Facing the cairn at Newgrange, Co. Meath

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This paper reviews the archaeological evidence for the presence of a quartz- and granite-faced dry-walled revetment built on top of the kerbstones that encircle the passage tomb at Newgrange, Co. Meath. Over time, doubts have been cast on the interpretation of the facing as put forward by the excavator, Professor M.J. O'Kelly (1915–82). It has been variously claimed that it is not typical of Neolithic construction, that such a sheer elevation would not have been able to stand or that it looks too contemporary. We review the evidence for the cairn facing, making use of the substantial excavation archive, the contents of which we list for future researchers. Among other materials, the archive includes copies of correspondence between O'Kelly and officials of the Office of Public Works that provides, inter alia*, a better understanding of the decision-making processes with regard to the restoration of the monument, and in particular of the quartz revetment[1]. The correspondence shows that O'Kelly insisted on the need to return the considerable quantity of fallen stones to the cairn from which they had slipped, behind a revetted exterior. The correspondence also indicates, however, that the decisions regarding the design and construction of the retaining revetment wall were made by the Office of Public Works architects and their advisers. We find that the cairn facing as interpreted by O'Kelly in the main withstands interrogation, and we provide evidence of similar cairn revetments recorded through fieldwork and excavation in Ireland and elsewhere in western Europe since the publication of the 1982 Newgrange report.*

INTRODUCTION

This paper presents an assessment of the interpretation and restoration of the quartz-faced revetment at Newgrange, Co. Meath, excavated by M.J. O'Kelly. Newgrange is the best known of the *c.* 1,700 megalithic tombs surviving in Ireland and belongs to the group of passage tombs, which are *c.* 5,000 years old. Since its 'discovery' in 1699 by landowner Charles Campbell, it has been *the* archaeological site *par excellence* to visit, a veritable icon of prehistoric Ireland. By the mid-twentieth century increasing numbers of people shuffling through the long, narrow passageway had resulted in wear-damage to the stones. Electric light was introduced in the early 1950s (Hartnett 1954), thus eliminating another issue, the damage from dripping candle wax. Further improvements began in 1961 when Bord Fáilte Éireann (the Irish Tourist Board) purchased six acres of land surrounding the monument and presented it to the state (Fig. 1). At the same time, M.J. O'Kelly was commissioned via the National Monuments Advisory Council to carry out excavations, the main objective being to enable the National Monuments Service of the Office of Public Works to improve the appearance of the site and make it accessible for tourist purposes. (See Appendix 2 for details of O'Kelly's brief.) The excavations ran from 1962 to 1975; the report was published in 1982, with O'Kelly's death occurring in October of that year. One of us (EST) was a student of O'Kelly's at University College Cork and worked on the site for several summers and on some of the post-excavation projects.

In recent years criticisms of the white quartz/granite-covered cairn exterior (Fig. 2), constructed by the Office of Public Works, have come from professional archaeologists and across popular media. In brief, it has been suggested that a substantial revetment of this kind was not typically Neolithic, could not have stood and looks too contemporary. We discuss the arguments for and against the revetment, and present a range of comparable Neolithic revetments from monuments in both Ireland and western Europe.

ARGUMENTS FOR AND AGAINST THE PRESENCE OF AN ORIGINAL REVETMENT

Detailed evidence and arguments for the quartz revetment can be found in O'Kelly's publications,

[1] Note: the roof-box/winter solstice orientation and other aspects of the restoration work at Newgrange fall outside the scope of this paper.



Fig. 1—Newgrange before excavation and reconstruction, 1962 (O'Kelly 1982, pl. 17; © National Monuments Service, courtesy of O'Kelly).



Fig. 2—Aerial image highlighting the reconstructed quartz-covered cairn exterior at Newgrange (Ken Williams).

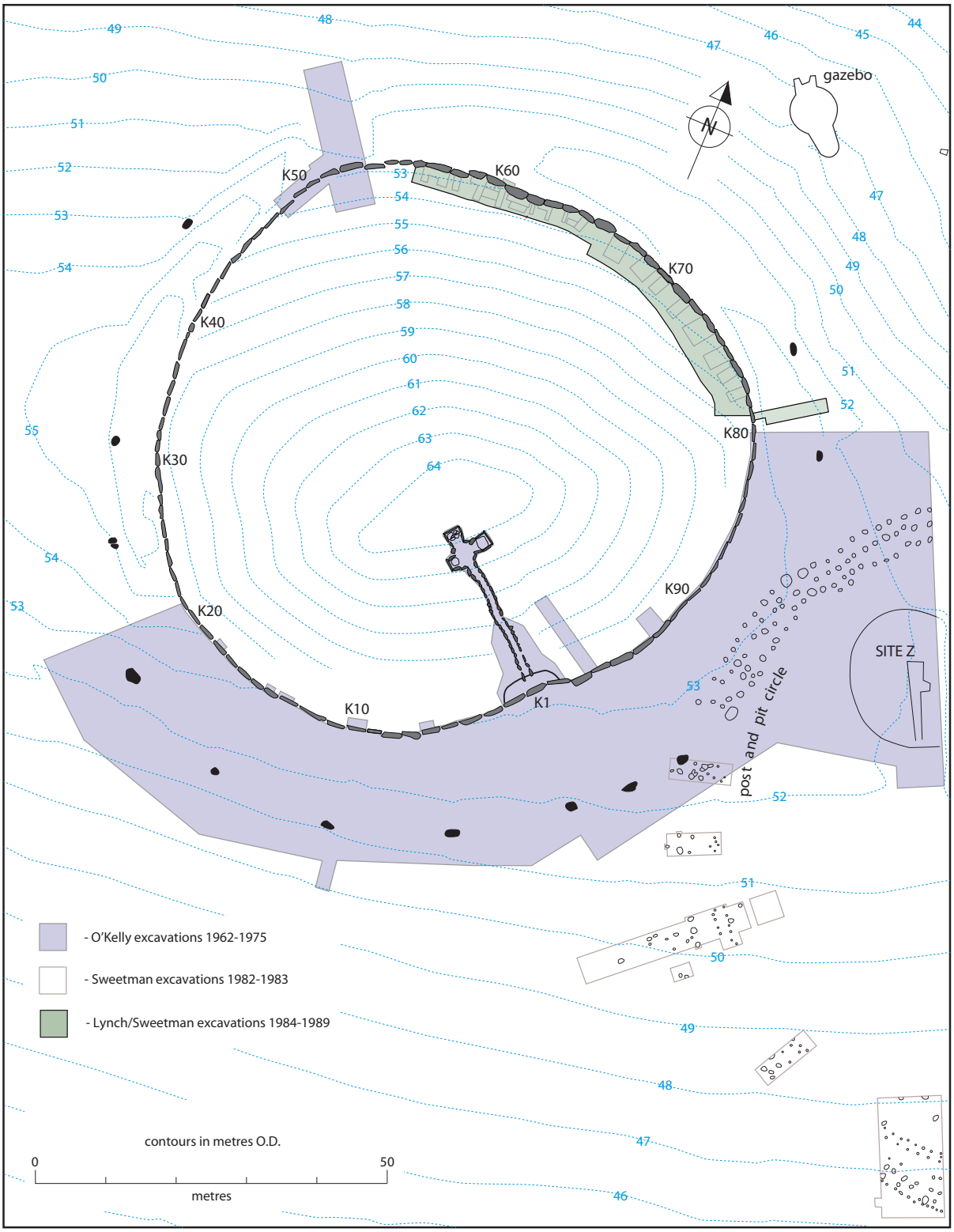


Fig. 3—Plan of Newgrange, with kerbstone numbers and areas excavated by O'Kelly, Sweetman and Lynch highlighted (after O'Kelly 1982, figs 3 and 5, and Lynch 2014, fig. 2).

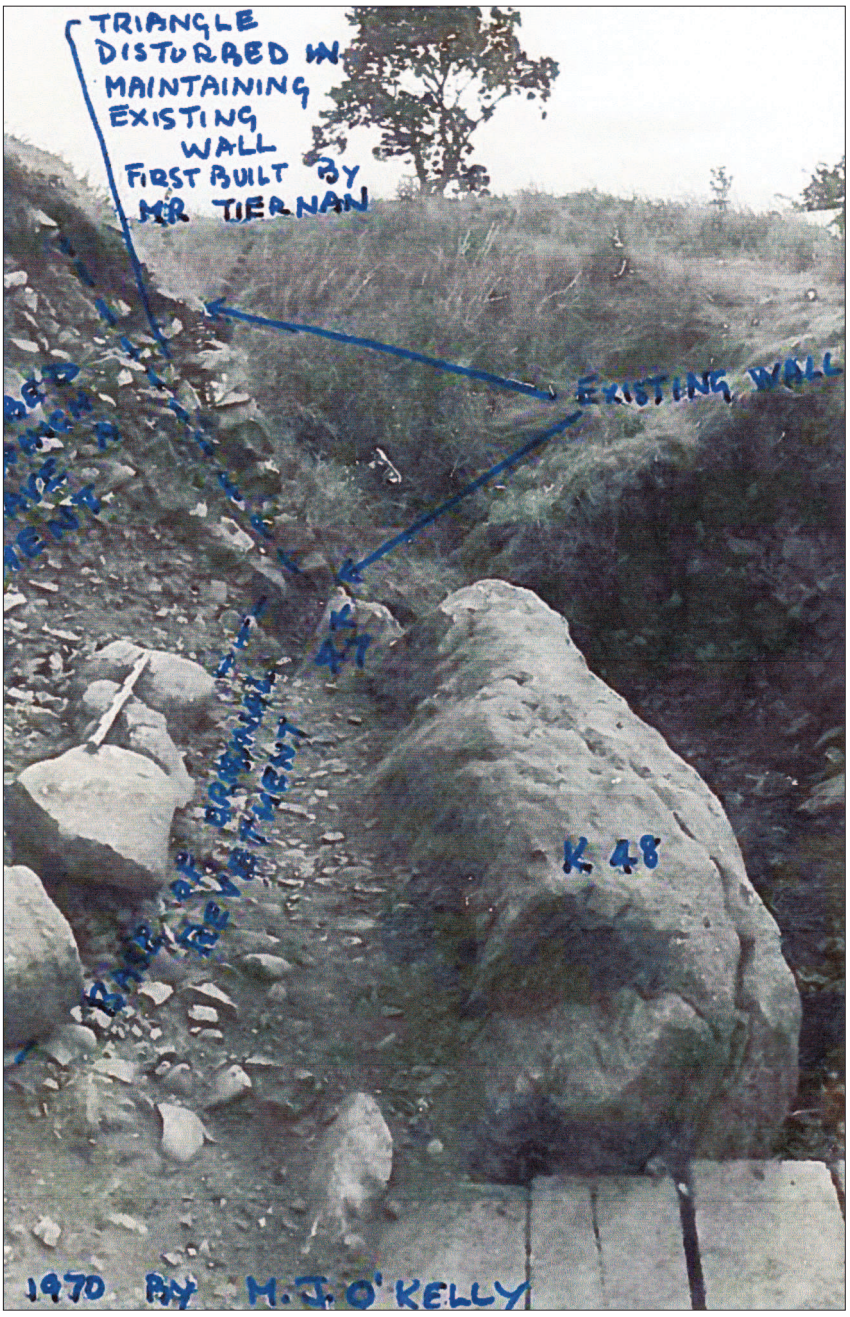


Fig. 4—Photograph of the north cutting from the archives, annotated by O'Kelly, to accompany a letter to J. McCarthy, Director, National Parks and Monuments, 16/03/1971 (© National Monuments Service). (The cropped text on the left-hand side of the illustration occurs in the existing copy of the photograph in the excavation archive.)

especially in the 1982 Newgrange excavation report. In brief, O'Kelly's arguments that the cairn had originally been revetted above the kerbstones were as follows:

- The profile of the slip, comprising quartz and oval granite cobbles, outside the kerbstones indicated that the stones had fallen quickly and cleanly from a steep-sided cairn. The quartz/granite slip was *c.* 0.5m thick nearest the kerbstones.
- When collapsed kerbstones were lifted, quartz/granite was not found beneath them (e.g. K96; O'Kelly 1982, fig. 6C). The kerbstones must therefore have fallen before the quartz/granite slipped off the mound.
- Some of the kerbstones were propped so as to achieve an even top line around the perimeter, better facilitating the construction of the revetted feature above (C. O'Kelly 1978, 104; O'Kelly 1982, 121). Excavations at the back of the cairn in the 1980s also found that kerbstone tops were placed in horizontal alignment (Lynch 2014, 65) (see Fig. 3 for a plan of the excavation area).
- O'Kelly recorded what he interpreted as a surviving basal course of the original revetment on top of kerbstones K48–K49–K50 at the rear of the cairn (Fig. 4; O'Kelly 1982, fig. 16). This was the

only location where such evidence was found at Newgrange, either by O'Kelly or by Lynch (2014, 38) during further excavations in the 1980s.

- O'Kelly noted that the layers of turves within the cairn would have stabilised it while it was being constructed, and in fact the uppermost turf layer in the mound shown in section would originally have 'run as far as a point almost vertically over the kerb where it would have been held by a revetment wall on top of the kerb' (O'Kelly 1982, 87, fig. 12).

It is important to clarify the terms used to describe the original cairn edge at Newgrange. O'Kelly referred to it as a 'revetment' or 'revetment wall' (e.g. O'Kelly 1979; 1982, 110–11). It is sometimes called a wall, but the terms 'facing' or 'revetment' are preferable because 'wall' refers to a free-standing feature with two faces, usually with a central rubble fill between them. Although O'Kelly's sectional drawing (1982, fig. 12) shows the suggested original edge of the cairn as a double-faced wall, labelled 'quartz wall', that is not how he generally described it. In a lecture (20/04/1985, pp 1–2 of archived typescript), his wife and excavation collaborator Claire O'Kelly stated unequivocally: '… it's not a wall, by the way. To me a wall means a free-standing structure and there is no such thing at Newgrange.' Confusion, terminological and otherwise, can also occur because a modern concrete wall was the primary mechanism used to achieve the Neolithic revetted appearance as determined by O'Kelly. In the restoration, a true free-standing concrete wall was built behind the kerbstones and then faced with quartz and granite.

The term 'drum-like' to describe the cairn, although used by O'Kelly (1982, 73), is not strictly accurate either: the facing was not vertical, as it would be on a drum. Equally, 'dry-walling', while regularly used to refer to such facings and revetments, is not always accurate, as these features may contain binding agents, as mentioned below (pp 65–6).

The interpretation of the edge of the cairn as being revetted seems to have been first published in 1968. O'Kelly (1968, 41) reported that 'Engineering research based on our detailed contour plan of the mound and on a series of typical section profiles … has revealed that the quartz was not spread on the surface of the mound, but was used as a building material for a revetment wall standing about 2.5m high on top of the kerb, the wall lying back about 30cm in this height' (Fig. 5). The recalculation to a height of 3m (thus 84° from the horizontal) may have resulted from investigations during Easter 1967 and again in November 1968, when O'Kelly's colleague John Fogarty, of the Civil Engineering Department at UCC, visited the site (letter from O'Kelly to Fogarty dated 18/12/1968). Fogarty had worked as an adviser on



Fig. 5—Detail of the restored quartz/granite revetment (Elizabeth Shee Twohig).

building dams in Africa and his '… particular field of study involved the behaviour and movement of mounded loose materials' (O'Kelly 1982, 110). O'Kelly gave the height as 3m at a conference in Aarhus in 1969; a typescript of his lecture was sent to J. McCarthy, Stiúrthóir/Director of National Parks and Monuments (16/03/1971), and the paper was published two years later (1973).

O'Kelly and Fogarty (O'Kelly 1979, 207–8; 1982, 73) undertook an experiment whereby they used excavated quartz and granite boulders from a 2m-wide cutting to build a 2m-high reproduction facing above the kerbstones in order to test the stratigraphic results of the fall of material from above. O'Kelly (1982, 73) states that the resulting stratigraphy, especially in the lower layers, was 'well-nigh identical' to that found in the excavations. There were several reasons why a higher quartz structure could not be constructed in this experiment. Some of the quartz was too shattered for use, and some of it had been dug out when the trench was cut out around the mound to reveal the kerbstones in the nineteenth century. Additionally, although this did not become clear to O'Kelly until two seasons later, the area of the perimeter at which the experiment took place, in front of kerbstones 81/82, happened to be where the quantity of quartz began to decrease towards the back of the mound.

The published and unpublished sections show the quartz/granite cairn slip as extending out 7.5m from K95 to as little as 3.5–4m in front of K92 and K93. It measured *c.* 5m in front of K1. In the 1980s excavations the only cutting made into the cairn slip was Trench A, in front of K79. The basal layer in the cairn slip contained 'up to 50% quartz'. Lynch (2014, 39–40, 66–70) has suggested that this layer was not on the ground in that area before the Chalcolithic, on the basis of a date of 2564–2298 cal. BC (UBA-25186; 3933±37 BP) obtained from a cattle tooth found on the subsoil under the cairn slip (Lynch 2014, table 6). Carlin (2017, 15–16) has interpreted the artefacts and date from this context differently than Lynch, however: he argues that the earlier part of the date range provides a more accurate date for the layer with quartz than the later interpretation favoured by Lynch (2014, 66). A cattle bone fragment from the cairn slip itself, in the same area, was dated to 3079–2891 cal. BC (UBA-23058; 4334±35 BP) (Lynch 2014, table 6). Notwithstanding the evidence in that location, the presence of Grooved Ware in the earth/stone layer above the quartz layer at the tomb entrance (O'Kelly 1982, 71; Cleary 1983, 60–2, 84–100, 115) lends weight to the likelihood that the quartz in the entrance area of the cairn had fallen by the mid-third millennium BC.

In short, O'Kelly envisaged the collapsed material as being formed firstly by a rapid slip of quartz/granite, followed by a slow roll-down of the uppermost layer of turves and humus from the upper part of the cairn. Next followed a '… sudden great slide of stones', perhaps owing to severe weather, e.g. freeze–thaw action, or even an earth tremor. Vegetation regrew, and then a final slide of stones established the angle of repose of the cairn (O'Kelly 1982, 72–3).

Lynch's (2014, 66) excavation at the eastern side of the cairn confirmed O'Kelly's (1982, 71) statement that quartz was concentrated along the 'front' of the cairn and petered out around the 'sides'. She found abundant quartz in Trench A outside K79, but cleaning of the 1870s trench showed that the quartz then tailed off and disappeared by K71 (Lynch 2014, 40). This corroborates the observations made by Ó Ríordáin and Ó hEochaidhe (1956) in the report on their 1954 excavation at Newgrange. In the cutting extending out from K76, at a distance of 7m from the kerbstone, they found two basal layers of large round stones and commented that these were suitable for cairn facing, whereas those of the top layer were small and more angular and would likely have come from the body of the cairn. O'Kelly (1982, 41) noted this and compared it with similar results from his own excavations on the north side of the tumulus in 1965, where 'rounded stones were found at the bottom of the stratification and were clearly a substitute for the quartz stones used as facing at the front of the tumulus'.

The arguments that have been published against O'Kelly's interpretation of the cairn revetment include those of Danish archaeologist Palle Eriksen, who questioned the revetment in three papers (2004; 2006; 2008), most extensively in 2008. The existence of layers of turves within the body of the cairn at the front—which Eriksen speculated were vegetation growths on the surfaces of a succession of mounds ranging in date from the middle Neolithic to the early Bronze Age—led him to conclude that the monument we see today is actually a multi-period structure that was eventually sealed in the Bronze Age. Similar lines of turves were not found by Lynch (2014, 65) in the area of the 1980s excavations, however; if there had been growths, presumably the entire mound would have exhibited some evidence of them. Moreover, the intra-cairn turves that O'Kelly found appear to have been similar in form to those in the turf mound at the back of the cairn and those redeposited under the cairn, i.e. cut strips of turf (O'Kelly 1982, 86; Lynch 2014, 23). This is important, as the similar turves in the other parts of the mound have been conclusively and repeatedly demonstrated through palaeoenvironmental analysis to have been cut from damp pasture and hence were not growths, thus undermining the foundations of Eriksen's hypothesis (Groenman-van Waateringe and Pals in O'Kelly 1982, 219, 222; Lynch 2014, 23–4). Cooney

(2006) is ambivalent on whether the quartz ever stood above the kerb, suggesting that, if it did, it may only have been for a very short time, before falling or being taken down to be used in a role as a platform around the monument (also see Simpson 1988).

Stout and Stout (2008, 1–5, fig. 3) proposed that the mound was edged by a quartz 'buttress', shown by them as rising for 2.3m above the cairn, at an angle of 36° above the horizontal. They argue that this slope represents the 'natural angle of repose' of all loose, mounded materials. However, the way that the quartz/granite ran out from the kerbstones for a distance of up to 7m argues against its falling from such a 'buttress', as it would then have simply slumped to the foot of the kerbstones (K. Williams, pers. comm.). Furthermore, one might ask whether these materials would have been transported over long distances only to be concealed inside a buttress. Quartz was brought to the Boyne area from the Wicklow Mountains, and possibly also from the little island of Rockabill off north Dublin (Mitchell 1992; Eogan and Cleary 2017, 557, 565), while the Mourne Mountain granite, and some intermixed granodiorite, was probably collected from beaches to the north around Dundalk Bay, Co. Louth. In recent years the granite and granodiorite boulders have been claimed as showing abraded ends from use in working stone during construction (Mitchell 1992, 136; Cooney 2004, 199; 2006, 703). This suggestion is open to question, however, as on excavation the outer surfaces of the granite boulders appeared soft, with an almost malleable surface that hardened on exposure to the air (EST observation and Frances Lynch, pers. comm.).

It has also been suggested that it would not have been possible to build a revetment with the irregularly shaped quartz stones and rounded granite cobbles, but this view is perhaps more a function of our modern lack of understanding of the skills of those working in stone. Stone wall-building was second nature to most Irish country people until recently. At Newgrange the mortar-bonded revetment of irregular cairn stones on top of the kerbstones, probably built in the 1870s by a tenant, Mr Tiernan, and subsequently repaired by the Board of Works, was up to 2m high (O'Kelly 1982, 38–40, pl. 23, fig. 6A) and still survives in part on the western side of the cairn (Fig. 4). O'Kelly (1982, 39) speculates: 'It is probable that the idea of the revetment wall was not entirely Tiernan's invention. He may have found traces of an original revetment as soon as he began to clear material from the tops of the kerbstones, as was found for example on the north side of the mound during excavation work in 1970.'

This goes to one of the central arguments for a revetment: how were the large quantities of material gathered around the base of the mound to be explained and then dealt with? If the material did not come down from above, where did it come from? A 'natural angle of repose' would not be able to incorporate this material, unless the mound was unsustainably tall, with a pointed/conical design, a highly unlikely scenario. As the spoil had to be returned to the mound, a design was required that could successfully accommodate this material—one that was available and regularly used in the Neolithic, and for which comparanda among Irish Neolithic monuments could be cited. The best-attested solution in the Neolithic period, we believe, was the revetted cairn exterior (see below), which allowed the edge of the cairn to rise to greater heights and thus could accommodate much greater quantities of material, allowing increasingly imposing monuments to be constructed.

To summarise the above, interpretations of the exterior appearance and design of the cairn exterior have centred around the following three principal models:

A. quartz/granite revetment up to 3m high built on top of kerbstones at an angle of *c.* 84° from the horizontal, followed by collapse in the Chalcolithic period (O'Kelly 1982);
B. low, wide quartz buttress built on top of kerbstones (Stout and Stout 2008);
C. cairn edge built with natural angle of repose (Eriksen 2006; 2008).

THE RESTORATION OF THE CAIRN EXTERIOR

The copies of letters contained in the archive give us some insights into the discussions that took place concerning the restoration of the cairn exterior. O'Kelly reports (Point 5 of 1967/1968 memorandum) that a schedule for work agreed between him and the National Monuments Branch (NMB) Inspector, W.P. Le Clerc, in February 1967 included the construction of the concrete wall behind the kerbstones, but he complains that only the first course had been laid by the end of that summer. It was partially built by the end of the year, and J. Fogarty's report of 18/12/1968 described a newly built 15ft-high (*c.* 4.6m) reinforced concrete wall running radially into the cairn and behind the kerbstones on the eastern side of the entrance.

Fogarty also stressed the need to insert 4in.-diameter (*c.* 10cm) weep-holes near the base of the wall to relieve hydrostatic pressure; the blocking up of these weep-holes is thought to have contributed to subsequent collapse of the older retaining wall on the north side of the cairn (Lynch 2014, 17). This report was sent on request to J. McCarthy, Stiúrthóir/Director

of National Parks and Monuments, on 17/04/1969 and on 8 July Fogarty was invited to act as 'Consultant for the design and supervision of work required to restore and stabilise the perimeter of the tumulus at Newgrange'. Fogarty's comprehensive, costed 'recommendations on the reconstruction of the perimeter of the mound at Newgrange' were sent to M.E. Ó Duinnsleíbe in NMB on 22/03/1971. Some details from that report are worth noting. Fogarty estimated that 'about 1020 cubic yards' of backfill material was stockpiled, partly on the mound and partly in front of it. He calculated that *c.* 1,140 cubic yards was required to fill behind the reinforced concrete walls and thus 'there is enough … to backfill the mound in the sector bounded by the r.c. [reinforced concrete] walls'. Regarding the facing, he advised that 'Initial experiments should quickly determine the best way of forming the facing. It can probably be built up one or two layers of cobbles at the time, the backing concrete being placed at the same time.'

The term 'reconstruction' used above as a heading to Fogarty's report is interesting, as in letters to O'Kelly of 8/1/1971 and 23/2/1971 McCarthy had noted serious difficulties in carrying out restoration as opposed to conservation, as the former was outside the scope of the Board's statutory powers. In the last letter of this group that has been curated (16/03/1971), O'Kelly sets out his arguments to McCarthy for the existence of a wall on top of the kerb, and states that:

> 'After the recent major works of excavation, reconstruction and conservation in the vicinity of the entrance to the tomb, Mr le Clerc, then Inspector of National Monuments, saw the necessity for a revetment wall and realised that if he built it dry as it was built originally, he would be faced with an endless problem of maintenance. His solution was to build a concrete wall first, this to be faced with quartz/granite on the SE arc of the periphery … The concrete was his decision, not mine. As I have told you I have since got engineering advice which recommends an easier and cheaper way of achieving the same result … with less disturbance of the edge of the mound.'

The latter point refers to the two alternate methods of stabilising the mound that Fogarty had reported on 18/12/68. Instead of building a concrete wall, he suggested that it would be possible to either cover each 3ft (*c.* 0.9m) layer of backfill with a thin slab of concrete, or to sprinkle a coat of thin cement grout on the backfill as it was being replaced.

O'Kelly went on to argue that the wall should be reconstructed, giving one of the most compelling reasons for the mound profile that he decided was necessary:

> '… as there is no other way of keeping the edges of the undisturbed layers of cairn material from fraying down. If there is no wall and they are allowed to fray down, this will be unforgivable from an archaeological point of view … Another question which arises and which must be answered for you by your advisers is this. What is to be done with the heaps of excavated spoil including a great mound of quartz and granite? Are they to be left as mounds where they are? Are they to be thrown back against the kerb where the material came from? Are they to be put back on the edge of the mound where excavation has shown the material originally belonged? Is the spoil to be carted away and disposed of elsewhere? I submit that the third alternative is the only acceptable one.'

But were revetments a feature of Neolithic construction? And could they have stood? As shown below, revetted, wall-like features were commonly employed at the time Newgrange was built, and were used in some of the greatest cairns constructed in antiquity, such as Gavrinis in Brittany and La Hougue Bie in Jersey, as well as at a number of Irish monuments.

REVETMENTS OUTSIDE IRELAND

The overview presented below of revetted features in Neolithic megalithic sites across Europe, including their various forms, uses and techniques of construction, may be helpful in assessing these arguments, and the authenticity or otherwise of the reconstructed cairn facing at Newgrange.

Cairn revetments were recorded at megalithic tombs in Brittany as early as 1840; in the early twentieth century Le Rouzic found many examples of both internal and external revetments in the Carnac/Locmariaquer area of southern Brittany, recording three circular enclosing elements at both Ile Longue and Le Notério between 1907 and 1909 (L'Helgouac'h 1964, 22, figs 3–4).

Revetments came to more widespread attention in the 1950s following the discovery, through quarrying, of eleven passage tombs in two conjoined multi-period cairns at Barnenez in northern Brittany and their restoration as a stepped cairn (Fig. 6) (Giot 1987; but see Cassen *et al.* 2013 for a critique of stepped cairn reconstructions). Many of the chambers there and at Ile Carn and Ile Guennoc, in the same area, were



Fig. 6—Stepped cairn at Barnenez, Finistère (Ken Williams).

built with dry-walling. More examples of dry-walled revetments are known in Normandy from the late fifth millennium BC onwards, e.g. La Hoguette at Fontenay-le-Marmion in Calvados (Caillaud and Lagnel 1972), while on Jersey at the great passage tomb of La Hougue Bie, though debated, a substantial revetment appears to have enclosed the primary cairn (Patton *et al.* 1999, 88, figs 71–72). In southern Brittany well-known multi-period sites have both internal and external dry-wall facings; the passage tombs at Gavrinis (Le Roux 1985, 46) and Le Petit Mont (Lecornec 1994, fig. 19) both have dry-walled cairn revetments surviving up to 4m high (Fig. 7). Dry-walled revetments also survived at many other Breton sites, such as Er Grah (Le Roux *et al.* 2006).

Several French researchers have recently begun to apply the methods of 'buildings archaeology' to megalithic tombs, thus establishing construction sequences and understanding the techniques used by the builders (Parron-Kontis and Laporte 2010; Cousseau 2016; Cousseau *et al.* 2017). This work arose from excavations of the complex long cairn built over small early chambers at Prissé-la-Charrière, Deux Sèvres (Scarre *et al.* 2003, fig. 7). The cairn was composed of a complex system of dry-wall facings involving cells, terraces, chambers and cairn (Fig. 8); similar features have been recognised at other sites in the same region, such as Bougon, and elsewhere in western France (Laporte 2016).

In Spain and Portugal, wall construction was also used in megalithic monuments over a long period, and pre-4000 BC examples of the use of both stone and clay walling are known. Chambers such as at El Romeral in Antequera (Fig. 9) were built later, in the centre, west and south of the peninsula (Bueno *et al.* 2016, 160), with compact clay commonly used to bond the courses and joints (Laporte 2016, 21).

In Denmark, restoration of over 70 megalithic tombs found that when stone walling was used to fill the gaps between tomb orthostats the interstices between the walling stones were filled with a binding agent or packing material such as clay, chalk or birch bark, designed to keep the interiors watertight. Dehn (2016, 61) explains the construction: 'As the dry-walling was built, its rear face was secured with a packing of crushed flint that, in turn, was held in position by the mound fill, comprised of stones, soil, or a combination of the two'. The use of a packing of soft materials between stones recalls O'Kelly's (1982, 101) discovery of caulking of sea sand and burnt soil between the roofstones along the passage at Newgrange and is a reminder that organic materials could also have been used to consolidate the revetment, as the turf layers consolidated sections of the cairn.



Fig. 7—South-west wall of Cairn I, Petit Mont, Morbihan, France (after Lecornec 1994).

In Britain, drystone walling is known from several groups of megalithic tombs. Passage tombs on the Orkney Islands have dry-walled passages, barrel-shaped long chambers, and tall chambers as at Maes Howe. In Orkney, in all cases where the cairns of Maes Howe-type passage tombs have been examined, the chambers have been enclosed within and supported by a core of cairn material delimited by a wall face, as at Newgrange. Many sites have further revetments between the core cairn face and the outermost revetment (Davidson and Henshall 1989, 40). Elsewhere in Scotland, passage tombs and chambered long cairns also have dry-walled chambers and cairn edges (Henshall and Richie 2001, 98–115). Heald and Barber (2015, 36–8), in discussing the chamber tombs of Caithness, conclude that many of the cairns there had stepped sides. This conclusion is partly based on the considerable technical knowledge and experience gleaned by Barber in constructing full-scale experimental reproductions of such cairns. Notably, Camster Round Cairn still has some of its façade surviving, and Camster Long had 'wall faces around its margin'.

Further south in Britain, careful stone construction techniques were extensively used in the tombs of Severn–Cotswold type. For example, Hazleton North in Gloucestershire had a series of revetted cellular units within the cairn and a 1.5m-high outer revetment (Saville 1990, 257, fig. 228). Similar techniques are also common in small chambers, so-



Fig. 8—Prissé-la-Charrière, Deux Sèvres, France (Chris Scarre).



Fig. 9—Tholos de El Romeral, Antequera, Andalucía, Spain (Ken Williams).

called 'rotundae', within Severn–Cotswold cairns, as first noted at Notgrove in Gloucestershire (Clifford 1936; Darvill 2004).

The use of walling is also well attested in the Neolithic houses and ceremonial structures of Orkney, e.g. Knap of Howar, Skara Brae and the more recently excavated houses of Barnhouse and the structures at the Ness of Brodgar (Richards 2005; Card *et al.* 2015). The Ness of Brodgar exhibits a great variety of wall size and type, including Structure 10 with walls over 5m thick (Card 2013). At the Ness of Brodgar, as at the Maes Howe tomb nearby, the quality of stonework is exceptionally high, with perfectly smooth surfaces achieved with Caithness limestone.

REVETMENTS AND THE USE OF QUARTZ IN REVETTED FEATURES IN IRELAND

An important instance of an *in situ* quartz revetment is recorded from the most prominent of the Loughcrew, Co. Meath, sites, Cairn T: 'Inside the retaining wall of large flag stones [i.e. the kerbstones], as far as was examined, and, apparently going all round the base of the carn [*sic*] was piled up a layer, rising from three to four feet in height, and about two feet in thickness, of broken lumps of sparkling native Irish quartz, a rock which does not geologically belong to this part of the island' (Conwell 1872, 91). Nothing of this facing can be seen now, and no records appear to survive from the OPW 1962–3 restorations, but local information reports that quartz souvenirs were carried off from around Cairn T at least up to the 1960s (C. O'Reilly, pers. comm.).

At Baltinglass, Co. Wicklow, a retaining wall was revealed during excavations in the 1930s and can still be identified on site: 'At the south-west side the inner kerb supported a definite wall-face, containing this part of the cairn: this extended for about 25 feet in length and was from four to five feet in height. This wall-facing was regularly aligned, receding as it ascended' (Walshe 1941, 223) (Fig. 10). Quartz was found around the circumference of the cairn, suggesting to the excavator that it had been 'placed on top of the stones of the cairn as a covering, and had slipped down' (*ibid.*, 229). Quartz



Fig. 10—Traces of exterior revetment at Baltinglass passage tomb, Co. Wicklow (Ken Williams).

was also found mixed with the human remains within two of the chambers.

Excavations at Knockroe passage tomb in County Kilkenny revealed significant spreads of quartz, especially on each side of the entrance to the eastern tomb. Large pieces of quartz constituted 'a major proportion' of the cairn material directly behind the tops of the kerbstones, and quartz was also found between the two parts of a split sandstone kerbstone (S8), again suggesting a fall from above. The preliminary report states: 'At Knockroe quartz occurred where O'Kelly argued that it had originally occurred in the Newgrange tumulus, that is, on the face of the cairn above the kerbstones' (O'Sullivan 1993, 13). Referring to the quartz, O'Sullivan (1993, 13) suggested 'an initial collapse followed by a series of minor slippages rather than a single major collapse as postulated by O'Kelly'.

The passage tomb cemetery at Knowth, only 1.2km to the north-west of Newgrange and excavated during the same period, was found to have discrete spreads of quartz, granodiorite and banded siltstones in front of the entrances to each of the passage tombs of the main mound (Knowth 1). Notably, the spread in front of the eastern tomb has a maximum depth of 0.4m where it abutted the kerbstones, and partly obscured some of the megalithic art (Eogan and Cleary 2017, 239–40). The exotic stones extended 4.8–5m from the entrance stones, as at Newgrange, and the layer was overlain by quarried and water-rolled stones like those of the mound. Nevertheless, the most recent analysis has concluded that Knowth 1 may have had a revetment above the kerbstones at the entrance areas which was '... embellished with "exotic" stones, certainly quartz but also perhaps granite and banded stones, similar to that proposed for the large mound at Newgrange' (*ibid*., 766–7).

Antiquarian accounts of revetments at passage tombs include Carnavanaghan, Co. Armagh, where a letter of 1799 to the Royal Irish Academy reported a '... wall situated east and west on either side of the doorcase …', running for a distance of 10ft (*c.* 3m) into the cairn (Herity 1974, 225). Presumably the letter-writer is referring here to the inner walls of the passage. Wilde (1846) reported the discovery of a 'mound' with a small chamber at Kintagh (*recte* Keentagh), Co. Down. Its kerbstones alternated with dry-walling which was '… coated with white pebbles, averaging the size of a goose-egg, of which there were several cart loads'. Kerbstones are a particularly Irish feature yet do not occur at all Irish sites. In some instances sites may have had ground-level edge revetments, as, for instance, at Tara, Co. Meath, where a low revetment of angular stones survived around the passage tomb known as *Duma na nGiall* (O'Sullivan 2005, figs 127–30).



Fig. 11—Revetted cairn at Mullyash, Co. Monaghan (Ken Williams).

Inner revetments are known from within several excavated and unexcavated cairns; for instance, cairn revetments have been noted at a number of passage tombs in County Sligo. At Cairn B, Carrowkeel, excavations revealed a drystone internal revetment 0.8m high, *c.* 3m in from the kerb and running for about half its perimeter on the south and west (Macalister *et al.* 1912, pl. XVII). Similar features can be observed at Cairns G and H at Carrowkeel (Hensey and Robin 2012, 28). Further north in the same county, evidence of revetments is found at Carns Hill West and Slieve Daeane. At Carns Hill West evidence of an internal and external revetment can be found, the latter running for about 5m along the north side of the cairn (Bergh 1995, 233). Stones of differing geology from that of the rest of the cairn are used in the revetment, as at Newgrange; igneous gneiss boulders were specially selected in contrast to the locally available limestone from which the rest of the cairn is composed (Bergh 1995, 84). At Slieve Daeane there are also traces of both an inner and an outer revetment (*ibid.*, 223). Bergh makes the salient point that revetments within the cairn/intra-cairn walls would have allowed the builders to control the shape of the cairn and the angle of its slope, i.e. to deliberately counteract the 'angle of repose'. As Bergh (1995, 85) notes, 'The gently sloping cairns of today are mainly a result of extensive cairn slips'.

Revetments are also known from many hilltop cairns that are not necessarily passage tombs: for instance, at Mullyash, Co. Monaghan, the cairn has a 2m-high revetment on the north-east, with traces also of an inner, concentric wall (Desmond 2000) (Fig. 11). The cairn on the eastern summit of Turlough Hill, Co. Clare, has a sheer and well-defined 4m-high exterior and forms part of a cluster of prehistoric sites of probable Neolithic or Bronze Age date (Jones 2004, 78; Stefan Bergh, pers. comm.) (Fig. 12). Dry-walling is also known at Irish court tombs, notably at Behy, Co. Mayo, where excavation revealed drystone walling on the cairn edge, the façade and the oval court, where it survived up to 1.5m in height, preserved within peat growth (de Valera and Ó Nualláin 1964, 5–6). Creggandevesky, Co. Tyrone, is another example of a court tomb with fine drystone walling, which remained intact under bog (Foley 1988; 1989). Façades play an important role in court tombs and in Clyde



Fig. 12—The 4m-high cairn revetment at Turlough Hill, Co. Clare (Stefan Bergh).

cairns in south-west Scotland, often featuring sections of drystone walls alternating with orthostats in a 'post-and-panel' arrangement.

O'Kelly was aware of some of the examples cited here, notably Cairn T at Loughcrew, Baltinglass and the Breton sites, to which he referred in a letter to J. McCarthy on 16/03/1971 and in later publications (O'Kelly 1989, 101–2; C. O'Kelly 1978, 101–2), even though in the excavation report he only referred to Barnenez South (O'Kelly 1982, 115–16). In addition, although perhaps insufficiently recognised, he identified evidence that the builders at Newgrange had the ability to construct substantial facings. He discovered the cairn-within-a-cairn that enveloped and held in place the 6m-high corbelled roof over the chamber; this 'boulder-cap', or perhaps more precisely a core-cairn, comprised a 'built revetment' of rounded stones, 5m along its slope (O'Kelly and Fogarty 1981, 219; O'Kelly 1982, pl. 50). Since O'Kelly's death, fieldwork and excavation across western Europe have revealed more fully the extent of the use of dry-walling in the construction and revetment of chamber tombs. Increasingly, evidence shows that revetment construction like that envisaged and reconstructed at Newgrange were commonly employed; dry-walling was used not only for retaining the edge of cairns but also for revetments within cairns, and frequently for building passages and chambers.

DISCUSSION

Considering the evidence outlined above, the presence of a revetment at Newgrange should not be regarded as an exception but rather as a relatively typical element of Neolithic construction. So why has this feature been so under-appreciated at Irish sites? One reason may be the focus on the concept of 'mega-liths', the large stones, with consequent disregard of the evidence for dry-walling to construct chambers, consolidate corbelled roofs and more particularly in revetting cairn edges. Another is that in Ireland there has been limited excavation of passage tomb cairns in the modern era; a fresh excavation at a passage tomb with evidence of internal or external revetting could go some distance towards clarifying how revetments were used in Irish passage tomb cairn construction.

The amount of interest and even emotion that the restored quartz revetment has occasioned is quite remarkable. Perhaps here we can detect resonances of how this crystalline white stone was esteemed in the past, when it was so highly regarded that it was often transported over long distances. Quartz blocks and pebbles were widely used for decorative and spiritual purposes in antiquity and into the historic period (see e.g. Darvill 2002; Bradley 2005). It is possible that passage tombs with astronomical or orientational

significance may have been emphasised through symbolic association with quartz. At Newgrange, O'Kelly (1979, 209) considered the possibility that the quartz revetment was further decorated, that the granite cobbles found on site might originally have been arranged on the facing in 'great spirals or zig-zags', but retreated from this option, noting that 'we had no evidence for this and therefore could not risk doing it', and so they were finally set randomly.

In this paper we have focused primarily on only one aspect of the work at Newgrange—the reconstructed cairn facing—rather than attempting to evaluate the restoration work in its totality. O'Kelly had a long-standing interest in the presentation of the past to the public; indeed, in the years just before beginning work at Newgrange he had excavated three small megalithic tombs and had carried out conservation to present them to the public. His reports included excellent artist's impressions showing how he believed the sites had looked originally (e.g. O'Kelly 1958, pl. 9). He had also made many models and dioramas for the Cork Public Museum, where he had been curator from 1944 to 1963. So although modern computer modelling was not available to him, he was entirely capable, if he deemed it a superior course of action, of presenting an artist's impression or a model of how he envisaged Newgrange had looked. In fact, following the initial meeting at Newgrange on 6/11/1961, Hartnett's minutes record that 'It was pointed out how impossible it would be for anybody to predict the original profile of the mound … Better leave the mound as it is and perhaps a model showing the conjectural profile and make-up of the mound in the little information kiosk would better serve the purpose' (item 8 in copy of memorandum sent by PJH to MJOK 9/11/1961). But as the archives show (letter of 16/03/71 quoted in Appendix 2 below), O'Kelly insisted that the material that had fallen from the mound should be put back up, and he believed that the only way to retain it in place was by building a revetment.

Deciding on the success or failure of the restoration and reconstruction work at Newgrange depends on the parameters by which one measures success. On the one hand, from a purely archaeological perspective, if such exists, the methods used by the Office of Public Works for reconstructing the Neolithic appearance of the cairn at Newgrange and its facing, as deduced through excavation, can certainly be critiqued. In particular, the introduction of large quantities of concrete and other modern materials is problematic, although it should be noted that all the quartz and granite utilised to face the concrete wall was found on site. The preferred archaeological practice at ruined monuments is *anastylosis*: the principle that a destroyed building or monument be restored using original architectural materials only (ICOMOS 1964, Article 15).

In its favour, the restoration accounts for and incorporates the rather large amounts of material found outside the mound during the excavations. To date, in our opinion, no rival interpretation of the mound composition and edge has elucidated how this quantity of material could otherwise have remained above the kerbstones. Moreover, the monument as it existed before excavation was in a vulnerable state, and access was greatly improved by the work, in line with O'Kelly's brief. As O'Kelly noted (memorandum 1967/8, Point 1), 'Numbers of tourists were increasing rapidly and it was obvious that this, one of the greatest monuments in Europe, could not be left in its then condition, no less from a scientific than from a purely materialistic viewpoint'. From a heritage-profile perspective, and the goals of the State Tourist Board in 1961, the work at Newgrange has been an unqualified success. The conservation and reconstruction work permitted the sizeable collection of megalithic art on the kerbstones and on top of the roofstones to be seen and studied, allowed safe access into the monument's chamber and directly resulted in the discovery of the world-renowned winter solstice alignment, all of which have greatly improved our understanding of the communities who constructed the site, as well as our experience of this unique monument.

O'Kelly was very mindful of compromises that had to be made: for example, regarding the widening of the space at the entrance for visitor access, even though the archaeological evidence suggested that the revetted façade approached each side of the entrance stone K1, and hence the open area in front of the passage mouth would originally have been far smaller (see O'Kelly 1982, 110). Claire O'Kelly's archived 1985 lecture notes record that while she herself was particularly unhappy with this aspect of the restoration, her husband '… was above all a pragmatist and accepted the realities of modern touristic situations'. In contrast, Heald and Barber (2015) caution against the dangers of excavation motivated by public access requirements, reconstruction and cultural tourism, noting that, among other issues, such objectives tend to narrow the focus to the most prominent period in a site's history and to favour unduly those aspects of the archaeology best suited to consolidation for display purposes. Similar choices also had to be made at Knowth following excavation of the large passage tomb and twenty smaller ones, spread over a 3.5ha site with multi-period use (see Gowen *et al*. 2017).

CONCLUSION

The information and analysis presented here indicate that a quartz-covered revetment above the kerb line was an original feature at Newgrange. The make-up of slip from the cairn was broadly similar in all the sections at the front of the cairn, and corroborated by the northern cutting and Lynch's 1980s Trench A to the east. At least some of the slip must have fallen quite quickly, as several sections were partly overlain by Late Neolithic material.

As noted, the required height of the revetment, 3m, was ascertained by a specialist engineering report. It cannot be ruled out that the quartz may have been more thickly set, and hence would not have covered as great an extent/height, but as it had been brought from a considerable distance it seems more likely that it would have been used to maximum effect in a thin skin on the revetment. The fact that it extended only along the 'front' of the monument also implies that it was a precious resource, and hence to be used sparingly. The façade must have been quite fragile if it reached 3m in height, which may explain its rapid/complete collapse, although equally it may have been deliberately brought down. The wedge shape of the cairn slippage extending from the kerbstones outwards argues against its being a platform, which might be expected to be flatter, and the visual impact of the quartz stones would have been greatly diminished if laid flat.

The archival materials presented here, and in particular the correspondence between O'Kelly and the officials, although not by any means a complete record, have to some extent helped us to see into developments at Newgrange as the excavation and restoration work progressed, including mention of competing strategies for reconstruction. O'Kelly was responsible for interpreting the form of the monument in the past, but it appears that he had only an advisory role in deciding the materials and means used to achieve the restoration. Unfortunately, those two areas of responsibility—the interpretation of the Neolithic appearance of the monument and how it was achieved—are often conflated in critiques of the work. Consequently, O'Kelly's interpretation of the Neolithic appearance of the revetted cairn edge is perhaps unfairly denigrated because of concerns around the materials and methods used in the restoration.

The quartz-faced revetment has been portrayed as unsustainable and out of character with other Neolithic sites, but, as shown above, revetments have significant currency in the Neolithic world, and many still survive today. In fact, the evidence suggests that the use of revetments and inter-cairn walling were important elements of the 'tool kit' of the builders, allowing them to alter the slope of the cairn and create dramatic architectural effects. Though the ubiquity of these features does not in itself prove that such was the exterior design at Newgrange, it does lend weight to O'Kelly's interpretation. That revetments were found at contemporary passage tombs in Ireland, sometimes associated with quartz or other exotic materials, further strengthens the case. We can say with confidence that the interpretation of a revetted cairn edge is in keeping with contemporary sites in Ireland and abroad—more so, perhaps, than grasped in previous accounts.

The restoration of Newgrange is not perfect—such work is always based on approximations and on the best evidence and methods available at the time—but a quartz-covered revetment above the kerbstones stands as the most convincing vision of how Newgrange once appeared.

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APPENDIX 1: THE NEWGRANGE ARCHIVE

The excavation archive was deposited with the National Monuments Service by the O'Kelly family. It is currently stored at the Collections Resource Centre in Swords, with the photographs held by the Photographic Unit at the National Monuments Service offices in the Custom House, Dublin. It is available for consultation on request, and has been viewed by others (see, for example, Stout and Stout 2008). In summary, the O'Kelly archive comprises the following.

- Letters to O'Kelly from officials in the Office of Public Works, together with drafts and carbon copies of O'Kelly's side of the correspondence and some annotated illustrations (e.g. Fig. 4). Four items from November 1981 deal with his agreeing to take on the excavation; fifteen letters and reports deal with site management and restoration from July 1967 to March 1971; three letters written in July 1974 relate to cracks appearing in the concrete wall; copies of letters and reports by J.V. Fogarty, O'Kelly's colleague in the Civil Engineering Department of UCC, whom O'Kelly engaged to calculate the

angle of slope of the revetment.

- Approximately 1,700 colour slides (catalogued), 96 sheets of contact prints (listed) and a box of photographs taken by O'Kelly.
- Original sectional elevations of the cairn and cairn slip, marked as having been archived in 2007, including some unpublished elevations from the cuttings east of the entrance.
- A series of narrow, overlying sheets on light permatrace on which are recorded at a scale of 1:25 the position of 26 lintels and corbels, including the 'roof-box' through which the sun shines into the chamber at the winter solstice, which were removed to enable the passage orthostats to be straightened. Each plan shows the stones that are on the same level.
- Two sheets with rudimentary drawings relating to calculations of the angle of slope of the wall.
- Notebooks relating to excavation administration, wages paid, etc., and notes on carvings on the kerbstones.
- Notes by O'Kelly on the 1972 winter solstice.
- Descriptions of carvings in the chamber by Frances Lynch.
- Typescript of a lecture given by Claire O'Kelly on 24 April 1985, in which she presented 'some background material' relating to the revetment reconstruction. Also her notes for a talk at the 'Stones and Bones' conference held in Sligo in 2002.
- Audio recording of O'Kelly in the chamber during the solstice days of December 1969.

The National Monuments Service Photographic Collection contains a comprehensive collection of photographs taken at Newgrange, with particularly good coverage of the removal and replacement of passage roofstones.

Only one letter relating to Newgrange appears to have survived in the files of the Office of Public Works, and O'Kelly (Point 6 in Memorandum written in 1967/8) expressed his annoyance that the files containing OPW records of work before 1962 had been reported as mislaid, although they had been made available in the mid-1950s to S.P. Ó Ríordáin and M. Ó hEochaidhe (1956, 53–5).

APPENDIX 2: COMMISSIONING THE WORK

Bord Fáilte (the Irish Tourist Board) played a major role in setting up the project at Newgrange. It was their archaeologist, P.J. Hartnett, who made arrangements for a subcommittee of the National Monuments Advisory Council (NMAC) to meet at Newgrange on 6 November 1961. Those listed as present in the minutes of the meeting sent by Hartnett to O'Kelly (9/11/1961) were: M.J. O'Kelly (University College Cork), R. de Valera (University College Dublin), A.T. Lucas (National Museum of Ireland) and W.P. Le Clerc (Inspector of National Monuments), all of whom were members of the NMAC, together with Hartnett and G. Bagnall from Bord Fáilte and two representatives of the Meath County Engineering Department. In the preface to the excavation report O'Kelly (1982, 10) also includes Frank Mitchell, Michael Duignan and Seán Ó Nualláin as present.

The committee initially discussed ten aspects that might be addressed. The minutes report that the main points were as follows.

- Kerbstones were to be displayed.
- 'The existing revetment was not a very happy solution and might be dispensed with: the stones forming the facing could be thrown back on the old mound and the original natural sloping face restored.'
- There should be 'Exploratory excavations around the entrance from the great stone circle to the base of the mound in order to locate the original ground levels' and hence to '… define which was original (archaeological) and which was later "slip"'.
- Clearance of scrub and vegetation from the top of the mound should take place. This was 'unanimously and vehemently agreed'.

There was no agreement, however, regarding infilling of the hollow on top of the mound, and it was decided that the proposal to remove struts along the entrance also needed further consideration. Finally, there was discussion on whether the entrance stone might be removed to the National Museum for its preservation and protection, or whether a porch might be built over it for protection and the sale of tickets and postcards.

A rather more ambitious plan, however, is claimed in Point 3 of a memorandum written by O'Kelly in winter 1967/8, in which he says that the aims were 'to discover as much as possible about the archaeological and historical context of Newgrange and the people who built it and to discover what its original finished appearance was so as to direct the NMB on how to reconstruct, conserve and restore the structure to its former condition and appearance'.

It should be noted that there is no mention of international guidelines for the conservation and restoration of monuments and sites such as the Venice Charter (ICOMOS 1964) in any publications or in the surviving archives relating to the restorations at Newgrange. In this period, it was usual to refer simply

to the 'aims' of a project or excavation; the concept of a comprehensive 'research design' had not entered the archaeological lexicon in Ireland. Then, as now, the conduct of an excavation may have had to be adjusted in light of discoveries made.

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