Proc Soc Antiq Scot, 114 (1984)

FICHE 2: CONTENTS

Proc Soc Antiq Scot, 114 (1984), fiche 2:A4-G5

EXCAVATIONS AT PIEROWALL QUARRY, WESTRAY, ORKNEY (continued)

N M SHARPLES

PIEROWALL, WESTRAY N M SHARPLES

CONTENTS

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
384		Honey	x	x 1						x							06:03:01	x			x	11
385		Cream	x							x			x				05:03:01	x	x		x	11
386		Cream	x	x 1		prox				x			x				05:03:01	x			x	11
387		Cream	x					x		x		x	x				05:03:01	x	x		x	11
388		Cream	x					x		x		x		x			03:05:01	x			x	11
389		P grey	x	x 1		prox				x							05:04:01	x			x	11
390		White	x							x							03:03:01	x			x	11
391		Orange	x			middle											04:04:01	x			x	11
392		Red		x	x	prox				x							03:05:01	x			x	11
393		P grey	x							x							07:03:01	x	x		x	11
394		P grey	x	x 1						x		x	x				06:03:01	x	x		x	11
395		White	x							x							06:04:02	x	x		x	11
396		Orange	x	x				x		x			x				07:04:01	x	x		x	11
397		Honey	x			middle											05:04:01	x	x		x	11
398		Pink	x	x 1		dist											05:04:01	x			x	11
399		Pink	x			prox		x		x		x	x				05:05:01	x			x	11
400		Cream	x	x 1				x			x						06:03:01	x			x	11
401		P grey	x			prox				x			x				05:05:01	x			x	11
402		Cream	x			prox				x			x				04:05:01	x			x	11
403	54	Cream	x			prox		x		x		x	x				06:05:01	x	x			11
404	61	Orange	x p	x						x			x				08:03:01	x	x			11
405	44	P grey	x								x		x				08:05:01	x	x			11
406	41	Cream	x							x			x				07:05:01	x	x			10
407	41	Cream	x							x							05:06:01	x	x			10
408	41	White	x							x							05:04:01	x	x			10
409	51	Cream	x					x		x		x					07:05:01	x	x			11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
410	51	P grey	x p	x						x			x				05:05:01	x	x			11
411	59	P grey	x			dist											03:06:01	x				11
412	48	Cream	x							x			x				06:04:01	x	x			11
413	53	Cream	x	x	1			x		x		x	x				05:03:01	x	x			11
414	53	Cream	x	x	1	prox				x		x	x				04:03:01	x	x			11
415	66	White	x	x	1					x							05:03:01	x				11
416	66	P grey	x														03:04:02	x				11
417		P grey	x							x							11:06:02	x			x	11
418		Orange	x							x			x				10:06:01	x	x	x		11
419		P grey	x					x		x							10:07:02	x	x	x		11
420		Cream	x					x		x			x				08:07:02	x	x	x		11
421		Orange	x p	x	1			x		x		x	x				10:06:01	x	x	x		11
422		Cream	x							x			x				08:07:01	x	x	x		11
423		P grey	x							x			x				09:07:02	x	x	x		11
424		White	x							x							10:05:01	x	x	x		11
425		Orange	x	x	1			x			x		x				08:08:01	x		x		11
426		White	x			prox		x		x							07:07:02	x		x		11
427		White	x			prox		x		x			x				08:07:02	x	x	x		11
428		Orange	x	x				x		x		x	x				10:05:01	x	x	x		11
429		Cream	x							x							09:05:01	x	x	x		11
430		Pink	x	x	1			x		x			x				10:05:01	x	x	x		11
431		P grey	x					x		x			x				11:05:01	x	x	x		11
432		Pink	x			segment											09:09:01	x		x		11
433		P°grey	x			prox		x		x		x	x				09:06:02	x	x	x		11
434		Cream	x						x				x				10:06:01	x	x	x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Prt O	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
435		Pink	x			prox				x			x				07:08:01	x	x	x		11
436		White	x					x		x		x					10:06:01	x	x	x		11
437		Orange	x								x		x				08:06:03	x		x		11
438		P grey	x p			distal											11:07:01	x	x	x		11
439		White	x p					x		x		x	x				11:05:01	x	x	x		11
440		P grey	x	x l				x		x		x	x				06:09:01	x	x	x		11
441		Orange	x	x l						x			x				09:04:01	x	x	x		11
442		P grey	x							x							09:04:01	x	x	x		11
443		Pink	x					x		x			x				10:04:01	x	x	x		11
444		Pink	x	x l		prox				x			x				06:08:01	x	x	x		11
445		Honey	x	x l		prox				x			x				07:07:02	x	x	x		11
446		Orange	x							x		x	x				11:04:01	x	x	x		11
447		Honey	x			prox				x							06:08:02	x		x		11
448		P grey	x			prox				x			x				09:04:01	x	x	x		11
449		White	x			prox		x		x		x	x				08:06:01	x	x	x		11
450		Orange	x	x l		prox				x							09:05:01	x		x		11
451		Pink	x	x l		dist											07:05:01	x		x		11
452		White	x					x		x		x	x				08:05:01	x	x	x		11
453		Pink	x	x l		prox		x		x			x				06:07:02	x		x		11
454		P grey	x							x			x				05:09:01	x		x		11
455		Pink	x			prox		x		x		x	x				06:06:01	x	x	x		11
456		White	x								x		x				06:08:01	x	x	x		11
457		P grey	x	x l				x		x		x	x				07:04:02	x	x	x		11
458		Orange	x			prox		x		x			x				08:04:01	x	x	x		11
459		Cream	x					x		x		x	x				07:05:01	x	x	x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
460		P grey	x			dist				x							07:06:02	x		x		11
461		Pink	x	x	1			x		x			x				07:04:01	x	x	x		11
462		Honey	x	x	1					x			x				08:04:01	x	x	x		11
463		P grey	x	x	1					x							06:07:01	x		x		11
464		P grey	x	x	1			x		x			x				06:07:01	x		x		11
465		P grey	x					x		x		x					07:05:01	x	x	x		11
466		White	x							x							07:04:01	x		x		11
467		Grey	x	p	x	segment											08:04:01	x		x		11
468		Cream	x							x			x				07:05:01	x	x	x		11
469		White	x							x							04:07:01	x		x		11
470		P grey	x					x		x							07:06:01	x		x		11
471		White	x			prox		x		x		x	x				06:06:01	x	x	x		11
472		P grey	x			prox		x		x		x	x				05:06:01	x	x	x		11
473		Pink	x			prox		x		x		x	x				07:08:02	x	x	x		11
474		Red		x		prox		x		x			x				05:05:01	x	x	x		11
475		Cream	x			prox		x		x		x	x				06:04:01	x	x	x		11
476		Pink	x	p	x	1				x		x					07:04:01	x	x	x		11
477		Cream	x							x							07:04:01	x	x	x		11
478		P grey	x			prox				x							06:06:01	x		x		11
479		P grey	x	x	1			x		x		x	x				06:05:01	x	x	x		11
480		Cream	x	x	1					x			x				05:06:02	x	x	x		11
481		Orange	x							x			x				08:04:01	x	x	x		11
482		White	x	x	1	segment											06:05:01	x	x	x		11
483		Grey	x		x	segment											04:07:01	x		x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
484		P grey	x							x			x				06:04:01	x	x	x		11
485		Honey	x	x 1				x		x		x					06:05:02	x	x	x		11
486		P grey	x			segment											06:05:01	x	x	x		11
487		Orange	x	x 1				x		x		x					04:07:01	x	x	x		11
488		White	x							x							06:05:01	x	x	x		11
489		White	x							x		x	x				07:04:01	x	x	x		11
490		P grey	x	x 1				x		x			x				05:06:01	x	x	x		11
491		Cream	x					x		x			x				05:05:01	x	x	x		11
492		Pink	x							x			x				07:04:01	x	x	x		11
493		P grey	x			prox		x		x		x	x				06:05:01	x	x	x		11
494		P grey	x					x		x							06:06:01	x	x	x		11
495		White	x							x							06:04:01	x	x	x		11
496		Cream	x	x 1		prox				x			x				07:04:01	x	x	x		11
497		White	x					x		x			x				05:06:01	x	x	x		11
498		P grey	x	x 1		prox				x							08:01:01	x	x	x		11
499		Cream	x			prox				x							06:04:01	x	x	x		11
500		Orange	x			prox				x							04:07:01	x		x		11
501		Orange	x					x		x		x	x				06:04:01	x	x	x		11
502		Honey	x							x			x				08:03:01	x	x	x		11
503		Orange	x	x 1						x			x				06:04:01	x	x	x		11
504		White	x							x							06:05:01	x	x	x		11
505		P grey	x							x			x				05:05:01	x	x	x		11
506		White	x							x							05:06:01	x	x	x		11
507		Honey	x	x 1		prox				x							05:06:01	x		x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
508		White	x							x							08:03:01	x		x		11
509		P grey	x	x 1	x												07:04:01	x		x		11
510		Grey	x	x 1	x								x				05:06:01	x		x		11
511		Orange	x	x 1						x							06:05:01	x		x		11
512		Cream	x														06:04:01	x	x	x		11
513		Pink	x			prox				x			x				07:04:01	x	x	x		11
514		White	x			prox				x			x				06:04:01	x	x	x		11
515		Red	x					x		x		x	x				04:05:01	x	x	x		11
516		White	x			prox				x							05:04:01	x	x	x		11
517		Orange	x	x 1				x		x			x				04:05:01	x	x	x		11
518		White	x			distal											05:05:01	x	x	x		11
519		Cream	x							x			x				06:05:01	x	x	x		11
520		Orange	x							x							05:05:01	x	x	x		11
521		P grey	x p	x 1						x			x				06:04:01	x	x	x		11
522		P grey	x	x 1						x							04:06:01	x		x		11
523		P grey	x p	x 1		prox				x							05:05:01	x	x	x		11
524		Orange	x	x 1		prox		x		x		x	x				04:05:01	x	x	x		11
525		Honey	x							x		x	x				06:04:01	x	x	x		11
526		Cream	x					x		x		x	x				05:04:01	x	x	x		11
527		Orange	x							x							06:05:01	x	x	x		11
528		P grey	x			prox				x			x				06:03:01	x	x	x		11
529		Cream	x	x 1		prox				x			x				05:03:01	x	x	x		11
530		Cream	x	x 1						x							04:05:01	x		x		11
531		P grey	x	x 1		distal											05:05:01	x	x	x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
532		Orange	x	x 1		prox				x		x	x				05:04:01	x	x	x		11
533		P grey	x	x 1						x			x				05:04:01	x	x	x		11
534		P grey	x							x			x				05:04:01	x	x	x		11
535		Cream	x			distal								x			07:02:01	x		x		11
536		Pink	x							x			x				06:04:01	x	x	x		11
537		Orange	x p	x 1		prox		x		x		x	x				06:04:01	x	x	x		11
538		Cream	x					x		x		x	x				05:05:01	x	x	x		11
539		Orange	x	x 1		prox				x			x				05:04:01	x	x	x		11
540		Pink	x					x		x		x	x				04:06:01	x		x		11
541		Orange	x	x 1		prox				x			x				05:04:01	x	x	x		11
542		P grey	x							x			x				05:04:01	x	x	x		11
543		P grey	x			distal											05:04:01	x	x	x		11
544		Orange	x	x				x		x			x				04:06:01	x		x		11
545		Cream	x			prox				x			x				05:04:01	x	x	x		11
546		Cream	x					x		x			x				06:04:01	x	x	x		11
547		White	x		x												04:04:01	x	x	x		11
548		White	x							x							04:06:01	x		x		11
549		Orange	x p	x						x			x				05:03:01	x	x	x		11
550		Cream	x							x							07:03:01	x		x		11
551		White	x			prox		x		x							05:05:01	x	x	x		11
552		P grey	x	x 1				x		x			x				04:04:01	x	x	x		11
553		P grey	x							x			x				04:04:01	x	x	x		11
554		Red	x														04:05:01	x		x		11
555		Pink	x	x 1		distal											05:04:01	x	x	x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
556		Cream	x							x							05:06:01	x	x	x		11
557		Orange	x			prox		x		x		x	x				02:04:01	x		x		11
558		Orange	x	x 1						x			x				05:05:01	x	x	x		11
559		Pink	x	x		prox		x		x			x				04:04:01	x		x		11
560		Cream	x							x			x				06:03:01	x		x		11
561		Orange	x	x						x		x					06:03:01	x	x	x		11
562		Orange	x	x							x		x				04:05:01	x		x		11
563		White	x			prox				x							05:03:01	x	x	x		11
564		P grey	x			middle											06:03:01	x	x	x		11
565		Pink	x			middle											06:03:01	x	x	x		11
566		Cream	x			middle											04:03:01	x		x		11
567		Cream	x						x								04:03:01	x	x	x		11
568		White	x						x				x				05:04:01	x	x	x		11
569		Cream	x						x				x				03:04:01	x	x	x		11
570		Cream	x			distal											03:05:01	x	x	x		11
571		Cream	x	x 1					x								04:04:01	x	x	x		11
572		Pink	x						x				x				05:03:01	x	x	x		11
573		P grey	x	x 1				x	x				x				04:03:01	x		x		11
574		Cream	x			middle											05:05:01	x		x		11
575		Pink	x			middle											05:02:01	x		x		11
576		P grey	x					x	x			x					04:03:01	x	x	x		11
577		Cream	x			middle											04:03:01	x		x		11
578		P grey	x			middle											03:04:01	x		x		11
579		Pink	x	x 1		middle											05:03:01	x		x		11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
580		Pink	x	x	1	middle											04:03:01	x			x	11
581		Cream	x			prox				x			x				04:03:01	x	x		x	11
582		White	x			middle											03:04:01	x			x	11
583		P grey	x			prox				x			x				04:03:01	x	x		x	11
584		Pink	x							x			x				04:03:01	x			x	11
585		Pink	x							x							03:04:01	x			x	11
586		Pink	x			distal											04:03:01	x	x		x	11
587		Cream	x			prox				x			x				03:04:01	x	x		x	11
588		Cream	x			middle											03:03:01	x	x		x	11
589		Cream	x			middle											03:03:01	x			x	11
590		Pink	x	x	1			x		x			x	x			08:07:01	x	x		x	11
591		White	x					x			x		x	x			09:07:01	x	x		x	11
592		P grey	x					x		x			x	x			09:06:02	x	x		x	11
593		P grey	x	x	1	segment											08:08:01	x			x	11
594		P grey	x					x		x			x	x			09:07:01	x	x		x	11
595		Pink	x					x		x			x	x			09:06:01	x	x		x	11
596		Cream	x			prox		x		x			x				06:09:02	x	x		x	11
597		Pink	x							x			x				09:06:02	x	x		x	11
598		Red		x	1	x											09:05:01	x	x		x	11
599		P grey	x	x	1			x		x			x	x			09:05:01	x	x		x	11
600		Cream	x	x	1			x		x			x	x			10:04:01	x	x		x	11
601		P grey	x	x	1	prox		x		x			x				10:06:01	x	x		x	11
602		Pink	x	x	1			x		x			x				10:07:01	x	x		x	11
603		Cream	x					x		x dble			x dble	x			10:05:01	x	x		x	11

Cat No	Site No	Colour	Cort	Pat	Burnt	Broken	Nat P	Art P	Fac	Dif B	Pro B	P Lip	P Trim	Hinge E	Macro E	D	Size	Deb	Ret	W	S	Layer
Inner Flakes (cont)																						
604		Cream	x							x		x	x				08:06:01	x	x	x		11
605		Pink	x			middle											07:07:02	x		x		11
606		P grey	x	x 1						x			x				07:07:01	x	x	x		11
607		Pink	x							x			x				03:04:01	x		x		11
608		Cream	x			middle											04:03:01	x		x		11
609		White	x			prox				x							03:03:01	x		x		11
610		Orange	x			prox				x			x				02:04:01	x		x		11
611		P grey	x	x 1		middle											02:02:01	x		x		11

Cat no	Site no		
		Retouched Pieces	
		a) Scrapers	**Layer**
612	32	Cortical flake; cream; broken; right half surviving; artificial platform; diffuse bulb; long sinuous sides diverge from narrow proximal to broad convex distal; shallow edge retouch around distal; macroscopic edge damage undercuts the retouch scars; 32:18:05; l 60°; r 29°; p 95°; d 76°; End Scraper.	10
613	64	Primary flake; pale grey; corticated; patinated; diffuse bulb; straight cortical sides diverge from blunt proximal to convex distal; some shattering on dorsal surface at proximal end; long steep retouch around distal end; macroscopic edge damage undercuts the retouch scars; 28:27:12; l 46°; r 45°; p 52°; d 76°; End Scraper.	11
614	104	Primary flake; yellow/pink; corticated; patinated; broken; distal surviving; roughly rectangular plan; small steep retouch across straight distal end; 18:19:06; l 82°; r 18°; p 110°; d 79°; End Scraper	11
615	13	Primary flake; pale grey/white; corticated; natural platform; diffuse bulb; triangular plan; straight sides diverge from pointed proximal to broad convex distal; small irregular retouch around distal; macroscopic edge damage undercuts retouch scars; 24:23:07; l 53°; d 64°; End Scraper.	9
616	199	Primary flake; pale grey; corticated; convex left side and sinuous right diverge from narrow proximal to convex distal; steep irregular retouch around distal; macroscopic edge damage undercuts the retouch scars and at the proximal end of the left side; 24:19:07; l 27°; r 55°; d 53°; End Scraper.	20

Cat no	Site no		
Retouched Pieces (contd)			
a)	Scrapers		Layer
617	115	Primary flake; pale grey/orange; corticated; lightly patinated; irregular plan; steep irregular retouch around convex distal; flatter irregular retouch at proximal; macroscopic edge damage undercuts the retouch scars at the distal end; 21:17:09; l 74°; r 59°; p 67°; d 78°; End Scraper.	20
618	4	Primary flake; white; corticated; slightly patinated; negative bulb; straight sides diverge from flat proximal to broad convex distal; proximal damaged by small irregular flakes on dorsal; right side cortex; left side affected by damage at proximal; small steep edge retouch around distal; macroscopic edge damage on distal; 18:22:07; l 40°; r 71°; d 74°; End Scraper.	unstrat
619	239	Secondary flake; pale grey; corticated; slightly patinated; natural platform; diffuse bulb; platform lip; straight sides diverge from proximal to convex distal; left side cortex; steep irregular edge retouch around distal; small irregular edge retouch on right edge; macroscopic edge damage on distal; 31:19:10; l 65°; r 65°; d 65°; End Scraper.	unstrat
620	74	Secondary flake; pale grey/brown; corticated; artificial platform; platform edge trimmed; diffuse bulb; straight right and left sides diverging from narrow proximal to oblique slightly convex distal; left side cortex, steep irregular retouch around distal, macroscopic edge damage undercuts the retouch scars; 24:24:08; l 83°; r 97°; p 118°; d 73°; End Scraper.	11

Cat no	Site no		
Retouched Pieces (contd)			
a)	Scrapers		Layer
621	204	Secondary flake; pale grey; slightly corticated; lightly patinated; broken; segment surviving; straight sides diverge from straight snap at proximal end to broad convex distal; left side mainly cortex; steep shallow retouch around distal; small irregular retouch on right edge and non cortical areas of left edge; macroscopic edge damage undercuts the retouch scars around the distal; ventral surface damaged by the removal of flakes from the centre of the right side; 26:21:06; l 66°; r 38°; p 87°; d 60°; End Scraper.	21
622	229	Secondary flake; honey; corticated; lightly patinated; natural platform; sub-rectangular plan with slightly convex distal; shallow irregular retouch around distal; slight macroscopic edge damage undercuts the retouch scars and at the proximal end of the left side; ventral surface damaged by the removal of flakes from the centre of the right side; 21:17:07; l 40°; r 66°; d 55°; End Scraper.	20
623	34	Secondary flake; pale grey; corticated; partially patinated; broken; distal segment surviving; irregular plan; long retouch around convex right half of distal; 22:32:09; l 72°; r 91°; p 94°; d 57°; End Scraper.	10
624	114	Inner flake; pale grey; corticated; lightly patinated; straight sides diverge from blunt proximal to convex distal; long shallow retouch around distal; small steep retouch at proximal end of left edge; long thinning flakes removed across the proximal end of the right side; slight macroscopic/	

Cat no	Site no		
Retouched Pieces (contd)			
a) Scrapers			Layer
624 (contd)	114	macroscopic edge damage undercuts the retouch scars around the distal; ventral surface damaged by the removal of flakes from the centre of the right side; 35:27:06; l 30°; r 31°; d 52°; End Scraper.	20
625		Inner flake; pale grey; slightly corticated; patinated; artificial facetted platform; diffuse bulb; sub-circular plan with straight left side; steep irregular retouch around distal; macroscopic edge damage undercuts the retouch scars and is on the dorsal edge of the broad platform at the proximal end; 15:18:06; l 81°; r 48°; p 102°; d 66°; End Scraper.	unstrat
626	224	Inner flake; white; corticated; broken; left half surviving; irregular plan; small steep retouch at proximal end of left edge and on surviving length of distal edge; 24:17:11; l 85°; d 78°; Broken End Scraper.	25
627	41	Inner flake; grey; partially corticated; heavily patinated; D-shaped plan with straight left edge; flake struck from a larger partially polished piece; left side blunted and straightened by polishing which has given it a curved hinge profile; the polishing is somewhat obscured by the patination; steep retouch around the rest of the margin of the flake gives the right edge a reversed S profile as it is flaked from the ventral surface at the proximal end but from the dorsal surface at the distal end meeting in a length of bifacial work at the centre of the edge; considerable macroscopic edge damage undercuts all retouch scars; 36:25:07; r 58°; p 87°; d 91°; Double-Ended Scraper.	10

Cat no	Site no		
Retouched Pieces (contd)			
a)	Scrapers		Layer
628	76	Cortical flake; cream; broken; segment surviving; triangular plan; curved left side and straight proximal and distal converge at right side; long steep retouch on left side; macroscopic edge damage undercuts the retouch scars; 21:24:09; l 69°; p 68°; d 65°; Side Scraper.	11
629	24	Inner flake;pink; corticated; broken; proximal segment surviving; artificial platform; diffuse bulb; triangular plan; broad straight proximal and right side; convex left side meets the right at a distal point; steep shallow retouch around left side; macroscopic edge damage undercuts the left side; right side and proximal also damaged; 19:26:09; l 76°; r 65°; p 67°; Side Scraper.	9
630	20	Inner flake; cream; corticated; pronounced bulb; triangular plan; straight proximal and straight left and right sides converge at distal; small irregular retouch along left edge; 22:20:05; l 60°; r 100°; Side Scraper.	10
631	42	Secondary flake; cream; corticated; broken; distal segment surviving; straight snaps along left side and proximal; convex distal and right side; small steep retouch around distal and right sides; macroscopic edge damage undercuts the retouch scars; 14:15:06; l 122°; r 83°; p 80°; d 72°; End and Side Scraper.	11
632	49	Secondary flake; cream; corticated; natural platform; rectangular plan with cortical left side; steep shallow retouch around distal and right sides; macroscopic edge damage undercuts the retouch scars; 15:16:08; l 123°; r 65°; p 91°; d 69°; End and Side Scraper.	11

Cat no	Site no		
Retouched Pieces (contd)			
a) Scrapers			Layer
633	38	Inner flake; white; corticated; diffuse bulb; irregular plan; small steep retouch on straight distal and straight distal end of right side; 15:18:05; r 80°; p 37°; d 64°; End and Side Scraper.	9
634	75	Secondary flake; white; corticated; broken; distal segment surviving; irregular chunky plan and profile; steep irregular retouch all round with the exception of part of the left side where cortex remains; macroscopic damage undercuts the retouch scars; 28:26:12; l 95°; r 86°; p 75°; d 72°; Horseshoe Scraper.	11
635	29	Inner flake; cream; corticated; artificial platform; diffuse bulb; irregular plan; triangular cross section with flat left side upon which the flake will stand; long shallow retouch extending down right side from central crest; deep macroscopic edge damage undercuts this retouch; 28:15:08; l 76°; r 56°; central crest 80°; Broken Scraper Face (possibly representing deliberate resharpening).	10
b) Edge retouched flakes			
636	21	Primary flake; honey; corticated; partially patinated; broken; proximal surviving; natural platform; diffuse bulb; shallow irregular retouch on sinuous left edge; 25:18:07; l 55°; r 49°; Broken Edge Retouched Flake; (flake knife).	10
637	217	Inner flake; pale grey; slightly corticated; lightly patinated; artificial facetted platform; platform edge trimmed; diffuse bulb with/	

Cat no	Site no		Layer
Retouched Pieces (contd)			
b)		Edge retouched flakes	
637 (contd)	217	with platform lip; long straight sides diverge from narrow straight proximal to broad convex distal; deep irregular retouch around the left, distal and right edges, macroscopic edge damage undercuts the retouch scars along both left and right sides; 56:26:05; l 68°; r 75°; p 108°; d 51°; Edge Retouched Flake, (flake knife).	22
638	108	Inner flake; white; corticated; broken; distal tip and part of left side removed; artificial platform; negative diffuse bulb; irregular plan due to break; slightly convex right side and narrow proximal; deep irregular retouch around the right edge and remnant of left edge; macroscopic edge damage undercuts the retouch scars and there is also some damage of the ventral surface along the right and left sides; 40:22:08; l 63°; r 56°; Edge Retouched Flake, (flake knife).	22
639	88	Inner flake; corticated; lightly patinated; broken; proximal surviving; artificial platform; diffuse bulb; platform edge trimmed; slightly sinuous sides lead from narrow straight proximal to broad straight snap below distal; irregular retouch on right edge; large deep retouch on left side; macroscopic edge damage on both sides; 24:22:08; l 64°; r 64°; Broken Edge Retouched Flake, (flake knife) possibly unfinished.	22
c)		Other retouch/	

Cat no	Site no		
Retouched Pieces (contd)			
c)	Other retouch		Layer
640	112	Primary chunk; white; corticated; one side steep shallow retouch; ventral surface some damage from the removal of shallow flakes; 21:20:08; retouched edge angle 60°; Miscellaneous Retouch.	20
641	40	Cortical flake; cream; broken; distal surviving; steep shallow edge retouch on small area of convex distal; 12:16:04; d 60°; Broken Retouched Flake.	10
642	6	Inner flake; red/brown; lightly patinated; broken; distal surviving; roughly rectangular plan; irregular inverse edge retouch on left side; 41:38:17; l 80°; r 74°; d 74°; Miscellaneous Retouch Flake.	6
643	146	*Inner flake; honey/cream; partially corticated;* lightly patinated; broken; proximal segment surviving; artificial platform; diffuse bulb; *irregular plan; steep irregular retouch on* straight right side; macroscopic edge damage undercuts retouch scars; ventral surface damaged by flakes removed along the right side; 32:24:11; r 67°; Miscellaneous Retouched Flake.	22
644	39	Inner flake; pale grey/cream; corticated; broken; central segment surviving; irregular steep retouch on straight left and convex right sides; in both cases the retouch is truncated by the snaps at both distal and proximal ends; considerable macroscopic edge damage undercuts the retouch scars; 22:23:07; l 75°; r 68°; Broken Retouched Flake.	10

STONE TOOLS

Ann Clarke

The assemblage comprises 20 items of which five are Skaill knives, eight are cobble tools, three have pecked hollows, and the rest are a collection of miscellaneous items, including a pebble rubbed in four places forming facets, one possible anvil stone, a sandstone slab smoothed over one surface and an irregular chunk grooved on three surfaces.

The Skaill knives are flakes from beach pebbles. The four smaller knives (646, 647, 648, 649) exhibit edge damage in the form of denticulation, snapping and light flaking. Experimental butchering using Skaill knives resulted in edge damage on the finer pieces similar to that appearing on these knives. The larger knife (645) appears to have been flaked bifacially around part of the perimeter before use to reduce the edge angle. Subsequent edge damage consists of heavy bifacial flaking and rounding around most of the perimeter.

The cobble tools consist of six pounders (650, 651, 652, 653, 654 & 655), a bifacial cobble (656) and one hammerstone (657). The pounders vary in shape, size and amount of wear although most exhibit the following general characteristics. All but two (650, 655) have been worked at both ends. This use wear is in the form of pecking and grinding which tends to form asymmetrical convex surfaces and a slight off centre ridge on which slight faceting can sometimes be seen. The pecking forms a lightly pitted surface but on some pieces the central protruding areas appear much smoother. This is perhaps due to a grinding or a stirring motion used to collect together the material being processed. The smoothing may also be as a result of holding the stone whilst using the opposite end.

On the finer sandstone pieces light flaking of the cortical material occurs around the perimeter of the pecked area through/

through use. The two coarse grained pounders (653, 654) appear to have been heavily used. Large step fractures have considerably reduced the working end. However, both are riddled with natural flaws which have encouraged this heavy flaking. The use that all the pounders have been put to is probably very similar despite the varying types of wear. Grain size and the occurence of inclusions or flaws will be important in determining the way the working end of the stone is moulded through use.

STONE TOOLS CATALOGUE

Skaill knives

645	67	Primary flake of grey micaceous sandstone. Further modified by bifacial flaking on part of the edge to reduce the edge angle. Edge damage consists of bifacial flaking and heavy rounding over most of the perimeter. 382g; 87; 170; 20	14
646	282	Secondary flake of grey micaceous sandstone. Edge damage consists of denticulation and light unificial flaking. 32g; 53; 48; 13	10
647	283	Primary flake of grey micaceous sandstone. Edge damage consists of denticulation and light unifacial flaking. 80g; 64; 84; 15	10
648	281	Primary flake of grey micaceous sandstone. Edge damage consists of denticulation. 59g; 68; 68; 12	6
649	280	Primary flake of grey micaceous sandstone. Edge damage consists of denticulation and snapping. 61g; 78; 69; 11	6

Pounders and Hammerstones

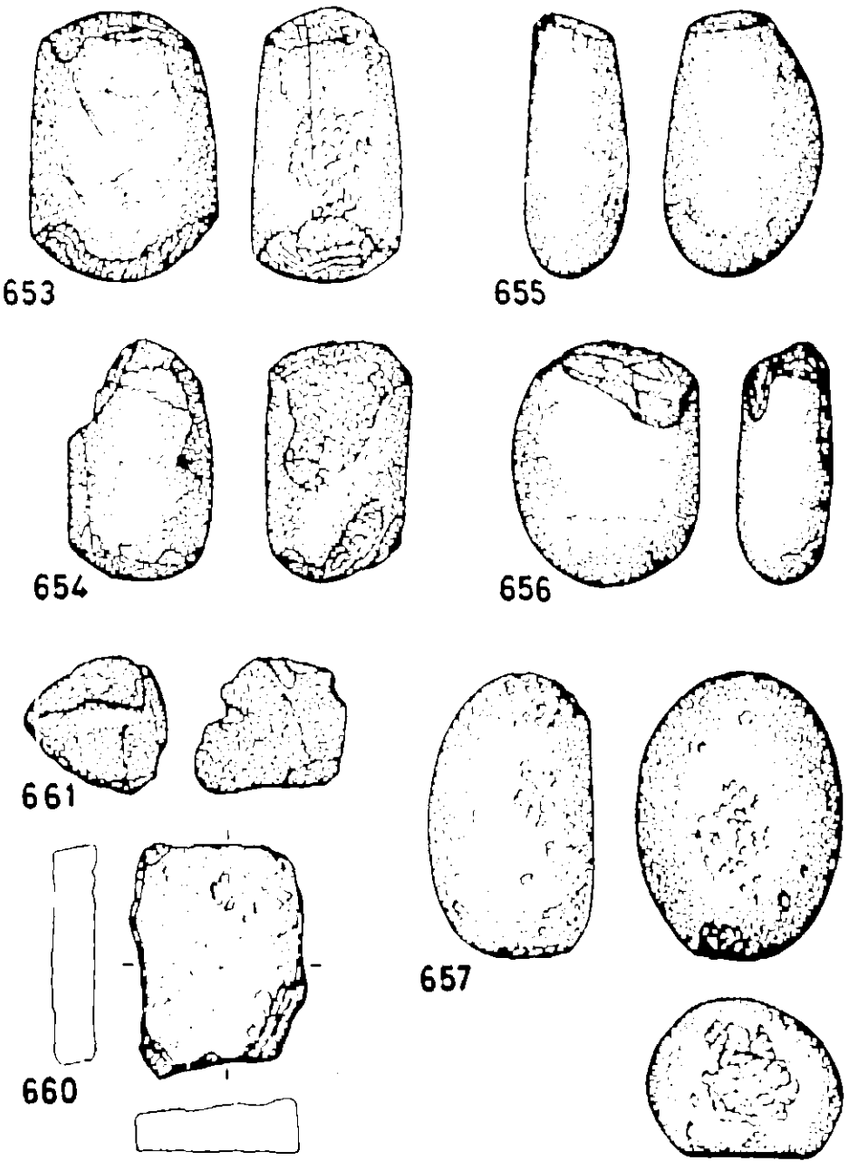
650	272	Coarse grained grey micaceous sandstone cobble. Elongated oval. Pecked on one end to form two facets. Flaking around perimeter of pecked area. Opposite end slightly smoothed perhaps through holding. 678g; 123; 80; 58	109
651	275	Medium grained grey micaceous sandstone cobble. Cylindrical. Pecked at either end to form convex surfaces. Facets appear to have been removed. Central areas smoother than rest of pecked area. 1073g; 117; 75; 70	6
652	274	Fine grained black micaceous sandstone cobble. Slightly square in section. Pecked at/	

Pounders and Hammerstones (contd)

652 (contd)	274	at either end to form convex surfaces. Facet-ing obvious around edge of pecked area. Flaking around perimeter of pecking. Central areas slightly smoother than rest of pecked area. 1183g; 710; 86; 79	107
653	273	Coarse grained micaceous sandstone cobble. Oval in section. Pecked on both ends. Natural flaws in the rock have caused con-siderable damage through step fracturing and flaking at either end. 1222g; 124; 85; 73	unstrat
654	277	Coarse grained micaceous sandstone cobble. Pecked at either end to form convex surfaces. Natural flaws in the rock have resulted in considerable damage through step fracturing and flaking. 806g; 112; 65; 69	unstrat
655	3	Medium grained grey micaceous sandstone cobble. Flat oval shaped. Pecking on one to produce two facets. Flaking around per-imeter of pecking. 656g; 120; 70; 48	unstrat
656	278	Medium grained grey micaceous sandstone cobble. Flat oval. Flaked on either side of distal end. Heavy pecking, rounding and flaking on modified edge. Utilized bifacial cobble. 667; 110; 88; 45	unstrat
657	276	Coarse grained red sandstone cobble. Oval with a smooth flat area on ventral face, pos-sibly natural. Rough pecking through hammer-ing on distal and proximal ends and dorsal face. Cobble hammerstone and possible abrader. 1436; 130; 95; 82; (smoothed surface 85 x 55)	unstrat

Miscellaneous tools

658	95	Regular rounded oval pebble of fine grained dark grey micaceous sandstone. Four areas of/	



Illus 36 Unstratified stone tools: 653-657, cobble tools; 661, grooved stone; 660, smoothed stone (scale at A4 1:3 except 660 which is 1:6)

Miscellaneous tools (contd)

658 (contd)	95	of smoothing on top, bottom and two opposite sides. One area is flat, one slightly convex and two concave. Fine striations can be seen especially on the concave surfaces. One large flake has been accidentally removed after smoothing. 185; 58; 49; 48	11
659	12	Oblong pebble of grey micaceous sandstone. Broken. Heavy pitting and light striations on one surface. Possible anvil stone. 242g; 93; 42; 33	6
660	284	Rectangular red sandstone slab. Appears to have been smoothed over one surface. Shallow longitudinal hollow in centre of face. Possible whetstone abrader. 6962g; 220; 150; 53	unstrat
661	279	Broken irregular lump of coarse grained red sandstone. Three grooves on three spaces, all truncated by the breakage. Grooves are U-shaped, the largest is 10mm wide and 12mm deep. 281g	unstrat

Stones with hollows

662	9	Oval slab of coarse grained sandstone. Roughly pecked hollow slightly off centre on ventral face. Probably pivot stone. 3552g; 200; 180; 75; hollow 70 diam 70 deep	5
663	10	Roughly triangular slab of grey micaceous sandstone. Shallow hollow of pecking on upper surface. 15548g; 380; 280; 111; hollow 50mm diam 5mm deep	6
664	285	Long narrow slab of grey micaceous sandstone, oblique at one end. Exhibits a regular oval shaped hollow on first third of one edge made by pecking. 2382; 390; 110; 55 hollow 85; 33; 10 deep	unstrat

665 287 This stone appears to be almost complete and it is possible to attempt a reconstruction of the design which occurs on one face only. Along the top edge the weathering is considerable and in particular the top left edge has suffered greatly from surface flaking. An estimated 15 to 25mm is missing from it. The sides and bottom seem to have suffered only a slight rounding of the edges though this has obscured some of the grooves of the design. Weathering on the surface has proceeded along the natural flaws in the stone and in some areas this distorts and obscures the original design.

The basic design consists of two pairs of spirals conjoined spectacle fashion (see Twohig 1981, 114). They are set back to back so that the upper right hand spiral turns anticlockwise and the upper left clockwise. The axis of symmetry is slightly offset. All the paired spirals have between 1¼ and 1½ turns. Both pairs are not only joined by the continuation of the spirals but are framed by another line along the front which joins onto the spirals at each end. In the blank space remaining on the left of the face another spiral has been carved. This runs anticlockwise for almost two complete turns before joining on to the line framing the top left hand spiral. An isolated line comes off the bottom of the lower left hand spiral and runs underneath the isolated spiral apparently tracing the original edge of the stone.

The line has been made by a series of closely set pick marks (Twohig 1981, 117). Many of the individual pick marks can still be discerned even though they have been subject to considerable weathering./

665 (contd) 287 weathering, thus it is clear that no attempt has been made to smooth these out to form an even groove. Where individual pickmarks occur they have a diameter of c 2-3mm. The width of the line formed varies considerably between 6 and 15mm. 316; 296; 140 unstrat

666 288 The question of whether this stone is complete is dependent on how one interprets the design. Again this occurs on one face, but unlike the other two stones it is restricted to only a third of the face to one side. There is very little weathering of this surface but several deep natural hollows occur over the undecorated part of the face.

The design consists of two very badly executed spirals set back to back. That on the right runs clockwise for c 1¼ turns that on the left runs anticlockwise for roughly half a turn. The tails of these spirals running roughly straight and parallel to each then disappear off the top edge of the stone. Around the bottom and free side of the right spiral is an arc which joins onto the bottom of the left spiral.

It seems unlikely that this was ever intended to be a completed design. It gives the impression that it is the bottom half of an opposed pair of linked spirals as is present on the two other stones from Pierowall. If this is in fact the case then either the stone has split in two or else it was carved in situ with the upper half of the design on an adjacent stone. The evidence would tend to favour the former hypothesis. This has happened to the large decorated stone, for example. The surviving portion of this stone also gives clear signs that it could yet split in two along a natural fault parallel to the upper surface.

Decorated stones (contd)

666 (contd) 288 The design was created in a similar manner to stone 665. Individual pick marks appear to be slightly larger; on average c 3½mm in diameter. The width of the grooves varies from c 9mm to 15 mm. 552; 255; 96 unstrat

667 289 This stone was found in two pieces approximately three months apart. Both, however, clearly join and together they represent the large part of one stone. Other than the two obvious chunks missing from the corners, it is thought that the decorated surface is complete and that the main dimensions of the stone accurately reflect its original shape. This claim is largely based on the overall integration of the decoration, the repeated use of dots along the edges and an attempt to decorate an area where the edge is not straight on the left side. The upper half of the decoration has been heavily weathered and in some areas the surface has flaked off. The weathering does not coincide with the edge of the split but as it does not appear on the lower part of the stone it is impossible to tell whether it occured before or after the stone broke.

The design originally completely covered the surface of the stone and consists of three main elements: two pairs of spectacle-linked spirals set back to back; two opposing sets of concentric arcs and a pair of linked spirals. As can be seen in the illustration (27) the upper pair of spectacle-linked spirals has a right anti-clockwise spiral of two turns and a left anti-clockwise spiral for 2¾ turns. The right spiral is increased by having a concentric arc which encompasses threequarters of its circumference. The/

667 289 (contd) The lower pair of spectacle-linked spirals consists of a right anticlockwise spiral of 3½ turns and a left clockwise spiral of 3½ turns. Both pairs are closed at the front. In the upper this is done by two arcs, in the lower by a straight line linking the heads of the spirals. All the spirals have a central dot and another dot appears between the spirals of the lower pair.

The opposed sets of arcs which are both centred on a dot at the stone's edge consist respectively of a group of nine semi-circles with an outer diameter of 0.24m and a group of 10 with an outer diameter of 0.19m. The contrast here between a large number of semi-circles occuring in a smaller area emphasizes a feature of the stone which is apparent also in the opposed pairs of spirals. The decoration of the stone including both these elements can be divided visually along its length into two sides, in which on one side the motifs reflect those on the other but are much smaller and more concentrated. This assymetry of the decoration may reflect an attempt to counteract the problems of perspective; the larger motifs being assigned to the part of the stone furthest from the eye. This, however, is probably unlikely because for such a device to be effective the stone would have to have been built into the cairn revetment at a much higher position than was found to be the case with any other lintel.

The final part of the design consists of a pair of spirals which, unlike the previous sets, both turn anticlockwise. The upper spiral has three turns, the lower spiral 2½ turns. The tail of the/

667 289 (contd) the lower spiral joins the upper spiral and this then encircles the pair completely before becoming an incomplete arc around the upper set of semi-circles. Again, both spirals have a dot at their centre.

Various techniques have been used to fill in the areas between and around these main motifs. To the left of the pair of spirals described above is a small group of three concentric arcs with a dot cupped by the smallest arc. The uppermost arc merges with part of the line which passes around the spiral near it and goes on to describe a shape like a triangle further up. There are two curving parallel lines which follow what seems to be a hollow at the edge of the stone above these arcs. Along the right edge of the stone there are a series of four or five arcs which lie concentric with the adjacent spirals. The tip of the stone outside these is decorated with a series of horizontal lines. Between the pairs of linked spirals and the opposed sets of concentric semi-circles there is a series of arcs concentric to the adjacent motifs. These define a lozenge-shaped space at the centre of which is a dot. There are dots also in the spaces between the main motifs on the lower edge of the stone. On the left side of the lower edge there also seems to be a line along the edge.

Finally, at the centre of the lower edge are three thin grooves which curve round cutting across the main elements of the design described above. They appear superficially to be later than the main design but none of them is carried into the original grooves, so this is difficult to prove.

Unlike/

Decorated stones (contd)

667 289 (contd) Unlike the two stones previously described the lines of the design are V-shaped grooves. On average these are c 15mm wise but there is a tendency for them to be narrower in the upper part of the stone. Presumably these grooves were formed by orignally pecking out these lines in a manner similar to the other stones. After this they were made deeper and more uniform by rubbing with a stone. 1300, 520, 410 unstrat

PUMICE

668	231	One possibly smoothed surface. 61; 47; 37	20
669		Irregular lump with three or possibly four shallow grooves running in various directions. 35; 28; 20	11
670	25	One slightly concave smoothed surface. 81; 60; 38	10
671	30	Irregular lump. 41; 26; 17	10
672	35	Triangular shaped piece with two smoothed surfaces, one slightly convex. 44; 36; 16	10
673		Irregular lump. 47; 30; 24	9
674		Irregular lump. 26; 26; 24	5

WORKED BONE

675	14	Bos 1st phalange. Irregular oval hole c 10 x 7mm through centre of shaft. 55; 30; 26	6
676	237	Immature bos 2nd phalange. Circular hole 5mm in diameter through centre of shaft. 27; 25; 23	107
677	222	Ovicaprid metapodial. Split longitudinally and shaped to a point at proximal end. Grinding on both sides of distal end. 130 long	21
678	5	Ovicaprid metapodial. Broken but apparently not split longitudinally. Shaped to a point at proximal end. 72 long	6
679	289	Two fragments the same flat bone of a whale. One surface has been deliberately smoothed down to reveal cancellous bone. 48; 53; 13; 47; 58; 12	9
680	290	Fragment of whale bone. Shaped. 76; 40; 16	6

HUMAN BONE

D A Birkett

Group I Layer 22

Cat no	Site no	
681	80	The right half of a mandible showing some very worn teeth with no caries

R maxilla L

87650000

mandible

0 = teeth lost after death

5,5, = number of teeth present

682	81	The upper half of an adult right ulna
683	82	Portion of mid shaft on an adult femur, probably male
684	83	Normal adult upper thoracic vertebra
685	84	Normal adult lower thoracic vertebra
686	85	Adult upper left rib
687	86	Normal adult left scapula
688	96	Upper 2/3 adult right ulna
689	97	Normal cervical vertebra - probably C 3, 4 or 5
690	98	Fragment of adult right scapula
691	99	Normal adult lower thoracic vertebra
692	111	Lumbar vertebra, thin with osteophytes, probably an older person
693	116	Right femur from a small infant
694	117	Normal adult mid-thoracic vertebra
695	118	Adult canine tooth
696	120	Upper left rib - adult
697	122	Upper left rib - adult

The sample provides little information about the age/slaughter pattern of the animals. One complete cattle mandible was present. The second molar had not yet erupted, indicating an age of between eight and 13 months. The presence of three loose worn third molars indicate that cattle over three years were also slaughtered. Little can be said of sheep and pig except that both young and mature individuals were present. The wild animals present consisted of red deer and pine marten.

Group 4 (table 8)

Only a small bone sample was found associated with deposits adjacent to the round-house. A MNI of four cattle, four sheep and one pig were present, cattle also produced a greater number of fragments. Five pieces of whale bone were present. The fragments were small so that neither the bone nor the species could be identified. Two pieces showed signs of working (see 'Pumice & worked bone' section in printed text).

The sample was again too small to provide any reliable data about the slaughter strategy of the inhabitants. Four partially complete cattle mandibulae were present. Two of these were from calves less than three weeks old. One individual was six or seven months and another between 18 and 30 months at time of death. One sheep mandible came from a lamb aged four months while a second came from a very old individual. In the latter most of the teeth were missing, with only the second pre-molar and third molar surviving. The only pig mandible present came from an individual between 21 and 23 months.

Summary

The animal bones from Pierowall show that during the Neolithic the livestock economy was dominated by sheep rearing. The age/slaughter pattern of the sheep would appear to suggest that they were primarily kept for dairying purpose but that meat production was also an important consideration./

HUMAN BONE

Group I (contd) Layer 22

Cat no	Site no	
719	155	Normal adult upper thoracic vertebra
720	156	Rib fragment
721	157	Fragmented lower end of adult femur
722	158	Small fragments of rib
723	159	Vertebral body
724	160	Upper half of adult right femur
725	161	Lower half of adult left radius
726	162	Tiny long bone fragment
727	163	Small fragment of bone
728	164	Fragment of shaft of long bone ? humerus ? femur
729	165	Mid shaft of adult femur
730	166	Fragmented shaft of right femur - adult
731	167	Small fragment from occiput of skull
732	168	Lower half of left tibia - signs of periostitis on it
733	169	Lower 2/3 of left male humerus with signs of severe arthritis
734	170	Adult sacrum and left ilium with a fused sacro-iliac joint - no evidence of any other disease to cause this sacro-iliac ankylosis
735	171	Fragments of mandible very worn teeth **654320 **tooth lost before death
736	172	Small fragment - probably pelvis
737	173	Fragment of left ilium with acetabulum
738	174	Lower 2/3 of left femur ? adult female

HUMAN BONE

Group I (contd) — Layer 22

Cat no	Site no	
739	175	Canine tooth
740	176	Upper thoracic vertebra
741	177	Fragmented mid shaft of adult humerus
742	190	Fragments of shaft of adult left femur
743	191	Normal adult right acetabulum and ischium
744	192	Fragment of femoral shaft
745	193	Lower end of adult femur ? male
746	194	Fragment of sacrum
747	195	Adult right rib
748	196	Lower end of femur - not belonging to 190 or 193
749	197	Portion of thoracic vertebra
750	265	Head of adult radius
751	266	Portion of right rib
752	267	Portion of right rib
753	268	Lower end of right humerus
754	269	Adult metatarsal
755	270	Portion of long bone shaft ? ulna
756	271	Fragment of rib

Group II — Layer 9

757	16	Lower 2/3 of right femur - adult ? male
758	22	Upper 2/3 of left femur - probably adult male
759	23	Head of adult femur
760	28	Neck and head of left femur
761	251	Tiny bone fragment

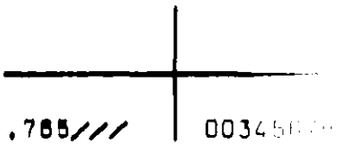
HUMAN BONE

Group II (contd) — Layer 9

Cat no	Site no	
762	252	Phalange of hand
763	253	Lower end of adult left humerus
764	254	Part of rib
765	255	Fragment of vertebral body
766	258	Fragment of small adult left scapula
767	257	Small fragment of scapula
768	258	Small part of shaft of tibia
769	259	Small fragment of skull vault
770	260	Upper end of adult right ulna
771	261	Fragment of long bone shaft ? humerus

Group III

772	73	Medial 2/3 of adult left clavicle
773	92	Worn molar tooth
774	235	Fragment of root of nose and frontal bone female skull
775	238	Adult left calcaneum
776	131	Worn upper canine tooth
777	223	Molar tooth - probably a wisdom tooth
778	27	Fragmented male mandible



Teeth worn and evidence of periodontal disease

/// = tooth space missing

HUMAN BONE

Group III
(contd)

Cat no	Site no		
779	101	Maxillary wisdom tooth	12
780	250	Fragment of sacrum	12
781	264	Lower end of adult ulna	12

Remaining Bone

782	262	Normal adult metatarsal	8
783	263	Lumbar vertebra	8
784	19	Worn molar tooth	10
785	33	Lower canine tooth	10

LARGE MAMMAL BONES

F McCormick

The excavation at Pierowall produced only a small sample of animal bone. The alkaline soil ensured good preservation throughout the site though it was noticeably better in the lower levels. Unfortunately the larger bones tended to occur in a very fragmented condition, perhaps due to redeposition or post-depositional movement of the rubble as it stabilised. The chambered tomb and its immediate environs was an occupation centre for human activity for nearly 2000 years. As has been discussed above, these successive periods of activity, involving both construction and destruction, often considerably disturbed the existing deposits on the site. As a result of this it is not only difficult to attribute certain deposits to specific periods but in many cases residual material must seriously confuse the analysis. Consequently this report deals with only a portion of the faunal assemblage, large closed associated groups which come from well stratified contexts. Even here, however, in certain cases there may be problems over residual material. In total four separate groups are discussed. The first two groups are all of a Neolithic date and will therefore be considered together. The latter two contexts, although containing a much reduced number of identifiable fragments, are important because they give some indication of livestock composition in the economy of the later occupation phase of the site.

Quantification and Ageing Data

The minimum number of individuals (MNI) was estimated using the method outlined by Chaplin (1971). This method entails the consideration of the animal's age and size as well as the frequency of the skeletal elements when calculating the MNI total. Only the articular ends of ribs were counted when calculating the fragments totals. The number of measureable bones present was too small to allow any useful discussion about the size and 'types' of animals present/

present on the site. The two complete ovicaprid longbones from the late Neolithic levels provide estimated withers heights of 563m and 591m (using multiplication factors of Teichart, quoted in von den Driesch and Boessneck 1974).

All the measurements are, however, recorded in tables 10 and 11 as they may in the future prove useful for comparative purposes

The age of the animals at time of death was based on data provided by Silver (1969). Only in groups 1 and 2 were the samples large enough to allow a detailed analysis of the age-slaughter pattern. Because of the absence of complete mandibulae this was based on the state of epiphyseal fusion of the bones using the method devised by Chaplin (1971).

Groups 1 and 2 (tables 2 & 3 in printed section)

After the partial collapse of the chambered cairn revetment there occur a number of layers on rubble which constitute a platform into which was built a small rectangular structure. A considerable quantity of bone was present in these layers. These were divided into two separate groups which will be considered separately. Although the assemblages can be dated to a limited period of occupation, they are derived from separate contexts and are probably the product of different depositional processes. Some artefactual material did occur in these layers but the animal bones provide the main evidence for occupation.

The bones from group 1 came from amongst the collapsed revetment stones (22) which formed the primary layer above the old ground surface outside the cairn. These bones were in a very fragmented state and some had been burned, particularly in the northern part of the excavated area. The second assemblage comes from the thick shillet layer (20) used as a foundation for the interior of the structure. This shillet lay immediately on top of, and to a degree was intermixed with, the collapsed revetment stones that contained the group 1 bones.

It is thought the bulk of the shillet layer was deliberately introduced in order to stabilize the underlying rubble and form a level floor for the structure. The animal bones, therefore, are not in their original position. It seems unlikely that this material was transported from any great distance as there are suitable sources of shillet in the immediate vicinity.

There were also several smaller assemblages of bones which are undoubtedly of late Neolithic date. The bones from these assemblages are listed in appendix 1.

General results

All the caprovine metapodia were identified as sheep on the basis of the criteria devised by Boessneck (1969). It is therefore assumed that goats are absent in the samples.

Sheep account for between 83% and 87% of the main food animals (cattle, sheep, pig, red deer) in groups I and II at Pierowall. This may seem unusually high as sheep generally play a minor role compared with cattle and pig during British Neolithic and early Bronze Age (Simmons & Tooley 1981, 198, 226-8). The livestock economy of the Orkneys, however, developed differently from the rest of Britain. Recent evidence from Skara Brae (Noddle unpublished) shows that during the late Neolithic/early Bronze Age there was a decline in the importance of cattle in the livestock economy and a corresponding increase in the importance of sheep.

In southern Britain sheep do not become a dominant domesticate until at least the late Bronze Age. Clark (1952) proposed an 'ecological' explanation for this late development of intensive sheep farming. He argued that the wooded environment of Neolithic and early Bronze Age western Europe was more suitable for the rearing of cattle and pig as woodland formed the natural habitat of the wild ancestors of both these species. He further stated that 'in the few parts of Europe where deciduous forest was absent or relatively unimportant as in the Orkneys, or on the rocky islets of Morbihan,/

Morbihan, sheep breeding was strongly developed during Neolithic times' (1952, 121). Clark based his Orcadian evidence on the faunal material from the early Skara Brae excavations (Watson 1931). The data from the recent excavations at the same site and from Pierowall strongly support this hypothesis. The recent Skara Brae material, however, poses one important problem. Noddle has shown that during phase I cattle were the predominant species and it was not until after c 2340 bc that a change to a livestock economy based primarily on sheep rearing occured (Noddle unpublished). Is it possible that the earliest Orcadian farming introduced a livestock economy similar to that of the mainland but that it was only after several hundred years that there evolved a livestock economy more suitable to the local environment?

Animal bone assemblages from in and around funerary monuments should always be treated with caution. Generally speaking, the majority of animal bones on settlement sites are related to the dietary activities of the inhabitants. This need not necessarily be the case with funerary monuments as the animal bones may be the product of ritual activity. Furthermore, non human factors, such as the use of monuments as dens by carnivores, may also account for the presence of osteological material. It is therefore necessary to examine closely the material from Pierowall Quarry in order to determine which factors account for the assemblages present. Only the two main late Neolithic samples were large enough to allow detailed analysis. The large quantities of Orkney vole and passerine bones present were almost certainly introduced by carnivores (see Barlow, infra).

Sheep: Age-mortality pattern (tables 4 & 17)

The age-mortality pattern for groups 1 and 2 was based on the state of epiphyseal fusion of the post-cranial bones; the samples are small so the results should be treated with due caution. Both groups were examined separately and the results varied considerably. In group 1 58% of the sheep died before the age of 10 months compared with less than 20% in/

in the case of group 2. Again, only 24% were older than 42 months in group 1 compared with 50% in group 2. As it has already been shown that both assemblages are largely contemporary these contradictory results raise some obvious problems of interpretation.

Payne (1973) has produced kill-off pattern models which one would expect for sheep in economies where they were being kept for different purposes. In each of his models he assumes an infant mortality rate of 25%. In a system where sheep were being kept specifically for meat the optimum time for slaughter was when the animals were between 18 and 30 months. Neither of the Pierowall groups corresponds to this model. In his model for a sheep dairying economy Payne predicts that nearly 60% would die during the first year. These would include the victims of infant mortality and the killing of unwanted lambs, especially males, so that the ewes' milk would be available for human consumption. There would also be a slight peak in slaughter of animals between two and four years owing to breeding selection. There would also be significant numbers of old animals present, consisting mainly of ewes which had passed their milk-producing prime. The age/death pattern in group 1 corresponds closely to this dairying model.

It should be noted that nearly all of the sheep in the 0-10 month group were neo-natal individuals, indicating that they were dead at birth or died, or were killed, soon afterwards. A high incidence of neo-natal individuals were also noticed in the chambers of the tombs at Quanterness and Isbister (Clutton-Brock in Renfrew 1979; Barker 1983). On both these sites the writers suggest that young animals were deliberately selected and deposited as part of the funerary rite. If dairying was the type of sheep livestock economy practised, it could be argued that this funerary practice was simply a ritualistic manifestation of an economic necessity. It is also possible that the neo-natal sheep commonly found in and around Orcadian chambered tombs may simply represent young lambs that died in sheltered places. Sick sheep and lambs/

lambs will often seek a sheltered place in which to rest and die. In 1960, for instance, 77% of the dead Soay sheep on St Kilda were found inside the deserted buildings on the island (Boyd et al 1964, 55). The large cairn stones and, if entry were possible, the chambers of the Orcadian tombs would have provided obvious shelter for sick and dying lambs.

The age/slaughter pattern of the sheep in group 2 does not correspond to either the meat production or dairying models of Payne. In this group there was a 15-20% kill-off for the first three years but a large proportion of the sheep (50%) were greater than 42 months of age at time of death. Only in Payne's model for wool production does a large proportion of the sheep survive into old age (1973, 284). In the latter the old sheep were between six and ten years of age but the actual age of the mature sheep in the Pierowall sample cannot be established. It is highly unlikely that sheep were being kept for wool production in late Neolithic Orkney. The fleeces of Neolithic sheep are regarded as being too hairy for textile production and the earliest surviving wool textiles known in Europe date to the Bronze Age (Ryder 1981, 184; 1983, 47). No woollen textiles are known from the Orcadian prehistoric period and the earliest indirect evidence for its production, ie spindle whorls, are from Iron Age contexts.

If the group 2 age/slaughter pattern does not represent a wool producing economy, how should it be interpreted? Very few neo-natal bones were present so the youngest age group (0-10 months) would appear to consist mainly of deliberately slaughtered lambs. The sample, therefore, does not contain the 25% infant mortality which Payne includes in all his models and therefore cannot be directly compared with them. If one were to increase the proportion present in the youngest age group in order to include the victims of infant mortality, the age/death pattern would correspond in some ways to Payne's dairying model. The relatively large numbers killed during the second and third years, however, would suggest/

suggest that meat production was also an important consideration, as this is the optimal age for slaughtering sheep for this purpose. It is unlikely that sheep were being kept exclusively for a single purpose and the evidence suggests that they were being kept both for their milk and their meat.

The sheep ageing data from Pierowall only allow suggestions to be made concerning the livestock economy practised by the site occupants, especially when one considers the small sample size and the unusual contexts in which the bones were found. The unusually high incidence of neo-natal sheep in group 1 may simply represent the natural phenomenon of sick lambs seeking a sheltered place among the cairn stones in which to rest and, ultimately, die. The group 2 bones come from a disturbed context as the shillet in which they were found was transported from elsewhere. Since little is known about the original archaeological context of the bones any interpretation of them must be of a speculative nature.

Sheep: Skeletal part distribution

Illus 32 shows the distribution of sheep skeletal parts from groups 1 and 2. It can be seen immediately that the distribution is similar in both groups. The more compact bones such as the calcanii, astragali and phalanges have survived at a much higher rate than skull fragments, long-bones and vertebrae. The distribution of bones can often be shown to reflect specific butchering practices. It is not, however, possible to demonstrate this in the present instance. Superficially, it would seem that the samples contain a large proportion of the waste skeletal elements. The absence of metacarpals and metatarsals, however, militate against such a purpose. Furthermore, it has already been argued that many of the bones present may be a product of natural rather than human processes. The bones that have survived well are the more compact and hard parts of the skeleton. The distribution can therefore be explained as a product of natural survival processes.

Other domesticates/

Other domesticates

Cattle and pig were of minor importance in the livestock economy. Two cattle were represented in the material from the cairn collapse. One of these was a neo-natal individual while the second was a juvenile.

The same group contained a minimum of only one pig. The calcaneus was unfused, indicating that it was less than 30 months old at time of death.

In group 2 cattle were again represented by two individuals. The first was a juvenile as the phalange had not yet fused, while the second had a fused proximal end of tibia indicating an age of at least 3½ years at time of death. The pig was represented by three individuals. The phalanges showed that they consisted of a neo-natal, an immature and a mature animal. One dog bone was present in group 2.

Wild animals

Red deer and otter were present in both groups while pine marten were only present in group 2. The red deer consisted of both meat-bearing and waste parts of the skeleton. Three pieces of antler were present. These consisted of two tines from group 1 and a shed burr and beam from group 2. There was no evidence for the use of antler as a raw material for industrial purposes.

The presence of otter and pine marten bones in group 2 may provide evidence for the hunting of animals for their skins. It is more likely, however, that the cairn at some stage was used as a den by these animals. Otter bones have previously been found at Quanterness and Skara Brae (Clutton-Brock in Renfrew 1979; Watson 1931). The pine marten bones are the first to have been recorded in Orkney. Their bones were also present in group 3 and several bones were found in other deposits on the site. Although the pine marten is generally regarded as an arboreal animal it can also thrive/

thrive in an open unforested environment. In treeless parts of Scotland, pine martens generally feed on small birds, rodents, voles, beetles, carrion and fish (Southern 1964, 236). A similar diet would have been available to Orcadian pine martens during the Neolithic and early Bronze Age. The pine marten may have formed part of the indigenous fauna of the Orkneys but as they are excellent swimmers they may have arrived on the islands after they were colonized by man.

A small group of bones were in the wall structure of the late Neolithic house (table 9). The sample contained the only grey seal bone found during the examination. This consisted of a juvenile third metacarpal. Seal bones are very rare on early prehistoric Orcadian sites. The only other known examples come from the recent excavations at Skara Brae (Noddle unpublished).

Groups 3A and 3B (tables 6 & 7)

The rectangular house at Pierowall was originally used as an industrial area and the floor (11) contained a large quantity of flint debris. A small sample of bone (3A) was found with the flint debris (table 6). The proportion of fragments and minimum numbers of individuals present, as well as the distribution of surviving skeletal elements, however, strongly suggest that the bones represent contamination from the underlying shillet.

The secondary occupation layer (10), in contrast, contained an assemblage (3B; table 7) so different from the preceeding layers that it must be regarded as a largely uncontaminated sample. The bone sample was much smaller than groups 1 and 2 and the results from their study are probably less reliable. They do suggest, however, that the earlier sheep dominated livestock economy had given way to an economy where cattle played the dominant role. The latter account for a MNI of four, compared with two each in the case of sheep and pig. Cattle bone fragments also greatly outnumbered the other two species.

The sample provides little information about the age slaughter pattern of the animals. One complete cattle ma dible was present. The second molar had not yet erupted, indicating an age of between eight and 13 months. The pr ence of three loose worn third molars indicate that cattl over three years were also slaughtered. Little can be sa of sheep and pig except that both young and mature indivi were present. The wild animals present consisted of red and pine marten.

Group 4 (table 8)

Only a small bone sample was found associated with deposits adjacent to the round-house. A MNI of four catt four sheep and one pig were present, cattle also produced a greater number of fragments. Five pieces of whale bone were present. The fragments were small so that neither t bone nor the species could be identified. Two pieces sh signs of working (see 'Pumice & worked bone' section in printed text).

The sample was again too small to provide any relial data about the slaughter strategy of the inhabitants. F partially complete cattle mandibulae were present. Two these were from calves less than three weeks old. One i ividual was six or seven months and another between 18 a 30 months at time of death. One sheep mandible came fro lamb aged four months while a second came from a very ol individual. In the latter most of the teeth were missin with only the second pre-molar and third molar surviving The only pig mandible present came from an individual between 21 and 23 months.

Summary

The animal bones from Pierowall show that during th Neolithic the livestock economy was dominated by sheep rearing. The age/slaughter pattern of the sheep would appear to suggest that they were primarily kept for dair ing purpose but that meat production was also an importa consideration./

consideration. The samples from the later contexts are relatively small and the results from their study must be treated with caution. They do suggest, however, that by the early Iron Age the emphasis had moved from sheep to cattle rearing. Unfortunately the samples cannot provide any detailed information about the later economy.

	Cattle	Sheep	Pig	Red Deer
Teeth	2	1	1	-
Caudal vertebra	-	-	2	-
Sacrum	1	1	-	-
Scapula	1	1	-	-
Radius	-	1	1	-
Ulna	-	1	-	-
Metacarpal	1	2	-	-
Pelvis	-	1	-	-
Femur	1	-	-	-
Patella	-	1	-	-
Calcaneus	-	1		-
Astragalus	-	8	-	-
Metatarsal	-	2	-	-
Phalanx I	1	5	-	1
Phalanx II	-	10	-	-
Phalanx III	-	5	-	-
Carpalia/tarsalia	-	4	-	-
Metapodia	1	-	-	-
TOTAL	8	44	4	1
MNI	1	4	1	1

Table 6

Mammal bones. Group 3A: skeletal parts and MNI from primary floor level in late Neolithic structure, layer 11

	Cattle	Sheep	Pig	Red Deer	Pine Marten
Horn core	1				
Skull fragment	5		1		
Mandible	5	1			
Teeth	34	7	2		
Thorasic vertebra		1			
Rib	1	1			
Scapula	3	2			
Humerus		2			1
Radius		1			
Ulna	2	1		1	
Metacarpal	3	2			
Pelvis	3	1			
Femur	1	3		2	
Tibia		6			
Calcaneum	1	1			
Astragalus	3	2			
Metatarsal	5	3			
Phalanx I	2	9			
Phalanx II	5	4	2		
Phalanx III	1	1			
Carpalia/tarsalia	6	3			
Metapodia	10				
TOTAL	91	51	5	3	1
Fragments %	60.3	33.8	3.3	2.0	0.7
MNI	4	2	2	1	1

Table 7
Mammal bones. Group 38: skeletal parts and MNI from secondary habitation level in rectangular structure, layer 10

	Cattle	Sheep	Pig	Red Deer	Dog	Whale
Horn core/antler	3			3		
Skull fragment	13	1				
Mandible		4	2			
Teeth	32	17	9		1	
Atlas	2					
Axis	1					
Cervical vertebra	4	2				
Thorasic vertebra	2	1				
Lumbar vertebra		2				
Caudal vertebra	3					
Rib	2	10				
Scapula	5	5				
Humerus	6	6	2			
Radius	6	3		1		
Ulna		1				
Metacarpal	2	2	1			
Pelvis	4	1	2			
Femur	3	5				
Tibia	1	5	1			
Patella	1	1				
Calcaneum	1	1				
Astragalus		6				
Metatarsal	3	4	1			
Phalanx I	2	1				
Phalanx II	6	1	1			
Phalanx III	2					
Carpalia/tarsalia	6	2		1		
Metapodia	3	1				
TOTAL	113	82	19	5	1	5
Fragments %	50.2	36.4	8.4	2.2	0.4	2.2
MNI	4	4	1	1	1	1

Table 8
Mammal bones. Group 4: skeletal parts and MNI from early Iron Age occupation layers

	Cattle	Sheep	Pig	Red Deer	Grey Seal
Skull fragment		2			
Mandible	2				
Teeth	5	10	1		
Cervical vertebra	1				
Thorasic vertebra		2			
Rib	1	4			
Scapula	2		1		
Humerus	1	3			
Radius		4		1	
Ulna	1				
Metacarpal	2	3			
Pelvis		1			
Femur		6			
Tibia	1	4			
Patella	1	1			
Calcaneum		2			
Astragalus		1			
Metatarsal	1	3			1
Phalanx I	1	10	1		
Phalanx II	6	5	1		
Phalanx		3			
Carpalia/tarsalia	10	5			
TOTAL	35	69	4	1	1

Table 9
Mammal bone. Group 5: skeletal parts and MNI from platform wall, layer 21

	Sheep	Cattle	Pig	Pine Marten	Red Deer
Teeth	2	3	-	-	20
Skull frag	-	-	-	-	5
Mandible	3	-	-	-	2
Vertebra	1	-	-	-	3
Scapula	1	-	-	-	-
Humerus	1	-	-	-	5
Radius	7	1	-	-	6
Ulna	-	-	-	-	1
Metacarpal	3	-	1	-	2
Pelvis	-	-	-	-	1
Femur	1	-	-	-	4
Tibia	7	-	-	1	4
Astragalus	7	-	-	-	3
Calcaneus	3	-	-	-	3
Metatarsal	1	-	-	-	6
Phalanx I	4	-	1	-	4
Phalanx II	2	-	1	-	5
Phalanx III	1	1	-	-	-
TOTAL	44	5	3	1	74
MNI	5	1	1	1	2

Table 10

Mammal bones. Group 6: collapse from platform wall, layer 13

	Sheep	Cattle
Teeth	1	3
Vertebra	1	-
Radius	2	-
Ulna	2	-
Femur	2	-
Tibia	3	-
Astragalus	4	-
Metatarsal	1	-
Phalanx I	2	1
TOTAL	18	4
MNI	2	1

Table 11
Mammal bones. Group 7: fill of robbing in cairn, layers 14, 15 & 16

	Sheep	Cattle
Skull frag	2	-
Vertebra	5	-
Humerus	1	-
Radius	2	-
Femur	1	1
Astragalus	1	-
Intertarsal	4	-
Phalanx I	3	1
Phalanx II	3	-
TOTAL	22	2
MNI	3	1

Table 12
Mammal bones. Group 8: cairn and outer revetment, layers 23 & 24

	Sheep	Cattle	Pig	Red deer	Pine marten
Teeth	-	4	-	-	-
Skull	1	-	-	1	-
Mandible	-	-	-	1	-
Vertebra	-	4	-	-	-
Scapula	1	-	-	-	-
Humerus	1	-	-	-	1
Radius	-	1	-	-	-
Ulna	-	1	-	1	-
Pelvis	1	-	-	-	-
Femur	1	-	-	-	-
Patella	4	-	-	-	-
Tibia	1	-	-	-	-
Astragalus	6	-	-	-	-
Calcaneus	3	-	-	-	-
Metatarsal	1	-	1	-	-
Phalanx I	7	-	-	-	-
Phalanx II	3	-	-	-	-
Phalanx III	-	1	-	-	-
TOTAL	30	11	1	3	1
MNI	5	1	1	1	1

Table 13
Mammal bones. Group 9: rubble layer, layer 12

	Sheep	Cattle	Red deer	Cetacean
Teeth	8	11	-	
Skull frag	-	1	-	
Mandible	2	-	-	
Vertebra	-	2	-	
Scapula	1	-	-	
Humerus	1	-	1	
Radius	2	2	-	
Ulna	1	1	-	
Metacarpal	1	1	-	
Pelvis	1	1	-	
Femur	3	1	-	
Tibia	-	3	-	
Astragalus	3	-	-	
Calcaneus	2	-	-	
Phalanx I	4	3	1	
Phalanx II	3	3	-	
Other	-	-	-	2
TOTAL	32	29	2	2
MNI	2	2	1	1

Table 14
Mammal bone. Group 10: layer of decayed stone formed over the Neolithic monument, layer 9

	Length (GL)	Proximal Width (BP)	Distal Width (BP)	Shaft Width (BP)	Group
Radius		29.9			1
		31.1			
Metacarpal		20.6			2
		18.9			
		22.1			
			23.9		
			23.9		
			24.7		
			24.8		1
			26.9		38
Tibia	187			13.2	2
			25.0		
Metatarsal	130.1	17.5	21.2	11.4	
			24.8		1
			23.6		
			26.9		38

Scapula: Greatest width of process articularis (GLP).
Group 2: 25.2, 28.6, 31.2

Calcaneum: Greatest length (GL): Group 1: 49.9, 52.5, 53.2, 54.9 Group 2: 49.0, 49.6, 49.6, 49.8, 51.1, 52.9

Astragalus: Greatest lateral length (GLl): Group 1: 25.1, 25.6, 25.6, 25.9, 26 , 26.3, 26.7, 26.7, 26.9, 26.9, 26.9, 27.0, 27.2, 27.2, 27.3, 27.3, 27 , 28.3, 29.0
Group 2: 21.1, 24.6, 25.1, 25.2, 25.4, 25.5, 26.1, 26.5, 26.9, 26.9, 27.1, 27.1, 27.9, 28.1, 28.4, 29.1, 29.3
Group 5: 25.9, 25.9, 26.0, 26.9, 27.1, 27.2

Table 15
Sheep bone measurements

Cattle

Scapula (GLP) Group 4; 69.9

Metacarpal (Group 5) GL 21.5, Bp 57.3, Bd 57.5, SD 31.1

Pig

Scapula (GLP) Group 5; 32.0

Red Deer

Radius (GL) Group 5; 246

Pine Marten

Humerus (Group 38) GL 70.9, Bp 12.3, Bd 14.6, SD 15.0

Table 16

Cattle, pig, red deer and pine marten measurements

Approx fusion age (in months)	Skeletal part	Group 1 Fused	Group 1 Unfused	Group 2 Fused	Group 2 Unfused
0-10	Scapula, Pelvis, Humerus P, Radius P	11 (42.3%)	15 (57.7%)	13 (81.2%)	3 (18.8%)
18-28	Tibia D, Metacarpal D, Metatarsal D	13 (40.6%)	19 (59.4%)	10 (66.7%)	5 (33.3%)
28-36	Ulna, Femur P, Calcaneus, Radius D	14 (24.6%)	43 (75.4%)	21 (51.2%)	20 (48.8%)
36-42	Humerus P, Femur D, Tibia P	4 (26.7%)	11 (73.3%)	4 (50.0%)	4 (50.0%)

Table 17

Epiphyseal fusion data for ageing of sheep (after Silver 1969)

SMALL ANIMALS

A Barlow

Feature	*Microtus arvalis* Lower incisor Left	Right	Upper incisor Left	Right	*Apodemus sylvaticus* MNI	Total	Anura fragments
9	7	8	5	12			1
11	4	1	2	2			
12	1	3	1	0			
13	61	48	29	28			22
15	4	0	3	3			
16	0	1	0	0			
20	47	66	42	34			80
21	39	44	63	49			29
22	168	167	162	167	1		86
23	10	5	5	6			12
TOTAL	341	343	312	301	1		

If one assumes that each feature is a closed context and thus the bones of any animal in one context cannot be present in another, then the minimum number of individuals of *Microtus arvalis* would be 392. This is the total of the highest figure in each layer. It is, however, unlikely that each layer can be examined in isolation: not only are several layers redeposited or introduced but others are of loose rubble which would allow easy percolation of such small bones. Thus the author would regard the figure of 343 as more representative of the number of *Microtus arvalis* present.

FISH BONES

G N Swinney

6	Gadus morhua	Ceratohyal	posterior	left
		Ceratohyal	mid	right (smaller than above)
		Articular	posterior	
		Premaxilla		
		Maxilla		
	Gadidae	Vertebra		
		Caracoid		
		Pre-operculum		
		Dentary	fragment	
13	Labrus bergylt	Pharyngeal mill		
20	Raja sp	Spine		
21	Labridae	Pharyngeal mill		
22	Labridae	Pharyngeal mill		
	Raja sp	Spine		
23	Labrus bergylta	Premaxilla		
	Gadidae	Jaw		

BIRD BONE

A S Clarke

Bird bones can be very difficult to identify since, for most families, individual bones have family characteristics and tend to differ mainly in size. It is not always possible, therefore, to be sure whether one is dealing with a large example of a smaller species or a small example of a larger species, eg guillemots, razorbills, puffins. This is particularly true for incomplete limb bones since total length is an important criterion.

This difficulty becomes greater the smaller the bird: the smaller passerines (perching or song birds) may require more than simple inspection and comparison with known examples and should be examined and accurately measured under a low power microscope. Much of this material consists of tiny passerine bones but, owing to other commitments, it was not possible to devote to their examination the amount of time necessary; nor do I think it likely that the resulting information would have carried sufficient stamp of certainty to justify the time spent.

Additionally, although the Royal Scottish Museum possesses skulls, and sometimes limb-girdles, of most of these smaller birds (finches, buntings, warblers etc) we do not, in general, possess complete skeletons, so for many of the smaller bird bones there was no possibility of identification by direct comparison. I do not think this is any great loss as such identification would, in the absence of any major climatic change, more acceptably confirm the presence in the past of species still present than they would establish species not now known in the area. The identifications given do not necessarily represent all the material in a sample, only that for which there was some certainty of correctness or at least a high degree of probability. Where a part bone, on inspection, looked like one already well represented I have usually ignored it.

BIRD BONE CATALOGUE

Gannet	layer
Mandible, right articulation	22
Vertebra, cervical	20
? Coracoid. Rather small for a gannet	21
Humerus, proximal. ? Juvenile	13
? Humerus, shaft	22
Humerus, distal	22
Ulna, distal	8
? Ulna, distal	11
? Radius, shaft. Rather small for a gannet	7
Radius, proximal and distal ends of one bone	12
? Tibia, shaft	20
Tarso-metatarsus	23
Phalange, first	9
Phalange, x3	15
Phalange, x2	20

Herring Gull	
? Mandible, tip	11
? Coracoid	12
? Coracoid	13

Little Auk/Common Tern	
Tibia, x2	20

Little Auk	
Humerus	20

Great Auk	
Femur	21

Guillemot/Razorbill	
Humerus	22

Puffin	
Humerus	22

Great Black-backed Gull	layer
? Sternum, anterior margin	13
Coracoid, x2	13
Humerus, proximal	20

Cormorant	
Ulna, distal	11
Ulna, proximal	20

Shag	
Humerus,proximal	22
? Ulna, distal	11

Cormorant/Shag	
Ulna, distal	11
? Ulna, proximal	20
? Radius	22

Swan	
Vertebra, cervical	22

Goose	
Sternum & keel, interior tip. Probably greylag	21
Femur, shaft. Probably greylag	21
? Tibia, shaft	22

Duck	
Sternum, anterior tip	22
Humerus, proximal. Possibly eider	20
Ulna, distal. Possibly mallard	12

Red-throated Diver	
? Ulna. Slightly larger than would be expected	20

Starling/

Starling	layer
Cranium	22
Humerus, x5	13
Humerus, x2	15
Humerus, x2	21
Humerus, x3	22
? Ulna	11
Ulna, x2	12
Ulna, x2	21
Pelvis	18
Femur	15
Femur	16
Femur	22
Tibia-tarsus	15
Magpie	
Ulna	20
? Phalanges 3, 4	6
? Phalanges 3, 4	11
Finch	
Humerus	21
Tibia-tarsus	20
Skylark	
Humerus, proximal	7
Lapwing	
Humerus, proximal	8
Blue Tit/Wren	
? Femur	22
Crow	
Humerus. Possibly hooded crow	22
Carpus	23
Jackdaw	
Carpus	9
Buzzard	
Coracoid, a pair	21
? Furcula	22
? Femur, distal	22
? Tarso-metatarsus	22

Blackbird	layer
Sternum, anterior	15
? Coracoid	11
Thrush	
Cranium. Song thrush	20
Cranium. Song thrush	24
Humerus	21
Humerus. Song thrush	22
Humerus	23
Humerus, pair	24
Ulna. Possibly mistle thrush	16
Ulna, x2. Song thrush	24
Radius, Song thrush	24
Tibia, distal. Song thrush	9
Tibia, x3. Song thrush	24
Blackbird/Thrush	
Ulna, x2 pair	20
Ulna	23
Redpoll/Twite	
? Mandible	22
Redshank	
? Ulna	23
Pigeon	
? Humerus. Possibly rock dove	3
Wader	
Tarso-metatarsus	22
Humerus, x2. Probably dunlin	22
Sanderling	
? Humerus	15
Warbler	
? Humerus	22

MARINE MOLLUSCS

A Barlow

The distribution of the numbers of shells throughout the stratigraphic sequence showed two main groupings, the largest by far being associated with the early Iron Age occupation deposits around the round-house. The other occurs amongst Neolithic activity against the outer revetment of the chambered tomb as discrete dumps of shells in association with deposits of disarticulated human bones. The walls, floor and fill of the late Neolithic structure built on the cairn rubble contained almost no shell at all. The two concentrations are also reflected in the greater number of species occurring suggesting shell collection rather than a natural, gradual accumulation over time.

Method

A minimum number of 5984 individuals was established, representing 14 marine species. 78 landsnails were also found, representing 2 species.

Gastropods

Each species was separated and given three categories, whole, apex and debris. Individuals were counted either as whole shells or apices. Then all three categories were weighed individually and combined to give an actual shell weight for each species within each layer, which were further combined to give weights for each species within the site and for the total shell from each layer.

Bivalves

These were counted basically as above, although different individually unique characteristics were selected. For mussels and cockles, beaks of the valves were counted. For oysters valve profile was taken as an indicator as hinges did not survive (see note at end of this section), and for the rest/

rest, hinges. These were then examined to determine left and right valves (fragmented shells without the chosen unique characteristic were discounted). All the valves of each species of bivalve were then compared with all other opposing ones of that species to determine any left-right matching. If so the individual would be assigned to the lower of the two layers. Individual valves which were not matched with any others were assumed to represent one animal.

Notes and observations on the species

Patella vulgata (Linné 1758). The subfossil remains of limpets varied considerably in weight, between 1.8g and 11.2g. The overall average weight for whole shells was 6.1g, compared with Evans's and Spencer's (1977, 215) average for a modern Welsh sample of 6.6g. An initial impression of a wide range of variation in shell size and profile was gained during counting, and it was seen that this could yield information on the provenance and pattern of exploitation of limpets.

Since limpets were known to vary in shell profile in relation to the amount of contraction exerted by the 'foot', and that this relates in turn to either the amount of time the animal spends exposed and not feeding, or the relative strength of wave action (Evans & Vaughan 1983; Evans & Spencer 1977, 216), it was suggested that the relative steepness of the limpet's profile could serve to separate the inter-tidal zones inhabited by the animals in life. The basal area of the shell gives the relative size of the limpet and, when plotted against the pointedness of the shell, can be used to characterize limpet samples from the different archaeological contexts in terms of shore zone exploited (assuming they were selected from the same or similar shores) and the size of animal being selected.

To investigate the difference between the two main limpet groups (layers 6 & 22) 300 whole shells were taken at random from each, and the lengths, breadths and heights were measured to the nearest millimetere. The relative distance up the eulittoral zone (Lewis 1964, 48) at which each limpet was growing is/

is indicated by the pointedness of the shell (Yonge 1949, 141), obtained by the function of base index over height,

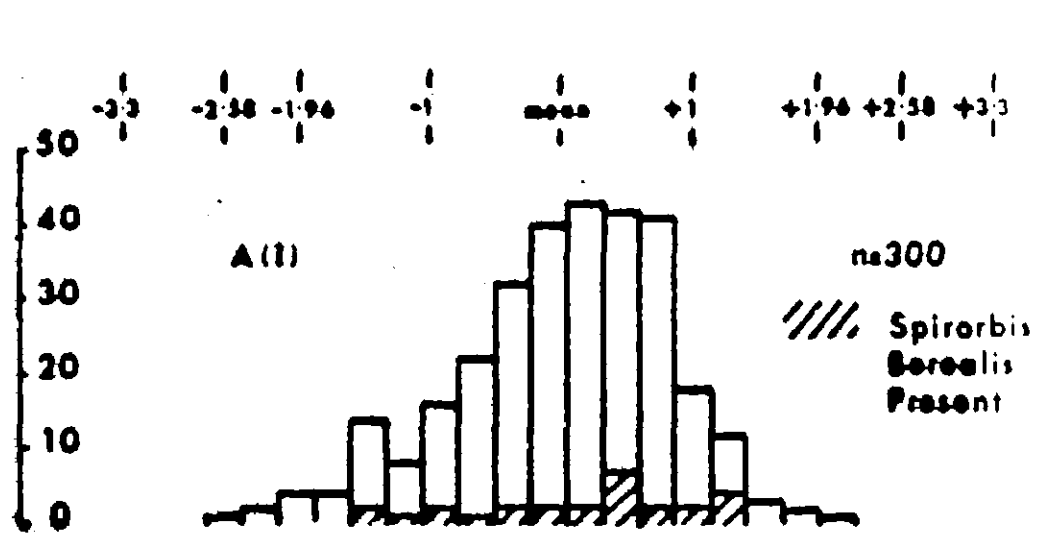
$\frac{1}{2}(l+b)/h=\tan\ \theta$

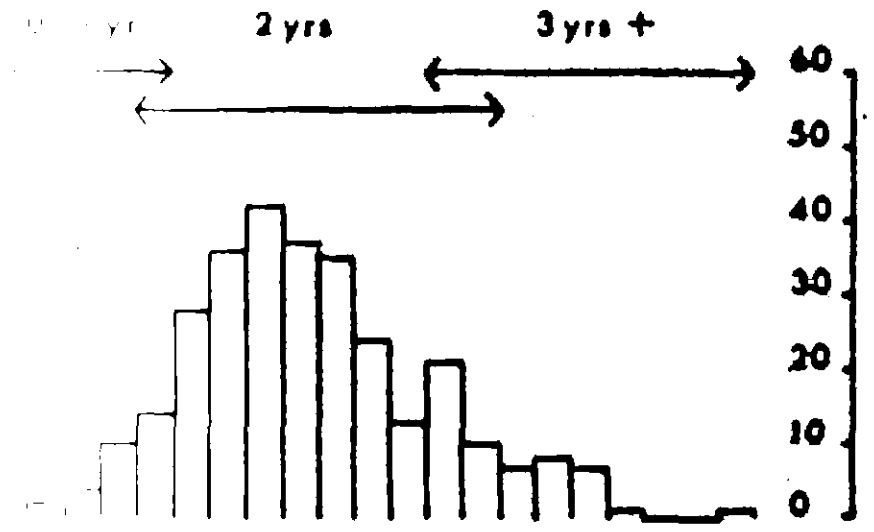
and the relative size of the animal was taken as the total basal area covered by the shell

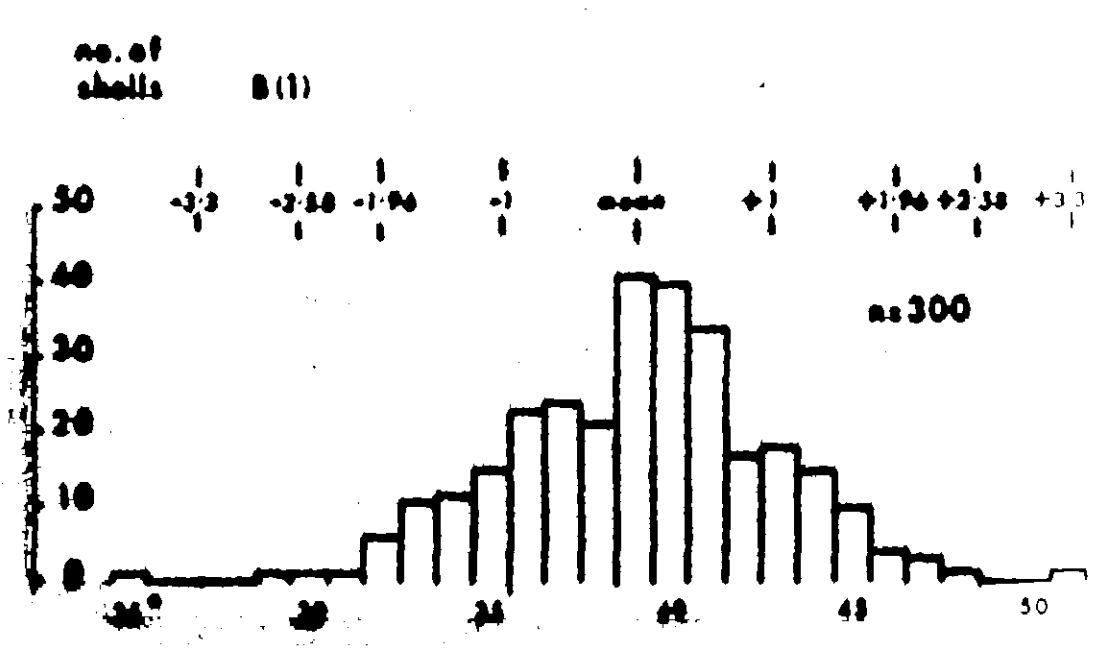
$pi(\frac{1}{2}l \times \frac{1}{2}b)$. Histograms were then prepared from the results (illus 37), which showed that the means of the samples were not significantly different from each other in either pointedness or size, implying that the basic characteristics of the limpet population or populations were the same in both samples, but examination of the figures shows possible bias in collection.

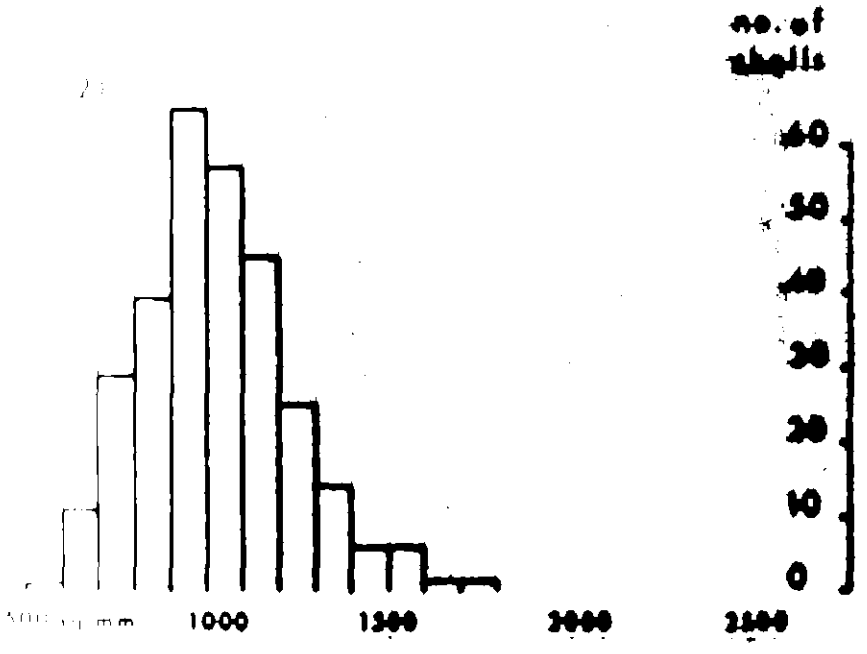
The same general size of limpet was being collected, but in the Neolithic phase the tendency was to collect from about the middle of the limpet zone down towards low water, whereas in the Iron Age collection ranged fairly evenly across the zone, without the abrupt cut-off at the upper end demonstrated earlier. This can be connected with the decrease in size of limpets in the Iron Age phase, with no limpet over two years old occurring, although the minimum size collected remained constant, at over one year old. The peak in both cases is $1\frac{1}{2}$ to 2 years. Under-exploitation could reduce the mean size of the population, due to overcrowding, but since not a single limpet of a size approaching the biological maximum is found in the Iron Age, over-predation seems to have been the main factor affecting the structure of the population. An optimizing collection strategy is therefore assumed, with a cut-off at a minimum of one year's growth.

Many of the Neolithic limpets (27%) had encrustations of the tubeworm Spirorbis spirorbis on the lower part of the outside of the shell. The larvae of this worm settle on clean rock, stable shingle and especially on the fronds of the eulittoral wrack Fucus serratus. The absence of barnacles on any shell from the site is possibly due to prevailing shore conditions of shelter, or at most semi-exposure promoting the growth of a heavy weed cover and holding them in check (Lewis/









Illus 37 Marine molluscs: 1, the cone steepness in degrees; 2, the basal area in square mm; A is the deposit in the Neolithic levels associated with the [illegible] B is the deposit in the early Iron Age occupation

(Lewis 1964, 261), and this is also suggested by the L. littoralis and, from a lower zone, P. pellucida. The indicators of a heavy weed cover disappear in the Iron Age, and sand or muddy gravel-dwelling species assume a distinct presence. This is probably linked with the onset of sand movement in the waters of a clean, rocky and sheltered bay, as the appearance of blown sand is first noted on the site between the Neolithic and Iron Age.

Patina pellucida (Linné 1758). All specimens of the blue-rayed limpet, with the possible exception of the fragment from layer 23, are of the form laevis, which is associated with the holdfasts of the tangles (Laminaria sp.) on which it lives almost exclusively; all these animals start life as the form pellucida, on the fronds of the weed, and a proportion survive into a second year of life by migrating down the stalks (stipes) to the holdfast, where they alter shape and coloration in response to the different environment. Laminaria digitata especially tends to cast its fronds and with them any adherent animals. (Yonge 1976, 62). This weed is characteristic of the infra littoral, normally uncovered only at the lowest spring tides, but in winter storms cast vast quantities of it ashore. All specimens of P. p. laevis come from the collapse of the cairn's outer revetment and the construction of wall 21. The apex of a shell from the outer revetment proper is possibly the frond-dwelling variety, although poor shell preservation makes certain identification difficult.

Littorina littoralis (obtusata) (Linné 1758). One specimen of the flat winkle, from layer 22 (collapse of cairn's outer revetment) had been perforated by a 1.5mm diameter hole bored through the wall of the third whorl at the junction of the body-whorl and the spire, perpendicularly to the shell surface. A sample of flat winkle shells gathered from the east and west coasts of Westray showed that out of 229 littoralis, nine showed analogous damage, giving an incidence of just under 4% as cause of death, since this presumably indicates predation by muricids or naticids, both of which prey on their fellow molluscs by drilling through the shell and/

and reaping out the flesh. It is most likely to be the common dogwhelk, Nucella lapillus, as the perforations are nearly cylindrical and not rebated as with neticids (Monge 1949, 267). Thus the shell was presumably empty on arrival on site. Seven other flat winkles came from the same layer, and 26 out of 31 shells (84%) came from layers 20, 22 and 23. This gastropod is associated almost exclusively with the wracks of the mid-littoral above the Laminaria zone, living mainly on Fucus and Ascophyllum.

These concentrations of Patina pellucida and Littorina littorella would best be explained by the presence of quantities of seaweeds, carrying a remnant of their former mollusc populations, rotting down in situ or drying on the rubble and shedding the shells which had adhered to it throughout its collection and transport. Dried seaweed can be stored indefinitely, be readily ground down, and can be rehydrated very easily. The seaweeds Laminaria, Fucus and Ascophyllum spp are all edible to some extent by humans. However, domestic animals appear to relish it, especially cattle and sheep. The most prominent example of this occurs in Orkney, on North Ronaldsay, where the sheep eat little else. Evans has also suggested the presence of seaweed by the presence of P. pellucida and L. littorella in the middens at Knap of Howar and Buckquoy (Evans & Spencer 1977, 216; Evans 1978, 22). Here he suggests that it was being used as a manure. Its use as both a foodstuff and manure are attested by numerous historical and ethnographic examples (Fenton 1978).

Venerupis rhomboides (Pennant 1777) and Venerupis pullastra (Montagu 1803). These carpet-shells are quite edible, and burrow in muddy gravel and other soft substrates between tidemarks (and below). These were both found in the fill of the round-house well.

Ensis ensis (Linné 1758). Some of these specis could be the very similar E. arcuatus (Jeffreys 1865), but the poor condition and fragmentation of the shells prevent certain identification./

identification. In any case, the archaeological implications are not affected, as in their habits, appearance and edibility they are almost indistinguishable and are found living in mixed populations, burrowing near the lower tideline in soft substrates, particularly coarse sand.

NOTE TO SHELL REPORT

	W	A	D		W	H/B/V	D
Patina pellucida	75	20	5	Ostrea edulis	0	73	17
Litt littorea	72	20	8	Mytilus edulis	0	53½	46½
Nucella lapillus	71½	19	9½	Cerastoderma ed	0	45	55
Litt littoralis	63	34	3	Ensis siliqua	0	42½	57½
Patella vulgata	56	29	15	Pecten maximus	n d	-	-
Buccinum undatum	46	28	26	Venerupis rhomb	n d	-	-
Litt saxatilis	n d	-	-	Venerupis pulla	n d	-	-
	GASTROPODS				BIVALVES		

W = whole: A = apices: H/B/V = hinges/beaks/valves: D = debris: n d = no data

This table shows the relative state of fragmentation of the shells of the 14 species of marine molluscs found, expressed as a percentage of the total weight of shell of that species. The four species with no data were represented by a minimum number of one individual.

No complete pairs of bivalve shells were found. It is therefore not possible to compare them with the gastropods directly, and it is necessary to take the following factor into account when assessing the relative state of fragmentation of three of these species:

Ostrea has a thinly laminar, loosely compacted shell, any part of which, once detached from the relatively more solid part of the valve towards the hinge, would break down rapidly into papery fragments once removed from a soil matrix in which it had had time to be affected by decomposition processes. Hence its position at the top of the bivalve part of the table is a result of bias in recovery, and not a result of any inherent solidity in the shell.

The shell of Mytilus is affected in a rather similar way, as is that of Patina, although to a lesser extent.

Layers	1	2	3	4	5	6	7	8	9	10	11	12	13	18	19	20	21	22	14	15	16	17	23	24	25
Patella vulg		25	44		175	3632	39	203	683	2	1	74	5			7	17	741	7	12	20		13		
Patina pell																2	3	2					1		
L. littorea		2	11		20	65	5	5	13			3	7			7	5	13					10		
L. saxatilis																							1		
L. littoralis		1				1			1							7		14			2		5		
Nucella lap		1	1				2		1								2			1					
Buccinum und			1		1	4		1	1								2								
Mytilus ed					4	12	2	2	4				1				+	3		1					
Ostrea ed					2	3	+	1	1	+	+					2	1	2							
Pecten max					+	+	+		1																
Cerastoderma					2	2		1	2		1					2	+	+							
Venerupis rh							1																		
Venerupis pu							1																		
Ensis siliqua					1	3	+	1	1			+	+			+	2	2			+				
TOTAL		29	57		204	3722	50	214	708	2	2	77	13			27	32	777	8	15	28		30		
Land snails																									
Arianta arb		1																2							
Cepaea hort		2					5		1			10	12			7	12	14		3	1		8		

Table 18
The total numbers of marine molluscs and land snails recovered from each context (+ indicates the presence of a species)

The loss during recovery due to attrition can also be roughly calculated for those species with a larger MNI (say = 100).

If the debris of shells is assumed to represent the same shells as those counted as apices and hinges, when these are combined as a single weight and divided by the number of significant fragmentary shells (total MNI minus number of whole shells), the figure (average weight per shell) should be less than or equal to the weight of whole shells divided by the number of whole shells, and the difference, if any, expressed as a percentage of the average weight of the whole shells.

In the limpets from the site as a whole the shortfall among broken shells was found to be nearly 31%, and in the winkles, 36½%; species with a lower MNI were not treated, as a layer by layer plot for limpets showed that error became unacceptable below about 70 specimens.