2 Introduction

2.1 Project background, aims and working hypotheses

It is generally recognized that, in the Stone and Bronze Ages of Scotland, numerous different lithic raw materials were used for the manufacture of tools (Saville 1994). While there are considerable variations at local level [eg involving bloodstone (Wickham-Jones 1990) or pitchstone (Haggarty 1991, 91)], taking Scotland as a whole the most common raw materials exploited are flint (the coastal regions and East Scotland), chert (the Southern Uplands) and quartz (the north, north-west and Highland regions of Scotland). The true importance of quartz has, to a degree, been obscured by research bias as, probably owing to difficulties associated with identifying tools in quartz (cf Lindgren 1998), many archaeologists have shunned this raw material.

As a result, many publications of Scottish quartz assemblages, as well as quartz reports world-wide, tend to be characterized by lack of enthusiasm, detail and precision (cf Saville & Ballin 2000, table 1). The sparse literature gives the impression that quartz was a raw material only used in a few remote corners of prehistoric Scotland, whereas in fact it was a major lithic resource, or at least an important supplement, in approximately one-third of the country over several millennia. The broader purpose of the project *Quartz Technology in Scottish Prehistory* (in the following text simply referred to as the Quartz Project) is to increase awareness of the significance of quartz throughout Scottish prehistory.

The main aim of the Quartz Project is to shed light on quartz variability, that is, to define how quartz assemblages in different periods and areas of the Scottish quartz province (the north, north-west and Highland regions of Scotland) differ. With the general variation defined, it will be attempted to explain the observed variation. In advance of the project, it was assumed that most differences between assemblages would be due to differences in:

- chronology
- regionality (territoriality)
- availability (access to resources)
- adaptation to the specific flaking properties of the available raw material, or
- activity patterns (subsistence economy and on-site behaviour).

Due to its general properties, quartz is undoubtedly more demanding to examine and characterize than, say, flint or chert. It is, however, the basic assumption of the present paper that, if quartz assemblages are excavated and examined as meticulously as assemblages in other raw materials, they offer similar potential for information on prehistoric societies and behaviour. If the tools to achieve this are not presently available, it is possible to develop these over time.

In the larger framework, the present paper forms part of international efforts to increase awareness of archaeological quartz as an important resource. It is hoped that the research put forward in the present paper may prove useful to quartz researchers in other parts of the world.

2.2 Methodology

In the course of the project, the following research topics were given special attention:

- raw materials
- typology
- technology
- spatial patterns (intra-site as well as inter-site), and
- assemblage dates.

These topics formed the back-bone of the defined standard research design, or approach, the purpose of which was to ensure comparability between the selected quartz-bearing assemblages (in the present paper, the term 'quartz-bearing assemblage' refers to an assemblage which is either completely dominated by quartz, or which has quartz as an important or a minority component. The selection of quartz assemblages for the Quartz Project is described below, as part of the project history [Section 2.3]).

2.2.1 Raw materials

When dealing with quartz, it is important to realize that this resource encompasses a group of closely related, but more or less distinctive, materials. The pilot project (see below) showed that milky quartz, rock crystal and 'greasy' quartz are three varieties with different appearances and different flaking properties, and they would probably have been perceived by prehistoric people as three different materials with different functional and perhaps symbolic values. The sub-division of quartz is discussed in Section 4.3. Generally, lithics analysts tend to lump all quartz sub-types into one main category. As Abbott states, this is '... like a faunal analyst putting all furry animal remains into a "mammal" category without separating them by specific name, genus and/or species' (Abbott 2003, 106). In doing so, a great deal of valuable information is lost.

2.2.2 *Typology*

The application of a sensible typo-technological framework is of immense importance to the discussion of chronology (diagnostic types), regionality ('style'; Wiessner 1983), as well as economical aspects and intra-site spatial patterns (functional types). It is a truism that it can be difficult to identify retouch, and thereby tools, in quartz. Another problem is that, due to the different flaking properties, many quartz blanks and tools have a different appearance to that of artefacts in flint-like silica. For this reason, some scholars have attempted to develop a typology solely for quartz artefacts (Broadbent 1979; Lehane 1986; Callahan 1987). Unfortunately, the introduction of a separate quartz typology prevents comparison of quartz tools and those in other raw materials, and the author believes this practice should be discouraged (discussed in more detail as part of Section 8.2). As demonstrated in the lithic analyses already undertaken as part of the pilot project (Ballin 2001c), it is quite practicable to apply the same typology to all raw materials.

2.2.3 *Technology*

The common use of bipolar technique in connection with reduction of quartz material, combined with the fact that the bipolar technique was not generally recognized as such until the mid-1980s (though correctly identified by White in 1968), means that most older presentations of quartz assemblages are heavily flawed (Saville & Ballin 2000, table 1). Bipolar material was classified as, *inter alia*, opposed-platform cores, wedges and scrapers, which firstly creates a bias in inferences about the assemblages and activities associated with them, and secondly makes comparison based on or including older literature highly problematic. With bipolar material classified correctly, it is possible to achieve a detailed picture of prehistoric lithic technologies, in particular combined with the *chaînes opératoire* approach (Leroi-Gourhan 1965; Lemonnier 1976; Eriksen 2000). As a consequence of this state of the art, it was chosen to re-examine a number of significant Scottish quartz assemblages, and update the general typo-technological terminology and nomenclature (eg Kilmelfort Cave, Argyll: Saville & Ballin forthcoming; Lealt Bay and Lussa River, Jura: Ballin 2001b; Ballin 2002b; Shieldaig, Wester Ross: Ballin *et al* forthcoming; and Scord of Brouster, Shetland: Ballin 2007a). The results of these analyses are summarized in Section 2.4.

2.2.4 *Distribution analysis*

Analysis of quartz assemblages may include distribution analyses to either: (i) shed light on intra-site settlement organization; or (ii) test the chronology of the site and/or the quartz assemblage. The main precondition for carrying out a distribution analysis is the existence of a standard grid system with square grids of maximum 1sq m (preferably 0.25sq m or less), or the recovery of finds must include detailed reference to site contexts (less precise).

In Scottish archaeology, quartz has rarely (if ever) been exposed to distribution analyses. This is not due to quartz being less suited for this kind of investigation; it is more a combination of traditionally low expectancies and recovery/recording policies. Most known quartz assemblages are from excavations, but unfortunately many of these were documented in ways inappropriate for distribution analysis (as, for example, in the case of the three assemblages studied in the pilot project; see Section 2.3).

Today, it is common practice in Scotland to excavate Stone and Bronze Age sites with accurate recording of finds to either standard grids or well-defined contexts, and many assemblages excavated in the last 15–20 years are well-suited for analysis of settlement organization. The assemblages selected for the Quartz Project were subjected to general distribution analysis whenever this was possible (eg Bayanne and Scord of Brouster, Shetland: Ballin 2007a; Ballin forthcoming j; Dalmore and Calanais, Lewis: Ballin forthcoming a; Ballin forthcoming g; and Rosinish, Benbecula: Ballin forthcoming h).

2.2.5 *Dating*

As demonstrated in the pilot project report (Ballin 2001c), quartz is just as useful for dating purposes as other lithic materials, as long as diagnostic artefacts or attributes are present. At a general level, dating quartz assemblages by the use of diagnostic artefacts or technological attributes is hampered by the lack in Scotland of an adequate typo-chronological framework for the Mesolithic and Neolithic periods. It must be an important aim in Scottish Stone Age research to improve the chronological framework by identifying new diagnostic types or diagnostic technological attributes. In connection with the Quartz Project, one implement type with chronological and regional diagnosticity was identified, namely the curved knife (see presentation of the Scord of Brouster assemblage; Section 2.4.3), which seems to be a form produced in the later part of the Early Neolithic period and, apparently, only in the Scottish quartz province (though not exclusively manufactured in quartz).

2.3 Project history

A draft project proposal was produced by the author and discussed with Alan Saville (National Museums of Scotland) and Patrick Ashmore (Historic Scotland). A two-stage project structure was suggested, with a pilot project to be completed in the financial year

2000/01 and a main project to be carried out over the following years, founded on the results and recommendations of the pilot project. Historic Scotland and the National Museums of Scotland agreed to fund the initial stage jointly, and during the main project funding was received from Historic Scotland, the National Museums of Scotland, the Society of Antiquaries of Scotland, the Russell Trust and the Catherine McKichan Bursary Trust.

2.3.1 Pilot project

After discussion of the selection criteria for the pilot project and following examination of material in the care of the National Museums of Scotland, a number of quartz assemblages were accepted as suitable for further research. As, at that time, most published quartz assemblages were of Bronze Age date, it was decided to focus on Mesolithic assemblages, and Kilmelfort Cave, Argyll (Coles 1983), Lealt Bay, Isle of Jura (Mercer 1968) and Shieldaig, Wester Ross (Walker 1973) were those selected for initial study. A specialist report was produced on each of the three chosen assemblages (for summaries, see Section 2.4), together with a project report (Ballin 2001c), which included recommendations for the proposed main project. In general, it was recommended that 'To satisfy the aims set up by this project, a substantial number of representative quartz assemblages must be examined and compared'. Specific recommendations included the following four points:

- chronology
- territoriality
- resources
- activities.

Chronology

It is most likely that the appearance of quartz artefacts will vary over time. To detect this variation it is necessary to examine assemblages from all quartz-using periods and phases. To test whether the observed variation is in fact chronological (that is, *not* due to differences in territoriality, raw material availability, specific flaking properties, or site economy/activities), it is vital to include in the project as many *different* assemblages as possible from each period and phase.

Territoriality

To test whether territoriality may explain some morphological details of individual quartz types (stylistic variation), as well as the composition of quartz assemblages, it is imperative that all regions of the Scottish quartz province are represented by suitable assemblages. Stylistic variation (Wobst 1977; Wiessner 1983; Gebauer 1988) is usually associated with the distinction of social territories (Clark 1975, 12; Ballin 2007a), and, for example, Scandinavian research (Bruen Olsen & Alsaker 1984; Andersen 1983; Andersen 1995a; Andersen 1995b) suggests social territories to be identical to specific sets of biotopes ('economic zones') delimited by significant topographical features (fjords, rivers, mountain ranges or water divides). For this reason, the Quartz Project should attempt to cover as many economic, as well as topographical, zones as possible.

Resources

The effect of chronology and territoriality on the variation within and between quartz assemblages is as yet unproven, but it is fairly certain that some of the observed variation is due to raw material differences. The following points have been established: (i) throughout the Scottish quartz province different types of quartz were used; (ii) of the main five quartz types (Section 4.3), some varieties are better suited for the manufacture of flaked tools than others; and (iii) in some assemblages, quartz was supplemented by other materials, or it was itself a supplement. In the attempt to analyse the influence of raw material variability (availability) on assemblage variability, quartz assemblages should be selected from all geological zones of the Scottish quartz province.

Activities

As the specific subsistence economy and activities at a particular site may influence the composition of its assemblage, the Quartz Project should include assemblages from different types of site. Relevant site types are: (i) open-air lithic scatters (ie sites not associated with more substantial dwelling structures); (ii) house sites; (iii) ritual sites; and (iv) burial sites. One could, for example, envisage a marked difference between assemblages from sites of Types i/ii and iii/iv. The composition of assemblages from the former group of sites may be dominated by utilitarian choices, and they might include a certain amount of production refuse. The composition of assemblages from the latter group of sites may be dominated by choices involving the symbolic value of artefact raw materials and style, and might contain less refuse, fewer blanks, and more tools.

In summary, it was concluded that the Main Project should attempt to cover:

- assemblages from all Stone and Bronze Age phases, as well as the Early Iron Age
- assemblages from as many biotopes/economic zones as possible
- assemblages in different types and sub-types of quartz, and assemblages in which quartz is supplemented by other raw materials
- assemblages from all main geological zones
- assemblages from different site types.

2.3.2 Main Project

During the Main Project, it was attempted to cover as many of the periods, zones, raw materials/raw material combinations, and site types listed above. The various sub-projects make up four groups, namely:

1. assemblages analysed as part of the author's general contract work as a lithics specialist
2. assemblages analysed in the form of additional research projects (Lussa River and Scord of Brouster)
3. privately funded/grant-funded investigation of the Cnoc Dubh quartz quarry
4. privately funded experimental work examining the effect of fire on quartz.

The Mesolithic quartz assemblage from Lussa River on Jura was examined first (Ballin 2002b) in an attempt to expand the available data on early prehistoric quartz reduction. This work was supported by a grant from the National Museums of Scotland. With the addition of the material from Lussa River, the Mesolithic period was satisfactorily covered (although it had not been possible to find suitable Early Mesolithic quartz assemblages), and as practically all quartz assemblages examined as part of contract work were from the Bronze and Early Iron Age periods, only the Early Neolithic period represented a serious chronological hiatus. Only one sizable Early Neolithic quartz assemblage was available for analysis, namely the finds from Scord of Brouster on Shetland (Ballin 2007a). This assemblage was originally excavated and published (by Whittle 1986), but as Whittle's analysis was carried out before the general recognition of bipolar technology, the collection was in need of re-examination, re-classification and, consequently, re-interpretation. This work was financed by Historic Scotland and the Society of Antiquaries of Scotland, and practical assistance was provided by the Shetland Museum and its staff.

As part of the general analysis of quartz procurement, the worked quartz vein, or quarry, of Cnoc Dubh on Lewis was inspected (2002), and a paper was produced (Ballin 2004e) in which the technical and territorial/social background to quartz procurement was explored. This sub-project was supported financially by the Catherine MacKichan's Bursary Trust, and practical assistance in the field was received from Western Isles Archaeologist Mary MacLeod and local amateur archaeologist James Crawford.

In response to an almost complete absence of reports on burnt quartz from excavated sites, the author decided to look into this question (Section 4.4.3). This work took two forms, namely, (i) experimentation and (ii) focused scrutinizing of quartz from contract and research projects. Quartz was deliberately exposed to fire to gain insight into the appearance of fire-affected quartz, and the experience from the experimentation was then applied as part of the general analysis of quartz assemblages. This work, which was funded privately, took place in 2003, and it is intended to publish the results in full at a future stage (Ballin forthcoming k).

Through the Pilot Project and the Main Project it has been possible to embrace most of the zones, raw materials/raw material combinations and site types listed above, but to a varying degree (illus 1): the Later Mesolithic period and the period from the Late Neolithic to the Early Iron Age are well-covered, but it has only been possible to analyse one Early Neolithic quartz assemblage and no Early Mesolithic assemblages (the material from Kilmelfort Cave is thought to be of a Final Palaeolithic date; Section 2.4.1); practically all assemblages are from coastal sites (defined as sites located directly on the coast, or with a distance to the coast of less than 10km; cf Higgs & Vita-Finzi 1972, 28; Ballin 2007b), with the only exception being the finds recovered along the St Fergus to Aberdeen Natural Gas Pipeline (FERG) in Aberdeenshire (Ballin forthcoming c); the analysed assemblages include all major quartz types (see Section 4), and a variety of geological zones are covered, with the only general exceptions being zones where quartz was rarely used; and a spectrum of site types are embraces, such as settlement sites (eg Dalmore), burial/ritual sites (eg Calanais). Even an assemblage from a cave site is represented (Kilmelfort Cave).

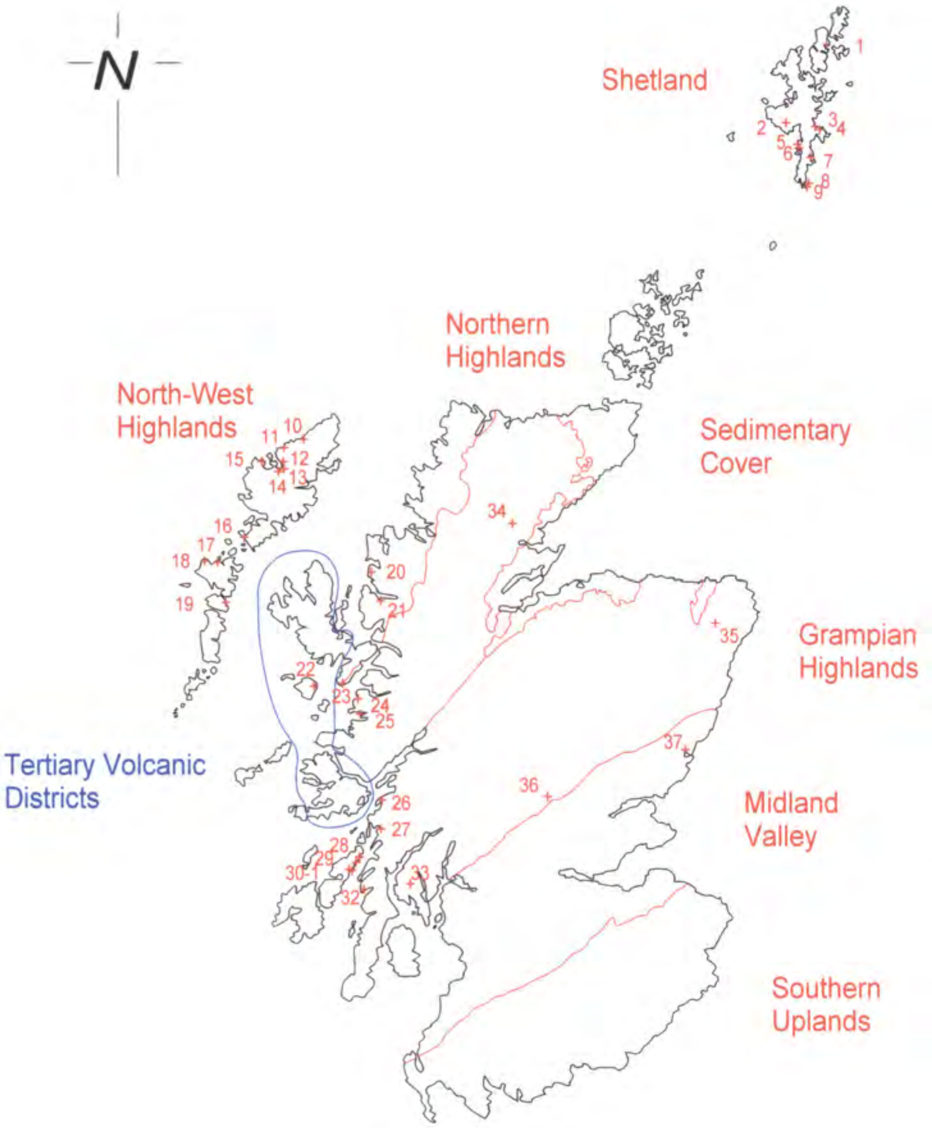
Some of the weaknesses, in terms of coverage, are remedied by assemblages available through the archaeological literature (Section 3), but at present substantial Early Neolithic quartz assemblages are simply not known (apart from the finds from Scord of Brouster). Inland sites with quartz are also rare, but a small number of these sites have been excavated, although they are still in the process of being written-up, or published (eg Ben Lawers; Atkinson *et al* 1998).

2.4 Presentation of sub-projects

In this section, the main results of the Quartz Project's various sub-projects are presented. The individual accounts are based on relevant sections of the original specialist reports and papers. In a number of cases, where assemblages include the exploitation of more than one raw material, the entire assemblage was examined (eg Kilmelfort Cave, Calanais and Dalmore), whereas in other cases only the quartz component of such assemblages was analysed (eg Lealt Bay, Lussa River and Shieldaig).

2.4.1 Palaeolithic material

Kilmelfort Cave, Argyll (original excavation report published in Coles 1983; re-examination to be published as Saville & Ballin forthcoming).



Illus 1 Prehistoric sites with quartz assemblages, or substantial quartz sub-assemblages. Shetland: *1) Bayanne, 2) Scord of Brouster, 3) Kebister, 4) Cruester, 5) Burland, 6) Tougs, 7) Catpund, 8) Sumburgh, 9) Jarlshof.* Western Isles: *10) Barvas, 11) Dalmore, 12) Olcote, 13) Calanais, 14) Cnoc Dubh (quarry), 15) Valtos, 16) Northton, 17) Udal, 18) Eilean Domhnuill, 19) Rosinish*. Southern Hebrides and West Mainland: *20) Redpoint, 21) Shieldaig, 22) Kinloch, 23) Camas Daraich, 24) Rudha'n Achaidh Mhòir (Morar), 25) Risga, 26) Carding Mill Bay, 27) Kilmelfort Cave, 28) North Carn Bay, 29) Lealt Bay, 30) Lussa River, 31) Lussa Wood, 32) Ellary Boulder Cave, 33) Auchategan*. Highlands and East Scotland: *34) Lairg, 35) FERG Sites 4 and 5, 36) Ben Lawers.* Midland Valley: *37) Fordhouse Barrow*

In 1956 the North of Scotland Hydro-Electric Board carried out construction work on the south-east face of An Sithean near Oban. The blasting operations exposed a small cave, and a number of flint and quartz artefacts were recovered (illus 2; illus 3; illus 4). Approximately 6m of the cave entrance were destroyed, and as the original cave depth was estimated to have been 10m, only a small part of the cave was left unaffected. A small number of lithic artefacts were recovered from the surviving parts of the cave, but the major part of the assemblage was recovered from the post-blast deposits in front of the cave (Coles 1983, plate 1). No artefacts were collected with reference to on-site provenance (grid system, context, etc).

Due to the manner in which the lithic finds were recovered, it is uncertain whether the flint and quartz sub-assemblages are contemporary. The two sub-assemblages are of roughly the same size (flint 404 pieces and quartz 336 pieces; Table 1), but the flint artefacts include 103 tools (of which 40 are 'micro-lithic' backed pieces) and the quartz artefacts only six. This difference may reflect different ages, but it may also simply be a result of different flaking properties, with flint representing the main lithic resource and quartz a local supplement for cruder tool forms.

Illus 2 Kilmelfort Cave. Blades, bladelets and spalls

Illus 4 Kilmelfort Cave. Crested pieces and tools: three crested blades / flakes, one end-scraper, and one bladelet with edge-retouch

Illus 3 Kilmelfort Cave. Cores: one discoidal core, and three bipolar cores

In the author's original report on the assemblage (Ballin 2001a), the many angle-backed pieces were perceived as large variants of Early Mesolithic microliths, and it was suggested that the finds may generally date to this period. Since then, the finds have been re-examined and discussed by the present author and Alan Saville of the National Museums in Edinburgh, who agree that, due to the similarity to

Table 1 The Kilmelfort cave lithic assemblage: general artefact list

Debitage	Flint	Quartz	Total
Chips	117	54	171
Flakes	120	210	330
Indeterminate pieces		40	40
Blades	18	5	23
Microblades	25	9	34
Crested flakes / blades	4	5	9
Total debitage	284	323	607
Cores			
Discoidal cores		1	1
Irregular cores	2		2
Bipolar cores	15	6	21
Total cores	17	7	24
Tools			
Various backed forms	40		40
Scrapers	23	3	26
Piercers	1		1
Burins	4		4
Burin spalls	7		7
Truncations	2		2
Piece w notch(es)	1	1	2
Denticulated piece	1		1
Combined tools	2		2
Pieces w edge-retouch	22	1	23
Hammerstones		1	1
Total tools	103	6	109
TOTAL	**404**	**336**	**740**

Table 2 The Lealt Bay quartz sub-assemblage: general artefact list

Debitage	Quartz	Rock crystal	Total
Chips	745	147	892
Flakes	738	109	847
Indeterminate pieces	656	9	665
Blades	4		4
Microblades	6	1	7
Crested flakes / blades	2		2
Total debitage	2151	266	2417
Cores			
Split pebbles	5		5
Single-platform cores	4		4
Opposed-platform cores		1	1
Irregular cores	1		1
Bipolar cores	13	4	17
Total cores	23	5	28
Tools			
Microliths	1		1
Short end-scrapers	8		8
Side-scrapers	5	1	6
Piercers	5		5
Burins	1		1
Pieces w oblique truncations	1		1
Pieces w notch(es)	3		3
Pieces w edge-retouch	6	1	7
Total tools	30	2	3
TOTAL	**2204**	**273**	**2477**

assemblages from the transitional period between the so-called Shouldered Point Complex (ie the Hamburgian and Creswellian material cultures; Burdukiewicz 1986) and the Federmesser Complex (cf Schwabedissen 1954), the assemblage may actually date to the Final Palaeolithic or, more precisely, *c* 12,000 BP.

A great number of similar assemblages are known from the north European plain, such as, Hoyle's Mouth in Wales (David 1991, fig 14.3) and Weitsche in eastern Germany (Veil & Breest 2002, fig 10; also Schwabedissen 1954). Apart from the actual curved-backed Federmesser points and some scalene, or angle-backed, forms, the Federmesser Culture is also characterized by large so-called 'Dreieckmessern', or triangular (isosceles) knives or points. The assemblage from Kilmelfort Cave includes two pieces resembling 'Dreieckmessern' (see Saville 2003a, fig 46.3.15–16). The flint and quartz artefacts from Kilmelfort Cave are to be presented and discussed in a future paper (Saville & Ballin forthcoming).

2.4.2 Later Mesolithic material

Lealt Bay, Jura (original excavation report published in Mercer 1968; re-examination filed as Ballin 2001b).

Lealt Bay was excavated by John Mercer in the late 1960s as part of his investigation of the Mesolithic chronology of the Isle of Jura (Mercer 1968; Mercer 1970; Mercer 1971; Mercer 1972; Mercer 1974; Mercer 1980; Mercer & Searight 1987). Mercer's main approach was to combine typological evidence with information regarding local shoreline displacement. In his presentation of the finds from Lealt Bay (1968), Mercer did not deal with the flint and the quartz separately, and, consequently, it is not possible to get an overall impression of the typology, technology and date of the quartz. The excavation of Lealt Bay was carried out with reference to site stratigraphy and trenches (Mercer 1968, 8), and the absence of a standard grid system makes it impossible to separate any Mesolithic and Neolithic units horizontally, or to define different activity areas, by distribution analysis.

The Lealt Bay quartz assemblage comprises 2417 pieces of which 89% is milky quartz (quartz) and 11% rock crystal (Table 2). The quartz was collected as pebbles, probably from a nearby shore, whereas rock crystal was quarried as crystals, probably in the local bedrock. Due to consistent sieving during excavation, the assemblage contains a large proportion of very small chips (37% of the debitage). Approximately one-third of the debitage is flakes; the quartz production at the site did not aim at manufacturing blades or microblades. Owing to differences in flaking properties, indeterminate pieces are abundant in milky quartz (31%) and rare in rock crystal (3%).

The core group is characterized by small platform cores (single-platform and opposed-platform cores) and bipolar cores, and the tool group is relatively varied, containing one microlith, scrapers, borers, burins, one truncated piece and a number of notched and retouched pieces. The microlith is a lanceolate microlith of Clark's type C. The scrapers are evenly distributed across short end-scrapers and side-scrapers. The piercers are relatively small, and include one small blade piercer, probably a drill-tip. The burin is a typical angle-burin. Most of the tools display some degree of use-wear.

Technologically, there is evidence of both platform technique and bipolar technique having been applied at Lealt Bay. One cannot exclude the possibility that some exhausted platform cores were reduced further in bipolar technique, but the evidence suggests that, generally, pebbles were dealt with entirely in one technique: larger pebbles were probably reduced in platform technique, as preparation of platform cores requires some surplus material, and smaller pebbles, unsuitable for decortication and preparation, were reduced in bipolar technique. A number of factors indicate a Mesolithic date for the quartz assemblage, corresponding to the date suggested by the flint assemblage from Lealt Bay (Mercer 1968).

Lussa River, Jura (original excavation report published in Mercer 1971; re-examination filed as Ballin 2002b).

Lussa River was excavated by John Mercer in the late 1960s as part of his investigations of the Mesolithic chronology of the Isle of Jura (Mercer 1968; Mercer 1970; Mercer 1971; Mercer 1972; Mercer 1974; Mercer 1980; Mercer & Searight 1987). The assemblage was recovered and recorded very much in the same way as the finds from Lealt Bay (see above). As a consequence, the quartz from Lussa River has been analysed as an unstratified and uncontexted assemblage.

Table 3 The Lussa River quartz sub-assemblage: general artefact list

	Quartz	Rock crystal	Total
Debitage			
Chips	2092	58	2150
Flakes	7215	71	7286
Indeterminate pieces	1104	1	1105
Blades	126		126
Microblades	260	5	265
Crested blades	1		1
Total debitage	10,798	135	10,933
Cores			
Split pebbles	3		3
Single-platform cores	12		12
Handle-cores	1		1
Opposed-platform cores	1		1
Cores with two platforms at an angle	3		3
Irregular cores	10		10
Bipolar cores	155	9	164
Total cores	185	9	194
Tools			
Microliths (needle points)	3		3
Fragments of microliths / backed bladelets	1		1
Blade-scrapers	1		1
Short end-scrapers	37	1	38
Double-scrapers	1		1
Side-scrapers	19		19
Side-/end-scrapers	1	1	2
Scraper-edge fragments	3		3
Piercers	2		2
Burins	1		1
Pieces with oblique truncations	2		2
Pieces with retouched notch(es)	3		3
Denticulated pieces	2		2
Pieces with edge-retouch	23		23
Total tools	99	2	101
TOTAL	**11,082**	**146**	**11,228**

A total of 11,228 pieces of worked quartz were recovered at the Lussa River site, 98.8% of which is milky quartz, with 1.2% being rock crystal (Table 3). The milky quartz was collected in the form of pebbles, either from the nearby river or from the shores of Lussa Bay, whereas the rock crystal was collected as fairly large crystals, probably from local

Illus 5 Shieldaig. Preparation flakes – four crested pieces, and one platform rejuvenation flake

rock outcrops. The rock crystal sub-assemblage includes larger proportions of cores and tools than the milky quartz sub-assemblage; this may be partly due to its better flaking properties, and partly to the possible symbolic value of this raw material.

The debitage is heavily dominated by flakes (67%), with chips amounting to *c* 20% and indeterminate pieces *c* 10%. Blades only make up 4%, and only a small number of these are regular platform blades, with the majority being elongated bipolar spalls. This composition clearly defines the Lussa River quartz assemblage as representing a flake industry. The core group consists mainly of bipolar cores (164 pieces), with bipolar cores outnumbering platform cores at a ratio of 6 to 1. Single-platform cores and irregular cores are present in roughly equal numbers (12 and 10 pieces, respectively), with other core types numbering no more than three pieces each. Three split pebbles most likely represent the first stage of a bipolar reduction sequence.

The tool group includes a large number of different implement types, such as microliths, scrapers, piercers, burins, truncated pieces, notched pieces, denticulates and pieces with edge-retouch. Almost two-thirds of the tool group are scrapers, and approximately one-quarter of the tools are pieces with edge-retouch. At four pieces, microliths are relatively uncommon, and each of the remaining tool types are even fewer in number.

Apart from one unspecified fragment of a microlith or backed bladelet, all microliths are needle points. The scrapers are mainly short end-scrapers and side-scrapers, supplemented by one blade-scraper, a double-scraper and some scraper-edge fragments. The only burin is a typical angle-burin. Two obliquely truncated pieces are interpreted as a flake-knife and an insert for a slotted bone point. The piercers, notched pieces and denticulates are all expediently made, rather informal pieces.

Technologically, the assemblage is characterized by the application of bipolar technique, with platform technique having been applied sporadically: amongst the definable unmodified and modified flakes, bipolar flakes make up *c* 80–90%; *c* 85% of the cores are bipolar specimens; and, with a few exceptions, all blades are elongated bipolar spalls. The evidence suggests that two reduction methods were applied at the Lussa River site, namely (i) a combination of platform technique and bipolar technique, with the latter representing the final stage of the reduction sequence, and (ii) the application of bipolar technique from opening of the nodule to abandonment of the core. The massive dominance of bipolar cores and blanks indicates that the exclusively bipolar approach may have been the preferred option.

The quartz assemblage itself gives few clues as to the date of the Lussa River settlement. The clear separation of the bipolar cores into smaller and larger specimens suggests that the quartz assemblage represents at least two different occupations at the site. The presence of small needle point microliths dates one of these as probably Late Mesolithic, and two radiocarbon dates (3450 and 2940 cal BC, respectively) indicate a Neolithic presence at the Lussa River site. The Neolithic date is supported by flints with invasive retouch and artefacts in pitchstone.

Shieldaig, Wester Ross (to be published as Ballin et al forthcoming; original archive report by Walker 1973).

The Shieldaig site was situated by the Shieldaig–Kenmore road at Loch Torridon in Wester Ross. As nearby gravel extraction and road construction

Illus 6 Shieldaig. Platform cores: one discoidal core, and one irregular (multi-directional) core

Illus 7 Shieldaig. Platform cores: three conical/sub-conical cores, and two opposed platform cores. No 5 was worked from one direction on one face, and from the opposite direction on the other face

threatened to undermine the site, a small excavation was carried out in 1973 by Dr Michael Walker, then at the Department of Anatomy, University of Edinburgh. The settlement had already been affected by the activities in the area, and there was little hope of recovering an intact assemblage. The aim of the excavation was therefore limited to retrieving the remaining *in situ* material before total destruction of the site.

The excavation of Shieldaig was carried out with reference to site stratigraphy and trenches (Walker 1973, 2), but the absence of a standard grid system makes it impossible to separate the Palaeolithic, Mesolithic and Neolithic units (for discussion of

Table 4 The Shieldaig quartz sub-assemblage: general artefact list

	'Ordinary' quartz	'Greasy' quartz	Quartzite	Other silica	Total
Debitage					
Chips	918	513			1431
Flakes	1273	1784	22	4	3083
Indeterminate pieces	81	164	1	2	248
Blades	9	36	2		47
Microblades	13	18			31
Core preparation flakes	1	8			9
Total debitage	2295	2523	25	6	4849
Cores					
Single-platform cores (incl. conical)	4	6	1		11
Opposed-platform cores	1	2			3
Discoidal cores		2			2
Irregular cores		13			13
Bipolar cores	14	17			31
Core rough-outs	1	1			2
Collected crystals	2				2
Total cores	22	41	1		64
Tools					
Microliths	5	12	2		19
Fragm. of microliths or backed bladelets	1	3			4
Microburins		1			1
Scrapers	4	14			18
Piercers	1	3			4
Pieces w truncations		3			3
Tanged implements		1			1
Pieces w notch(es)		1	1		2
Pieces w invasive retouch		1			1
Pieces w edge-retouch	4	5			9
Hammerstones	1				1
Total tools	16	44	3		63
TOTAL	**2333**	**2608**	**29**	**6**	**4976**

dating, see below) horizontally, or to define different activity areas, by distribution analysis.

A total of 4976 artefacts in quartz were recovered during the excavation of the site (illus 5; illus 6; illus 7; illus 8; illus 9; illus 10). Most of these pieces are in 'ordinary' quartz or 'greasy' quartz (in roughly equal proportions), with less than one per cent being in quartzite or other raw materials (Table 4); a large (unquantified) part of the material defined as 'ordinary' quartz is rock crystal, albeit not in crystal form. The recovered quartzite is probably from local bedrock, whereas almost all the quartz was quarried at (probably local) vein sources.

Approximately one-third of the debitage is chips, and two-thirds are flakes. There are considerable differences between the composition of the debitage in 'ordinary' quartz and 'greasy' quartz, which can be explained by different flaking properties and focused selection processes. There are several core preparation-flakes in the assemblage, mainly in 'greasy' quartz. The core group is dominated by bipolar cores (approximately half of all cores), irregular cores and single-platform cores; other core types present are opposed-platform cores and discoidal cores. Two core rough-outs (one in 'ordinary' quartz and one in 'greasy' quartz) are excellent examples of how cores were prepared at Shieldaig. The tool group is relatively varied and dominated by microliths and scrapers (*c* one-third of all tools each). The two dominant tool types

Illus 8 Shieldaig. Bipolar cores

Illus 9 Shieldaig. Microliths: ten geometric microliths, and one microburin

Illus 10 Shieldaig. Tools: one tanged implement, three end-scrapers, one side-scraper, two piercers, and one piece with an oblique concave truncation (?knife)

were supplemented by one microburin, and a few piercers, truncated pieces, pieces with various retouch and a hammerstone. A tanged implement is most probably a small knife, and a piece with invasive retouch may be a rough-out for a leaf-shaped arrowhead. The microlith assemblage includes lanceolates, small isosceles and scalene triangles, crescents and needle points.

In general, the quartz technology at Shieldaig does not differ from the technology at some later sites, such as Bayanne, Shetland (Ballin forthcoming j). The main bulk of the raw material was obtained from local veins; the technology is a flake technology based on platform technique supplemented by bipolar technique to exhaust cores completely; and cores were carefully prepared before (cresting) and during (trimming) production. The main visible difference is the fact that the production at Shieldaig aimed at the manufacture of relatively small flakes in comparison with the more 'chunky' blanks of later sites.

The Shieldaig quartz assemblage contains some diagnostic material, primarily microliths, suggesting that most of the finds belong to the Mesolithic period. The microlith sub-types allow this date to be narrowed down to the later Mesolithic, and comparison with the microliths from Gleann Mor, Islay (Mithen & Finlayson 2000), suggests a date in the region of 7000 BP. A flake with invasive retouch is possibly evidence of the intrusion of Neolithic material. This corresponds well with the flint assemblage from Shieldaig, as this material includes the same types of microliths and two Neolithic leaf-shaped points. In addition, the flint assemblage contains a typical Ahrensburgian point (Ballin & Saville 2003), testifying to the site having been visited before the Mesolithic occupation.

2.4.3 Early Neolithic material

Scord of Brouster, Shetland (original excavation report published in Whittle 1986; re-examination published as Ballin 2007a).

The Scord of Brouster settlement and field system is situated in the west mainland, or Walls peninsula, of the Shetland Islands, at the northern shores of Gruting Voe. At the time of the Scord of Brouster excavation, the area of the Gruting Voe inlet had already been extensively investigated, and the site formed part of a group of mainly Neolithic and Bronze Age house sites and settlements (Calder 1956; Calder 1964). Scord of Brouster was excavated by Alasdair Whittle in the late 1970s, and the main purpose of the investigation was to shed light on early agricultural settlement in Britain by examining a settlement site in a remote part of the country, unspoilt by modern development. The fieldwork produced sizeable assemblages of pottery, stone tools and lithic artefacts (almost exclusively quartz), with struck, and probably struck, quartz numbering nearly 10,000 pieces. Unfortunately, the

Illus 11 Scord of Brouster. Single-platform core

Illus 12 Scord of Brouster. Bipolar cores. Nos 1 and 3 have been burnt

Illus 13 Scord of Brouster. Leaf-shaped points

Illus 14 Scord of Brouster. Curved knives. Note the scorched surface of No. 2 (upper right corner)

Illus 15 Scord of Brouster. End-scrapers. No. 8 has been burnt

worked quartz was characterized at a time when quartz technology and, in particular, the associated bipolar technique was poorly understood, and, as the excavator puts it, '. . . further advance in our understanding of this important raw material must be wished for as soon as possible' (Whittle 1986, 64).

From Scord of Brouster, a total of 9687 lithic artefacts were recovered. Almost all finds are in quartz (illus 11; illus 12; illus 13; illus 14; illus 15; illus 16; illus 17), supplemented by eight pieces in flint, one piece of felsite, one piece of metamorphic rock, and eight pieces of 'other' raw materials (Table 5). The struck quartz is a combination of white milky quartz and fine-grained quartz, some of which

Table 5 The Scord of Brouster lithic assemblage: general artefact list (if the raw material of a type is not specified, all pieces are in quartz). * Two short end-scrapers in sandstone are described as part of the Scord of Brouster monograph's chapter on stone tools (Rees 1986, 64–5).

	Numbers				Percentages			
	House 1	House 2	House 3	Total	House 1	House 2	House 3	Total
Debitage and natural pieces								
Chips, quartz	854	755	8	1617	15.5	20.8	3.5	17.2
Flakes & indet. pieces, quartz	4306	2748	170	7224	78.1	75.4	75.6	77.0
Flakes & indet. pieces, other	8	8	1	17	0.2	0.2	0.4	0.2
Flakes & indet. pieces, flint		4		4		0.1		0.1
Flake with dorsal polish, metamorphic rock	1			1	<0.1			<0.1
Natural pieces, quartz	308	120	44	472	5.6	3.3	19.6	5.0
Natural pieces, steatite or chlorite	34	8	2	44	0.6	0.2	0.9	0.5
Total debitage	5511	3643	225	9378	100.0	100.0	100.0	100.0
Cores								
Single-platform cores	13	6	1	20	23.2	15.4	100.0	20.8
Cores w two platforms at an angle	6	1		7	10.7	2.5		7.3
Discoidal core	1			1	1.8			1.0
Irregular cores	5	6		11	8.9	15.4		11.5
Bipolar cores (incl. 1 flint)	28	23		51	50.0	59.0		53.1
Core fragments	3	3		6	5.4	7.7		6.3
Total cores	56	39	1	96	100.0	100.0	100.0	100.0
Tools								
Leaf-shaped arrowheads	2			2	1.7			0.9
Knife (scale-flaked)	1			1	0.8			0.5
Curved (bifacial) knives	5	7		12	4.1	7.8		5.7
Short end-scrapers* (incl. 1 felsite)	62	54		116	51.2	60.0		54.7
Double-scrapers	4	4		8	3.3	4.4		3.8
Side-scrapers (incl. 2 flint)	10	6		16	8.3	6.8		7.6
Side-/end-scrapers	5	1		6	4.1	1.1		2.8
Other scrapers	4			4	3.3			1.9
Scraper-edge fragments	6	4		10	5.0	4.4		4.7
Piercers	4	2		6	3.3	2.2		2.8
Piece with oblique truncation	1			1	0.8			0.5
Pieces with retouched notch(es)	2			2	1.7			0.9
Denticulated pieces		2		2		2.2		0.9
Pieces with invasive retouch	3	4		7	2.5	4.4		3.3
Pieces with edge-retouch (incl. 1 flint)	9	5	1	15	7.4	5.6	100.0	7.1
Fabricator	1			1	0.8			0.5
Hammerstones	2	1		3	1.7	1.1		1.4
Total tools	121	90	1	212	100.0	100.0	100.0	100.0
TOTAL	**5688**	**3772**	**227**	**9687**				

derives from pebble sources and some from vein sources. It is thought that several vein sources were exploited, probably all within a 10km radius.

As much of the quartz had been burnt to a degree preventing precise characterization, it was decided to combine the categories of flakes and indeterminate pieces. A total of 8863 pieces of debitage were recovered, with 1617 being chips and 7246 flakes and indeterminate pieces; true blades are practically absent. Approximately half of the cores are bipolar,

Illus 16 Scord of Brouster. Side- and side-/end-scrapers

Illus 17 Scord of Brouster. Piercers. No. 1 has been burnt

supplemented by single-platform and irregular cores, as well as a small number of cores with two platforms at an angle. The assemblage includes a large number of tools, most of which are scrapers. Two leaf-shaped points, three basal fragments of such points, six piercers and 12 curved knives were also found, as well as several expedient implement forms. The curved knives may be a regionally and chronologically diagnostic tool type, characteristic of Late Neolithic northern Scotland, as it has only been recovered from two other sites in this area (Camster Long, Caithness, and Druim Arstail, Oronsay; Wickham-Jones 1997, fig 22.28; Wickham-Jones *et al* 1982, plate 3.197).

Due to the severely burnt state of a large proportion of the assemblage it was decided not to undertake an attribute analysis of the sizeable collection of debitage. However, the initial detailed classification of cores and tools did give the author an impression of the applied percussion techniques (platform core: bipolar core ratio 47:53), and the debitage is undoubtedly dominated by bipolar material, though flakes detached by the application of hard percussion are also common. A significant proportion of the platform flakes have trimmed platform-edges. The technological attributes of the various core types suggest the sequential transformation of one core type into another, with single-platform cores representing the first stage of the reduction sequence and bipolar cores the last. The first step of core preparation at Scord of Brouster was the removal of adhering rock, or cortex, and poor-grade outer quartz. Core rough-outs were produced, characterized by the existence of a mainly plain platform and, usually, two bilateral crests or guide ridges.

The distribution of artefacts within the individual houses, and across the three houses, was discussed. The distribution analysis proved that some spatial organization took place at both levels. Within the houses, it was possible to show how work was organized around the hearths, as well as within the individual cells. House 3 appears to have had a workshop-like function, focusing on the decortication of raw quartz and possibly production of rough-outs, whereas Houses 1 and 2 may have been actual dwellings.

The presence of one kite-shaped point suggests a date of the assemblage in the later part of the Early Neolithic period (eg Green 1980, 85). This estimate is supported by a series of radiocarbon dates, dating Houses 1 and 2 to this point in time (possibly with one dwelling replacing the other), but with House 3 probably dating to the Early Bronze Age. Dates from Camster Long are contemporary with the earliest settlement at Scord of Brouster, and this assemblage also combines kite-shaped points and curved knives.

By comparing this Neolithic Shetland collection with contemporary material from other regions of Scotland, it was possible to define two distinctly different raw material provinces, as well as a third, hybrid form. The quartz province, to the north and west, and the flint/chert province, covering the eastern, central, and southern parts of the country, were characterized as techno-complexes, whereas the author was uncertain which status to attach to the mixed quartz/flint province of the west mainland and the Southern Hebrides. This topic is discussed in more detail in the present paper.

2.4.4 Late Neolithic/Early Bronze Age material

Calanais, Lewis (to be published as part of Ashmore forthcoming).

In order to allow necessary repairs of the central cairn, Historic Scotland undertook excavations of the Calanais ritual complex. These excavations were carried out by Patrick Ashmore (1980/81) and the results subsequently published in popular form

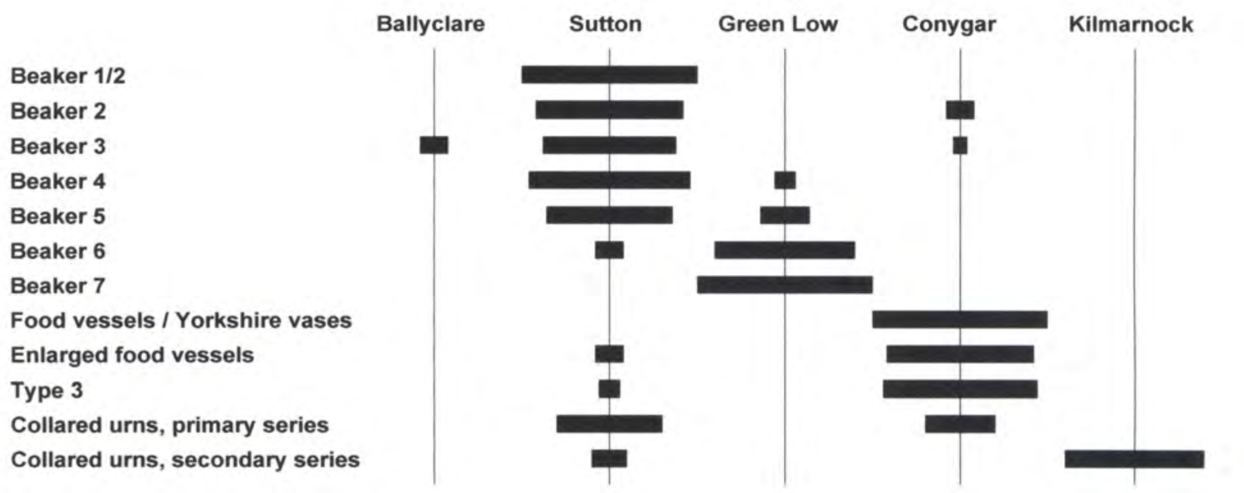
Illus 18 Calanais. Cores: one single-platform core, and one bipolar core

Illus 19 Calanais. Barbed-and-tanged arrowheads. No. 5 is probably a damaged rough-out

Illus 20 Calanais. Tools: three end-scrapers, one side-scraper, and one flake with edge-retouch (?knife). No 4 may have been burnt

Table 6 The Calanais lithic assemblage: general artefact list

	Quartz	Flint	Mylonite	Others	Total
Debitage					
Chips	9	6	2		17
Flakes	83	26	13	1	123
Indeterminate fragments/chunks	118	3	10		131
Blades	1		1		2
Microblades		1			1
Total debitage	211	36	26	1	274
Cores					
Single-platform cores	4				4
Bipolar cores	4				4
Core-fragments	1	1			2
Total cores	9	1			10
Tools					
Barbed-and-tanged arrowheads	5		1		6
Short end-scrapers	3	3	6		12
Double-scrapers		1			1
Side-scrapers	1	1	1		3
Pieces w bifacial retouch		1	1		2
Pieces w edge-retouch	3	3			6
Total tools	12	9	9		30
TOTAL	**232**	**46**	**35**	**1**	**314**



Illus 21 Seriation of British barbed-and-tanged arrowhead sub-types in relation to pottery styles (produced for Ashmore forthcoming)

(Ashmore 1995). This publication dealt mainly with the monuments (stone circle, cairn, avenue and half-oval structure), and the sequence of construction and abandonment of the structures at Callanais. The small finds were only mentioned briefly.

The lithic assemblage from Calanais is relatively small. It contains 314 pieces, most of which is quartz (74%) (illus 18; illus 19; illus 20), supplemented by some flint (14%) and mylonite (11%) (Table 6). The quartz and flint is probably local, with the quartz being quarried vein quartz, and the flint having been collected as small pebbles on a nearby beach. The mylonite is probably from local sources on Lewis (Smith & Fettes 1979, fig 3).

The assemblage comprises 274 pieces of debitage, nine cores and 30 tools. The cores are single-platform cores (quartz) and bipolar cores (quartz and flint), and the tool group is dominated by barbed-and-tanged arrowheads (Sutton) and thumbnail scrapers. All arrowheads are in quartz, with several being in 'greasy' quartz, whereas the scrapers were manufactured in all three raw materials. The quartz and mylonite sub-assemblages were produced by the application of platform technique, with the flint material manufactured mainly in bipolar technique.

Almost all the lithic artefacts were recovered from within an area of up to 2m from the cairn. Approximately half of the quartz came from trench D, with the remaining quartz material being evenly distributed across trenches B and H. The flint artefacts were evenly distributed across trenches B and D, and the mylonite came almost exclusively from trench B. For details on the excavation's trench structure, as well as the site's general layout (see Ashmore forthcoming). Quartz, flint and mylonite were found at all stratigraphical levels, but with a major part of the quartz being early, and most of the flint and mylonite being late. Cores and tools, as well as burnt lithics, appeared at all levels, that is, contexts from before the construction of the stone circle till after the central cairn's construction.

The only truly diagnostic lithic artefacts in the assemblage are the six barbed-and-tanged arrowheads. Barbed-and-tanged arrowheads are datable to the Early Bronze Age, and the fact that all arrowheads in the Callanais assemblage are of Green's Sutton type suggests that they are from the Beaker period (illus 21). One arrowhead was found in the chamber of the cairn and three east of the cairn, assumed to be cleared-out material. One arrowhead was recovered in a context associated with a half-oval structure and one from a palisade slot, suggesting a Bronze Age date for both features (Ashmore forthcoming).

Callanais is a highly complicated site with structures and finds representing activities in the Early Neolithic (pre-stone circle cultivation), the Late Neolithic (stone circle and cairn), and the Early Bronze Age/Beaker period (secondary burials, clearing-out of the cairn chamber, and cultivation). Due to the complicated stratigraphy of the site, it is not possible to prove absolute contemporaneity of any two artefacts, although some are so stylistically similar that contemporaneity is likely (for example, the quartz arrowheads from the area east of the cairn). It is thought that most of the quartz artefacts represent settlement material (earlier, contemporary with, and later than the structures), whereas a proportion of the tools (quartz, flint, and mylonite arrowheads and scrapers) may represent activities associated with the structures (probably mainly the cairn).

2.4.5 Early Bronze Age (Beaker) material

Rosinish, Benbecula (to be published as part of Shepherd & Shepherd forthcoming; preliminary report published in Shepherd 1976)

Illus 22 Rosinish. Platform cores: one single-platform core, two irregular (multi-directional) cores, and one crested flake. No. 1 is distinctly burnt

Illus 23 Rosinish. Bipolar cores: Nos 1 and 6 are distinctly burnt

In 1964, Iain Crawford excavated a circular, corbelled structure at Rosinish on Benbecula, Outer Hebrides (Crawford 1977). It was discovered that wind-induced erosion was taking place, affecting the main east-facing dune slope at Rosinish, thus revealing old land surfaces and occupation traces from the Beaker Period. In 1974, a survey and a trial excavation were carried out at Rosinish,

Illus 24 Rosinish. Scrapers: three end-scrapers, and two side-scrapers. No. 3 has split along the long-axis. No 4 (which is distinctly burnt) has a slightly concave working-edge along the left lateral side. No 5 (which was made on an abandoned bipolar core) has a simple working-edge along its right lateral side

followed in 1975, 1976 and 1977 by full scale rescue excavations (Shepherd & Tuckwell 1974; Shepherd & Tuckwell 1975; Shepherd & Tuckwell 1976; Shepherd & Tuckwell 1977). This resulted, *inter alia*, in the lithic assemblage presented below. The excavation results in general have been briefly discussed previously (Shepherd 1976; Shepherd & Tuckwell 1977b).

Due to a stylistic analysis of the pottery from Rosinish, it is assumed that the lithic assemblage from the site is Early Bronze Age (Beaker period) with a possible admixture of some material from the Late Neolithic. The assemblage is mainly in milky quartz (illus 22; illus 23; illus 24) and flint, supplemented by a small number of unworked flakes in quartzite. There are only 27 artefacts in flint to 3532 artefacts in quartz, but almost half of the tools are in flint (17 of 37). As is commonly seen in the case of Bronze Age quartz assemblages (eg Calder 1956; Hamilton 1956), the majority of the tools are scrapers (Table 7); in this particular case, half of the scrapers are small regular thumbnail scrapers, whereas the quartz scrapers are larger and much more irregular. Other tools, mainly in quartz, include three piercers, a burin, a truncated piece (a knife), two pieces with edge-retouch, and two hammerstones. Approximately one-third of the quartz is heavily burnt.

Technologically, the Rosinish assemblage is characterized by a combination of platform and bipolar techniques, with the latter dominating heavily. In Binford's terminology (Binford 1976), the quartz assemblage represents expedient technology, whereas the flint assemblage represents curated technology. This is probably mainly due to the fact that flint has better flaking abilities than quartz, and at Rosinish it is much rarer, possibly exotic.

A basic distribution analysis showed that most of the artefacts are concentrated in three south-west/north-east orientated bands ('ridges') with find-poor bands ('valleys') separating them. At present, it is not known whether this distribution pattern is due

Table 7 The Rosinish lithic assemblage: general artefact list

	Quartz	Quartzite	Flint	Total
Debitage and blanks				
Chips	992			992
Flakes	1767	7	6	1780
Indeterminate pieces/chunks	678	2		680
Crested flakes	1			1
Total debitage	3438	9	6	3453
Cores				
Single-platform cores	3			3
Opposed-platform cores	1			1
Irregular cores	12			12
Bipolar cores	57		4	61
Total cores	73		4	77
Scrapers				
Circular scrapers			1	1
Short end-scrapers	7		11	18
Side-scrapers	7			7
Other scrapers	1			1
Scraper-edge fragments			1	1
Piercers	1		2	3
Burins	1			1
Pieces with a straight truncation	1			1
Pieces with edge-retouch	1		1	2
Pieces with invasive retouch			1	1
Hammerstones	2			2
Total tools	21		17	38
TOTAL	**3532**	**9**	**27**	**3568**

to human activities or natural causes (wind activity and dune building). The most important distributional phenomenon is the fact that most of the burnt quartz was recovered immediately to the north, north-west, west, and south-west of the site's U-shaped structure. The burnt quartz must therefore be associated with this structure and activities in it. A weaker tendency in the distribution of flint artefacts suggests that the flint tools were not produced and used in the same areas, with the unworked flakes mainly deriving from the southern part of the main trench (Area I), and the flint scrapers from areas outside this zone. Generally there is very little flint debitage, and most likely the majority of the flint tools were manufactured outside the site.

2.4.6 Early Bronze Age (non-Beaker) material

Dalmore, Lewis (to be published as part of Sharples forthcoming; original archive reports by Sharples 1983a; Sharples 1983b).

In 1978 Trevor Cowie of the National Museums of Scotland carried out a coastal erosion survey of Lewis and Harris. As part of this survey, the beach at Dalmore was explored. A small surface collection of finds was examined, suggesting the presence of a prehistoric settlement. As there was little sign of *in situ* archaeological deposits, the site was not excavated. In 1979 a breakwater was constructed to protect the western part of the Dalmore beach from erosion. It was noticed that the construction trench cut through a layer rich in archaeological finds, and this layer appeared to extend in front of the breakwater where it was exposed to erosion. Over the following four years, this area was closely monitored by local amateur archaeologist Mrs Margaret Curtis (then Ponting), who managed to excavate a large area, and a significant number of archaeological artefacts were recovered.

At the end of 1982, severe gales and rainstorms altered the beach configuration dramatically, and the sea wall collapsed. Following this event, a modified sea wall was erected, which involved horizontal ties running into the dune, anchored by large cast iron piles. As part of the construction work, a large area

Illus 25 Dalmore. Platform cores: core rough-out (with two crude opposed crest along the lateral sides), single-platform core (with its flaking-front to the left), and an irregular (multi-directional) core

Illus 26 Dalmore. Bipolar cores. No 2 has been burnt

Illus 27 Dalmore. Barbed-and-tanged arrowheads: rough-outs, rejects, and almost complete specimens. No. 2 has been burnt. Nos 5 and 7 have characteristic Kilmarnock Type tangs (Green 1980, 123)

of the machair was removed behind the breakwater, and further archaeological deposits were exposed. Mrs Curtis was encouraged to examine the deposits, which turned out to be deep and complex and associated with structures.

At this stage, Niall Sharples from Cardiff University was asked by Historic Scotland (then the Scottish Development Department) to undertake excavations in order to gauge the extent and significance of the preserved deposits, and to provide a context for the now large collection of artefacts obtained from the site. The excavation was carried out in 1983, covering an area originally exposed and examined by Mrs Curtis, as well as a 2m wide untouched strip.

Illus 28 Dalmore. Tools: three end-scrapers, and one burnt piercer

The trench measured approximately 10 x 9m, at its widest (Sharples 1983a; Sharples 1983b).

During Sharples' excavation a number of superimposed structures were investigated. These structures were separated stratigraphically into five main phases, as well as a number of sub-phases: Phase I (the earliest occupation), Phase II (House 077), Phase III (House 078), Phase IV (House 091, including recess 033), and Phase V (the final stage of destruction). In association with these structures, a large number of prehistoric artefacts were discovered, such as pottery and worked lithics.

The large lithic assemblage from Dalmore (2665 pieces; illus 25; illus 26; illus 27; illus 28; Table 8) consists of two parts, namely finds from Sharples' 1983 excavation, and material collected and excavated by Mrs Curtis before and after this excavation. The Dalmore lithics report (Ballin forthcoming g) is based on the detailed analysis of the entire assemblage from Sharples' investigation of the site (2564 pieces), as well as the cores and tools from the Curtis collection (101 pieces). In total, Sharples' excavation resulted in the recovery of 2503 pieces of debitage, with a somewhat smaller number having been found by Mrs Curtis (due to constraints on time, the debitage from Mrs Curtis' collection was not included in the initial analysis). The combined Dalmore collection includes 72 cores and 90 tools, and 92% of this assemblage is in quartz, with 4% being flint, 3% mylonite and less than 1% 'other' raw materials (mainly gneiss and basalt).

The dominant core types are irregular and bipolar cores with 16 and 35 pieces, respectively, but, summed up, the various forms of platform cores (including irregular specimens) number 33 specimens, thus making them as numerous as the bipolar cores. Disregarding 'pieces with edge-retouch', which is not a *proper* tool type but a category of indeterminate tools and tool fragments, the combined tools are dominated by arrowheads and scrapers. Barbed-and-tanged arrowheads and rough-outs for arrowheads make up 19 pieces, whereas scrapers amount to 38 pieces. These tools are supplemented by a small number of piercers, hammerstones, and notched, denticulated, truncated and retouched pieces.

The lithic technology is a combination of platform and bipolar techniques, including a hybrid approach. Most probably, blank production was initiated on single-platform cores which, as the reduction process progressed, acquired more and more platforms. When a platform core had become too small to work in free-hand style, it was supported on an anvil and, finally, the resultant very small cores would be reduced in bipolar technique (cf Callahan 1987).

The vertical and horizontal distribution of the lithic artefacts support the phasing suggested previously (Sharples 1983a; Sharples 1983b). Most of the lithics were found inside the site's small building, and primarily in association with its hearths. The lithic distribution suggests that, in each phase, the house had one hearth, which was relocated between phases. Probably most activities, such as primary and secondary production, as well as tool use, was carried out by the dwelling's fireplace. When debitage, cores or tools were abandoned, they were either tossed to the periphery of the house or

Table 8 The combined Dalmore lithic assemblage: general artefact list

Debitage		**Quartz**	**Flint**	**Mylonite**	**Others**	**Total**
Chips		1460	64	53	5	1582
Flakes		432	20	5	5	462
Indeterminate pieces		256		1	4	261
Wet-sieved quartz flakes/indet.		196				196
Microblades			2			2
Total debitage		2344	86	59	14	2503
Cores						
Split pebbles		1				1
Core rough-outs		5				5
Single-platform cores		7				7
Opposed-platform cores		1				1
Cores w two platforms at an angle		2				2
Discoidal cores		2			1	3
Irregular cores		16				16
Bipolar cores		24	7	3	1	35
Core fragments		2				2
Total cores		60	7	3	2	72
Tools						
Barbed-and-tanged arrowheads		6		2		8
Arrowhead rough-outs		9		2		11
Backed blades/bladelets			1			1
Scrapers:	Discoidal scrapers		2	1		3
	Short end-scrapers	11	13	2		26
	Double-scrapers		1			1
	Side-scrapers		4	2		6
	Other scrapers	1				1
	Scraper-edge frags	1				1
Piercers		4				4
Pieces w straight truncations			1			1
Pieces w notch(es)		1				1
Denticulated pieces		2				2
Pieces w invasive retouch		3				3
Pieces w edge-retouch		14	1	4		19
Hammerstones		2				2
Total tools		54	23	13		90
TOTAL		**2458**	**116**	**75**	**16**	**2665**

deposited in one of the door dumps. The main activities at Dalmore, as suggested by the composition of the lithic collection, include production of arrowheads and the production and use of scrapers. The relatively acute scraper-edge angles of the latter indicate the processing of hides or skin.

It is not possible to recognize any typo-technological differences between the lithic sub-assemblages from the various phases, and the collection's only strictly diagnostic tool type is the barbed-and-tanged arrowhead. This type suggests a date in the Early Bronze Age in general, and the presence of a small number of Kilmarnock points (Green 1980, 123) demonstrates that at least part of the occupation at the Dalmore site took place in the later part of this period (the Urn Period; see illus 21). Analysis of the Dalmore pottery supports the general date of Early Bronze Age, with the recovery of Beaker and Food Vessel influenced ceramics, as well as sherds from at least one very large carinated urn.

Table 9 The combined lithic assemblage from FERG Sites 4 and 5: general artefact list

	Flint	Quartz	Others	Total
Debitage				
Chips		1		1
Flakes	8	45	1	54
Indeterminate pieces	2	10		12
Total debitage	10	56	1	67
Cores				
Split pebbles		2		2
Single-platform cores	3			3
Irregular cores	2	4		6
Bipolar cores	4			4
Core fragments		2		2
Total cores	9	8		17
Tools				
Discoidal scrapers	1			1
Short end-scrapers	2	1		3
Double-scrapers		1		1
Side-/end-scrapers	1			1
Other scrapers	1			1
Scraper-edge fragments		1		1
Pieces w convex truncations	1			1
Pieces w retouched notch(es)	2	1		3
Pieces w edge-retouch	4			4
Total tools	12	4		12
TOTAL	**31**	**68**	**1**	**100**

With its combination of mainly Early Bronze Age artefacts in quartz, flint and mylonite, the Dalmore collection compares well with a number of contemporary assemblages excavated or collected along the west coast of Lewis and Harris, such as, Barvas 2 (Ballin 2003a), Olcote (Neighbour 2005), Calanais (Ballin forthcoming a), Berie Sands (Lacaille 1937) and parts of the Northton assemblage (Simpson 1976; Murphy & Simpson 2003). Together, these Early Bronze Age assemblages present a detailed picture of lithic variation within a limited geographical area.

FERG Site 4, Aberdeenshire (to be published as part of Johnson forthcoming).

In 2001 CFA Archaeology Ltd carried out excavations along the route of the St Fergus to Aberdeen Natural Gas Pipeline (FERG) in eastern Aberdeenshire (Cameron 2002). The investigation dealt with a number of sites, but only from Sites 1, 4, 5 and 6 were lithic artefacts recovered. The first lithic finds from these sites were discussed in Ballin (Ballin 2003b). Additional lithic artefacts from FERG Site 4 were described in a later report (Ballin 2004c), and the main characteristics of this more substantial collection are summarized below. This site is located roughly 400m south-east of Auchmachar Farm and included two truncated ditches (contexts 005 and 006), a shallow pit (context 001) and two rock outcrops (contexts 004 and 008).

The assemblage from Site 4 includes 66 lithic artefacts (Table 9). Twenty-two of these are flint, 43 are quartz and one small flake is in dolerite. Most of the flint and quartz is assumed to have been collected locally, the flint possibly from the Buchan Ridge Gravel deposits. The quartz was most likely procured in the form of erratics, though individual pieces may be from river or beach sources. Three large objects in fine, grey flint may represent imported raw material (cf Saville 2003b, 407). The dolerite flake may have been based on an erratic nodule.

Thirty-nine pieces are unmodified debitage, supplemented by 15 cores and 12 tools. The debitage is mainly milky quartz, whereas the cores and tools are dominated by flint. The debitage consists of 32 flakes and seven indeterminate pieces, and no chips or blades were recovered. The cores include three regular single-platform cores, six irregular cores and four bipolar cores; two split pebbles had been worked in bipolar technique. The tool category is dominated by seven scrapers, supplemented by two notched pieces and three pieces with edge-retouch. An end-scraper and a retouched piece, both with coarse inverse retouch, may be early-stage 'flaked flakes' (Ashton *et al* 1991).

The assemblage is dominated by a simplistic hard-percussion/bipolar technique (Industry 1), but three single-platform cores represent a microblade industry (Industry 2), characterized by soft percussion and sophisticated core preparation. However, no blades or microblades were found at Site 4. The distribution patterns of the assemblage suggest that flake production, by the application of hard and bipolar percussion, was centred on rock outcrop context 008 (for site details, see Johnson forthcoming), whereas the single-platform cores may have been scattered across the site in connection with relatively recent dumping of soil.

The dates of the two industries are indicated by a combination of typology, technological attributes and raw material preference. It is suggested that Industry 1 is most likely to be post Early Bronze Age, due to its simple core forms, the presence of possible early-stage 'flaked flakes' (cf Ballin 2002a), and the use of possibly imported grey flint (Saville 2003b, 407), whereas Industry 2, with its single-platform microblade cores, must be early prehistoric (either Late Mesolithic or Early Neolithic).

One quartz chip and one indeterminate piece in quartz, both from Pit 001, were discussed previously (Ballin 2003b). They were not included in the present analysis.

FERG Site 5, Aberdeenshire (to be published as part of Johnson forthcoming).

This site was excavated as part of the same general project as FERG Site 4 (above). The main lithic assemblage from FERG Site 5 were characterized (in Ballin 2004d), and the main characteristics of this collection are summarized below. This site is located towards a low ridge, *c* 200m from Mains of Bruxie Farm, and it included the truncated remains of a ring-ditch and a number of internal pits.

The assemblage from Site 5 includes 34 lithic artefacts, nine of which are flint, with the remainder being quartz (Table 9). Both raw materials are assumed to have been collected locally, the flint probably from the Buchan Ridge Gravels, and the quartz most likely in the form of erratics, though some may be from river or beach sources. Twenty-eight pieces are unmodified debitage, supplemented by two core-fragments and four tools. The debitage is mainly quartz, the core-fragments are in quartz, and all tools are in flint. Only one chip was found, as well as 22 flakes and five indeterminate pieces. The two core-fragments are detached core-sides. The tools include one discoidal scraper, one truncated piece, one notched piece and one retouched piece.

None of the flakes are soft-percussion blanks, with hard percussion and bipolar technique having been applied in equal measure. Core preparation appears to have been kept to a minimum, and only the truncated blade (CAT 29) has had its platform edge trimmed. Though it is not absolutely certain that CAT 29 is contemporary with the rest of the assemblage, the entire assemblage is probably the product of one or more expedient flake industries, and a general date of the later prehistoric period seems likely. No diagnostic artefact types were found. The excavators (Cameron 2002) suggest an Iron Age date for the site's ring ditch, and the lithic assemblage may be residual to this structure. This option is not contradicted by the stratigraphical position of the finds.

Eleven lithic artefacts from the same site were discussed in Ballin (Ballin 2003b), and this small assemblage has a typological, technological and raw material composition similar to the material described above. The 2003 assemblage, which was not included in the present analysis, generally supports the above conclusions.

2.4.7 Later Bronze Age material

Bayanne, Shetland (to be published as part of Moore & Wilson forthcoming a).

During the excavations at Bayanne on Yell, Shetland, EASE Archaeological Consultants recovered a large lithic assemblage which consists almost entirely of quartz. The work was carried out in response to the threat from continued coastal erosion of the site and, though parts of the deposits were lost to the sea, several structures were still intact, or partly intact, as were their contents of, *inter alia*, pottery and lithic artefacts. The internal site chronology includes six phases, covering early cultivation and a post-built structure, a number of Later Bronze Age dwellings, workshops and middens, two Pictish figure-of-eight houses, as well as layers relating to site abandonment and later cultivation.

The large lithic assemblage from Bayanne includes 2955 pieces (illus 29; illus 30; illus 31; Table 10), or approximately 40 kg, of which 99.4% is in quartz and the remainder in quartzite. Contrary to most other quartz assemblages, the Bayanne material contains a large number of classifiable cores and tools, with a tool ratio of 7%. Cores amount to 53 pieces, whereas tools constitute 205 pieces, of which 153 (75%) are scrapers, 11 are piercers, 23 are retouched pieces and 16 are hammerstones; one piece was classified as a small knife, and one piece is a fragmented barbed-and-tanged arrowhead. Most of the scrapers are plain short end-scrapers (111 pieces, or 73% of the scraper group), supplemented by some double-scrapers and side-scrapers.

The primary reduction technique at Bayanne is a combined approach applying hard-hammer as well as bipolar technique. This is indicated by the cores, the core preparation/rejuvenation flakes, and the debitage: most cores are hard-hammer cores

Illus 29 Bayanne. Cores: three single-platform cores, one opposed-platform core, one irregular (multi-directional) core, and one bipolar core

Table 10 The Bayanne lithic assemblage: general artefact list

Debitage		**Tools**	
Chips	281	Circular scrapers	2
Flakes	1416	Short end-scrapers	111
Chunks	972	Double-scrapers	18
Blades	14	Side-scrapers	16
Microblades	8	Scraper-edge fragments	6
Crested blades and flakes	4	Piercers	11
Platform flakes	2	Pieces with a curved truncation	1
Total debitage	2697	Pieces with edge-retouch	23
Cores		Combined tools (scraper-piercers)	1
Single-platform cores	13	Hammerstones	16
Opposed-platform cores	2	Total tools	205
Irregular cores	19	**TOTAL**	**2955**
Bipolar cores	18		
Core rough-outs	1		
Total cores	53		

Illus 30 Bayanne. Preparation flakes and tools: one crested flake, one core rejuvenation flake, one base of a barbed-and-tanged arrowhead (with residual barbs), two piercers, and one backed knife

(platform and irregular cores) with approximately one-third of the cores being bipolar; bulbar and bipolar flakes are present in roughly equal numbers. A detailed inspection of the cores and the debitage suggests that hard-hammer technique was the main percussion technique, with bipolar technique mainly being applied in the initial and final stages of production, that is, in connection with the 'quartering' of raw nodules and with the reduction of exhausted platform cores.

The quartz artefacts were distributed across 14 events (six phases), with quartz deriving from wall cores, occupation layers in houses, as well as middens. Most pieces of quartz were found outside the houses, suggesting that either the main part of the primary production took place in the open air, or the houses were cleaned regularly and rigorously. It is at present unknown which activities required the large quantities of scrapers, but use-wear analyses suggest that steep edge-angles, as seen in connection with the scrapers from Bayanne, were not intended for hide-working but for the processing of harder materials, such as wood, bone and antler (Broadbent & Knutsson 1975; Knutsson 1978; Knutsson 1988, 133; Broadbent 1979, 89; Jeppesen 1984; Thorsberg 1986; Juel Jensen 1988, 70f). The fact that the Bayanne scrapers are generally heavily worn and damaged support this.

In the report (Ballin forthcoming j), the Bayanne assemblage is compared to other quartz assemblages from Shetland, and a basic (and preliminary) techno-chronological schema is presented. In this schema, the material from Bayanne is suggested to typify an Early to Late Bronze Age stage, differing technologically from earlier and later stages. The presence of a barbed-and-tanged arrowhead indicates an Early Bronze Age date for the quartz of Phase 1, whereas the complete absence of invasive retouch in the later phases indicates a Later Bronze Age date for the remaining quartz assemblage. The relatively sophisticated operational schema of the Bayanne industry rules out an Iron Age date, as Shetland assemblages with Iron Age components appear to have been produced in a more expedient manner (Section 2.4.8). The dating proposed by the typological and technological attributes of the collection is

Illus 31 Bayanne. Scrapers: four end-scrapers, one double-scraper, one side-scraper (working-edge along the left lateral side), and one side-/end-scraper (the lateral working-edge is to the right side)

supported by radiocarbon evidence, suggesting a date for the Phase 1 finds of approximately 3400 BP, and a date of *c* 3200–2700 BP is suggested for the main bulk of the assemblage.

Cruester, Shetland (to be published as part of Moore & Wilson forthcoming c).

In October–November 2002 EASE Archaeological Consultants carried out excavations at the Cruester burnt mound on Bressay, Shetland. The work was undertaken in response to the threat from continued coastal erosion of the site. Prior to excavation the site was visible as a large mound measuring some 20m in diameter, and it was about 2m high (Moore & Wilson 2003a).

The burnt mound at Cruester was initially described by surveyors of the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS 1946, no 1092), and resurveyed by the Ordnance Survey during 1964. In 1996, the site was examined as part of the Shetland Burnt Mounds Project (Moore & Wilson 1999), funded by Historic Scotland and Shetland Amenity Trust. At this point of time, the entire erosion face was transformed into a 17m long section, and the overall site area and the section face were recorded in detail. The excavation of 2000 revealed a complex cellular stone structure at the centre of the mound, almost identical in plan to the structure associated with the burnt mound at Tangness, Eshaness, Shetland (Moore & Wilson 1999). This structure was incorporated into the burnt mound, demonstrating some degree of contemporaneity between the activities associated with the burnt mound and the cellular structure.

With its 173 lithic artefacts (Table 11), the Cruester assemblage is relatively small. It includes 160 pieces of debitage, nine cores and four tools. Apart from a single flint artefact, all finds are in quartz. Some quartz is homogeneous milky quartz of uncertain provenance, but the larger part of the assemblage is dense saccharoidal quartz from the local shores. The debitage is heavily dominated

Table 11 The Cruester lithic assemblage: general artefact list

Debitage	
Chips	1
Flakes	42
Blades	4
Indeterminate pieces	111
Crested flakes	2
Total debitage	160
Cores	
Single-platform cores	3
Opposed-platform cores	1
Irregular cores	1
Bipolar cores	3
Core fragments	1
Total cores	9
Tools	
Short end-scrapers	1
Pieces with retouched notch(es)	1
Pieces with edge-retouch	1
Hammerstone	1
Total tools	4
TOTAL	**173**

by indeterminate pieces (*c* 70%), supplemented by some flakes (*c* 25%), and small numbers of chips, blades and crested pieces. The flakes were mainly detached by the application of hard percussion, but bipolar flakes are also present. Most of the cores are platform cores, with three single-platform cores dominating the category. Three bipolar cores were also recovered. The tools are plain and include an end-scraper, a notched piece, a piece with edge-retouch and a hammerstone.

The industry represents a flake technology, with blanks having been produced mainly on simple single-platform cores. The operational schema did not include systematic decortication, cresting or platform preparation, but some trimming of platform-edges did occur. Rejuvenation of platforms by the detachment of core tablets did not take place either. When platform cores were abandoned, they were frequently reduced further by the application of bipolar technique. A proportion of the many indeterminate pieces may reflect the activities associated with the covering burnt mound (splitting due to the exposure to heat), rather than the lithic technology.

The assemblage is probably mainly a product of activities associated with the construction and use of the central structure (Phase 3), and activities post-dating the abandonment of this structure (Phase 4). These activities are likely to include primary and secondary production, as well as the use of unmodified and modified tools. During Phase 3, quartz blanks and tools were produced, used or stored throughout the structure. The horizontal distribution of quartz may suggest some specialization between the various cells. The lithic assemblage does not include diagnostic elements, but, combined, the structural details of the building, burnt mounds in general, radiocarbon and thermoluminescense dates, and diagnostic pottery suggest a Later Bronze Age date.

2.4.8 ?Iron Age material

Burland, Shetland (to be published as part of Moore & Wilson forthcoming b).

In 2000 and 2002, EASE Archaeological Consultants carried out excavations at Burland Farm on the isle of Trondra, Shetland. The work was undertaken in response to the threat from continued coastal erosion of the site. The project was commissioned and funded by Shetland Amenity Trust and Historic Scotland. The presumed settlement site was visible as a low mound near the coastal edge at *c* 5m OD, with the hinterland to the east rising to approximately 50m OD.

The excavations uncovered the remains of at least three separate structures, and the deposits were divided into the following seven phases of activity (Moore & Wilson 2003b):

- Phase I: Early cultivation remains
- Phase II: Early activity (anthropogenic soils and cut features) – associated with metalworking
- Phase III: Structure 2 – associated with metalworking
- Phase IV: Structure 3
- Phase V: Structure 1
- Phase VI: Abandonment (hill wash)
- Phase VII: Peat stack.

The 515 lithic artefacts (illus 32; illus 33; illus 34; illus 35; illus 36) were mainly recovered from Phases II–III (22%) and VI–VII (76%), with Phase IV–V contexts constituting an almost sterile separation of the two groups of finds (<2%). No worked quartz was found in Phase 1 deposits. The following summary focuses on the finds from Phases II–III and VI–VII, and the similarities and differences between the two sub-assemblages.

The assemblage from Burland Farm includes 515 lithic artefacts (Table 12), 514 of which are in quartz with one piece being in jasper. The quartz was procured from a number of vein and pebble sources; the vein quartz probably from east or south Trondra, whereas the pebble quartz may be from the local beach. The jasper may have been collected or quarried on the island (forming part of the metamorphic Whiteness Division), though jasper is more frequently encountered in igneous environments (eg Papa Stour).

The 437 pieces of debitage are heavily dominated by indeterminate pieces (68%), supplemented by

Illus 32 Burland. Platform cores: one large and one small irregular (multi-directional) core, and one small single-platform core (lower right corner)

Table 12 The Burland lithic assemblage: general artefact list

	Total		Total
Debitage		**Tools**	
Chips	3	Leaf-shaped arrowheads	1
Flakes	126	Short end-scrapers	12
Blades	12	Side-scrapers	5
Indeterminate pieces	295	Hollow scrapers	1
Crested pieces	1	Scraper-edge fragments	1
Total debitage	437	Piercers	3
Cores		Backed knives	1
Single-platform cores	3	Notched pieces	2
Irregular cores	13	Pieces with edge-retouch	7
Bipolar cores	21	Fabricators	6
Core fragments	1	Other tools	1
Total cores	38	Total tools	40
		TOTAL	515

Illus 33 Burland. Bipolar cores: two large specimens, and three smaller specimens

some flakes (29%), and small numbers of chips, blades and a crested piece. More than nine-tenths of the flakes and blades were detached by the application of bipolar technique, with the remainder having been manufactured mainly by hard percussion. Approximately 55% of the 38 cores are bipolar cores, supplemented by 34% irregular cores and a small number of single-platform cores. However, all irregular and single-platform cores were reduced by the use of an anvil, and, though both core types are technically platform cores, some bipolar flakes may have been produced on these cores (due to the application of anvils), explaining the discrepancy between the technological composition of the debitage and core categories.

The 40 tools are mostly expedient forms of scrapers, piercers, fabricators, notched pieces and edge-retouched pieces, but a fragment of a leaf-shaped point in jasper, and a backed knife were also found. The scrapers dominate the tool category (48%), with edge-retouched pieces and fabricators representing *c* 16% each. The fragment of a leaf-shaped point represents a fairly well-executed bifacial piece, which probably broke during manufacture. It stands out as an implement of much higher quality than the main bulk of the assemblage, and it probably predates it.

Though distributed across two stratigraphical levels (Iron Age Phases II–III, and later hillwash layers), separated by almost sterile Norse layers, the assemblage appears to represent a single, very simplistic industry. Both sub-assemblages are based on the same mixture of vein and pebble quartz, and they follow the same typological and technological schemas. Typologically, the two sub-assemblages include almost the same, mostly plain and informal, tool types, with large fabricators being an important common denominator; three piercers and a knife are exclusive to the Iron Age level. Technologically, the two sub-assemblages are based on the same combination of bipolar and platform-core-on-anvil approaches, and the individual debitage and core types of both finds groups cluster metrically to form separate size categories. Most likely, this is an expression of a phased operational schema, with large flakes and cores representing the first

Illus 34   Burland. Scrapers: three end-scrapers, two side-scrapers (with a left and right lateral working-edge, respectively), and one concave scraper (furthest to the right)

Illus 35   Burland. Tools: one knife (backing along the right lateral side), two piercers, and one notched piece

Illus 36 Burland. Fabricators

Table 13 The Barvas 2 lithic assemblage: general artefact list

Debitage	Quartz	Flint	Total
Chips	1		1
Flakes	18	6	24
Indeterminate pieces	7	1	8
Total debitage	26	7	33
Cores			
Split pebbles	3		3
Irregular core	1		1
Bipolar cores		1	1
Total cores	4	1	5
Tools			
Short end-scrapers	1		1
Pieces w notch(es)		1	1
Pieces w edge-retouch		5	5
Combined tools		1	1
Total tools	1	7	8
TOTAL	**31**	**15**	**46**

step of the reduction process ('quartering'), while the smaller pieces represent the second and last step (discarded blanks and totally exhausted cores). Though the Burland industry is based on few and very simple technological choices, it clearly represents a planned process or operational *schema*.

Apart from the fragment of a residual Early Neolithic leaf-shaped point, the assemblage does not include any diagnostic types. The basic lithic technology, however, suggests a date of the main bulk of artefacts in the later part of Scottish prehistory. The distribution of finds across the Phase II and III Iron Age features and structures indicates that, at Burland, quartz knapping may have occurred later than usually expected. Similar Iron Age dates have been obtained from the quartz-bearing layers at Kebister, Shetland (Clarke 1999, 164; Owen & Lowe 1999, 148), and the presentation of the finds from Jarlshof (Hamilton 1956, 15, 26) suggests production of simple quartz blanks and tools around the transition of the Bronze Age and Iron Age periods, and possibly into the Iron Age proper.

The majority of the finds were recovered from the upper hillwash layers, and, due to the similarity between these finds and finds from the Iron Age layers, it is thought that they originally formed part of a peripheral section of the Iron Age settlement located east of the structures at a higher topographical level. From this position, they slid down the hillside, encouraged by the combined forces of gravity and modern ploughing. Even if the lithic material from the site's Iron Age level should prove to represent hillwash, and therefore pre-date the Iron Age settlement, a date earlier than the Bronze Age–Iron Age transition is unlikely.

2.4.9 Minor assemblages

Barvas 2, Lewis (Ballin 2003a).

During archaeological investigation of the dune area near Barvas on the Isle of Lewis, Western Isles, 46 lithic artefacts were recovered. The assemblage includes 31 pieces of quartz and 15 pieces of flint (Table 13). The quartz is partly milky quartz and partly saccharoidal quartz. Flint as well as quartz were procured from the local beaches. Most of the lithic finds constitute debitage, supplemented by five cores and eight tools. Flakes make up three-quarters of the debitage, with the remainder being indeterminate pieces; the cores include three split pebbles (early-stage bipolar cores), one bipolar core and one irregular core; and the tools are mainly edge-retouched pieces, supplemented by one end-scraper, one notched piece and a combined tool (scraper-piercer).

Approximately 80% of the flakes were manufactured by the application of bipolar technique, with 4% having been produced in hard-hammer technique and the remainder in indeterminate platform technique. Most likely, some flakes were produced on irregular cores and then, when these cores became too small for further free-hand reduction, flake production continued by the application of bipolar technique. However, the presence of split pebbles, worked in bipolar technique, shows that some nodules were reduced entirely by the use of anvils. The total absence of true blades, combined with a largely unschematic operational schema, favour a date in the later part of prehistory.

Catpund, Shetland (Ballin 2005).

In connection with the excavation of the Late Neolithic/Early Bronze Age house at Catpund, a number of quartz artefacts were recovered, in total 31 bags of quartz. Unfortunately, it has only been possible to locate one of these bags (SF 513), and the following summary of the quartz assemblage is based on this sample (31 pieces). If SF 513 represents an average bag, the assemblage will have contained approximately 900 pieces of quartz. However, this bag is from a small dense concentration of samples from the north-west corner of the house, and it is likely that these bags contained a higher than average number of quartz, with the bags collected from scatters in the rest of the house being slightly less full. Assuming that the quartz assemblage constituted 450–900 pieces, the sample SF 513 could account for 3.3–6.7%. As the contents of this bag corresponds well to quartz assemblages from other Late Neolithic and Bronze Age sites in the west and north of Scotland (compare with other accounts in this section), it is quite possible that bag SF 513 is representative of the entire Catpund assemblage.

Table 14 The Catpund lithic assemblage: general artefact list

Debitage	Total
Bipolar flakes	17
Platform flakes (?)	1
Total debitage	18
Bipolar cores	5
Tools	
Piercers	1
Short end-scrapers	6
Double scrapers	1
Total tools	8
TOTAL	**31**

SF 513, the only quartz bag it was possible to locate, contained 31 artefacts of white pebble quartz (milky quartz). The assemblage comprises 18 flakes, five cores and eight tools (Table 14). Apart from one possible platform flake, all flakes and cores are bipolar, and all tools are on bipolar flakes. The tool group consists of one piercer, six short end-scrapers and one double-scraper. On the basis of the available quartz it could be concluded that the assemblage from Catpund represents an almost exclusively bipolar technology. This corresponds well with other Scottish quartz assemblages based mainly on pebble quartz (eg Rosinish, Benbecula: Ballin forthcoming h, and Sumburgh, Shetland: Finlayson 2000). No attempt had been made at producing blanks of certain fixed dimensions (eg blades or elongated flakes).

A distribution analysis based on information from the initial artefact and site reports of 1988 and 1990 demonstrated that the quartz had mainly (71%) been recovered from the later post-occupation phases (Phases VI and VII) and none from the main occupation phase (Phase III). Most of the late quartz came from two clusters in the central and eastern parts of the house, possibly activity areas. The densest cluster of nine bags was situated between the wall and the north-west orthostat and may be a cache. The quartz, as a whole, is completely non-diagnostic and the assemblage cannot be dated more accurately than to the interval Neolithic–Early Iron Age.

2.4.10 The Cnoc Dubh quartz quarry project (Ballin 2004e)

In 2002, an examination was carried out of a small quartz vein at the knoll of Cnoc Dubh, a few hundred metres from the bottom of Loch Ceann Hulabhig on the Isle of Lewis. The vein (illus 37) proved to have been worked in prehistoric time, defining it as a quarry, and it was measured, photographed and characterized. The Cnoc Dubh quartz quarry is presented in detail in Ballin (Ballin 2004e), to allow comparison with other lithic quarries, and it is attempted to define attributes diagnostic of prehistoric exploitation, and to schematically describe the 'mining operations' by which the quartz was procured. As part of this process, quartz quarrying is compared to the procurement of other lithic and stone raw materials, mainly drawing on research from Scandinavia, Australia and the USA, and the location of quartz quarries in relation to prehistoric settlements is discussed. The average distance between quartz sources and Neolithic–Bronze Age sites on Lewis is then used to discuss ownership of, and access to, prehistoric quartz sources, as well as the possible exchange of quartz.

Results of this research form part of the discussions in Sections 5–8.

2.4.11 The burnt quartz project ('The recognition of burnt quartz and its relevance to the interpretation of prehistoric sites'; Ballin forthcoming k)

It is a well-known fact that flint, when exposed to fire, undergoes a number of distinct changes. Depending mainly on distance to the heat source and duration of the exposure, flint artefacts may change colour, lustre, and weight, and they will, ultimately, crackle and disintegrate (eg Fischer *et al* 1979, 23). These alterations are used by lithics analysts to interpret assemblages and sites, and burnt flint has, *inter alia*, been used to suggest the presence of otherwise invisible hearths (eg Ballin forthcoming j), site maintenance (dumping of hearth material; eg Binford 1983), the destruction of prehistoric dwellings by fire (eg Fischer *et al* 1979, 22–7), and heat-treatment of lithic raw material (Price *et al* 1982). As a consequence, the recording of burnt flint has become a standard part of post-excavation processing of flint assemblages.

In contrast, burnt quartz is rarely recognized, reported, described or discussed, and, as a result, analyses of quartz assemblages appear less fruitful. This state of affairs has added to the general perception in the archaeological world, that investing in the analysis of quartz assemblages is 'a waste of time and money'. However, a combination of experimentation and analysis of prehistoric assemblages suggests that burnt quartz *is* recognisable, although it may be more difficult to identify than burnt flint. Inspired by observations, first of all the non-random distribution of potentially burnt quartz on Neolithic and Bronze Age sites in north-west Scotland (eg Rosinish: Ballin forthcoming h; Calanais: Ballin forthcoming a; Dalmore: Ballin forthcoming g), the author undertook a series of trials. The experimental burning of quartz showed that quartz, when exposed to fire, undergoes the same basic alterations as flint (change of colour, lustre, weight and general cohesion), and the tests managed to elucidate some of the observations, whereas other observations remain unexplained.

Preliminary results of this research are discussed in Section 4.4.

Illus 37 The Cnoc Dubh quartz quarry, Lewis