

Lambay lithics: the analysis of two surface collections from Lambay, Co. Dublin

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Abstract

Two collections of unsystematically surface-collected lithics from the island of Lambay, Co. Dublin, were analysed using an integrated methodology focused on a Geographical Information System-based approach, incorporating a number of analytical perspectives. Analysis and mapping of this material provides an important new perspective on prehistoric human activity on the island. Assessment of the diagnostic artefacts demonstrated the presence of human activity during the Later Mesolithic and it seems very likely that people were present on Lambay from the Early Mesolithic. There were a number of significant individual assemblages and two of these are discussed in detail. Widespread activity across the island has also been revealed as well as the persistent use of key locales over long periods. The study provides an important complement to the results of the excavation at the Neolithic axe-quarry site on the island at the Eagle's Nest as well as a consideration of Lambay's context and long-distance contacts in the wider Irish Sea region.

Introduction

Lithics are the most resilient, widespread and ubiquitous form of archaeological evidence available to us from prehistory. The study of these stone artefacts can illuminate many aspects of prehistoric peoples' identities, beliefs, rituals and technological practices (e.g. Binford 1973; Edmonds 1995). Their significance is as everyday objects seen, made or used by people living in Ireland over at least six millennia. Surface collections of lithics played a large part in the early development of archaeology as a discipline in Ireland and large antiquarian assemblages were amassed (e.g. Woodman *et al.* 2006). However, with the development of excavation approaches, the widespread collection of artefacts became generally less significant and popular as a field methodology. Nonetheless, collection did continue (e.g. Stacpoole 1962) and from the 1970s onwards there has been a recognition of the value of a research-orientated approach to surface scatters, for example, in understanding the distribution and location of Mesolithic material (e.g. Woodman 1978; Anderson 1993; Warren *et al.* 2009; see also Hodgers (1973, 1975, 1979, 1994) work in the coastal areas of Co. Louth)). Following on the international development of systematic field-walking methodologies (e.g. Schofield 1991a, 2000; Bintliff *et al.* 2000), the 1980s and 1990s saw the large-scale Bally Lough (Green and Zvelebil 1990; Peterson 1990; Zvelebil

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et al. 1992) and Lough Swilly surveys (Kimball 2000); the smaller scale Mount Oriel (Cooney 1990) and Red Mountain surveys (Cooney and Brady 1998); and a number of graduate theses (Cafferkey 1996; Collins 1997; Cross 1991; Guinan 1992). Brady (2007a, 2007b) has recently completed a field survey of the Brú na Bóinne area, which has added significantly to our understanding of the earlier prehistory of this key area; advanced the methodology of systematic collection and analysis of plough-zone scatters; and provided a valuable overview and summary of previous work.

Recent research then has concentrated on systematic field-walking surveys. The present paper however deals with the combined analysis of two unsystematic surface collections from Lambay, an island in the Irish Sea off the Dublin coast. It is an attempt to maximise the knowledge gained from a problematic archaeological resource and to demonstrate the value of surface collections in providing a landscape perspective that complements that available through excavation. Understanding unsystematic collections inevitably requires individually tailored methodologies. From a historical perspective, the dominance of unsystematic compared to systematic collections—in the United Kingdom (Schofield 2000; Smith 2005) and in Ireland (see discussion in Woodman *et al.* 2006; Brady 2007a)—means that innovative approaches and case studies are needed to facilitate the interpretation of the value of unsystematic collections. In the case of the analysis of the Lambay collections, a varied suite of methodologies were utilised. They were integrated through a Geographical Information System (GIS)-based approach and incorporated traditional artefact analysis, beach pebble survey, spatial and statistical analysis. The objective of the analysis was to recognise and deal effectively with specific taphonomic problems; maximise the archaeological potential of the collections; and provide a complementary and broader landscape perspective to the data coming from excavations and other surveys on the island.

Background

Lambay (Pl. I) is the largest island off the east coast of Ireland. It lies approximately 4km off the Dublin coast, east of Portrane, about 10km north of Howth and Ireland's Eye (Fig. 1). Current settlement on Lambay is focused on the western lowland area, which makes up about one-third of the island. This area faces the mainland coast of Ireland and has the safest landing places and the thickest soil cover. The rest of the island is higher, more exposed and has frequent rocky outcrops. Much of the island is composed of a suite of volcanic rocks. Lambay, and the rocky foreshore of the mainland at Portrane, are believed to be the remnants of a volcanic island, which was created from a muddy sea bed by eruptions of basaltic and andesitic lava during the late Ordovician period. The oldest rocks on the island are the sea-floor sediments (mudstones and shales), which occur on the north-west and south-east coasts. On the south-east coast there are also shallow water limestones, representing the fringing calcareous reef of the volcanic island. There are three distinct groups of igneous rocks. Later the Ordovician rocks were folded and faulted by the Caledonide orogeny. In one location in the north-west (Broad Bay), these rocks were overlain by red sandstone and conglomerate of probable Carboniferous age. The western low-lying area of the island is extensively overlain by glacial till of Midlandian Cold Stage date (Stillman 1994). The coastline is



PL. I—Lambay from the east. (Photo: Rob Sands.)

largely precipitous except on its western and south-western sides and a low rocky stretch at Carrickdorrish in the north-east.

Lambay has a long if punctuated history of archaeological enquiry. In the nineteenth century there were finds of worked flint (e.g. Seymour 1896) and an Iron Age gold strip, allegedly found with an iron sword (Raftery 1983, 279–80). In the Keiller-Knowles Collection there is a small patinated flint blade labelled Lambay 1908 (Woodman *et al.* 2006, 49; KK07968). Wall construction at the harbour in 1927 revealed Neolithic activity and Iron Age crouched inhumation burials (Macalister 1929; Rynne 1976; Herity 1982; Raftery 1994). In the 1940s Mitchell (1990, 48) collected lithics on the island and recognised the presence of a large univallate promontory fort at Scotch Point, in the north-west corner of the island, west of the trivallate promontory fort at Gouge Point (also known as the Garden Fort) surveyed by Westropp (1922). Ó'Flóinn and Cherry (1992) excavated a burial west of the nineteenth-century chapel, which is located on top of, or close to, the medieval church that served the island community. The fauna and flora of the island was the subject of an intensive survey in 1905 and 1906 (Praeger 1907).

Collection and analysis of the lithic collections, which are the subject of this paper (Dolan 2005; 2006), were undertaken in the context of a wider archaeological project being carried out by one of the authors (Cooney), aimed at understanding the long-term settlement history of the island. The initial focus of this work was the recognition of a Neolithic axe quarry and production site at



FIG. 1—Lambay and some other locations mentioned in the text.

the Eagle's Nest (e.g. Cooney 1998, 2004a, 2005) utilising porphyritic andesite (porphyry). This has been complemented by other excavations (Cooney 1996, 2002, 2003a) and a range of survey approaches, which is providing the basis for a new understanding of the pattern of human settlement on Lambay (Cooney 2009). One notable landmark is the prehistoric hilltop cairn at Knockbane (Pl. II), one of a number of cairns on the island. Looking from Knockbane, the wider Irish Sea setting of Lambay and its potential significance in the long-term settlement history of the island is very clear (Cooney 2004b). From the island there is a commanding view of the Irish coastline with the Mourne and Cooley mountains visible to the north, the Dublin/Wicklow mountains dominating the land horizon to the south and Snaefell on the Isle of Man can be seen to the north-east in clear weather.



PL. II—View of Knockbane from the harbour (centre of picture, on skyline). (Photo: Brian Dolan.)

Collection, taphonomy and methodology

Two separately collected, unsystematic assemblages were examined: one consisting of material collected by Cooney and his team between 1992 and 2005 (Collection 1: 493 artefacts) and a smaller group collected by Beatrice Kelly over a similar period (Collection 2: 156 artefacts). The two collections were gathered during walks covering the whole island (Fig. 2), although some areas would certainly have been visited more than others. Areas known to produce finds, areas of broken ground and the accessible coastal zones were visited repeatedly. The detail of spatial information for finds was variable; ranging from detailed provenances, with specific national grid references, to more general provenancing to an area on the island.

Collection strategies can introduce significant biases in surface collections but when they are recognised it is relatively straightforward to take them into account during interpretation. On Lambay, the variety of unusual taphonomic processes operating on the lithics were a far more complex problem. The majority of artefacts in Collections 1 and 2 were exposed by rabbits: Lambay has a fluctuating population of rabbits (estimated at over 15,000 in 2005) and their burrowing has caused significant disturbance of subsurface artefacts. Historically, it is known that rabbits were initially introduced as a commercial resource in the medieval period (McCormick 1999). Rabbit activity tends to be concentrated in areas of deeper soil,

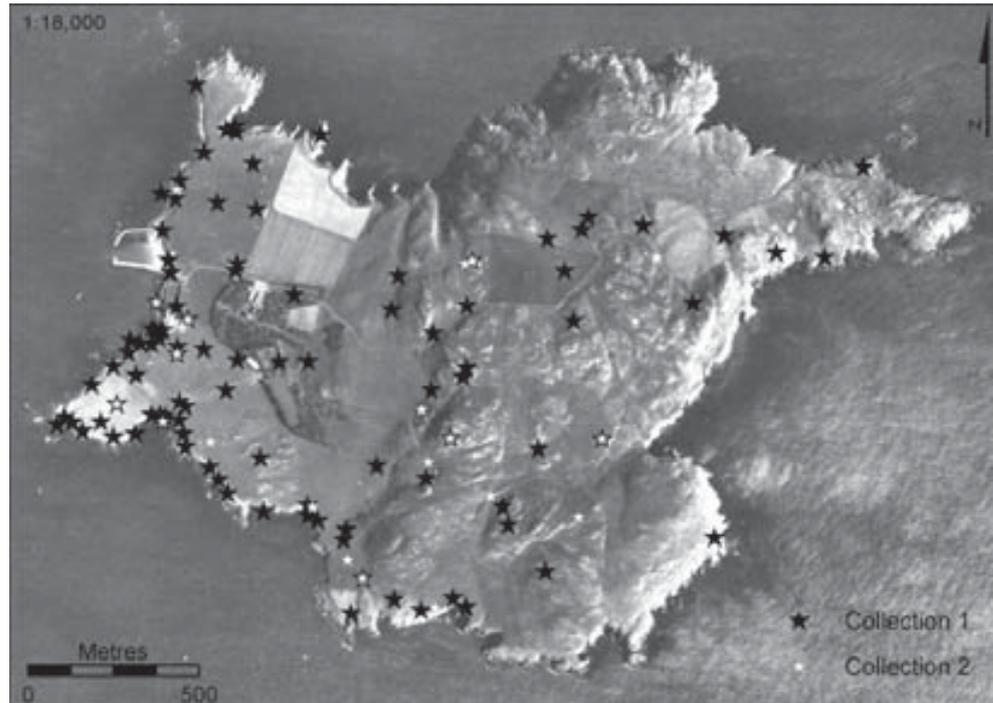


FIG. 2—Map showing the spatial extent of collections 1 and 2. © Irish Air Corps/Government of Ireland.

particularly sandy areas on the western shore and where the glacial till is thickest. However, it is also widespread, if less dense, across the rest of the island and is absent only in areas of particularly thin soil. Other significant processes exposing material include coastal erosion along the western and south-western coasts and cattle erosion on tracks and at field gates.

None of the collected artefacts on Lambay have come from an active plough-zone but evidence of medieval (in the form of plough pebbles (see Brady 1988; Dolan 2006)), and later ploughing in some parts of the island (Cooney 2002), particularly in the lower, western area, means that at least a portion of the ‘total assemblage’ has been affected by this process. Spade cultivation may have had an effect on a larger proportion of the assemblage. Evidence for this practice can still be seen in the widespread occurrence of lazy beds on the island and it is clear that it was common on Lambay in the nineteenth century, certainly in upland areas (see Cooney 2003b). There is a lack of research into the effects of spade cultivation on subsurface archaeology but it seems likely to have caused some lateral movement, particularly downslope, though not over substantial distances. While these diverse taphonomic processes will certainly have considerably disturbed the artefacts being discussed here, research into the effects of modern ploughing (e.g. Schofield 1991b) and other relevant processes (e.g. Barclay 1994; Holdaway *et al.* 1998; Dolan 2006) suggest that non-local archaeological patterns, at an island-wide scale, will have survived and can be accessed through appropriate methodologies.

For the Lambay collections, a GIS was used to combine spatial, topographical and artefactual information. Artefacts were amalgamated into ‘assemblages’ if they were from the same find-spot. Find-spots consisted of specific national grid co-ordinates which were assigned graded confidence levels depending on the quality of the spatial information associated with them (see Table 1 for details). This allowed visual representation of the spatial accuracy of the data (Fig. 3). Individual artefacts were subject to macroscopic morphological examination according to a standard descriptive system designed to assess the character of primary and secondary technology within the overall assemblage of the lithic material (Dolan 2005). A pebble survey of all the accessible pebble beaches on the island was undertaken to address questions relating to raw material availability.

The GIS allowed an integrated approach to the methodologies utilised in the analysis. It facilitated rapid and efficient interrogation, interpretation and presentation of the results of the analyses. The ability to view any aspect of the spatial, topographical or artefactual data in any combination, almost instantly, was a powerful interpretive aid that allowed sophisticated treatment of the database, visual identification of archaeological patterns and clear presentation of the data.

Character of the assemblage

While the ‘total assemblage’ is composed of material from two separate collections, comparison of the two makes it clear that they can be looked at as a whole. The collections overlap spatially (Fig. 2), with shared find-spots. Furthermore, the character of the technologies, the broad range of the collections and the raw materials used in both are remarkably uniform (Dolan 2005). This suggests that collection biases are not a serious factor in comparing the two. They present a surprisingly consistent view of the overall character of prehistoric lithics on Lambay, hence allowing their analysis as a single ‘total assemblage’ (Table 2).

TABLE 1—Grading of spatial information.

<i>Grade</i>	<i>Criteria</i>
1	Finds likely to be associated with each other. Location certain. Located using hand-held GPS to specific grid co-ordinates or can be located to within a few metres on the map.
2	Finds likely to be associated with each other. Location not entirely certain. Plotted on a field map but not close to landmarks.
3	Finds possibly associated with each other. Located to a specific locale. A central grid co-ordinate has been set for the locale. Finds may not have come from this exact spot but from no more than tens of metres away.
4	Finds unlikely to be associated with each other. Located to a general area on the island (For example a field or a hill slope). A central grid co-ordinate has been set for finds from this area but it is not known where exactly they were picked up.
5	Finds unlikely to be associated with each other. Located to a specific area of a beach, fresh finds. These finds are likely to have been eroded from the shoreline nearby.
6	Re-deposited material. For example finds located to a beach and very rolled or finds from paths which have been renewed with material from beaches.
7	No spatial information.

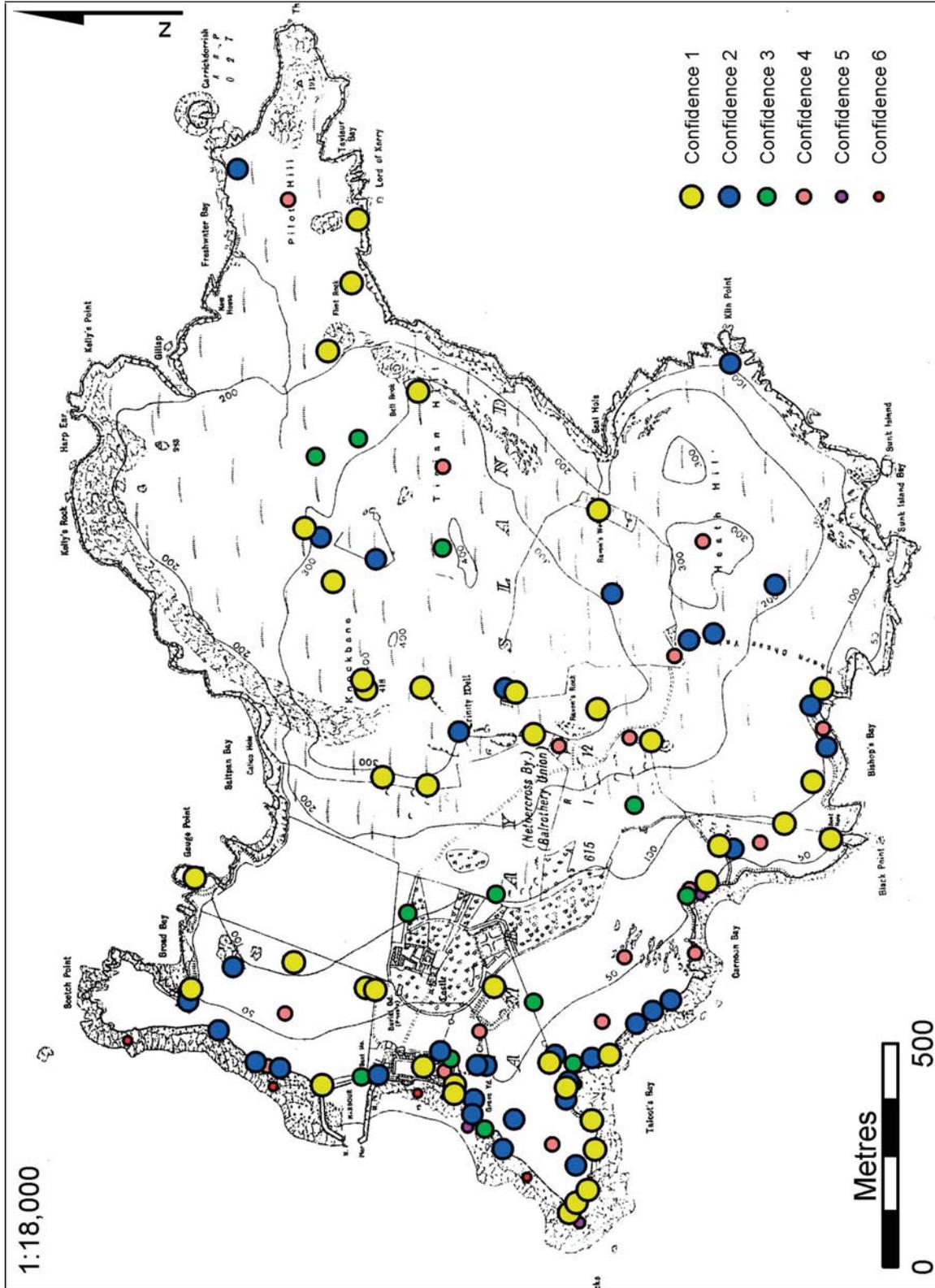


FIG. 3—Map showing confidence level of spatial grading. (Confidence grade 1 equals high confidence, grade 7 has no spatial information.) © Ordnance Survey Ireland/Government of Ireland. Copyright Permit No. MP 001610.

Some 119 assemblages (649 artefacts) were identified ranging in size from single artefacts to over a hundred individual finds. Here the overall character of the collections in terms of raw materials, condition, primary technology and secondary technology is discussed. Assemblage 10, which is by far the largest assemblage, and Assemblage 11, the second largest, are also discussed.

Raw materials

The surface collections from Lambay are overwhelmingly dominated by flint (over 96%), while some quartz and other materials are also represented. Recognising that collection bias against non-flint raw materials may be a factor, the dominance of flint appears to be a real phenomenon and is paralleled in the majority of surface scatters analysed in Ireland (Brady 2007a, 108). The pebble survey of Lambay’s coast confirmed that flint pebbles are available on a number of beaches, varying in size up to 80mm in maximum dimension. Larger pebbles between 60mm and 80mm in diameter are restricted to two beaches on the western side of the island, south of the harbour (Dolan 2005). Flint also occurs in Lambay’s glacial till but survey of exposed sections suggests that it is too small to be usable. It is clear that flint nodules from coastal beaches were an important resource in Dublin, Meath and Louth (e.g. Stacpoole 1962; Hodgers 1994; Guinan 1992; Brady 2007a). Analysis of the size of artefacts in the assemblage shows that, with possibly one significant exception, all of the flint collected from Lambay could have been produced from local sources (Fig. 4).

TABLE 2—Summary of total assemblage.

<i>Primary technology*</i>	<i>Qty</i>	<i>Percentage of total assemblage</i>	<i>Retouched artefacts/ Secondary technology</i>	<i>Qty</i>	<i>Percentage of total assemblage</i>
Regular flake	221	34.1%	Butt-trimmed Flake	2	0.3%
Irregular flake	146	26.9%	Leaf-shaped arrow-head	1	0.2%
Bipolar flake	3	0.5%	Notched flake	1	0.2%
Indeterminate flake	15	2.8%	Retouched blade	4	0.6%
Chunk	74	11.4%	Retouched flake	30	4.6%
Blade	50	7.7%	Serrated blade	1	0.2%
Chip	10	1.5%	Indeterminate retouched tool	1	0.2%
Pebble	7	1.1%	Scraper: concave	2	0.3%
Indeterminate	7	1.1%	Scraper: convex	11	1.7%
Cores	50	7.7%	Scraper: complex	1	0.2%
—	—	—	Scraper: end	2	0.3%
—	—	—	Scraper: irregular	5	0.8%
—	—	—	Scraper: denticulate	1	0.2%
—	—	—	Scraper: side	3	0.5%
—	—	—	Scraper: disc	1	0.2%
Total	583	89.8%	Total	66	10.2%
Assemblage Total	649				

*Includes artefacts where retouch was indeterminate.

Only two artefacts exceed the 80mm maximum size of beach pebbles from the island. One (C05.1:0233), at just 84mm, could be accepted without much argument as originating on the island. However, the other (Fig. 5; C05.1:0174) is a significantly larger (106mm) secondary flake. This flake was struck from an even larger core and there is no evidence that nodules of this size are available on Lambay, although it is not impossible that they were in prehistory. The alternative is that the flake was produced from flint originating on a beach on the east coast of Ireland or possibly even from farther north, from the primary source in Antrim where chalk is covered by Tertiary basalt (e.g. Wilson 1972). However, the artefact lacks a chalk cortex as would traditionally be expected from Antrim flint in a primary context.

Quartz is also available from Lambay's beaches and as veins in outcropping rock. The single conglomerate pebble core (C05.1:0562) is likely to have been sourced from Broad Bay in the north-west of the island where the material is abundant. The single pitchstone artefact (Fig. 5; C05.1:0318) is a definite import and is discussed below. Other artefacts illustrated in Figure 5 are also discussed where relevant below.

Condition of the material

A large proportion of the finds (43%) had evidence of abrasion or rolling (Fig. 6). Much of the rolled material originated from beaches and the abrasion of a large

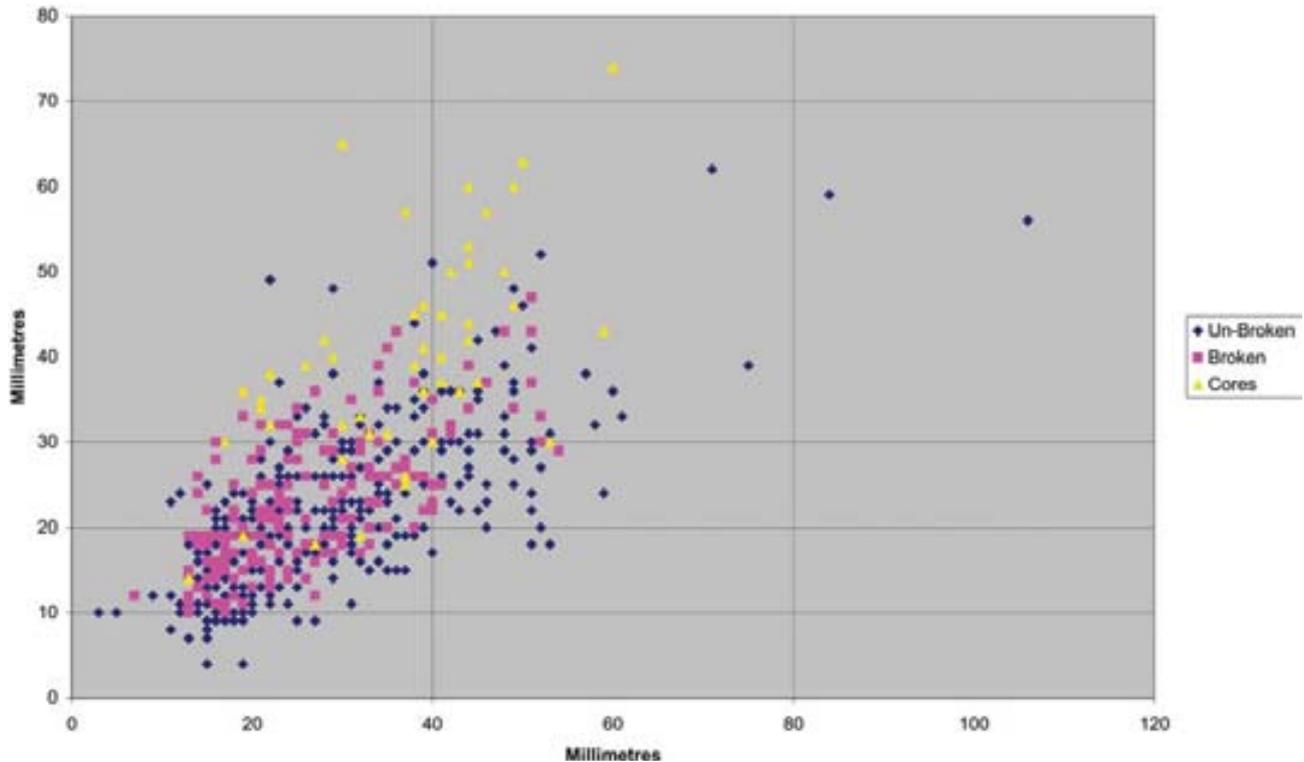


FIG. 4—Artefact size (total assemblage), excludes chips.

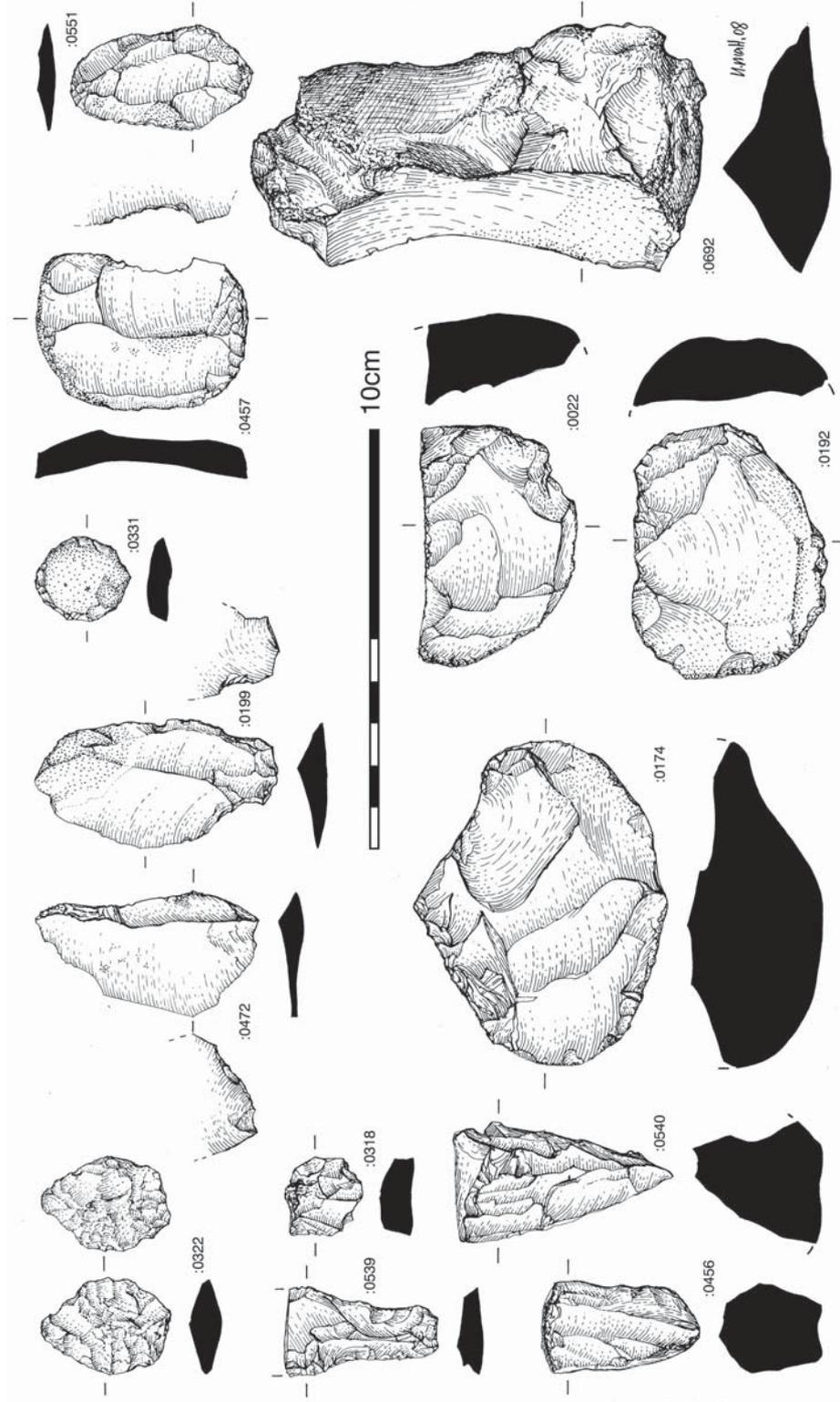


FIG. 5—A selection of artefacts from the Lambay surface lithic assemblage. (Drawn by Ursula Mattenburger.)

percentage of artefacts can probably be explained through exposure, trampling and burrowing. On the other hand, the fact that more than half of the assemblage (57%) is fresh is surprising in the context of a surface assemblage. This may be explained by a number of factors, including the relatively limited spatial extent of ploughing on the island and the restriction of widespread spade cultivation to an 80-year period in the nineteenth century. It may also suggest that rabbit-burrowing brings previously undisturbed artefacts to the surface and that long-term rabbit disturbance does not abrade artefacts. In relation to movement, rabbits certainly move artefacts, particularly when burrowing on steep slopes, but in most cases their effect is very localised (Dolan 2006). Patination was recorded on 123 artefacts (19%) from the assemblage but its distribution across the island closely mirrors the general density of the material, showing no interpretable pattern. Colour was also recorded, but again no notable patterns were encountered. Identification of 'Antrim flint' through colour and chalk cortex (e.g. Dillon 1997) was rejected because there is chalk cortex on some of Lambay's flint pebbles, which are also varied in colour. Only 6.8% of the artefacts show evidence of burning and no particular artefact type deviates significantly from this trend. The distribution of burnt lithics across the island broadly follows the overall distribution of artefacts with no significant concentrations except at Assemblage 10 (see below) where 12.2% of artefacts are burnt.

During the analysis, flakes and blades were classified as broken or unbroken in an attempt to identify any unusual patterns resulting from either deliberate human action or taphonomy (Fig. 7). Overall a large proportion (64.6%) was found to be intact but when the figures for individual categories are examined a more complicated picture emerges. Irregular flakes are far more likely than blades or regular flakes to be undamaged. Blades are particularly vulnerable to fracture with some 58% being incomplete. Surface collections are particularly vulnerable to trampling, whether by people or animals, and it is likely that irregular flakes are less susceptible to these processes due to their morphology and robustness.

Primary technology

The core reduction sequence for the 'total assemblage' is what would be expected from an assemblage representative of all stages of lithic production (Table 2, Fig. 8). Irregular flakes are more commonly primary or secondary, blades are predominantly secondary or tertiary and regular flakes are similarly dominant late in the reduction sequence. The implication is that importation of previously worked blanks, in late stages of the production sequence, did not play any significant role in the working of flint on Lambay. Clearly, remembering the chronological and contextual limitations of what is a disparate surface collection, this is a generalisation that may not have held true at all times and in all places on the island.

The cores from the assemblage are dominated by platform technology, with a very small proportion of bipolar cores (Table 3). This is surprising considering the prevalence of bipolar technology at Barnageeragh on the Dublin coast (Guinan 1992), in north-east Wicklow (Cafferkey 1996) and from the excavated Eagle's Nest

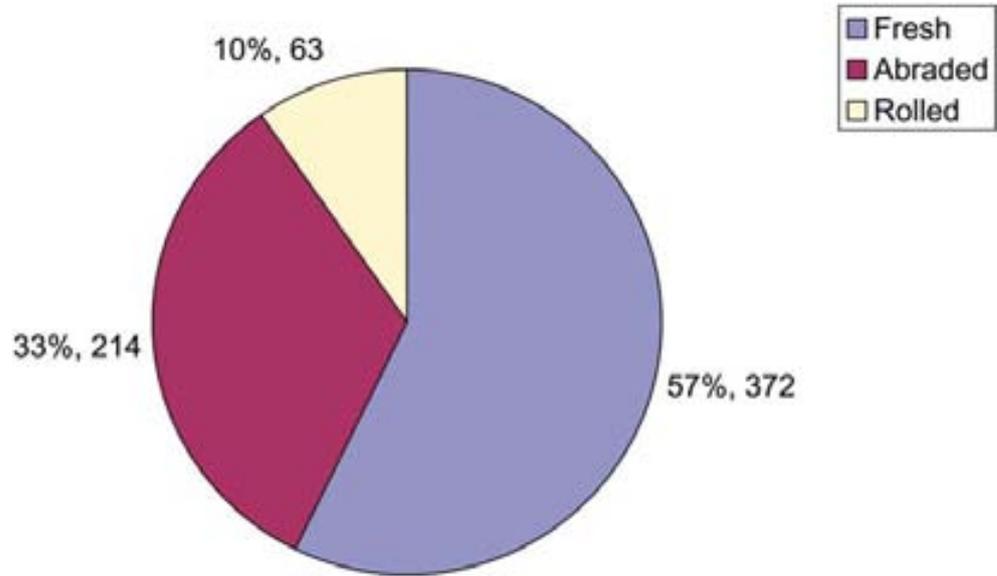


FIG. 6—Condition (total assemblage).

site on Lambay (Dolan in prep). The variation in use of the bipolar technique may be a product of chronological distinctions, with bipolar working being more prevalent in later prehistory (see Woodman *et al.* 2006, 126–7). It is often explained as a response to poor resource availability. However, while this may have been a factor, it is in reality an active technological (and chronologically distinct) choice, not a passive reaction to local flint sources. At the Eagle’s Nest site, evidence of deliberate bipolar reworking of platform flakes and retouched artefacts, particularly scrapers;

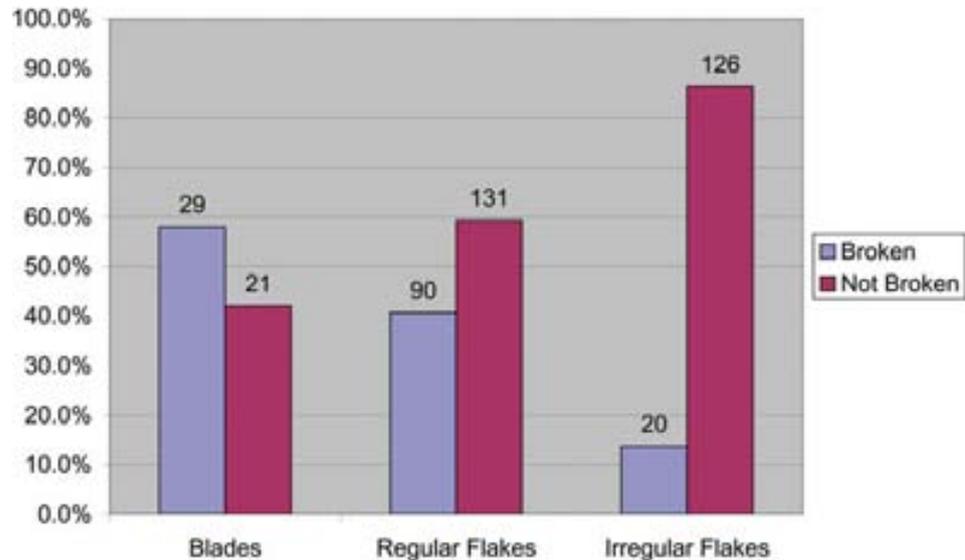


FIG. 7—Breakage of flakes and blades (total assemblage).

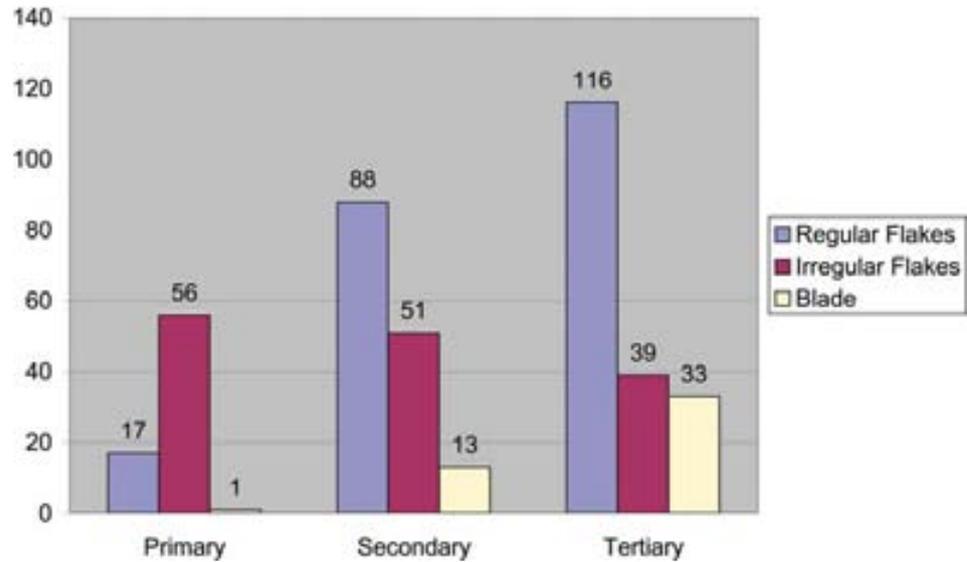


FIG. 8—Core reduction sequence (total assemblage).

combined with the availability of flint on the island; the rarity of bipolar working elsewhere; and evidence for complex, structured deposition of bipolar cores and split pebbles suggests that the technology could be used for other reasons, beyond the mundane (see Cooney 1998; 2005; Dolan in prep.).

Secondary technology

The proportion of retouched artefacts in surface assemblages can be highly variable. In the Lambay assemblage, 10% of the material is retouched. Table 4 details the percentage of artefacts which have been retouched in a selection of Irish surface collections (after Brady 2007a). The figures suggest that large assemblages from coastal contexts (near secondary flint sources in the form of beach pebbles), such as at Salterstown, Co. Louth, Barnageeragh and North Wicklow, tend to have low proportions of retouch, probably as a result of a large amount of primary working at source. Inland surface collections, as those at Mount Oriel and Newgrange have substantially higher proportions. Interestingly, 20% of an excavated plough-zone assemblage in a coastal location at Malahide, Co. Dublin, was found to be retouched (Keeling and Keeley 1994). Two other assemblages do not conform to these trends: the very large percentage of retouched material from the Lough Swilly

TABLE 3—Cores from the total assemblage.

<i>Bipolar core</i>	<i>Dual platform core</i>	<i>Irregular core</i>	<i>Irregular platform core</i>	<i>Single platform core</i>	<i>Uni-facial core</i>	<i>Total</i>
6	1	10	1	29	3	50
12%	2%	20%	2%	58%	6%	—

TABLE 4—Percentage retouch from a selection of Irish surface collections (after Brady 2007a).

<i>Project name</i>	<i>Lough Swilly Archaeological Survey</i>	<i>Newgrange Environs Survey</i>	<i>Mount Oriel Project</i>	<i>Red Mountain Transect</i>	<i>Salterstown Collection Project</i>	<i>Barnageeragh Survey</i>	<i>North Wicklow Survey</i>
Percentage retouched*	44%	16%	17%	5%	2%	4%	3%

*Excludes pebbles/nodules to allow comparison with Lambay assemblage.

Survey (Kimball 2000) can be explained as a product of low raw material variability (Brady 2007a, 70) but it is not clear why the inland Red Mountain transect (Cooney and Brady 1998) has such a low proportion of retouched material (Table 4). The Lambay assemblage—where 10% of the material has been retouched—falls somewhere between the range of inland collections and the coastal sites.

The majority of retouched artefacts were unclassifiable retouched flakes and blades (Table 2). A variety of scrapers were also identified, both convex and concave. No classic hollow-shaped scrapers were present in the assemblage. Only one artefact had invasive retouch, a rolled leaf-shaped arrow-head (Fig. 5; C05.1:0322), although javelin-heads and planoconvex knives are known from the island (Macalister 1929; Herity 1982). One unusual artefact is a tang (Fig. 5; C05.1:0539) from an indeterminate broken artefact very similar to a miscellaneous retouched artefact (KK06969) in the Keiller-Knowles Collection (Woodman *et al.* 2006, 195). There is further discussion of the chronologically diagnostic artefacts from the assemblage below.

Assemblage 10

Assemblage 10 is the largest assemblage on the island (123 artefacts, 19% of the ‘total assemblage’). It incorporates artefacts collected from a cattle scratch and group of rabbit burrows, forming a scar approximately six metres in diameter, situated about 350m north-east of Knockbane, on a small terrace orientated towards the north-east (Pl. III). The finds make up some 19% of the ‘total assemblage’: while they are discussed here as a group, it is important to note that they may not be chronologically associated. No diagnostic artefacts have been identified, however the large proportion of blades and the general technology used, including bipolar, platform and irregular cores (Table 5), suggest the assemblage dates to later prehistory, probably prior to the final Neolithic (Woodman *et al.* 2006, 126). A magnetometry survey of the terrace has indicated the presence of a small enclosure or structure and this raises the question of whether it was associated with the range of activities indicated by the lithics.

Flint is the dominant raw material in the assemblage although there is a small quartz (4 artefacts) and conglomerate (1 artefact) element. There is a low proportion of cores when compared with the figure for the ‘total assemblage’ (4.9% vs 10.2%), including one bipolar flint core, an irregular conglomerate core and four single platform cores; one of which is made from quartz. The assemblage has an unusually high percentage of fresh material (71%), reflecting repeated collection from a location



PL. III—Photo of area of Assemblage 10 from the north. The assemblage was collected from the disturbed area just left of centre. (Photo: Brian Dolan.)

where material is being eroded from an undisturbed context. Irregular flakes show the same proportion of breakage as for the ‘total assemblage’ while far more blades and regular flakes are broken (Fig. 9). Trample is probably a significant factor in this considering the part cattle have played in its erosion, but given the character and context of this assemblage the possibility of breakage in use in prehistory is also likely.

The most striking thing about the assemblage is the lack of irregular and primary flakes, suggesting it was not a manufacturing area (Fig. 10). There is a clear

TABLE 5—Summary of Assemblage 10.

<i>Primary technology*</i>	<i>Qty</i>	<i>Percentage of Assemblage 10</i>	<i>Retouched artefacts/ Secondary technology</i>	<i>Qty</i>	<i>Percentage of Assemblage 10</i>
Regular flakes	58	47.2%	Convex scraper	1	0.8%
Irregular flakes	12	9.8%	Scraper	1	0.8%
Indeterminate flakes	3	2.4%	Retouched flake	6	4.9%
Blade	17	13.8%	Retouched blade	2	1.6%
Chunk	14	11.4%	Total	10	8.1%
Indeterminate	2	1.6%	<i>Core types</i>		
Chip	1	0.8%	Bipolar core	1	—
Cores	6	4.9%	Single platform core	4	—
Total	113	91.9%	Irregular core	1	—
Assemblage total	123				

*Includes artefacts where retouch was indeterminate.

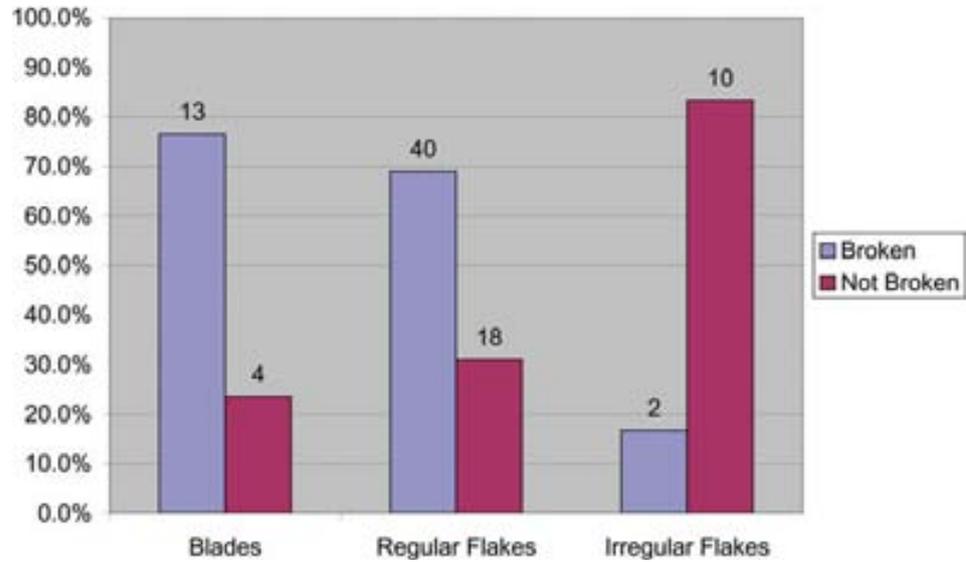


FIG. 9—Breakage of flakes and blades (Assemblage 10).

dominance of tertiary and regular flakes. The site was a focus for artefacts from late in the reduction sequence; usable artefacts with sharp edges. The retouched artefacts are also predominantly regular apart from one scraper and two retouched flakes. The high proportion of burning referred to above is likely to have occurred in prehistory and is consistent with a domestic assemblage focusing on the use of sharp flakes and blades with some small-scale manufacturing and/or rejuvenation being carried out. We may be seeing here, in an island context, a microcosm of the broader pattern

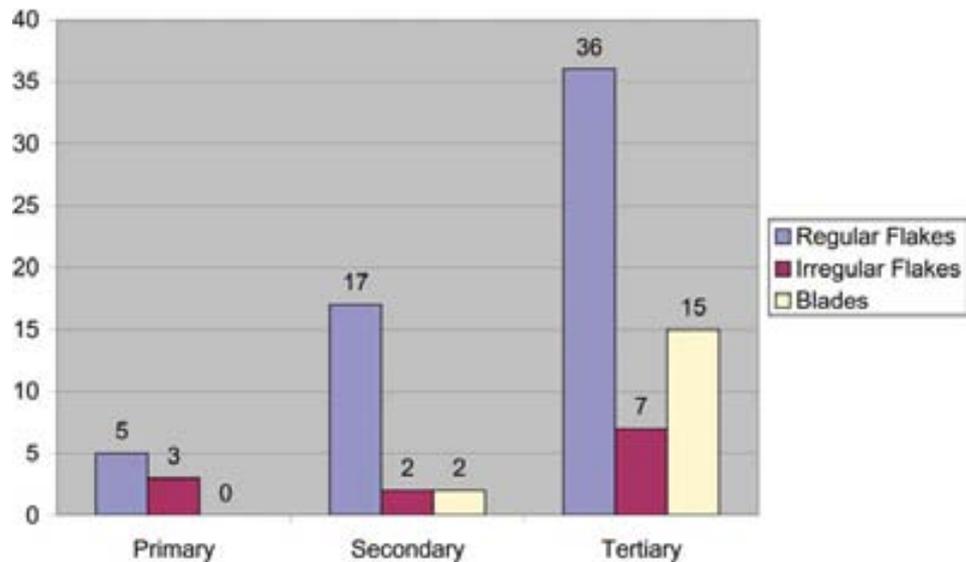


FIG. 10—Core reduction sequence (Assemblage 10).

recognised in the east coastal region of Ireland with primary reduction taking place on the west coast of Lambay.

Assemblage 11

Assemblage 11 was very unusual as 25 out of the 26 artefacts (4% of the ‘total assemblage’) were found together, *in situ*, eroding out of a small area of thin soil cover about 1.5m in diameter, on a rocky ridge in a field in the lowland north-west of the island where there is generally a low density of lithic finds. This suggests it may be a chronologically associated group. Unfortunately, it contains no datable artefacts and cannot be dated technologically. The assemblage contains no cores, is dominated by tertiary artefacts (Table 6, Fig. 11) and is made up of flakes smaller than 32mm in maximum

TABLE 6—Summary of Assemblage 11.

<i>Primary technology*</i>	<i>Qty</i>	<i>Percentage of Assemblage 11</i>	<i>Retouched artefacts/ Secondary technology</i>	<i>Qty</i>	<i>Percentage of Assemblage 11</i>
Regular flakes	10	38.50%	Retouched flake	1	3.80%
Irregular flakes	8	30.80%			
Blades	1	3.80%	—	—	—
Chip	1	3.80%	—	—	—
Chunk	4	15.40%	—	—	—
Total	25	96.20%	Total	1	3.80%
Assemblage Total	26				

*Includes artefacts where retouch was indeterminate.

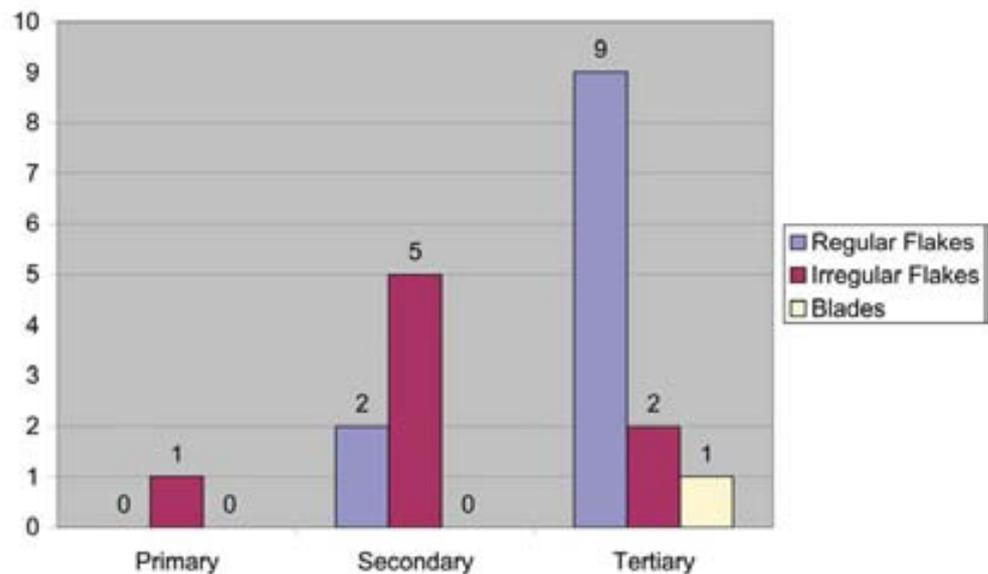


FIG. 11—Core reduction sequence (Assemblage 11).

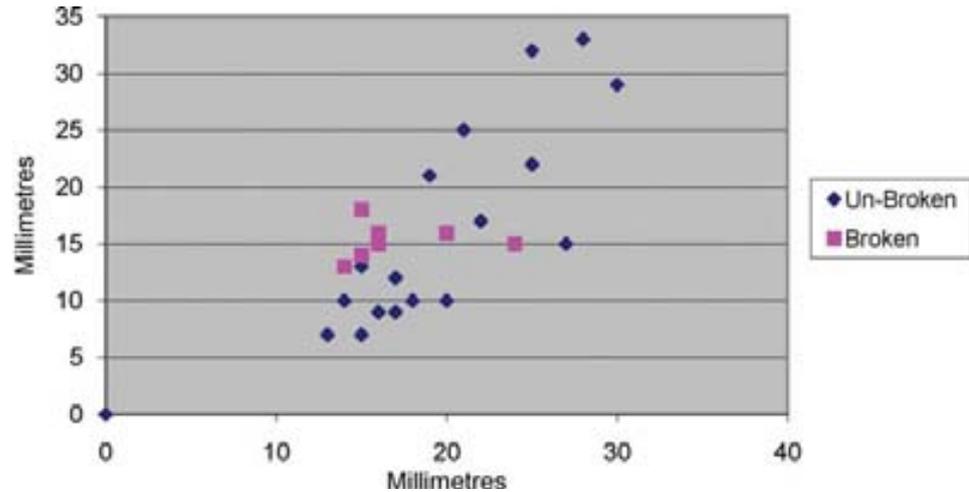


FIG. 12—Artefact size (Assemblage 11), excludes chips.

dimension. Indeed, a large proportion measure between 10mm and 20mm (Fig. 12). None of the flakes are bipolar and a subset of the assemblage (18 artefacts) is made from a uniform grey flint, possibly from the same core. It is possible that some of these stem from a particular episode of retouching.

Spatial analysis

The spatial analysis of surface scatters is fraught with difficulties relating to chronology, definitions of site, interpretation of density and the effects of theoretical approaches, collection strategies and taphonomy (Schofield 1991a; Bintliff *et al.* 2000). Dating surface scatters is highly problematic, particularly in Ireland (see Brady 2007a, 180–5); hence the approach taken below is cautious. Diagnostic artefacts are considered and plotted with reference to the whole island (Fig. 13); the presence of diagnostic artefacts is not used to date spatially associated artefacts and only in the case of Assemblage 10 and the ‘total assemblage’ was it possible to use technology as a chronological indicator.

In the past, density was often simply equated with ‘sites’ and sites with settlement (see Schofield 1991b, 1991c; Carman 1999). This study uses a landscape rather than a site-based approach, exploiting the defined terrestrial boundaries of the island and the high-quality spatial data available for individual artefacts. The use of the concept of ‘assemblages’, based on spatial data rather than density, allows the incorporation of individual artefacts into an overall view of the collection and the island (Fig. 14), while avoiding the problem of identifying ‘sites’. In reality, the treatment of the material from Assemblages 10 and 11 is akin to considering them as ‘sites’, but as a preliminary view and particularly in relation to Assemblage 10 this seems justified. The greatest concerns when taking a landscape perspective are problems of differential collection and exposure; we should remember that distribution maps of find-spots and densities are a reflection of those conditions. The reality is that artefacts were only collected from broken ground and the majority of the island

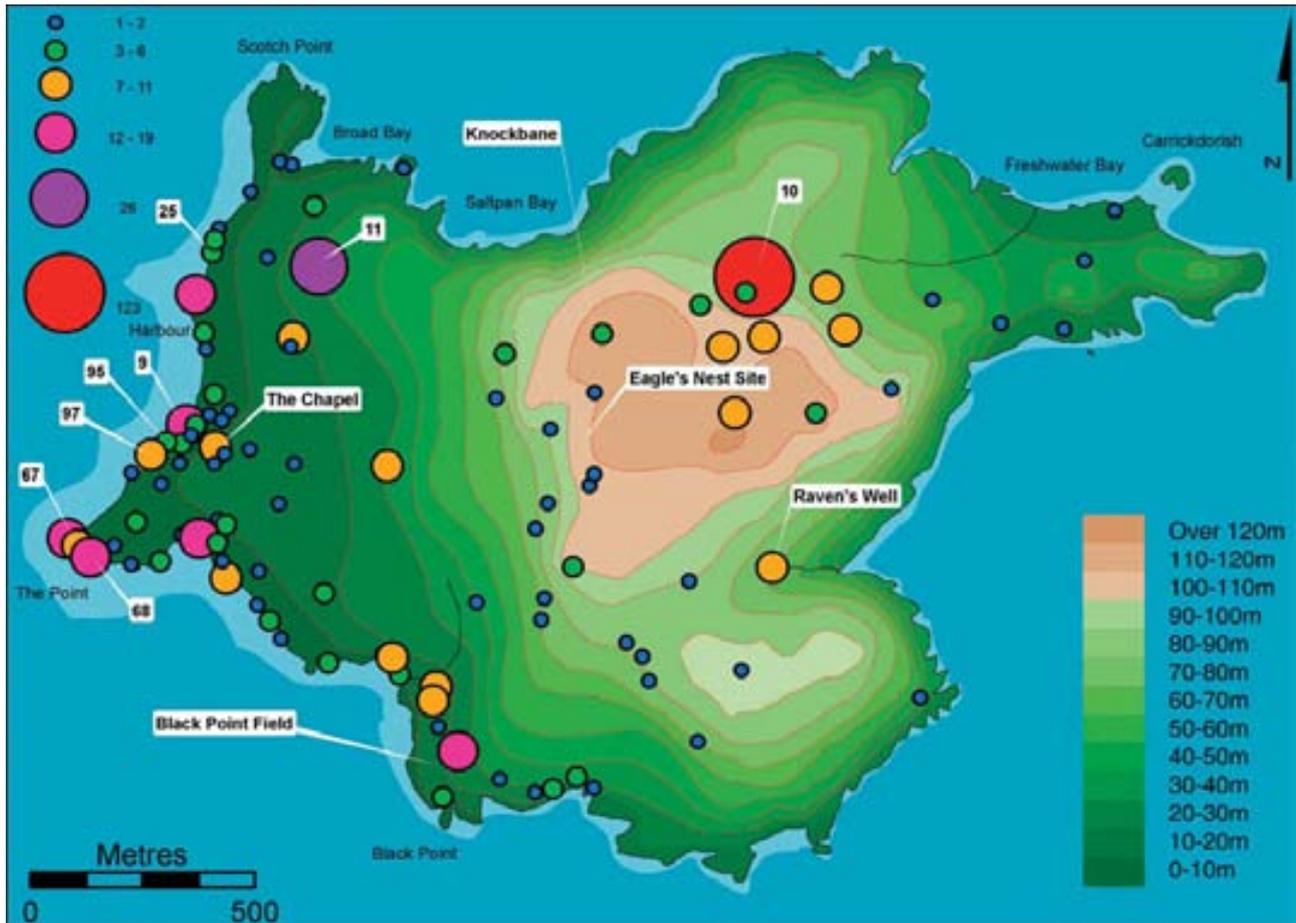


FIG. 14—Map of artefact density across the island, excluding confidence levels 5–7.

has a cover of grass or rougher vegetation. For this reason discussions of density will consider areas of both presence and absence, attempting to interpret both the former and the latter.

Chronology

In Ireland, understandings of lithic technological change have a lower chronological resolution than in Britain and can only be used for dating purposes in the broadest way, even within excavated assemblages (Brady 2007a, 180; Woodman *et al.* 2006, 126). The technological evidence from Lambay suggests that the lithic assemblage has a dominantly later prehistoric character. This is based on the large number of single-platform, hard hammer cores, some evidence of bipolar working, irregular cores and scrapers and a predominance of small regular flakes with some blades. There is an absence of any Early Mesolithic diagnostic forms, particularly micro-liths. Two small, conical blade cores (Fig 5: C05.1:0456, C05.1:0540; Fig. 13) very

similar to those indicative of the period (Costa *et al.* 2005) cannot be seen as diagnostic but are suggestive of Early Mesolithic activity. Similarly, three uni-plane or uni-facial cores (Fig. 5: C05.1:0174, C05.1:0022, C05.1:0192; Fig. 13) found along a restricted stretch of the south-west shoreline (one is a beach find but is fresh and probably had not moved far) suggest a Late Mesolithic date (Woodman *et al.* 2006, 111).

A small number of diagnostic artefacts provide some slightly more definite chronological evidence for the assemblage (Table 7). Probably the most significant find is a Late Mesolithic butt-trimmed flake (Fig. 5: C05.1:0199) from the south of the island (Fig. 13). It is a Type A tanged-form (Woodman *et al.* 2006, 120), one of the earliest butt-trimmed forms found at Newferry, Co. Antrim (Woodman 1977; 1978, 82–87). A possible second butt-trimmed flake (Fig. 5: C05.1:0472) is broken and cannot be definitively classified. Later diagnostic evidence includes a rolled leaf-shaped arrow-head (Fig. 5: C05.1:0322) probably dating to the early Neolithic (Woodman *et al.* 2006, 181); and a small disc scraper (Fig. 5: C05.1:0331) with steep, peripheral retouch creating a subcircular form that is likely to come from a Beaker context (Woodman *et al.* 2006, 159). The frequency or absence of diagnostics in such a small assemblage cannot be read as reflecting the levels of activity or absence of activity in particular periods. The numbers of diagnostics from different periods vary and they constitute only a small fraction, even of complete assemblages (Brady 2007a, 34). The chronological evidence presented here is preliminary and future work on excavated assemblages and surface finds will enhance the picture substantially.

Density

The movement of artefacts due to taphonomic processes has been discussed above, as has the methodology used to mitigate these issues. Figure 14 is a product of this methodology, showing only the 560 artefacts from 107 assemblages with a spatial confidence level between one and four (Table 1). While the map in many cases does not show the exact location of deposition of an artefact in prehistory or indeed the exact find-spot, it is sufficiently accurate for its scale. It shows that while artefacts

TABLE 7—Diagnostic artefacts.

<i>Name</i>	<i>Estimated Date</i>	<i>Assemblage</i>	<i>Identification number</i>
Blade core	Early Mesolithic?	51	C05.1:0456
Blade core	Early Mesolithic?	63	C05.1:0540
Uni-facial core	Late Mesolithic?	68	C05.1:0174
Uni-facial core	Late Mesolithic?	7	C05.1:0022
Uni-facial core	Late Mesolithic?	66	C05.1:0192
Butt-trimmed flake	Late Mesolithic	43	C05.1:0199
Possible butt-trimmed flake	Late Mesolithic?	–	C05.1:0472
Leaf-shaped arrow-head	Neolithic	102	C05.1:0322
Disc scraper	Early Bronze Age	103	C05.1:0331

have been collected from almost every part of the island, the density of these finds is by no means uniform. The reasons behind these variations in density are a complex mixture of accumulation due to prehistoric activity over millennia, combined with taphonomic issues of exposure and collection. Below we attempt to interpret patterns of prehistoric inhabitation of the island from this complicated tangle of relationships.

The coast

Perhaps the most striking pattern in the material is the large number of artefacts collected along the shoreline south of the harbour and west of Black Point (Fig. 14). Almost all of the diagnostic artefacts were found in this area (Fig. 13). There is a particularly unusual cluster of uni-plane cores (mentioned above) at the south-western tip of the island. To some extent this general pattern might be expected given that this area is in the direct vicinity of the best beach sources of pebble flint on the island. Another factor is the large number of rabbit burrows along the coast, particularly the southern coast west of Black Point, around the harbour and west of the chapel. The large number of burrows may, in some areas, be related to rabbits' preference for sandy soils (Harting 1986).

A number of assemblages (Fig. 14; 25, 9, 67, 68, 95, 97) contain finds collected from coastal exposures of raised beach material. These include platform cores, flakes, blades and split pebbles. The combination of a concentration of prehistoric activity in coastal locations close to the important flint sources, coastal erosion and rabbit activity has created the significant density of artefacts in this area. While differential erosion is probably exaggerating the pattern seen in Figure 14, particularly relative to areas with few finds, it is likely that it has some archaeological validity. Light sandy soils, a sheltered location, availability of flint, access to coastal resources and proximity to the beaches with easiest access to and from the island, particularly from the Irish mainland, would have made this area a focus for settlement and/or industrial activity at many times in prehistory, as it is today.

The character of the remainder of Lambay's coastline contrasts sharply with the western, particularly the south-western, coast. Heading east from Black Point on the south coast all the way around to Scotch Point at the north-west there is an almost total absence of lithic artefacts. To a large extent this is explained by steep cliffs and slopes with the implication of limited or specialised use in prehistory. The small quantities of artefacts that have been found have come from rabbit burrows, which occur all around the coast.

The interior

Many locations in the interior of the island have produced very small assemblages made up of one or two finds. These find-spots are spread all over the island, corresponding to areas where the ground is disturbed: at field-gates, burrows, tracks and watering holes. Indeed, it is unusual for an area of disturbed ground not to have

yielded one or more lithics. These ‘background’ finds attest to widespread human activity on the island in prehistory.

A small number of large assemblages or groups of assemblages can be discussed in more detail (for locations see Fig. 14). Assemblage 11 has already been mentioned as an exceptional collection of associated finds found in an otherwise generally low-density area. Assemblage 10 is located in an area with a number of assemblages of a higher than average size. It is also located about 500m north-east of the very large (14,000 objects) lithic assemblage (this is the non-porphyrific andesite material) from the Eagle’s Nest excavation (e.g. Cooney 2005; Dolan in prep.), indicating the potential scale and density of the subsurface archaeology in the area. Assemblage 10 also overlooks the valley of the largest stream on the island, which runs north-east to enter the sea at Freshwater Bay. It is a sheltered location with reasonably thick soil coverage and access to a landing area at Carrickdorrish. Other large assemblages also occur in the vicinity of the island’s two other streams at Raven’s Well and west of Black Point. These may indicate other areas with obvious potential for occupation that were used repeatedly throughout prehistory, resulting in a higher than average density. In this context it should be noted with regard to the west coast that a stream ran westwards into the sea north of the chapel before it was piped underground in modern times, so there was also a fresh water source in this area. Here south of the harbour and in the vicinity of the chapel the coastal lithic concentrations extend inland indicating that this was a significant area of repeated prehistoric activity.

Lambay in context

In considering the wider cultural and landscape context of the surface collections from the island, it is critical to approach the question from the perspective that Lambay was not an isolated place. It has always been in easy reach of the mainland and the other islands off Dublin’s coast (Cooney 2004b). On the other hand, the island landscape was also not static through prehistory. Sea-level was as much as 5m lower than current levels in the Mesolithic period (Brooks and Edwards 2006). Hence, the island would have extended further west, certainly in the early Mesolithic, and the western coastline of that period is now submerged. In contrast to the predominantly open character of the island today, which is the result of millennia of human activity, the range of wood species recognised in the charcoal from the Eagle’s Nest excavations indicate that there may have been areas of woodland on the island during the fourth millennium BC (Ellen O’Carroll pers. comm.). Here the wider context of the surface lithic collections during the Mesolithic and Neolithic is discussed.

Looking at the evidence of lithic collections from the mainland, Stacpoole (1962) noted the abundance of prehistoric artefacts around Malahide. She also collected artefacts further north on the Dublin coastline. Surface-collected assemblages from coastal Louth, Meath and Wicklow have also demonstrated the widespread occurrence of lithics, with indications that the coastal area was a production zone with worked material being moved inland (Guinan 1992; Collins 1997, see discussion in Brady 2007a).

Excavations at both Dalkey and Sutton have produced evidence of significant Late Mesolithic activity in the form of middens (Mitchell 1956, 1972; Liversage

1968; Leon 2005; Woodman *et al.* 1997). On the mainland, fish traps have been found dating to the Late Mesolithic in estuarine mud from the River Liffey (McQuade and O'Donnell 2007) and butt-trimmed flakes are known from Dun Laoghaire, Rathfarnham and Loughlinstown (Corlett 1999, 10). Clearly then, people were living within view of Lambay from the Mesolithic period onwards. Considering the evidence for the use of other islands such as Dalkey and Howth during the period, as well as the evidence for the wider Mesolithic use of islands (e.g. McCartan 2000, 2003; Mithen 2000) it is no surprise that we have definite evidence of the use of Lambay from the Late Mesolithic, with strong indications that it was used from the Early Mesolithic onwards. It seems likely that Mesolithic people, exploiting maritime resources and using the sea for transport and communication were regular visitors to Lambay. The rich and varied bird-life, with both resident and migratory species, that is a feature of the island today would have been one important resource, as is the probability that there would have been a breeding population of seals. One of the important aspects of the current Lambay seal population is the presence of both harbour (or common) seals and grey seals. Harbour seal pups are born in midsummer while grey seal pups are born between September and December (see Cabot 1999, 378–86; Nairn 2005, 42–3). And of course there was the deep, enduring attraction of travelling to an island. For people who were aware of the power of the sea and guided by its daily and seasonal rhythms islands were important places, seamarks and landmarks, where the land begins (Nicholson 2001, 61; see discussion in Warren 2000). The cosmological significance of islands for European Mesolithic societies has been widely recognised and discussed (e.g. Schulting 1998; Bradley 2000; O'Sullivan 2002).

Dalkey and Sutton both produced evidence for continued use in the Neolithic while a number of Neolithic sites have been found on the mainland (see Stout and Stout 1992 for general discussion). The first, at Feltrim Hill, near Malahide, produced a large assemblage of Neolithic lithics (Hartnett and Eogan 1964). Close by at Paddy's Hill, a dense cluster of artefacts revealed by ploughing was excavated in 1983 (Keeling and Keeley 1994). This assemblage was mainly from the plough-zone, but a pit containing material, interpreted as the remains of a knapping floor, including flint, charcoal, bone fragments, hammer-stones, part of a porcellanite axe-head and a quantity of periwinkle shells, was excavated and dated to the Late Neolithic or Early Bronze Age. This pit deposit is reminiscent of the structured deposits at the Eagle's Nest on Lambay (Cooney 2005), those recognised on Dalkey (Leon 2005) and Neolithic pit deposits in Britain (e.g. Edmonds 1995, 42–5; Garrow *et al.* 2005; Lamdin-Whymark 2008, 100–37).

Guinan (1992) analysed Stacpoole's unsystematic surface collection, as well as a small systematic collection of his own, from Barnageeragh, north of Skerries. This demonstrated the intensity of prehistoric settlement in the area, and Guinan interpreted the collections as evidence of sedentary Neolithic activity with the possibility of a Bronze Age element (1992, 119). Subsequent development-led survey and excavation here revealed the presence of multi-period prehistoric activity, with extensive Neolithic occupation, including structures (Baker 2006; Corcoran 2009). Other development-led excavations in the north Dublin coastal zone, for example at Lusk (McCabe 2003) and Beaverstown, Donabate (Hagen 2004), demonstrate that Neolithic activity was widespread in this area. An early Neolithic rectangular house was identified in excavations

at Flemington, north-west of Balbriggan (Bolger 2009, 25–6). While the focus of monumental Neolithic evidence from Dublin comes from south of the Liffey in what could be termed a zone of preservation in the Dublin/Wicklow mountains (Cooney 2000, 143–5), in the north of the county, there is a portal tomb on Howth (Ó’Nualláin 1983). The passage tomb on the coast at Knocklea, near Rush (Newenham 1836–40), facing Lambay, forms part of a coastal group extending north to Bremore and Gormanston (Rynne 1960; Herity 1974; Cooney 2007a; Baker 2009, 91).

This brief overview of the Neolithic evidence from the coastal area of Dublin indicates substantial activity on the mainland with continued use of offshore islands. A key link that connects Lambay to this coastal zone of activity is the occurrence of a small number of porphyry (porphyritic andesite) axe-heads from the Eagle’s Nest source on Lambay. For example, they occur in the assemblage from Feltrim Hill (Harnett and Eogan 1964, 17; Stephen Mandal pers. comm.). The construction of the cairn on Knockbane was clearly located to be a landmark, widely visible when seen from the Irish coast. In these two aspects of working stone, the quarrying of porphyry for axe-heads and the construction of monuments we see how the use and perception of Lambay may have changed between the Mesolithic and Neolithic. It is clear that during the Neolithic the island was occupied regularly at least on a seasonal basis, and the question of whether there was a resident population on the island is one of the foci of the analysis of materials from the Eagle’s Nest excavation. The use of the sea and islands may now have also been more to do with communication and contact, with the islands featuring as nodes in a pattern of exchange involving stone objects and other items in a new network of social relations, extending over land and sea in which we see the use of both local and distant sources (Cooney 2007b; Cooney 2008 with references). Certainly by the later fourth millennium BC Lambay was part of a sea-based web of communication focused on the passage tomb tradition, as evidenced in the material from the Eagle’s Nest excavation (Cooney 2005, 26; see wider discussion in Sheridan 2004).

Evidence for these links to a wider Irish Sea community in the Lambay surface collection is limited but one artefact is particularly relevant to the discussion. There was one pitchstone artefact, mentioned briefly above, identified from the assemblage (Fig. 5; C05.1:0318). It was found in gravel on the shore beside the south harbour wall and is a retouched irregular flake. Pitchstone is a type of volcanic glass found quite widely in the British Tertiary Volcanic Province in both Scotland and Northern Ireland, but geochemical analysis suggests there is only one known archaeological source, on the Island of Arran in the Firth of Clyde, Scotland (Thorpe and Thorpe 1984; Ballin 2009, 41). Pitchstone artefacts are found throughout Scotland, northern England and north-east Ireland. Ballin (2009, 27–39) has demonstrated that in most of northern Britain pitchstone use and exchange may have been largely Early Neolithic in date (with Mesolithic use on Arran itself). While on Arran, Argyll and Bute, parts of the Southern Hebrides and Orkney pitchstone use continued into the Late Neolithic and with the exception of the latter area to the end of the Early Bronze Age. The pitchstone found on Lambay is classic Arran pitchstone (Graeme Warren pers. comm.), indicating that inhabitants of, or visitors to, Lambay were engaging in direct or indirect contact with the island of Arran 275km to the north. It is the most southerly pitchstone find in Ireland (Ballin 2009, 70). Given the striking appearance of pitchstone, its movement over long distances and its association with

a single source, in all likelihood it would have had significant symbolic resonance. The coastal site of Ballygalley, Co. Antrim (Simpson and Meighan 1999), has a major concentration of pitchstone. It is clear that pitchstone formed part of a system of exchange in materials across the north Irish Sea also certainly also involving flint axes and other artefacts and porcellanite axes from north-east Ireland (Cooney 2000, 224–8). Pitchstone has also been identified on Rathlin (Conway 1996; Mandal 2008), an island where the porcellanite outcrop at Brockley was one of the two major porcellanite sources used for the production of stone axe-heads during the Neolithic (Cooney and Mandal 1998, 58; Cooney 2000, 190–204).

The pitchstone artefact would have been used in a local context on Lambay and it is a good example of how we can see the active interplay between a regional cultural milieu and its reworking at a local, island level (Robb 2001, 196). Looking more widely at the distribution of the lithics across Lambay, they indicate both ongoing widespread activity and also what could be termed persistent places where there are significant assemblages of material. These seem to transcend specific periods and may indicate some of the key nodes of activity on the island. They are also crucial in terms of understanding the nature and island context of the Neolithic activity at the Eagle's Nest site where porphyry was worked, a series of deliberate deposits placed and which during the course of the Neolithic became a locus to which people brought and deposited a range of other material (Cooney 2005).

The result of the analysis of the two lithic collections provides a new understanding of Lambay's prehistoric landscape; a view which has enabled us to complement the detailed perspective gained through excavation at the Eagle's Nest to provide an impression of the real extent of people's activities on Lambay in prehistory. Certainly, during the Neolithic the island was used extensively and analysis of the Lambay surface collection has contributed to our understanding of those activities and further demonstrated the significance and potential of surface scatters for enhancing our knowledge of prehistoric landscapes.

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References

- Anderson, E. 1993 The Mesolithic: fishing for answers. In E. Shee Twohig and E. Ronayne (eds), *Past perceptions: the prehistoric archaeology of south-west Ireland*, 16–24. Cork. Cork University Press.
- Ballin, T.B. 2009 *Archaeological pitchstone in Northern Britain: characterization and interpretation of an important prehistoric source*. British Archaeological Reports (British Series) 476. Oxford. Archaeopress.
- Barclay, G. 1994 Earthwork erosion in eastern Scotland. In A. Berry and I. Brown (eds), *Erosion on archaeological earthworks: its prevention, control and repair*, 25–8. Clwyd Archaeology Service. Welshpool, Powys. CPAT.
- Baker, C. 2006 Archaeological excavation and monitoring final report. Balbriggan–Skerries waste water treatment works, Barnageeragh, Co. Dublin. Unpublished report for Margaret Gowen and Co. Ltd.
- Baker, C. 2009 Fingal’s past in the present: an overview. In C. Baker (ed.), *Axes, warriors and windmills: recent archaeological discoveries in north Fingal*, 88–103. Swords. Fingal County Council.
- Binford, L.R. 1973 Interassemblage variability—the Mousterian and the “functional argument”. In C. Renfrew (ed.), *The explanation of culture change: models in prehistory*, 227–53. London. Duckworth.
- Bintliff, J., Kuna, M. and Venclová, N. (eds) 2000 *The future of surface artefact survey in Europe*. Sheffield. Sheffield Academic Press.
- Bolger, T. 2009 Organising the landscape: archaeological excavations at Flemington, Balbriggan. In C. Baker (ed.), *Axes, warriors and windmills: recent archaeological discoveries in north Fingal*. 23–35. Swords. Fingal County Council.
- Bradley, R. 2000 *The archaeology of natural places*. London. Routledge.
- Brady, C. 2007a A landscape survey of the Newgrange environs: earlier prehistoric settlement at Brú na Bóinne, Co. Meath. Unpublished PhD thesis, University College Dublin.
- Brady, C. 2007b The lithic landscape of the Newgrange environs: an introduction. In M. Larsson and M. Parker Pearson (eds), *From Stonehenge to the Baltic, living with cultural diversity in the third millennium BC*, 213–20. British Archaeological Reports (International Series) 1692. Oxford. British Archaeological Reports.
- Brady, N. 1988 The plough pebbles of Ireland. *Tools and Tillage* 6, 47–60.
- Brooks, A. and Edwards, R. 2006 The development of a sea-level database for Ireland. *Irish Journal of Earth Sciences* 24, 13–27.
- Cabot, D. 1999 *Ireland: a natural history*. London. Harper Collins.
- Cafferkey, S. 1996 Prehistory of the ploughzone in north-east Co. Wicklow. Unpublished MA thesis, University College Dublin.
- Carman, J. 1999 Settling on sites: constraining concepts. In J. Brück and M. Goodman (eds), *Making places in the prehistoric world: themes in settlement archaeology*, 20–9. London. UCL Press.
- Collins, K. 1997 Prehistoric land use at Bremore, north County Dublin: the evidence from fieldwalking and lithic analysis. Unpublished MA thesis, University College Dublin.

- Conway, M. 1996 Excavations at ‘Shandragh’, Knockans, Rathlin Island, 1994–1996. A preliminary statement (unpublished summary account of excavations). Department of the Environment, Northern Ireland.
- Cooney, G. 1990 The Mount Oriel Project: an introduction. *County Louth Archaeological and Historical Journal* **21**, 125–33.
- Cooney, G. 1996 The Point, Lambay. In I. Bennett (ed.) *Excavations 1995*, 25–6. Bray. Wordwell.
- Cooney, G. 1998 Breaking stones, making places. In A. Gibson and D.D.A. Simpson (eds), *Prehistoric ritual and religion*, 108–19. Stroud. Tempus.
- Cooney, G. 2000 *Landscapes of Neolithic Ireland*. London. Routledge.
- Cooney, G. 2002 Lambay Island. In I. Bennett (ed.), *Excavations 2001*, 126–8. Bray. Wordwell.
- Cooney, G. 2003a The Point, Lambay. In I. Bennett (ed.), *Excavations 2002*, 170–1. Bray. Wordwell.
- Cooney, G. 2003b An axe in three plays. In J. Fenwick (ed.), *Lost and found: discovering Ireland’s past*, 23–33. Bray. Wordwell.
- Cooney, G. 2004a Neolithic stone axe quarries and production sites in Scotland and Ireland. In I.A. Shepherd and G. Barclay (eds), *Scotland in ancient Europe: the Neolithic and Early Bronze Age of Scotland in their European context*, 191–223. Edinburgh. Society of Antiquaries of Scotland.
- Cooney, G. 2004b Neolithic worlds; islands in the Irish Sea. In V. Cummings and C. Fowler (eds), *The Neolithic of the Irish Sea: materiality and traditions of practice*, 145–59. Oxford. Oxbow.
- Cooney, G. 2005 Stereo porphyry: quarrying and deposition on Lambay Island, Ireland. In P. Topping and M. Lynott (eds), *The cultural landscape of prehistoric mines*, 14–29. Oxford. Oxbow.
- Cooney, G. 2007a *The Bremeore promontory—a prominent and persistent headland in Fingal*. Archaeology Ireland Heritage Guide 39. Bray. Wordwell.
- Cooney, G. 2007b Parallel worlds or multi-stranded identities? Considering the process of ‘going over’ in Ireland and the Irish Sea zone. *Proceedings of the British Academy* **144**, 543–66.
- Cooney, G. 2008 Engaging with stone: making the Neolithic in Ireland and western Britain. *Analecta Praehistorica Leidensia* **40**, 203–14.
- Cooney, G. 2009 The prehistory of Lambay, a long view. In C. Baker (ed.), *Axes, warriors and windmills: Recent archaeological discoveries in north Fingal*, 8–22. Fingal County Council. Swords.
- Cooney, G. and Brady, C. 1998 The Red Mountain transect; the results of a pilot fieldwalking survey in the Boyne Valley area. Unpublished report, Department of Archaeology, University College Dublin.
- Cooney, G. and Mandal, S. 1998 *The Irish Stone Axe Project, monograph 1*. Bray. Wordwell.
- Corcoran, E. 2009 Multi-period excavations at Barnageeragh, Skerries, Co. Dublin. In C. Baker (ed.), *Axes, warriors and windmills: recent archaeological discoveries in north Fingal*. 36–50. Swords. Fingal County Council.
- Corlett, C. 1999 *Antiquities of Old Rathdown*. Bray. Wordwell.

- Costa, L.J., Sternke, F. and Woodman, P.C. 2005 Microlith to macrolith: the reasons behind the transformation of production in the Irish Mesolithic. *Antiquity* **79**, 19–33.
- Cross, S. 1991 An intensive survey of the earlier prehistoric archaeology in the environs of Fourknocks, Co. Meath. Unpublished MA thesis, University College Dublin.
- Dillon, F. 1997 The lithics. In G. Eogan and H. Roche (eds), *Excavations at Knowth 2*. Dublin. Royal Irish Academy.
- Dolan, B. 2005 An analysis of the surface flint assemblage from Lambay Island, Co. Dublin. Unpublished MA thesis, University College Dublin.
- Dolan, B. 2006 Lambay lithics: the taphonomy of a non-ploughzone surface scatter. In K. Cleary and G. McCarthy (eds), *Proceedings of the Association of Young Irish Archaeologists annual conference 2006*, 1–12. Cork. AYIA.
- Dolan, B. In prep. Report on the excavated assemblage from Eagle's Nest, Lambay.
- Edmonds, M. 1995 *Stone tools and society: working stone in Neolithic and Bronze Age Britain*. London. Routledge.
- Garrow, D., Beadsmoore, E. and Knight, M. 2005 Pit clusters and the temporality of occupation: an earlier Neolithic site at Kilverstone, Thetford, Norfolk. *Proceedings of the Prehistoric Society* **71**, 139–57.
- Green, S.W. and Zvelebil, M. 1990 The Mesolithic colonization and agricultural transition of south-east Ireland. *Proceedings of the Prehistoric Society* **56**, 57–88.
- Guinan, B.P. 1992 Ploughzone archaeology in north Dublin: the evidence from a lithic collection and fieldwalking survey. Unpublished MA thesis, University College Dublin.
- Hagen, I. 2004 Beaverstown, Donabate, Co. Dublin. In I. Bennett (ed.), *Excavations 2003*, 117. Bray. Wordwell.
- Harting, J.E. 1986 *The rabbit*. Southampton. Ashford Press Publishing.
- Hartnett, P.J. and Eogan, G. 1964 Feltrim Hill, Co. Dublin; a Neolithic and Early Christian Site. *Journal of the Royal Society of Antiquaries of Ireland* **94**, 1–37.
- Herity, M. 1974 *Irish passage graves*. Dublin. Irish Academic Press.
- Herity, M.J. 1982 Irish decorated Neolithic pottery. *Proceedings of the Royal Irish Academy* **82C**, 247–404.
- Hodgers, D. 1973 A report on surface finds from County Louth. *Journal of the County Louth Archaeological and Historical Society* **18**, 46–59.
- Hodgers, D. 1975 A report on further surface finds from County Louth. *Journal of the County Louth Archaeological and Historical Society* **18**, 198–210.
- Hodgers, D. 1979 A third collection of surface finds from County Louth. *Journal of the County Louth Archaeological and Historical Society* **19**, 227–37.
- Hodgers, D. 1994 The Salterstown surface collection project. *Journal of the County Louth Archaeological and Historical Society* **23**, 240–68.
- Holdaway, S., Witter, D., Fanning, P., Musgrave, R., Cochrane, G., Doelman, T., Greenwood, S., Pidgon, D. and Reeves, J. 1998 New approaches to open

- site spatial archaeology in Sturt National Park, New South Wales, Australia. *Archaeology in Oceania* **33**, 1–19.
- Keeling, D. and Keeley, V. 1994 Excavation of a flint scatter on Paddy's Hill (Robswalls), Malahide, County Dublin. *Proceedings of the Royal Irish Academy*, **94C**, 1–23.
- Kimball, M.J. 2000 *Human ecology and Neolithic transition in eastern County Donegal, Ireland, the Lough Swilly archaeological survey*, British Archaeological Reports (British Series) 300. Oxford. British Archaeological Reports.
- Lamdin-Whymark, H. 2008 *The residue of ritualised actions: Neolithic deposition practices in the Middle Thames Valley*. British Archaeological Reports (British Series) 466. Oxford. Archaeopress.
- Leon, B.C. 2005 Mesolithic and Neolithic activity on Dalkey Island—a reassessment. *Journal of Irish Archaeology* **14**, 1–21.
- Liversage, G.D. 1968 Excavations at Dalkey Island, Co. Dublin, 1956–1959. *Proceedings of the Royal Irish Academy* **66C**, 53–233.
- Macalister, R.A.S. 1929 On some antiquities discovered upon Lambay Island. *Proceedings of the Royal Irish Academy* **38C**, 240–6.
- Mandal, S. 2008 Petrographical report on stone artefacts from archaeological excavations at Craigmacagan, Rathlin Island, Co. Antrim. Unpublished report. Department of the Environment, Northern Ireland.
- McCabe, S. 2003 Lusk, Co. Dublin. In I. Bennett (ed.), *Excavations 2002*, 174–6. Bray. Wordwell.
- McCartan, S.B. 2000 The utilization of island environments in the Irish Mesolithic: agendas for Rathlin Island. In A. Desmond, G. Johnson, M. McCarthy and E. Shee Twohig (eds), *New agendas in Irish prehistory*, 15–30. Bray. Wordwell.
- McCartan, S.B. 2003 Mesolithic hunter-gatherers in the Isle of Man: adaptations to an island environment? In L. Larsson, H. Kindgren, K. Knutsson, D. Loeffler and A. Åkerlund (eds), *Mesolithic on the move: papers presented at the 6th international conference on the Mesolithic in Europe. Stockholm 2000*, 331–9. Oxford. Oxbow.
- McCormick, F. 1999 Early evidence for wild animals in Ireland. In N. Benecke (ed.), *The Holocene history of European vertebrate fauna. Modern aspects of research*, 355–71. Archaeologie in Eurasien, no. 6. Rahden. Verlag Marie Leidorf.
- McQuade, M. and O'Donnell, L. 2007 Late Mesolithic fish traps from the Liffey Estuary, Dublin, Ireland. *Antiquity* **81**, 569–84.
- Mitchell, G.F. 1956 An early kitchen midden at Sutton, Co. Dublin. *Journal of the Royal Society of Antiquaries of Ireland* **86**, 1–26.
- Mitchell, G.F. 1972 Further investigations of the early kitchen-midden at Sutton, Co. Dublin. *Journal of the Royal Society of Antiquaries of Ireland* **102**, 151–9.
- Mitchell, G.F. 1990 *The way that I followed*. Dublin. Country House.
- Mithen, S. (ed.) 2000 *Hunter-gatherer landscape archaeology: the Southern Hebrides Mesolithic Project 1988–98*. Cambridge. McDonald Institute for Archaeological Research.

- Nairn, R. 2005 *Ireland's coastline: exploring its nature and heritage*. Cork. The Collins Press.
- Newenham, R. 1836–40 On a tumulus or barrow near Rush, County Dublin. *Proceedings of the Royal Irish Academy* **1**, 247–9.
- Nicolson, A. 2001 *Sea room: an island life*. London. Harper Collins.
- Ó Floinn, R. and Cherry, S. 1992 Lambay Island. In I. Bennett (ed.), *Excavations 1991*, 16. Bray. Wordwell.
- Ó Nualláin, S. 1983 Irish portal tombs: topography, siting and distribution. *Journal of the Royal Society of Antiquaries of Ireland* **113**, 75–105.
- O'Sullivan, A. 2002 Living with the dead amongst hunter-gatherers. *Archaeology Ireland* **60**, 10–12.
- Peterson, J.D. 1990 From foraging to food production in south-east Ireland: some lithic evidence. *Proceedings of the Prehistoric Society* **56**, 89–99.
- Praeger, R.L. 1907 Contributions to the natural history of Lambay, County Dublin. *Irish Naturalist* **16**, 1–112.
- Raftery, B. 1983 *A catalogue of Irish Iron Age antiquities*. Veröffentlichung des vorgeschichtlichen seminars Marburg, Sonderband 1. Marburg. University of Marburg.
- Raftery, B. 1994 *Pagan Celtic Ireland*. London. Thames and Hudson.
- Rynne, E. 1960 Survey of a probable passage grave cemetery at Bremore, Co. Dublin. *Journal of the Royal Society of Antiquaries of Ireland* **90**, 79–81.
- Rynne, E. 1976 The La Tene and Roman finds from Lambay, Co. Dublin: a re-assessment. *Proceedings of the Royal Irish Academy* **76C**, 231–44.
- Robb, J. 2001 Island identities: ritual, travel and the creation of difference in Neolithic Malta. *European Journal of Archaeology* **4**, 175–202.
- Schofield, A.J. (ed.) 1991a *Interpreting artefact scatters: contributions to plough-zone archaeology*. Oxbow Monograph 4. Oxford. Oxbow.
- Schofield, A.J. 1991b Interpreting artefact scatters: an introduction. In A.J. Schofield (ed.), *Interpreting artefact scatters: contributions to ploughzone archaeology*. Oxbow Monograph 4, 3–8. Oxford. Oxbow.
- Schofield, A.J. 1991c Artefact distributions as activity areas: examples from south-east Hampshire. In A.J. Schofield (ed.), *Interpreting artefact scatters: contributions to ploughzone archaeology*, Oxbow Monograph 4, 117–28. Oxford. Oxbow.
- Schofield, A.J. 2000 *Managing lithic scatters: archaeological guidance for planning authorities and developers*. London. English Heritage.
- Schulting, R. 1998 Creativity's coffin: innovation in the burial record of Mesolithic Europe. In S. Mithen (ed.), *Creativity in human evolution and prehistory*, 201–26. London. Routledge.
- Seymour, H.J. 1896 Excursions of Dublin Naturalists Field Club to Lambay. *The Irish Naturalist* **5**, 185–6.
- Sheridan, A. 2004 Neolithic connections along and across the Irish Sea. In V. Cummings and C. Fowler (eds), *The Neolithic of the Irish Sea: materiality and traditions of practice*, 9–21. Oxford. Oxbow.

- Simpson, D.D.A. and Meighan, I. 1999 Pitchstone—a new trading material in Neolithic Ireland. *Archaeology Ireland* **13**, 26–30.
- Smith, G.H. 2005 The north-west Wales lithic scatters project. *Lithics: The Journal of the Lithics Studies Society* **26**, 38–56.
- Stacpoole, G.C. 1962 The Larnians of County Dublin. *Dublin Historical Record* **18**, 34–44.
- Stillman, C. 1994. Lambay, an ancient volcanic island in Ireland. *Geology Today* **62**, 62–7.
- Stout, G. and Stout, M. 1992 Patterns in the past: County Dublin 5000 BC–AD 1000. In F.H.A. Aalen and K. Whelan (eds), *Dublin city and county: from prehistory to the present*, 5–14. Dublin. Geography Publications.
- Thorpe, O.W. and Thorpe, R.S. 1984 The distribution and sources of archaeological pitchstone in Britain. *Journal of Archaeological Science* **11**, 1–34.
- Warren, G. 2000 Seascapes: people, boats and inhabiting the later Mesolithic in western Scotland. In R. Young (ed.), *Mesolithic lifeways: current research from Britain and Ireland*, 97–104. Leicester. University of Leicester.
- Warren, G, Little, A. and Stanley, M. 2009 A late Mesolithic lithic scatter from Corralanna, Co. Westmeath and its place in the Mesolithic landscape of the Irish midlands. *Proceedings of the Royal Irish Academy* **109C**, 1–35.
- Westropp, T. 1922 The promontory forts and adjoining remains in Leinster, Part 1: County Dublin. *Journal of the Royal Society of Antiquaries of Ireland* **52**, 52–76.
- Wilson, P. 1972 *Regional geology of Northern Ireland*. Belfast. HMSO.
- Woodman, P.C. 1977 Recent excavations at Newferry, Co. Antrim. *Proceedings of the Prehistoric Society* **43**, 155–200.
- Woodman, P.C. 1978 *The Mesolithic in Ireland: hunter-gatherers in an insular environment*. British Archaeological Reports (British Series) 58. Oxford. British Archaeological Reports.
- Woodman, P.C., Finlay, N. and Anderson, E. 2006 *The archaeology of a collection: the Keiller-Knowles Collection of the National Museum of Ireland*. Dublin. Wordwell.
- Woodman, P.C., McCarthy, M. and Monaghan, N. 1997 The Irish Quaternary fauna project. *Quaternary Science Reviews* **16**, 120–59.
- Zvelebil, M., Green, S.W. and Macklin, M.G. 1992 Archaeological landscapes, lithic scatters and human behaviour. In L. Wandsnider and J. Rossignol (eds), *Space, time and archaeological landscapes*, 193–226. London. Plenum Press.