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THE CLAVA CAIRNS OF SCOTLAND, MIDSUMMER FULL MOON AND THE MAJOR LUNAR LIMIT

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ABSTRACT

The Clava Cairns of the Central Highlands of Scotland were recognised by Aubrey Burl (1973) as largely lunar orientated. Their defining feature is a southwest orientation, as described by Audrey Shore Henshall (1972), Stuart Piggott (1982), Clive Ruggles (1999) and Richard Bradley (2000). However Balnuaran of Clava has two passage-graves which Ewan MacKie (1975) found aligned with midwinter sunset and Bradley (2016) compared this orientation with those of Maes Howe, Durrington Walls and Stonehenge. Bradley (2000) also suggested that midsummer sunrise at Balnuaran of Clava connected the central ring-cairn with a separate monument at Mains of Clava, neither monument being directly opposite Balnuaran's passage-graves. This posed questions about the comparative roles of ring-cairns and passage-graves, light versus dark, potentially summer versus winter.

This paper considers the major lunar limit, by exploring the topography of the region's river systems which are orientated northeast-southwest. Skyscape archaeology fieldwork focused on the southern horizon and the major lunar limit at one hundred and thirty eight locations. One hundred riverside (non-cairn) locations constituted the expected baseline for data, plus thirty eight cairn sites. Each exhibited a lunar horizontal event during major lunar limit years, ranging from normal to invisible. Most Clava cairns were located at sites where interesting lunar phenomena were visible, such as skimming, disappearing and emerging, despite the bulk of the terrain being in midsummer full moon darkness (non-visibility) during major limit years. Balnuaran of Clava was significantly different, exhibiting midwinter sunset, while experiencing midsummer full moon darkness, confirming Ruggles' (1999) description of the site as exceptional.

KEYWORDS: Early Bronze Age, monuments, skyscape archaeology, midwinter sunset, light, dark, ring-cairn, passage-grave

1. INTRODUCTION

This research explored the Clava cairn region, in the central Highlands of Scotland, from the perspective of the southern horizon, in order to comprehend whether the midsummer full moon, at major lunar limit, had any potential visual impact. The Clava cairns have a well described southwest orientation as their defining architectural feature, (Henshall, 1972, 271; Piggott, 1982, 129; Ruggles, 1999, 130; Bradley, 2000, 122-126). They were constructed during the Early Bronze Age (henceforth EBA), c.2200-2000 BCE but reused, as burial monuments, during later periods (Bradley, 2000, 119-121). Richard Bradley's calibrated radio-carbon dates suggest the main construction at Balnuaran of Clava took place around 2000 BCE comparing favourably with radio-carbon dates from John Thawley's and Derek Simpson's excavations at Newton of Petty and Raigmore (Bradley 2000, 118-120; Bradley and Matthews 2000, 158; Simpson 1996, 65). Their original purpose remains unclear. Bradley's distribution figure indicates their locations, most being riverine, in relation to Orkney-Cromarty cairns and Recumbent Stone Circles - see Figure 1 (Bradley, 2000, 2).

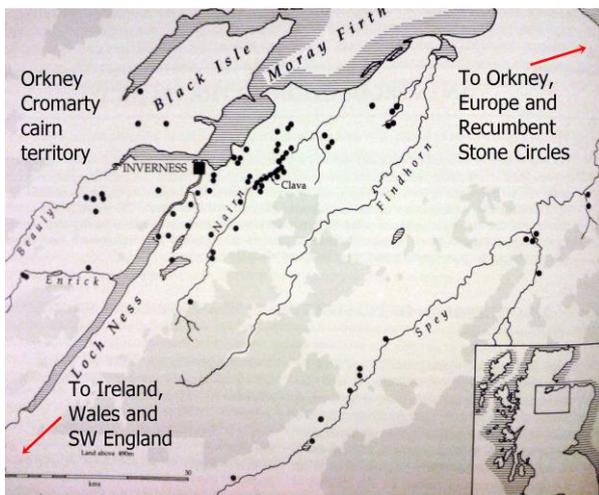


Figure 1 Clava Cairn distribution, (black dots) adapted from Richard Bradley. Scale reads 30km.

The name Clava is derived from the valley in which the best preserved were found. They consist of a cairn surrounded by a free-standing stone circle: circle-stones always taper to tallest in the southwest, as seen in John Knowles photograph, see Figure 2 (Knowles, 2015). There are two types of Clava cairn, passage-graves and ring-cairns. H. Boyle Somerville and Euan MacKie recorded both Balnuaran of Clava passage-graves as orientated on midwinter sunset, and Bradley noted the similarity to midwinter sunset at Maes Howe, Durrington walls and at Stonehenge (Somerville, 1910, f.159; Somerville 1923, 221; MacKie, 1975, 206; Bradley, 2016, 56). Douglas Scott found

two sunrise alignments for Balnuaran of Clava central ring-cairn (Scott 2016, 61). The author confirmed midwinter sunrise aligned with one of the circle orthostats connected with the ring-cairn by one of four rays (low rubble structures). Another ray aligns with equinoctial sunrise and the other two align with the minor limit moonrise and moonset. Indeed Aubrey Burl suggested that the Clava group, as a whole, favoured moonset for the minor and major extremes (Burl, 1973, 165).

Bradley noted that midsummer sunrise at Balnuaran of Clava, highlighted the central ring-cairn (no specific alignment) and the monument at neighbouring Mains of Clava, but was not directly opposite the entrances to the two passage-graves (Bradley, 2000, 125-126). Midsummer sunrise is delayed due to the altitude of the hills, so that the ring-cairn appears deliberately offset to catch sunrise, rather than align with the two midwinter sunset orientated passage-graves, despite Bradley's evidence that all three monuments were constructed contemporaneously (Bradley, 2000, 119.121). This posed questions about the separate roles of ring-cairns and passage-graves, light versus dark, potentially summer versus winter. Although Clava cairns are a culturally distinct group, there are similarities with Recumbent Stone Circles in nearby Aberdeenshire, Maes Howe in Orkney, Wedge-tombs in southwest Ireland, and Stonehenge in Wessex.



Figure 2 Balnuaran of Clava North East passage-grave, the tallest circle-stone is far left, SW and smallest top right, NE. Photograph John Knowles (2016).

2. METHODOLOGY

The region's topography was explored; seven river-systems were selected, all but one having north-east-southwest orientations, the Beauly, Enrick, Findhorn, Muckleburn, Ness, Nairn and Spey. Sky-scape archaeology fieldwork focused on measuring the southern horizon at each location for potential lunar rising and setting at these latitudes from Azimuths 150 to 210°, to verify visual phenomena during the major lunar limit (henceforth MLL) years at 138 locations, including 38 cairn sites, 25 being Clava-type cairns: see figures three and four. The lines in Figure 3 indicate the azimuth and altitudinal

measurements taken. Measurement 1 is the right side of the largest kerb-stone to the left side of the largest circle-stone, the left side of the largest kerb-stone to the right side of the largest circle-stone and repeated in reverse. Measurement 2 is taking the measured centre of the space where the corresponding kerb-stone is missing to the two sides of the circle stone and in reverse. Measurement 3 is along the passage (where they existed) from innermost right-sided passage-stone to the outermost left-sided passage-stone at the entrance, plus the innermost left-sided passage-stone to outer-most right-sided entrance stone and in reverse; Figure 3 is adapted from Bradley's diagram of Balnuaran of Clava North East (Bradley, 2000, 34). Measuring tools were a Suunto KB-14 compass: providing $0^{\circ}.5$ precision, plus minimum uncertainty of 1° and an Eyeskey sighting clinometer $0^{\circ}.5$ precision and uncertainty of $0^{\circ}.75$. These tools were selected, over a theodolite, because most cairns have no straight lines. The heights of all hills to the south were measured from azimuths 150 to 210° as this is the normal MLL moonrise and setting range for these latitudes, during the EBA cairn-building period. Wider azimuths were taken where the horizon behind southwest cairn-stones and/or passages merited clarification (Figure 5). The resulting data was subject to statistical analysis with Chi-squared tests.

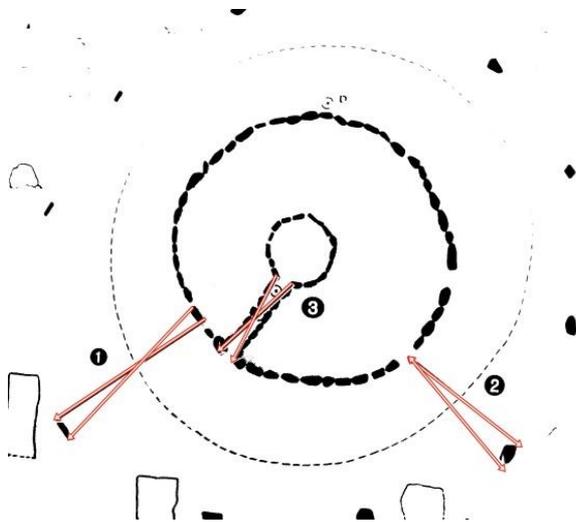


Figure 3 Bradley's diagram of Balnuaran of Clava North East adapted to indicate measuring windows of visibility at cairns. 1 kerb-orthostat to circle-orthostat, 2 where the kerbstone is missing and 3 along the passage.



Figure 3 Measuring hills, due south and along the horizon from azimuths $150-210^{\circ}$. Balnuaran of Clava SW Photograph Anna Estaroth 28 March 2015.

3. RESEARCH RESULTS

One hundred riverside (non-cairn) locations constituted the expected baseline for data, providing a suitable comparison with separate measurements taken for the twenty-five Clava cairn-sites. All exhibited a lunar horizontal event during MLL years, ranging from normal to non-visible, which is when the Moon is too low to be seen and the land is in darkness. Cairns were found to cluster at sites where interesting lunar phenomena were visible, such as skimming, disappearing and emerging. Despite the bulk of the terrain being in midsummer full Moon darkness (non-visibility) during MLL years, most cairns were in lunar-light (visible) locations in the west of the territory.

Seven different types of lunar events were found. For examples of the seven types see Figures 5.1 to 5.7, where all horizontal figures are true azimuths (177° is true south; magnetic south measurements were taken at 180° and later converted to true, allowing for alterations over time). Vertical figures are hill altitudes in clinometer degrees, hills are brown. The MLL lunar height is most frequently less than 3° during the EBA period. The dark figures are mega-lithic stones: uprights are circle orthostats; circular stones define the passage entrance. Moons are blue circles.

The seven categories are: A. Dark Moon or Non-visible Moon, B. Disappearing Moon, C. Emergent Moon, D. Emergent and Disappearing Moon (E&D), E. Partial Moon, F. Skimming Moon, G. Normal Moon. No Clava cairn exhibited a normal lunar event only types A to F. Moon sizes in F and G appear larger because the scale is smaller.

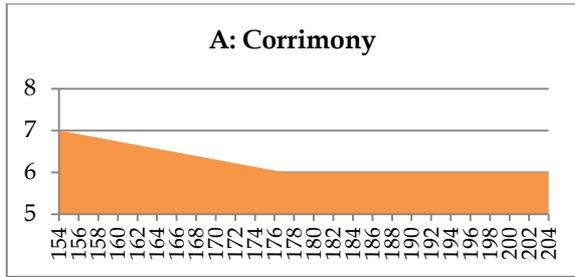


Figure 5.1. Corrimony passage-grave - Dark Moon or Non-visible Moon: hills prevent the Moon rising above the horizon. The site is in darkness.

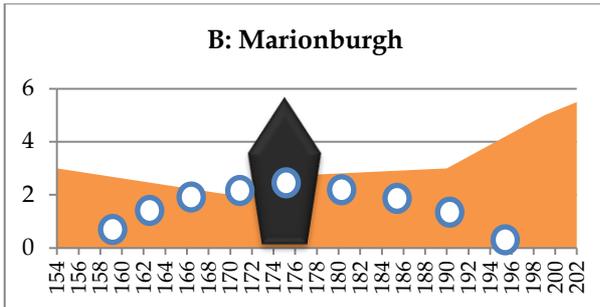


Figure 5.2. Marionburgh ring-cairn - disappearing Moon: the Moon rises then vanishes into a taller southwest hill before setting. The left rim of the Moon is the last seen, as though entering the earth.

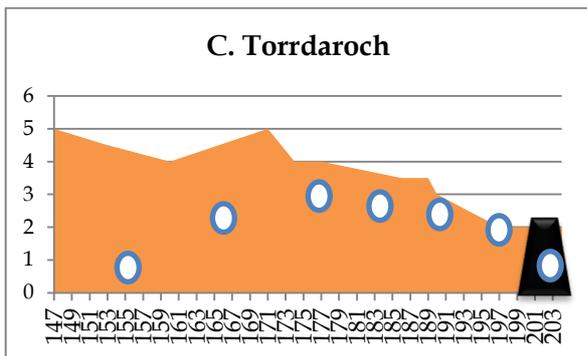


Figure 5.3. Tordarroch ring-cairn - emergent Moon: the Moon emerges from a hillside; the right rim is first visible, as though coming out of the earth.

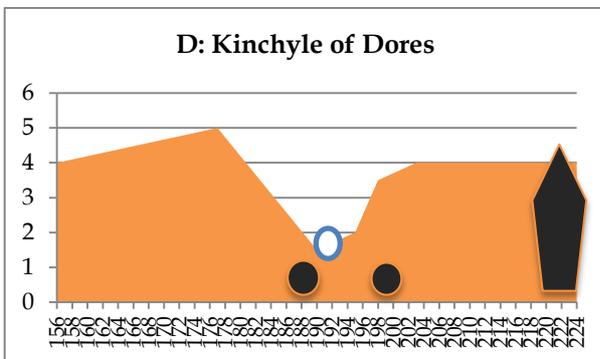


Figure 5.4. Kinchyle of Dores passage-grave - Emergent and Disappearing Moon E&D: the Moon emerges from one hillside before vanishing behind another, in this instance appearing to merge into the earth opposite the passage. Note no moonlight passes along the passage.

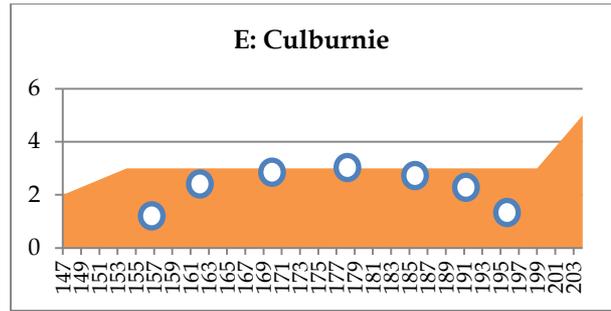


Figure 5.5. Culburnie ring-cairn - partial Moon: half, or upper rim, of the Moon is seen on the horizon, due south. On certain years adjacent to MLL these sites can become skimming Moon sites.

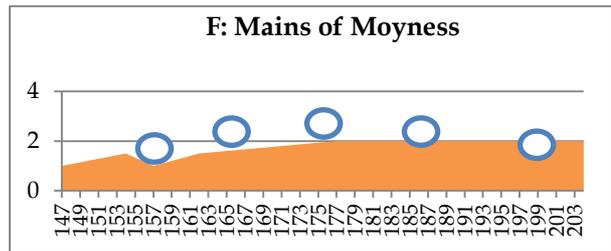


Figure 5.6. Mains of Moyness ring-cairn - skimming Moon: the Moon appears to sit or skim along the horizon. Partials can become skimming sites, but skim sites cannot become partial. This is similar to Calanais stone circle.

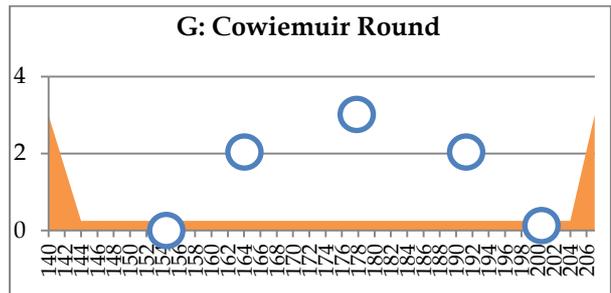


Figure 5.7. Cowiemuir Round Cairn - normal: the Moon rises and sets with the upper limb visible first and last, which largely occurs at coastal sites. Cowiemuir is a non-Clava, late Bronze Age cairn.

By amalgamating light-moon sites (all categories except dark) and comparing these to dark-moon (non-visible) sites for non-cairn and cairn locations, Chi Squared test graphpad.com gave 'chi square = 5.991 with 1 degree of freedom and two-tailed P value 0.0144' which is statistically significant. Thirteen non-Clava cairn sites were also surveyed and the differences between all cairn sites and Clava cairn sites were negligible ('Chi square = 0.045 with 1 degree of freedom, P value 0.8328'). The non-cairn expected data are statistically unlike cairn sites, suggesting that cairn builders selected sites favouring an observation of the southern horizon and the MLL Moon, or at least exhibited an awareness of these lunar events.

However the Findhorn River was found to have steep banks and completely lacked Clava cairns; indicating that river-access and role of the river was

significant. The following two tables visually compare the lunar phenomena at Clava cairn sites (25) with non-cairn sites (100) - see Figures 6.1 and 6.2.

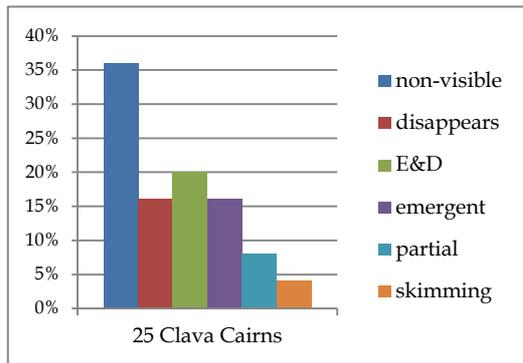


Figure 6.1 Clava Cairn sites (25)

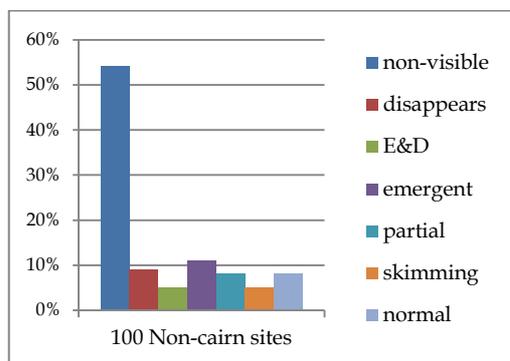


Figure 6.2 Non-cairn sites (100)

4. DISCUSSION

Potentially these lunar phenomena constituted the kinds of experiences ancient travellers encountered and it is suggested that cairns were deliberately located to take advantage of these dramatic visual effects. Clava territory lies between latitudes 57° to 58° N and Alvar Ellegård explained that the MLL Moon does not set north of 62°N (Ellegård, 1981, 105). Vincent Malmström suggested that losing sight of the Moon at MLL created greater anxieties for megalithic people than lunar circumpolar action (Malmström, 2010, 7). This may explain why few megaliths appear north of 62°N and yet so many exist within this region.

Balnuran of Clava was significantly different in experiencing midsummer full Moon invisibility. Bradley commented that the unusual building technique, specific use of raw materials to demarcate the northeast-southwest axis and potential focus on multiples of twelve orthostats helped to give a unitary sense to the Balnuran group (Bradley, 2000, 121; Bradley, 2012, 105). The size and quantity of Balnuran's cairns, coloured stonework, the ring-cairn's rays, midwinter alignments and the unusual MLL Moon darkness all confirm Ruggles' description of the site as exceptional (Ruggles, 1999, 246). It is

therefore inappropriate to generalise from the Balnuran group and perhaps from the Clava valley. Clava valley cairns constitute the majority (all except two) of cairns with MLL invisible Moons. Balnuran of Clava consists of five separate monuments (of which three are EBA Clava cairns). The Clava valley contains several other cairns; including four further Clava cairns, plus Late Bronze Age additional cairns, although only Clava cairns were included in the research. The entire valley is in MLL midsummer Full Moon darkness - these seven cairns account for nearly a third of the surveyed Clava cairns. In contrast sixteen of the remaining twenty-five cairns are located where there was an opportunity to observe distinctive lunar events at MLL midsummer full Moon. Such locations are remarkably hard to find in a landscape with predominantly high southerly hills. The following table illustrates data for midsummer full Moon visibility (light) to non-visibility (dark) across the region, see Figure 7.

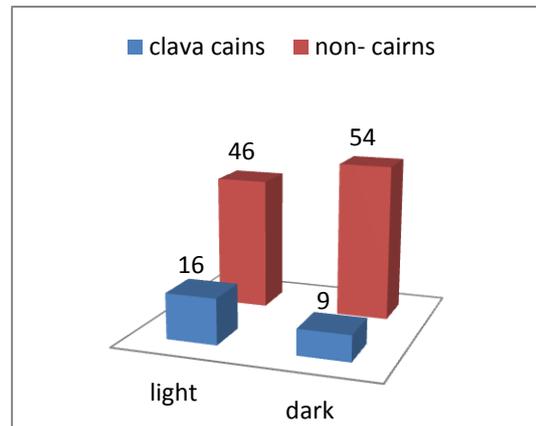


Figure 7 Comparing sites with high southerly hills (dark) with sites where the Moon can be seen for non-cairn sites (red 100) and Clava cairns (blue 25).

Within the Clava region cairns divided into those orientation upon midsummer sunrise and MLL (suitable for summer festivals) compared to midwinter sunset and minor lunar limit (suitable for winter festivals). However contrasting styles (passage-grave vs ring cairn) did not yield a dichotomy of purpose, as both styles appeared to provide the same seasonal facilities to the community. Every part of the region is within reasonable walking or boating distance of a summer or winter cairn, except along the territory of the river Findhorn, which lacks Clava cairns; probably due to its inaccessibly steep river-banks. This finding suggests that river-access was integral to cairn design; in much the same way as Michael Parker-Pearson et al suggested the River Avon linked Stonehenge and Durrington walls as a processional route (Parker-Pearson et al, 2004, 51). Cairns were also found to cluster at significant transport locations along rivers, suggesting old pilgrimage path-

ways and trading routes. Cairns and their villages later developed into the region's towns. In a mountainous region there are limited options for alternative routes. The development of villages at cairn cluster locations was potentially both practical (the need to cross fords and tributaries) and spiritual (a place to view the Moon meeting the earth).

5. CONCLUSIONS

This research considered the southern horizon of the whole river-landscape of the Clava region, because only by so doing can it be argued that cairn-placement was deliberate, much as Lionel Sims considered the landscape around Silbury Hill (Sims, 2009, 389). Lunar skimming was expected, such as Gerald Hawkins found at Calanais, and was named by James Cornell (Hawkins, 1965, 130; Cornell, 1981, 78). However seven varieties of lunar horizon phenomena were encountered along-route, hinting at pilgrimage staging posts and potentially different

rituals, depending on how the Moon was perceived. It enabled comparison between visible with non-visible Moons, for both cairn and non-cairn locations. While hills and hill-shadow would be expected to dominate in a mountainous landscape, Clava cairn builders located the majority of their cairns in the minority of visible-moon sites to the west of their territory. Exploring the role of MLL midsummer full Moon light and dark sites (visible vs non-visible) along Central Highland Rivers and riverside Clava cairns, posed further questions about how prehistoric peoples may have responded to low horizontal Sun and Moon at these latitudes in winter and summer. There are wider implications. Mountains everywhere block out the Sun or Moon, during some part of their horizontal journeys, potentially demarcating spaces in the landscape that were, and still are, considered sacred.

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