University of Reading





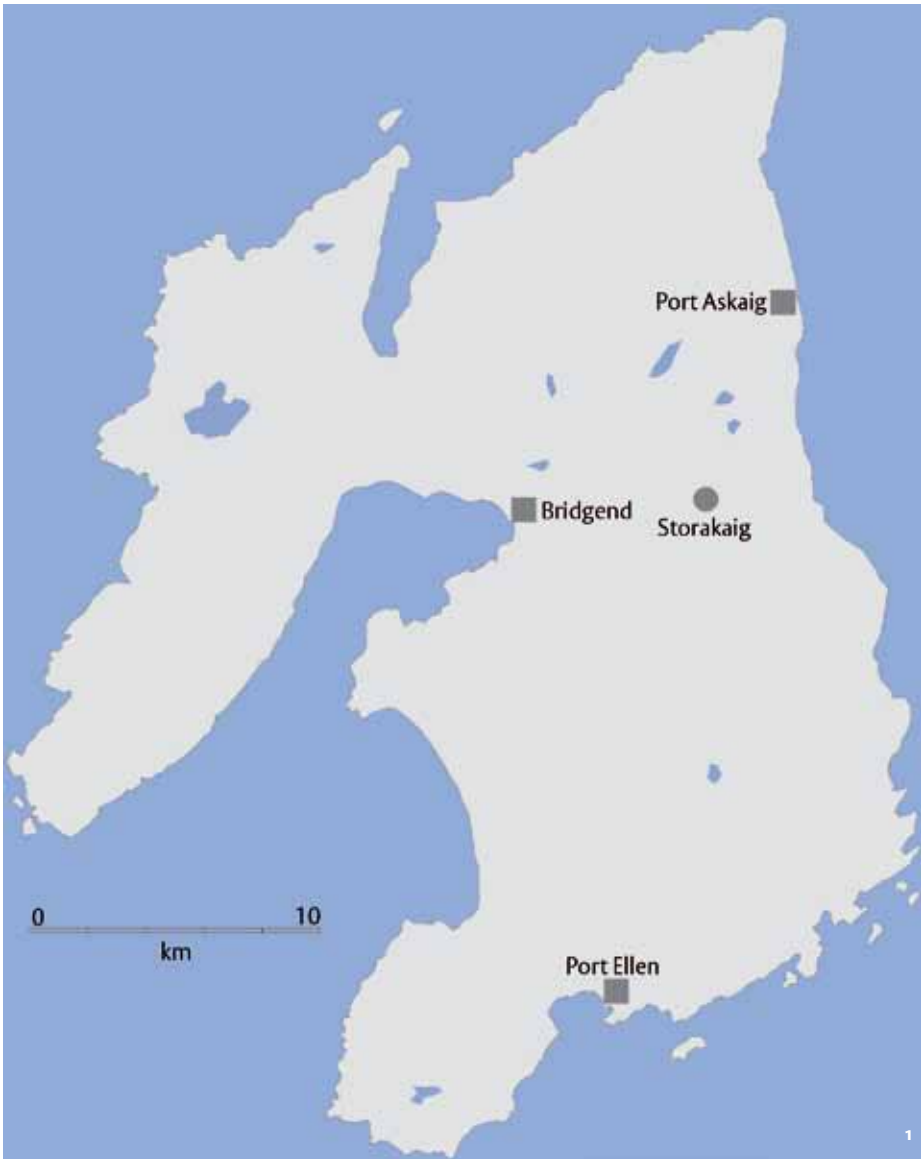

Storakaig

Excavations at the Mesolithic site and coring of Loch Bharradai

by Steven Mithen and Karen Wicks
with contributions from Anne Pirie, Ann Clarke and Claire Ingrem

Report 2 | May 2012

East Islay Mesolithic Project
EIMP



1 Map of Islay showing the location of the Mesolithic sites at Storakaig and Rubha Port an t-Seilich

Steven Mithen is Professor of Early Prehistory in the Department of Archaeology and Pro-Vice Chancellor for Internationalisation and External Engagement at the University of Reading.

Karen Wicks PhD is a Research Fellow in the Department of Archaeology, University of Reading. She is an expert in Hebridean vegetation histories and palaeoenvironmental reconstruction.

East Islay Mesolithic Project

This is the second report of the East Islay Mesolithic Project (EIMP). It describes the 2011 excavation at the Mesolithic site of Storakaig and the extraction of peat cores from Loch Bharradail that will provide data for reconstructing the Mesolithic environment.

The fieldwork was undertaken between 20 August and 2 September 2011 by a team of 20 archaeologists and student volunteers.

The 2011 fieldwork built on the accomplishments of the 2010 field season, as described in EIMP Report No. 1 (November 2010). By exploring the finds of stone artefacts within a ditch made by local residents on Islay, that fieldwork discovered a Mesolithic settlement dating to approximately 6000 years ago which contained preserved animal bone, charred plant material and stone artefacts. Initial analysis of the finds identified the hunting of wild boar, red deer, roe deer and badger, the roasting of hazelnuts and manufacture of a diverse range of tools. The significance of the Storakaig finds led to the establishment of the East Islay Mesolithic Project (EIMP) to enable the excavation and analysis of Storakaig, along with a similarly well preserved Mesolithic site discovered in 2010 at Rubha Port an t-Seilich. The project is also designed to locate additional Mesolithic sites and to engage in a reconstruction of the Mesolithic environment. Its overall aim is to make a key contribution to our understanding of the earliest settlement of Islay and Western Scotland in general. A brief summary of the Mesolithic period and its role in Scottish prehistory is provided within EIMP Report No 1.

The possibility of environmental reconstruction arises from the study of peat deposits within Loch Bharradail. This is located less than one kilometre northwest of the Storakaig site and was shown in 2010 to have deep peat deposits from which sediment cores could be extracted, potentially reaching back to the earliest Holocene (starting at c. 11,500 years ago). During the course of the 2010 fieldwork we also became aware of the remarkably rich archaeological landscape within which the Mesolithic site is located, one that potentially covers the whole of the prehistoric and historic periods. A survey of the later prehistoric monuments and the historic township of Airigh Ghuiadhre was undertaken during the course of the 2011 fieldwork, as described within a Supplementary Report (May 2011).

1 The Mesolithic site of Storakaig marked by the polytunnel, seen from the south-west, with the Paps of Jura providing a striking backdrop. We don't know, but must suspect that the Mesolithic people had their own mythological stories about the Paps and other distinctive features of the Hebridean landscapes

2 Storakaig during excavation: the debris from the Mesolithic occupation – stone artefacts, fragmented animal bones and charred plan material, are being exposed on the surface of the occupation horizon

3 The 2011 field team consisted of professional archaeologists and student volunteers from the University of Reading

Excavation of the Mesolithic occupation

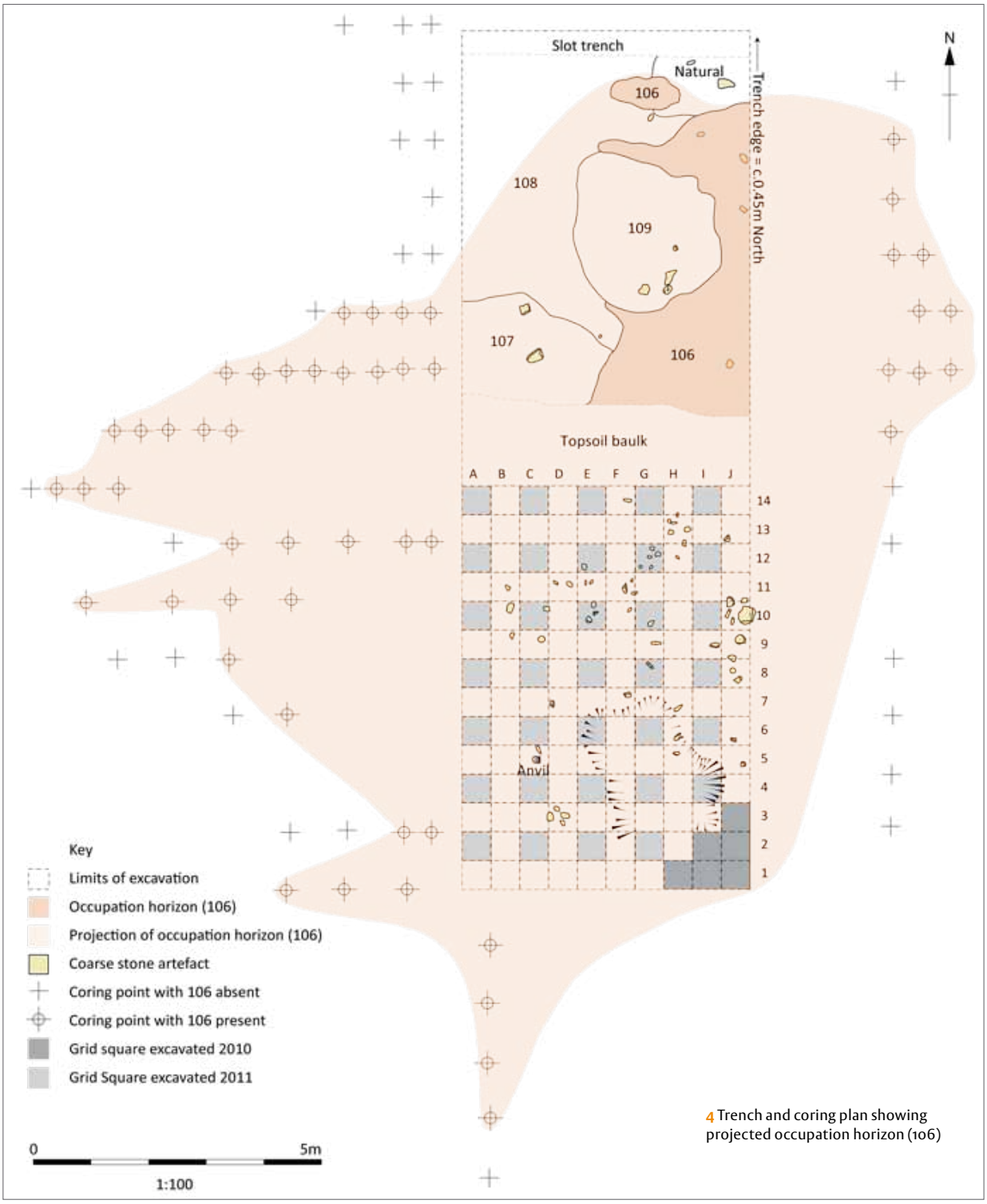
Establishing the extent of the deposit

The 2010 fieldwork established that the Mesolithic settlement, comprising an artefact, bone and charcoal rich occupation deposit, extended for at least 12 metres in a north-south direction between 116m OD and 113m OD. Test-pitting had indicated that it also extended several metres to both the east and west, but the entire spatial extent had remained unclear. To that end, a hand coring survey was undertaken in the vicinity of the occupation deposit (designated as context 106). Because this had a distinctive black and greasy appearance, its presence could be detected from augur cores without risking significance disturbance to the deposit. As illustrated (Figure 4), this survey demarcated its total area as being approximately 15m north to south, and 14m east to west at its widest point.

Exposure and sampling the occupation deposit

The 2011 excavation began the exposure of the occupation deposit and systematic recovery of the artefacts, bones and charcoal. It aimed to locate features such as fire places, rubbish pits and post-holes. To that end a 15m × 5m area was stripped of its turf and topsoil either directly onto the occupation deposit (106) or onto intervening horizons of sediment. This trench was an extension of the 3m × 3m trench started in 2010. (Figures 5, 6, 7, 8)

In the southern area of the trench, context 106 was found immediately below the top soil as a homogenous deposit. Numerous artefacts, bone fragments and pieces of charred plant material were exposed on its surface but there were no evident signs of features. Removal of the topsoil in the northern part of the trench exposed a more complicated series of deposits. Context (106) appeared patchy, discontinuous and more lightly coloured. The deposit was continuous in the eastern extent of the area, dissipating approximately one metre from the furthest point north within the trench and continuing about three metres east to west. Two irregular circular deposits were noted: (109) situated in the centre of the northern exposed area of the trench and (107) in the south-west also in the northern area. These were initially thought to be pits but after archaeological investigation they were identified as silt depressions in the uneven surface of Context 106 (See figure 2). A homogenous deposit (Context 108) comprising poorly sorted silts and gravels occupied the majority of the western extent of the area, which was initially thought to underlie Context



4 Trench and coring plan showing projected occupation horizon (106)

5 De-turfing the selected area for the excavation to the immediate west of the Storakaig ditch

6 Removing the peaty top-soil below the turfs. This soil contains some archaeological artefacts but these will all have been in disturbed locations arising from the recent farming activity and are consequently of limited value

7 Cleaning the lower top-soil down onto the black Mesolithic occupation horizon that can be seen in the ditch section

8 The 15m by 5m trench, looking north, cleaned down onto the Mesolithic occupation horizon and ready for excavation

106. To test this, a 0.50 metre exploratory slot was placed 1.5 metres south from the northern extent of the trench running east to west across the whole area. This demonstrated that Context 108 was stratified above Context 106, which was shown to continue almost to the western extent of the trench ceasing at c.0.25 metres from the edge.

Sampling of the occupation deposit (Context 106) was undertaken in the southern half of the trench. Having been protected from the elements by a poly-tunnel, this 5m x 7m area was divided into 0.5m grid squares, each having a unique alpha-numeric identifier (A1, B1 etc). Thirty-four of the 140 grid squares were excavated by removing a 0.10m spit of the occupation deposit. This was placed into two large rubble sacks and sent for wet sieving through a 3mm mesh on site. An additional 0.5 litre sample of the material from each square was taken for stack sieving through 4mm/2mm/1mm/0.5mm mesh in the archaeology laboratory at the University of Reading. (Figures 9, 10, 11, 12, 13).

9 The occupation deposit within the southern part of the trench was divided into half metre squares, a sample of which were then excavated to gain a representative distribution of archaeological materials across the whole trench

10 & 11 To recover artefacts and other material from the excavated sediments samples are washed through a wet sieve to remove the dirt silt and sand. The residue is then left to dry and meticulously picked through to remove the archaeological material

12 & 13 Mesolithic artefacts are being recovered with fine tweezers from the wet sieve residue

Wet sieving and sorting archaeological finds

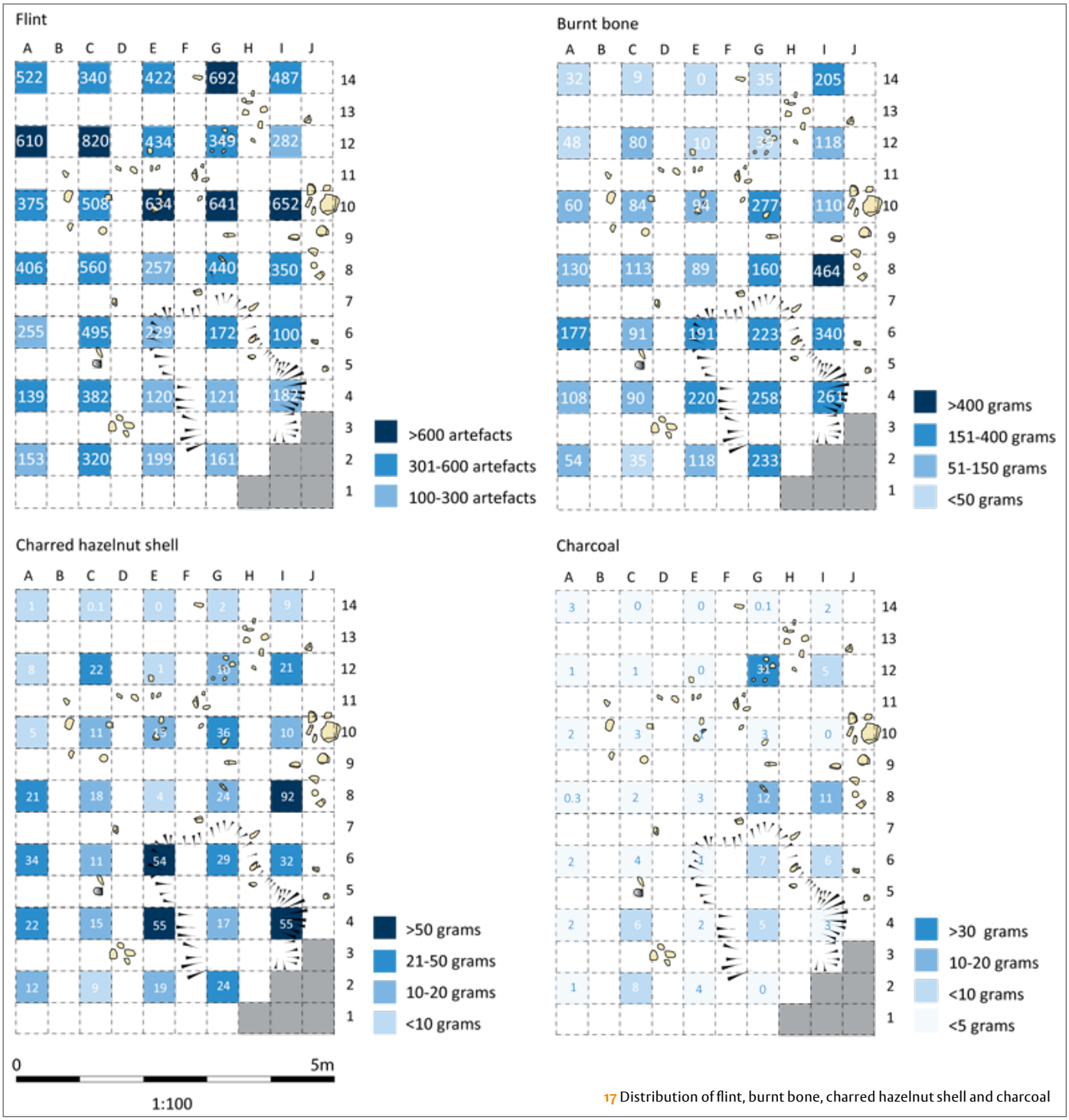
The on-site wet sieving removed the finer fractions of sediment. The remaining residues were then dried and sorted on site to remove the following classes of material: (1) chipped flint, (2) potentially chipped quartz and other stone materials; (3) potential coarse stone artefacts – those which may have either been deliberately ground into shapes or have traces of use-wear; (4) animal bone; (5) charred hazelnut shell fragments; (6) wood charcoal; (7) further miscellaneous items that were of potential archaeological significance. (Figures 14, 15, 16).

14 & 15 Josh Brunt washing excavated sediment through fine mesh within the research laboratory at the University of Reading for the recovery of microfauna

16 Lauren Hale sorting the very fine sieve residues within the research laboratory at the University of Reading

These collections were further sorted and cleaned in the archaeology laboratory in preparation for study by specialists. The quantities of recovered chipped flint, fragmented bone and charred hazelnut shell are substantial: more than 12,500 pieces of chipped stone, 4600g of bone, 700g of charred hazelnut shell and 140g of wood charcoal were recovered from the thirty-four grid squares sampled from Context 106 (Figure 17).

Additional samples of the sediment from each of the excavated grid squares were washed through 2mm/1mm/0.5mm wet sieves within the laboratory. The fine fractions were then sorted for any archaeological materials that might have been unrecoverable from the in-field 3mm wet sieving. This resulted in the recovery of a number of seeds, small bones and teeth of micro-fauna.



17 Distribution of flint, burnt bone, charred hazelnut shell and charcoal

A new Mesolithic site at Airigh Ghuaidhre

During the course of the excavation we were shown a barley field immediately to the east of Airigh Ghuaidhre (Grid ref. NR 401630) where local residents had collected chipped stone artefacts while it was under plough. Artefacts were still visible on the surface of the plough soil between the barley stalks. A cursory examination of the collection indicated the presence of a Mesolithic chipped stone assemblage including platform cores, blades and microliths with the use of both flint and quartz as raw materials. The collection is currently being examined and catalogued as part of student dissertation research at the University of Reading for incorporation into the EIMP catalogued corpus of chipped stone artefacts collected from East Islay. (Figures 18, 19, 20, 21, 22)

18 Stone artefacts collected when this barley field was being ploughed in the spring of 2011 have provided evidence for a second major Mesolithic site in the vicinity of Storakaig

19 Mesolithic flint artefacts can still be seen in the ground between the barley stalks, suggesting an especially rich archaeological site

20 The stone artefacts collected from the barley field provide evidence for a second Mesolithic site in the vicinity of Storakaig, confirming that this was a particularly attractive location on Islay for Mesolithic settlement

21 Students from Islay High School provided a most welcome hand with the backfilling of the trench at the end of the field season

22 Lauren Hale explaining the archaeological finds and methods of excavation to children at Keills Primary school. They were enormously interested and have since been collected many interesting objects from around the island

The radiocarbon dates

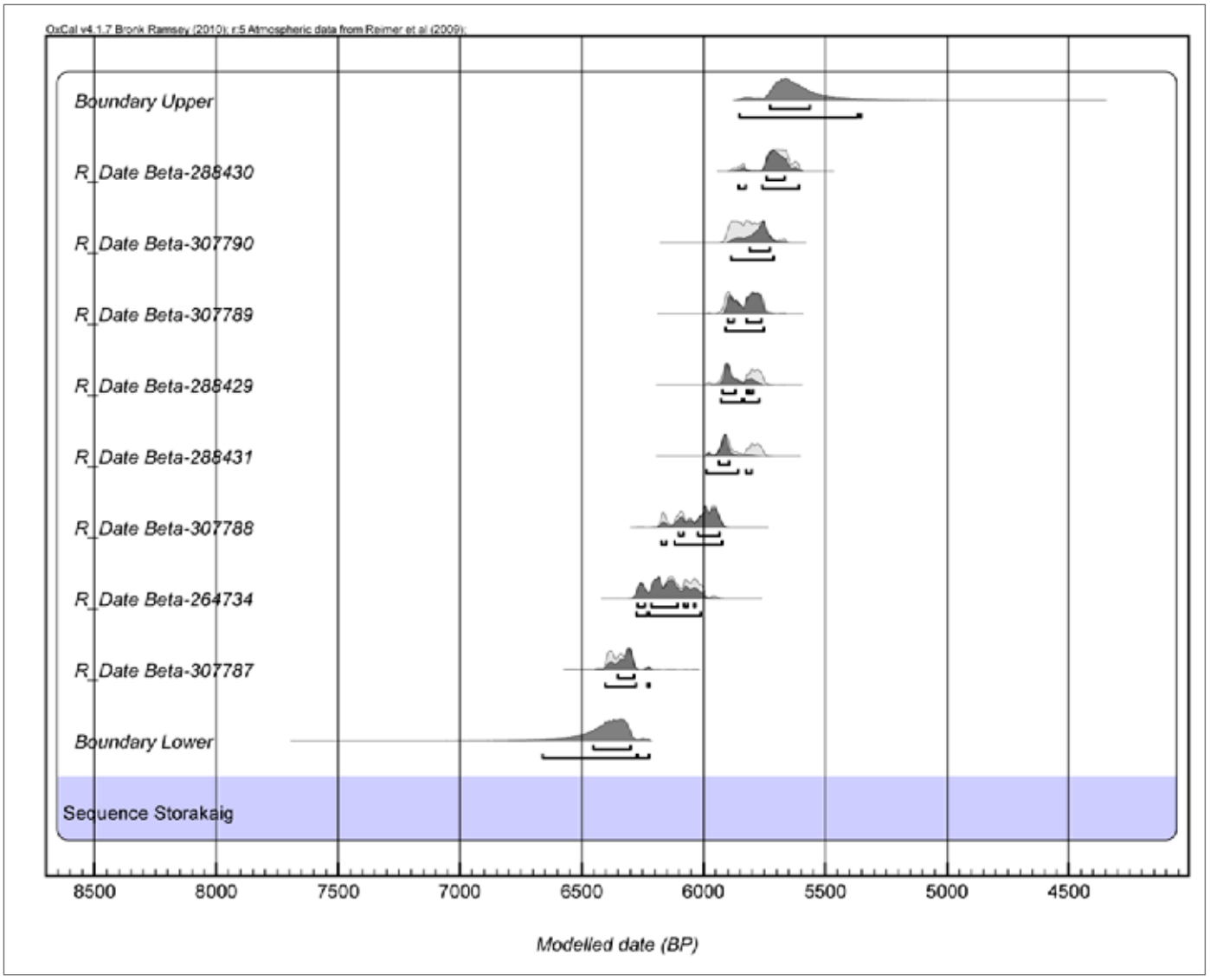
Four radiocarbon dates were obtained from single fragments of charred hazelnut shell recovered from the grid squares excavated during 2011. These added to the chronological framework for occupation established in previous years by radiocarbon dates obtained from a single piece of charred hazelnut shell removed from the upthrow of the ditch in 2009 and three fragments of hazelnut shell from the small area of the occupation horizon that was exposed during excavation in 2011.

Calibration[1] and Bayesian statistical analysis[2] of the radiocarbon dates were used to provide modelled age ranges for activity at the site based on a calendrical time-scale and to determine the minimum number of activity events that resulted in the formation of the occupation horizon.

Context	Radiocarbon dates
SK1 (106) Grid Square G1	4970±40 14C BP (Beta-288430, 5860-5600 cal BP)
SK1 (106) Grid Square C4	5060±40 14C BP (Beta-307790, 5890-5710 cal BP)
SK1 (106) Grid Square G8	5100±40 14C BP (Beta-307789, 5910-5750 cal BP)
SK1 (106) Grid Square I1	5120±40 14C BP (Beta-288429, 5930-5770 cal BP)
SK1 (106) Grid Square I2	5130±40 14C BP (Beta-288431, 5990-5800 cal BP)
SK1 (106) Grid Square I10	5250±40 14C BP (Beta-307788, 6180-5920 cal BP)
SK1 (106) Unprovenanced	5350±50 14C BP (Beta-264734, 6280-6010 cal BP)
SK1 (106) Grid Square E12	5540±40 14C BP (Beta-307787, 6410-6220 cal BP)

1 Calibration of conventional radiocarbon ages (^{14}C years BP) was achieved using default settings in OxCal v4.1.7 (Bronk Ramsey, C.R. 2009. *Radiocarbon* **51**: 337-360) and the most recent IntCal 09 and Marine09 radiocarbon calibration curves (Reimer et al. 2009. *Radiocarbon* **51**: 1111-1150).

2 Bayesian modeling of radiocarbon dates is becoming widely applied to the evaluation of chronologies within archaeology. This approach incorporates stratigraphic and successional information into the calibration process to generate a set of prior (unconstrained) and posterior (constrained) probability distributions for the radiocarbon age determinations (Buck et al. 1991. *Antiquity* **65**: 808-21; Buck et al. 1992. *Journal of Archaeological Science* **19**: 497-512). The Bayesian probability device incorporated in the OxCal 14C calibration program was used to calibrate the radiocarbon time-scales providing the means by which to define the beginnings and endings of phases of deposition.



23 Radiocarbon date ranges from Storakaig modelled using Bayesian statistics. The large square bracket down the left hand side of the diagram along with the OxCal keywords defines the overall model. The beginning and end of occupation are indicated by the age range estimates provided at the bottom and the top of the plot, respectively.

The conventional radiocarbon dates[3] range from the mid-6th to the end of the 5th millennium BP. When calibrated and modelled the date ranges span about 800 years indicating that the start of occupation occurred after 6440 cal BP with the end of site occupation coincident with the start of the Mesolithic-Neolithic transition. That was a major cultural shift that marked a move away from a hunter-gatherer way of living to a more sedentary existence reliant upon farming activities such as rearing domestic animals and crop cultivation. Statistical analysis also provided an indication of the number of times that the site was occupied based on the order and chronological alignment of the suite of radiocarbon dates obtained[4]. This indicated that a minimum of four activity events centred on 6320 cal BP, 6070 cal BP, 5840 cal BP and 5810 cal BP[5] had resulted in the formation of the occupation horizon. The latter two events may have derived from one period of continuous occupation or an increase in the frequency of visits given their chronological similarity. This indicates, therefore, that a 250 year hiatus separated the first two occupations, whilst the latter two were separated by 30 years rendering it entirely possible that the same group of people were returning to Storakaig within a single lifetime at the end of the 6th millennium cal BP.

24 Tea break

25 Night-time swim and fire at the Long Strand

3 Conventional radiocarbon dates are measurements of radiocarbon years (^{14}C years) BP (Before Present = 1950). These dates diverge from the calendrical timescale due to the variability in atmospheric carbon over time. This variability can be accounted for by calibrating the radiocarbon timeline against independent chronologies established for tree-ring growth (a technique known as dendrochronology) to match calendar years before present (cal BP).

4 Radiocarbon dates were subjected to chi-square tests to ascertain evidence of inconsistency (Ward, G.K. & Wilson, S.R. 1978. *Archaeometry* **20**: 19-31). In those cases where there was no such evidence, the dates were deemed to be statistically consistent with the possibility of having derived from a single depositional event. By using chi-square tests it was possible, therefore, to suggest a minimum number of phases of activity from which the eight radiocarbon dated samples derived.

5 Beta-264734 & Beta 307788: 6190-5940 cal BP (2σ probability); $\chi 2$ df=1, T=2.4, 5%=3.8
Beta-288431, Beta-288429, Beta-307789 and Beta-307790: 5920-5750 cal BP (2σ probability); $\chi 2$ df=3, T=1.8, 5%=7.8
Beta-307789, Beta-307790 and Beta-288430: 5900-5720 cal BP (2σ probability); $\chi 2$ df=2, T=5.5, 5%=6.0

The archaeological finds from Storakaig

Chipped stone artefacts, Anne Pirie

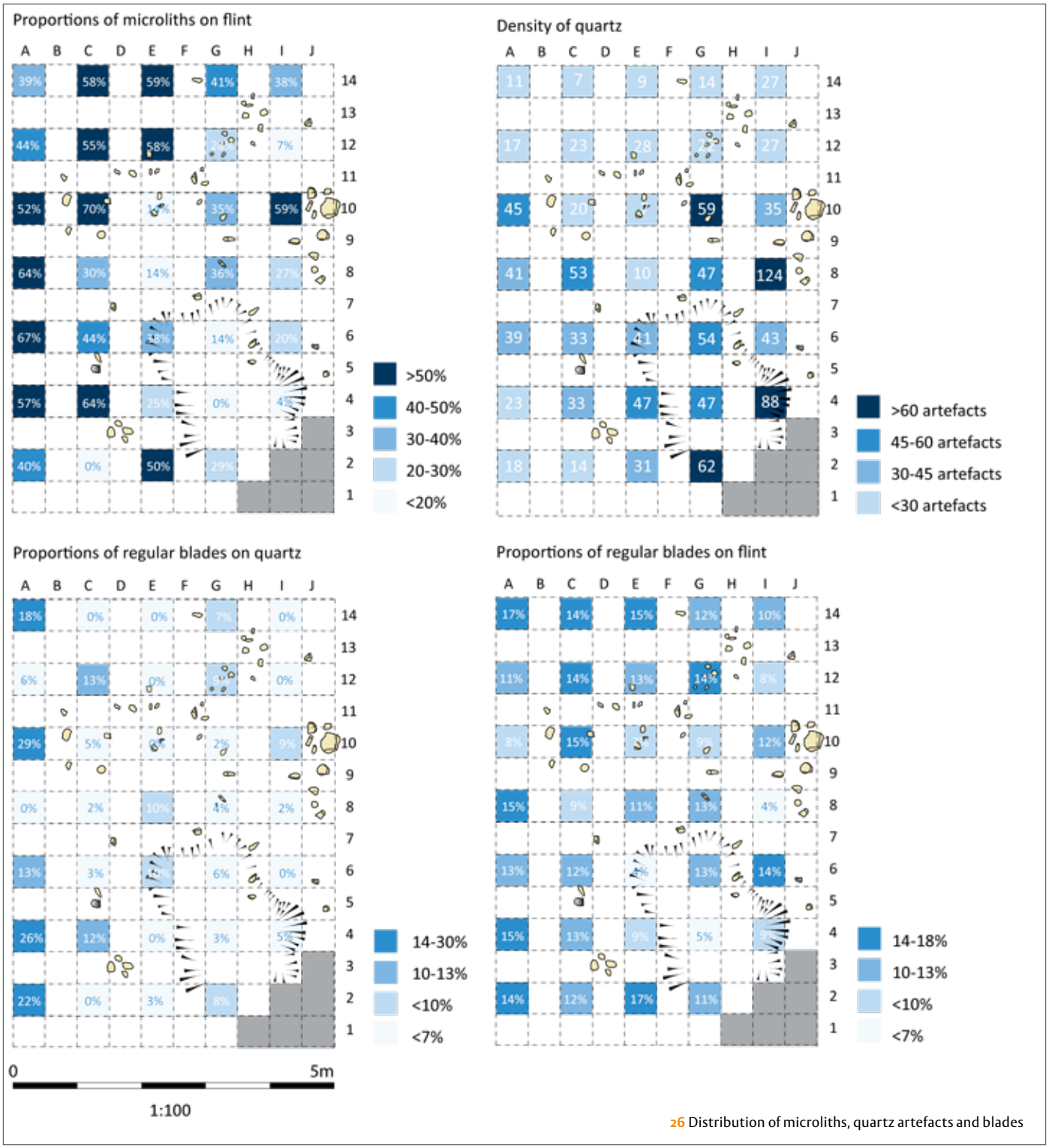
The 2011 area excavation generated about 15,000 chipped stone artefacts from the occupation horizon, 50% of which were subjected to a preliminary examination to provide an overview of the sample across the entire excavated area. Artefacts larger than 2mm coming from the excavated grid squares were catalogued according to their artefact class, raw material and condition. (Figure 26)

The chipped stone artefacts are mainly made from flint (83%) with most of the remainder made of quartz. One bloodstone and two rock crystal artefacts are present. The material was heavily patinated and burnt across the entire site. Overall, the assemblage contains many traditionally diagnostic Mesolithic elements in its narrow blade technology. Numerous microliths and their associated waste products of microlith manufacture such as microburins and notches with snaps are present suggesting tool making occurred at the settlement itself. Many of the microliths are scalenes with backed pieces, crescents, rods and partially backed fragments also present. Much of the assemblage is blade/let and flake oriented while cores are relatively rare comprising mainly of bipolar and platform forms including sub-pyramidal platforms. Other common tools include notches, truncations (over half of which are microlithic in scale), awls, scrapers, marginally retouched pieces, used pieces and pieces esquillees.

The larger area exposed during the 2011 excavation provided the means to study the spatial distribution of chipped stone artefacts across the site thereby allowing questions raised during the 2010 excavation to be addressed. In the previous season, it was noted that the excavated assemblage from the occupation horizon had few microliths and was dominated by bipolar technology, with many quartz artefacts. The spatial distribution of the assemblage collected during 2011 shows that it varies across the site in these aspects, with the southeastern part of the excavated area (this comprising the excavated assemblage from 2010 as well as parts of the assemblage collected in 2011) containing a more quartz-dominated assemblage with fewer signs of platform technology, microliths or other formal tools. In contrast, the northern part of the excavated area contains an assemblage with considerably higher proportions of flint, together with platform technology, regular blades and associated tools. While quartz artefacts and bipolar technology are still present they make up a smaller part of the assemblage in this area of the trench.

The proportions of microliths on flint vary substantially across the site from being entirely absent in grid square G3 to 70% in C9. Of particular interest is the evidence that the highest proportions of microliths are not necessarily associated with the areas of highest flint density: the western area of the site has tool assemblages dominated by microliths extending to the north where dense concentrations of flint are present but also to the south where flint densities are much reduced.

The presence of regular blades is also variable across the excavated area. For those made from flint, their proportions vary from 3.8% of the total assemblage in grid square E5 to 17.3% in A13. For those made on



26 Distribution of microliths, quartz artefacts and blades

quartz in grid squares with >50 artefacts, proportions range from 1.7% in G9 to 28.9% in A9. Areas with a relatively high flint density contain some of the highest proportions of flint regular blades, while areas with greater quartz density contain lower proportions of regular blades, even on flint. For example, in grid square G9 both flint and quartz are dense yet regular blades only amount to 9.3% of the flint assemblage and 1.7% of the quartz assemblage, respectively.

Significant new insights into the likely duration of settlement at Storakaig have emerged from the 2011 excavation. Some artefacts in the tool assemblage have a Neolithic appearance (n=20). These include some broader, regular blade fragments, which are often retouched or used, and occasionally truncated. There are also a number of tools with regular invasive retouch, including two knives, as well as various fragments of flakes with similar retouch. There are several tools with often ad hoc 'tangs', sometimes with invasive retouch. Such tools either indicates that the Mesolithic hunter-gatherers were adopting a new Neolithic technology or there were Neolithic arrivals on the island who also occupied Storakaig and ultimately replaced the indigenous Mesolithic hunter-gatherers. The Neolithic artefacts appear to be scattered across the site and are indistinguishable from the rest of the assemblage in condition and patination. As such, we favour the former of these interpretations.

In summary, the 2011 excavation has demonstrated the presence of both flint and quartz artefacts distributed across the site, with both materials reduced using bipolar and platform techniques, occasionally being used on the same core. There is evidence, however, for the preferential use of raw materials in particular areas of the site and in the production, use and/or discard of certain tools and blanks. The northern part of the site contains a more traditional narrow blade industry with heavy use of flint, while in the south-eastern area quartz is more common with more bipolar technology. In this part of the site, blade production/use is not as common on either flint or quartz as it is in the northern and the western part of the excavated area.

The significance of these differences in the distributions of tool classes and raw materials raises three possible interpretations that will need to be tested by further excavation and detailed cataloguing of the chipped stone assemblage:

1. there are two separate cultural phases of activity at the site;
2. there is continuity in site use by the same group returning on numerous occasions over several generations;
3. spatial variability in activities has resulted in the deposition of a diverse chipped stone assemblage.

27 Mark Reynier from Bruichladdich learning about some of the Mesolithic artefacts

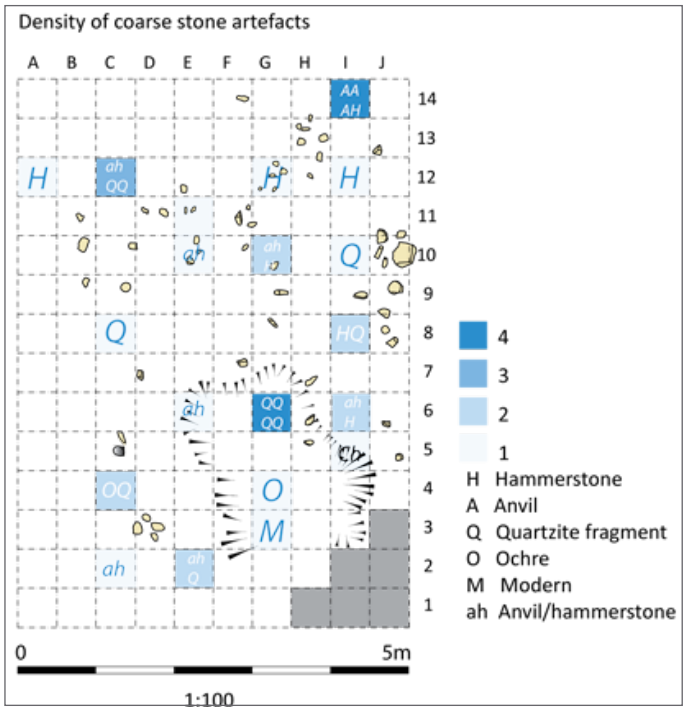
28 Thirty German archaeologists and students on a study tour in the UK visited the Storakaig excavations, many of them making their first visit to Scotland

28 Steven Mithen gave a public lecture in the Natural History Field Centre in Port Charlotte about the Mesolithic excavation – it was a sell out with over 100 people and standing room only

Coarse stone artefacts, Ann Clarke

Thirty-eight coarse stone tools and tool-fragments were recovered by the 2011 excavation including hammerstones, anvils, a 'chopper', worked quartzite and ochre. Most of these were made on water worn cobbles of quartzite or other fine-grained meta-sediments, presumably derived from nearby beach or riverine sources. Many of the fragments could not be assigned to specific artefact types based on wear patterns since most of the use wear traces were truncated by breakage. In general, most of the pieces appear to have been used in a broadly similar manner which left traces of pecking on the faces of the cobble and/ or around their perimeters. The flatter cobbles which have pecking on one or both surviving faces have been classified as anvils whilst those with additional pecking around the perimeter have been designated as hammerstone/anvils. A few of the fragments are from more rounded cobbles which do not distinguish between flatter faces and edges and these were classified as hammerstones. The evidence for use wear in the form of pecking around the edges and on the surfaces of the coarse stone tools suggests that they were used in a similar manner, most likely for knapping flint. In particular, the presence of fine linear marks on the faces and edges of some of the cobbles suggest their use as a hammers or anvils for bipolar lithic reduction. (Figure 30).

An anvil recovered from grid square I13 may have been used for a different purpose due to the presence of a small, circular hollow located in its centre indicating the working of something other than flint. Unusually for a Mesolithic site in Scotland, the



30 Distribution of coarse stone artefacts

assemblage lacks bevelled pebbles though an unused elongated pebble recovered from grid square C3 could be interpreted as a blank for such a tool form. Another simple tool, coming from Grid Square I4, is the flat pebble chopper, unshaped prior to use but with edge damage suggestive of some form of light cutting/chopping motion. Its utilised edges are lightly flaked and rounded, being reminiscent of edge damage patterns on Skaill knives which are large sandstone flakes from Neolithic Orkney thought likely to have been associated with butchering activities[6]. Though direct comparisons of edge damage cannot be made across different tools and stone types, it is possible that this expedient stone tool from Storakaig was used against similarly soft or malleable materials.

6 Clarke, A. 2006. *Stone Tools and the Prehistory of the Northern Isles*. BAR 406.

Coarse Stone Tool Type	Number
Hammerstone	2
Hammerstone/Anvil	1
Anvil fragment	3
Hammerstone/Anvil fragment	7
Hammerstone fragment	7
Worked quartzite	11
Chopper	1
Ochre	4
Unused cobble	1
Modern?	1

The majority of the stone tools (85%) occur as fragments with more than one broken, irregular face. The reason for this is unclear; judging from the surviving wear traces most of the tools had been used for light percussion which would not have resulted in fracture during use. Fragmentation may have occurred from heat damage; one or two show spalling or some light cracking on the surface indicative of a heat source. Because the majority of the tool fragments have no obvious surface damage from fire, they appear to have been heated quickly and then removed from the source rather than subjected to intense heat for a prolonged period. As such, the cobbles would have cracked from the rapid periods of heating and cooling. Hot rocks could have been used to provide heat in cooking pits or as pot boilers to heat water. If the tools were reused in this manner then the excavated scatter would not be representative of any of the original working areas. This suggestion is supported by the distribution of coarse stone artefacts across the site that lacks any clustering that would indicate discrete activity areas.

Several pieces of possibly worked quartzite were also collected. In the main they were large chunks that may have derived from either heat shattered or flaked cobbles. Two primary quartzite spalls were almost certainly detached by heating while there are two definite flakes recovered from grid squares G5 and I7. One has a cortical platform while the other has a crushed platform, both indicating that quartzite was knapped on site.

Rough lumps of orange-red ochre were found in grid squares C3 and G3. These are likely to have been brought to the site from sources elsewhere. One dark red piece collected from grid square G3 has a smoothed face possibly arising from being rubbed against the surface of another material. Little is known about the use of ochre during the Mesolithic, although it occurs at several sites, such as at Staosnaig on Colonay and at Musselburgh, East Lothian. Ochre can be used dry but when applied with water the colour is released as a red viscous liquid reminiscent of blood and can be applied like paint. As well as a decorative application ochre can also be used in the preparation of hides.

There is evidence for the re-working of modern coarse stone material into the prehistoric deposits probably by ploughing. A rectangular block of abraded fine-grained orange sandstone was recovered from the Mesolithic occupation horizon in grid square G3, possibly representing some kind of architectural building fragment. (Figures, 31, 32, 33, 34)

The animal bones, Claire Ingrem

The assemblage of small, calcined and fragmentary animal bones recovered in 2011 was similar in character and composition to that recovered during the 2010 field season. The new assemblage was rapidly scanned to isolate potentially identifiable pieces of bone which were then examined in order to provide a basic count of the Number of Identified Specimens (NISP). Almost all the remains were less than 10mm in size and consequently identification to species was

31 Mesolithic people visited the beaches of Islay to collect flint pebbles which provided the raw materials for their stone tools. Flint pebbles can still be found today and one of the best ways to learn about this Mesolithic technology is to learn to knap pebbles for oneself. Here Steven Mithen provides a knapping lesson for the students on Kilchiaren beach

32 Visiting Kilchoman distillery on a day off from digging

extremely difficult especially as the material was distorted as a result of burning. This is compounded by the morphological similarity of bones belonging to roe (*Capreolus capreolus*) and red deer (*Cervus elaphus*), and evidence for the existence of a population of dwarf red deer on nearby Oronsay during the Mesolithic period[7]. As a result, identification of deer bones to species is tentative and in some cases it was only possible to assign specimens to family or size class.

The potential of the assemblage to provide taphonomic information was estimated by recording the condition of the bone on a graded scale of 1 to 5. That assigned to '1' was deemed to be in excellent condition, demonstrating little post-depositional damage whilst bone material classed as '5' exhibited severe surface erosion and was identified only as 'bone'. The majority of the material was in good condition although the degree of fragmentation rendered much of it unidentifiable.

A total of 4,662g of animal bone was recovered of which approximately 85g (2%) was identifiable. Of the 116 identifiable specimens, 7 belonged to pig (*Sus scrofa*), 14 to roe deer (*Capreolus capreolus*) and 18 to red deer (*Cervus elaphus*). A further 51 specimens belonged to deer but the small size of the fragments renders it impossible to identify them to species level with any degree of confidence.

The assemblage was dominated by foot bone - carpals, tarsal and phalanges. With the exception of a few carpals and sesamoids all the bones were incomplete. Pig was represented solely by small pieces of 1st, 2nd and 3rd phalanges. In addition to phalanges, the roe deer assemblage contained a few pieces of metacarpal, a fragment of indeterminate metapodial, a piece of calcaneus and a carpal (unciform). Similarly, half of the red deer bones were phalanges with pieces of metacarpal, metatarsal, carpals and tarsals also present. A considerable number of tooth fragments were recovered and a few are sufficiently complete to allow them to be assigned to cf. *Cervus elaphus* on the

7 Grigson, C. & Mellars, P. 1987. In, Mellars, P. *Excavations on Oronsay*. Edinburgh: Edinburgh University Press, 243-89.

33 Swimming at Machrins Bay

basis of size. The majority, however, were just single layers of enamel which could not be identified to species.

Infrequent finds included a distal metapodial belonging either to a small dog (*Canis lupus familiaris*) or fox (*Vulpes vulpes*); bird was represented by a caudal vertebra and two phalanges similar in size to shag (*Phalacrocorax carbo*), while bones deriving from small amphibians were represented by a humerus along with a few limb bone fragments, though the possibility of the latter belonging to a small mammal is also possible.

The Storakaig bone assemblage contains specimens belonging to roe deer, red deer and pig (probably wild boar) indicating that meat, skins and other animal resources were obtained by hunting wild animals. The presence of red deer, roe deer and wild boar is unsurprising as all have been identified in Mesolithic deposits from the neighbouring island of Oronsay12.

Research into the effect that intense burning has on bone indicates that very small bones often survive intact whereas larger bones shatter into many pieces. At Storakaig, the majority of bones have been destroyed by such fragmentation and consequently the surviving assemblage is heavily biased in terms of anatomical representation. A piece of deer humerus is present, however, along with unidentifiable components containing a mixture of bone types which strongly suggest the original assemblage had contained bones from various parts of the body, rather than just heads (as indicated by teeth) and feet. The only evidence for ageing comes from the state of epiphyseal fusion of the proximal phalanges; where present all were fused so there is no evidence for juveniles.

It is well known that burnt bone survives better in the soil than unburnt bone. It also appears to be more resistant to dissolution in acidic soils probably as a result of the structural changes that occur on heating. Consequently, the absence of unburnt bone (with the exception of a probably intrusive gull [Laridae spp.] bone recovered during 2010) is most likely a function of preservation bias rather than a true reflection of the material originally deposited at the site.

How and why the animal bone recovered from Storakaig came to be burnt is less easy to explain. Assemblages of similarly burnt bone have been recovered from several Neolithic sites elsewhere in Scotland such as Beckton Farm near Lockerbie in Dumfries and Galloway and Maybole in South Ayrshire.

According to research into the effects of burning, the calcined (white/grey) appearance of the material recovered from Storakaig suggests either that it was subjected to temperatures in excess of 650 degrees Celsius and/or was heated for a considerable time[8,9]. Experimental studies on wood camp fires have shown that temperatures in excess of 900 degrees would have been required to obtain this effect[10], while modern sheep metatarsals have been transformed into entirely calcined specimens after four hours in a wood fire having been left to cool overnight. Such types of transformations are unlikely to occur as a result of cooking carcasses or joints of meat over a fire as the bones are protected by their soft tissue. It is possible that after consumption of the meat, however, some bone waste was deliberately thrown onto the fire (either as fuel or waste) and left there to burn for a considerable period of time.

There are other explanations that may account for the heavily calcined bone assemblage. It is possible that animal bone may have been valued as a source of fuel despite wood having been abundant on Islay at the end of the Mesolithic period. Studies have shown that bone and wood have different combustible properties with the high flames produced by bone making it particularly suitable for producing light[11]. Mixed fires can also be more fuel efficient as suggested by comparisons of the duration of the flames produced by wood fires and mixed fuel fires. These indicate that on average mixed fires burn one third longer than wood fires[21: 55]. Hence, bone may well have been valued as a secondary source of fuel with which to supplement the wood supply especially because unlike wood, bone does not require seasoning before it will burn. Acquiring sufficient dry wood may have been a challenge for mobile communities as freshly cut wood requires storage for 6–18 months before it will burn easily. Furthermore, dead wood has its limitations as when dry, it burns twice as fast as seasoned wood and in winter it can be soaked with water. Consequently, it is quite conceivable that Mesolithic people living on Islay may have routinely disposed of animal bone on domestic fires since it would have offered a convenient and efficient method of extending its life and generating light.

34 Curry night out in Bowmore – a welcome change from home cooking, especially for Hannah, the dig cook, seen enjoying herself (front left)

8 Shipman et al. 1984. *Journal of Archaeological Science* **11**: 307-25
9 Lyman, R.L. 1994. *Vertebrate Taphonomy.* Cambridge: Cambridge University Press.
10 Stiner et al. 1995. *Journal of Archaeological Science* **22**: 223-37.
11 Théry-Parisot et al. 2005. In, Mulville, J. & Outram, A. (eds.) The Zooarchaeology of Milk and Fats. Oxford: Oxbow Books

	Sus scrofa	*cf. S. scrofa*	*Capreolus capreolus*	*cf. C. capreolus*	*Cervus elaphus*	*cf. C. elaphus*	Cervidae spp.	Carnivore	Medium mammal	Small mammal	Amphibian	Bird	Total
Humerus			1								1		2
Unciform			1	1	3								5
Carpal									1				1
Cuneiform					1								1
Lateral malleolus					1								1
Astragalus									1				1
Calcaneum			1		2								3
Sesamoid							6		1				7
Metacarpal			3		1								4
Metatarsal					1								1
Metapodial			1		1			1					3
1st phalanx	1	1	4	1	5	3	1		6				22
2nd phalanx	3		4		3	1	1		4				16
3rd phalanx	3		1										4
Distal foot phalanx												1	1
Phalanx												1	1
Caudal vertebra												1	1
Tooth fragment						9	27						36
Limb bone fragment										4	3		7
Total	7	1	16	2	18	13	35	1	13	4	4	3	117

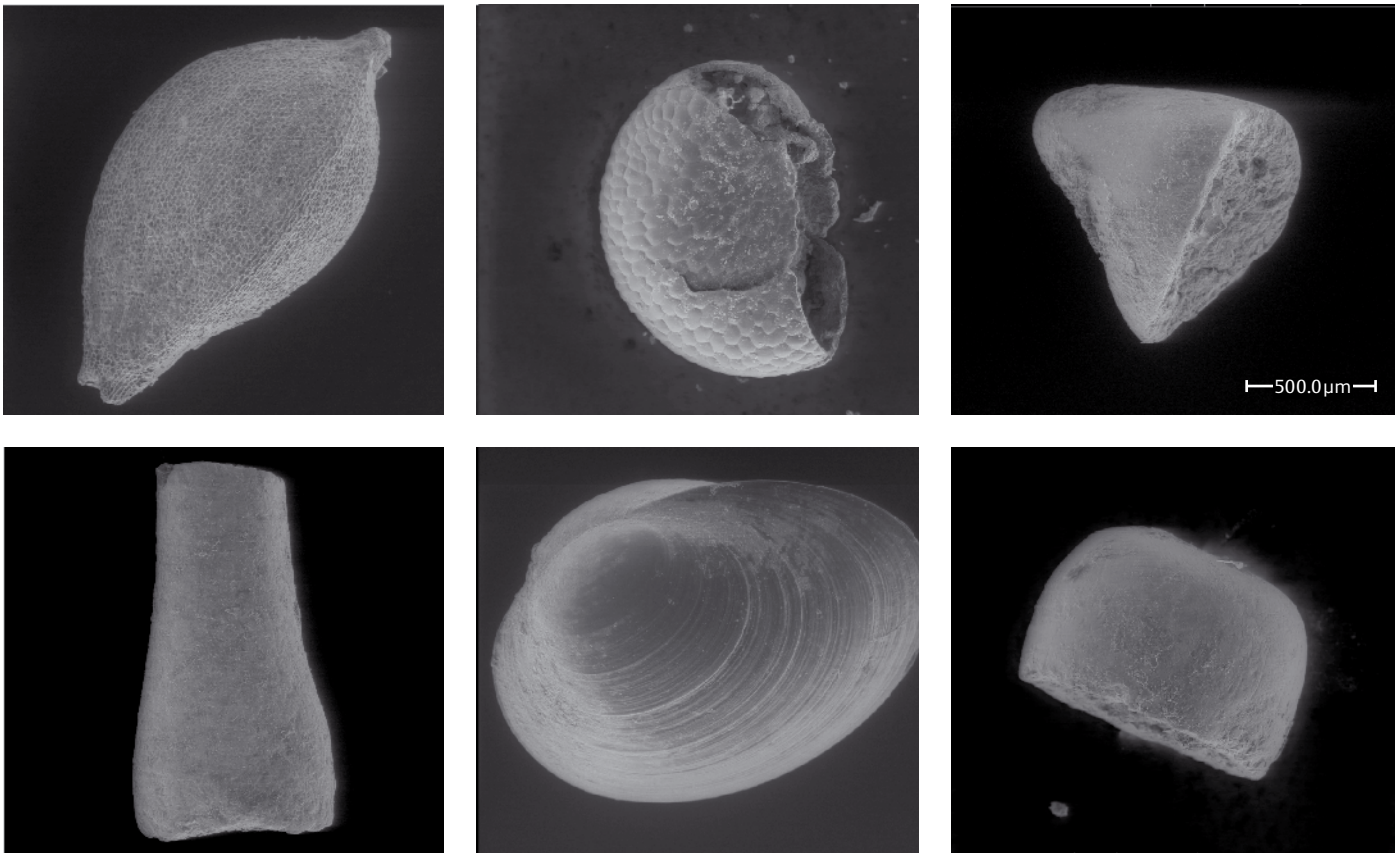
Animal bones from the 2011 excavation at Storakaig

Microfauna

Fine sieving of bulk samples in the laboratory produced a small collection of microfauna remains - very small animal bones, teeth and shells that would normally be lost through the 3mm wet sieves on site. Such finds provide additional environmental evidence about the surrounding landscape and the environmental conditions on-site. A cursory examination of the microfauna assemblage indicated the presence of limb bones likely to derive from small rodents, along with several fish teeth similar to the forms found on pharyngeal plates of fish such as Ballan wrasse (*Labrus bergylta*), a popular modern day food fish commonly found around the rocky shorelines of western Scotland. These teeth are located on a plate at the back of the throat and are used for grinding up the molluscs that the fish feed on. A freshwater ostracod was also identified indicating the presence of freshwater sources. This may have derived from aquatic plants and fish brought onto the site from the nearby freshwater Loch Bharradail or it may indicate that wet places or streams existed in close proximity to the Mesolithic settlement.

The plant remains

Charred plant remains constituted the majority of botanical remains recovered from the occupation horizon during the 2011 excavation. Approximately 700g of charred hazelnut shell and 140g of wood charcoal were collected by wet and fine sieving. Hazelnuts provided a staple ingredient in Mesolithic diets perhaps served roasted or as a paste. Once the nutritious nut was consumed, it is likely that its inedible husk would have been discarded as waste or perhaps deliberately added to domestic fires as an additional source of fuel. On-going analysis of the wood charcoal is being undertaken with the intention of providing further insights into the composition of local woodland to augment the pollen studies of a peat deposit from a nearby loch. The wood charcoal is likely to derive from the hearths of domestic fires, although the possibility that it derived from natural wild fires will be tested in subsequent analysis of the entire wood charcoal assemblage collected during the 2010-2012 field seasons.



35 Photographic images of extremely small environmental remains recovered by fine sieving. These images were taken using a Scanning Electron Microscope (SEM) that is particularly useful for examining microscopic entities in detail. The composite SEM image shows on the top row seeds of herbaceous plants such as sedge (Carex spp.) on the left, a tall grass-like perennial herb frequently found in aquatic or wet places; and blinks (Montia fontana) on the right, a perennial procumbent or floating herb found in many kinds of damp places, from streams to seasonally damp hollows. The middle row shows what appears to be the epiphysis of a long bone probably from a small rodent on the left and a tiny freshwater crustacean called an ostracod on the right. The bottom row shows the different forms of teeth that grow on the pharyngeal plate found at the back of the mouths of fish.

Careful recovery of tiny plant remains using fine sieves generated a small assemblage of uncharred plant material including a variety of sedge (*Carex* spp.) and grass seeds, along with seeds from other herb taxa such as blinks (*Montia Fontana*) and bracts from shrubs such as willow (*Salix* spp.). Preliminary analysis indicates that the assemblage is dominated by macro-botanical remains deriving from plants favouring wet conditions for growth such as wet hollows and streams. Either these plant remains were brought onto the site by people collecting plants from the nearby Loch Bharradail and its tributaries or that marshy, stream-fed habitats were formerly located in close proximity to the occupation horizon. The latter suggestion is supported by the presence of stratified peat immediately to the south of the excavated area indicating that the site was located on the edge of boggy ground downslope of the settlement.

Coring of Loch Bharradail

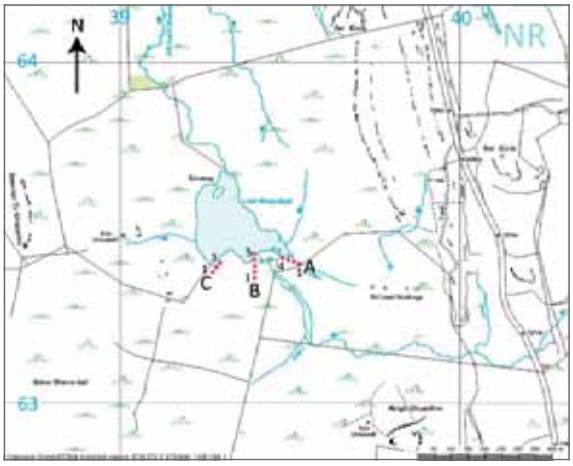
Loch Bharradail (Grid reference: NR 393 635; Site Code: LB/08/11) is a freshwater loch situated c. 1 km to the north-west of Airigh Ghuaidhre. Test-coring in 2010 indicated the presence of deep, well-preserved peat deposits with the potential for providing pollen, microscopic charcoal and tephra (volcanic ash) records suitable for landscape reconstruction (Figure 3). An AMS radiocarbon date of (Beta-288422) 2020 ± 40 14C years BP (2110 to 1080 cal BP; 170 cal BC to cal AD 70; 95.4% probability) obtained from a bulk sample of peat c. 1 cm thick, sampled at a depth of -6.47 m below the surface in 2010, indicated that relatively rapid accumulation of peat had occurred in the late Holocene peat levels.

Loch Bharradail covers an area of c. 3.5 ha, flanked to the south-east by the limestone rock outcrop on which the deserted post-medieval township of Airigh Ghuaidhre is situated. The peak of Beinn Bharra-dail reaches an altitude of 170 m O.D. to the south-west while the loch itself is coincident with the 100 m contour marked on O.S. Landranger Map 60 (1:50,000). The loch forms a basin in Dalradian sediments surrounded by plant communities typical of the oceanic blanket mires found across the west coast of Scotland. Plants such as *Scirpus cespitosus* (Deer grass), *Eriophorum vaginatum* (Hare's-tail cottongrass), *E. angustifolia* (Common cottongrass), *Carex* spp. (Sedges), *Molinia caerulea* (Purple Moorgrass), *Calluna vulgaris* (Heather), *Myrica gale* (Bog myrtle), *Erica tetralix* (Cross-leaved heath), *Narthecium ossifragum* (Bog Asphodel), *Succisa pratensis* (Devil's-bit Scabious) and *Potentilla erecta* (Tormentil) represent the dominant vascular constants on the mire surface, while *Sphagnum capillifolium* (Acute-leaved peat moss) and *S. papillosum* (Papillose Bog-moss) form an extensive ground mass. Colonies of *Isoetes lacustris* occur in the shallow waters at the edges of the loch. Gradual in-filling of the loch is most pronounced at its southern edge where terrestrial (peat) sediments are the most extensive. The in-filling sediments at the southern edge of the loch support a monoculture of *Phragmites australis* (Common reed) while shrubs of *Salix caprea* (Goat's willow) form occasional stands of woodland reaching c. 2-3 m in height along the ditches and burns serving the loch.

Coring and sample collection

Three coring transects (A, B and C) were arranged across the southern limits of the loch to obtain lithostratigraphic descriptions and to determine the location of the deepest sediments. Test cores were taken using a gouge auger with an internal chamber

36 Loch Bharradail, located two kilometres north of the archaeological sites of Storakaig has peat deposits that well record the history of vegetation change and human impact on the environment from the earliest settlement to the post medieval period



37 Coring transects at Loch Bharradail

length of 100 cm and diameter of 3 cm to enable field lithostratigraphic descriptions; pollen cores were collected using a Russian peat sampler with an internal chamber length of 50 cm and diameter of 5 cm.

The placement of Transects A, B and C ensured that coring stations were distributed from the edge of the wetland to collect records from the wetland/dryland interface, extending across the in-filling terrestrial sediments to open water. Transect A comprised four test-cores placed at 10 m intervals at the south-east tip of the loch along a south-east to north-west alignment, this running parallel to the drain marked on the O.S./ Edina map. Transect B comprised five test-cores placed at 10 m intervals along a north-south alignment where in-filling terrestrial sediments appeared to be the most extensive, while Transect C was placed along a south-west to north-east trajectory at the south-western limit of the loch comprising 3 test cores, again placed at 10 m intervals. (Figures 38, 39, 40).

Test coring revealed a well-defined sedimentary sequence with three distinct sedimentary units although the thickness of these units varied from station to station. The following description of the sedimentary sequence at Loch Bharradail is based on field lithostratigraphic descriptions of the sediments examined in Test Core 1, Transect A, these being representative of the field descriptions recorded at the site as a whole:

0 to -0.33 m	Very dark grayish brown *Phragmites australis* root mat in c. 10 cm of standing water (telmatic peat). Diffuse (> 10 mm) contact with:

38 Having established that Loch Bharradail had deep peat deposits during the 2010 season, coring was undertaken during 2011. This required numerous test cores to identify the prime location amongst the reeds

39 Coring at Loch Bharradail entailed going through six metres of peat to find the earliest deposits that are likely to date to the end of the ice age at 11,600 years ago

40 50cm long sections of peat core are successively removed as the core gradually penetrates through the peat deposit to the earliest horizons

-0.33 to -7.00 m	Dark reddish brown herbaceous peat with well-preserved monocot stems, leaves and rootlets with Phragmites australis rhizomes penetrating to c. -0.50 m below the surface. Humified peat horizons recorded at -0.63 m to -0.69 m, -1.87 m to -2.00 m and -2.70 m to -3.00 m, these being discontinuous across the site. Woody stems recorded at -3.74 m to -3.78 m, -5.13 m to -5.25 m, -5.38 m to -5.40 m and -5.52 m to -5.44 m. Diffuse (> 10 mm) contact across all peat lithostratigraphic boundaries. Diffuse (> 10 mm) contact with:
-7.00 to -8.61 m	Very dark brown to dark olive brown humified detrital peat with occasional woody stems at -7.60 m to -7.63 m and -8.23 m to -8.24 m, along with ostracods (?) at -8.00 m. Very sharp (< 1 mm) contact with:
-8.61 to -9.06 m	Very pale brown gyttja. Gradual (c. 2 mm) contact with:
-9.06 to -9.11 m	Dark brown humic clay with detrital herbaceous peat remains < c. 0.1 mm. Diffuse (> 10 mm) contact with:
-9.11 to -9.23 m	Dark bluish grey anoxic clay

The general sedimentary sequence comprised of basal blue anoxic clays overlain by gyttja and then herbaceous peat deposits within which occasional ligneous remains had accumulated. The nature of the contact between the gyttja and overlying peat deposits suggests that the basal levels of peat may have formed above an erosional surface. The deepest peat deposits were recorded in Test Core 3, Transect C where c. 8.50 m of peat overlay c. 0.50 m of gyttja over basal clay to a depth of -9.41 m below the surface of the terrestrial sediments. A pollen core was collected at this coring station (Pollen Site Code: LB/08/11/1). Despite placing the Russian peat sampler

41 At the base of the peat, organic lake muds and clays possibly derive from the end of the last ice age

within close proximity to the test core it was not possible to collect a similar depth of sediment as that recorded during test-coring. A 6.80 m deep sedimentary sequence was sampled providing 6.39 m of peat overlying 0.31 m of gyttja and c. 0.10 m of basal clay. This disparity may be due to undulations in the surface of the bedrock at the coring site as the Russian peat sampler penetrated the entire sedimentary sequence contacting bedrock at -6.80 m below the surface.

To enable an evaluation of pollen source area and site formation history across the coring site, two additional peat cores were collected for palaeoenvironmental analysis from Transect B at Test-Core stations 2 (Pollen Site Code: LB/08/11/3) and 3 (Pollen Site Code: LB/08/11/2); these providing c. 3.50 m of peat over c. 1.50 m of gyttja and clay, and 5.50 m of peat over c. 1.50 m of gyttja and clay, respectively.

Sub-samples of herbaceous and ligneous plant remains were also collected during test-coring for identification to provide details of the principle plant taxa growing on the surface of the in-filling sediments to augment the pollen records.

Pollen core laboratory analysis

It is anticipated that pollen and microscopic charcoal analysis of the deepest peat deposits and gyttja will provide records that are contemporary with the Mesolithic occupation at Storakaig. This will be confirmed by radiocarbon dating. High resolution pollen analysis comprising a contiguous sub-sampling strategy is planned for the Mesolithic levels contained in sediments from Loch Bharradail, after relatively detailed framework pollen diagrams have been produced for the entire sedimentary sequence. Analyses will include the generation and interpretation of pollen proportions, concentrations and influx from all of the peat cores collected from Loch Bharradail, along with sediment characterisation using particle size distribution measurements, loss on ignition and geochemical analysis of tephra horizons.

Overview

The 2011 fieldwork at Storakaig has confirmed the impression gained in 2010 that this is a site of considerable archaeological significance. It is now firmly dated to the boundary between the Mesolithic and Neolithic periods at 5800 years ago (3800 BC), that between hunter-gatherer and farming lifestyles. This is the most important cultural and economic transition in British prehistory with a long-running debate between those archaeologists who favour the adoption of Neolithic lifestyles by indigenous communities and those who envisage the arrival of new people, dispersing from England and ultimately continental Europe. The full excavation of Storakaig and analysis of its material will provide a substantial contribution towards resolving this debate.

In addition to its date, the fieldwork has established that a well preserved occupation deposit survives at Storakaig. The sampling of this in 2010 and 2011 has recovered a large collection of animal bones. Although these are heavily fragmented and burnt, severely constraining their identification, their presence is of immense importance because of the extreme rarity of animal bones at all other Mesolithic sites in Western Scotland. Other than at Storakaig, Mesolithic animal remains are only otherwise found at coastal shell midden sites, such as on Oronsay. Their survival can be attributed to the intense burning, the reason for which remains unclear. This seems unlikely to have arisen by accident, such as from casual discard into hearths or natural woodland fires. The bones may have been used as an additional source of fuel or may even have been burned as part of some ritualistic activity.

Although only a small fraction of the bones can be identified, the presence of wild boar, roe deer, red deer, wild pig and badger is of considerable interest because this shows a traditional Mesolithic hunting economy at the timing of the transition to the Neolithic. There no traces of domesticated sheep or cattle. The large number of charred hazelnut shells also reflects a traditional Mesolithic diet, while the chipped stone assemblage contains the range of tools that had been used by hunter-gatherers in Islay since their earliest appearance on Islay at 8300 years ago. The presence of a small number of Neolithic tool types is intriguing. Because these are mixed in with the Mesolithic artefacts, made on the same materials and subject to the same surface conditions, we favour the idea that these reflect a Mesolithic community adopting new technology rather than the arrival of new people at Storakaig.

In addition to making stone artefacts, hunting and butchering game, roasting hazelnuts and burning bone, the excavation has been able to identify further activities at the site. Cobbles were used as hammers and anvils for making the stone tools and most likely as pot-boilers, leading to many becoming fractured. The few pieces of ochre suggest that pigment had been used for decorative purposes, ether as body painting - 'Mesolithic cosmetics' - or on artefacts. A functional interpretation such as hide preparation should not necessarily be discounted.

The location of the settlement provides outstanding views across the landscape suggesting that is was positioned to watch for game, while having access to a wide range of wild resources. It appears to have been immediately next to a fresh-water mire, extending the range of plant foods, while the nearby Loch Bharradail would have enabled fishing and hunting for otters. The coast was nearby with the presence of teeth from wrasse indicating that sea fish had been brought to the site.

The radiocarbon dates suggests that the settlement was repeatedly used, it being a favoured location in the landscape, probably one of several in this vicinity of Islay. We suspect that each period of occupation was short, perhaps a few weeks, with the site being part of a settlement system that encompassed not only Islay but also the adjacent islands of Jura, Oronsay, Colonsay and the mainland. On-going research at the University of Reading involves comparing its artefacts, activities and radiocarbon dates to those from other sites within this region to reconstruct the settlement pattern at this critical juncture between the Mesolithic and Neolithic periods. Analysis of the sediments from Bharradail will enable a reconstruction of the composition of the woodland and other elements of the environment in the immediate vicinity of the settlement and in the wider region.

Further excavation at 2012 will continue investigating the site, aiming to locate hearths, rubbish pits and the traces of structures. It will acquire further samples of the artefacts to help reconstruct both site specific activities and the relationship of Storakaig to Mesolithic and Neolithic sites elsewhere in Western Scotland.

Acknowledgements

Thanks are due to several individuals who were instrumental in supporting the 2011 fieldwork season. Firstly, the fieldwork at Storakaig and Loch Bharradail was made possible by the kind permission of the Schroder family. We are particularly grateful to David Gillies, Islay Heads, John Morris, Islay Campbell and Donald James MacPhee at the Dunlossit Estate., for their advice, support and the storage of our field equipment over the winter period. Malcolm Ogilvie of the Islay Natural History Trust, Kathleen Johnston at Keills Primary School and Stephen Harrison and Freddie Bell at Islay High School all kindly enabled us to share Islay's heritage with the island's community. The project has been financially supported by the University of Reading, the Society of Antiquaries of Scotland and Mrs Leonie Fane. We are also grateful to the team of archaeologists and students who assisted with excavation, test-coring and sample processing during 2010 and 2011 field-seasons, especially Matt Gittins, Lauren Hale and Nick Mithen.

Storakaig

For more information, please contact:

Karen Wicks

University of Reading
Whiteknights
Reading, RG6 6AB

k.wicks@reading.ac.uk
Tel (0118) 378 7973

www.reading.ac.uk

The Queen's Anniversary Prizes
2009 & 2011