Ireland's longest serving millstone quarry? Millstone Mountain in the Mourn Mountains, Co. Down, Northern Ireland

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Abstract: This paper comprises a detailed case study focusing on millstone production in the Mourne Mountains, Co. Down, Northern Ireland, with a specific focus on the quarry located on the aptly named Millstone Mountain on the eastern side of the mountain range. Both medieval and post-medieval production techniques and millstone sizes, which differed significantly, are discussed. Research questions concerning quarry placement, geology, transport and chronology of exploitation are addressed. Discussion of post-medieval economic environment in the northeast corner of Ireland is provided with a distribution of known granite millstones surviving within the wider landscape.

Keywords: Ireland, Mourne Mountains, millstone, quarry, extraction, roughout, transport

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Introduction

Unlike the study of millstone quarries in continental European countries such as France (Belmont 2006) and Norway (Grenne *et al.* 2008), the representation of Irish examples within international academic discourse has been grossly neglected. There has been no excavation of a millstone quarry in Ireland. A total number of twelve are identified in the Republic of Ireland (and therefore granted a basic protected status under the Irish National Monuments Act 2004) by the Irish National Monuments Service (National Monuments Service 2016). Millstone Mountain, located in the Mourne Mountains, Co. Down, is unique amongst the millstone quarries of Northern Ireland in that it is listed as number 0356500000 on the Industrial Heritage Record of Northern Ireland (Northern Ireland Environmental Agency 2016), although this is due to the importance of the place name rather than the industrial activity carried out there. This research as part of a (now completed) PhD focusing on the millstone quarries of Ireland has identified 57 examples on the island of Ireland as a whole. These date predominantly from the post-medieval period, although the arrival and widespread use of milling technology into Ireland by the sixth and seventh centuries AD (Rynne 2011) suggests the production of indigenous millstones from the same centuries onwards.

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The Mourne Mountains

Several areas in Ireland where multiple millstone quarries were worked at an industrial level during the 18th and 19th centuries provide evidence of centres of commercialised production. Millstones were produced for local, national and in some examples, international markets. The Mourne Mountains provides one such case study. These consist of sixty to seventy summits (Evans 1951), which cover an area of 150 km², and are located in the south-east of the Province of Ulster in Co. Down, Northern Ireland (Wilson 2004). Evidence of millstone production was recorded in seven quarries all of which are located in two areas of the Mourne Mountains, one on the western perimeter of the mountains and one on the eastern near the coast (Fig. 1a). The size of these millstone quarries differs dramatically. Some display opportunistic millstone production, where suitable pieces of stone were fashioned into one unfinished millstone still visible in the landscape. Others, such as Millstone Mountain in theest of the Mourne Mountains and Hen Mountain in the west provide examples of extensive industrial zones where large amounts of millstones were produced and where quarries were worked over prolonged periods of time.

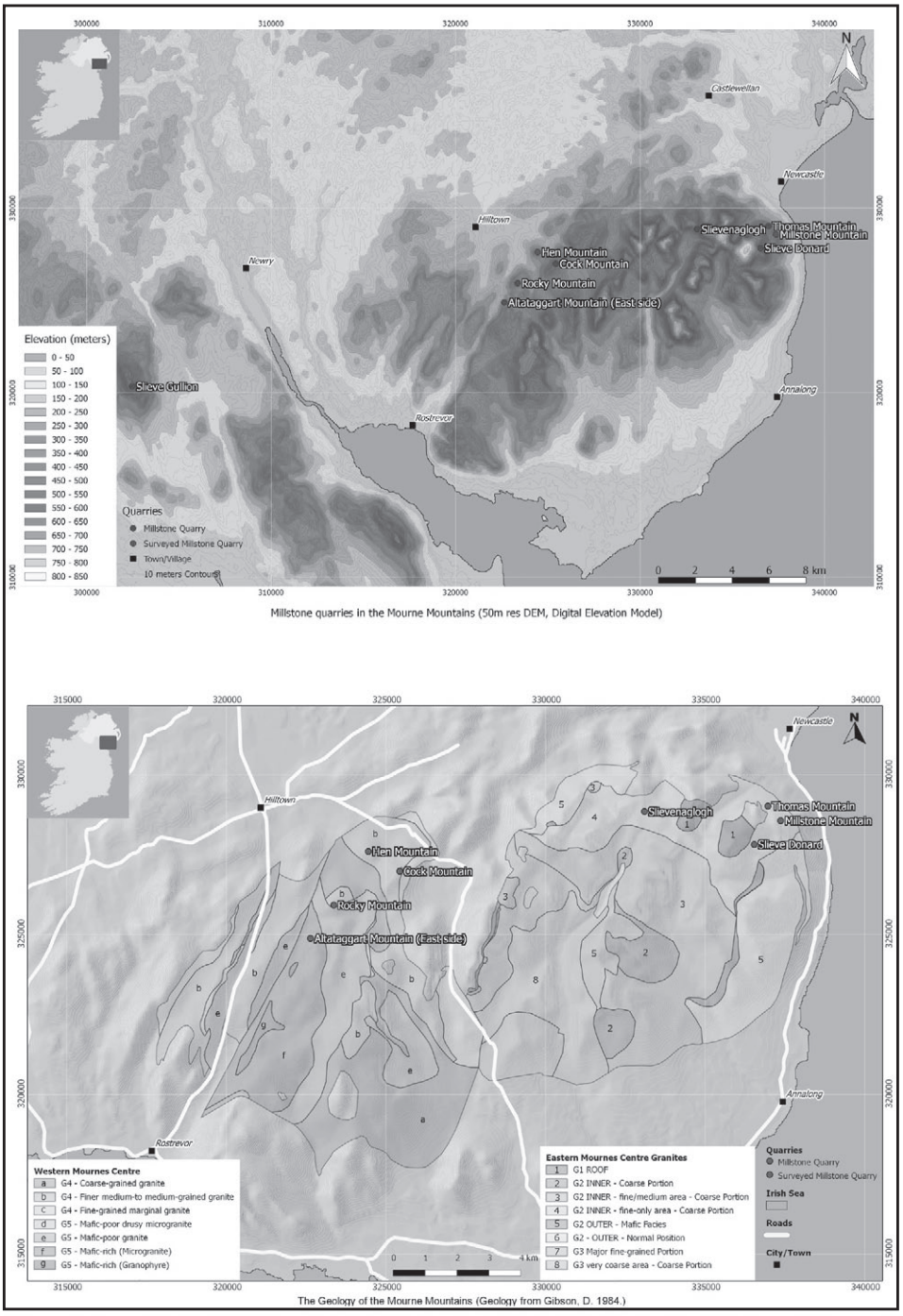

Fig. 1: Digital Elevation Model of Mournes (a) with millstone quarry locations (left) and granite types (b) with millstone quarries locations (after Colfer, 2016, Vol. 2: 99, fig. 7.3.

Geology

The bedrock of the Mournes specifically consists of five distinctive types of granite of between 54 and 56 million years in age, which are referred to as G1-G5 (Fig. 1b). These types are identified according to age, placement and petrographic characteristics and are subdivided into from two to four types of fine to coarse-grained granite (Cooper and Johnson 2004).

G1-G3 constitutes the eastern side of the Mournes and all date to roughly 56 million years ago. The western side contains G4 and G5, which date to approximately 56 and 54 million years respectively (Gibson *et al.* 1995). Over long periods of time the slow process of denudation has revealed the "round, dome-shaped summits" (Rohleder 1931, 161) in the form of granite outcrops at high elevations, such as Slieve Donard, the oldest (G1) and highest outcrop of granite in the Mournes (Moore 2012).

Millstone Quarry Location

The placement of the millstone quarries was in no way arbitrary. Once viewed on a geological map the relationship between the five different types of granite that make up the Mournes and the indigenous millstone industry is immediately apparent. All millstone activity is located in areas of fine or fine-to-medium grained biotite granite, a hard stone comprised of grains of quartz and both plagioclase and alkali feldspar found in the G2, G4 and G5 types (Cooper and Johnson 2004). The granular nature of the stone ensured the millstone would retain a rough grinding face suitable for the processing of cereals (Fig. 2). The fine-to-medium grain size was obviously favoured by the quarry workers for two reasons. Firstly, the stone was easier to cut. Secondly, the smaller grain size in the granite bedrock resulted in smaller pieces of stone breaking off the millstone and contaminating the flour.

The gradual cooling and contraction of the molten magma resulted in both horizontal and vertical shrinkage cracks which are set at right angles (Mitchell and Ryan 1997). Vitally, the horizontal 'joints' occur parallel to the hill slope, a fact that dictates the nature and methods of quarrying in the Mournes. The depth of the 'joints' located in the G2, G4 and G5 types also dictated the placement of quarries, as slabs of bedrock of a similar depth to a millstone would have been of obvious benefit.

Millstone Mountain

Millstone Mountain (located on the eastern side of the Mourne Mountains, overlooking the Irish Sea) was chosen as the focus of the paper presented here due to the array of millstone production techniques still visible, allied to the industrial nature of the quarrying which took place over a wide area. This quarry is also unique in Ireland in that there is evidence of both medieval (7th century) and post-medieval (18th century) millstone manufacture. The name of the mountain itself attests to the importance of the industry in this location. The survey undertaken of millstone production on Millstone Mountain during Spring of 2012 identified the quarry as being primarily post-medieval in date, with surviving evidence of medieval millstone manufacture within the post-medieval industrial zone. This surveyed aimed to establish a chronology of exploitation as well as identifying techniques of manufacture and how these techniques changed depending on the nature of stone procurement.

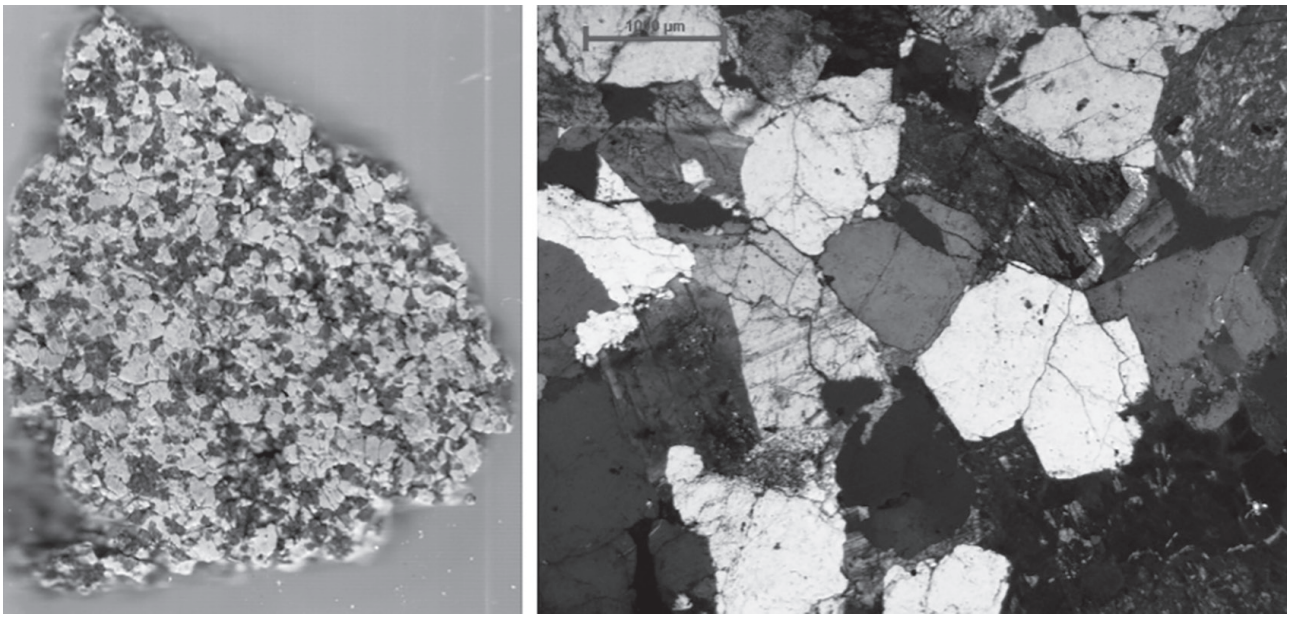

Fig. 2. Thin section of finer-to-medium grained granite used in millstone production in the Mourne Mountains showing quartz and feldspar crystals. Photo: Shane Kenny, School of Earth Sciences, University College Dublin.

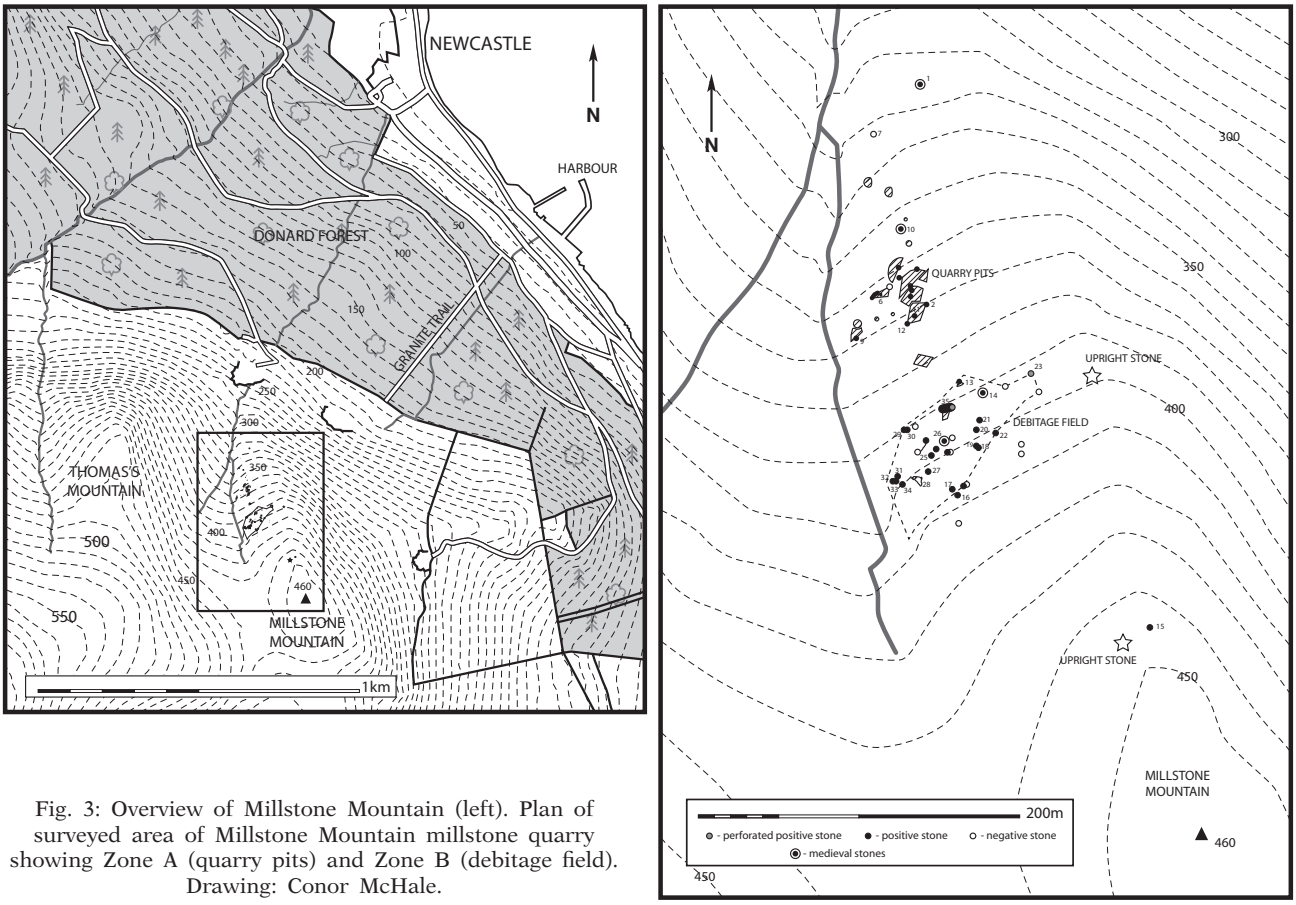

Fig. 3: Overview of Millstone Mountain (left). Plan of surveyed area of Millstone Mountain millstone quarry showing Zone A (quarry pits) and Zone B (debitage field). Drawing: Conor McHale.

Quarry Landscape

Millstone quarrying activity was carried out on the northern and north western slopes of Millstone Mountain between 305 m and 445 m above sea level where the angle of the slope varied between 30 and 45 degrees (Fig. 3).

Two distinct zones were identified with contrasting methods in stone extraction. The first, Zone A, is between 340 m and 380 m OD, and corresponds to a sub-rectangular area containing 14 quarry pits. This area measured approximately 120 m (north-south) by 65 m (east-west) and was located on a steep south-east to north-west slope (Fig. 3). The second, Zone B, was located at a higher level of between 387 m and 412 m OD. Here stone was wedged off the top layers of granite outcrop to manufacture millstones. This area measured approximately 130 m (south-west/north-east) by 50 m (south-east/north-west). The topography differed considerably from Zone A, as there was less bog growth, flooding and outcrops of granite visible throughout. This area also contained a significant amount of debitage associated with millstone production.

Both zones show signs of medieval and post-medieval millstone manufacture.

Fig. 4: Quarry pit with millstone roughout and debris, facing south-east. Photo: N. Colfer.

Post-Medieval Millstone Production

The two areas of millstone production, as defined above, display significant differences in manufacturing methods. This may be an indication that they were not active contemporaneously, although the recorded millstone diameters in both areas indicate a post-medieval date.

Zone A

The quarry pits, which were in the main circular or sub-circular, were dug specifically to gain access to suitable stone for millstone production. There was no uniformity in size, shape or depth. The depth of the pits ranged from 0.5 m to 1.5 m, with larger examples having a diameter of up to 15 m. All the quarry pits were dug into the north-western

slope of Millstone Mountain, with the quarry faces also pointing in a north westerly direction. In some examples up to four layers of granite bedrock had been quarried and in all quarries the debris associated with millstone production was evident, indicating the millstones were shaped within the quarries themselves (Fig. 4). The quarry debris ranged in size and form, ranging from discarded and broken roughout millstones, to rectangular and triangular shaped blocks of stone with visible triangular wedge pits.

All stages of millstone manufacture were apparent in the quarry pits. When a large piece of stone, which was of sufficient depth and quality, as well as being free from flaws, was identified it was detached from the pit face using triangular wedge pits into which levers were inserted. Both horizontal and vertical natural geological joints would have been taken advantage of in this process. Once freed from the parent bedrock the use of straight lines of wedge pits as opposed to curved is essential to this method. This is best identified by a large quarried granite slab (Fig. 5), which has been shaped into a hexagon, with the remains of straight lines of wedge pits visible on all sides. The beginning of an unfinished internal straight line of wedge pits is clearly visible towards its southern end, which if finished, would have resulted in a triangular piece being removed. This process would have been continued on each angular corner of the slab ensuring its gradual reduction in size and transformation to a circular shape.

Examples of millstone roughouts produced by the above process were located throughout Zone A. Once the large slab was reduced in size to roughly that of the intended millstone the process of transforming the millstone preform was started:

Stage 1. The shaping of the faces of the millstone was undertaken. The stone was propped up on three pieces of granite on its western side to make it level while being worked. A trench was then cut through the centre of the millstone, which in one preform millstone measured 0.13 m at its widest point and 0.04 m deep. When discussing the manufacture of American millstones from sandstone conglomerate in 18th and 19th century Kentucky, Hockensmith (2009) refers to these trenches as "levelling crosses" (Hockensmith 2009, 30). After the quarrying of the single trench, or an "I-shaped cross" (ibid. 30), across the centre of the millstone face (Fig. 6), a second trench or 'trough' was then quarried across the millstone perpendicular to the first, dividing the stone into four quadrants and providing reference points as to the desired depth of the millstone face which was shaped using a using long handled doubled sided pick (Agapain 2002) (Figs 6 and 7).

Stage 2. The centre hole or 'eye' was then quarried through half the depth of the stone. This is indicted by an unfinished roughout millstone located on the eastern edge of Area B, which was also located resting on granite blocks (Figs 6 and 7). One face, along with its corresponding centre perforation, was finished. The stone was then turned

Fig. 5: Quarried hexagonal slab with straight line of wedge pits. Photo: N. Colfer.

Fig. 6: Millstone roughout showing use of granite blocks to prop up millstone and 'levelling cross' on top face. Photo: N. Colfer.

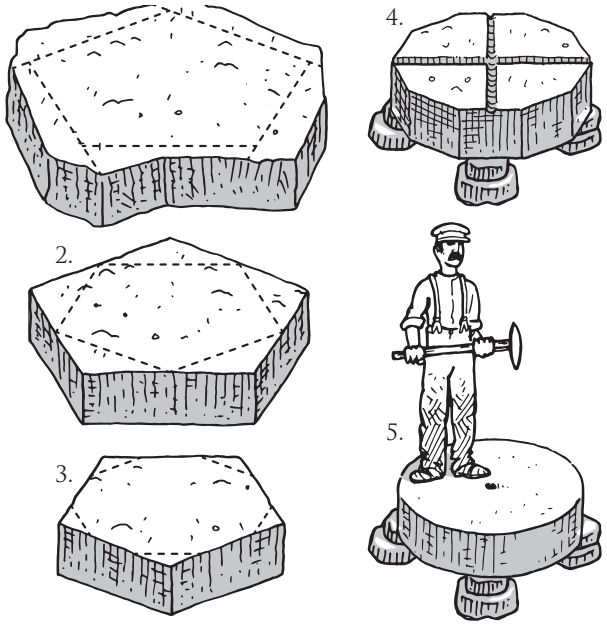

Fig. 7: Reconstruction of method of reducing a slab of granite into a millstone roughout. Drawing: Conor McHale.

over, to be worked on the second side, where the levelling cross as well as pockmarks of the picks were clearly visible.

Stage 3. The millstone was then turned over where the procedure to shape the face was repeated. The second half of the centre perforation was cut.

Stage 4. The sides of the roughout millstone, which would still consist of six to eight straight lines or rectangles, would be reduced and the millstone was given a circular shape.

Zone B

A second source of millstone production was identified on Millstone Mountain approximately 50 m south of Zone A. This sub circular area is located between 387 m and 412 m OD (Fig. 3) and differentiated from the area containing the quarry pits due the nature of stone procurement as well as the density of millstone roughouts with associated debris, which indicated production at a more industrial level. One millstone was also located at 444 m OD near the peak of the mountain.

All stone used in millstone manufacture in this second area was quarried from the upper layer of granite bedrock with the exception of one small quarry pit at the 390 m OD gradient. There were two significant differences in methodology when compared to production in the quarry pit area:

1. The use of curved and semi-circular lines of wedge pits was evident throughout Zone B. Five roughout millstones were located directly beside their curved negative impression on the parent bedrock, with wedge marks still visible. In one example, a large semi-circular line of wedge pits is visible with the outline of a smaller millstone inside it (Fig. 8), an obvious aborted effort to remove a large circular slab that was perceived as being free of flaws. This slab is the only example where the working of different stages of production (i.e. the removal of the slab and the smaller intended millstone) at the same time was evident.

2. The use of lines of horizontal wedge pits, or 'stitching', to decrease the depth of the slab being worked to that of the intended millstone was also recorded.

The evidence suggests that once the stone was quarried from the bedrock the process of shaping the millstone was identical to that described above in the quarry pit area, apart from the edges of the millstones being already rounded. This would have decreased the amount of stone working considerably and would have been a more efficient methodology, negating the work needed to decrease the size of a large slab of bedrock through straight lines of wedge pits.

Unlike Zone A, where debris was largely contained within the quarry pits pieces of granite associated with the production of millstones is at a high volume throughout Zone B. A second dissimilarity is that all the debitage had a universal shape (Fig. 9). All were roughly sub-triangular with the longest side of the triangle being heavily curved, indicating they had been taken directly off the intended millstone. The curved edges of the debitage measured between 0.5 m and 1 m in length. The high volume of sub-triangular debris suggests that the use of semi-circular lines of wedge pits with which to free slabs from the parent rock, after which triangular pieces were removed to reveal the circular shape of the preform millstone, was prevalent in the production process.

Fig. 8: Use of circular lines of vertical wedge pits or to produce semi-circular slab of stone. The intended millstone shape is also visible within the larger circle. Photo: N. Colfer.

Quarry Organisation

Three examples of platforms, consisting of stone debris were identified within three quarry pits in Zone A. These were all located towards the back (or opposite side to the face) of the quarry. These platforms would have had the dual function of providing a surface on which to work stone on/against and also a use for the discarded stone. These ranged in size from 0.75 m by 2 m to 1.25 m by 2.3 m in height and length respectively. The stone used to construct these platforms consisted of broken rubble, longer rectangular pieces with visible wedge marks as well as broken rough out millstones (Fig. 10).

Two large upright stones were located in the vicinity of the surveyed area at 400 m and 445 m OD. There was no correlation between their size and shape. The lower example had a sub-triangular shape and measured 0.95 m in height and 1.05 m at its base. The second stone was rectangular and measured 1.1 m in and only 0.2 m in width (Fig. 11). Although their use, if any, is uncertain, they suggest the organisation of space within the quarry, possibly marking a certain point of ownership, or area of a layer of stone of suitable depth. Alternatively, they may have been utilised in the actual manufacture of millstones, possibly as something to lean the stone against in a vertical position when being worked (a practiced utilised in the post-medieval millstone quarries of southern Spain (Anderson 2016). Further examples have also been located in the Mourne Mountain complex at Thomas Mountain and Hen Mountain in post-medieval contexts. There is no evidence to suggest a ceremonial or ritualistic function.

Fig. 9: Millstone quarry debris in Zone B, facing south-east. Photo: N. Colfer.

The lack of surviving formal structures in the vicinity of the quarry suggests the quarry workers did not stay at the quarry for long periods of time and that the work did not take place during the harsh conditions of the winter months. In the case of millstone production at Millstone Mountain, the quarry workers came from the coastal town of Newcastle (Evans, 1951), which is situated 1.2 kilometres north/north-east of the quarry, from where the men made the steep climb to between 300 m and 400 m OD for a days work.

Fig. 10: Quarry platform, facing north-east. Photo: N. Colfer.

Fig. 11: Upright stone in Millstone Mountain quarry, facing north-east. Photo: N. Colfer.

The use of some form of temporary shelter by the quarry workers is likely. Johnston (2012) suggests the use of dry stonewalls as shelters at the millstone quarries of Inglesborough in Yorkshire. It is possible the above mentioned quarry platforms on Millstone Mountain, which measure only 0.75 and 1.25 m in height, could have served the dual purpose of both platform and one half of a shelter, comparable to those used at La Ferté-sous-Jouarre in France as a "stone dressers' shelter" (Ward 1993, 41).

Transport

Evans (1951) describes how the millstones were "laboriously sledged down the rough mountain sides" (Evans 1951, 155) of Millstone Mountain during the mid-19th century. The sledge alluded to here is known in the Mournes as a 'slype' and was used to transport all types of quarried granite off the mountains. This method entailed placing the millstone horizontally on the slype, which was then slowly moved down the hillside with a horse harnessed at the front to pull and one at the back to act as a break (Russell 2011).

A very similar method is discussed by Conry (1999) to transport an edge runner stone in Ballinvally, Co. Carlow, Ireland, in 1876. In this instance the slype was referred to as a "skid" (ibid. 39) and like its equivalent from the Mourne Mountains was made from the forked bough of a bush or tree (Fig. 12).

The building of a harbour at Newcastle in the early 19th century roughly one kilometre north-east of the millstone quarry provides an obvious link to maritime transport (Fig. 3). It is highly likely the transporting of millstones would have been in a north-easterly direction from the quarry towards the harbour, although no route has been found in this area.

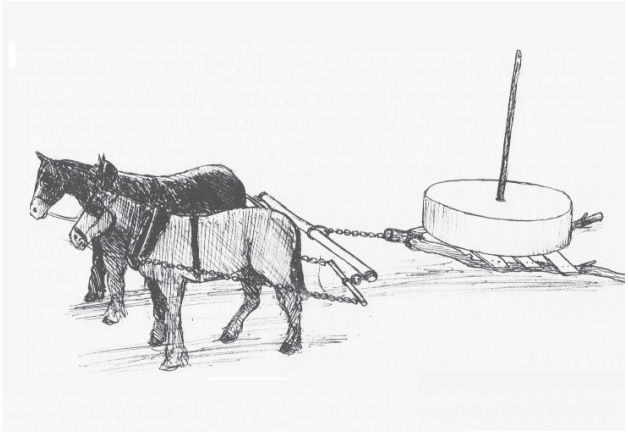

Fig. 12: Transporting a millstone on a 'slype' (after Conry 1999: 39, fig. 5.2).

Post-Medieval Historical and Social Background

Historical evidence attests to the millstone industry in The Mourne Mountains as reaching its economical peak between 1700 and 1850. The earliest known reference to millstone quarrying in the Mourne region comes from the 1744 work The Antient and Present State of the County of Down, which provides the information "in Slieve Donard are quarried Mill-stones" (Harris 1744, 125). Although only a brief reference to a quarry abutting Millstone Mountain on its west side, it provides affirmation of an economically important industry.

This reference to millstone production made by Walter Harris in 1744 identifies the millstone industry was active in the eastern Mournes when William Annesley purchased the Newcastle estate

(which included Millstone Mountain and surrounding mountains) from Edward Matthews in 1749 (Russell 2007). The building of a pier at Newcastle by Richard Annesley in 1807-8 (Russell 2007) provided an outlet for the transportation of quarried stone items, such as millstones (Evans 1951).

Eighteenth century economic changes relevant to millstone production in The Mournes included an increase in population due to the industrialisation of the linen trade (McCutcheon 1980), the introduction in 1758 of bounties on the carriage of flour to Dublin and the rise in wheat export to England (Whelan 2011). A discussion of the mills of Co. Down is included by Dubourdieu (1802 255/6) who states:

... watermills are most in use but there are also several windmills in this county, for grinding all types of grain...Very extensive flour mills have been erected in different places in the county.

The presence of 245 mills in Co. Down on the 1st Edition Ordnance Survey maps of the 1834 (Hogg 2008), indicate a county in which milling was at the heart of both the economic and social life in the mid 19th century and provides a context for the development of the millstone industry. Although a high percentage of these (approximately 100 in number) were involved in the linen trade, the use of 'edge runner stones' (an object defined by Tucker (1985) as a millstone type), in the processing of flax (Feehan 2003) suggest their manufacture in the surveyed quarries, as the first mills dedicated to the processing of flax for the production of linen appeared in the north of Ireland in the first quarter of the 18th century (McCutcheon, 1980).

The importance of grain milling in Co. Down can be accredited to a number of factors, including its sheltered, dry climate making it "one of the most important grain-growing areas in Ireland" (Green 1963, 36). Co. Down had the highest number of windmills in Ireland with over 100 marked on the Ordnance Survey 1st Edition maps of the 1830s and 1840, the vast majority of which were producing oatmeal and flour (McCutcheon 1980).

The presence of a number of granite millstones still visible in the landscape today provides a legacy of the millstone industry in the north-east of Ireland (twelve locations are currently known, some with multiple millstones) (Fig. 13). Many examples are in a milling environment, such as at and Annalong Mill, which is situated on the coast on the eastern side of the Mournes (Fig. 14). The lack of historical references to millstones from this area being sold elsewhere allied to the number of granite millstones in the Co. Down area suggests an industry that was localised but continued over a long period of time. This could possibly be due to the fact that granite was relatively unsuitable for cereal grinding as it wore done at a faster rate than

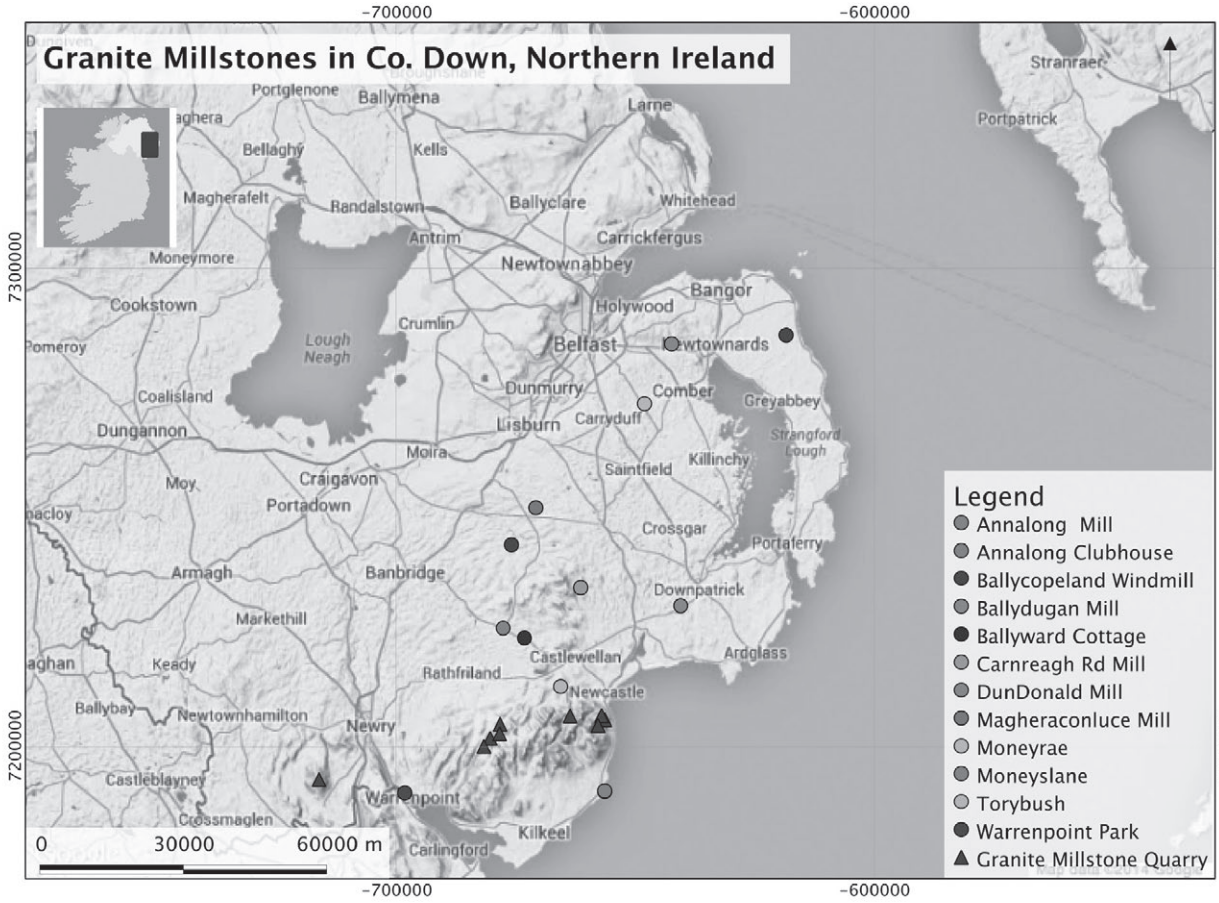

Fig. 13: Distribution of surviving granite millstones in Co. Down, Northern Ireland.

Fig. 14: Granite millstone from the Mourne Mountains in the restored watermill at Annalong, Co. Down. Photo: N. Colfer.

sandstone conglomerate. The latter bedrock was quarried in both south-east and north-west Ireland to some commercial success, with millstones from both regions sold in the north-east (the location of the Mourne Mountains) during the 18th and 19th centuries (Colfer 2016).

Medieval Millstone Production

Recognition of the value of the millstone quarry as a place of significance and the millstone as an item of extreme value from the early medieval period onwards is suggested by stories that have survived as part of Irish folklore and hagiography. The Life of St Bridget, written by Cogitosus in the mid-7th century, is the earliest known example of this:

Once, the prior of the greatest and most celebrated monastery of Saint Brigit…sent workers and stone-cutters to look for a stone and chisel out a millstone wherever they could find one. Without any previous knowledge of the route, they went up a very difficult and a steep road and reached the top of a rocky mountain. And cutting it all the way round, they fashioned it into a circular and perforated millstone (Connolly and Picard 1987, 24-25).

The identification of Mourne granite in the production of the pair of the late 8th century millstones uncovered 50 kilometres north-east of the Mourne Mountains at Nendrum monastery on Strangford Lough, (Meighan 2007), consolidates the theory that this bedrock would have been recognised as suitable in the manufacture of millstones from the introduction of milling technology to Ireland in the 7th century (Rynne 2006). The stone quarried for these millstones was identified as coming from a quarry only two kilometres south of Millstone Mountain (Meighan 2007). These millstones constitute the singular examples of medieval millstones on the island of Ireland that have been provenanced to their quarry of origin.

McErlean (2007) lists 33 Irish sites where early medieval millstones have been identified, with all examples measuring between 0.55 m and 1.06 m in diameter. The five proposed medieval millstones located on Millstone Mountain vary in diameter between 0.75 m and 1.05 m, with an average of 0.92 m placing them squarely within this range.

Evidence for the production of five medieval millstones was identified during the archaeological survey. All were located within the boundaries of the post-medieval/early modern millstone quarry site (in both Zones A and B) and were in the process of being extracted from loose slabs as opposed to bedrock (Fig. 3).

There were two factors that differentiated the early medieval millstones from the post-medieval type and enabled their identification. Firstly, their size was considerably smaller. This mirrored the smaller and less powerful type of watermill in which they were used where channelled hydraulic force was sufficient to drive a large millstone of around 1 m in diameter (McErlean 2007). Secondly, the method of production was vastly different.

Unlike their post-medieval counterparts where wedge pits and metal wedges were used to extract the roughout millstone, the earlier millstones were produced by marking out the intended millstone on a loose granite slab the width and depth of which was as close to that of the millstone being produced. The evidence recorded suggests there were two ways of removing the excess stone surrounding the millstone.

a. This was achieved by cutting a U shaped trench around the millstone and then a series of straight trenches, perpendicular to the circular trench, dividing the excess stone into removable parts. The completion of the trenches would, in theory, produce the desired roughout millstone (Fig. 15a).

b. Here a loose slab with a sub-rectangular shape had been chosen to be worked the width of which roughly matches that of the intended millstone, negating the need to cut stone from the northern and southern sides. The eastern and western sides, which have considerable excess, are removed by cutting a single trench on both sides (Fig. 15b).

There was a slight variation in the sizes of the trenches cut around the intended millstones. Two examples had trenches, which partially or fully enclosed the intended millstone and measured 4 cm wide and 3 cm and 5 cm deep respectively. The examples where trenches were needed only on the eastern and western sides of the intended millstone were considerably wider (up to 12 cm) and 5 cm in depth.

The use of a pick is indicated by three consistent rows of cutting on both sides, which measured 20 m to 30 cm in width. The use of trenches in the production of medieval millstones was recently recorded at the Serre Mountain range of the French Jura (Jaccottey 2012). Describing the cutting of the trench with a pick as being carried out in stages, the writer states

... a first segment is cut in one direction while the second segment, which joins the first, is cut in the opposite direction. This change of direction allows the quarryman to benefit from more working space… To cut the trench, the quarryman used three passes: two on each side and one in the middle to remove residual stone (Jaccottey 2012, 302).

The depth of the millstone was determined by the depth of the slab or joint of bedrock, which had previously, and naturally, detached from the bedrock. This is echoed in medieval millstone production centre at Hyllestad in Norway where millstones are cut and removed with the aid of the cleavage plane for the schist bedrock (Grenne *et al.* 2008). Once the millstone roughout was removed from the slab the stone was then shaped.

Archaeological Survey Data and Chronology

A total of 29 preform or roughout millstones were located during the survey of Millstone Mountain (Fig. 16). Five were deemed to be medieval. All were at various stages of production and were associated with large amounts of millstone manufacture debris. The majority of the evidence recorded on Millstone Mountain represents the last vestiges of the millstone industry in this region. All the millstones, apart from one example adhere to the description of 'cylindrical', although as unfinished millstones a convex shape may have been intended for an unknown number of examples.

The average diameter of the 23 post-medieval or early modern millstones in both areas of the quarry was 1.53 m indicating a late 18th or 19th century date (Sass 1990). Of the 23 millstones, 18 examples measured in between 1.5 m and 1.7 m (4.9 ft and 5.5 ft), a possible indication that millstones were being manufactured to standardized sizes of 5 ft and 5.5 ft. This date is reinforced by the only historical quote to millstone manufacture in the Mourne Mountains, which was written in a 1744 in reference to quarries on Slieve Donard (Harris 1744, 125), a mountain abutting Millstone Mountain to the south.

The presence of early medieval millstones at Millstone Mountain would indicate over a thousand years of production, although it is not known if

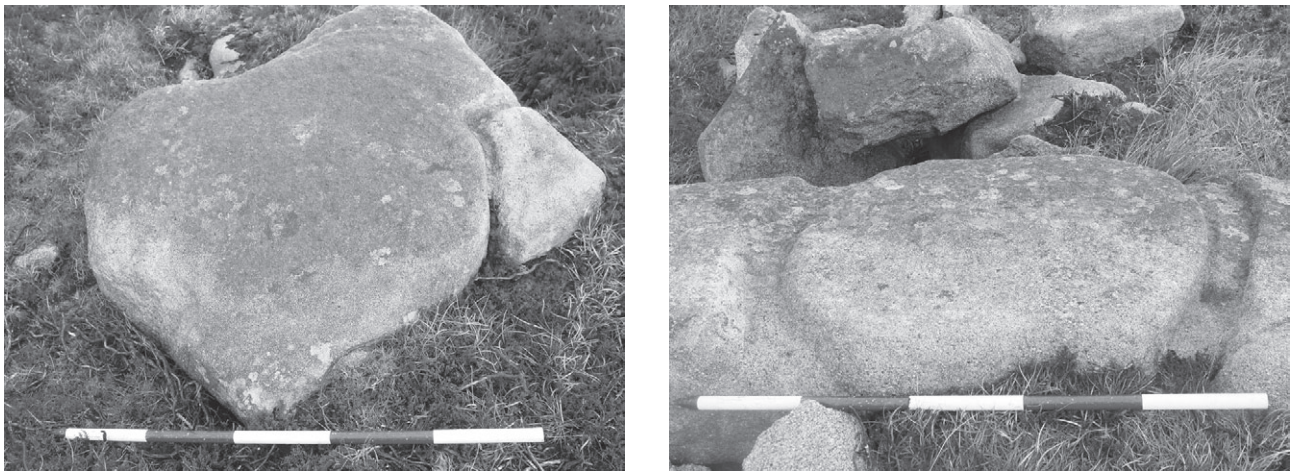

Fig. 15a and b. Medieval millstone production showing trench method. Photo: N. Colfer.

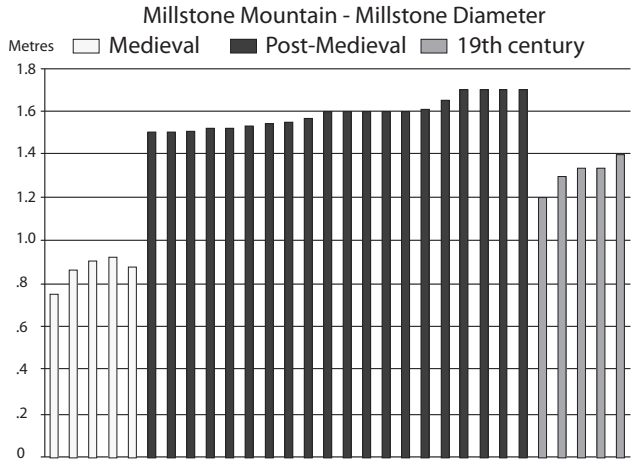

Fig.16. Millstone diameters and dating in Millstone Mountain.

this was continuous. The uniformity in sizes of post-medieval millstones in both Zones A and B hinders the development of a theory considering the progression of use. The fact that Zone B shows a far higher industrialisation of manufacture may indicate a possible later date, but also, the rounded nature of the lines of wedge pits may be dictated by the fact the stone was quarried directly from the surface, thus enabling this method of production. This is in contrast to the nature of stone procurement in Zone A, where stone has been taken from pits in slab form, which dictates the use of straight lines of wedge pits.

Conclusion

The physical remains as evident in the quarries located portray an industry of substantial size and importance, one that through unique geological characteristics provided the inhabitants of the Mourne Mountains with an additional way of making a living as quarry workers. The typological evolution of millstone manufacture techniques since the 8th century is clearly evident on Millstone Mountain, as well as the intricacies of 18th and 19th century production. The use of the 'trench' technique to cut medieval millstones is the only known example on the island of Ireland where this has been recorded. The manufacturing change made from the straight line wedge pit method to the curved line variety denotes a progression during the post-medieval period that enabled a heightened industrialisation of millstone production on Millstone Mountain.

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