3 The Assemblage

In connection with the archaeological investigation of the site, 9687 lithic pieces were recovered. The composition of the assemblage is shown in Table 1.

The definitions of the main lithic categories are as follows:

Chips: All flakes and indeterminate pieces the

Table 1 Lithics – 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, 84–5)

	Numbers				Percentages			
	House 1	House 2	House 3	Total	House 1	House 2	House 3	Total
Débitage and natural pieces								
Chips, quartz	854	755	8	1617	15.5	20.8	3.5	17.2
Flakes and indet. pieces, quartz	4306	2748	170	7224	78.1	75.4	75.6	77.0
Flakes and indet. pieces, other	8	8	1	17	0.2	0.2	0.4	0.2
Flakes and 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 débitage	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 with 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 one 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 one felsite)	62	54		116	51.2	60.0		54.7
Double-scrapers	4	4		8	3.3	4.4		3.8
Side-scrapers (incl two 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 one 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				

greatest dimension (GD) of which is ≤10mm.
Flakes: All lithic artefacts with one identifiable ventral (positive/convex) surface, GD>10mm and L<2W (L = length; W = width).
Indeterminate pieces: Lithic artefacts which cannot be unequivocally identified as either flakes or cores. Generally, the problem of identification is due to irregular breaks, frost-shattering or fire-crazing. Chunks are larger indeterminate pieces, and in the case of quartz, for example, the problem of identification usually originates from a piece flaking along natural planes of weakness rather than flaking in the usual conchoidal way.
Blades and microblades: Flakes where L≥2W. In the case of blades W>8mm, in the case of microblades W≤8 mm.
Cores: Artefacts with only dorsal (negative/concave) surfaces – if three or more flakes have been detached, the piece is a core; if fewer than three flakes have been detached, the piece is a split or flaked pebble.
Tools: Artefacts with secondary retouch (modification).

3.1 Raw materials

The lithic assemblage from Scord of Brouster consists almost entirely of quartz (9153 pieces of worked quartz), supplemented by eight pieces of flint, one piece of felsite, one piece of metamorphic rock and eight pieces of 'other' raw materials. Bagged with the worked lithics were 44 small pieces of raw steatite or chlorite and 472 gravel- and pebble-sized pieces of unworked quartz (some rounded, others – such as the pieces from House 3 – as more irregular, crumbly quartz/sandstone mixtures).

The struck quartz represents a number of varieties, such as white homogeneous milky quartz, a slightly bluish variety of milky quartz with a 'waxy' lustre, and fine-grained (saccharoidal) white quartz. Other varieties of quartz probably owe their different appearances (for example, colour and lustre) to anthropogenic factors, for example, exposure to fire. The author is presently carrying out experiments aimed at shedding light on the appearance of burnt quartz (Ballin, in prep d), with the burning of typically vitreous quartz resulting mainly in:

- a change of lustre from relatively clear and vitreous to dull and opaque
- 'pot-lidding' or pitting of the surface
- 'granulation' and, eventually, disintegration.

However, more research is required to expand our understanding of burnt quartz.

At Scord of Brouster, the above characteristics of burnt quartz are frequently associated with a yellow–brown colour, a phenomenon common to burnt quartz from later prehistoric (late Neolithic to Bronze Age) assemblages from the Western Isles, but not experienced in connection with the author's analyses of mainly Mesolithic assemblages from western mainland Scotland and Jura. Presently, the author's working hypothesis is that this discolouration may be associated with the burning of peat, and experiments to test this theory are in progress. The number of burnt quartz pieces cannot be quantified accurately at present, but for the Scord of Brouster assemblage burnt quartz is estimated at *c* 41% of the total.

This is a fairly high proportion, but in Scotland large quantities of burnt quartz characterize many late prehistoric assemblages, such as those from Rosinish, on Benbecula, and Calanais and Dalmore, on Lewis (Ballin, forthcoming b; Ballin, in prep a; Ballin, in prep c). In these three cases, burnt quartz makes up between one-third and half of the assemblage. The cause of these high burnt quartz ratios is presently unknown.

The physical attributes of the quartz from Scord of Brouster suggest the exploitation of a number of different raw material sources. The presence of smooth abraded surfaces is evidence of the collection of pebble quartz from a beach source, whereas rough surfaces and the frequent adhesion of material from the original rock matrix indicate the quarrying of vein quartz (cf Ballin 2004). Vein quartz commonly forms layers separated by cracks, and along these cracks the adjoining surfaces tend to acquire colours such as red, yellow or brown. A small number of pieces exhibit these surfaces, supporting the suggested use of vein quartz.

The rock adhering to the quartz includes several different types, such as sandstone, feldspar and steatite or chlorite, demonstrating the exploitation of more than one vein. Samples of the latter were discussed with geologist Dr Alan Hall (Department of Archaeology, University of Glasgow), with the author believing the adhering material to be steatite (due to the on-site presence of fragmented steatite vessels, demonstrating the procurement of this material), but according to Dr Hall it is almost impossible, when dealing with geological hand-samples, to distinguish between steatite and chlorite. The sandstone indicates the use of local veins, as the area around Gruting Voe is completely dominated by Old Red Sandstone (Mykura 1976, 52). The large feldspar crystals points to the use of veins from areas of igneous (granite) or metamorphic rock (gneiss), whereas steatite and chlorite indicate the exploitation of veins from areas of metamorphic rock. The nearest known outcrops of granite or gneiss are at 6–10km distance towards the south (the Sandsting Complex) and east (east of the Walls Boundary Fault) (Mykura 1976, figs 9–10), whereas the steatite/chlorite may derive from the metamorphic zone east of the Walls Boundary Fault (Mykura 1976, plate IV).

Eight flint pieces (four flakes, one core and three tools) are in light-brown, fine-grained flint with few impurities and good flaking properties. Only one piece is corticated (CAT 595), with the cortex being smooth and abraded. The cortex of CAT 595 suggests

the exploitation of a pebble source, with the only known Shetland source being beach deposits on Yell (Whittle 1986, 72).

One small end-scraper (CAT 2293) is in a grey, mottled rock type with one face being polished. The piece was examined by Dr Hall, who defined it as a feldspathic porphyry, or felsite. The main outcrops of felsite are in the northern parts of mainland Shetland, on the peninsula of North Roe (Mykura 1976, 94–5). During the late Neolithic and Early Bronze Age (Fojut 1986, 17–18; Saville 1994, 60–1) this material was used in the manufacture of large unperforated axeheads and polished 'Shetland knives'. With a thickness of more than 1cm, it is most likely that the scraper in question was formed on a piece of an abandoned axehead, and not a fragment of a thin polished knife. Usually, felsite displays a range of very bright blue to bluish–green colours, and the dull appearance of CAT 2293 is probably due to its having been burnt.

A distal fragment of a flake with a polished dorsal facet (CAT 2294) is most probably a part of an abandoned axehead. The piece was also examined by Dr Hall, who classified it as a green meta-sedimentary (metamorphic) rock. The provenance of this rock type is presently unknown, but metamorphic rocks are not present in the immediate vicinity of the site.

Seventeen flakes and indeterminate pieces have been defined as 'other' rock types. Most of these are probably varieties of sandstone from the local Walls Formation (Mykura 1976, 61), the same type of sandstone as the one adhering to many of the worked and unworked pieces of quartz. Though this material is coarse-grained and breaks up easily it was used in the manufacture of tools; two scrapers from Scord of Brouster are in sandstone (presented as part of the assemblage of stone implements; Rees 1986, 84–5), and a number of large scrapers in the present collection are in a layered mixture of quartz and sandstone (CAT 2038, 2065, 2234). When used to process hard materials (wood, bone, antler), quartz scrapers are rendered useless after a few hundred strokes (Broadbent & Knutsson 1975), and one must assume that the 'lifetime' of a scraper with a sandstone edge would be considerably shorter than that of a pure quartz scraper.

3.2 Débitage

Due to the fact that a large proportion of the débitage has been burnt to a degree preventing precise characterization, as well as constraints on time, it was decided to combine the two categories of flakes and indeterminate pieces. A total of 8863 pieces of débitage were recovered: 1617 chips and 7246 flakes and indeterminate pieces; true blades are practically absent. All the chips are in quartz, whereas 7224 flakes and indeterminate pieces are in quartz, with four being in flint and 17 in 'other' raw materials (mainly sandstone). One flake with dorsal polish is in a green metamorphic rock (CAT 2294).

Table 2 The percussion techniques applied to detach the tool blanks

	Numbers	Percentages
Bipolar technique	33	24
Hard percussion	25	18
Indeterminate platform technique	7	5
Uncertain	73	53
TOTAL	138	100

The chip ratio (17.2%) was not very high, indicating either limited primary production on the site (Ballin & Lass Jensen 1995, 227) or lack of consistent sieving (selective sieving?) during retrieval (Illus 2). The high proportion of débitage (*c* 97%) in relation to tools (*c* 2%), combined with the retrieval of many cores (96 pieces) and three hammerstones, suggest the latter.

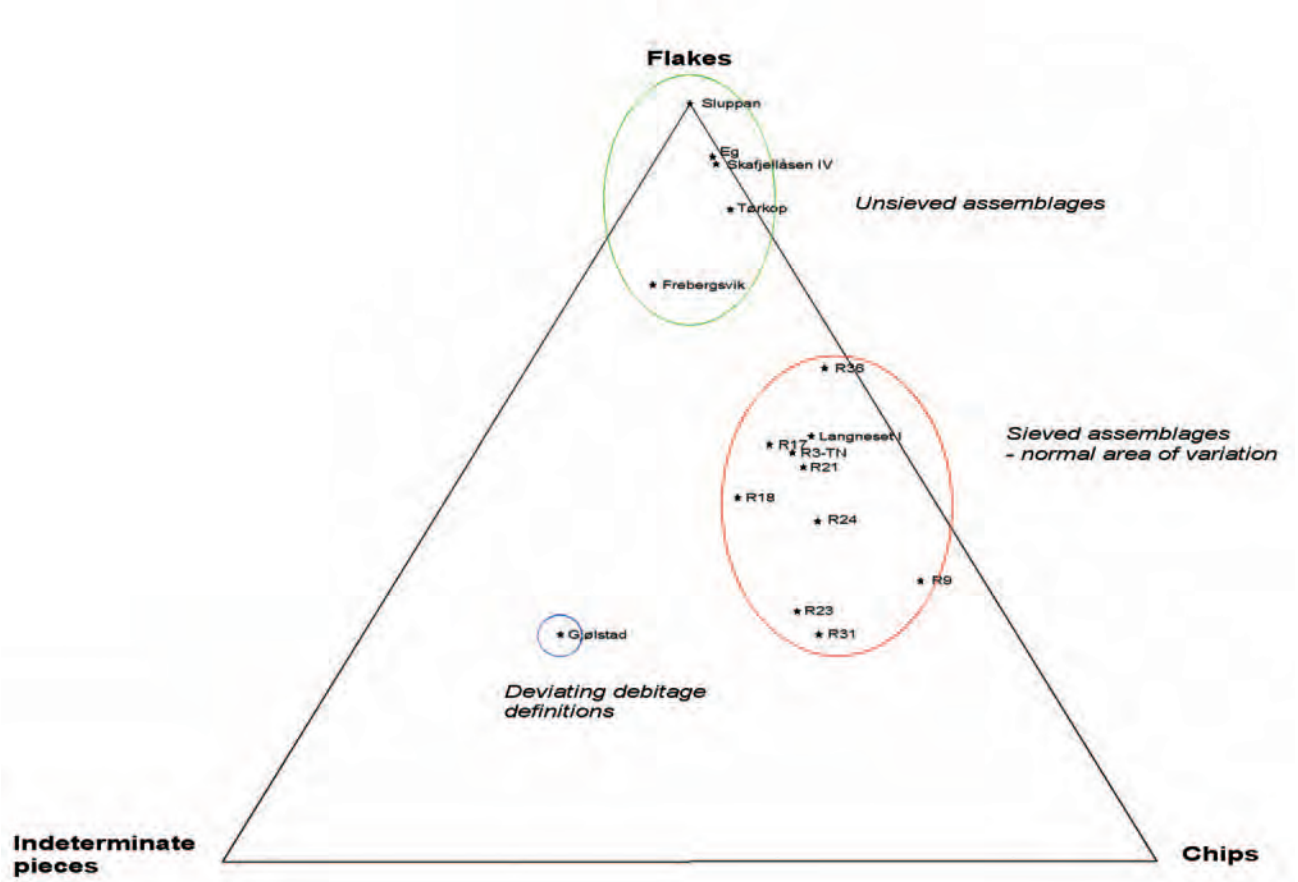
Due to the severely burnt state of a large proportion of the assemblage it was decided not to undertake an attribute analysis of the sizeable collection of débitage. However, the initial general classification process did give the author an impression of the applied percussion techniques, and the débitage was undoubtedly dominated by bipolar material, though flakes detached by the application of hard percussion were also common. A significant proportion of the platform flakes had trimmed platform-edges.

The general characterization of the tools (see below) includes definition of the applied percussion techniques (Table 2) and, though the technological attributes of the tool blanks may not necessarily mirror those of the débitage exactly, the tool blanks support the general impression presented above.

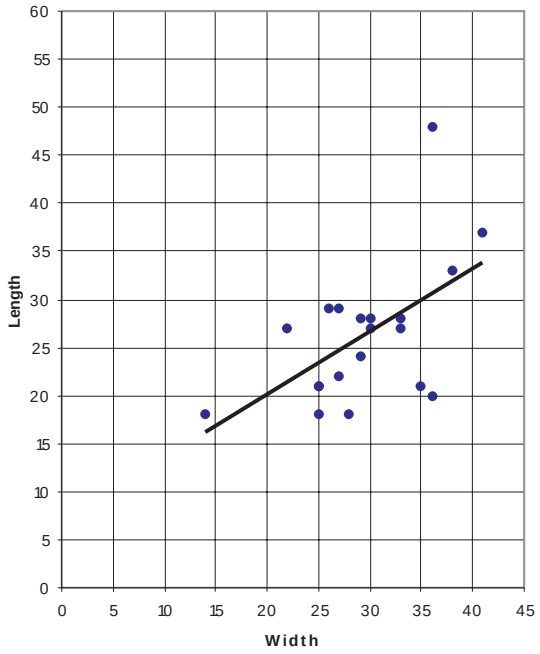
3.3 Cores

In total, 96 cores were retrieved during the excavations: 20 single-platform cores, seven cores with two platforms at an angle, one discoidal core, 11 irregular cores, 51 bipolar cores and six indeterminate core fragments. The percentage distribution of platform cores:bipolar cores is 47:53. Apart from one bipolar core in flint, all cores are in quartz.

The dimensions (L × W × Th) of cores are measured in the following ways: in the case of platform cores, the length is measured from platform to apex, the width is measured perpendicular to the length with the flaking-front orientated towards the analyst and the thickness is measured from flaking-front to the often unworked/cortex-covered 'back-side' of the core. In the case of bipolar cores, the length is measured from terminal to terminal, the width is measured perpendicular to the length with one of the two flaking-fronts orientated towards the analyst



Illus 2 The distribution of débitage on chips, flakes and indeterminate pieces in sieved and unsieved Norwegian assemblages (Ballin 1999b, 103). In unsieved assemblages the chip ratio varies between c 0 and 10%, and in sieved assemblages between c 30 and 55%



Illus 3 The dimensions of all single-platform cores (incl fragmented specimens)

and the thickness is measured from flaking-front to flaking-front.

Twenty single-platform cores are recovered from the site, 13 of which are fragmented. The seven intact cores are all relatively small (average dimensions: 27 × 29 × 34mm; Illus 3), with some of the fragmented cores being considerably smaller (for example, CAT 2085). The shapes of the cores differ considerably, with some being regular and approximately conical or sub-conical (for example, CAT 2059, 2085, 2095) (Illus 4; Illus 5; AW 59.34, 59.38, 60.1, 60.8, 61.35, 61.44), whereas two (CAT 2227, 2290) (Illus 7; Illus 8; AW 60.3, 60.6) were formed as handle-cores or keeled cores, with the main flaking-front being at one narrow end of an elongated platform. However, due to the irregular flaking patterns of quartz, most of the single-platform cores are less than regular, and their platforms tend to be slightly angular (for example, CAT 2072) (Illus 6).

Two cores are knapped around the entire circumference (CAT 2059, 2275), while 10 are knapped around three-quarters to half of the circumference, and two only around one-quarter of the circumference. Six fragmented cores are knapped around the entire surviving part of the circumference. Approxi-

Illus 4 Single-platform core: CAT 2059

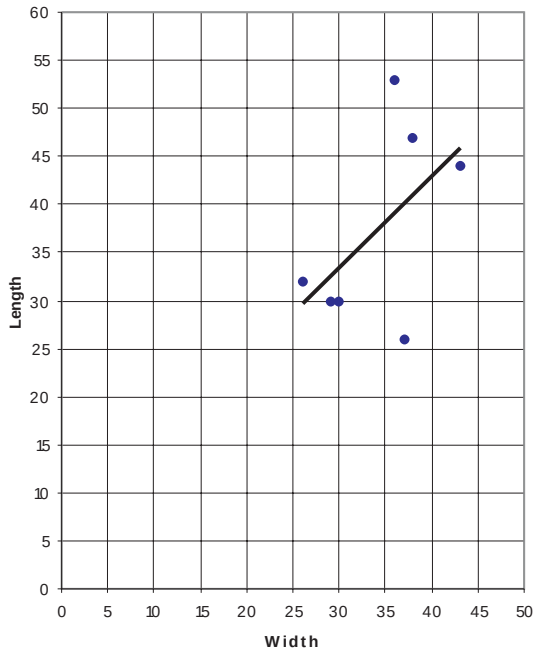
Illus 5 Single-platform core: CAT 2095

Illus 6 Single-platform core: CAT 2072

Illus 7 Handle-core: CAT 2227

Illus 8 Handle-core: CAT 2290

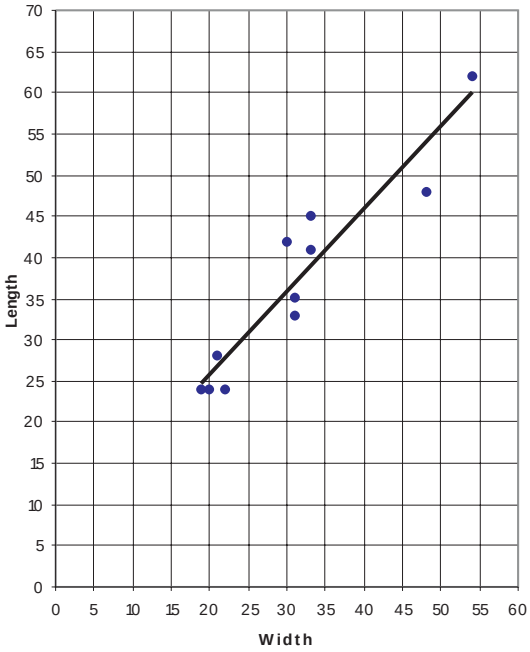
mately half (11 pieces) of the platform-edges are regularly trimmed. Most of the platforms are plain, and only in a few cases (for example, CAT 2085) was faceting of the platform carried out as part of the core preparation. In two cases (CAT 2039, 2059), part of a bilateral crest survives at the apex.



Illus 9 The dimensions of all cores with two platforms at an angle

Illus 10 Core with two platforms at an angle: CAT 2217

Illus 11 Core with two platforms at an angle: CAT 2292



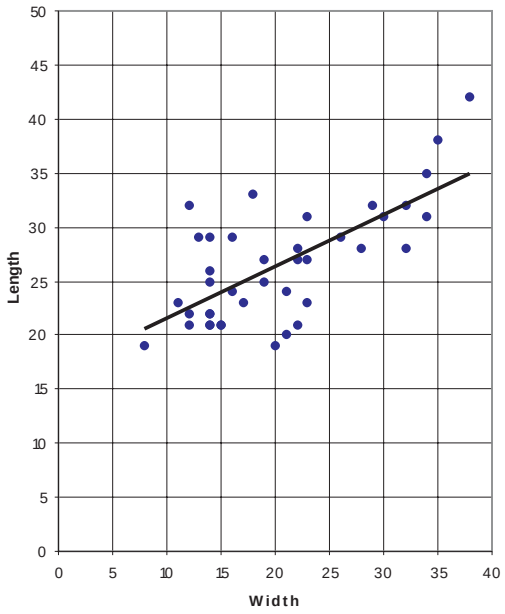
Illus 12 The dimensions of all irregular cores

The seven cores with two platforms at an angle are generally larger than the single-platform cores (av dim: 37 × 34 × 26mm; Illus 9), and less regular (Illus 10; Illus 11; AW 58.20, 60.5, 61.46). Most of the cores (CAT 2055, 2117, 2206, 2226, 2292) have one platform approximately at a right angle to the other platform, and probably represent continued reduction of single-platform cores; these pieces are relatively regular. Two cores (CAT 2056, 2217) have one platform at a distinctly oblique angle to the other platform and are morphologically more akin to irregular cores, though they probably represent continued reduction of single-platform cores. Most of these dual-platform cores are roughly cubic, and their platform-edges are generally untrimmed.

With 11 specimens, irregular cores are fairly common (AW 58.17). They vary considerably in size (av dim: 37 × 31 × 24mm; GD 24–65mm; Illus 12), with four being very small (CAT 2158, 2181, 2218, 2231), five medium-sized (CAT 2069, 2096, 2169, 2241) and two very large (CAT 2070, 2255). They are mostly amorphous, though a small number possess one or more regular platform-edges (for example, CAT 2070, 2096).

One fragmented discoidal core (for definition, see Wickham-Jones 1990, 58) was recovered from Scord of Brouster (38 × 22 × 21mm). One side of this disc-shaped piece has broken off, leaving approximately three-quarters of the original, circular knapping seam. Along the edges of the break a number of little flakes have been detached. The assemblage also includes six core fragments (core fragments are defined as fragments of cores which cannot be identified more precisely; Ballin 1996, 13 – if a fragment of a core can be defined as the fragment of a specific core type, the piece is listed with these cores), mostly smaller than GD 25mm (av dim: 26 × 26 × 18mm). In all cases, a stretch of platform-edge survives, defining them as fragments of platform cores, but they cannot be classified more precisely. Half of the platform-edges are trimmed and half of them are untrimmed.

More than half of the cores (51 specimens) are bipolar cores (Illus 13; Illus 14; AW 58.1, 58.22, 59.32, 60.4, 60.7, 60.18, 60.33, 61.58). They form a relatively homogeneous group of small cores (av dim: 27 × 20 × 12mm) and, unlike other quartz assemblages (for example, Lussa River and Bayanne; Ballin 2002; Ballin, forthcoming c), no large bipolar cores suggest the use of bipolar technique for quartering nodules, or as an exclusive approach for reducing nodules. Most likely the majority of the bipolar cores from Scord of Brouster represent the final reduction of exhausted platform cores, as illustrated by a small number of cores (for example, CAT 2256) with surviving stretches of platform-edge on



Illus 13 The dimensions of all intact bipolar cores

one face. CAT 2073 is a bipolar core on a large milky-quartz crystal – one face display five crystal facets, and the original crystal probably had a diameter of *c* 30mm. Approximately 78% of all bipolar cores have one set of terminals, with the remainder having two sets of terminals. This evidence indicates that approximately one-fifth of the bipolar cores were re-orientated during the reduction process.

3.4 Tools

The 212 tools are heavily dominated by 160 scrapers (75%), compared to 52 other tools. The 'other' tools include two leaf-shaped points, one scale-flaked knife, 12 curved bifacial knives, six piercers, one truncated piece, two notched pieces, two denticulated pieces, seven pieces with invasive retouch, 15 pieces with edge-retouch, one fabricator and three hammerstones. The tool ratio is 2.3%, which is similar to, or slightly higher than, the ratio

Illus 14 Bipolar cores: CAT 2022, 2015, 2014, 2108

Illus 15 Leaf-shaped points: CAT 2296, 2297

of many quartz assemblages (usually 1–1.5%). It is highly likely that some tools have been missed, as retouch, and particularly delicate retouch, may be difficult to recognize on the white, reflective surfaces of quartz. In the present case, some retouched areas may have been shed, along with the general 'peeling-off' of surfaces as a result of the artefacts' exposure to fire (see Section 3.1 – Raw materials, above). Apart from two side-scrapers (CAT 2209, 2269) and one edge-retouched piece (CAT 2267) in flint, all tools are in quartz.

3.4.1 Arrowheads

Two leaf-shaped arrowheads were found during the excavations (Illus 15; AW 60.28–29). One (CAT 2297) is teardrop-shaped, short and squat (28 × 21 × 7mm)

Illus 16 Scale-flaked knife: CAT 2243

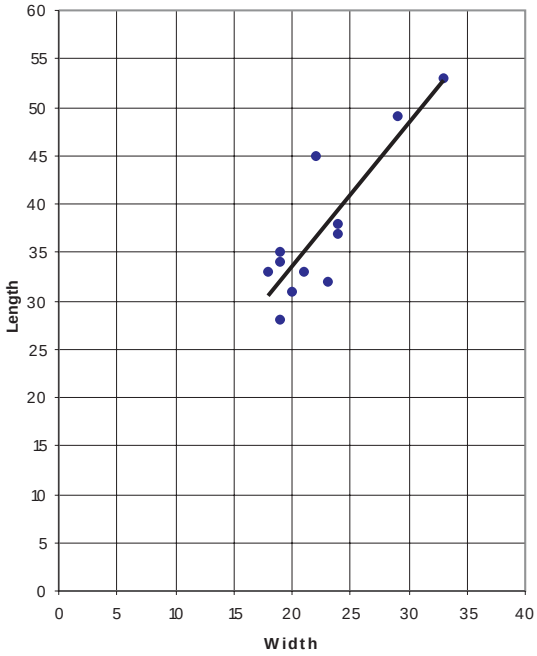
with uneven, crudely denticulated lateral edges; it may be a rough-out. The other (CAT 2296) is elongated and slim (38 × 19 × 9mm) with the broadest point near the base; as the straight lateral sides meet the pointed base at obtuse angles, the point assumes an approximate kite-shape. The two pieces belong to Green's types 3A and 3C, respectively (Green 1980, 69–72).

3.4.2 Scale-flaked knife

CAT 2243 (Illus 16; AW 60.21) has been classified as a scale-flaked knife (definition following Healy 1996, 76). One straight lateral side has been sharpened by acute, slightly denticulated, scale-flaked retouch, whereas the other side is angularly curved with sporadic blunting of the central part. The knife is on a thick hard-hammer flake (29 × 28 × 13mm).

3.4.3 Curved knives

The term 'curved knives' was suggested by Whittle in the original presentation of the finds from Scord of Brouster (Whittle 1986, 66–72) and, considering the general morphology of the pieces (see presentation below), the term must be considered apt. According to Whittle, this tool type has not been found anywhere else in the Northern Isles, and he suggests that the type may have been missed from earlier excavations on Shetland (Whittle 1986, 72). By examining the wider archaeological record, the author has only been able to find two other British curved knives, namely a piece from Camster Long, Caithness (no 28 in Davidson & Henshall 1991, illus 21; no 367 in Wickham-Jones 1997, fig 22), and a piece from Druim Arstail, Oronsay (Wickham-Jones *et al.* 1982, plate 3.197). The flint implement from Camster Long is bifacial and asymmetrical, with one lateral side being distinctly concave (the cutting-edge) and the other distinctly convex. The marked



Illus 17 The dimensions of all curved knives

lack of symmetry rules out the possibility that it may be a variant of the leaf-shaped arrowhead or a rough-out for an arrowhead. Like the present assemblage, the Camster Long material includes kite-shaped arrowheads. The piece from Druim Arstail has the same shape as the Scord of Brouster curved knives of type 3 (see below), and the assemblage includes a number of different leaf-shaped points as well as barbed-and-tanged arrowheads and a possible chisel-shaped point.

Twelve bifacially retouched artefacts have been classified as curved knives on the basis of their general curved shape. With the exception of two larger pieces (CAT 2305, 2306), the knives are of roughly the same size (av dim: 37 × 23 × 9mm; GD 28–53mm; Illus 17). They are mainly characterized by one lateral side being convex and one concave, with varying shapes of base and tip. The pieces either have a flat base, which in most cases represents the blank's platform remnant (CAT 2301, 2304, 2305, 2306), or a bifacially shaped ridge (a 'knapping seam') connecting the two lateral sides (CAT 2298, 2299, 2300,?2302); CAT 2309 seems to be a hybrid form, and CAT 2303 has had the base shaped by edge-retouch of a (pre- or post-modification?) break. Some bases are straight, and some are more or less convex, but CAT 2298 has a rudimentary basal tang. The tips are either pointed (CAT 2298, 2299, 2302, 2303, 2305, 2306, 2309) or rounded (CAT 2300, 2301, 2304). The curvature of either lateral side is more or less pronounced. CAT 2302 has a small patch of steatite/chlorite on one face, and two pieces (CAT 2300, 2307) retain small areas of abraded cortex.

Based on a number of morphological attributes, the curved knives may be sub-divided into four groups (Table 3):

Table 3 The main attributes of the curved knives

CAT no	SF no	House	Phase	L	W	Th	L:W	W:Th	Base	Tip	Cutting edge	Cortex	Burnt
2298	683	2	1	45	22	9	2.1	2.4	Knapping seam (rudimentary tang)	Pointed	Concave		
2299	239	2	2	35	19	7	1.8	2.7	Knapping seam (straight)	Pointed	Concave, slightly		X
2300	240	2	2	32	23	8	1.4	2.9	Knapping seem (convex)	Rounded	Concave	X	
2301	892	1	1	31	20	8	1.6	2.5	Uncertain (damaged)	Rounded	Slightly concave		
2302	1185	1	1	34	19	7	1.8	2.7	Uncertain (damaged)	Pointed	Straight	Steatite/chlorite	X
2303	1023	1	1	33	18	7	1.8	2.6	Edge-retouch (convex, repair?)	Pointed	Straight, serrated		
2304	1078	1	1	33	21	8	1.6	2.6	Flat (natural), edge-retouch	Rounded	Concave		X
2305	784	2	1	53	33	12	1.6	2.8	Flat (platform), edge-retouch	Pointed	Slightly concave		X
2306	606	1		49	29	12	1.7	2.4	Flat (platform), edge-retouch	Pointed	Concave		X
2307	527	2	1	28	19	8	1.5	2.4	Uncertain (damaged)	Unfinished?	Uncertain (damaged)	X	
2308	910	2	2	37	24	12	1.5	2.0	Uncertain (damaged, repair)	Unfinished?	Straight? (unfinished)		
2309	241	2	2	38	24	7	1.6	3.4	Flat (platform), edge-retouch	Pointed	Straight? (damaged)		X

Illus 18 Curved knives, category 2: CAT 2305, 2306

Illus 19 Curved knives, category 3: CAT 2298, 2299, 2302, 2303

Type 1 Two specimens (CAT 2307, 2308) are relatively crude, thick pieces and may be rough-outs (av dim: 33 × 22 × 10mm); neither lateral sides, faces, bases nor tips have been finished off, and the curvature of the concave cutting edge is less pronounced – CAT 2307 may be fragmented (AW 58.12, 58.15).

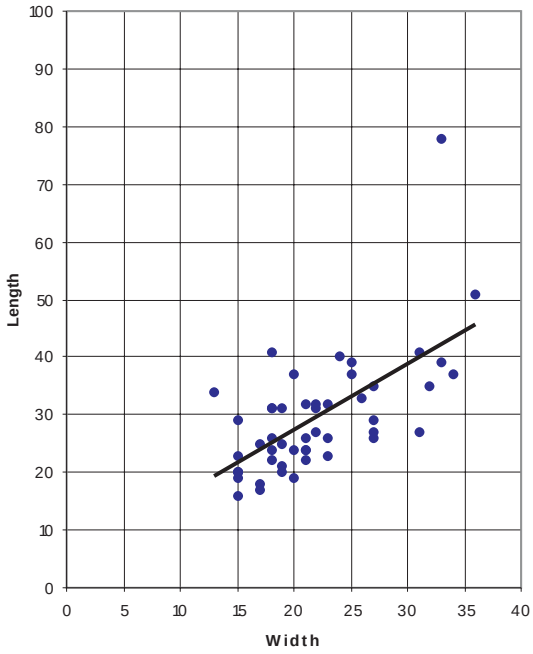
Type 2 Two pieces (CAT 2305, 2306) are larger than average (av dim: 51 × 31 × 12mm), with pointed tips and flat bases (Illus 18; AW 58.11).

Type 3 Five curved knives (CAT 2298, 2299, 2302, 2303, 2309) form the largest sub-group, being of approximately the same small size with pointed tips (av dim: 37 × 20 × 7mm) – most have ridged bases (Illus 19; AW 58.10, 59.26, 59.28, 60.23–4).

Type 4 Three small and slightly shorter pieces (CAT 2300, 2301, 2304) (av dim: 32 × 22 × 8mm) have rounded tips and either flat or ridged bases (Illus 20; AW 59.27, 60.22, 60.25). Curved knives of Type 4, with rounded tips, may be repaired specimens of Type 3 knives, which have had their pointed tips broken off.

Two knives (CAT 2306, 2309) are severely burnt and three (CAT 2302, 2304, 2305) are slightly burnt, obscuring the finer details somewhat, but CAT 2298, 2299, 2300, 2301 and 2303 are fine pieces with delicate bifacial retouch. The central, unmodified part of each face of CAT 2299 appears burnt, whereas the peripheral areas have been shaped by the application of invasive retouch; though some analysts dispute the usefulness of heat-treating quartz (Flennikin 1981, 27; this statement is modified by Knight 1991, 44, who proposes that heat treatment of quartz may not alter the quartz itself, but the heat possibly alters minerals within the quartz, thereby improving the working characteristics of the quartz), this particular piece may nevertheless have been subjected to this specialized

Illus 20 Curved knives, category 4: CAT 2300, 2301, 2304



Illus 21 The dimensions of all intact short end-scrapers

form of reduction. The curved knives were recovered from House 2 (Phases 1 and 2) and House 1 (Phase 1), but no sub-type is exclusive to any structure or phase.

3.4.4 Scrapers

As mentioned above, scrapers dominate the tool group completely (75%). A total of 160 scrapers were subdivided into 116 short end-scrapers, eight double-scrapers, 16 side-scrapers, six side/end-scrapers, four other scrapers and 10 scraper-edge fragments.

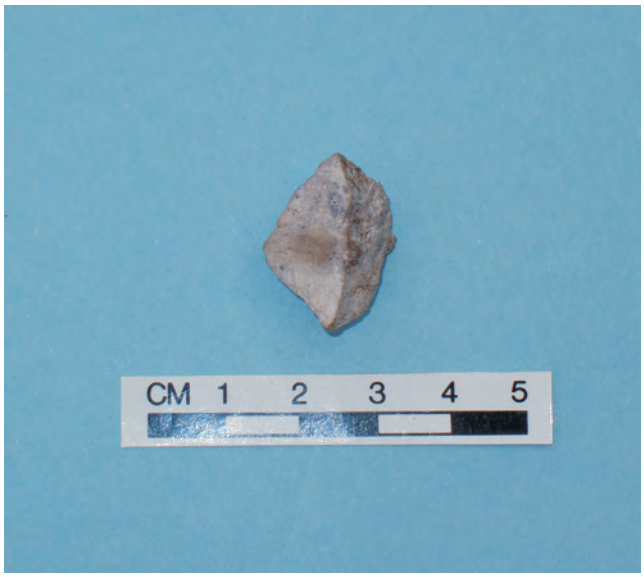
An end-scraper is defined by having a working-edge approximately perpendicular to the longer of the two dimensions, L and W (L being the dimension proximal end to distal end), whereas a side-scraper has its edge on the longer of the two dimensions. If L>W (elongated blank) the working-edge of the end-scraper will be distal (sometimes proximal) and the edge of the side-scraper will be lateral. If W>L (broad blank) the working-edge of the end-scraper will be lateral and the edge of the side-scraper will be either proximal or distal. Or, in short: the edge of an end-scraper is not necessarily at the distal or proximal end, and the edge of a side-scraper is not necessarily at one of the two lateral sides. A short end-scraper is defined metrically by L<2W, whereas long end-scrapers (or blade-scrapers) were defined by L≥2W (Ballin 1996, 54).

The 116 short end-scrapers form a heterogeneous category (av dim: 28 × 22 × 12mm; Illus 21), varying in length between 16mm and 78mm (Illus 22–25; AW 58.6–7, 58.8–9, 58.16, 58.21, 58.23–5, 59.33, 60.8, 60.10–14, 60.16, 60.19, 61.36, 61.38–9, 61.47–8, 61.50, 61.55, 61.57). Thirty-three end-scrapers are fragmented, missing either the end opposite the scraper-edge, one lateral side, or corners or central pieces of the working-edge. The vast majority, 88 pieces, are on flakes, while 27 are on indeterminate pieces and one is on an abandoned irregular core (CAT 2214). Twenty-four of the flake blanks are bipolar flakes, 15 are hard-hammer flakes and seven are indeterminate flakes. Practically all scraper-edges are slightly convex to convex, with one being nosed (CAT 2100) and one straight (CAT 2141). Eleven of the scraper-edges are decidedly uneven or slightly denticulated. Most of the end-scrapers are simple pieces without ancillary modification, but the lateral sides of seven scrapers have been blunted.

Three short end-scrapers are on outer vein material and consist of a rather unstable mixture of quartz and sandstone; one (CAT 2234) is relatively small (GD 21mm), whereas the other two (CAT 2038, 2065) (Illus 23) are the largest end-scrapers of the assemblage (GD 51–78). As mentioned above, two

Illus 22 End-scrapers: CAT 2099, 2120, 2127, 2135, 2210, 2221, 2245, 2273

Illus 23 End-scraper, outer vein material: CAT 2038



Illus 24 End-scraper, polished felsite: CAT 2293

scrapers were in sandstone and form part of the assemblage of stone artefacts (Rees 1986, 84–5). CAT 2293 is a small end-scraper in felsite (Illus 24); it has an expediently made working-edge at one end, its 'ventral' face or 'under-side' is polished and it has been burnt. It is most likely on a piece of an abandoned (damaged?) axehead, as the piece is too thick (23 × 17 × 11mm) to have been part of a polished 'Shetland knife'. Due to its burnt state, the piece has lost its original vibrant colours and now appears mottled grey.

The scraper-edge angles vary considerably, but

Illus 25 End-scraper, burnt: CAT 2044

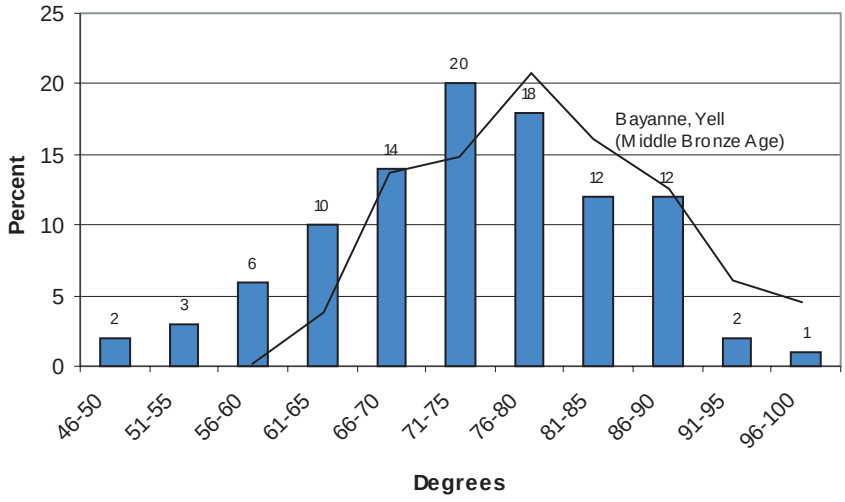
most (76%) are steep (> 65°), with 21% being acute (≤65°) and 3% obtuse (≥90°). Scrapers with acute edge-angles (55–65°) have been associated with processing of hides or skin, whereas steep-edged scrapers (70–80°) have been associated with processing of harder materials, such as wood, antler and bone (Broadbent & Knutsson 1975; Knutsson 1978; Broadbent 1979, 89; Jeppesen 1984; Thorsberg 1986; Juel Jensen 1988, 70; Knutsson 1988, 133). As shown in Illus 26, the edge-angles of the Scord of Brouster end-scrapers correspond approximately to those from the Middle Bronze Age settlement of Bayanne on Yell, Shetland (Ballin, forthcoming c). In Illus 26, the edge-angles from Scord of Brouster form a regular bell-shape with a peak at 71–75° and, most likely, the majority of those scrapers were manufactured to process harder materials. Compared to the scrapers from Bayanne, it is possible that a slightly higher proportion of the Scord of Brouster scrapers were produced for the working of skin and hides (21% acute scraper-edges versus 8%).

3.4.5 Double-scrapers

Eight scrapers have a convex, steep scraper-edge at either end. They vary greatly in size (av dim: 30 × 24 × 13mm; GD 20–50mm), and the artefact group as a whole has an *ad hoc* appearance. One blank is an indeterminate piece (CAT 2119), with the majority of the pieces being on a mixture of bipolar and indeterminate flakes. Most of the double-scrapers have their working-edges at opposite ends, more or less symmetrically located on the long axis, whereas CAT 2102 and 2239 are asymmetrical with one end, and the corner of the other end, having been retouched. Two pieces have additional lateral blunting (CAT 2083, 2102). CAT 2119 and 2168 form a small sub-group commonly experienced in quartz assemblages (for example, Bayanne, Lussa River, Shieldaig; Ballin 2002; Ballin, forthcoming c; Ballin *et al*, forthcoming): one scraper-edge is retouched from one face, and the other edge from the opposite face. Several pieces are missing either lateral sides (for example, CAT 2119), most of one working-edge (for example, CAT 2202; Illus 27; AW 60.17), or corners of one or more working-edges (for example, CAT 2168).

3.4.6 Side-scrapers

The assemblage includes 16 side-scrapers (Illus 28; AW 58.3, 59.31, 59.36, 59.41–2, 60.27, 61.42, 61.45, 61.54, 61.59), which are generally relatively small (av dim: 13 × 19 × 9mm); they vary in length between 15mm and 52mm. Most side-scraper blanks are flakes (nine pieces), but also indeterminate pieces (two pieces) and bipolar cores (five pieces) were used. Two of the flakes are hard-percussion flakes, two are bipolar, and the



Illus 26 Scraper-edge angles of all short end-scrapers. For comparison, the edge angles of the scrapers from Bayanne, Yell (Ballin, forthcoming d), are shown (curve)

Illus 27 Double-scraper: CAT 2202

remainder are indeterminate. Most of the side-scrapers have one straight, slightly convex or convex working-edge, but CAT 2257 has two opposed scraper-edges, one with normal retouch and one with inverse. CAT 2191 has two opposed retouched edges as well, but only one is a typical steep scraper-edge, whereas the other less robust retouch may represent blunting. At one end, the slightly concave lateral scraper-edge of CAT 2116 curves in a manner suggesting that the broken-off end may have formed an additional working-edge.

3.4.7 Side/end-scrapers

The six scrapers of this category (Illus 28; AW 60.9, 61.49, 61.56) are less varied than the side-scrapers (av dim: 31 × 23 × 12mm). Five of the blanks are fairly regular flakes (two hard-percussion flakes, two bipolar flakes and one indeterminate flake), and one blank (CAT 2113) is a more irregular indeterminate piece. Apart from CAT 2113, they generally have a regular convex scraper-edge at one end, supplemented by a straight to slightly convex lateral working-edge. The more expediently made scraper, CAT 2113, has one straight edge at one end and one straight edge at one lateral side.

3.4.8 Other scrapers

Four 'other' scrapers (AW 61.43, 61.52) are defined by not being attributable to one of the formal scraper categories presented above (av dim: 44 × 33 × 23mm). In general, the factor rendering these pieces unclassifiable is blank-shape, with two of these scrapers being on irregular indeterminate pieces (CAT 2250, 2276), and the remaining two on irregular cores (CAT 2228, 2269). CAT 2250 is on a triangular chunk of outer vein material, and it has its convex working-edge on one of its three corners. CAT 2276 is an amorphous chunk with a convex scraper-edge at one end; this scraper-retouch alternates and continues along one lateral side, relating the piece to the category of side/end-scrapers. CAT 2228 is an irregular core with a straight scraper-edge on one lateral side, which is no shorter or longer than any of its other edges, making it impossible to define the scraper as either an end- or side-scraper. CAT 2269 is an irregular core with a convex scraper-edge on one pointed corner.

3.4.9 Scraper-edge fragments

Ten scraper-edge fragments represent such small parts (av dim: 15 × 20 × 8mm) of scrapers that they

Illus 28 Side-scrapers: CAT 2128, 2295; and side/end-scrapers: CAT 2204, 2288

Illus 29 Piercers: CAT 2098, 2260

cannot be defined with more precision. However, most of these broken-off working-edges are fairly narrow and convex, and it is more likely that they are former parts of end-scrapers than side-scrapers.

3.4.10 Piercers

Six piercers were retrieved during the excavations of Scord of Brouster, and they form a rather informal, expediently made artefact category; in the description of piercers and their retouch, the following concepts are applied (Ballin 2000):

Normal retouch Retouch initiated from the ventral face (covering the dorsal face)
Inverse retouch Retouch initiated from the dorsal face (covering the ventral face)
Propellar retouch Retouch which is normal on one lateral edge and inverse on the other.

The blanks are four flakes (one bipolar flake and two indeterminate flakes) and two indeterminate pieces, with tips formed on whatever end or corner the knapper found suitable. The piercers vary greatly in shape and size (av dim: 34 × 29 × 15mm; GD 27–50mm), and the general appearance of these pieces indicates random selection of blanks. As noticed in connection with the author's analysis of other quartz assemblages (for example, Bayanne; Ballin, forthcoming c), the two retouched lateral sides of a number of piercers meet at almost right angles (CAT 2064, 2203, 2260), with three piercers having more acutely pointed tips (CAT 2084, 2098, 2224) (Illus 29). In three cases (CAT 2084, 2203, 2224), the outermost part of the tip has broken off. The tips of all six piercers have been manufactured by the use of normal retouch only, with no piercer tips having been made by the application of inverse or 'propellar' retouch.

3.4.11 Truncated piece

One small hard-hammer flake (CAT 2176) (19 × 12 × 5mm) has a straight oblique truncation at the distal end. The retouch of the piece is slightly uneven and may be blunting. The edge opposite the modified area is sharp. Most likely, CAT 2176 is a small expediently made knife.

3.4.12 Notched pieces

Two notched pieces were recovered during the archaeological investigation of the site. CAT 2173 is a fragment of an indeterminate flake with a retouched notch in one lateral side; the chord of the notch is *c* 10mm. CAT 2054 is a fragmented, possibly burnt, indeterminate piece with three notches distributed along the circumference. One notch may have been formed by retouch or 'rubbing', whereas two are plain single-removal notches; the chords vary between 4mm and 7mm. The function of these pieces is uncertain.

3.4.13 Denticulated pieces

A number of tool types are defined by one or more series of teeth, namely denticulated pieces, saws and serrated pieces. Denticulates are defined as pieces with coarse denticulation formed by the working of either contiguous notches or by the detachment of small flakes; saws are intermediately serrated pieces, the teeth of which are formed by two or more small removals on either side of each tooth; and serrated pieces are defined as mostly straight-sided blanks with one, or occasionally both, lateral edges finely serrated by the removal of a single chip on either side of each tooth (Healy 1996, 76).

Two relatively small denticulated pieces were found at Scord of Brouster (av dim: 28 × 19 × 14mm). Denticulated pieces are frequently recovered from later prehistoric contexts (for example, Humble, forthcoming), and it is uncertain whether they have a specific function, or whether they may represent an amalgamation of several functional groups (various expedient tool forms, and plain core types, such as flaked flakes; Ashton *et al.* 1991). CAT 2090 is a fragment of an indeterminate piece with relatively fine denticulation along one edge (three surviving teeth) and may have been a denticulated scraper. CAT 2258 (Illus 30; AW 58.2) is a fragmented indeterminate piece with cruder denticulation along the entire circumference (six surviving teeth) and is most possibly a small core.

3.4.14 Pieces with invasive retouch

The assemblage includes seven pieces, mainly fragments, with invasive retouch. Two pieces (CAT 2080, 2286) are large (av dim: 62 × 28 × 14mm) and

Illus 30 Denticulate: CAT 2258

Illus 31 Large piece with invasive retouch: CAT 2080

five pieces (CAT 2050, 2092, 2114, 2124, 2178) are small (av dim: 28 × 19 × 8mm) (Illus 31; Illus 32; AW 59.29–30). Two of the small pieces (CAT 2114, 2178) are flakes with limited unifacial invasive retouch along various edges; it is not possible to say whether they are regular, relatively plain tools (for example, small knives with sporadic invasive blunting or sharpening of edges) or fragments of early-stage rough-outs for more elaborate tools (for example, arrowheads or curved knives). The two large objects (CAT 2080, 2286) are both fragments of bifacial pieces and they both split along the long axis. They are thick, obviously unfinished pieces, and the neatly rounded base of CAT 2080 suggests that they may be rough-outs for relatively large leaf-shaped points. Three small fragments have both faces completely covered by fine invasive retouch and are probably fragments of completed leaf-shaped points (CAT 2092) or rough-outs for leaf-shaped points (CAT 2050, 2124). They are most likely arrowhead base fragments.

3.4.15 Pieces with edge-retouch

This artefact category consists of 15 pieces, which form a diverse group, differing considerably in size and shape (27 × 20 × 10mm; GD 18–41mm). Two are based on indeterminate pieces, three on abandoned bipolar cores and the remainder on flakes; one flake blank is bipolar, three are hard-percussion-flakes and six are indeterminate flakes. Twelve of the 15 retouched pieces are fragments of larger tools. The functions of the artefacts are uncertain.

3.4.16 Fabricator

One rod-shaped piece (CAT 2274) has been classified as a fabricator (AW 60.30). The blank is a long indeterminate piece with a triangular cross-section (71 × 20 × 18mm), and one end and one lateral side broken off. The surviving end was shaped to form a point by retouching and merging the three lateral sides of the rod. This point is battered and abraded from repeatedly striking hard objects. One lateral edge adjacent to the broken-off end has been retouched, and it is possible that the piece originally had two working-ends.

3.4.17 Hammerstones

Three hammerstones (AW 61.37) were recovered from Scord of Brouster (av dim: 54 × 50 × 42mm). They are all unevenly rounded, with severely

Illus 32 Small pieces with invasive retouch: CAT 2050, 2092, 2124

battered edges and points. Unlike the 'archetypal' hammerstone, which would usually have one or two specialized working-ends, every protuberant area of CAT 2068, 2213 and 2266 has been crushed. Generally, three or four crushed points can be identified, and every ridge connecting these points has been battered as well.

3.5 Technology

The operational schema of a lithic industry may be subdivided into a sequence of logical stages (Eriksen 2000, 81; Ballin, forthcoming c), such as: acquisition of raw material, core preparation, blank production and secondary modification. Stage 3 may include a number of blade/flake series, separated by rejuvenation of platform, platform-edge and core sides, and the core may develop from blade core, over flake core to bipolar core (Ballin, forthcoming c). As 99.8% of the present assemblage is quartz, the following analysis will focus mainly on the operational schema responsible for the production of quartz blanks and tools.

3.5.1 Acquisition of raw material

As discussed in Section 3.1 – Raw materials (above), quartz was acquired from a number of local and non-local sources. Many of the artefacts have parts of the original rock matrix adhering to them. Most of this material is sandstone, suggesting that much of the quartz assemblage was quarried from veins in the local Sandness Formation. Chunks from the outer parts of these veins (pieces in sandstone/quartz mixtures or pure sandstone 'decortication' rubbish) were found in all three houses, but the sub-assemblage from House 3 consists almost entirely of this sort of débitage, suggesting that 'decortication' of quarried quartz may have dominated the lithic activities of this structure. As removal of excess weight from quarried quartz plates or nodules mostly took place at or near the quarry or vein (Powell 1965), this also suggests that the vein in question was in close vicinity to the settlement.

A small proportion of quartz has feldspar or steatite/chlorite adhering to it, testifying to the exploitation of additional veins. The feldspar indicates the use of a quartz vein in granite or gneiss bedrock, with the closest sources being at 6–10km distance, either to the south (the Sandsting Complex) or to the east (east of the Walls Boundary Fault) (Mykura 1976, figs 9–10). Steatite and chlorite both derive from the metamorphic areas of Shetland. The nearest reported source of steatite is at a distance of *c* 20km, on Burra Isle (Whittle 1986, 74), but other authors (Mykura 1976, plate IV; Woodland 1979) indicate a small serpentinite source immediately east of the Walls Boundary Fault, which may include some steatite as well as chlorite (approximately 10km distance).

Due to the burnt state of much of the quartz, it is difficult to assess the outer surfaces of the artefacts, and an actual attribute analysis was not carried out. It is, however, the author's impression that pebble quartz was collected as well, as demonstrated by many pieces with abraded cortex, and pebble sources possibly supplied the same amount of raw quartz as the various quartz veins. Most likely, quartz pebbles were collected along the shores of the nearby Gruting Voe.

3.5.2 Core preparation

The platform core:bipolar core ratio (47:53) of the assemblage defines an industry based on platform technique, with bipolar technique applied to exhaust abandoned platform cores completely. In comparison, the mainly bipolar industry of Lussa River (Ballin 2002) has a ratio of 15:85. The technological attributes of the various core types (see Section 3.3 – Cores, for description of characterization) suggest the sequential transformation of one core type into another, with single-platform cores representing the first stage of the reduction sequence. Most likely, single-platform cores would be transformed into cores with two platforms at an angle when their shapes made this transformation necessary, and these dual-platform cores might then later be transformed into irregular cores by the formation of a third platform. When a platform core had become too small to handle, it would in most cases be exhausted completely by the application of bipolar technique.

As touched upon above, the first step of core preparation at Scord of Brouster was the removal of adhering rock, or cortex, and poor-grade outer quartz. The masses of quartz-with-sandstone suggest that this process to a large extent took place in or around the three houses, completely dominating the lithic activities of House 3. As part of this 'decortication' process, rough-outs for single-platform cores were manufactured. The rough-outs were characterized by the existence of a mainly plain platform and, usually, two bilateral crests or guide ridges. No preparation flakes were recovered in connection with the excavation of the site, but two single-platform cores (CAT 2039, 2059) retain parts of crests at their apexes. As a large number of flakes, as well as approximately half of the single-platform cores, have trimmed platform-edges, it is most likely that modification of the platform-edges was standard procedure before commencement of actual blank production.

3.5.3 Blank production

The industry of Scord of Brouster focused entirely on the production of slightly elongated flakes, with proper parallel-sided blades being absent. The first flake series of a single-platform core would be commenced by the detachment of one of its crests, but in many cases this action was unsuccessful. The

fact that the two conical or sub-conical cores (CAT 2039, 2059) have retained parts of crests at their apexes is evidence that insufficient force was applied, and that the resulting (crested) flakes were too short. The two handle-cores, or keeled cores (CAT 2227, 2290), were both abandoned as the attempt to detach the terminal crest (an extension of the keel) resulted in the development of large hinge-fractures.

With quartz flaking as unpredictably as it does (partly demonstrated by the problems experienced in the attempts at detaching the crests), it is to be expected that adjustment, or rejuvenation, of the cores would become urgent at a relatively early stage. The lack of complete or partial core tablets, as well as the fact that the vast majority of all cores have plain unfaceted platforms, suggest that core rejuvenation by the detachment of platforms was not part of the operational schema. Most likely, adjustment of obtuse platform-edge angles and irregular core-sides was carried out by detaching entire core-sides ('flaking fronts'), as documented in the operational schema of the Southern Scandinavian Brommian Culture (Andersen 1972, 25–7). In the Brommian Culture, core tablets are exceedingly rare, whereas large thick core-side flakes are common.

When a core could no longer be adjusted within the framework of a specific core-type, the core would be re-shaped to allow continued reduction. In the case of single-platform cores, this would generally happen by the addition of a second platform-edge almost at a right angle to the first. At this stage the core would acquire an almost cubic shape. Later, cores with two platforms at an angle might be transformed into irregular amorphous cores with three or more platforms. The final stage would be the total exhaustion of small platform cores by the application of bipolar technique.

The operational schema presented above is entirely opportunistic, and if the quartz knappers of Scord of Brouster found it appropriate to skip one or more stages, they would do so. If, for example, the original quartz nodule was small, a bipolar approach may have become appropriate at an earlier time. Thus, a single-platform core may have been transformed into a bipolar core without the intermediate steps of dual-platform cores and irregular multi-platform cores. Likewise, cores could have been abandoned at every step if, for example, damage prevented adjustment and further production.

3.5.4 Secondary production

At Scord of Brouster, modification of the blanks was carried out in two ways: either by edge-retouch or by invasive retouch. Most of the tools (for example, scrapers, piercers, truncations, notches and denticulates) were manufactured by exclusively retouching one or more edges. Arrowheads and knives were mainly shaped by invasive retouch, with the site's leaf-shaped arrowheads and curved knives owing their general morphology entirely to the use of invasive, bifacial retouch. One scale-flaked knife (CAT 2243) was formed by a combination of edge-retouch (the blunted 'back') and invasive retouch (the straight cutting-edge).

Curved knife CAT 2299 retains an unmodified, superficially burnt area in the central part of either face, whereas the peripheral zone of the piece – which appears unburnt – has been modified by the bifacial detachment of thin flakes. This suggests that some quartz blanks may have been subjected to heat-treatment. Experiments (Crabtree & Gould 1970, 194; Eriksen 1999) have shown that flakes from heat treated silica nodules tend to become thinner than flakes from raw nodules, and it is possible that at Scord of Brouster blanks were heat-treated mainly as part of the production of bifacial implements (thinning). The fact that many implements (for example, many scrapers) had been burnt after their modification into tools indicates that heat treatment is not the main cause of the high burnt quartz ratio of this assemblage.