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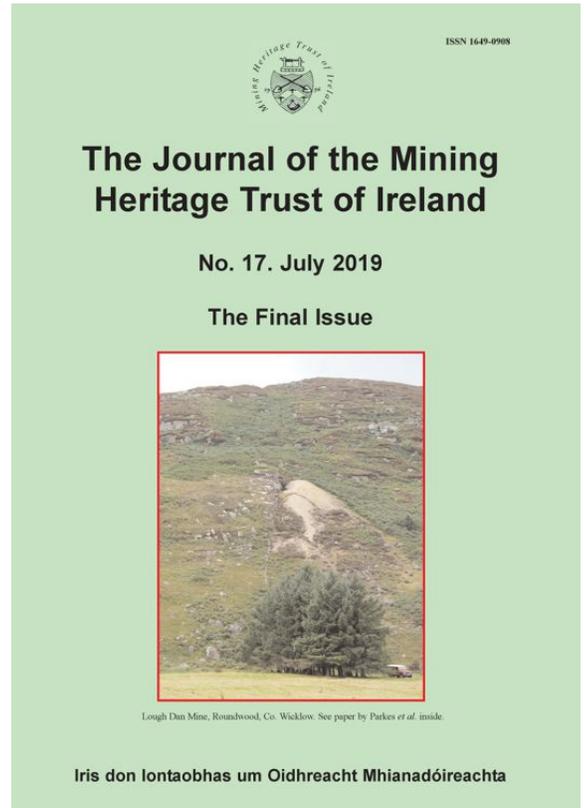
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# THE MILLSTONE QUARRY OF LOUGH ESKE, CO. DONEGAL

by Niall Colfer

**Abstract:** This paper comprises a detailed study of a millstone quarry located on the west side at Lough Eske, Co. Donegal, the product of which was widely used in the north of Ireland during the 18th and 19th centuries.

**Methods of stone extraction and shaping are analysed in depth. Research questions concerning geology, transport and techniques used to transform a 'roughout' piece are addressed. Discussion of post-medieval economic environment in the northwest corner of Ireland is provided in association with factors determining the commercialisation of Lough Eske millstones.**

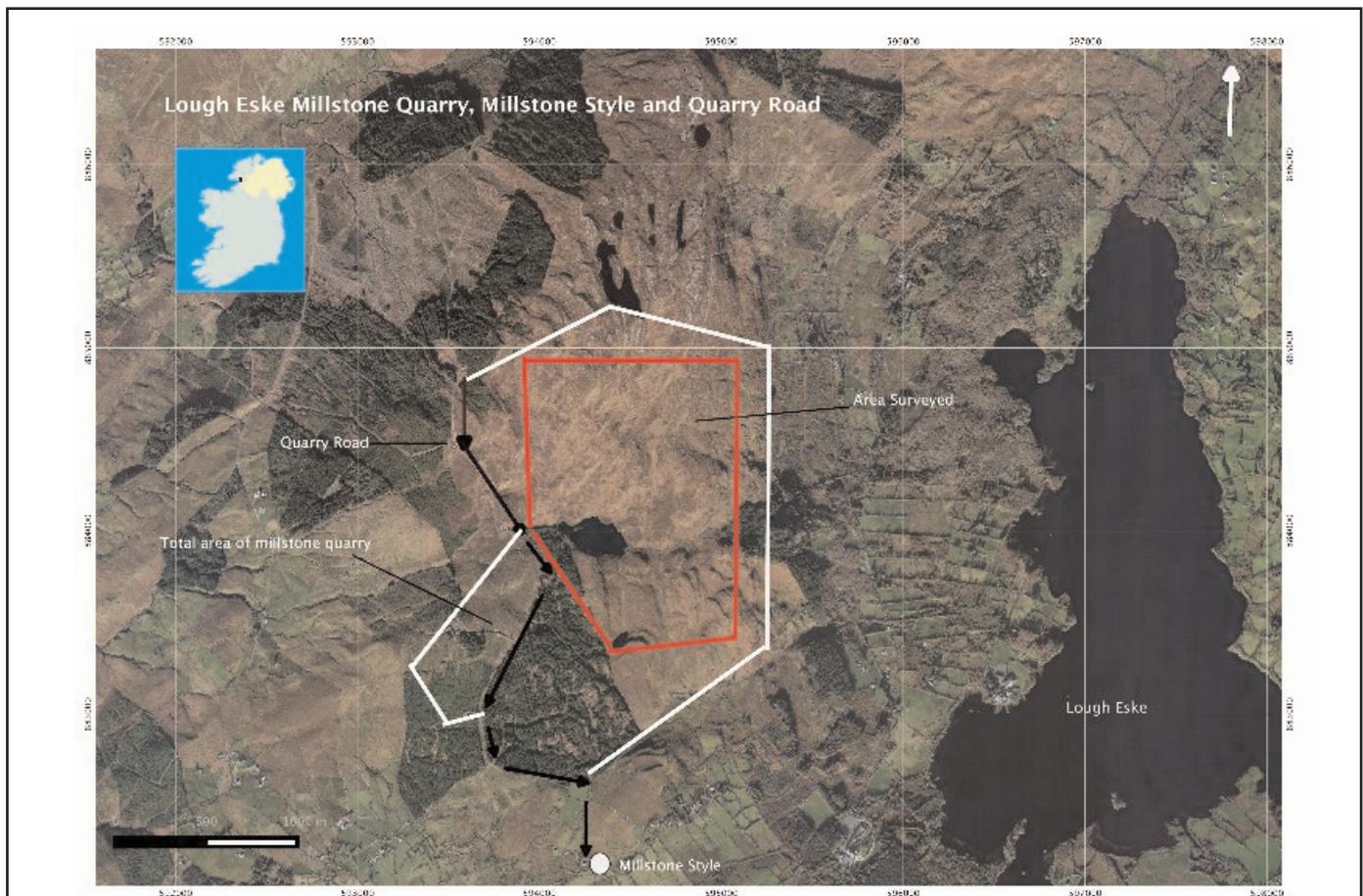
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## INTRODUCTION

County Donegal offers some extremely important information regarding millstone production on the island of Ireland. A total of eight millstone quarries, active during the post-medieval period and utilising a total of three different types of bedrock, have been identified in the county by the writer (Colfer 2016). A continuation of millstone production in the northwest corner of Ireland from the early medieval period onwards is suggested by three millstones located in Ray Old Church, Falcarragh, in northern Co. Donegal, which were extracted from local quartzite bedrock and reused as a foundation for a 10th-century

high cross (Graham 1955).

Situated in the townlands of Altilow and Banagher (approximately 5.5km northeast of Donegal town), on the western side of the Lough Eske (Figure 1), the millstone quarry that provides the focus of this paper is the principle example in Co. Donegal both in terms of size and economic achievement. In conjunction with the millstone quarries in Waterford Harbour, the quarry at Lough Eske represents the most commercialised and successful in the millstone industry on the island of Ireland.



**Figure 1.** Location of millstone quarry in the townlands of Altilow/Banagher on the western side of Lough Eske. Quarry road identified on western side of quarry.

## GEOLOGY

The millstone quarry at Altilow/Banagher provides the only recorded example on the Island of Ireland where two stone types (feldspathic sandstone and sandstone conglomerate) were used to produce millstones (Colfer 2016). The quarry is located on the 'Banagher Formation' which is composed of feldspathic sandstone and sandstone conglomerate (Long and McConnell 1999) (Fig. 2). These were formed as a result of long periods of deposition of silts, pebbles and stone in the flood plains of rivers running from the granite mountains to the north of Co. Donegal (ibid).

Unlike the sandstone conglomerate used to produce millstones elsewhere in Ireland (which is Devonian in age (Holland, 2009)), the Banagher formation at Lough Eske is Carboniferous (Gibson 2013). This is composed of sandstone with rounded quartz pebbles (Figure 2). The feldspathic sandstone is coarse with a grain size of less than 2mm and consists of grains of quartz (up to 80%), feldspar and small bits of granite stone which had been broken down by the river in which the particles travelled. Once these had been redeposited they were cemented by silica (Long and McConnell 1999).

The form taken by both the sandstone conglomerate and feldspathic sandstone defined the methods by which stone was cut in order manufacture millstones. The conglomerate was accessed by stonemasons in the form of bedrock outcrops. The feldspathic sandstone was visible in the quarry area in the form of boulders that were sitting on the surface where they had been weathered in situ. The presence of voids between the particles of quartz and feldspar in the feldspathic sandstone enabled the weathering and breaking down of the feldspathic sandstone bedrock by water at a quicker rate than the conglomerate, creating the boulders visible throughout the quarry.

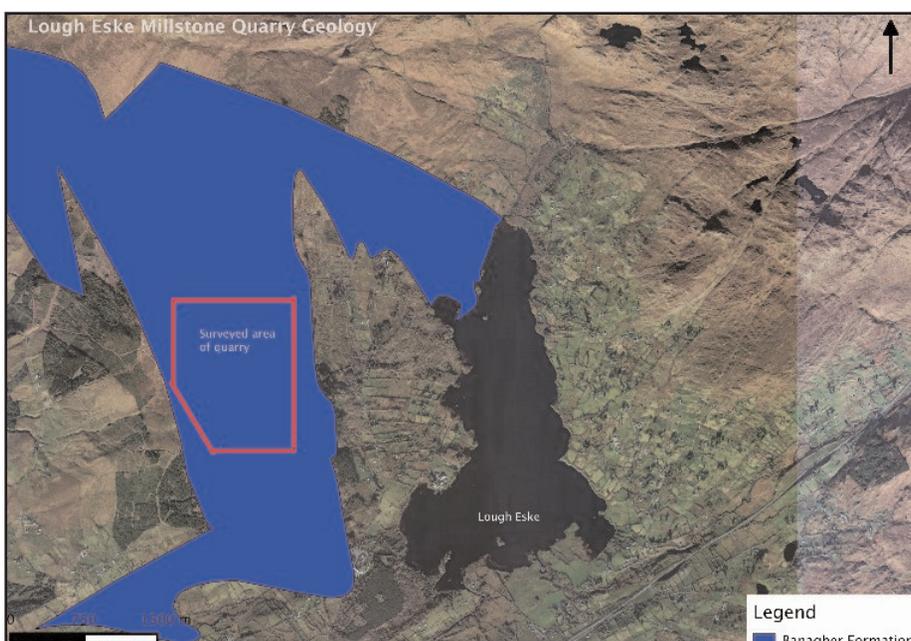
The importance of both the stone and the millstone industry at Lough Eske was also referenced by two noted geologists of the 19th century. Wilkinson, writing when the quarry was still active, describes the bedrock as "coarse conglomerate, cement, felspathic" (Wilkinson 1845, 330). The above description provides the reason for the success of the millstone industry at

Lough Eske; both the conglomerate stone and feldspathic sandstone were extremely hard with high levels of quartz providing a constant cutting edge on the grinding face of the stone. Kinahan (1889 249) describes the stone as being "dirty yellow. Varying from granular to conglomeritic; very quartzose; semi-crystalline; hard; cement felsphatic".

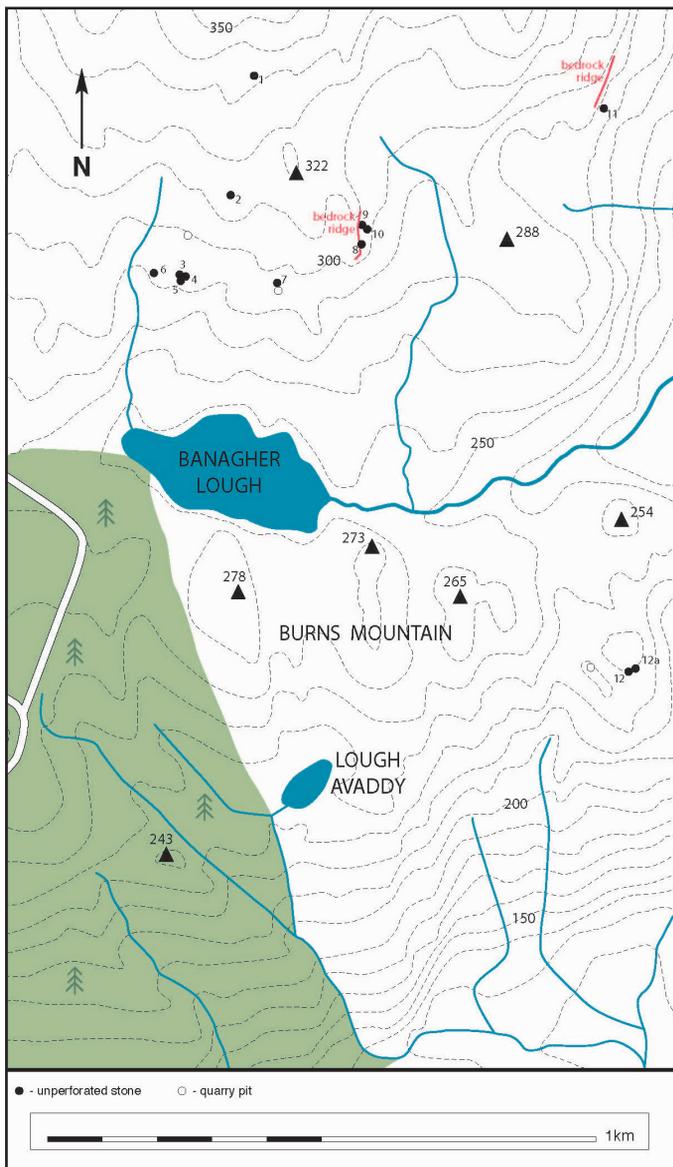
## MILLSTONE QUARRY LANDSCAPE

The surveyed quarry landscape consists of undulating scrub and moorland and stretches over an area of approximately 1km east to west and 0.5km north to south on the northern side of Burns Mountain (Figures. 1 and 3). Evidence of millstone production had at one point been evident over an area measuring approximately 2km north-south and 1.5km east-west, which encompassed all of Burns Mountain (pers. comm Patsy McNulty, local historian). This area was defined along much of its western side by a road that was used to transport millstones and is still used today to gain access to same upland area (Figure 1). The surveyed area (Figure 3) was defined by where millstone production was still evident. Agricultural use of land and heavy forestation had resulted in much of the evidence of production being both destroyed and covered on the lower slopes of Burns Mountain.

Large sandstone boulders occurred throughout the survey area (Figure 4). These varied in size, with some up to 2.5m in length. The most common shape was sub-rectangular. Outcrops of sandstone conglomerate were also visible on the high ground on the north slope of Burns Mountain. Bedrock was quarried in the surveyed area at two north to south ridges. These were situated on the east facing slopes on the western side of Lough Eske. This ridge is now heavily overgrown although evidence of millstone production, in the form of millstone roughouts (unfinished examples) is still visible. The millstone spread was concentrated between 330m and 280m OD on a gradual northwest to southeast slope. Millstone activity was recorded in an area which extended for a distance of approximately 1km in a southwest to northeast direction. Two millstone roughouts were also recorded on the western slope of Burns Mountain.



*Figure 2. Banagher Formation at Altilow/Banagher.*



**Figure 3. Lough Eske millstone quarry survey area (Conor McHale).**

**Figure 4. Feldspathic sandstone boulders at Lough Eske millstone quarry.**



## METHODS OF MANUFACTURE

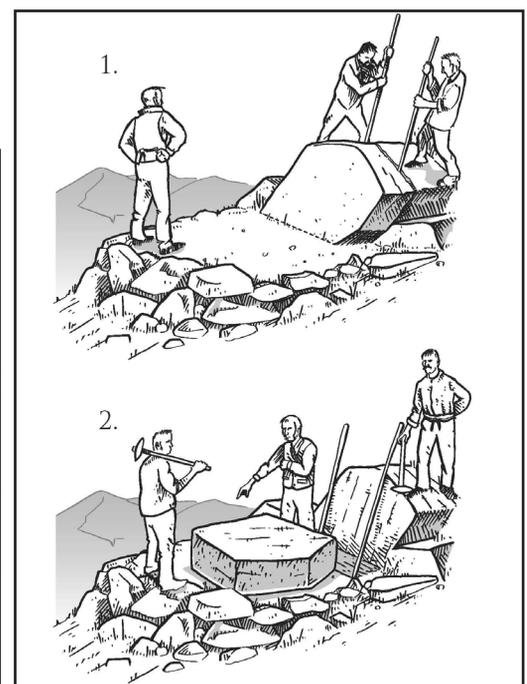
Two methods of millstone manufacture were recorded at Lough Eske, both of which were dictated by the source and type of stone. According to an account relating to the millstone quarry at Lough Eske written in the Ordnance Survey Memoirs of Co. Donegal in the 1830s, two stonemasons worked on each stone and produced one a week (Day and McWilliams 1997b, 98).

### A. Sandstone Conglomerate

Historical references suggest sandstone conglomerate as the more dominant stone type to be quarried in the production of millstones. In common with millstone quarries in Cork, Tyrone and Kilkenny, slabs or blocks of conglomerate were removed from a bedrock outcrop. Millstone preforms were manufactured in the following way:

(i) A stone block/slab was taken from bedrock with the longer cut in a vertical direction. This was done using vertical wedge pits into which long wooden levers were inserted. Natural fractures in the bedrock were taken advantage of in order to take the block from the parent rock (Figure 5).

(ii) The detached stone block was then reduced in size. Evidence recorded throughout the millstone quarry suggests that straight lines of wedge pits were cut around the intended roughout. The number and length of the straight lines of wedge pits varied depending on the size and shape of the block/slab. Unlike methods used elsewhere in Irish millstone quarries (such as at Millstone Mountain in the Mourne Mountains, Co. Down, where lines of wedge pits were all roughly the same length around the intended preform) the lines, or 'stitching' (Evans 1951) cut at Lough Eske were irregular and long in length, reaching up to 1.2m and intended to reduce the overall size of the slab rather than create a hexagon or octagon and therefore a shape more resembling a circular millstone (Figure 6).



**Figure 5. Reconstruction drawing of the method of extraction of bedrock in millstone production at Lough Eske (Conor McHale).**



**Figure 6.** Quarried bedrock place on stone blocks and shaped using straight lines of wedge pits. Parallel lines of pickmarks are visible on the upper face.

(iii) The roughout was then shaped. Once the block had been reduced in size, the outline of the millstone was marked and the top face and the top half of the edge of the millstone was cut. This process was visible on three roughouts located in the mid-section of the surveyed area (Figure 7).



**Figure 7.** Millstone roughout showing shaped convex upper face. Half of the edge have also been shaped. The excess stone from bottom face and edge is normally removed after the stone has been turned.

Parallel lines, or rows of pick marks, cut in order to shape the face of the roughout, were visible on the top face of unfinished examples. These were cut by the two stonemasons working on the stone moving around the top of the stone from at least six standing positions, always starting in the middle of the stone. The roughout stone was also placed on blocks at three points in order to make it level for working (Figure 6).

Two roughouts had convex top faces. These examples provided evidence on how the overall desired shape of the roughout was achieved. Wedge pits were not used to take off the excess stone

around the roughout (the last use of wedge pits in millstone production at Lough Eske was to remove excess stone from around the intended millstone in straight lines, as described above). Direct percussion (Andersen 2013), using a pick, was utilised to chip away the excess stone. Indirect percussion, using a hammer and a chisel, was then used to shape the top half of the edge of the millstone. This process was carried out before the depth of the block was reduced to that of the intended millstone. The roughout was then turned over in order for the second face (normally the grinding face) and second half of the edge.

## B. Feldspathic Sandstone Boulders

The boulders (which had been weathered in situ and were not erratics) that provided the source of stone at Lough Eske determined the nature of the methods of manufacture. In essence, they provided readymade blocks from which roughout millstones could be produced. The process was as follows:

(i) A suitable boulder was selected and cut. A slight sub-circular depression or pit was recorded around several unfinished millstone roughouts. This was dug to gain access to the boulder and also determine its size. A slab, the depth of which equalled the intended millstones was then taken off on either a horizontal or vertical plane using triangular shaped wedge pits. This is best exemplified by a large boulder that had been cut horizontally with irregular sized and spaced wedge pits. Once the slab had been cut and moved slightly a stone was placed between the divided pieces in order to make a space into which a wooden lever would have been placed (Figure 8).



**Figure 8.** A slab in the process of being removed from a feldspathic sandstone boulder with horizontal wedge pits.

(ii) The new cut slab was then reduced in size using straight lines of wedge pits (averaging 0.20m in length, 0.05m high and 0.15m in depth). In common with the 'stitching' carried out on slabs removed from sandstone conglomerate bedrock at Lough Eske, these were of irregular length and were usually cut in order to reduce the overall size of the slab rather than to achieve a shape closer to millstone cylinder. One example (F3) was recorded where the slab had been shaped into a perfect hexagonal shape (Figure 9).

(iii) Once the slab was the desired size, the millstone roughout was marked. Using a pick, the excess stone surrounding the millstone was then removed.



**Figure 9.** Two millstone rough outs. One (background) been placed upright, with a block behind it to prop it up before being shaped. The second has been cut into a hexagonal shape and has parallel pick lines on its upper face.

(iv) The top face of the millstone was shaped. Where visible the process indicated parallel lines of picks marks suggesting the stonemason(s) were standing on top of the stone and working from the middle outwards from at least six different standing locations (Figure 9). This was carried out before the edges of the stone were started as all examples where this process was recorded still had roughly hewn straight lines defining the shape of the stone.

The roughout was placed on blocks in order to make it stable and level before being worked. In one example, a slab had been placed upright with a block behind it to prop it up before being shaped (Figure 9). This method may have been deemed better by the stonemason making the millstone in question. The top half of the edge of the millstone was then shaped. No millstone was located with the central perforation cut.

(v) The millstone was turned and the process repeated.

## ARCHAEOLOGICAL MEASUREMENTS

Two millstones (Figure 7) were recorded at Lough Eske with their edges cut, therefore providing a finished diameter for the stone. Both of these were cut from sandstone conglomerate and measured 1.4m in diameter, suggesting a 19th-century date of production (Sass 1990) and a standardised size of millstone. Wedge pits were all subtriangular and ranged greatly in size, from between 0.22m wide, 0.05m high and 0.25m deep to 0.48m wide, 0.1m high and 0.12m deep. Rows of pick marks used to level the millstone face measured between 0.4m and 0.5m in length, with each pick strike leaving a small depression measuring 0.015m in diameter and 0.01m deep.

## TRANSPORT

There was a considerable distance between the quarry site and the point from which the millstones were collected and subsequently transported by horse and cart. This point was known as the 'Millstone Style' and is visible on the Ordnance Survey 1st Edition maps of the 1830s approximately 1.5km south of the

southern perimeter of the surveyed area (Figure 10). Up to 40 pairs of millstones were brought to the 'style' per year for exportation (Day and McWilliams 1997b, 106). Although this amount may seem small, when added to millstones made for the local market, the overall number that were moved to this point of collection must have exceeded this amount. Each millstone was moved from the quarry down the western side of the mountain and along a road running north to south along the western base of the mountain (pers. comm. Patsy McNulty local historian). There was a maximum distance of approximately 6km to be travelled on this road (Figure 4). The two stonemasons who were involved in the manufacture of the millstone were responsible for its transportation to the collection point (Day and McWilliams 1997b, 106). These men were aided by 11 others who were paid directly by the two quarry workers. The central perforation in the millstones may have been cut at a barn near the 'Millstone Style' where the final work to be carried out on Lough Eske millstones was undertaken.

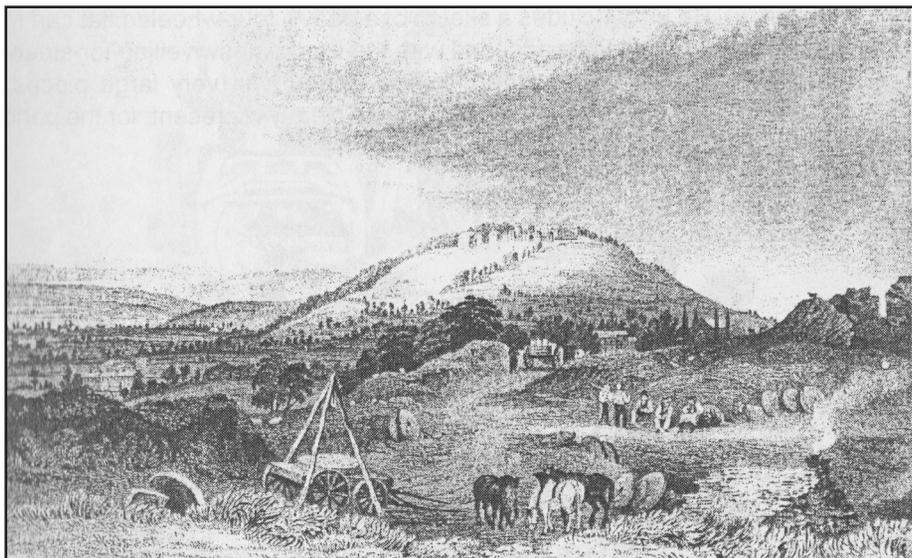


**Figure 10.** The 'Millstone Style' marked on the 1st Edition Ordnance Survey map of the 1830s.

Mirroring the method of millstone transport used in the Mourne Mountains, the millstones at Lough Eske were moved from the surrounding hills on a 'slype' (Evans 1978). This method entailed placing the millstone horizontally on the slype, which was then slowly manoeuvred down the hillside with a horse harnessed at the front to pull and one at the back to act as a break (Russell 2011). It is likely horses were also used at Lough Eske. The Ordnance Survey Memoirs of the 1830s reported six stones a day could be moved to the 'Style' at Lough Eske by the 13 men (the same historical source reports the exportation of 40 pairs of millstones a year (above)) (Day and McWilliams 1997b, 106). Given the weight of the millstones, this feat would have been extremely difficult, if not impossible, without horses to pull the slypes, with one man at both the front and back controlling the horses.

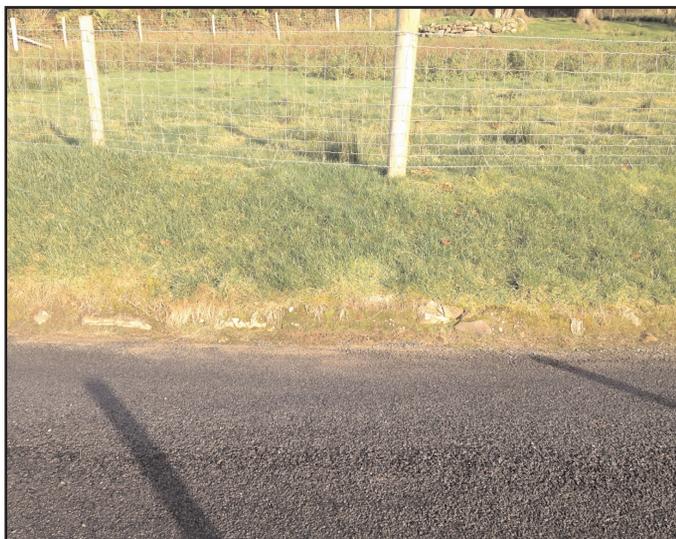
Once off the mountain, the millstone would have been placed in a cart. A method employed to achieve this difficult feat is displayed in an engraving of a millstone quarry at Duxon Hill, in the Whittle Hills area of Lancashire (Clarke 2003) (Figure 11). Here four wooden poles have formed a pyramid shape, the apex of which had been utilised to establish a pulley system. With the aid of this system, the selected millstone has been lifted to such a height (while staying parallel to the ground) that a cart can move between one side of the pyramid and under the millstone, which is then placed in the horse drawn cart.

The base of the 'style' is still visible to the south of the quarries in the townland of Altilow and Banagher, at the base of the



**Figure 11. Engraving of Duxon Hill millstone quarry, Whittle Hills, Lancashire, showing wooden pole 'pyramid' pulley system (after Clarke 2003).**

southern slopes of Burns Mountain (Figure 12). This consists of a row of roughly cut stones approximately 2m in length. The style would originally been the height of a cart. The millstones would have been placed on the style and then pushed horizontally onto the cart. It is likely the cart, or carriage may have been reinforced in order to be able to withstand the weight of the millstone.



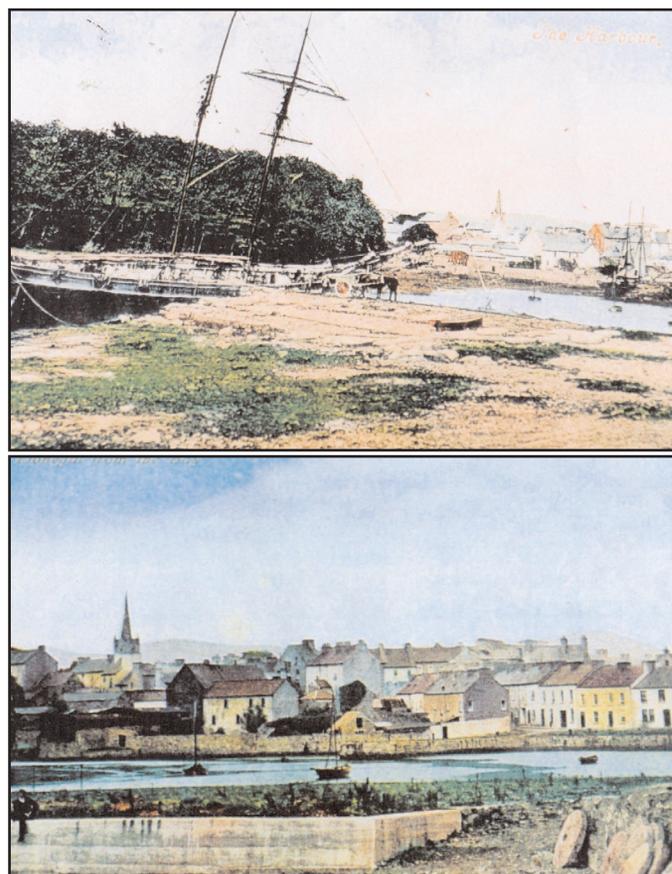
**Figure 12. Base of the 'millstone style' to the south of the surveyed area. Facing north.**

Millstones from Lough Eske were transported to areas in the northwest (Day and McWilliams 1997b) and also Belfast (Belfast Newsletter) (see below for more discussion). They were also exported to England and America (Day and McWilliams 1997b). Undated photographs (two of which were used as postcards and possibly all taken at the same time by the same photographer) of Donegal Harbour (Figure 13) provide a visual link between the quarry and the maritime transportation of the stones (pers. comm. Patsy McNulty, local historian). In the two examples, millstones have travelled the 6km from the quarries to the harbour and are visible on the quayside at Donegal town quayside awaiting collection. The schooner into which the millstones were to be loaded is visible. Although

there are no millstones still visible at the quayside in Donegal town, a millstone transported from Lough Eske to Donegal is now located in the grounds of Killymard Church in Donegal town (Figure 14).

## HISTORICAL BACKGROUND

The population of Co. Donegal, in conjunction with the rest of the country, expanded greatly in the 18th and 19th centuries to over 137,000 directly before the famine (Hogg 2008). The majority of these people were the small farmer classes living on estates owned by absentee landlords (only 29% of landlords were resident on their estates in Co. Donegal in the 1830s (O'Donnell 2013)). This was partly due to the varying quality of the land in the county with the eastern half far more fertile than the poorer west (Bell 1995).



**Figure 13. Photographs of Donegal Harbour showing Lough Eske millstones awaiting collection (pers. comm. Patsy McNulty, local historian).**

The growth of the linen industry in the northwest, which reached its heyday between the years 1740 and 1790 due to an English demand for Irish linen (Gavin 2013), was the foremost important economic development in post-medieval Donegal. This provided employment for a huge number of the population and also partly aided the establishment of the millstone industry. In the Donegal census of 1841, three quarters of the economically active females were 'spinsters' (ibid). Kinahan (1889) refers to the 'flax crushers' being produced in the millstone



**Figure 14. Lough Eske millstone at Killymard Church, Donegal town. Note slightly convex upper face. Lines on upper face are a modern effort to make the stone into a sundial.**

quarries at Lough Eske. These edge runner stones providing a link between the growth of the millstone and linen industries in Co. Donegal. Flax "had to be pulled by hand, and then steeped, so that the inner woody core rotted and could be removed from the valuable fibre that was used for making linen thread. Large stone wheels were used to crush or 'bruise' flax, to make it easier for the core to be beaten out" (Bell and Watson 2013, 367). This practice remained in Co. Donegal well into the 20th century (McCutcheon 1980).

A total of 329 mills are marked in Co. Donegal on the 1st Edition Ordnance Map of 1836 (Hogg 2008), making it the highest density of any county on the island of Ireland. Out of this number, 124 were corn mills, four were flour mills and 13 were concerned with brewing or in a distillery. All of these mills would have housed at least one pair of millstones. A total of 51 mills were not identified as a specific type leading to the conclusion that this number would have been higher, 130 (the largest number in Ireland) were flax mills.

Although millstones were not used in flax mills, the use of edge runner stones in the early stages of flax processing added to the high number of flax mills identifies a market for the edge runner type millstone in northeast Ireland. Linen yarn (which was derived from flax) was the northwest's chief export for the greater part of the 18th century and resulted in an era of prosperity in the last three decades of that century (Gavin 2013).

Before the second half of the 19th century, the majority of the land in Co. Donegal was still divided according to the 'rundale' system (Bell 1995). The small nature of the landholdings dictated by this system coupled with unfertile land aided the growth in the popularity of flax cultivation. Flax was a crop from which a farmer with a small holding could make a profit due to the additional form of income provided by weaving the crop (Andersen 1995). Oats was by far the most common crop in Donegal in the mid-19th century. A total of 100,882 acres of the crop was grown in 1851 (Bell 1995) also highlighting the dependence (along with potato) of the population on oatmeal as a staple part of their diet (Beattie 2013). A high number of corn mills (which would have ground wheat, oats, maize, fodder etc.), in Co. Donegal (124 in total (Hogg 2008)) in the mid-1830s signals the viability of a millstone industry, particularly at Lough Eske where the millstones were "peculiarly adapted for corn mills" (Day and McWilliams 1997 106).

#### Historical References to Lough Eske millstone production

Historical references suggest that the millstones produced at Lough Eske were the most profitable examples being produced in the northwest of the country between the 18th -and mid-19th centuries. A piece in The Dublin Newsletter on 30th September 1825 suggests the selling of millstones manufactured at Altilow/Banagher from at least the first quarter of the 18th century saying "conglomerate of excellent quality for Millstones he found in many places, but particularly in the parish of Banagher; and yet we understand that for more than a century back the remotest parts of the county of Donegal have, by water carriage, furnished the county of Londonderry with these necessary articles of rural husbandry". This was also highlighted by Curwen in 1818, saying "the quarries of this neighbourhood yield the best millstones of any procured in Ireland and a considerable number of them are annually exported" (Curwen 1818, 271).

Two 18th-century advertisements in The Belfast Newsletter (12th September, 1769 and 16th-19th June, 1789) selling 'Lough Eske Millstones' would indicate that the industry and its product was known to millers on a national scale at this time. The brand name 'Lough Eske Millstones' was used in a Belfast paper known as The Northern Whig on the 9th April 1832 (Figure 15), after which 'Donegal Millstones' were advertised in various papers in Belfast in the mid-19th century, including the Belfast Mercury (6th April, 1855), The Vindicator (28th August, 1847), The Northern Whig (9th April, 1832) and the Ulster General Advertiser (18th November, 1848) identifying the north of Ireland as the main market area for millstones from Lough Eske.



**Figure 15. Advertisement for Lough Eske millstone in the Northern Whig, Monday 09 April 1832.**

Three descriptions of this enterprise, provided by the Ordnance Survey Memoirs of Donegal of 1835, portray an industry of considerable size, as well as detailing methods of transportation, prices and reasons for the demise of the industry. These have been discussed elsewhere in this chapter but are quoted in full here.

1. "In this parish, in the estate of the late James Hamilton and Thomas Young Esquire are millstone quarries. They are at present rented by a lady in Donegal who exports annually about 40 pair of stones. The quality of the stones is most excellent, being freestone mixed with whin and peculiarly adapted for corn mills. The quarries are well situated for exporting their produce being only two miles from the town of Donegal with a good road to its quay" (Day and McWilliams 1997b, 106).

2. "Mrs. Walker of Donegal rents all the millstone quarries in the parish. They are found in the town land of Attiliou. She pays the quarrymen 27s 6d apiece for 5-foot stones delivered at "the style", a convenient spot on some adjacent road for carrying them away....two men will furnish a stone a week, from whose wages the expense of bringing them from the quarry to "the style" must be deducted. They hire 11 men at 15d a day each to assist them and the 13 are able to leave six stones daily at the appointed place. The old price was 12 guineas a pair. At present Mrs. Walker will transport them to Milltown in Tullyaughnish for five guineas. The texture of the stone is good and, as the trade fallen into decay by the great exportation of corn, Mrs Walker is now exporting millstones to Liverpool and America" (Day and McWilliams 1997b, 98).

3. Mrs Walker's millstones also get a brief mention in the Ordnance survey memoirs relating to Tullyaughnish Parish in Co. Donegal saying:

"A good pair of millstones are [were] brought from Donegal and deposited in this parish by Mrs Walker for 4 guineas" (Day and McWilliams 1997a, 89).

Historical references suggest production had ceased by the start of the 20th century. This point is confirmed by the geologist Kinahan (1889, 249), who provided a detailed description of the bedrock (above) in 1889 writing that millstone were "formerly" manufactured there. Wilkinson (1845, 330), who also provides a description of the bedrock in Altילוw writes "used also for millstones, carriage costs 1s 8d per ton". These quotes identify the end of the industry at Lough Eske as having taken place between 1845 and 1889.

## CONCLUSION

An amalgamation of geological, societal and coastal conditions aided the establishment and longevity of the millstone industry in Ireland. Until the 18th century, the norm in Ireland was for small quarries to be opened to provide millstones to local mills over their lifetime. With the commercialisation of flour in the second half of the 18th century, indigenous millstones became a vital part of the growth of milling and the agricultural economy in general. Historical sources suggest the millstones quar-

ried from sandstone conglomerate in the townlands of Altילוw and Banagher on the western side of Lough Eske were, by far, the most sought after millstone from the northeast.

The stonemasons manufacturing millstones at Lough Eske had an extensive knowledge of the form taken and techniques used to work and shape bedrock. Their relationship with the stone was economic and industrial but was also personalised through an intimate knowledge of the stone, which was passed on through generations as a trade and a way of making a living.

## BIBLIOGRAPHY

- Andersen, J. 1995. Changing farming methods in Donegal. In Nolan, W., Ronayne, L. & Dunlevy, M. (eds.). *Donegal: History and Society*, 447-470. Dublin.
- Andersen, T.J. 2013. *Millstone quarries in the southern Iberian Peninsula from protohistory to the modern times*. Unpublished PhD thesis, University of Grenoble, France.
- Bell, J. 1995. Changing farming methods in Donegal. In Nolan, W., Ronayne, L. & Dunlevy, M. (eds) *Donegal: History and Society*, 471-490. Dublin.
- Bell, J. and Watson, M. 2013. Historical aspects of farming in Donegal. In MacLaughlin, J. & Beattie, S. (eds.) *A Historical, Environmental and Cultural Atlas of County Donegal*, 364-367. Cork.
- Clarke, R. 2003. Millstone Quarries at Whittle Hills, Lancashire. *Wind and Watermills* **22**, 15-23.
- Colfer, N. 2016. *Turning Stone into Bread: Millstones Quarries in Post-Medieval Ireland*. Unpublished PhD Thesis, University College Dublin.
- Curwen, J.C., 1818. *Observations on the state of Ireland Volume I*. London.
- Day, A., McWilliams, P. (eds). 1997a. *Ordnance survey memoirs of Ireland, Vol. 38, Parishes of Co. Donegal. Part I, 1833-5, North-East Donegal*. Dublin.
- Day, A., McWilliams, P. (eds). 1997b. *OS Memoirs of Ireland, Vol. 39. Parishes of Donegal, Part II, 1835-6, west and south*. Dublin.
- Evans, E. E. 1951. *Mourne Country-Landscape and life in South Down*. Dundalk.
- Evans, E. E. 1978. *Mourne Country-Landscape and life in South Down*. 2nd Edition. Dundalk.
- Gavin, R. 2013. Social and economic links between Derry and Donegal in the eighteenth and early nineteenth centuries. In MacLaughlin, J. & Beattie, S. (eds.). *A Historical, Environmental and Cultural Atlas of County Donegal*, 188-198. Cork
- Gibson, P.J. 2013. The Geological Evolution of County Donegal. In MacLaughlin, J. & Beattie, S. (eds) *An Historical, Environmental and Cultural Atlas of County Donegal*. 31-37. Cork.
- Graham, A. 1955. An Irish millstone cross. *Proceedings of the Society of Antiquarians of Scotland* **87**, 187-191.
- Hogg, W. 2008. *Mills of Ireland: a list dated about 1850*. Dublin
- Kinahan, G.H. 1889. On the Economic Geology of Ireland. *The Scientific Proceeding of the Royal Dublin Society* **6**, 343-354.
- Long, C.B. & McConnell, B. 1997. *Geology of North Donegal: a geological description to accompany the bedrock geology 1:100,000 scale map series, sheet 1 and part of sheet 2, North Donegal*. Dublin, Geological Survey of Ireland.

- McCutcheon, W.A. 1980. *The Industrial Archaeology of Northern Ireland*. Cranbury.
- O'Donnell, M. 2013. The Estate system of landholding in County Donegal. In MacLaughlin, J. & Beattie, S. (eds.), *A Historical, Environmental and Cultural Atlas of County Donegal*. 239-250. Cork.
- Russell, N. 2011. *Slieve Donard's Domain*. Ballaghbeg Books, Newcastle.
- Sass, J. 1990. *The Versatile Millstone, Workhorse of many industries*. Tennessee.
- Wilkinson G, 1845. *Practical geology and ancient architecture of Ireland*. London.

#### **Internet Sources**

- Belfast Newsletter index [internet]  
<http://www.ucl.ac.uk/louisiana.edu/cgi-bin/belfst/Search.cgi>  
 [accessed 6/4/13]
- British Newspaper Archive [internet]  
<http://www.britishnewspaperarchive.co.uk/> [accessed  
 12/03/2015]
- Ordnance Survey 1st Edition Maps [internet]  
<http://maps.osi.ie/publicviewer/#V1,675212,602167,6,0>  
 [Accessed 15/06/09]