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South Cuidrach: a new Late Upper Palaeolithic and Mesolithic site on the Isle of Skye, western Scotland

Karen Hardy FSAScot[*] and Torben Ballin FSAScot[†]

ABSTRACT

A new site in north Skye has revealed evidence of human occupation from the Late Upper Palaeolithic as well as the Early and Late Mesolithic periods, suggesting repeated visits by humans for at least 5,000 years from the Late Glacial Interstadial through the Loch Lomond Readvance and up to the mid-Holocene, a time of dynamic climatic and sea-level change. South Cuidrach is one of several sites in the north of the Isle of Skye and around the Inner Sound with lithic (stone tool) evidence diagnostic of a human presence before the mid-Holocene. These sites currently represent a unique concentration of pre-Late Mesolithic sites in Scotland. The lithic evidence which forms the backbone of the cultural and temporal characterisation of the site at South Cuidrach is outlined here. This includes characteristic points and microliths, burins, cores and other items diagnostic of specific cultural groups. Additionally, it has become evident that Rum bloodstone, a raw material well known from the Late Mesolithic period in the region, may be absent before the Early/Late Mesolithic transition, with baked mudstone from Staffin in North Skye being the primary raw material used before this time. The need for detailed knowledge of the region's lithic technology and typology is well illustrated here, as small details frequently reflect important chronological differences.

INTRODUCTION

CLIMATIC BACKGROUND

As the ice melted after the maximum Devensian glaciation that peaked around 20,000–18,000 years ago, first plants then animals and humans gradually moved north into the new lands during the period known as the Late Glacial Interstadial, between ~14,670 and ~12,900 years ago (approximately 12,500 BC–11,000 BC). This was a relatively warm period that occurred between the last full Devensian glaciation, and the shorter Younger Dryas Stadial, also known in the UK as the Loch Lomond Readvance. The Loch Lomond Readvance began around 12,900 years ago (10,900 BC) with an abrupt drop in temperature in the space of a few years. This severely cold period then lasted for around 1,500 years, before an equally rapid increase between ~11,700 and ~11,610 years ago (around 9800 BC) in Europe led to temperatures that are akin to those of the present day (Cheng et al 2020). The severity and speed of these temperature changes were such that it would have required notable adaptive capabilities for populations in Scotland to survive. The division between the Late Upper Palaeolithic and Mesolithic periods occurs across Europe around the same time as the geological switch from the Late Pleistocene to Holocene

[*] Department of Archaeology, University of Glasgow, Molema Building, Lilybank Gardens, Glasgow G12 8RZ
karen.hardy@glasgow.ac.uk https://orcid.org/0000-0003-1127-2397

[†] Banknock Cottage, Denny, Stirlingshire FK6 5NA lithicresearch@gmail.com
https://orcid.org/0000-0003-4097-4195

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(*c* 11,700 BP, 9800 BC) that also reflected the end of the Younger Dryas (Loch Lomond Readvance) cold period.

As part of a project to increase our understanding of the Late Pleistocene and Early Holocene human presence in north-west Scotland (Hardy et al 2021), we present a new multi-period Late Upper Palaeolithic and Mesolithic site at South Cuidrach, in the northern part of the Isle of Skye, and we outline lithic evidence for the human occupation of this site in north Skye. During five years of fieldwork, evidence of several different lithic material traditions covering a period of 7,000–8,000 years has been recovered, dating to the later part of the Late Upper Palaeolithic, Early Mesolithic and through the Late Mesolithic. A series of cylindrical cores which is unique in Scotland and which may represent a specific, and as yet unrecognised, Late Upper Palaeolithic industry, phase or local group has also been recovered. The finds embrace surface scatters of highly weathered and rounded artefacts that suggest an offshore origin, typologically identifiable Late Pleistocene and Early Holocene, unrolled lithic artefacts and an in-situ Late Mesolithic dwelling. Lying immediately above the dwelling is a raised-beach deposit that is linked to the mid-Holocene sea-level increase (Best et al 2022).

Below, we summarise the regional context of the Late Upper Palaeolithic and Early Mesolithic periods within the framework of the established cultural sequences from northern Europe. Following this, we describe three groups of lithics from our new site that are characteristic of the different cultural periods identified here. We end by outlining the relevance of these and their chronological place within the broader north European cultural sequence.

NORTH EUROPEAN CULTURAL CONTEXT

The only way to reconstruct the human occupation and presence of different cultural groups in north Europe at this time is through the analysis of lithic technology and typology, since these can be characteristic of cultural groups (Ballin 2021a) and frequently this is all that survives. In north continental Europe a well-defined sequence based on differences in lithic technology and core and tool typology has been developed (eg Schwabedissen 1954; Terberger 2006; Vermeersch 2013). The earliest human populations in what is today the north-easterly part of continental Europe, including north Germany, Belgium, Netherlands, Poland and southern Scandinavia, gradually spread northwards as the ice melted. The earliest of these is the Hamburgian, which lasted for just short of one millennium, between around 12,700 and 12,000 BC (Weber 2012). During this time, Doggerland would have been exposed, allowing these first populations to walk over from continental Europe to what is today Britain (Ballin 2016). As the climate gradually warmed up (and the sea level rose), the people of the Hamburgian culture, understood to be terrestrial hunters, were replaced by the makers of the *Federmesser* industry, whose presence in northern Europe has been recorded between around 12,000 and 10,800 BC (Grimm et al 2020). Following this, between around 10,800 and 9800 BC, evidence for the Ahrensburgian culture is also found in northern Europe (Winkler 2019).

THE EVIDENCE FROM SCOTLAND

Overall, the traces of the people responsible for these industries in north Britain are few and far between, but over the past few years evidence has emerged suggesting that members of different cultural groups ventured across Doggerland, most probably following herds of reindeer, and reached what is today Scotland, both during the Late Glacial Interstadial and the subsequent Loch Lomond Readvance (Ballin & Saville 2003; Saville & Ballin 2009; Saville et al 2012; Ballin 2019a, 2021b; Ballin et al 2011, 2018; Berg-Hansen et al 2019). Yet, although it is now well established that there was a Late Upper Palaeolithic and Early Mesolithic presence in Scotland, the size of the population and its distribution across Scotland remain unclear. For example, it is still not clear whether the human presence before the Late Mesolithic represented occasional trips to Scotland by highly mobile groups or a small permanent population, or, indeed, whether the climatic deterioration

during the Loch Lomond Readvance that reglaciated parts of west Scotland led to a reduction of the human population in Scotland at this time. However, the recovery of likely Ahrensburgian material near the edges of the glaciers in western Scotland suggests that a population did survive and adapt to this very rapid and dramatic temperature drop (Ballin 2016).

The change from the Late Upper Palaeolithic to the Early Mesolithic is reflected in Scotland by a change in lithic technology towards reduced implement size, a different artefact typology and different lithic reduction methods (Ballin 2019a). There is relatively little evidence for the Early Mesolithic across Scotland (ScARF 2012) but the Scottish west coast is well known for its abundance of Late Mesolithic evidence (Lacaille 1954; Mercer 1968, 1971, 1975; Mellars 1987; Wickham-Jones 1990; Russell et al 1995; Mithen 2000; Wickham-Jones & Hardy 2004; Bonsall et al 2009; Hardy & Wickham-Jones 2009; Saville et al 2012). Different chronological affinities are determined in lithic assemblages through artefact typology (for example, broad- and narrow-blade microliths, representing either the Early or the Late Mesolithic), technological attributes (including core typology and reduction methods) and raw material preferences (eg Saville 2008; Ballin 2019a; Ballin & Ellis 2019). However, it is not always possible to provide a specific attribution to the different Late Upper Palaeolithic and Early Mesolithic industries, as at this time there was a generalised use of broad-blade technology, so while the artefacts may appear clearly 'pre-Late Mesolithic' it can sometimes be uncertain whether they date to the Late Upper Palaeolithic or the following Early Mesolithic period (Ballin 2021a).

THE LATE UPPER PALAEOLITHIC PERIOD IN SCOTLAND (TABLE 1)

Only a small number of Scottish Late Upper Palaeolithic sites can be dated precisely by typo-technological attributes (Table 2). Howburn is located in the Biggar Gap, between the rivers Tweed and Clyde. Trench 1 (Ballin et al 2018) is datable to the Late Hamburgian by a large number of intact and fragmented Havelte points, supplemented by other diagnostic pieces. Howburn Trench II, Blocks 3–4 (Ballin et al 2018) is datable to the *Federmesser* period by backed points, supplemented by other diagnostic pieces. Both assemblages from Howburn were based on the extensive use of opposed-platform broad-blade technology, which in Scotland is characteristic of the Late Upper Palaeolithic – small opposed-platform cores do form part of later assemblages, but these are generally reshaped conical cores (Ballin 2019a). The supplementary diagnostics include scrapers with acute edge-angles, *becs* and complex burins, and in the case of Howburn *en éperon* technique supported the date indicated by the site's Havelte points. This technique may be identified by the blades' finely faceted platforms and a small spur at the front of the platform remnant. This technique is known only from the

TABLE 1

Late Upper Palaeolithic/Mesolithic chronology for Scotland. The dates for the industries of the Late Upper Palaeolithic are based on European dates and may change as continued research into the period makes more data available. The remainder of the dates are based largely on information from the Scottish LUP/Mesolithic research framework (ScARF) panel report (ScARF 2012; information relating to the Late Upper Palaeolithic from Sonia Grimm pers comm)

Mesolithic	Late Mesolithic	8400–4000 BC
	Early Mesolithic	9800–8400 BC
Late Upper Palaeolithic (LUP)	Ahrensburgian	10,800–9800 BC
	Federmesser-Gruppen	12,000–10,800 BC
	Hamburgian	12,700–12,000 BC

TABLE 2
Well-known Scottish sites with Late Upper Palaeolithic components and diagnostic Late Upper Palaeolithic stray finds, and their chronological status (LUP: Late Upper Palaeolithic; EM: Early Mesolithic)

Safely dated sites	*Diagnostics*	*Date*
Howburn Trench I 2009, South Lanark	Havelte points, etc	Late Hamburgian
Howburn Trench II, Blocks 3–4, South Lanark	Backed points, etc	*Federmesser-Gruppen*
Kilmelfort Cave, Oban	Backed points, etc	*Federmesser-Gruppen*
Rubha Port an t-Seilich, Islay	Tanged point	Ahrensburgian
South Cuidrach, Skye	Tanged point	Ahrensburgian
Sites dated to the LUP in general		
South Cuidrach, Skye	5 tips of tanged or backed points, complex burins, scraper with acute edge-angle, opposed-platform blade technology	Likely Ahrensburgian and possibly other LUP traditions; EM
Lunanhead, Angus	Complex burins, blade-scraper with acute edge, opposed-platform blade technology	LUP
Milltimber, Scatter 4, Aberdeen	Opposed-platform blade technology	LUP
Guardbridge, Fife	One tanged point and the tip of a second, opposed-platform blade technology	LUP
Individual stray finds		
Shieldaig, Loch Torridon	Tanged point with long tang	Ahrensburgian
Balevullin, Tiree, Inner Hebrides	Tanged point with long tang	Ahrensburgian
Brodgar, Mainland, Orkney	Fosna-Hensbacka type single-edged point	Fosna-Hensbacka Complex or Ahrensburgian
Millfield, Stronsay, Orkney	Plain tanged point	Ahrensburgian

Hamburgian, Creswellian and Late Magdalenian industries (Barton 1990).

The assemblage from Kilmelfort Cave, near Oban (Saville & Ballin 2009) was dated mainly on the basis of numerous curve- and angle-backed points and the absence of tanged points, supplemented by other diagnostic pieces. At Rubha Port an t-Seilich, Islay, Mithen et al (2015) identified a small number of artefacts that they identified as Ahrensburgian, and one rolled (likely redeposited) tanged point that is characteristic of the Ahrensburgian. At South Cuidrach artefacts characteristic of the Late Upper Palaeolithic have been recovered, including a range of techno-typologically characteristic artefacts and a probably Ahrensburgian tanged artefact. Several assemblages have been dated more generally to the Late Upper Palaeolithic period, mainly on the basis of their use of opposed-platform broad-blade technology combined with their use of excessive core preparation, creating numerous crested pieces and platform rejuvenation flakes. They also generally include a few other diagnostic pieces, but none that would allow more precise dating within the Late Upper Palaeolithic. These sites include Lunanhead (Ballin 2021c), Milltimber Scatter 4 (Ballin 2019b) and Guardbridge (Ballin

forthcoming). Lunanhead is located on the River Lunan in Angus, Milltimber on the River Dee in Aberdeenshire, and Guardbridge is a coastal site in Fife.

In addition, stray Late Upper Palaeolithic points have been recovered from a number of sites in mainland western Scotland, the Inner Hebrides and Orkney. Two related, probably Ahrensburgian, points were retrieved from Shieldaig in Loch Torridon and Balevullin on Tiree (Livens 1956; Ballin & Saville 2003). A plain, probably Ahrensburgian, tanged point was retrieved from Millfield on Stronsay (illustrated in Ballin & Bjerck 2016: fig 1). A Fosna-Hensbacka type single-edged point was retrieved from Brodgar on mainland Orkney (Ballin & Bjerck 2016). Ahrensburgian tanged points are characterised by being considerably smaller and usually simpler than Hamburgian points, and where Hamburgian Havelte points have asymmetrical tangs, Ahrensburgian ones have symmetrical tangs. Although Ballin & Bjerck (2016) suggested that the Brodgar point might represent contacts with the Scandinavian Fosna-Hensbacka complex, due to the fact that such points are numerous in Fosna-Hensbacka assemblages, it is possible that this piece could also be Ahrensburgian, as small numbers of such points have been found in Ahrensburgian assemblages in north-western Europe (Buck Pedersen 2009: fig 22).

It has been suggested that two flints from sites on the Dee in Aberdeenshire (Clarke in Wickham-Jones et al 2021: illus 7.14 & 7.47) are Early Hamburgian shouldered points, but we dispute this as neither fits the definition of a shouldered point. One has the general outline of a shouldered point but not the necessary basal modification, while the other is probably an Early Mesolithic isosceles triangle. Additionally, the evidence from continental European sites suggests that the northward expansion of the Hamburgian (first into Denmark and then Scotland) began around the Early/Late Hamburgian transition (Weber 2012), not before.

THE EARLY MESOLITHIC PERIOD (TABLE 3)

There are currently only around five sites identified on lithic evidence as Early Mesolithic in

TABLE 3
Well-known Scottish sites and areas with Early Mesolithic components, and their chronological status (LUP: Late Upper Palaeolithic; EM: Early Mesolithic; LM: Late Mesolithic)

Site	*County*	*Date and composition*	*Settlement status*
South Cuidrach	Skye	LUP, EM, LM	Multiple
Clachan Bay	Raasay	EM (? LUP)	Unknown
Donich Park	Argyll & Bute	EM	Single visit
Cramond	Edinburgh	EM–LM transition	Probably single visit
Morton Site A	Fife	EM	Probably several visits
An Corran	Skye	Mostly EM, with LM admixture	Probably several visits
Glenbatrick Waterhole	Jura	EM half and LM half, spatially separated	Probably several visits
Nethermills Farm	Aberdeenshire	Palimpsest with EM component	
Lussa Bay	Jura	Palimpsest with EM component	
Lussa Wood	Jura	Palimpsest with EM component	
Shewalton Moor	Ayrshire	Multi-period surface collections with EM component	
Dryburgh Mains	Borders	Multi-period surface collections with EM component	
Dee Valley	Aberdeenshire	Multi-period surface collections with EM component	
Tentsmuir Sands	Fife	Multi-period surface collections with EM component	

Scotland. Cramond is the only site of this period that has been radiocarbon-dated (8620–8304 cal BC). Otherwise, as with the Late Upper Palaeolithic sites, these assemblages have been dated by typo-technological diagnostic artefacts and attributes. For the Early Mesolithic, these comprise usually a combination of broad isosceles and trapezoid microliths, broad microburins, robust burins, broad blades and matching relatively large single-platform blade cores.

Of the Early Mesolithic sites, only two are likely to be chronologically unmixed, or almost unmixed: Donich Park in Argyll & Bute with 29 characteristic obliquely blunted points and three isosceles triangles (Ballin & Ellis 2019), and Cramond in Edinburgh (Saville 2008). Cramond was presented as an example of an assemblage straddling the Early/Late Mesolithic transition, and the microlithic typology (71 microliths) and blade size, in conjunction with the site's radiocarbon dates, were used to define the approximate time of this transition (*c* 8400 cal BC). The illustrated microliths appear to be composed of small isosceles, scalene and other forms, making this a typological hybrid assemblage.

One of the best-known Early Mesolithic sites is Morton Site A in Fife (Coles 1971), which yielded a numerically large assemblage of broad microliths (226 pieces), dominated by isosceles triangles. However, the extensive area of this site (Coles 1971: fig 4) suggests that it would almost certainly have been visited several times, and that the finds may include pieces from later periods, although this remains unclear, and the site needs to be re-examined.

An Corran, at the northern tip of Skye (Saville et al 2012), is an interesting rockshelter site, associated with midden remains and an outcrop of baked mudstone, which was used for the production of most of the lithic assemblage here. The assemblage includes a relatively small number of microliths (32 pieces); of these, 15 are diagnostic Early Mesolithic pieces, with the remainder being either Late Mesolithic types (three scalene triangles and two crescents) or undiagnostic forms or fragments. In addition, a number of particularly large blades from the lowest levels may pre-date the main Early Mesolithic assemblage.

Glenbatrick Waterhole on Jura (Mercer 1973) includes two sub-assemblages – one Early Mesolithic and one Late Mesolithic, possibly focused on different parts of the site. It appears that the assemblage may include substantial numbers of isosceles triangles and some trapezoids, although much of the material remains to be studied.

Three other assemblages were characterised as being from palimpsest sites with limited research potential (Nethermills Farm in Aberdeenshire, and Lussa Wood and Lussa Bay on Jura; Ballin 2017a; Mercer 1971, 1980). Nethermills Farm is dominated by Late Mesolithic material, but it has a substantial proportion of Early Mesolithic pieces. Most of the formal microliths from Lussa Wood are Early Mesolithic forms, but in addition the assemblage contains many informal and fragmented narrow-blade microliths (Mercer 1971: fig 6). Lussa Wood, on the other hand, is heavily dominated by narrow microliths, supplemented by small numbers of broad forms suggestive of the Early Mesolithic (Mercer 1980: figs 7 & 8).

Several relatively large areas, either in drained moors or along riverbanks, have been extensively fieldwalked, and as a result many Early Mesolithic pieces have been recovered from those areas. They include Shewalton Moor in Ayrshire (Lacaille 1930, 1937), Dryburgh Mains in the Borders (Lacaille 1937), the Dee valley (Lacaille 1937; Ballin 2018; Wickham-Jones et al 2021), and Tentsmuir Sands in Fife (Lacaille 1944) (see also Lacaille 1954).

A numerically small assemblage of broad blades was recovered from a submerged site in Clachan Harbour, Raasay (Ballin et al 2011). The finds include no diagnostic pieces, and the assemblage could date to the Late Upper Palaeolithic as well as the Early Mesolithic period. Two radiocarbon samples from a peat layer above the lithics returned a date of *c* 7600–7000 cal BC (GU-17165, GU-17166), which provides a *terminus ante quem* for the assemblage.

At the site of Chest of Dee, at the upper end of the River Dee where the vast majority of the lithic finds and radiocarbon dates are Late Mesolithic, three isosceles triangles were also recovered, suggesting that the territories of Early Mesolithic

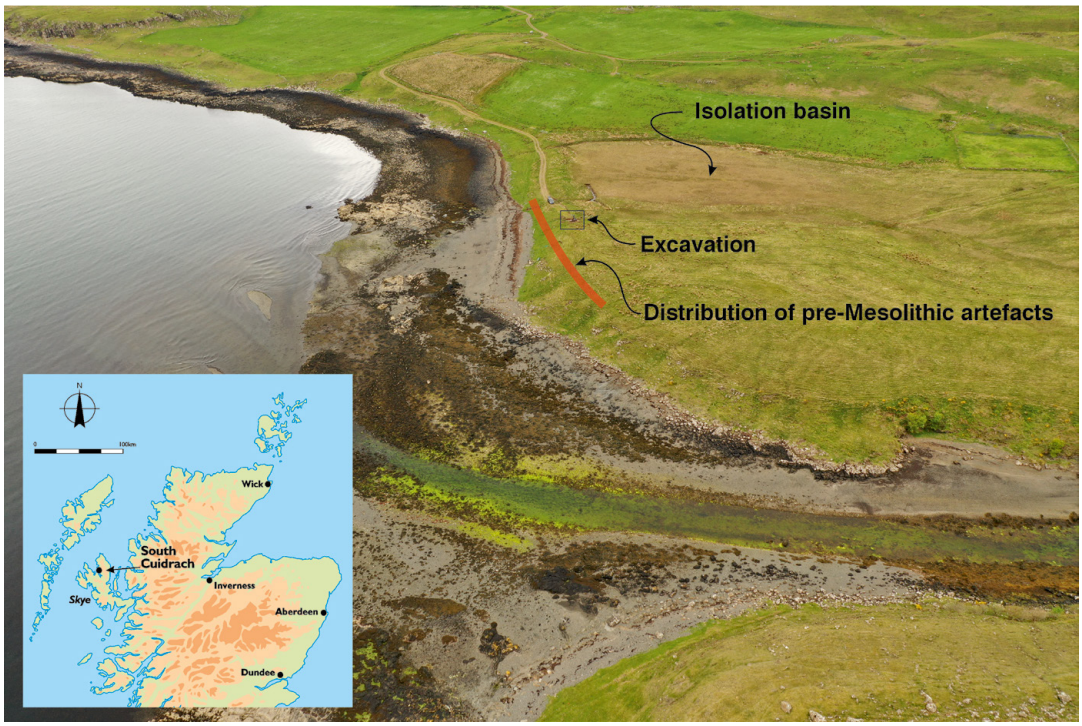
people in Scotland included uplands and mountain ranges (Wickham-Jones et al 2021).

Conneller et al (2016) suggested, on the basis of the presence of one microlith with light inverse basal retouch among the microliths from Cramond (Saville 2008), that Honey Hill type assemblages (defined by microliths with inverse basal retouch), commonly found in southern England, might be present in Scotland. However, there is no secure evidence for this industry north of Lincolnshire (Butler 2005).

SOUTH CUIDRACH

South Cuidrach (NG 38352 57729) is located in north Skye on the west coast of the Trotternish Peninsula (Illus 1). The site lies at the southern end of a 200m stretch of low-lying raised beach that is around 3m in altitude and contained to the south by a bedrock platform and to the north by an earlier, higher raised beach. An isolation basin located behind the raised beach may have provided fresh water at least until the mid-Holocene. The Hinnisdal River empties into Loch Snizort, directly to the south. Following many years of monitoring an assumed Late Mesolithic lithic surface scatter (Illus 2, Areas 1–6), a visit in 2017, shortly after the creation of a new farm track, revealed a new concentrated scatter of large, unrolled, Palaeolithic-style lithics (Illus 2, Areas 5, 6, 7).

Despite numerous later prehistoric archaeological sites, including Neolithic cairns and standing stones, Bronze Age hut circles and Iron Age duns within a 3-mile radius of the site, no archaeological evidence for a human presence after the end of the Mesolithic has been found in the immediate vicinity of the South Cuidrach site. The site is low-lying (around 3m OD) and close to the shore, and likely remained inundated until relatively recently (Best et al 2022),



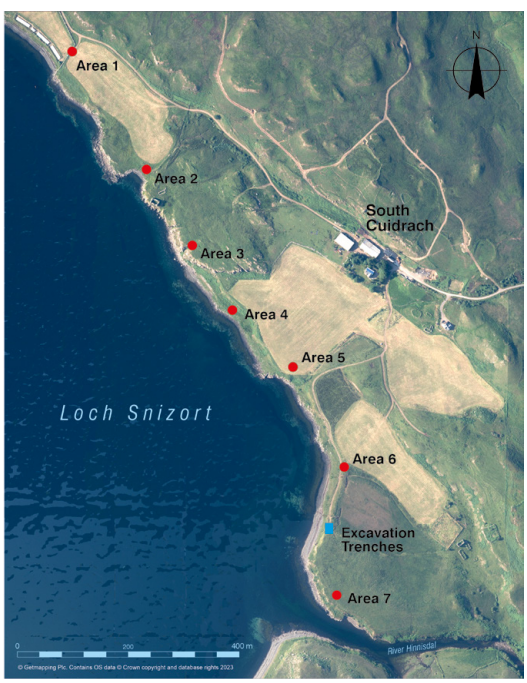
ILLUS 1 South Cuidrach from the south. (Photograph by Jamie Booth, Isle of Skye, adapted by Lorraine McEwan, University of Glasgow)

explaining the absence of any later prehistoric or more recent remains here.

Extensive test pitting in 2018 and 2019 uncovered Late Upper Palaeolithic or Late Upper Palaeolithic/Early Mesolithic lithic artefacts, possibly from several different material cultural traditions, as well as from excavated trenches, among the raised-beach deposits and above and below these, in addition to the surface (Hardy et al 2018). Some artefacts are very sharp, and because of their pristine or near-pristine state it is evident that they have moved little after deposition; for example, an apparently undisturbed deposit that contained primarily large broad blades (Illus 3) lies immediately beyond the southern limit of the raised-beach area. Following excavation of this deposit, further excavations of five 1 × 1.5m trenches in 2020–22 revealed at least two Late Mesolithic phases as well as a lithic assemblage dating from different Late Upper Palaeolithic and Early and Late Mesolithic periods. All excavated material below the turf was sieved using a flotation tank with a 1mm mesh to ensure recovery of all artefactual material. Some artefacts recovered from archaeological deposits are in near-pristine condition while others are somewhat rolled or heavily rolled, indicating post-depositional movement. This suggests that there may be at least one site in an area that is currently offshore (Hardy et al 2021), and one or more sites onshore, nearby. The Late Mesolithic deposit appears slightly mixed, in that it contains some rolled artefacts from earlier periods that have clearly washed in from probably now-submerged deposits, suggesting that the site was inundated either during occupation, causing the site to be abandoned, or very shortly afterwards. In either case, this effectively covered and sealed the Late Mesolithic deposits. While finds from the earlier periods comprise exclusively knapped lithic artefacts, for the Late Mesolithic, worked ochre and coarse stone artefacts, a charcoal assemblage and identifiable animal hairs have also been recovered. Micromorphological analysis (Hardy 2021) suggests that once deposited, the material has moved little.

Because many of the artefacts recovered are evidently redeposited, some of the assemblage from this site is culturally and temporally mixed. This means that, in contextual terms, the analysis of much of this assemblage has been conducted as though it was a surface collected site (see, for example, Ballin 2018) and no distribution or attribute analysis was carried out. Instead, we have chosen to present and group diagnostic and otherwise interesting lithic objects from South Cuidrach according to the chronological categories listed in Ballin (2021a) based on typology, technological attributes and blade size.

We focus on three groups of finds to illustrate the broad range of the recovered material: 1) Individual Late Upper Palaeolithic and Early Mesolithic artefacts; 2) a Late Upper Palaeolithic/Early Mesolithic broad-blade assemblage; 3) a Late Mesolithic narrow-blade assemblage. Here, the main focus is on the Late Upper Palaeolithic and Early Mesolithic lithic material and we present a number of selected artefacts from the site, diagnostic of these periods, as evidence of the timing of human presence at South Cuidrach.



Illus 2 Distribution of lithic surface scatters. (Adapted by Lorraine McEwan, University of Glasgow)

Illus 3 A selection of broad blades. (Photograph by Beverley Ballin Smith)

RAW MATERIALS

Only certain types of stone, which take a conchoidal fracture, can be used for flaked stone tool technology. These are normally readily identifiable and their sources can sometimes be specifically located. The South Cuidrach assemblages comprise six main raw material categories:

- Staffin baked mudstone, etc
- Flint
- Quartz
- Rum bloodstone
- Durness chert
- Other raw materials.

Baked mudstone occurs at a number of locations throughout Scotland and in the Hebridean area (for example, the Shiants north-west of the Isle of Skye; Foster & Hooper 2005), but in the Inner Hebrides it is present only as a notable and

easily accessible outcrop of flakeable raw material at An Corran, Staffin Bay, north-east Skye (less than 15km north-east of South Cuidrach). In the Staffin Bay area, it occurs within the local igneous rocks as rafted sediments which were altered by contact metamorphism (Saville et al 2012: 19). It is a fine-grained, black (monochrome), flint-like lithic raw material with excellent flaking properties, its only major flaw being natural fault planes running through this finely foliated type of rock. When weathered, its outer surfaces disintegrate and become powdery to slightly 'soapy', its original colour changes to grey, light olive-grey or fawn, and it is generally opaque.

Similar raw materials found in Skye are dolerite and tuff, which can be difficult to distinguish from baked mudstone when weathered or rolled. Dolerite, a lava, tends to be dark-grey/brownish-grey to black and with slightly coarser grains than baked mudstone, and it is occasionally recognisable by small cavities left by gas-bubbles. Dolerite and tuff are available from the local environment. Since many likely dolerite and tuff artefacts from South Cuidrach are weathered or rolled, these visually similar artefacts have been grouped together as most likely baked mudstone. Dolerite and tuff have slightly poorer flaking properties than baked mudstone and may have been used only on an expedient basis and probably not procured systematically.

The flint from South Cuidrach is generally fine-grained, mottled-grey material, with some pieces being medium-grained, more opaque, and either cream, browny or even black. Many pieces are highly fossiliferous or contain internal chalk balls, which lowered the flaking properties of the material. The occasionally centimetre-thick cortex of the flint is generally abraded. The only place that flint pebbles have been found in Skye is on the beach to the west of An Corran, by Staffin. A source of flint was also identified off the island of Eigg (Wickham-Jones & Collins 1978: 12).

Quartz is available from igneous and sedimentary as well as metamorphic rock formations, but some vein quartz may be from sandstone and is likely to derive from the Torridonian sandstone in Skye (Bell & Harris 1986: 11). Most likely, most of the quartz was collected from beach walls near the site.

Bloodstone is a member of the chalcedony family (Ballin 2018). Bloodstone (green jasper with red filaments) is also called heliotrope, and heliotrope and plasma (green jasper without red filaments) are frequently found in the same geological environments (Hall 2000: 93), such as for example around the extinct volcanoes on the Isle of Rum in the Scottish Inner Hebrides. Although bloodstone is common in Late Mesolithic assemblages in the area, there is no evidence it was used before this.

The chert is grey Durness chert from the Durness limestone (Raine 2009) that stretches from Durness, near Cape Wrath, to Loch Torridon and across the southern parts of Skye, just south of the island's volcanic centre. The nearest known source of unaltered chert is found near Ord in Sleat, on the southern shores of Loch Eishort (Bell & Harris 1986: 25), where worked artefacts have been found on the beach.

The group 'other raw materials' includes pieces of mostly sandstone and granite; these raw materials are available in the local environment.

THE LITHIC ASSEMBLAGE

A lithic assemblage comprising 2,921 pieces has been recovered from the surface, the test and shovel pits and the larger excavation trenches from 2017 to 2022 (Table 4). Many pieces, in particular of baked mudstone, showed some degree of weathering, while only a small number were categorised as 'certainly rolled', such as scraper Cat 2 (Illus 8). Many of the flint artefacts are slightly corticated/discoloured but retain sharp edges, but a small number of pieces were defined as clearly rolled. Lithic finds are usually described in terms of the raw materials used, debitage (unmodified waste and blanks), and core and tool typology, while blade width and flaking techniques may indicate relative age (in the Late Upper Palaeolithic/Mesolithic broad blades tend to be early and narrow blades late). When these attributes of a lithic assemblage are brought together, they may reveal which different material

TABLE 4
All lithic finds from South Cuidrach. The classification of the pieces follows Ballin (2021a)

	Baked mudstone	*Flint*	*Quartz*	*Rum bloodstone*	*Durness chert*	*Others*	*Total*
Debitage							
Chips	554	226		4			784
Flakes	1,031	245	5	12	4	31	1,328
Blades	322	37					359
Microblades	56	30					86
Indeterminate pieces	51	26			1		78
Crested pieces	16	12			1		29
Platform rejuvenation flakes	3	2		1			6
Total debitage	**2,033**	**578**	**5**	**17**	**6**	**31**	**2,670**
Cores							
Single-platform cores	14	5					19
Opposed-platform cores	5	1					6
Cores with two platforms at angle	3	1					4
Discoidal cores	1						1
Irregular cores	13	8				2	23
Bipolar cores	3	4					7
Core fragments	1						1
Total cores	**40**	**19**				**2**	**61**
Tools							
Tanged implement		1					1
Fragments of possible backed/ tanged points	2						2
Microlith preforms		1					1
Obliquely blunted points	1	2					3
Micro-isosceles triangles		1					1
Scalene triangles	1						1
Edge-blunted microliths	4						4
Microliths, atypical		1					1
Fragments of microliths	1	1					2
Fragments of microliths/backed bladelets	18	7					25
Microburins, broad	6	1				1	8
Microburins, narrow	1	2					3
Backed bladelets	3	3					6
Short end-scrapers	10	11	1	1		1	24
Blade-scrapers	2	1					3

TABLE 4
Continued

	Baked mudstone	*Flint*	*Quartz*	*Rum bloodstone*	*Durness chert*	*Others*	*Total*
Double-scrapers	1						1
Side-scrapers	2	3					5
End-/side-scrapers		2					2
Concave scrapers		1					1
Scrapers, atypical		1					1
Scraper-edge fragments		1					1
Piercers	1	2					3
Drill bits		2					2
Backed knives	2	1					3
Truncations		4					4
Burins	9	3					12
Notches	1						1
Combined scraper/burins	1	1					2
Pieces with edge-retouch	37	30					67
Total tools	**103**	**83**	**1**	**1**		**2**	**190**
TOTAL	**2,176**	**680**	**6**	**18**	**6**	**35**	**2,921**

cultural traditions are included within a mixed assemblage (for example, Ballin 2019a).

Below, we have split the collection's diagnostic elements into the following four chronological categories:

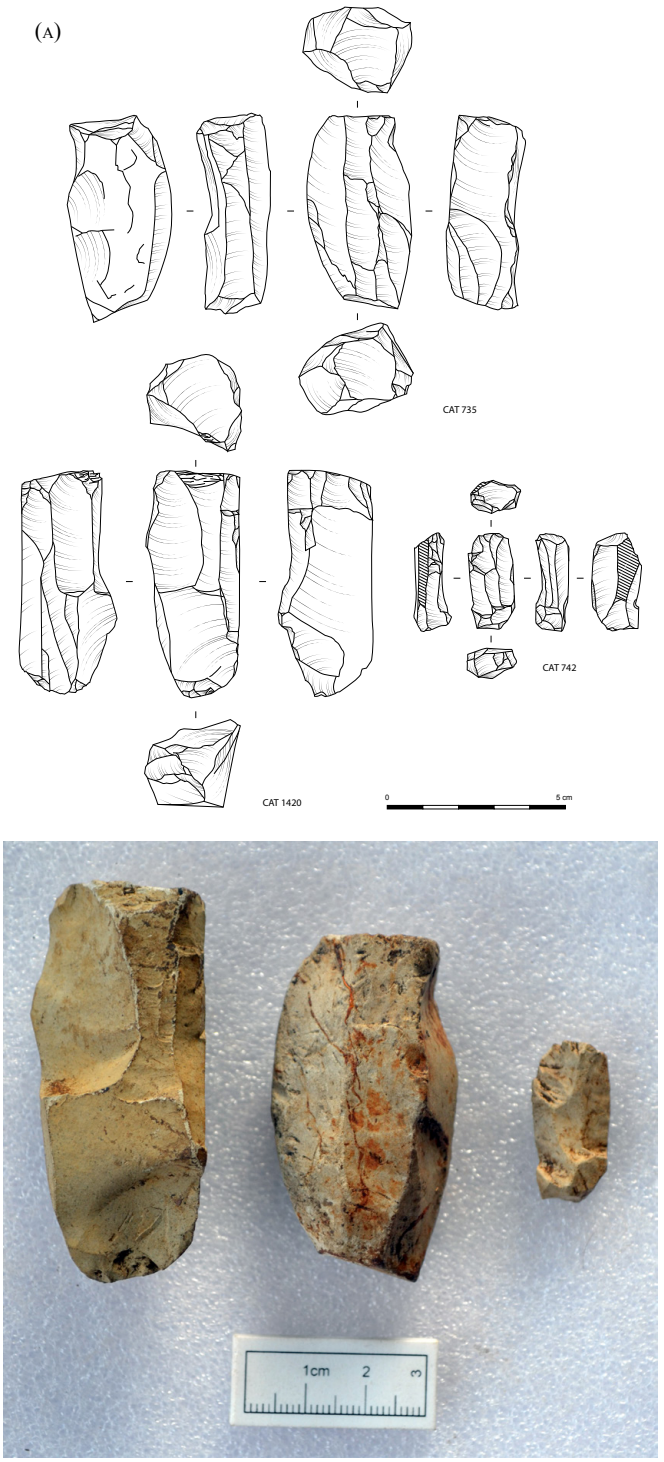
a) Certain or most likely Late Upper Palaeolithic
b) Artefacts that are pre-Late Mesolithic but unspecific in terms of the Late Upper Palaeolithic/Early Mesolithic
c) Artefacts that are most likely from the Early Mesolithic period
d) Artefacts that are most likely from the Late Mesolithic period.

Within these categories, diagnostic forms of debitage, core and tool types are characterised and discussed. Where possible, diagnostic artefacts have been illustrated, although in some cases, due to their condition (fragmentation, weathering), this was not possible.

The Late Upper Palaeolithic

Opposed-platform cores

Four cylindrical opposed-platform broad-blade cores (CAT 735, 742, 1420, Illus 4; CAT 2418, not illustrated) were retrieved from the site, in addition to two less regular opposed-platform cores. The four cylindrical baked mudstone cores are all highly regular, they have plain, trimmed platforms, and have been knapped around most of their circumference. The largest piece (CAT 1420) measures 64 × 31 × 24mm, whereas the smallest (CAT 742) measures 26 × 13 × 8mm. They are so similar in appearance that they must represent a well-defined operational schema based on meticulous core preparation. Compared with other industries focused on the production of large blades from regular, standardised opposed-platform cores (Ballin et al 2018; Ballin 2019a), the operational schema of the opposed-platform industry from South Cuidrach



ILLUS 4 Cylindrical opposed-platform cores CAT 735, 742, 1420. (A: drawing by Leeanne Whitelaw; B: photograph by Beverely Ballin Smith)

must have included the detachment of numerous platform rejuvenation flakes and crested pieces. These cores correspond formally to cores from the Ahrensburgian site Three Ways Wharf, Scatter A, West London (Lewis & Rackham 2011: fig 46), and some continental European Ahrensburgian sites, such as Berlin-Tegel A, Germany (Winkler 2019: Tafel 5).

Preparation flakes

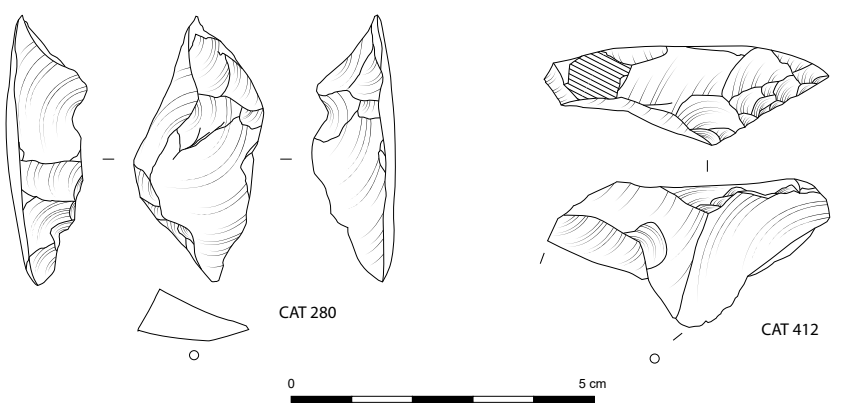
As shown in Table 4, a large number of preparation flakes were recovered. In total, 29 crested pieces (eg CAT 280, 298, 323, 376, 450, 468) and six core rejuvenation flakes (eg CAT 412) were found (Illus 5). Twenty-two of the crested pieces are blades/microblades and 82% of those are broad blades, several of which are almost 20mm wide. Although it cannot be ruled out that some of these broad crested pieces may be Early Mesolithic, the large number of preparation flakes suggests that they most probably date to the Late Upper Palaeolithic and that they are associated with an industry based on more vigorous preparation of core rough-outs than Early Mesolithic industries (Ballin 2019a).

Serial cresting and detachment of series of core tablets were noticed in connection with the analysis of the likely Late Upper Palaeolithic assemblage from Milltimber Zone 4 in Aberdeenshire, where in several cases it was possible to refit up to three crested blades and up to three core tablets (Ballin 2019b).

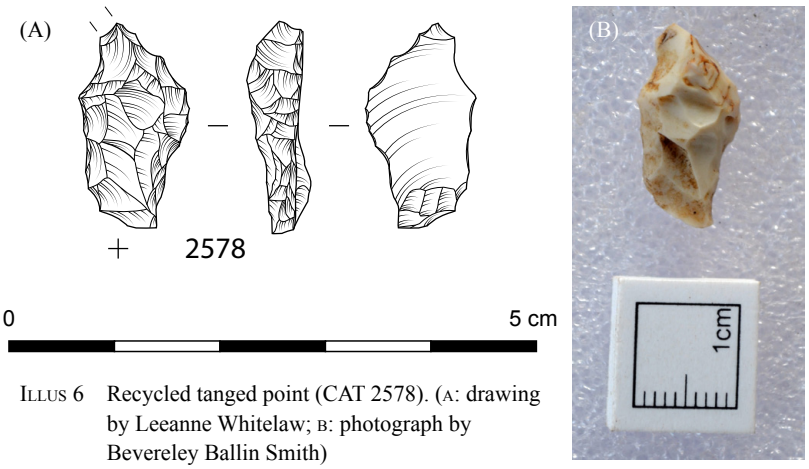
Tanged points

Tanged points are the main defining tool types of the Late Upper Palaeolithic, where large points with asymmetrical tangs characterise the Late Hamburgian (the Havelte phase), and small points with symmetrical tangs characterise the Ahrensburgian. No shouldered points from the Early Hamburgian (the Meiendorf phase) have yet been found in Scotland, and the *Federmesser* period (between the Hamburgian and Ahrensburgian periods) is defined by its backed points and an absence of tanged points. In Scotland, blade-based tanged points do not occur after the Late Upper Palaeolithic (the much later invasively retouched Bronze Age pieces are referred to as barbed-and-tanged points) (Ballin 2021a).

A solitary tanged implement (CAT 2578) was recovered from the site (Illus 6). It is based on a short hard-hammer blade or flake of flint, and it measures 19 × 10 × 5mm. At its proximal base it has a symmetrical, shouldered tang, and it is thought that this piece may be a recycled tanged point of Ahrensburgian affinity (Schwabedissen 1954; Winkler 2019). The tip half of this point was then secondarily transformed into a curved piercer tip, the outermost part of which has broken off. Although curved Late Upper Palaeolithic piercer tips are usually associated with Hamburgian *Zinken* (Weber 2012; Ballin et al 2018), the tips of *Zinken* are almost always



Illus 5 Crested piece (CAT 280); platform rejuvenation flake (CAT 412). (Drawings by Leeanne Whitelaw)



Illus 6 Recycled tanged point (CAT 2578). (A: drawing by Leeanne Whitelaw; B: photograph by Bevereley Ballin Smith)

orientated towards the right, whereas the tip of the present piece is orientated towards the left.

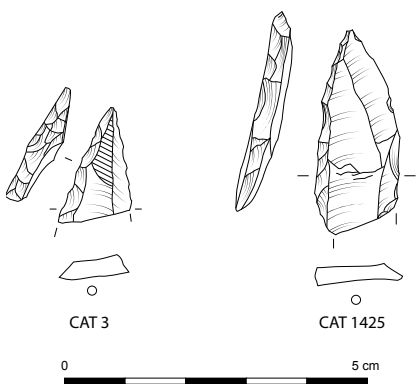
Possible tips of tanged or backed points

Two pieces were defined as the possible tips of tanged or backed points (CAT 3 and CAT 1425; Illus 7). They are the proximal or distal ends of broad blades, CAT 3 measuring 17 × 11 × 5mm and CAT 1425 measuring 33 × 14 × 4mm. They are both characterised by a notably acute frontal truncation. Knives with an oblique truncation (as well as some Creswellian angle-backed points; Jacobi 2004) tend to have a truncation with a *c* 45 degree angle against the cutting-edge, whereas the oblique truncation of, for example, later Hamburgian Havelte points tend to have a considerably shallower angle against the cutting-edge (just below 30 degrees; Ballin et al 2018). CAT 3 has an angle of truncation of *c* 30 degrees, and the truncation of CAT 1425 has an angle of *c* 28 degrees, suggesting that they are the tips of unspecified Late Upper Palaeolithic tanged or backed points (Schwabedissen 1954; Weber 2012; Winkler 2019). However, it cannot be ruled out that these two pieces could be fragments of unusually large Early Mesolithic points.

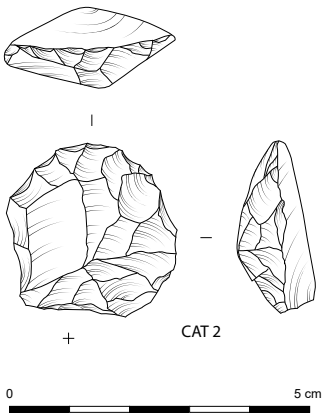
Scrapers with acute scraper-edges

Several scrapers were also recovered (Table 4). In the present context, one end-scraper is particularly interesting, namely CAT 2 (Illus 8). Although this piece is heavily water-rolled, it was clearly a well-executed implement, and its acute scraper-edge suggests that this may be a Late Upper Palaeolithic piece (cf Ballin et al 2018: fig 23). It measures 28 × 30 × 14mm.

Where most prehistoric scrapers from Scotland have steep scraper-edges, the evidence from Scottish sites suggests that only two periods are characterised by having many scrapers with acute scraper-edges, namely the Late Upper Palaeolithic and the later Neolithic/Early Bronze Age periods (cf the scrapers from Hamburgian Howburn and those from later Neolithic Overhowden; Ballin 2011; Ballin et al



Illus 7 Possible tips of tanged or backed points (CAT 3; CAT 1425). (Drawing by Leeanne Whitelaw)



Illus 8 Notably rolled short end-scraper with an acute working-edge (CAT 2). (Drawing by Leeanne Whitelaw)

2018). However, as no post-Mesolithic artefacts have been identified at South Cuidrach, scraper CAT 2 is most likely to date to the Late Upper Palaeolithic.

Burins (Illus 9)

In Scotland, typologically certain and contextually safely dated burins have been recovered only from pre-Neolithic sites and contexts (eg Saville & Ballin 2009; Ballin & Ward 2013; Ballin & Barrowman 2015; Ballin et al 2018; also see Lacaille 1938). It is quite likely that one or more of the burins from South Cuidrach may date to the Mesolithic period, but several factors suggest that most of them are Late Upper Palaeolithic. Firstly, burins are quite rare on Mesolithic sites, either being absent or appearing in ones, twos or threes, whereas they are more numerous on Late Upper Palaeolithic sites. The Hamburgian (Havelte) site of Howburn in the Clyde valley, for example, yielded 40 burins (Ballin et al 2018). The fact that 12 burins were recovered from South Cuidrach out of an assemblage of less than 3,000 lithic artefacts indicates that most of these pieces, and most of the site, may be quite early.

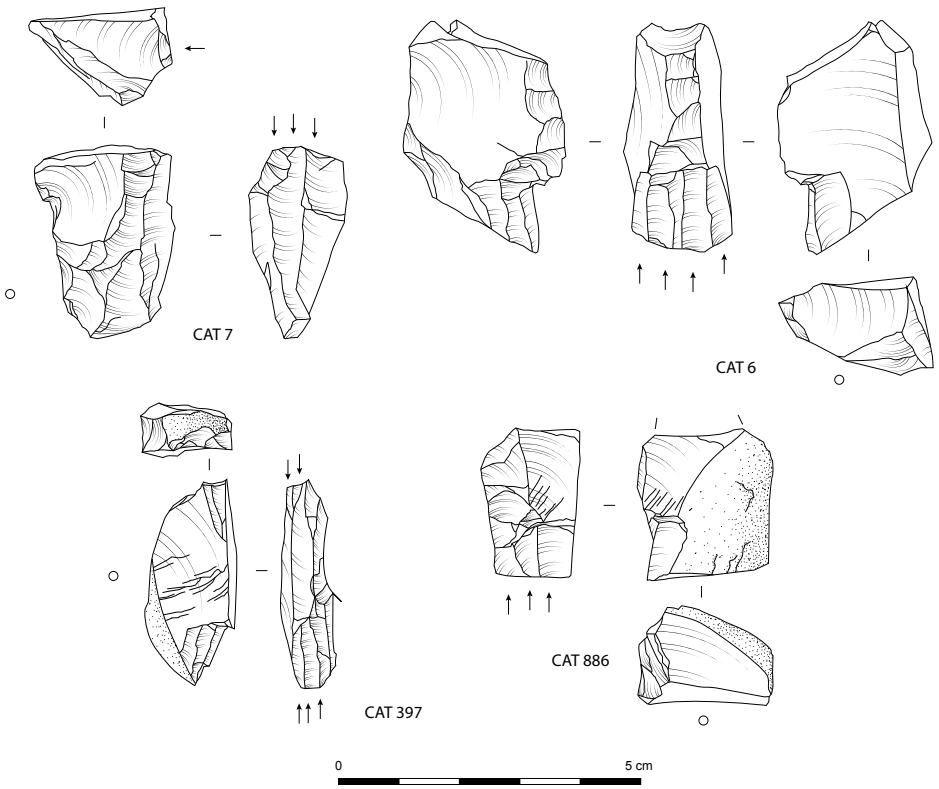
Secondly, whereas most burins from Scottish Mesolithic sites tend to be relatively delicate (see for example the burins from Nethermills Farm, Aberdeenshire, Ballin 2017b), burins from Late Upper Palaeolithic sites are usually more robust (larger and thicker). Thirdly, whereas most Mesolithic burins from Scotland tend to be simple burins on breaks, many Late Upper Palaeolithic burins fall into the category of 'complex burins', a category which includes, first and foremost, burins on truncations, but also double-burins, dihedral burins, polyhedral burins and combined tools with a burin function.

Late Upper Palaeolithic/Early Mesolithic

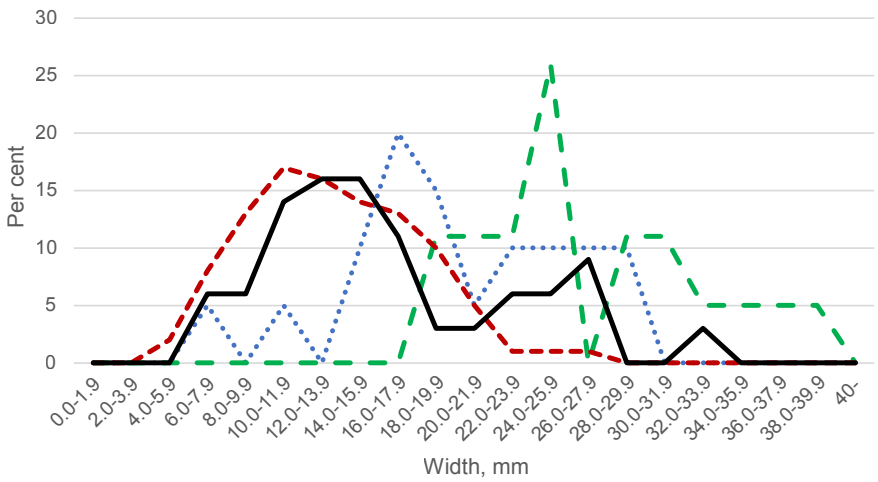
The debitage from Test-trench 1, Contexts 4.1, 4.2 and 5

While much of the diagnostic material discussed here concerns core and tool types, one collection of blades appears to be almost unaffected by the turbulent environment of the raised beach, namely TT1, Contexts 4.1, 4.2 and 5. The size and quality of the blades suggest that this sub-assemblage dates to an unspecified part of the Late Upper Palaeolithic/Early Mesolithic period. From these contexts, 202 lithic finds were recovered, including 184 pieces of debitage, eight cores and ten tools (Table 4). In this section, only the 67 blades (93% being broad or very broad blades) are discussed. The debitage from this broad-blade assemblage consists almost exclusively of baked mudstone, supplemented by small amounts of flint (93.07%).

Illus 10 (the width of all blades) shows that the finds from one location (TT1, Contexts 4.1, 4.2 and 5) represent material left by one or more broad-blade industries, but a small plateau left of the curve's main peak probably indicates an almost negligible Late Mesolithic presence (in the form of six delicate microblades). The broad-blade material forms two peaks, with the main peak at width 10–18mm ('broad blades') and a number of small peaks and plateaux at width 22–34mm ('very broad blades'). It is thought that all the blades from these contexts represent settlement within the Late Upper Palaeolithic/Early Mesolithic period. This blade assemblage also includes three broad crested blades with widths of 11mm, 15mm and 19mm, respectively (CAT 280, 298, 376). The main peak in Illus 10 ('broad blades') probably corresponds size-wise



Illus 9 Dihedral burin (CAT 7); combined dihedral/polyhedral scraper/burin (CAT 6); double polyhedral burin (CAT 397); and robust, dihedral burin on a break (CAT 886). (Drawing by Leeanne Whitelaw)



Illus 10 The width of the blades from TT1, Contexts 4.1, 4.2 and 5 (black line), the Late Upper Palaeolithic sites of Howburn in South Lanarkshire (red dotted), Lunanhead in Angus (blue dotted), and Milltimber in Aberdeenshire (green dotted) (Ballin et al 2018; Ballin 2019b, 2021c). (Image by Torben Ballin)

to the general blade assemblage from An Corran (Saville et al 2012: illus 23 & 24), whereas the second peak ('very broad blades') corresponds to the blades from the lowest levels at An Corran (Saville et al 2012: illus 25 & 28). This interpretation is supported by the presence of diagnostic Late Upper Palaeolithic and Early Mesolithic core and tool types at South Cuidrach (eg the cylindrical cores and the broad microliths and microburins).

Table 5 shows the percussion techniques applied to produce the blades of this sub-assemblage, and the composition clearly differs from the composition expected of a Late Mesolithic assemblage. There are more soft-hammer blades and fewer hard-hammer blades. It is thought that the blades may generally have been produced by direct soft percussion, but with some early-stage (and broader) blades possibly having been produced by the application of hard percussion. This combined direct hard/direct soft approach also characterises the assumed Late Upper Palaeolithic *Riesenklingen* (or 'giant blade') sub-assemblage from Milltimber Zone 4 in Aberdeenshire and Lunanhead in Angus (Ballin 2019b, 2019c, 2021b). Late Mesolithic blade assemblages from Scotland tend to be dominated by narrow blades produced by the application of pressure-flaking (cf the assemblages from Standingstones, Aberdeenshire, and Dunragit Site 19, Dumfries and Galloway; Ballin 2019a, 2021b), although the narrow blades on the Scottish west coast and in the Hebrides may to a notable extent have been produced by bipolar technique (cf the assemblage from the Late Mesolithic site Camas Daraich, southern Skye; Hardy et al forthcoming). Illus 11 demonstrates the distribution in TT1 Contexts 4 and 5. Many of the artefacts in this relatively dense artefact concentration were lying vertically when recovered. This, and the irregular shape of the deposit with the concentration of artefacts at the lowest point, suggest they accumulated in a small body of water and that they were affected slightly by one or more storm surges. However, the artefacts are sharp and unrolled, suggesting their initial point of deposition was nearby and they have moved very little over time.

Large single-platform blade-cores

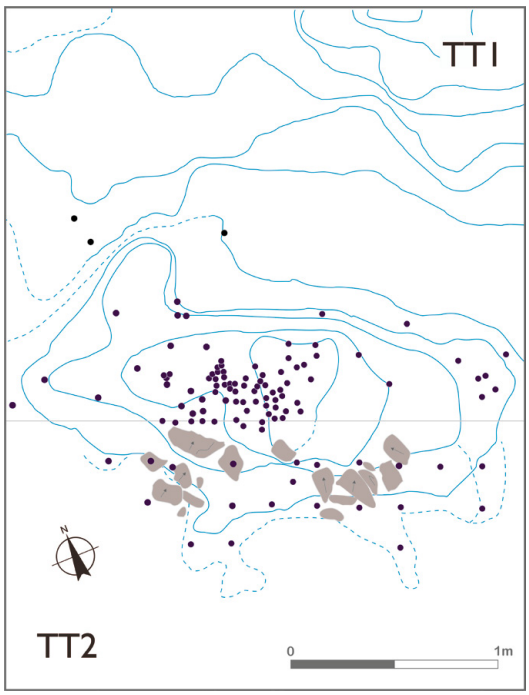
Single-platform cores are not diagnostic as such, but the sheer size (57 × 42 × 27mm) of baked mudstone blade-core CAT 193 indicates an early date, either in the Late Upper Palaeolithic or in the earliest part of the Early Mesolithic (possibly contemporary with the very large baked mudstone blades from the lowest levels at An Corran, Staffin Bay; Saville et al 2012) (Illus 12). This piece has a trimmed, plain platform and the face opposite the main flaking-front is characterised by a natural fault-plane.

Obliquely blunted points/Zonhoven points

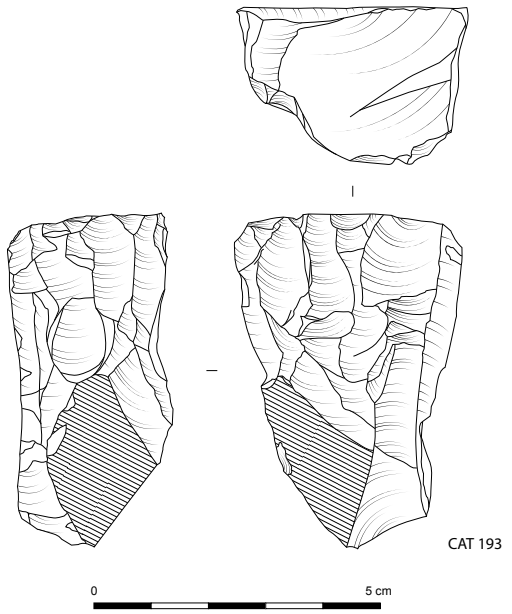
Obliquely blunted points include two sub-types, namely Late Upper Palaeolithic specimens which

Table 5
The applied percussion techniques of technologically definable unmodified and modified blades from TT1, Contexts 4.1, 4.2 and 5. (Note: As no general and more detailed attribute analysis was carried out, more general categories were used in this table, to a large extent based on the nature of bulbar area attributes: hard percussion is direct hard percussion; soft percussion is direct soft percussion, punch technique and pressure-flaking; and bipolar technique is percussion by the use of an anvil.)

Technique	*n*	*%*
Hard	13	17
Soft	22	29
Platform	5	7
Bipolar	0	0
Uncertain	35	47
Total	**75**	**100**



Illus 11 The distribution of artefacts in TT1 Contexts 4.1, 4.2 and 5 and TT2. (Drawing by Lorraine McEwan University of Glasgow)



Illus 12 Conical single-platform blade-core (CAT 193). (Drawing by Leeanne Whitelaw)

were *not* produced by microburin technique (so-called Zonhoven points; Vermeersch 2013: 55) and Early Mesolithic ones which *were* (Ballin & Ellis 2019). The collection's three obliquely blunted points, which are all somewhat damaged, appear to have been produced without the application of microburin technique, suggesting that they may be fragments of Ahrensburgian Zonhoven points (Illus 13). Likewise, some Zonhoven points differ from Early Mesolithic obliquely blunted points by having more concave frontal truncations (Lewis & Rackham 2011: 53), thereby making them slightly more pointed (which may have made the creation of a sharp-edged *piquant trièdre* (microburin facet) less essential, as is also the case with CAT 798). However, the recovery from the raised beach of several broad microburins suggests that these three pieces could also potentially be Early Mesolithic specimens which simply had their microburin facet retouched.

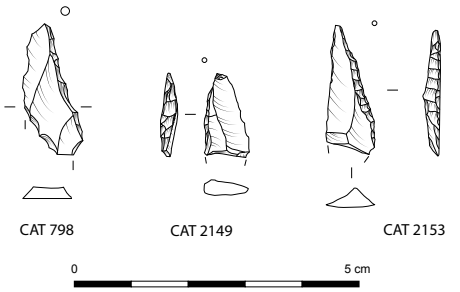
Blade-scrapers

Three blade-scrapers were recovered from the site, and one broken blade-scraper of baked mudstone (CAT 761; Illus 14) is based on a blade so broad that an early date is almost certain (Late Upper Palaeolithic or the early part of the Early Mesolithic, corresponding to the lowest levels at An Corran). It has a convex, steep scraper-edge at the distal end, and both lateral sides have been blunted by retouch. It measures 41 × 26 × 8mm.

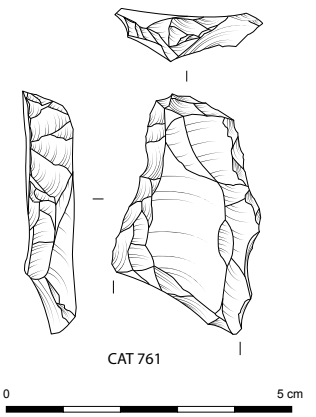
The Early Mesolithic

Broad microburins (Illus 15)

Only a small number of pieces are strictly diagnostic of the Early Mesolithic period, namely the site's broad microburins. Microburin technique was only rarely used prior to the Early Mesolithic (Vermeersch 2013) (apart from the distinct double-notch microburins from the production of the tangs of tanged points; Clausen 1995: fig 10),



Illus 13 Three obliquely blunted points (CAT 798, 2149, 2153). (Drawing by Leeanne Whitelaw)



Illus 14 Blade-scraper with lateral blunting (CAT 761). (Drawing by Leeanne Whitelaw)

and microburins produced by breaking narrow blades (W: 8mm) are almost all Late Mesolithic (cf the assemblages from all well-known Late Mesolithic assemblages from Scotland, such as those from Dunragit 19 in Dumfries and Galloway and Standingstones and Nethermills Farm in Aberdeenshire; Ballin 2017b, 2019c, 2021b).

A total of 11 microburins were recovered from the site, with three-quarters of those being broad specimens. Most of these are of baked mudstone, with one being of flint and one of sandstone. The many broad microburins are probably waste from the production of obliquely blunted points (and possibly isosceles triangles, although none was found at South Cuidrach), and they generally date to the Early Mesolithic period.

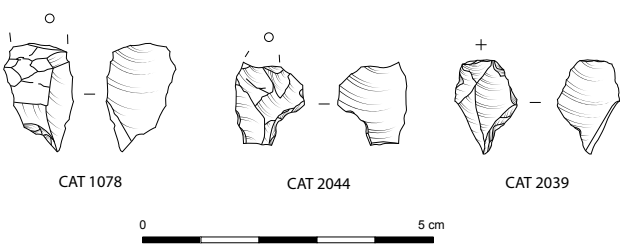
The broad microburins from South Cuidrach have widths of 9–13mm. Only two formed a proper sharp-edged burin facet or *piquant trièdre* (de Wilde & de Bie 2011: 730), whereas most failed and simply snapped straight across.

The Late Mesolithic

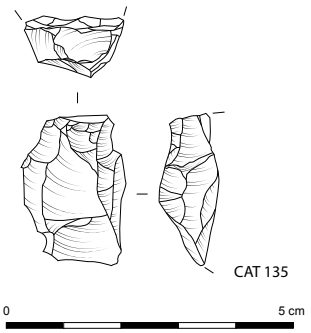
A number of categories were defined as Late Mesolithic on technological grounds, such as small conical narrow-blade cores and narrow microliths/microburins (cf Butler 2005; Ballin 2021a). Some categories are likely to be Late Mesolithic on negative grounds, that is, they are absent from all Late Upper Palaeolithic and Early Mesolithic artefactual material but appear in relation with the narrow blades and narrow-blade cores and tools. These categories include the first appearance of Rum bloodstone and Durness chert raw materials, and also bipolar cores and debitage.

Cores (Illus 16)

Some small single-platform narrow-blade cores are almost certainly Late Mesolithic (cf Butler



Illus 15 Broad microburins (CAT 1078, 2039, 2044). (Drawing by Leeanne Whitelaw)



Illus 16 Conical single-platform narrow-blade core (CAT 135). (Drawing by Leeanne Whitelaw)

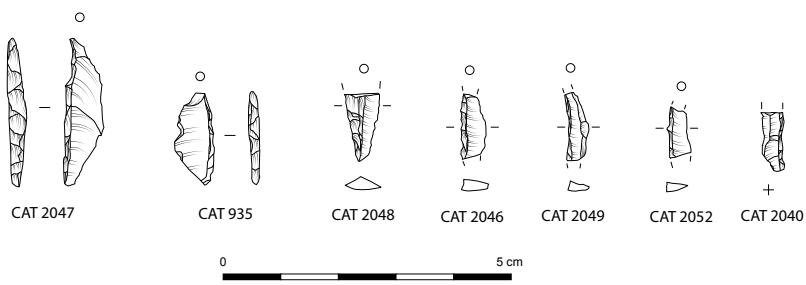
2005; Ballin 2021a). They tend to have lengths of *c* 20–30mm, where earlier single-platform cores not uncommonly have lengths of 40–60mm (see above). The removals from these cores were probably mostly used as blanks for microliths and drill bits, although in western Scotland many microlith blanks are bipolar spalls (eg the assemblage from Camas Daraich; Hardy et al forthcoming). Some narrow, crested pieces are probably associated with the preparation and curation of these single-platform cores.

Narrow microliths and microburins (Illus 17)

Narrow-blade microliths are traditionally dated to the Late Mesolithic period (cf Butler 2005; Ballin 2021a). They include scalene triangles, crested pieces and edge-blunted microliths, as well as micro-isosceles and scalene triangles. Backed bladelets (with surviving bulbar ends) are also considered Late Mesolithic. The assemblage from South Cuidrach includes one scalene triangle, several edge-blunted microliths, one micro-isosceles triangle and a number of fragments of either narrow-blade microliths or backed bladelets.

In addition, the tip of one needle-shaped drill bit was recovered (CAT 2042). These pieces, which have also been referred to as needle-points or fine points, have traditionally been grouped with the microliths, but they ought to be grouped with the piercers (cf Dunragit Site 19 in Dumfries and Galloway, Nethermills Farm in Aberdeenshire, as well as Lealt Bay and Lussa River on Jura; Mercer 1968, 1971; Ballin 2017b, 2021b).

Only three narrow-blade microburins were recovered. Although the assemblage includes notably higher numbers of narrow microliths than broad ones, it also includes notably higher numbers of broad microburins than narrow ones. This discrepancy is probably due to the fact that broad microliths were generally produced by the application of microburin technique (cf Donich Park; Ballin & Ellis 2019), whereas in the northern part of the Inner Hebrides, with its limited supply of good-quality lithic raw materials, narrow microliths were in many cases produced without the use of microburin technique, simply by retouching a suitable pointed end (cf the assemblage from Camas Daraich; Hardy et al forthcoming).



Illus 17 Edge-blunted microliths (CAT 2047, 935); fragments of microliths or backed bladelets (CAT 2048, 2046, 2049, 2052); backed bladelet (CAT 2040). (Drawing by Leeanne Whitelaw)

DISCUSSION

The general composition of the assemblage from South Cuidrach suggests that the location was visited during the Late Upper Palaeolithic, Early Mesolithic and Late Mesolithic periods. As Late Mesolithic sites are not uncommon in western Scotland and the Hebridean area, this paper has focused on the Late Upper Palaeolithic and Early Mesolithic finds.

The technological composition of the sub-assemblages indicates that the earliest industries may have relied largely on a combination of platform techniques, with opposed-platform blade technology being an important part of the Late Upper Palaeolithic operational schema. Bipolar reduction was probably introduced relatively late, possibly towards the Early/Late Mesolithic transition. Artefacts from South Cuidrach which are diagnostic of the Late Upper Palaeolithic include highly regular cylindrical opposed-platform cores, large, crested blades, platform rejuvenation flakes, one heavily rolled scraper with an acute scraper-edge and several so-called 'complex' burins, while one particularly broad blade-scraper is either Late Upper Palaeolithic or Early Mesolithic. A small, probably re-functioned, tanged arrowhead indicates an Ahrensburgian presence, while two possible tips of tanged or backed points are also likely to date to the Late Upper Palaeolithic.

Scotland's Late Upper Palaeolithic industries are generally associated with opposed-platform blade technologies, with many blades being of substantial size (Ballin 2019a). However, no known Late Upper Palaeolithic site from Scotland has as yet yielded opposed-platform broad-blade cores, which can best be described as highly regular, slender, cylindrical cores, like the ones from South Cuidrach. At present, we do not know which cultural industry is responsible for these cores, they may be Ahrensburgian, but they may also come from another cultural period in the Late Upper Palaeolithic. Without doubt, the operational schema must have been sophisticated, including meticulous core preparation. Likely Early Mesolithic pieces include large single-platform blade-cores (although the largest of them could possibly date to the Late Upper Palaeolithic), broad microburins and one broad microlith preform. Several obliquely blunted pieces may date to the Early Mesolithic, although they could possibly be Late Upper Palaeolithic Ahrensburgian Zonhoven points.

Likely Late Mesolithic pieces include small conical narrow-blade cores, crested microblades, one micro-isosceles triangle (similar to those from Dunragit in south-west Scotland and Nethermills Farm in Aberdeenshire; Ballin 2017b, 2021b), narrow edge-blunted microliths, narrow microlith fragments, backed bladelets, narrow microburins and one needle-shaped drill bit, while ochre artefacts and flat pebbles from these contexts have evidence of use. The plain burins may date to any part of the Late Upper Palaeolithic/Mesolithic framework. Late Upper Palaeolithic and Mesolithic artefacts have been found on the ground surface, and through the raised beach as well as in a small area immediately to the south (Illus 2). Additionally, there is a Late Mesolithic in-situ deposit, most probably the remains of a dwelling, sealed beneath parts of the raised beach. Together, this illustrates the complex formation processes at play at South Cuidrach.

Baked mudstone from An Corran at Staffin in north-east Skye was the primary raw material used at South Cuidrach, supported by a relatively small amount of flint, likely also from Staffin. The absence of Rum bloodstone among the Late Upper Palaeolithic material and in the early broad-blade assemblage (TT1, Contexts 4.1, 4.2 and 5) may indicate that bloodstone was not exported from Rum until the end of the Early Mesolithic period. There is very little extraneous raw material, suggesting that by the time the inhabitants reached South Cuidrach the raw material sources at Staffin were probably already known.

South Cuidrach is a complex site, and understanding lithic assemblages from turbulent environments such as the raised beach and its associated deposits is challenging. However, while the value of mixed deposits may be reduced

for later prehistoric periods where chronologically unmixed sites and assemblages are available, in some parts of the country (particularly the west coast and the Hebridean area), exposed areas such as raised beaches may be among the few places where evidence from the Late Upper Palaeolithic/Early Mesolithic period survives and is accessible.

The archaeological remains found within the raised beach at South Cuidrach may be the result of a rare combination of geomorphological processes and near-offshore sites. Another example of an early raised beach is found on Iona, where one obliquely blunted point from the deposits may be either an Early Mesolithic point or an Ahrensburgian Zonhoven point (Barber 1981: fig 44, 323.1). Although we have not been able to produce a neat stratigraphic sequence through the South Cuidrach raised beach, we have been able to demonstrate a human presence here during a period of mobile populations that stretches for thousands of years before the first appearance of farming in Scotland.

South Cuidrach is one of few Scottish sites with evidence of repeated use over thousands of years during the earliest periods of human habitation of Scotland (Table 6). This and the use of the primary raw material, baked mudstone, that is found in only one location, raise fascinating questions regarding knowledge transmission across different cultural periods over extended time scales and highlights the essential role of a detailed understanding of lithics as the foundation for developing a framework for human occupation during this long time period.

From a settlement point of view, the location of the site is highly favourable. It lies on a west-facing shoreline at the mouth of a river and on the edge of a sea loch. An isolation basin directly behind the site was a small freshwater loch throughout the period of occupation, and the site is close to upland areas where game could have been hunted. However, as there is no organic survival at the site, any suggestion of subsistence strategies would be purely speculative. It is not currently clear exactly where the sea was at the time of occupation but, if nearby, it could also have been exploited for fishing and hunting marine mammals, while the isolation basin may have been exploited for fowling as well as collection of edible sedges, many of which have nutritious underground storage organs. Ochre, for which there is abundant evidence in the Late Mesolithic contexts, is found on the beach and outcrops nearby, while raw material sources of baked mudstone and beach flint are found at Staffin in north-east Skye, approximately 15km away.

There are several other Late Upper Palaeolithic/Early Mesolithic sites nearby, including An Corran at Staffin (Saville et al 2012), Clachan Harbour on the island of Raasay (Ballin et al 2011), and a submerged and low intertidal site at Sconser, opposite Raasay, on Skye (Hardy et al 2021) (Table 6). While all these sites can currently only be categorised as Late Upper Palaeolithic/Early Mesolithic, slightly further afield at Shieldaig, an Ahrensburgian point has been recovered (Ballin & Saville 2003; Hardy 2014). Two Ahrensburgian points have also been found on islands further south, one in Islay (Berg-Hansen et al 2019) and one in Tiree (Ballin & Saville 2003).

During the early part of the chronological sequence reflected in the lithic assemblage from South Cuidrach, the sea level is likely to have been significantly lower than today, and much of the North Sea would have been dry land. Since the lithic artefacts from South Cuidrach are typo-technologically linked to material cultures found in northern Germany, southern Denmark and beyond, and since there are no indications of links to the contemporary material cultures further south in England (eg the Creswellian, as well as the Early Mesolithic Horsham and Honey Hill industries; Jacobi 2004; Conneller et al 2016; Waddington et al 2017), we assume that the people visiting South Cuidrach during the earliest part of Scottish prehistory would be the descendants of those who crossed Doggerland and made their way across northern Britain, most likely up river valleys such as the Clyde as reflected in the archaeological evidence at Howburn (Ballin et al 2018). The earliest

TABLE 6
North European cultures with a presence in Scotland

Culture	*European distribution*	*Age*	*Evidence in Scotland*	*Climate/environment (Walker & Lowe 2019)*
Late Hamburgian (Havelte)	North Germany, the Low Countries, southern Scandinavia, Poland	12,700–12,000 cal BC 14,500–13,500 BP	Howburn, Lanarkshire (Ballin et al 2018)	Grasses, sedges, *Empetrum* (crowberry), *Rumex* (docks and sorrels), birch, juniper, willow
Federmesser	North Germany, France, the Low Countries, south Scandinavia, Poland	12,000–10,800 cal BC 14,000–12,800 BP	Kilmelfort Cave, Argyll (Saville & Ballin 2009)	Grasses, sedges, *Empetrum* (crowberry), *Rumex* (docks and sorrels), birch, juniper, willow
Ahrensburgian	North Germany, the Low Countries, Poland, south Denmark	10,800–9800 cal BC 12,900–11,700 BP	**South Cuidrach**; Tiree; Shieldaig, Loch Torridon (Ballin & Saville 2003); Islay (Mithen et al 2015)	Cold. Grasses, sedges. Reduction in tree species. Increase in *Empetrum* (crowberry)
Early Mesolithic	Extensive across Europe and Scandinavia	9800–8400 cal BC 11,700–10,300 BP	**South Cuidrach**; Morton, Fife (Coles 1971); Donich Park, Argyll (Ballin 2019a); Lussa Bay and Glenbatrick Waterhole, Jura (Mercer 1970, 1975); An Corran, Skye (Saville et al 2012); Nethermills Farm, Aberdeenshire (Ballin 2013); Shieldaig (Hardy 2014)	Warming, developing tree cover. Birch, willow
Late Mesolithic	Extensive across Europe and Scandinavia	8400–4000 cal BC 10,500–5500 BP	**South Cuidrach**; extensive across Scotland	Relatively warm, conifer and deciduous forested. Hazel, pine
Unspecified; Late Upper Palaeolithic/ Early Mesolithic		12,700–8400 cal BC 14,500–10,300 BP	**South Cuidrach**; An Corran, Skye; Lunanhead, Angus; Milltimber, Aberdeenshire; Clachan, Raasay; Sconser, Skye	Relatively warm, conifer and deciduous forested. Hazel, pine

typo-technologically diagnostic evidence from Scotland suggests that humans could potentially have reached Skye while some parts of Scotland were still covered in ice. Although this largely disappeared during the Late Glacial Interstadial, mid-Skye, including the Cuillin range, reglaciated during the Loch Lomond Readvance. The evidence for Ahrensburgian material in and near Skye, as well as elsewhere on the west coast, suggests that people remained in Scotland through the Loch Lomond Readvance (Younger Dryas) and adapted to this very cold period and its rapidly changing environment. Finally, because Doggerland was so expansive at the time, it is not inconceivable that the earliest people, on arriving in Skye and west-coast Scotland, encountered the sea for the first time (Hardy et al 2021). This offers an extraordinary template, and

we can only speculate what their impression of this might have been and how they may have reacted and adapted to it.

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IMPORTANT NOTE

South Cuidrach is a large working croft. The area around the site is normally full of livestock and can only be reached through a busy farmyard. Therefore, it is not open to visit. Access can be arranged with the lead author at certain times of the year.

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