected by any close buried feature (Gaffney and Gater 2003, 40–41). The application of two magnetometers forms a spatial high-pass filter which largely cancels out diurnal variations (Aspinall *et al.* 2009, 33). Hematite or iron oxide in soil can become magnetically enhanced through heating/burning (thermo-remanent magnetism). Magnetic enhancement can also occur through fermentation whereby bacteria create an atmosphere of reduction in decaying organic material and magnetic minerals can be magnetically enhanced (Fassbinder *et al.* 1990, 163; Aspinall *et al.* 2009, 25). Organic matter is more frequent in topsoil and this results in a higher magnetic susceptibility than in subsoil. In an archaeological context the redeposition of topsoil within features that are cut into the ground creates an enhanced magnetic anomaly that can be identified using magnetic techniques.

Readings were taken in zig-zag mode over Circles C and D and data was collected at 0.5m traverse and 0.125m sample intervals. Higher resolution data collection was undertaken within Circle B at 0.25m traverse and 0.125m sample intervals in parallel collection mode. The higher sample density was employed to record in as much detail as possible, the archaeological features identified on Ó Ríordáin's 1939 excavation, as well as other unrecorded features. The gradiometer was zeroed every second survey panel to avoid magnetic drift. All data was processed using Geoscan's Geoplot 3.0.

Geophysical survey at Grange: Results and interpretation

Two areas were surveyed, including the interior of Circle B (Area 1) and Circles C and D (Area 2). Area 2 was on level terrain at the south-eastern side of a large rectangular field and bounded at the south, east and north by earth and stone field fences with trees. Electric fences sub-divided the field and were not encountered during the survey and therefore did not affect the geophysical results. Previous geophysical survey work immediately south of Circle B revealed possible remains of a stone circle which measured 13m in diameter and a bivallate ring-ditch of *c.* 12m diameter (Cleary and Hogan 2013, 97).

Area 1 (Figs 3 and 4)

Geophysical survey recorded features excavated by Ó Ríordáin (1951) within the interior of Stone Circle B. These included the circular enclosures A, B, D and E (G12) visible in the geophysical survey as bands of negative readings and a linear stone setting to the south of the interior, apparent as a faint negative anomaly. Ó Ríordáin (1951, 44) noted that the enclosure ditches were difficult to identify during excavation and could in some cases only be detected after rain. The sectional profiles show the ditches cut through the old ground surface and were infilled with yellow clay (Ó Ríordáin 1951, plate 1). At

¹⁸ Bartington 601 fluxgate gradiometer.

¹⁹ The distance between the two sensors determines the depth of penetration of the instrument.

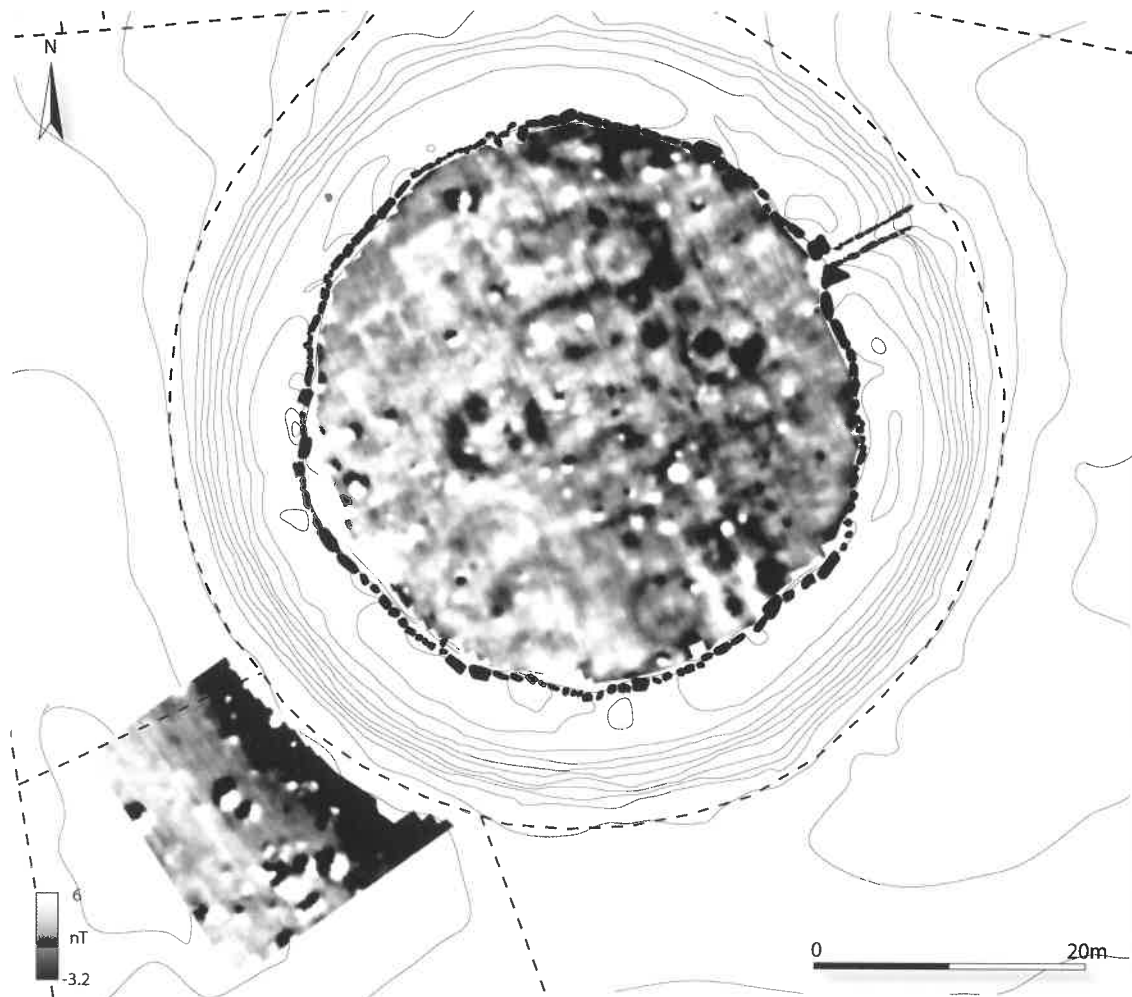


Fig. 3 Area 1 - gradiometry survey of Stone Circle B (The Great Stone Circle).

Lough Gur the yellow clay is usually redeposited boulder clay. These features are probably visible in the geophysical survey results as negative readings because the boulder clay is less magnetically enhanced than the soils surrounding them, creating a contrast visible in the recorded data.

The circular enclosure A was partially excavated by Ó Riordáin and the southern unexcavated side was identified in the geophysical survey. The excavated portion comprised two roughly concentric shallow ditches approximately 4.5m and 7m in diameter. The southern portion of the outer ditch was detected in the survey as a broad band of negative magnetism (G3).

Three previously unknown circular anomalies (G4, G7 and G9) were recorded in unexcavated ground (SW quadrant) immediately south of enclosure A. These anomalies likely represent enclosures similar to those excavated by Ó Riordáin (1951, plate I). G4 comprised two concentric circular bands of negative magnetism with diameters of 7m and 9m respectively, with an intermediary distance of up to 1.3m. The outer band was

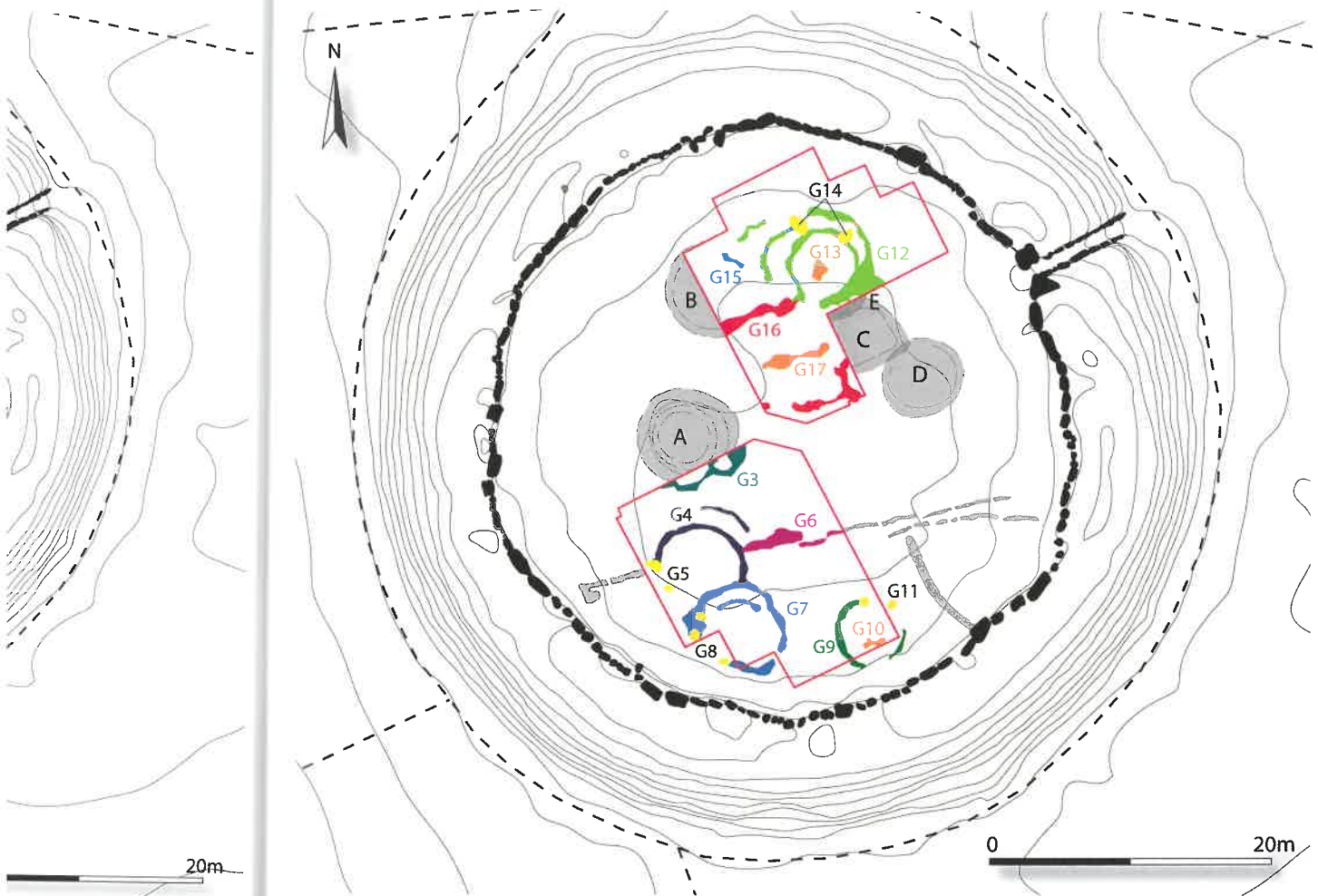


Fig. 4 Area 1 - gradiometry survey of Stone Circle B - interpretative plan.

partially visible at the north-east. The eastern section of the circuit appeared to be truncated by and pre-date a stone setting (G6) and a second possible ring-ditch (G7). The two concentric anomalies (G4) probably represent infilled trenches and were comparable in size with enclosure A of Ó Ríordáin's excavation. A 1.1m break in the western section of the inner trench of G4 may have been an entrance feature. The terminals of this gap had two strong negative anomalies (G5) that could represent pit features, possibly used to deposit cremated bone.

A positive linear magnetic anomaly (G6) abutted the east side of the enclosure G4. The anomaly (G6) extended from the 'two lines of stone' excavated by Ó Ríordáin (1951, 44) and was identified in the geophysical survey. These magnetic anomalies confirmed Ó Ríordáin's suggestion that the stones continued into the unexcavated SW quadrant. The positive linear anomaly (G6) corresponds well with the excavated features. The displacement of backfill material due to the presence of these stones likely created a contrast where the material was thinner over the feature, creating a negative anomaly. G6 trun-

cated the outer circular enclosure of **G4** indicating that the enclosure was an earlier feature.

A circular band of negative magnetism (**G7**) also truncated the southern ditch of enclosure **G4**. **G7** comprises two concentric bands of negative magnetic readings measuring 6m and 8m in diameter and were morphologically similar to enclosure A. The two bands had an intermediary spacing of approximately 1.1m and may represent shallow ditches. Similar to **G4**, **G7** may have had an east-facing entrance (**G8**) comprising a 1.5m wide gap with two strong, negative anomalies (**G8**). Again, these could represent substantial pit features that included cremated bone.

A third potential unrecorded enclosure (**G9**) was identified 4m to the east of **G7**. This circular band of negative magnetism (**G9**) surrounded a central diffuse negative anomaly (**G10**). This negative anomaly (**G10**) may be interpreted as a central low-rise mound. **G9** measured approximately 5.2m in diameter and can be interpreted as a ditch. Similar to **G4** and **G7**, **G9** exhibited features reminiscent of an entrance (**G11**) which was 1.2m wide and north-facing. The possible entrance was defined by two strong, negative anomalies (**G11**), positioned at the terminals of a break in the enclosure **G9** and may represent pit features.

In the unexcavated NE quadrant, a large, circular band of negative readings approximately 6m in diameter (**G12**) surrounded a small spread of negative magnetism (**G13**). Part of an outer band of negative readings (**G12**) was apparent to the east and north at a distance of 1.3m. This has an estimated diameter of *c.* 9m. **G12** may be interpreted as two roughly concentric ditches and probably represented a continuation of enclosure E, recorded on Ó Ríordáin's excavation. A 2m wide break in the outer circuit suggested an entrance feature on the north side. Two strong negative anomalies (**G14**) were recorded in the outer band to the north and may represent pit features associated with burial deposits.

Enclosure B, which was partially excavated by Ó Ríordáin, was located to the west of **G12**. The unexcavated portion of this enclosure may be represented by a short arc of negative magnetism (**G15**) which probably represented the continuation of the excavated ditch. A gap in the geophysical response at the east may represent an entrance.

A possible enclosure of sub-rectangular plan (**G16**) abutted the south side of enclosure B. This was visible as a rectangular band of negative readings surrounding a central linear strip of negative magnetism (**G17**). The enclosure (**G16**) measured 9.5m by 6.2m and was similar in plan to the excavated sub-rectangular enclosure C which was immediately east of **G17**. Ó Ríordáin (1951, 46) noted that enclosure C truncated and post-dated the circular enclosure E. As enclosure C was constructed in the introduced layer and the foundations were 0.15m from the present surface (see above), it was likely to have been a modern construct. Similarly the potential rectangular structure **G16** may be modern. Enclosure B was also truncated by the possible rectangular structure **G16**. It can be suggested that the two rectangular structures (enclosure C and **G16**) may be modern and the seven circular enclosures identified by excavation and geophysical survey represent prehistoric ring-ditches. This remains to be confirmed by excavation.

Enclosure A and three potential enclosures (**G4**, **G7** and **G12**, which was probably part of enclosure E) identified through geophysical survey, each comprised two concentric ditches. While a possible interpretation of these ditches may be footing trenches for houses, the intermediary space between the inner and outer trenches is too wide to form a practical double walled structure. The irregular intermediary spacing of 0.2–0.9m between the ditches of enclosure A does not support an interpretation as a double walled structure as the foundation trenches would have been asymmetrical. Similarly, wide intermediary spacing in enclosures **G4**, **G7** and **G12** of 1.1–1.3m militate against such

an interpretation. The remains are therefore best interpreted as ring-ditches. Three enclosures (B, D and **G9**) had single enclosing ditches and were also likely to have been ring-ditches. The width of the ditches also corroborates this interpretation as ring-ditches tend to be wider relative to their external diameter with an average diameter–width ratio of 8:1 (McGarry 2009, 415). The width of the external ditch in enclosure A was approximately 1m, that in enclosure B was 0.5–0.6m and *c.* 0.9m in enclosure D. Cleary and Hogan (2013, 97) identified an anomaly similar to **G4**, **G7**, **G12** and enclosure A approximately 90m to the east of Circle B. This comprised two concentric bands of magnetism separated by approximately 1.1–1.5m and measuring 20m in maximum diameter. This was also interpreted as the remains of a ring-ditch.

An area abutting the embankment of Circle B was surveyed to identify possible associated features (Fig. 3). There were no obvious archaeological features recorded although some dipolar anomalies were probably due to buried modern ferrous metal.

Area 2 (Figs 5 and 6)

Circle D was investigated using magnetic gradiometry and electrical resistance. This monument comprised a levelled stone circle located less than 10m to the north-west of the Circle B. Nine orthostats on the north-west arc of the circle remain upstanding although Windle (1912) recorded twelve stones in the early part of the twentieth century. The Ordnance Survey letters (O'Donovan 1840) indicate that the majority of the orthostats were approximately 0.9m in height and that a number of outlying stones were originally present. The site was depicted (Fig. 2A) in the first edition (1844) Ordnance Survey map as a large stone circle approximately 58m in diameter and was levelled prior to the 1902 edition. Hachures on the Ordnance Survey suggest that an earthen bank may have backed the outer side of the stone circle. Ó Ríordáin (1951, 38) considered this hachuring as an indication that the interior was higher than the surrounding ground or that it was embanked, although early accounts of the monument by Beaufort (1828, 138) and O'Donovan (1840) suggest that the ground around and within the circle was level. This possible enclosing bank is faintly visible today, particularly along the northern perimeter and there are no surface traces of a ditch. If the presence of a bank can be confirmed, the total diameter of the stone circle with embankment was at maximum approximately 78m²⁰. As such, electrical resistance was specifically used to identify and record anomalies associated with this possible bank.

The results of the gradiometry survey corroborate the first Ordnance Survey (1844) map depiction. **G18a** and **G18b** represent a circular band of magnetic enhancement approximately 56m in diameter. These anomalies are contiguous and follow the projected curve of the surviving stones to the north-west. **G18a** and **G18b** probably represent the stone sockets and circuit of the levelled stone circle. Low resistance features (**R2**) positioned along the line of the stone circle (projected from the gradiometry survey and visible as a red dashed line in Fig. 7) may also represent the remains of stone sockets. The electrical resistance survey also confirmed the likely presence of a bank (**R1**) abutting the external face of the stone circle (Fig. 7). It is not possible to estimate the size of this feature from the geophysical results as the bank was most likely spread across and beyond the original extent. The measurement derived from the Ordnance Survey maps (78m in diameter) may be a good indication as to the original size of the bank.

A possible entrance (**G18c**) to the circle was visible at the south and faces towards Circle B. The entrance comprised a 2m wide break in the circuit of stone sockets (**G18a**

²⁰ This measurement derives from the 1st edition Ordnance Survey map.

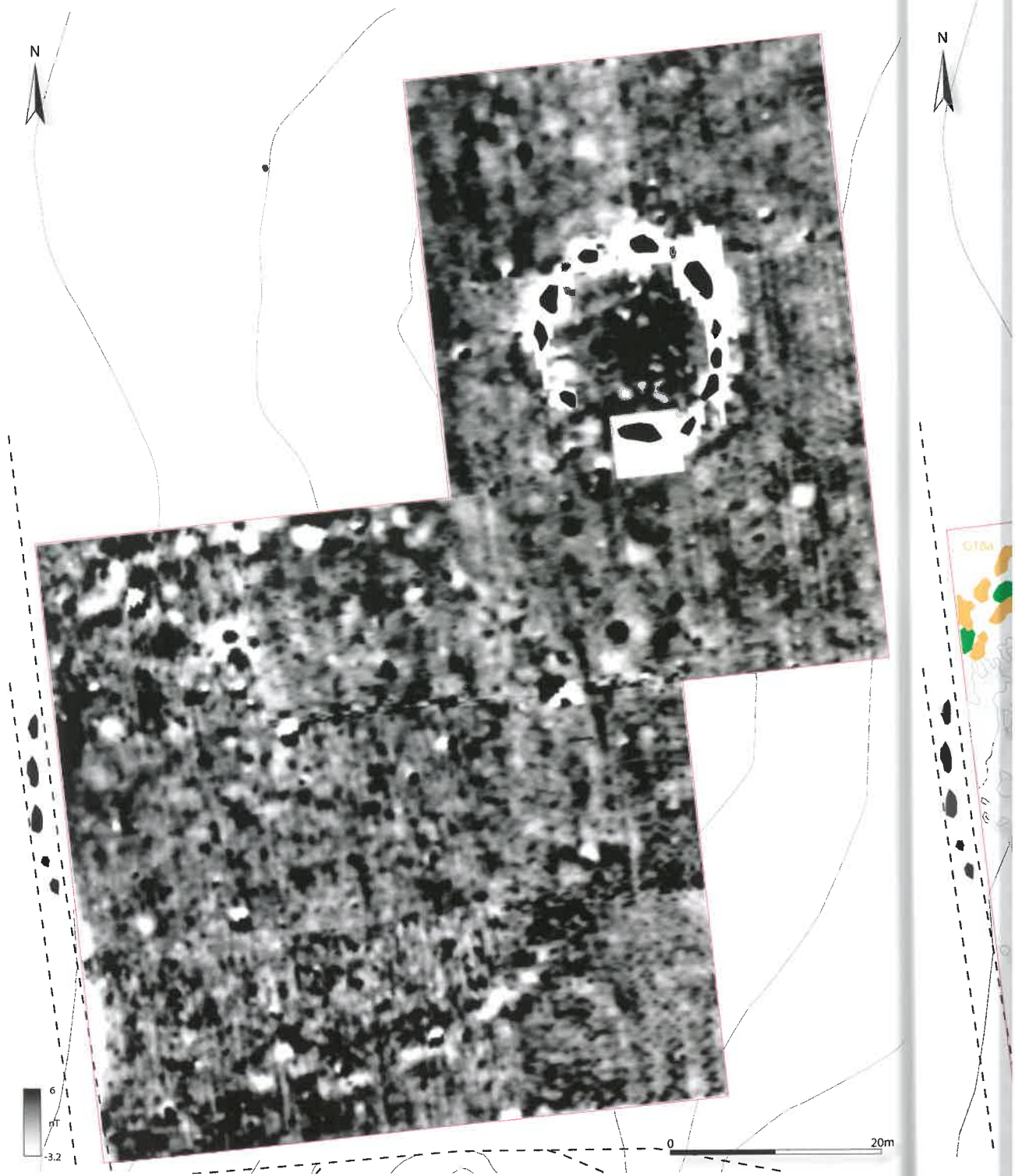


Fig. 5 Area 2 - gradiometry survey of Stone Circles C and D.

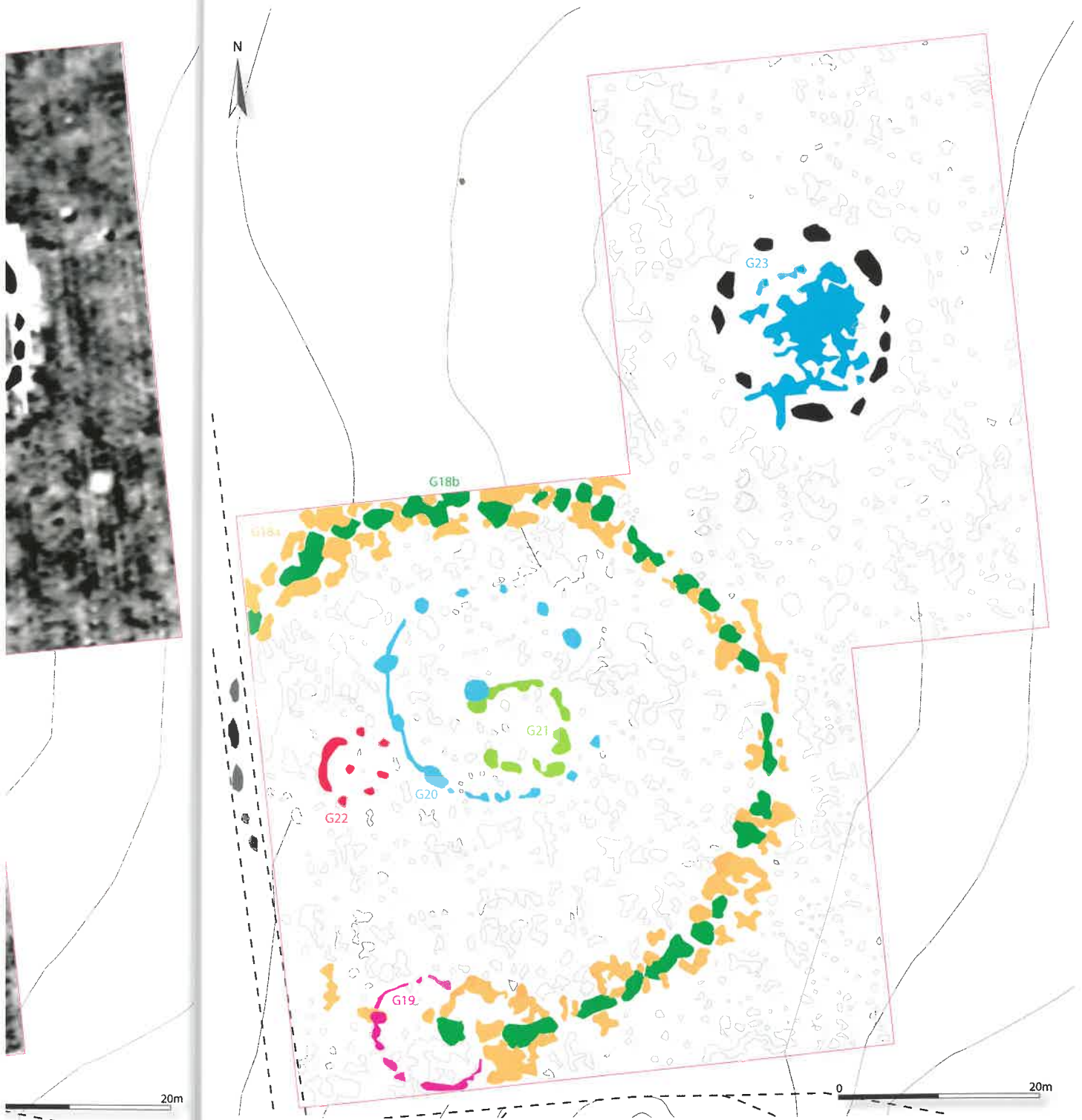


Fig. 6 Area 2 - gradiometry survey of Stone Circles C and D - interpretative plan.

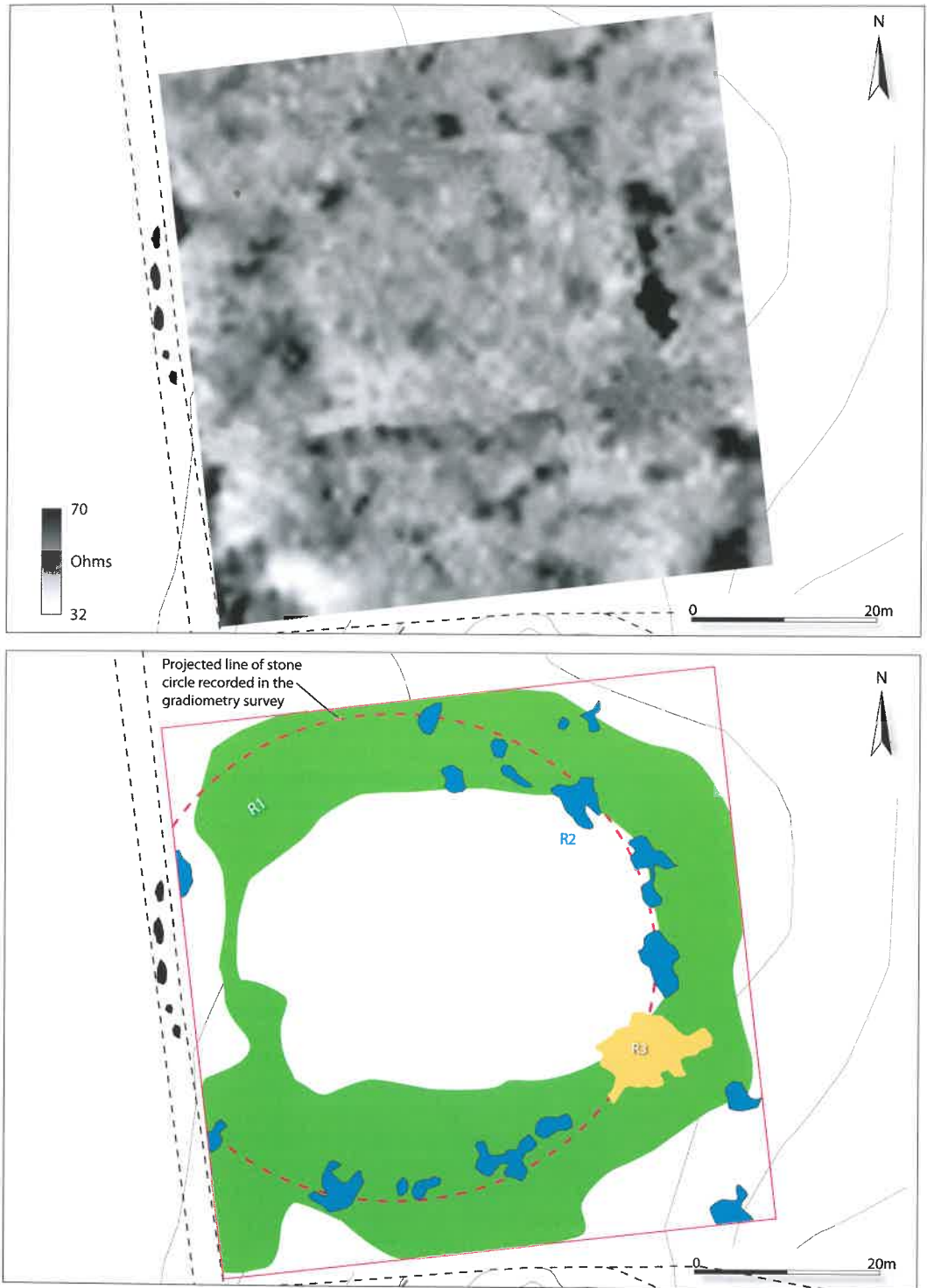


Fig. 7 Area 2 - Electrical resistance survey and interpretative plan.

and **G18b**). This gap may alternatively be interpreted as a wide space between orthostats. The electrical resistance survey did not reveal a corresponding break in the possible external embankment, although the process of levelling the embankment may have masked an entrance.

A circular band of positive magnetism (**G19**) was apparent immediately west of the possible entrance (**G18c**). This measured *c.* 12m in diameter and may represent a structural feature. It was partially truncated by **G18a** and **G18b** and may pre-date Circle D.

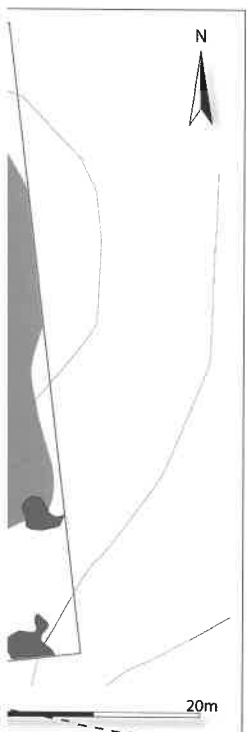
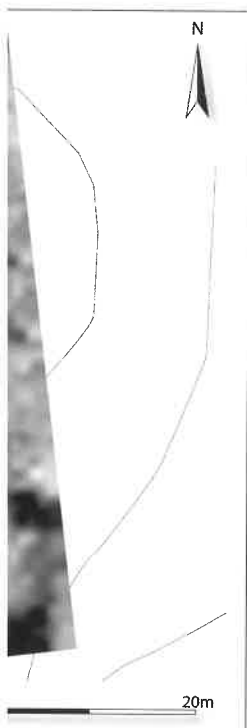
A number of possible structural features were visible within the interior of Circle D. The most dominant features were an off-centre circular setting of large pit-like anomalies (**G20**) which possibly represented post-holes that were connected by a series of smaller stake-holes. These may represent a timber structure with a diameter of 20m that was destroyed by fire. A dipolar anomaly which is a typical response to ferrous metal was recorded in the centre of **G20**. Dipolar anomalies often represent surface or near-surface material derived from modern farming, although in this instance, the central position of the anomaly suggests some antiquity. The possible structure (**G20**) surrounded a *c.* 9m diameter smaller circular setting of large pits or possible post-holes (**G21**) which may also represent a structural feature. **G21** was positioned in the south-east quadrant of the interior of **G20**. A *c.* 2.8m wide break was recorded on the west of **G21** and may be an entrance. Anomalies (**G22**) on the western interior of Circle D were a circular setting of pit-like features, possibly post-holes, measuring 7m in diameter with a central pit feature. **G22** may represent the burnt remains of a timber structure. Without excavation it is not possible to establish a chronological framework for anomalies **G20**, **G21** and **G22** although it can be suggested that these represent structures which were contemporary with or pre-date Circle D. The large number of pit-like features within and surrounding the stone circle suggests a more complex site history than a single event of stone circle construction.

The north-east section of the levelled embankment of Circle D extended to the extant Circle C. Circle C comprises fifteen orthostats with an internal diameter of approximately 17m. A slight outer bank is faintly visible today. A broad, low-rise mound visible at the centre of the circle corresponds with an area of increased magnetic gradient (**G23**) in the gradiometry results. The central anomaly (**G23**) suggests it was part of past activity centred on Circle C.

Geophysical Survey at Grange: Discussion

The identification of a second embanked stone circle (D) less than 10m to the north of Circle B is an important addition to the impressive ritual landscape surrounding Circle B at Grange. A possible structure was recorded at the centre of the large oval enclosure (LI032-002) *c.* 170m west of Circle D (Fig. 2B). The Ordnance Survey (1924 [25" scale map]) identified this enclosure as the site of a stone circle. Although this has been interpreted as a possible henge with central archaeological features (Cleary and Hogan 2013, 96; figs 4–5), the presence of a bank may suggest it was an embanked stone circle with a possible central structure and is remarkably comparable to Circle D. Up to five possible stone circles have therefore been identified concentrated in an area of approximately 5.4ha and infer an area of exceptional ritual importance. Three of these circles (B, D and LI032-002) may have been embanked. This follows a trend in the Lough Gur area where stone circles, including Site O and Site P (Cleary and Hogan 2013), were also surrounded by earthen embankments.

The geophysical survey at Circle D confirmed a wide external bank with a possible overall maximum diameter of 78m. A break at the southern side of the stone circle may



ve plan.

have been an original entrance which faced toward Circle B. The absence of an obvious ditch suggests that the monument may have been constructed using introduced boulder clay to form the bank similar to Circle B. A circular setting of magnetic anomalies within Circle D was 20m in maximum diameter and may represent a series of large post-holes connected by smaller post/stake-holes near the centre of the site. This inner structure is reminiscent of a timber circle of Neolithic date and may infer a Grooved Ware ritual site. Other possible structures were recorded within Circle D, although in the absence of excavation, it is not possible to speculate on their contemporaneity. The central internal structure at Circle D may have been a timber circle which was subsequently replaced by the larger stone circle. Timber circles are linked to the use of Grooved Ware ceramics and this tradition has been established through the recovery of Grooved Ware pottery on the excavation at Circle B. In Scotland, excavation has confirmed that timber circles preceded stone circles at Croft Moraig, Perth and Kinross and on two sites at Marchrie Moor, Aran (Barclay 2005, 84–5). Indeed Gibson (1998, 24–25) has noted that a common link between stone and timber circles include common orientations, circularity, association within henges and a decrease in size through time.

Excavation by Ó Ríordáin and geophysical survey by the authors identified seven possible ring-ditches within Circle B; two rectangular structures were probably of modern origin. Ring-ditches are common in east Limerick and west Tipperary and 128 were recorded by medium altitude aerial survey (Doody 2008). Ring-ditches appear in the archaeological record as simple annular or penannular ditched enclosures without central mounds (Newman 1997, 157). The difference between barrows and ring-ditches is largely in the survival of a central mound and possibly an outer bank in barrows. With the exception of **G9** of this survey, none of the ring-ditches in Circle B had a slight rise in the internal ground level or an external bank.

Excavation in the Lough Gur area as part of Seán P. Ó Ríordáin's Lough Gur excavation campaigns included barrow cemeteries at Rathjordan (Ó Ríordáin 1947; 1948) and Caherconey (Mac Dermott 1954). Barrows 1 at Rathjordan had double concentric ditches similar to enclosure A and **G4** and **G7** recorded by geophysical survey within Circle B. A single ditched enclosure was recorded at Barrow 3, Rathjordan and at Caherconey, similar to enclosures B and D and **G9** recorded by geophysical survey. The excavated Rathjordan and Caherconey barrows were also larger than those recorded at Circle B and had diameters of 12m (Caherconey), 13m (Rathjordan 1 and 2) and 22.5m by 12.5m (Rathjordan 3). A double ring-ditch with a diameter of 20m identified by geophysical east of Circle B is comparable to the larger sites at Rathjordan while a smaller ring-ditch with a diameter of 13m south of Circle B was similar to those within Circle B (Cleary and Hogan 2013, 97).

Dating of ring-ditches can be problematic for sites excavated prior to radiocarbon dating. The stratigraphic evidence from Circle B indicates the enclosures A, B, D and E were below the introduced layer within the circle and that enclosure C was '6" [0.15m] from the present grass surface' and at the top of the introduced layer (Ó Ríordáin 1951, 44). The enclosure **G16** detected by geophysical survey had a similar ground plan to enclosure C and was possibly a comparable type of structure. The geophysical survey cannot plot the relative depths of recorded features and it is possible that **G16** was higher up in the stratigraphy and probably later than the ring-ditches and more likely to be relatively modern.

Available dating of barrows and ring-ditches in the Munster region shows these archaeological sites have a long currency of use spanning the Neolithic to the late Iron Age (Cleary and Hawkes 2015, 105). Dating of ring-ditches and barrows excavated

before radiocarbon dating was by associated finds including ceramic vessels. An off-centre pit at Barrow 1 Rathjordan contained Neolithic pottery dating to *c.* 3800–3500 BC (Ó Ríordáin 1947). Ó Ríordáin argued that pit was initially dug and immediately covered by the mound without an interval and therefore both the mound and the pit were contemporary (*ibid.*, 3). If the dating is correct, Barrow 1 at Rathjordan is the earliest known barrow in Ireland. Barrow 2 at Rathjordan also had a single fragment of Neolithic pottery from a central pit (Ó Ríordáin 1948). Barrow 3 at Rathjordan (Ó Ríordáin 1948) also included early Neolithic pottery and 50 sherds of Beaker pottery (20% of an assemblage) and may be dated to *c.* 2500–2300 BC. The form and decoration of the other vessels from Barrow 3 suggest Food Vessel Bowls which can be dated to 2160–1930/20 BC (Brindley 2007, 328). One sherd of undecorated Neolithic pottery was found in the mound at Caherconney (MacDermott 1954) and if the sherd is contemporary with the construction of the barrow, the barrow may also date to as early as 3800 BC. A fragmentary arrowhead which may have been part of a leaf-shaped arrowhead also suggests a Neolithic date. The difficulty with associating Neolithic pottery with barrow construction at Rathjordan and Caherconney is that some of the finds may be residual from earlier site use. Finds of Mesolithic date including possible Bann flakes and microliths were also recovered from the Rathjordan barrows and were likely residual from Mesolithic communities along the Camoge River. There are also limited published details of where the pottery finds were recovered and they may have been from the pre-mound surface, the mound or ditch.

Further afield from Lough Gur, Seán P. Ó Ríordáin excavated 21 barrow sites at Lizzard near Galbally, Co. Limerick. Most of these did not produce any finds that allowed the excavator to date the monuments. One site at Lizzard had a burial associated with fragments of a cinerary urn (Ó Ríordáin 1936). Although only fragments of the urn were recovered, the vessel is similar to an urn type known as a 'cordoned urn' and is datable to the period 1770–1550 BC (Brindley 2007). Other sites excavated on the Limerick gas pipeline in 1986 included a ring-ditch at Doonmoon near Elton where Beaker pottery from the site suggests use in the period 2500–2200 BC (Gowen 1988, 52–61). An ash charcoal sample from the fill of the Doonmoon ring-ditch returned a radiocarbon date of 2618–2033 cal.²¹ BC (3870±100BP; GrN 15395) and oak, ash and hazel charcoal from a cremation pit (F3) returned a date of 1745–793 (3000±200BP; GrN 15397). These dates are too broad to provide any meaningful dating framework. Ring-ditches at Shanaclogh, Duntryleague, Raheen and Adamstown were uncovered on the gas pipeline between Galbally and Elton and the suggested dates were Late Bronze Age based on ceramic finds (Gowen 1988). A single radiocarbon date from the ring-ditch at Shanaclogh was returned from oak charcoal at 1407–1276 cal. BC (3070±20BP; GrN 15401). Ash and alder charcoal from a hearth (F3) at a distance of 5.5m from the ring-ditch at Duntryleague returned a date of 2878–2299 cal. BC (4030±100BP; GrN 15400) and is of little use in dating the ring-ditch. Charcoal from cherry (*Prunus*) and alder from the ring-ditch fill at Raheen returned a date of 1494–1064 cal. BC (3020±90BP; GrN 15391). Alder charcoal from the ring-ditch at Adamstown was dated to 896–729 cal. BC (2655±35BP; GrN 15398). While the dating of ring-ditches on the gas pipeline has a broad spectrum, there is a tendency towards Middle/Late Bronze Age.

Ring-ditches are linked to funeral rites although the recovery of human bone from excavated sites is minimal. Strong negative anomalies were recorded in the potential ring-ditches **G4**, **G7** and **G9**. These were in areas interpreted as possible entrance features and may have derived from pit digging associated with burials at significant

²¹ OxCal 4.1.

locations in the ring-ditches. Cremated bones from Barrow 1 at Rathjordan were identified as probably burnt pig rib and toe bones (Ó Ríordáin 1947). The cremated bone from Barrow 2 at Rathjordan was identified as being from non-specific animals and unburnt bones were fragments of ox teeth (Ó Ríordáin 1948, 22). At Barrow 3, Rathjordan the pit fills included small fragments of unidentifiable burnt bone, possibly animal. There were no traces of burial within the barrow at Caherconney. Ó Ríordáin (1947; 1948) and MacDermott (1954) both argued that soil acidity may have dissolved the bone or that the mound material of the barrows lightly covered inhumed burials which had 'completely disappeared' (Ó Ríordáin 1947, 4). A cremation deposit was recorded in a pit adjacent to the ring-ditch at Doonmoon, Co. Limerick and contained unidentifiable bone (Gowen 1988, 54; Ó Donnabháin 1988, 194). The cremated remains of two adults were recovered at Shanaclogh and unidentifiable cremated bone, but possibly human was found at Adamstown, Raheen and Duntryleague (Ó Donnabháin 1988). Minute quantities of human bone were recovered from ditch fills at Mitchelstowndown, Co. Limerick (Daly and Grogan 1993). Apart from soil acidity, the most plausible explanation for the lack of burial evidence may be that the ring-ditches were part of a funeral rite rather than a final ossuary (Daly and Grogan 1993, 60).

Conclusions

The stone circles at Grange have a long and complex history. The construction date for Circle B was originally based on ceramic and other finds. What was identified as Lough Gur Class II Ware was recovered from turf lines within the bank (Ó Ríordáin 1951, 47). Radiocarbon dating from residues on this pottery has confirmed that the pottery can be dated to the early third millennium BC and rather than being Bronze Age Class II Ware the ceramic is within the Irish Grooved Ware pottery style. Decorated Grooved Ware was also found under the bank and on the old ground surface within the interior of Circle B. These finds led Ó Ríordáin (1951, 71–72) to propose comparisons with henge monuments associated with pre-Beaker cultures and Ó Ríordáin suggested that Beaker-using people may have been a contributing group in erecting the monument. The possibility is that the site of Circle B was in use as a ritual area prior to the adoption of Beaker culture. Geophysical survey has identified a circular post-built structure within Circle D and this may also indicate a timber circle which pre-dated the construction of Circle D.

The location of Beaker pottery on Ó Ríordáin's (1951, 55–58) excavation is recorded as being from the sockets of the circle orthostats and the old ground surface within the circle. Beaker pottery was not recovered from below or in the bank. A re-plot of the ceramic finds where information is available from the site archive indicates the absence of Beaker pottery from the stone sockets. There is also the strong possibility that the stratigraphy of the stone sockets was considerably disturbed during the 'restoration' in the 1870s. The Beaker element for dating the construction of Circle B is not convincing and it is possible that Beaker cultural elements represent a secondary phase of use of a pre-existing ritual site.

Other pottery from the site is recognisably Food Vessel and dates to the end of the third millennium. Excavation and geophysical survey has identified seven ring-ditches within the circle which are not closely datable. Ó Ríordáin (1951, 45) suggested these were the foundations of huts associated with the Cromwellian campaign in Lough Gur. The centre of Cromwellian activity at Lough Gur was at Bouchier's Castle (Donnelly 2009, 88) and it is unlikely that the army was dispersed across a hostile terrain. The identification of the enclosures as ring-ditches suggests a continued use of Circle B as a ritual site into the Bronze Age.

A review of the stratigraphy and an excavation (Cleary 2013) as well as antiquarian accounts suggest that Circle B was 'restored' and that the bank was heightened, stones were straightened and the probability is that more than 40 stones were added to the circuit. It is also possible that the interior was levelled-up. Circle B may originally have had a relatively low bank and morphologically may have been similar to Circle D where geophysical survey confirmed Circle D as an embanked stone circle.

The archaeological remains at Grange suggest a place of assembly over several generations. The weight of evidence indicates an area of exceptional ritual importance. The ritual may have been linked to community history and places of ceremony. The sites above all suggest places of assembly where people experienced social interaction and expressed cultural or now esoteric beliefs.

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