12. STONE TOOLS AND FLAKING DEBRIS

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Introduction

The lithic collection reported here consists of 4,775 stone tool occurrences and an estimated 243,194 pieces of flaking debris. Analysis involves standardized methods applied in the past to many regional Plains Village collections obtained through comparable recovery techniques. Goals in this chapter include the following:

1. Describe and summarize the character of the chipped, ground, and otherwise utilized lithic materials in the site, focusing on variables related to raw material selection, reduction technology, artifact function, and artifact discard.
2. Explore specialized features and behavior in lithic artifacts such as recycling and reuse behavior, the purpose of bipolar reduction, and application of heat treatment.
3. Explore temporal changes in assemblage composition and selected lithic-oriented behavioral features within the Scattered Village sample.
4. Conduct intersite comparative analysis regarding, in particular, lithic data from components of similar age at nearby Slant Village (representing prehistoric Mandans) (Ahler et al. 1997), and, more generally, data from other sites in the Heart and Knife regions that may lie in the Mandan cultural tradition (Ahler and Smail 2000) and in the Hidatsa cultural tradition (Ahler and Toom 1993 and other reports).
5. Evaluate the probable ethnic association of cultural components at Scattered Village based on available lithic data.

The effort reported here involves substantial input from all authors. Eric Feiler analyzed and coded all of the stone tools reported here, with Ahler working closely with Eric in these tasks to ensure consistency with analysis and coding previously applied to several other Plains Village artifact samples. Ahler checked and corrected the encoded data set and database regarding errors and inconsistencies, occasionally reexamining specific artifacts. Chad Badorek and Monicque Christiansen analyzed and coded all of the flaking debris reported here. Monicque began this work in 1999 and coded about 90% of the flakes from Block 5 and 60% of the flakes from Block 1. Chad completed the flake coding during the following several months. Chad and Eric often worked simultaneously on stone tools and flakes, and they conferred frequently regarding raw material classifications to enhance consistency between these two data sets. At the completion of Chad's work, Ahler checked the flake data set and database and corrected any discernable errors and inconsistencies. Chad conducted all of the data entry work for both stone tools and flaking debris, a rather monumental task that he completed with efficiency. Ahler conducted intensive analysis of the resulting data sets and wrote the following chapter.

The methodology applied here has been adapted very closely from procedures used with many Plains Village and other collections from North Dakota (see Ahler et al. 1994). Much of the specific, relevant methodology has recently been described in detail for work conducted with the large aggregate of tools and flaking debris from nearby Slant Village (Ahler et al. 1997:261-268) and from sites along the Highway 1806 By-pass Project (Ahler and Smail 2000:117-127). A detailed discussion of methods used for flaking debris occurs in Appendix B.

Chipped Stone Flaking Debris

Sample Description and Material Source Locations

The studied flaking debris sample consists of an actual count of 124,046 flakes and an estimated count of 243,194 flakes from all time periods. Estimated counts are used in this analysis because sampling was involved during the sorting and coding of specimens in size grade G4. Sampling methods and procedures for estimating total number of flakes in Priority 1 excavated contexts are discussed in Appendix B. The size grade distribution of the total sample is shown by time period in Table 12.1. A small fraction of the sample (4.2%) comes from village contexts that cannot confidently be assigned to a specific temporal period (TP0); a miniscule fraction of the sample (n=87 flakes; 0.04%) are from previllage contexts (TP5). When discussing the entire village collection we include materials from TP0 through TP4. For certain purposes, we will frequently confine study and discussion to the village specimens that can be assigned to time periods TP1 through TP4.

Table 12.1. Actual and estimated count data by size grade for the analyzed chipped stone flaking debris sample from Scattered Village (32MO31), 1998 excavated collection.

Time	Actual Counts of Studied Flakes					Estimated Counts of Studied Flakes				
Period	G1	G2	G3	G4	Total	G1	G2	G3	G4	Total
TP0		40	1091	3265	4396		40	1091	9119	10250
TP1	5	405	7161	15398	22969	5	405	7161	55777	63348
TP2	12	622	12985	51968	65587	12	622	12985	106466	120085
TP3	6	259	3730	12874	16869	6	259	3730	28233	32228
TP4	1	122	2222	11793	14138	1	122	2222	14851	17196
TP5		1	4	82	87		1	4	82	87
Total N	24	1449	27193	95380	124046	24	1449	27193	214528	243194
%	.0	1.2	21.9	76.9	100.0	.0	.6	11.2	88.2	100.0

An initial step in analysis was to explore bias in classification of lithic raw material type due to the effects of size in very small flakes. Extremely small flakes, such as those in size G4, cannot be classified by raw material as accurately as larger flakes or artifacts of the same material due to a lack of diagnostic features as well as increased translucency and apparent color shift in very small specimens. We explore for such bias and recombine originally coded raw material classes into collapsed classes when data on flakes of all sizes are under discussion. In the case of Scattered Village, we made the decision to combine data for Knife River flint (the dominant type within the site) with data for yellow/light brown chalcedonies (type 9) and dark brown chalcedonies (type 10) that are easily confused with Knife River flint. Similarly, we combined data for definite silicified wood (type 52) with data for clear/gray chalcedonies (type 8) and moss agate (type 53). The methods we used to confirm sample bias and details of material class combinations are discussed in greater detail in Appendix B. In this chapter, we will be explicit regarding whether we are using data for combined raw material classes or for the "originally coded" raw material classes.

In Table 12.2 we present a summary of mass analysis data (count, cortex percentage, and weight data by size grade) for the combined raw material classes. We have further reorganized the type listing into three general groups, termed local fine-grained stones, local coarse-grained stones, and exotic fine-grained stones. Within each group, types are arranged in order of decreasing total flake frequency. In discussing the specific raw materials that occur in flaking, debris many of the comments that follow are equally relevant to these same stone types as they occur in stone tools at the site. Approximate source locations for the various types assigned to the fine-grained categories are shown in Figure 12.1. Knife River flint/brown chalcedonies (burned and unburned) makes up 56.8% of the total flake sample. Smooth gray TRSS makes up 17.9% of the sample. A third suite of materials including silicified woods and lighter colored chalcedonies/agate collectively make up an additional 15.4% of the total flake sample. Together, KRF, smooth gray TRSS, and the chalcedonies/silicified woods make up 90.0% of the total site flake sample.

We can explain a bit more about why these are considered to be locally available stone types, in addition to the fact that they are so abundant in the collection. KRF is obviously concentrated in the primary source area in Mercer and Dunn Counties, North Dakota (Ahler 1986a:Figure 12.2), and the nearest known quarry area is about 80 km (50 miles) west-northwest of Scattered Village in Mercer County. The natural distribution of KRF is much more extensive than the quarry area proper (Clayton et al. 1970), and the stone is known to occur in surface lag and alluvial deposits throughout parts of Oliver County (just 30-35 km north of Scattered) and Mercer, Dunn, and Stark counties, North Dakota. Furthermore, it is reasonable to assume that the stone has been transported through alluvial processes down the major drainages that originate in the natural source area (the Knife and Heart Rivers), and that it therefore occurs in alluvial gravels along the Missouri River near Scattered Village. This supposition is supported by the fact that medium-sized cobbles of KRF occur in some abundance in Missouri River terraces on the Cross Ranch in Oliver County, ND, and that KRF occurs as small cobble tools as far downstream as the Medicine Crow site in Buffalo County, South Dakota (Ahler 1995:71). Therefore, we conclude that KRF was locally available to Scattered Village residents in the form of pebbles and small cobbles, while somewhat larger pieces could have been obtained not a great distance from the village to the west-northwest. KRF flakes and tools in the study sample could readily represent a combination of very local as well as somewhat more distant sources.

Smooth gray Tongue River silicified sediment (TRSS) was discussed by Ahler (1977a) as naturally occurring primarily in southern Morton and Sioux counties on the west side of the Missouri River in North Dakota, due south of Scattered Village. Specific sources for this stone are still unknown to the authors, although it is rumored among archaeologists and geologists working in the state that natural deposits of good-quality smooth gray TRSS have been pinpointed at locations somewhere south of the city of Mandan. The evidence for it being local relative to Scattered Village is largely circumstantial or indirect. This stone type is dominant or prominent in many archaeological lithic collections of various ages observed along the Missouri

Table 12.2. Summary or raw mass analysis data for all chipped stone flaking debris, following collapsing of raw material classes and separation by burning, Scattered Village (32MO31), 1998 excavations.

	Count By Size Grade					% With Cortex by Size Grade				Weight by Size Grade, g				Ratio
Raw Material Type	1	2	3	4	Total	1	2	3	4	1	2	3	4	G4:G13
Local Fine Grained:														
unburned KRF/chal	3	318	8770	90615	99706	100.0	59.1	28.8	10.7	52.60	833.71	2928.19	2881.93	9.97
burned KRF/chal	2	297	6073	31936	38308	100.0	57.2	26.2	13.8	56.70	822.40	2211.64	1166.07	5.01
smooth gray TRSS	11	468	6099	36846	43424	100.0	68.6	36.6	15.7	271.80	1449.60	2287.08	1282.50	6.60
unburned wood/chal	1	66	2035	27704	29806	100.0	78.8	47.2	19.4	9.10	214.90	631.76	781.86	13.18
burned wood/chal		62	1210	6368	7640		79.0	58.1	29.8		192.50	438.28	216.56	5.01
Swan River chert		1		2	3		100.0		0.0		2.30		.06	2.00
Local Coarse Grained:														
coarse silcrete	5	129	746	2115	2995	60.0	62.0	34.6	20.4	291.60	743.30	395.13	114.47	2.40
metaquartzite		7	45	353	405		71.4	40.0	7.1		29.20	23.80	14.15	6.79
silt/lime/mud stone	1	1	38	170	210	100.0	100.0	18.4	4.1	21.50	3.10	16.60	5.07	4.15
granitic	1	1	9	60	71		100.0	11.1	41.7	38.40	11.60	8.30	2.56	5.45
basaltic		6	23	29	58		66.7	43.5	20.7		63.20	9.73	1.36	1.00
scoria		3	17	14	34		0.0	0.0	0.0		12.40	7.90	.73	0.70
other/unidentifiable		2	2	9	13		50.0	50.0	0.0		5.70	.60	.30	2.25
quartz			2	11	13				54.5			6.00	.56	5.50
compact sandstone			3	4	7			33.3				.80	.11	1.33
coarse sandstone			1		1			100.0				.30		-
Exotic Fine Grained:														
orthoquartzite		40	894	7425	8359		20.0	7.7	2.1		87.40	279.48	228.33	7.95
grn/yell/oth dendritic		17	380	3686	4083		17.6	5.8	1.4		43.10	110.38	119.64	9.28
porcellanite		10	244	2895	3149		40.0	14.8	5.9		20.60	63.65	92.43	12.37
red dendritic chert		10	258	2010	2278			5.8	1.1		22.00	70.92	68.15	7.50
misc. jasper/chert		4	132	1066	1202			13.6	6.1		13.80	47.92	37.12	7.84
White River Group		3	82	520	605			18.3	3.5		8.70	24.13	19.62	6.12
plate chalcedony		2	77	314	393		50.0	50.6	11.5		3.60	25.40	12.32	3.97
non-volcanic glass		1	46	280	327			2.2	2.1		1.20	16.50	16.47	6.09
obsidian			1	95	96			0.0	0.0			.50	3.47	95.00
Rainy Buttes silic. wd		1	5	1	7		100.0	60.0	0.0		6.40	5.60	.03	0.17
Turtle V. quartzite			1		1			100.0				1.40		-
Total	24	1449	27193	214528	243194									

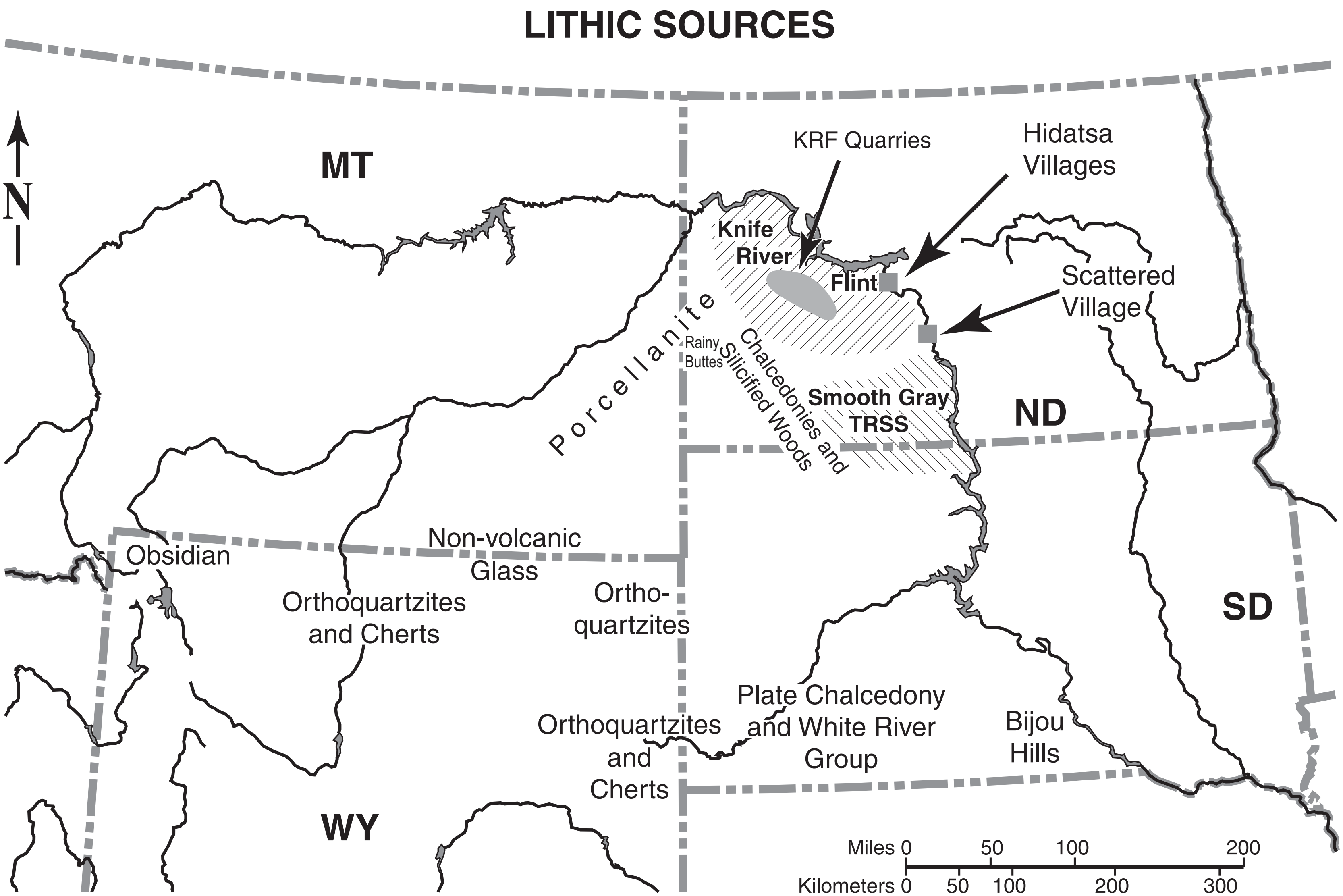

Figure 12.1. Approximate natural source locations for local and non-local fine-grained lithic raw material types in relation to Scattered Village (32MO31) and Hidatsa villages near the mouth of the Knife River.

River trench from Mobridge, South Dakota, to the mouth of the Heart River. Geologically related stone types (coarser versions of the silicified sediment) have been observed in lag deposits over an extensive area extending west of the Missouri River generally along the North Dakota-South Dakota state line (cf. Ahler 1977; Keyser and Fagan 1987). While some of the smooth gray TRSS occurring in project collections may have been transported from quarries some distance from the project area, other on-site pieces may have been obtained from surface contexts within a few km of the project area.

Chalcedonies and silicified woods are observed to be abundant in surface lag and alluvial deposits near several buttes in unglaciated southwestern North Dakota and adjacent regions of South Dakota, and these materials are assumed to occur relatively abundantly in the alluvial deposits of the major streams draining these areas (specifically the Heart, Little Heart, and Cannonball Rivers). The natural area of occurrence for such stones is thought to overlap to the east with the natural distribution of smooth gray TRSS and to overlap to the north with the natural distribution of KRF. Chalcedonies of this nature, in fact, generally form the second most common stone type (albeit, as a distinct minority) in sites directly in the KRF primary source area in Dunn County.

From what is understood of regional geology and bedrock sources for these three stone groups would suggest that KRF and chalcedonies, but probably not smooth gray TRSS, could be found in relative abundance but in small form in the gravels along the Heart River. It is perhaps meaningful to observe that all three groups of lithic types, while categorized as local, are better described as "near-local", meaning that they each can probably be found in greater abundance and quality at some distance (perhaps 30-60 km) from the village itself. Each stone group or type has its own "quality/abundance direction," or direction one must move from the village in order to obtain stone in better quality or abundance than might be available in an immediately local gravel bar. For KRF, this would be west-northwest, for the woods/chalcedonies west-southwest, and for smooth gray TRSS, south or south-southwest. In procuring stone from any of these directions, occupants of Scattered Village would need to take into consideration other resident villagers (or nomadic groups) who lived in or most frequently used the territory in each of these directions. For Scattered Village overall, the relative proportions of these three stone groups suggest a stronger quality pull or access to the west-northwest, with lesser emphasis on stone sources most concentrated in other directions.

Exotic fined grained stones are types with likely or certain sources at substantially greater distance from Scattered Village than 30-60 km. Probable source areas for these stones are shown on Figure 12.1. Together, stones from exotic sources comprise about 8.4% of the total flake sample, which is a relatively high figure compared to other assemblages in the area.

The orthoquartzite group almost without exception consists of high-quality, fine-grained, very knappable stone, with pink to light gray colors being most common in the Scattered collection. This material closely resembles the range of quartzites available in the Hartville uplift area (Reher 1991) as well as in several sources south of (solid quartzite in Ahler 1977a:136-137) and northwest of (Church 1996) the Black Hills in South Dakota and Wyoming. While the sources near and south of the Black Hills are probably the closest sources for the exotic jasper/cherts (see below) and orthoquartzites at Scattered Village, both stone types can also be obtained in abundance at more distant sources in mountainous areas in Wyoming and Montana, for example, in the Bighorn Mountains, the Pryor Mountains, etc. Orthoquartzite occurs naturally in a much wider array of colors than is seen in the Scattered collection, and individual outcrops of the stone are frequently dominated by a narrower range of colors. This color restriction within the site suggests that the stone of this type entering the village was derived from a relatively small number of specific outcrops, rather than from the full array of potential sources for this stone. This in turn may reflect a small number of actual procurement events associated with the stone at the site, or some other filtering process that tended to restrict the color variation reaching the village.

The second-most most abundant exotic stone is jasper/chert, which, as a general class makes up about 3.1% of the site flake sample. As a whole, this group most closely resembles cherts which are abundant in the Hartville Uplift area of eastern Wyoming (Reher 1991), and secondarily, it resemble cherts naturally available a short distance farther north in the Big Badlands area of South Dakota (cf. Ahler 1977:134). The majority of the jasper/cherts have black dendritic inclusions and are green, yellow, or greenish yellow in color. It is unclear where these particular stones are coming from; the Spanish Diggings contain stone of this color, but chert from the Schmidt chert mine in distant Montana also contains these same color grades. Like the exotic orthoquartzites, there appears to be a fairly narrow color range within the jasper cherts, again suggesting some filtering process regarding the range of such materials that entered the site (restricted time, or access limited to one or only a few actual sources).

Porcellanite and non-volcanic natural glass (Fredlund 1976; Frison 1974) are two geologically related stone types of coal-burn origin. Porcellanite (1.3% of the flake sample) is several times as abundant as the glass (0.13% of the sample), a pattern that is normal in village sites. Porcellanite occurs naturally in knappable quality deposits in the Little Missouri badlands in western North Dakota and apparently much more abundantly in deposits within the Powder, Tongue, and Yellowstone River drainages in Montana and Wyoming (Clark 1985). Non-volcanic natural glass is a high quality, vitreous sub-type of porcellanite and it is presumably much rarer and possibly more restricted in distribution. Natural deposits of this material are not known to the authors within western North Dakota, and it is thought to occur primarily within the upper Tongue River and middle Powder River drainages (Keyser and Davis 1981 cited in Clark 1985:41) where it is presumed to be associated with the most dense and extensive porcellanite deposits. Fredlund (1976) reports one non-volcanic glass source in Bighorn County, Montana.

White River group materials comprise 0.2% of the total flake sample. The closest known source for this stone, formerly described as Flattop chalcedony (Hoard et al. 1993; see Ahler 1977:134), is in the Big Badlands of South Dakota; slightly more distant sources occur in western Nebraska and eastern Colorado. Plate chalcedony (Ahler 1977:136) is a very distinctive stone that occurs in the Big Badlands of South Dakota (Porter 1962); a few hundred flakes of this material occur, comprising about 0.2% of the flake sample. Obsidian occurs predominantly in G4 size flakes and is rare in the site sample. The obsidian flakes are too small for accurate source analysis by non-destructive X-ray fluorescence techniques. All samples of obsidian from Missouri River sites tested so far derive from sources within or near Yellowstone Park, Wyoming (Ahler and Haas 1993:150-151). A very small number of flakes of Rainy Buttes silicified wood fracture (Loendorf, Kuehn, and Forsman 1984) and Turtle Valley quartzite occur in the sample; these are from very restricted sources west and southwest of the village.

In summary, Knife River flint is clearly dominant among the fine-grained, near-local stones and is more than twice as abundant as combined percentages of the other two nearly local stones (smooth gray TRSS and woods/chalcedonies). Exotic stones comprise a fairly large fraction of the total site flake sample (more than 8%). Among the exotics, types that can be obtained from the region near the Black Hills and Hartville Uplift area are collectively most common (orthoquartzites, dendritic cherts, White River group, and plate chalcedony); only porcellanite, nonvolcanic glass, and obsidian come from sources that almost certainly lie in a westerly rather than southwesterly direction from the site. Local, coarse-grained stones comprise less than 2% of the flake sample. A form of silcrete that grades into the smooth gray TRSS is the most common, and both materials were probably procured from the same near-local sources south of the site.

Previllage Component Flaking Debris

Scattered Village was established on a ground surface that had been exposed for ca. 2000 years and that probably experienced brief occupations by previllage age cultural groups. Direct evidence for such occupation is very scant, consisting primarily of a few Plains Archaic dart points that occur with the village artifacts, occasional patinated pieces of flaking debris scattered among the village deposits, one minor burn or hearth feature found well below the village deposits in Block 1 (Feature 181), and one small concentration of burned rock inadvertently discovered in a similar context in Block 3 (Feature 182). We excavated deep tests in Block 1 and Block 2, well below the extent of village horizons, to systematically sample cultural materials in those horizons. These tests recovered extremely few artifacts and, except for the existence of F181 in Block 1, revealed no clear evidence of substantial previllage age components. Table 12.3 shows the vertical distribution of flakes within the deep tests and with F182 in Block 3. A lack of vertical concentration of flakes is apparent. The eight flakes found directly within F182 are small (7 G4, 1 G3 flake) and include equal numbers of KRF and orthoquartzite specimens. The remaining 79 flakes in the deep tests are also small (>90% G4) and have a raw material composition that closely mimics that for the site as a whole (KRF ~50%, with various chalcedonies and smooth gray TRSS being next most common, and with occurrences of orthoquartzite and dendritic chert). It is very likely that most if not all of the flakes in these two tests reflect simply trickle down artifacts from the overlying artifact-rich village layers.

In addition to the 87 flakes discussed above, there are an additional 257 flakes with varying degrees of patination. The majority of these are moderately patinated (36%, and raw materials are predominately clear/gray chalcedony (n=145), yellow/light brown chalcedony (n=44) and KRF (n=32). It is very likely that these flakes derive from previllage age cultural deposits that existed at the site location when the village was established and have subsequently been incorporated into the village middens. These specimens are approximately equally distributed among all excavation blocks, with the exception of Block 8. It is significant that Block 8 was the only area where the village midden did not directly overlie remnants of the

Table 12.3. Distribution of flaking debris by 10-cm excavation level in deep tests in excavation blocks, Scattered Village (32MO31), 1998 excavations.

General Level	Block 1	Block 2	Block 3	Total N	Percent
10.0	2			2	2.3
11.0	3	20		23	26.4
12.0	5	3		8	9.2
13.0	4	6		10	11.5
14.0	9	3		12	13.8
15.0	7	0		7	8.0
16.0	6	2		8	9.2
17.0	3	3		6	6.9
18.0	3			3	3.4
Feature 182			8	8	9.2
Total N	42	37	8	87	
%	48.3	42.5	9.2	100.0	

previllage A soil horizon on which the village was built. In summary, flaking debris documents the probable existence of a minor previllage cultural component in the A horizon on which the village was built, with only very ephemeral cultural components occurring stratigraphically beneath that layer. From this point forward in the study of flaking debris, the deeper excavated samples as well as all patinated flakes will be considered to be part of these components, and will be excluded from general summaries of flaking debris data for the village as a whole.

Technological Analysis

Two approaches were used for technological analysis of flaking debris. The first was through flake typology which characterizes the mode of derivation of individual flakes. Because of the time-consuming aspects of flake typology, most of the typological classification was limited to larger, size grade G1 and G2 flakes. A limited, focused flake type study was conducted with G3 flakes. Flakes in these size ranges are derived predominantly if not exclusively from percussion reduction, and therefore inform us directly about percussion operations performed on-site with various raw materials. Most recovered pressure flakes fall in size grade G4, and typological study of flakes that excludes G4 specimens omits potentially important information related to pressure flaking operations that are probably most closely linked to tool finishing and sharpening behavior.

Flake type data for 1,081 G1-2 flakes are presented by raw material type in Table 12.4; the data are restricted to unburned flakes and to raw material types having six or more unburned specimens. In Table 12.4 we also present frequency of cortex data for these same flakes. In this data set we revert to the original, non-collapsed raw material categories, because size bias should not have affected classification of flakes in this size range. By far the most common types are simple flakes (those with two or fewer dorsal scars, reflecting early stage core reduction or tool production; 43% of the sample) and complex flakes (those with <3 dorsal scars, reflecting later stage core reduction or tool production; 35% of the sample). Shatter/chunks, which are not technologically distinctive but which tend to occur more commonly during cobble testing and core reduction, are next most common, making up 15% of the sample. Bifacial thinning flakes are decidedly less common (4.8% of the sample), and bipolar flakes make up an even smaller fraction (2.5%). Three polyhedral blades occur in the sample (0.3%). As a whole, this data set indicates a broad range of percussion reduction activities occurring on the site, with focus on early and late stage core reduction (simple and complex flakes), and with significant but lesser amounts of biface thinning and bipolar percussion activity.

The chi-square values for Table 12.4 indicate a strong non-random relationship between flake type and raw material type, and also between cortex occurrence and raw material type. Cells with adjusted standardized cell residual values of >+1.0 are highlighted for emphasis. The relative frequencies of all G1-2 flakes by raw material type (Table 12.4) also tell us something directly about the use of those stones, especially when considered in light of raw material breakdown for flakes of all sizes combined (as discussed above). Although it is the third most common material type in the site, smooth gray TRSS produced the greatest number of unburned large flakes, indicating that objects of this stone are probably entering the site in greater mean artifact size than objects made from other materials. This suggests a greater emphasis on early stage core reduction with smooth gray TRSS than with other stones. This is borne out by chi-square analysis and cell residual values (Table 12.4) that indicate that other simple flakes and cortical flakes (both indicators of early stage reduction) are significantly more common in smooth gray TRSS. Coarse silcrete, while comprising only about 1.2% of flakes of all sizes (Table 12.2), is the third most abundant stone in larger flakes (Table 12.4). This also indicates that this stone was entering the site in the form of larger pieces and cores, and that heavy percussion is primarily involved in reduction of this stone. This again is supported by unusually high frequencies of shatter and simple flake types – indicators of early stage reduction.

KRF, the most common raw material in the site, has the second greatest number of large flakes (behind smooth gray TRSS). This is partly due to exclusion of burned flakes in KRF (399 total in G1-2), but it also is a very clear indication that KRF artifacts were entering the site in a much smaller mean size than were objects made of smooth gray TRSS and even coarse silcrete. KRF is also characterized by emphasis on bifacial thinning, bipolar, and complex flakes, with a distinct lack of simple flakes, and with a relatively high frequency of non-cortical flakes. This pattern indicates that KRF was more heavily involved than several other raw materials in technologies involving late stage core reduction, biface reduction, and bipolar reduction.

Silicified wood, another stone type with substantial numbers of large flakes, exhibits a technological pattern that is distinct from KRF and other chalcedony-like stones. This material has unusually high frequencies of shatter and bipolar flakes, as well as cortical flakes. This suggests early stage work, perhaps focused use of bipolar reduction for this raw material, and movement of relatively unreduced pieces of wood onto the site. All this suggests fairly local procurement, little off-site reduction, and a reduction strategy for woods that is distinct from that for chalcedonies and KRF. No particularly consistent reduction patterns are evident in chalcedonies as a group. Clear/gray chalcedony is noted for higher incidence of bifacial thinning flakes, yellow/light brown for more shatter, and dark brown chalcedony for blades, complex, and bipolar flakes.

Table 12.4. Size grade G1 and G2 flakes. Cross-tabulation of flake type and presence/absence of cortex according to common raw material types (n>5), unburned flakes only, Scattered Village (32MO31), 1998 excavations. Data include counts (top), percentage (middle) and standardized cell residual values (bottom). Cell residuals >+1.0 are shaded.

	Flake Type						Cortex		
Raw Material Type	shatter/ chunk	bipolar	biface thinning	blade	other simple	other complex	absent	present	Total
smooth gray TRSS	55	8	12	1	239	164	147	332	479
Knife River flint	30	11	21	1	91	107	109	152	261
obvious silic. wood	13	4	2	0	16	16	8	43	51
clear/gray chalced	2	0	3	0	6	3	5	9	14
yell/lt brn chalced	8	0	2	0	9	14	9	24	33
dk brown chalced	1	2	0	1	6	17	12	15	27
orthoquartzite	3	0	4	0	11	22	32	8	40
all jasper/chert	2	1	6	0	4	14	24	3	27
porcellanite	0	0	1	0	3	6	6	4	10
coarse TRSS	41	1	1	0	70	20	50	83	133
basaltic	2	0	0	0	4	0	2	4	6
smooth gray TRSS	*11.5%*	*1.7%*	*2.5%*	*.2%*	*49.9%*	*34.2%*	*30.7%*	*69.3%*	*100.0%*
Knife River flint	*11.5%*	*4.2%*	*8.0%*	*.4%*	*34.9%*	*41.0%*	*41.8%*	*58.2%*	*100.0%*
obvious silic. wood	*25.5%*	*7.8%*	*3.9%*	*.0%*	*31.4%*	*31.4%*	*15.7%*	*84.3%*	*100.0%*
clear/gray chalced	*14.3%*	*.0%*	*21.4%*	*.0%*	*42.9%*	*21.4%*	*35.7%*	*64.3%*	*100.0%*
yell/lt brn chalced	*24.2%*	*.0%*	*6.1%*	*.0%*	*27.3%*	*42.4%*	*27.3%*	*72.7%*	*100.0%*
dk brown chalced	*3.7%*	*7.4%*	*.0%*	*3.7%*	*22.2%*	*63.0%*	*44.4%*	*55.6%*	*100.0%*
orthoquartzite	*7.5%*	*.0%*	*10.0%*	*.0%*	*27.5%*	*55.0%*	*80.0%*	*20.0%*	*100.0%*
all jasper/chert	*7.4%*	*3.7%*	*22.2%*	*.0%*	*14.8%*	*51.9%*	*88.9%*	*11.1%*	*100.0%*
porcellanite	*.0%*	*.0%*	*10.0%*	*.0%*	*30.0%*	*60.0%*	*60.0%*	*40.0%*	*100.0%*
coarse TRSS	*30.8%*	*.8%*	*.8%*	*.0%*	*52.6%*	*15.0%*	*37.6%*	*62.4%*	*100.0%*
basaltic	*33.3%*	*.0%*	*.0%*	*.0%*	*66.7%*	*.0%*	33.3%	66.7%	*100.0%*
smooth gray TRSS	*-1.7*	*-1.1*	*-2.3*	*-.3*	*2.5*	*-.4*	*-2.4*	*1.8*	
Knife River flint	*-1.3*	*1.8*	*2.4*	*.3*	*-1.9*	*1.5*	*1.2*	*-.9*	
obvious silic. wood	*2.1*	*2.4*	*-.3*	*-.4*	*-1.2*	*-.5*	*-2.5*	*2.0*	
clear/gray chalced	*.0*	*-.6*	*2.8*	*-.2*	*.0*	*-.9*	*-.1*	*.1*	
yell/lt brn chalced	*1.5*	*-.9*	*.3*	*-.3*	*-1.3*	*.7*	*-.9*	*.7*	
dk brown chalced	*-1.5*	*1.6*	*-1.1*	*3.4*	*-1.6*	*2.4*	*.6*	*-.5*	
orthoquartzite	*-1.2*	*-1.0*	*1.5*	*-.3*	*-1.5*	*2.1*	*4.4*	*-3.4*	
all jasper/chert	*-1.0*	*.4*	*4.1*	*-.3*	*-2.2*	*1.4*	*4.4*	*-3.4*	
porcellanite	*-1.2*	*-.5*	*.7*	*-.2*	*-.6*	*1.3*	*1.2*	*-.9*	
coarse TRSS	*4.9*	*-1.3*	*-2.1*	*-.6*	*1.8*	*-4.0*	*.0*	*.0*	
basaltic	*1.2*	*-.4*	*-.5*	*-.1*	*.9*	*-1.5*	*-.2*	*.1*	
Total N	157	27	52	3	459	383	404	677	1081
%	14.5%	2.5%	4.8%	.3%	42.5%	35.4%	37.4%	62.6%	100.0%
	Chi-Square = 180.220 DF = 50 p = .000						87.471 DF = 10 p = .000		

The three most common exotic stones (orthoquartzites, cherts [all varieties combined], and porcellanite) each reflect a high incidence of non-cortical flakes and complex flakes. In addition, the cherts and orthoquartzites have high relative frequencies of bifacial thinning flakes. These patterns are consistent with our perception of them as exotic stones, with cortex removal occurring at off-site locations, and with the materials entering the site in the form of bifaces as well as cores in advanced stages of preparation if not reduction.

A curious feature in the site sample is the relatively common occurrence of objects with bipolar technology in the stone tool/core category, opposed to the relatively low frequency of bipolar flakes among flaking debris. More than 600 tools/cores with bipolar technology occur, comprising more than 12% of the tool/core sample; non-bipolar cores are less than half as frequent. It is clear that bipolar percussion involving lithic items was a common behavior at the site, but it is not clear if such artifacts were involved in production of flakes or use of bipolar percussion as punching or wedging activities.

The relative low frequency of bipolar flakes (n=27, 2.5% of unburned G1-2 flakes; Table 12.4) suggests that bipolar activities were not directed toward core reduction and flake production. It is possible however, that flakes produced from bipolar cores were predominately smaller in size, and occurred in size G3 flaking debris rather than in G1-2 debris. To explicitly test this idea, a sample of 3,442 size G3 flakes from 34 individual catalog lots were studied and classified for flake typology. These flakes reflect a good cross section of the site flake sample (about 12.7% of all G3 flakes in the site), distributed about equally among four defined time periods.

Flake type frequency data for G3 flakes are tabulated by raw material type in Table 12.5, confining the study to the specific raw materials listed in Table 12.4 and to unburned specimens (n=2,055, nearly twice the sample of G1-2 flakes in Table 12.4). Strikingly, bipolar flakes are even less abundant, in a relative sense, among smaller flakes than among larger flakes (1.7% of G3 flakes; 2.5% of G1-2 flakes). If this figure of 1.7% is applied to the total sample of size G3 debris (n=27,193), then there are an estimated 450 G3 bipolar flakes in the collection. Even with the added G1-2 bipolar flakes, this is fewer than the number of bipolar cores/tools in the collection – i.e., it is less than one flake per tool/core. This indicates very strongly that bipolar lithic percussion activities at Scattered Village were not directed toward core reduction and flake production. The alternative is that bipolar objects were used as punches, wedges, or chisels. This subject will be dealt with again in the discussion of stone tools and tool function.

The data in Table 12.5 also are informative regarding the application of specific technologies to specific lithic raw material types. Because the total count of items in the table is larger than in Table 12.4, we have emphasized only cells having residual values >+2.0 in order to focus attention only on the strongest non-random patterns. The strongest non-random patterns regarding flake typology in size G3 flakes (Table 12.5) very closely parallel patterns for larger flakes in Table 12.4. This greatly strengthens any interpretations we might make from these data. Most specifically, we note that smooth gray TRSS and coarse silcrete have relative high frequencies of simple flakes, and shatter is also common in the latter stone, indicating greater use of early stage reduction in these two stone types. Knife River flint is in stark contrast, which

Table 12.5. Size grade G3 flakes. Cross-tabulation of flake type according to common raw material types, unburned flakes only, Scattered Village (32MO31), 1998 excavations. Data include counts (top), percentage (middle) and standardized cell residual values (bottom). Cell residuals >+2.0 are shaded.

	Flake Type					
Raw Material Type	shatter/ chunk	bipolar	biface thinning	other simple	other complex	Total
smooth gray TRSS	52	3	4	355	247	661
Knife River flint	28	25	27	268	326	674
obvious silic. wood	17	2	3	55	40	117
clear/gray chalced	5	2	0	51	43	101
yell/lt brn chalced	6	1	1	64	45	117
dk brown chalced	1	0	2	18	19	40
orthoquartzite	1	0	0	43	36	80
all jasper/chert	1	1	2	34	76	114
porcellanite	3	0	0	14	16	33
basaltic	0	0	0	2	0	2
coarse TRSS	23	0	1	82	10	116
smooth gray TRSS	*7.9%*	*.5%*	*.6%*	*53.7%*	*37.4%*	*100.0%*
Knife River flint	*4.2%*	*3.7%*	*4.0%*	*39.8%*	*48.4%*	*100.0%*
obvious silic. wood	*14.5%*	*1.7%*	*2.6%*	*47.0%*	*34.2%*	*100.0%*
clear/gray chalced	*5.0%*	*2.0%*	*.0%*	*50.5%*	*42.6%*	*100.0%*
yell/lt brn chalced	*5.1%*	*.9%*	*.9%*	*54.7%*	*38.5%*	*100.0%*
dk brown chalced	*2.5%*	*.0%*	*5.0%*	*45.0%*	*47.5%*	*100.0%*
orthoquartzite	*1.3%*	*.0%*	*.0%*	*53.8%*	*45.0%*	*100.0%*
all jasper/chert	*.9%*	*.9%*	*1.8%*	*29.8%*	*66.7%*	*100.0%*
porcellanite	*9.1%*	*.0%*	*.0%*	*42.4%*	*48.5%*	*100.0%*
basaltic	*.0%*	*.0%*	*.0%*	*100.0%*	*.0%*	*100.0%*
coarse TRSS	*19.8%*	*.0%*	*.9%*	*70.7%*	*8.6%*	*100.0%*
smooth gray TRSS	*1.2*	*-2.4*	*-2.5*	*2.1*	*-1.7*	
Knife River flint	*-2.5*	*4.1*	*3.8*	*-3.1*	*2.7*	
obvious silic. wood	*3.3*	*.0*	*.5*	*-.2*	*-1.3*	
clear/gray chalced	*-.7*	*.3*	*-1.4*	*.4*	*.1*	
yell/lt brn chalced	*-.6*	*-.7*	*-.8*	*1.0*	*-.6*	
dk brown chalced	*-1.0*	*-.8*	*1.4*	*-.3*	*.6*	
orthoquartzite	*-1.9*	*-1.2*	*-1.2*	*.7*	*.4*	
all jasper/chert	*-2.4*	*-.6*	*-.1*	*-2.8*	*4.1*	
porcellanite	*.5*	*-.7*	*-.8*	*-.5*	*.6*	
basaltic	*-.4*	*-.2*	*-.2*	*1.1*	*-.9*	
coarse TRSS	*5.5*	*-1.4*	*-.8*	*3.5*	*-5.5*	
Total N	137	34	40	986	858	2055
%	6.7%	1.7%	1.9%	48.0%	41.8%	100.0%

Chi-Square = 216.062 DF = 40 p = .000

suggests a combination of late stage tool/core reduction, biface reduction, and bipolar percussion with this stone type. Again, silicified wood exhibits a heavy concentration of shatter, indicating bipolar flakes, bifacial thinning flakes, and complex flakes being much more common in this stone. Again, this represents cobble/pebble testing and early stage work. Curiously, the exotic stones orthoquartzite and porcellanite show no particular pattern, while jasper/chert exhibits a high concentration of complex flakes as was seen in the large flaking debris.

In summary, flake type data are particularly informative about percussion reduction technologies performed on site and about the relationship between raw material type and reduction strategies. Smooth gray TRSS and coarse silcrete entered the site in the form of fairly large artifacts, and these particular raw materials were most frequently involved in early stage or less complex core reduction and less often in more refined or complex reduction strategies. In contrast, Knife River flint items entered the site in the form of somewhat small and more fully reduced, non-cortical artifacts. Percussion reduction strategies applied to KRF involved bipolar percussion, bifacial thinning, and later stage or more complex core reduction (perhaps prepared cores). Silicified wood is involved to some degree in bipolar reduction but also in knapping strategies that consistently leave a large amount of large and smaller size shatter. This suggests some on-site testing of woods, which overall, may not be as high a quality of stone as KRF and smooth gray TRSS. As one might expect for exotic stone types, such materials entered the site in relatively advanced stages of shaping and decortication. A substantial amount of orthoquartzite and jasper/cherts underwent biface reduction on the site, and it is reasonable to assume that these materials entered the site, in part, in the form of partially reduced bifaces. These two stones, along with porcellanite, were frequently involved in late stage reduction operations. The various chalcedonies exhibit diverse patterns of percussion reduction; the fact that no strong flake typology patterns are evident in these stones among smaller, G3 flakes suggests that quite diverse reduction strategies were used with all chalcedonies.

The mass analysis approach takes into account the full range of flake sizes in the recovered sample and the range of technologies that might be represented. Table 12.2 contains mass analysis data for all raw material types in the collection. Various studies of archaeological and experimentally derived mass analysis data (for example, Ahler 1989a:111-112) illustrate that two of these variables are particularly sensitive measures of both the relative stage in manufacture (reduction stage -- early vs. late) and the contrast in debris produced by percussion versus pressure techniques. These are the *percentage of cortical flakes in size grade G4 flakes,* and the *ratio of small to large flakes* (expressed as the count of G4 flakes divided by the count of G1-G3 flakes combined). A simple bivariate scatterplot of these two variables has proven to be a very powerful interpretive tool. Data for these two variables are plotted in Figure 12.2 for the six most abundant raw material classes (unburned, collapsed material classes are used).

Virtually all flake samples in the collection, and particularly site-wide aggregates, can be considered to derive from a mix of technologies. The mass analysis method and the scatterplot display does not isolate discrete technologies, but it does allow ready comparison of one sample or raw material to the next regarding the nature of the mix. Relative positions within the scatterplot can indicate significant differences in the overall composition of a sample. In Figure 12.2 the ratio of small to large flakes is plotted on the horizontal axis. Flakes with a larger ratio,

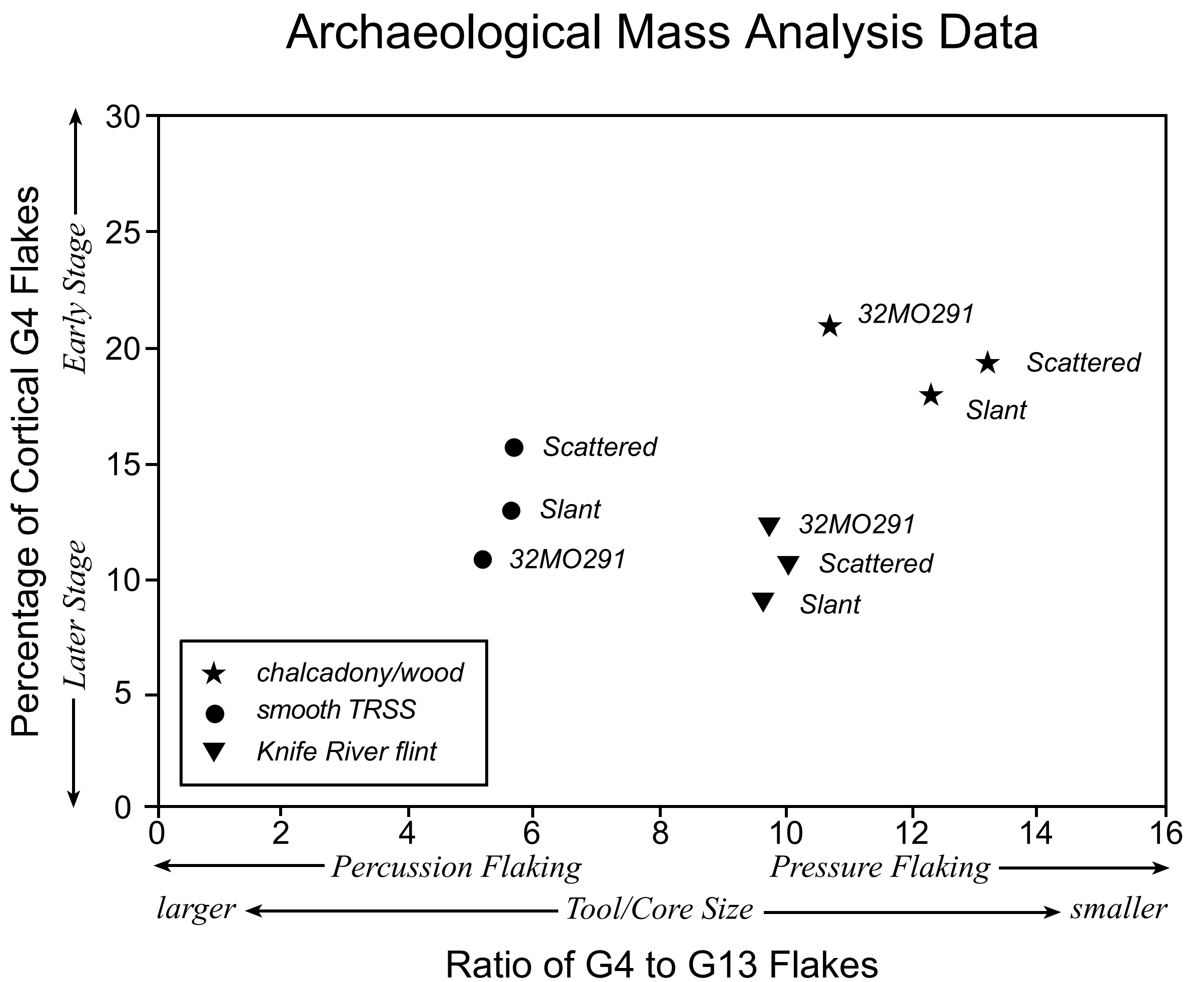

Figure 12.2. Scatterplot of flake ratio and cortex data for specific raw material types, illustrating technological variation according to material type at Scattered Village (32MO31, 1998 excavations.

with proportionately more very small flakes, reflect a greater relative importance of some combination of pressure flaking (producing only small flakes) and reduction of artifacts of small size (in which case the artifact or core size constrains the size of flakes that can be produced). The percentage of G4 cortical flakes is plotted on the vertical axis. This is a very direct measure of reduction stage. Flakes, large or small, that derive from initial stages of reduction of a cortex-bearing cobble will have higher proportions of cortical flakes; as reduction progresses, cortex will be removed from the nucleus and cortex-bearing flakes will be progressively less common.

By simply observing relative positions of mass analysis data plots for different raw materials we can learn a great deal about how different raw materials were used on site (Figure 12.2). The two raw materials with the greatest percentage of cortical flakes are coarse silcrete and the clear/gray chalcedony-silicified wood groups; each has slightly more than 20% cortical flakes. This indicates rather strongly that both of these types entered the site in the form of cobbles or raw material pieces that had seen relatively little prior reduction. These two stone types, however, are maximally separated along the horizontal axis in the plot, differing greatly in relative abundance of very small flakes. This suggests a marked difference in original cobble size for these two materials, with coarse silcrete entering as relatively large pieces and with the woods/chalcedonies entering as very small pieces. Pressure flaking or other late stage trimming work could contribute to the large number of small flakes in woods/chalcedonies, but not to a great degree given the high frequency of cortex in the smallest flakes. It is suggested that the woods/chalcedonies were procured and reduced very little away from the village; many small, whole cobbles (even pebbles) were probably carried directly onto the site for flaking and use as needed. This also suggests that the woods/chalcedonies are truly a locally available resource.

One need only examine the mass analysis data plot for orthoquartzites and jasper/chert to see a very contrastive situation. Both material types have extremely low percentages of cortex, indicating that artifacts entered the site in highly reduced form. The flake ratio is intermediate between the woods/chalcedonies and the coarse silcrete. This indicates that a substantial combination of both percussion work and pressure work was used with these materials, and also that original artifact size at time of site entry was moderate (overall, larger than the pieces of wood/chalcedony). Porcellanite, another exotic stone, also has a relatively low percentage of cortex but also has a substantially higher small flake ratio. This indicates late stage work with small tools, with a high probability of pressure flaking.

KRF is distinguished by a relative high flake ratio and an intermediate percentage of cortex. Mixed technologies with substantial amounts of small tool, late stage core reduction is indicated. Smooth gray TRSS, one of the three prominent near-local stones in the site, exhibits a much lower flake ratio and a higher percentage of cortex. Early stage reduction, a higher proportion of percussion work, and larger tool/core size is indicated, especially when compared to KRF/brown chalcedonies.

In summary, the flake typology and mass analysis approaches provide complementary information about reduction technologies performed on-site and specific reduction strategies for common raw materials. Smooth gray TRSS entered the site in largest initial artifact form, and in relative unreduced form (cobbles, early stage bifaces, useful cores) and experienced proportionately more percussion reduction than other common stone types. KRF frequently entered the site as partially finished and probably fairly complex artifact forms (bifaces with advanced reduction, patterned or complex cores), as items somewhat smaller in initial size than smooth gray TRSS artifacts, and was differentially selected for bipolar percussion operations (albeit, in very low overall frequency). Silicified woods and chalcedonies entered the site in the form of relatively small cobbles and pebbles, in fairly unreduced state; on-site, these materials were reduced through a combination of smaller-scale, light percussion operations (trimming and shaping) and very light percussion and pressure flaking. The exotic materials orthoquartzite and jasper/cherts (mostly dendritic) entered the site as sizeable but highly flaked bifaces and cores with complex flaking patterns. On-site they were reduced by further bifacial thinning and core reduction operations, in addition to trimming and pressure flaking. Bipolar reduction for flake production was a relatively insignificant aspect of lithic reduction behavior with all of these raw materials. Although bipolar percussing activities did commonly occur, they were rarely directed toward core reduction and production of useable flakes.

Temporal Change in Flaking Debris

We examine data concerning burning, lithic raw material types, flake technological types, and mass analysis data for variation according to time period units for village occupations within the Scattered Village sample. It can be reiterated that the time units are, from oldest to youngest, Period 4= AD 1550-1660 (with atypical ceramics); Period 3 = 1550-1600; Period 2 = 1600-1650; and Period 1 = 1650-1700. Burning is common in flaking debris in all time periods, averaging 26% within KRF, woods, and chalcedonies in which burning is readily detectable. The relative proportion of burning varies by time period, from ca. 25% in Periods 1, 2, and 4, to ca. 33% in Period 3. While statistically significant, this variation is probably largely a byproduct of sampling variation and depositional context.

Raw material frequencies in flaking debris are arrayed by time period in Table 12.6 for the entire site sample. The chi-square analysis (p=.000) and table cell residual values indicate very significant shifts in raw material type frequencies through time. Specific raw materials are organized in the table with the most common, near-local types first, exotic types next, and with all coarse local stone combined into a single class. Regarding the common, near-local classes, there is a general decrease in the use of KRF/brown chalcedony through time (with a slight rebound in its use in the latest time period. Concomitantly, there is a strong tendency for woods/chalcedonies to be used more commonly in later periods (1 and 2). Smooth gray TRSS shows a strong, punctuated increase in Period 2. Coarse local stone shows a consistent increase in use through time, culminating in maximum level of occurrence in the latest period.

Exotic stones exhibit some significant time trends, as well as patterns that are specific to certain periods. Period 4 stands apart as marked by an interesting combination of Swan River chert, Rainy Buttes silicified wood (both are rare types), non-volcanic glass, obsidian, and red dendritic chert. As a stone more likely to occur in eastern North Dakota, we were interested in tracking Swan River chert as a possible marker for Hidatsa groups who may have migrated from the east. It is of interest that flakes of this stone occur only in the Period 4 samples. Three of the other four types that distinguish Period 4 are of interest because they have a distinct and common source directionality with regard to the village – all occur in what are probably fairly restricted sources on a pathway west and west-southwest of the village. These patterns suggest geographically focused access to distant raw materials in Period 4, and a pattern differing from those in later periods.

Red dendritic chert, miscellaneous cherts, and, especially, green/yellow/other dendritic cherts are markedly more abundant in Period 3. The latter two types also show increased occurrence in Period 1. For Period 2, only a single exotic stone stands out, this being porcellanite (three times as abundant as it was in previous periods). Period 1 is marked by a very interesting suite of exotic stone types, in addition to the cherts just mentioned. Orthoquartzite,

Table 12.6. Frequency distribution of raw material types by time period, Scattered Village (32MO31), 1998 excavations. Data include counts (top), percentages (middle), and standardized cell residual values (bottom). Cell residual values >+2.0 are shaded.

	TP1	TP2	TP3	TP4	Total
KRF/brown chalcedony	36317	66459	18951	10728	132455
smooth gray TRSS	9487	23903	4999	2606	40995
silic. wood/chalced/agate	9955	18851	4689	2217	35712
Swan River chert	0	0	0	3	3
obsidian	14	46	12	11	83
Rainy Buttes silic wood	0	4	0	2	6
non-volcanic natural glass	52	101	20	142	315
red dendritic chert	555	801	578	253	2187
misc. jasper/chert	362	449	280	58	1149
green/yell/oth dend. chert	1176	1625	930	224	3955
porcellanite	844	1921	157	111	3033
orthoquartzite	2476	3814	1160	642	8092
White R. group	317	263	10	12	602
plate chalcedony	200	139	24	4	367
coarse local & misc.	1531	1563	386	167	3647
KRF/brown chalcedony	*57.4%*	*55.4%*	*58.9%*	*62.4%*	*56.9%*
smooth gray TRSS	*15.0%*	*19.9%*	*15.5%*	*15.2%*	*17.6%*
silic. wood/chalced/agate	*15.7%*	*15.7%*	*14.6%*	*12.9%*	*15.4%*
Swan River chert	*.0%*	*.0%*	*.0%*	*.0%*	*.0%*
obsidian	*.0%*	*.0%*	*.0%*	*.1%*	*.0%*
Rainy Buttes silic wood	*.0%*	*.0%*	*.0%*	*.0%*	*.0%*
non-volcanic natural glass	*.1%*	*.1%*	*.1%*	*.8%*	*.1%*
red dendritic chert	*.9%*	*.7%*	*1.8%*	*1.5%*	*.9%*
misc. jasper/chert	*.6%*	*.4%*	*.9%*	*.3%*	*.5%*
green/yell/oth dend. chert	*1.9%*	*1.4%*	*2.9%*	*1.3%*	*1.7%*
porcellanite	*1.3%*	*1.6%*	*.5%*	*.6%*	*1.3%*
orthoquartzite	*3.9%*	*3.2%*	*3.6%*	*3.7%*	*3.5%*
White R. group	*.5%*	*.2%*	*.0%*	*.1%*	*.3%*
plate chalcedony	*.3%*	*.1%*	*.1%*	*.0%*	*.2%*
coarse local & misc.	*2.4%*	*1.3%*	*1.2%*	*1.0%*	*1.6%*
KRF/brown chalcedony	*1.5*	*-7.0*	*4.6*	*9.6*	
smooth gray TRSS	*-15.8*	*19.0*	*-9.0*	*-7.7*	
silic. wood/chalced/agate	*2.4*	*3.2*	*-3.6*	*-8.2*	
Swan River chert	*-.9*	*-1.2*	*-.6*	*5.9*	
obsidian	*-1.8*	*.5*	*.2*	*2.0*	
Rainy Buttes silic wood	*-1.3*	*.5*	*-.9*	*2.3*	
non-volcanic natural glass	*-3.6*	*-4.8*	*-3.6*	*24.6*	
red dendritic chert	*-1.6*	*-9.7*	*15.8*	*7.2*	
misc. jasper/chert	*2.8*	*-5.9*	*9.6*	*-2.9*	
green/yell/oth dend. chert	*3.0*	*-9.2*	*16.4*	*-4.0*	
porcellanite	*.7*	*9.0*	*-12.8*	*-7.6*	
orthoquartzite	*5.8*	*-5.6*	*1.2*	*1.8*	
White R. group	*12.0*	*-2.7*	*-8.0*	*-4.9*	
plate chalcedony	*10.0*	*-3.7*	*-3.8*	*-4.4*	
coarse local & misc.	*17.1*	*-7.3*	*-5.3*	*-6.2*	
Total N	63286	119939	32196	17180	232601
%	100.0%	100.0%	100.0%	100.0%	100.0%

White River group, and plate chalcedony are particularly abundant. Interestingly, all these stones can be found in sources in relatively close proximity to one another within and just east of the Black Hills, South Dakota.

Overall time trends in exotic stones, therefore, show a focus on several western sources early in time, a shift to increased emphasis on several kinds of dendritic cherts, then a shift in later periods to increased use of porcellanite, and finally, in the latest period, increased use of a suite of materials from sources distinctly farther south in western South Dakota or nearby areas. These patterns strongly suggest shifting zones of either movement out of Scattered Village or directions of interaction for the village.

Technological differences in flaking debris can be explored in part through study of flake typology. Flake type frequency was tabulated by time period for each of the most common, near-local raw material classes. Smooth gray TRSS and woods/chalcedonies show some modest time trends but a lack of overall statistical significance. KRF shows a statistically significant shift in flake type through time. The trend in KRF is mimicked in the other stone types, so the best expression of these technological trends is achieved by simply combining data across all of the common, near-local fine grained stone types, as shown in Table 12.7. One strong time trend is apparent, this being an increase in occurrence of bipolar flakes through time. Although analysis discussed above indicates that bipolar reduction for flake production is not a major activity at the

Table 12.7. Cross-tabulation of flake type for G1-2 flakes and collapsed raw material classes according to time period, Scattered Village (32MO31), 1998 excavations. Data include counts (top), percentages (middle), and standardized cell residual values (bottom). Cell residual values >+1.0 are shaded.

Time Period		Flake Type						
		shatter	bipolar	bifacial	blade	simple	complex	Total
TP1		31	18	7	0	77	90	223
TP2		52	4	23	1	181	147	408
TP3		16	2	5	2	73	51	149
TP4		8	0	5	0	27	27	67
TP1		*13.9%*	*8.1%*	*3.1%*	*.0%*	*34.5%*	*40.4%*	*26.3%*
TP2		*12.7%*	*1.0%*	*5.6%*	*.2%*	*44.4%*	*36.0%*	*48.2%*
TP3		*10.7%*	*1.3%*	*3.4%*	*1.3%*	*49.0%*	*34.2%*	*17.6%*
TP4		*11.9%*	*.0%*	*7.5%*	*.0%*	*40.3%*	*40.3%*	*7.9%*
TP1		*.5*	*4.6*	*-1.1*	*-.9*	*-1.8*	*.8*	
TP2		*.1*	*-2.2*	*.9*	*-.4*	*.7*	*-.4*	
TP3		*-.7*	*-1.1*	*-.8*	*2.0*	*1.3*	*-.6*	
TP4		*-.2*	*-1.4*	*1.0*	*-.5*	*-.2*	*.4*	
Total	N	107	24	40	3	358	315	847
	%	12.6%	2.8%	4.7%	.4%	42.3%	37.2%	100.0%

Chi-Square = 45.69182 DF = 15 P = .00006 site, these data show that such activities, while uncommon, did increase markedly during the latest time period. The earliest period (4) is marked by a high relative frequency of bifacial thinning flakes, and Period 3 has greater occurrence of blades and simple flakes (Table 12.7).

Temporal shifts in reduction technology expressed in flaking debris can also be explored in mass analysis data. In this study, we restrict analysis to the three abundant near-local fine-grained stone groups that capture the majority of stone reduction behavior occurring on the site. Table 12.8 contains data for two key variables arrayed by time period. For KRF, no clear or significant changes by time period are apparent. Flake ratio increases slightly then decreases, but the changes are not great; the percentage of G4 cortical flakes shows little temporal variation. For smooth gray TRSS, a slight but possibly meaningful temporal trend can be noted. Flake ratio tends to increase slightly through time, with the Period 1 value being about 30% higher than the Period 4 value. At the same time, the relative frequency of cortex is greater in later periods than in earlier periods. This suggests no dramatic change in the way this stone was used, but possibly a slight shift toward the use of progressively smaller pieces of stone through time. Because frequency of cortex increases through time, this possibly indicates the incorporation of more, small, cortical pieces into the site deposit later in time, and a slight shift away from introduction of larger, partially reduced cores into the site. This may reflect more restricted access to higher quality, southern sources of smooth gray TRSS later in time.

Table 12.8. Mass analysis data for major raw material types and by time period for Scattered Village (32MO31), 1998 excavations.

	G4-G13 Flake Ratio					Percent G4 Cortical Flakes				
Raw Material Type	TP1	TP2	TP3	TP4	All	TP1	TP2	TP3	TP4	All
KRF	10.08	10.33	10.34	9.43	9.97	10.8	10.9	9.7	10.2	10.7
Smooth Gray TRSS	6.26	5.47	5.77	4.45	5.59	16.0	16.8	11.9	14.9	15.7
Woods/Chalcedonies	12.20	14.16	13.08	10.41	13.18	18.9	18.9	21.6	22.0	19.4

For woods/chalcedonies, reduction patterns remain relatively constant through time. Flake ratio tends to rise slightly then drop off, and percentage cortical flakes decreases slightly through time. It is difficult to interpret these changes as any kind of substantial shift in reduction strategy for this stone; these changes are overshadowed largely by the contrast between data for this stone type and the other two stone types. In summary, mass analysis data indicate that continuity in the pattern of use of each stone type is much more the rule than is change in use of these materials. Some trend in the use of smooth gray TRSS toward inclusion of smaller, yet more cortical pieces is apparent, but this is a minor variation within the overall themes of reduction consistently applied to each stone type throughout the history of site occupation.

Intersite Comparisons

It is useful to compare the raw material composition and technological characteristics of the Scattered Village flake sample to comparably collected data sets from nearby sites. For these purposes, useful data are available from excavations at Slant Village (32MO26) (Ahler et al. 1997) and from site 32MO291 in the Highway 1806 By-Pass Project (Ahler and Smail 2000). For such comparisons data are collapsed across time periods (1-4) for Scattered Village; data are restricted to Periods 2 and 3 only for Slant Village (ca. AD 1575-1725 – most comparable to

Scattered Village); and data for the whole site are used for 32MO291, falling in a chronological period (ca. AD 1415-1460) distinctly earlier than either Scattered Village or Slant Village.

Raw material frequency data for each comparative sample are displayed in Table 12.9. With a total table flake count of more than 320,000 specimens, chi-square analysis predictably yields significant results. High positive cell residual values are highlighted to emphasize the strongest and most contrastive patterns in the data. Regarding near-local fine grained stones (the three classes are collapsed in a fashion similar to that used for the Scattered data, as discussed above), site 32MO291 stands apart due to its much greater emphasis on smooth gray TRSS. Scattered and Slant also differ substantially from each other, in that Scattered Village has a greater use of KRF/brown chalcedony, and an especially greater use of woods/chalcedonies. At Scattered, diminished use of smooth gray TRSS is apparently traded off against much greater use of woods/chalcedonies. Scattered Village also stands apart from the other two sites with regard to a much higher frequency of coarse, local stone, although this remains a minor category at all three sites.

Distinct differences exist in use of exotic stone types at the three sites. Porcellanite is the only exotic stone used in any frequency at site 32MO291, and this site stands apart from the other two, later settlements due to the overall rare occurrence of exotic material of any kind. The arrays of exotic raw material for Scattered Village and Slant Village are very similar, with the main difference between the sites being the significantly high relative occurrence of all of these types (except non-volcanic glass) at Scattered Village. White River group materials may not have been consistently recognized at Slant Village, but this possibility aside, Scattered Village exhibits consistently higher relative abundance of orthoquartzite, jasper/chert, porcellanite, and plate chalcedony than in comparison to Slant Village. This suggests that, overall, residents of Scattered Village were more involved than were residents of Slant Village in processes leading to procurement of stone from distant areas to the west and southwest.

Technological composition of flaking debris samples was compared among sites using both flake type data as well as mass analysis data. Flake typology data displayed in Table 12.10 were restricted to unburned, G1-2 flakes in the two most abundant raw material types in each site. Some interesting contrasts are apparent. Site 32MO291 stands apart from the other two settlements in terms of much higher frequencies of complex flakes in both raw material classes. This probably indicates a generally greater emphasis on complex or patterned core reduction in both material types. Slant Village stands apart by having greater relative abundance of bifacial thinning flakes in both raw material types. At all sites, KRF is more heavily involved in bifacial thinning than is smooth gray TRSS, and the degree of emphasis on this technology at Slant Village is a matter of a two-fold increase in percentage values (Table 12.10). Finally, we can note that Scattered Village stands apart from the other two in terms of relative abundance of bipolar flakes. Bipolar technology is rare at all three sites, and we have already noted that extremely little bipolar core reduction was actually occurring at Scattered; nonetheless, bipolar activity is more prominent at Scattered than elsewhere.

Table 12.9. Comparison of raw material type occurrence in flaking debris for Scattered Village and two other Heart region sites. Data include counts (top), percentages (middle), and standardized cell residual values (bottom). Cell residual values >+3.0 are shaded.

		Site			
Raw Material Type		32MO31 Periods 1-4 AD 1550-1700	32MO26 Periods 2-3 AD 1575-1725	32MO291 Periods 1-3 AD 1415-1460	Total
KRF/brown chalcedony		132455	32863	10268	175586
smooth gray TRSS		40995	18544	16328	75867
silic. wood/chalcedonies		35712	4250	1379	41341
orthoquartzite		8092	1391	30	9513
jasper/chert		7291	1693	48	9032
porcellanite		3033	96	292	3421
non-volcanic glass		315	335	1	651
White R. Group		602	4	0	606
plate chalcedony		367	45	8	420
obsidian		83	14	3	100
Swan R. chert		3	3	0	6
Rainy Buttes silic wood		6	0	0	6
coarse local stones		3647	565	92	4304
KRF/brown chalcedony		*56.9%*	*55.0%*	*36.1%*	*54.7%*
smooth gray TRSS		*17.6%*	*31.0%*	*57.4%*	*23.6%*
silic. wood/chalcedonies		*15.4%*	*7.1%*	*4.8%*	*12.9%*
orthoquartzite		*3.5%*	*2.3%*	*.1%*	*3.0%*
jasper/chert		*3.1%*	*2.8%*	*.2%*	*2.8%*
porcellanite		*1.3%*	*.2%*	*1.0%*	*1.1%*
non-volcanic glass		*.1%*	*.6%*	*.0%*	*.2%*
White R. Group		*.3%*	*.0%*	*.0%*	*.2%*
plate chalcedony		*.2%*	*.1%*	*.0%*	*.1%*
obsidian		*.0%*	*.0%*	*.0%*	*.0%*
Swan R. chert		*.0%*	*.0%*	*.0%*	*.0%*
Rainy Buttes silic wood		*.0%*	*.0%*	*.0%*	*.0%*
coarse local stones		*1.6%*	*.9%*	*.3%*	*1.3%*
KRF/brown chalcedony		*14.5*	*.8*	*-42.5*	
smooth gray TRSS		*-59.7*	*37.0*	*117.1*	
silic. wood/chalcedonies		*33.2*	*-39.4*	*-37.8*	
orthoquartzite		*14.4*	*-9.1*	*-28.0*	
jasper/chert		*9.2*	*.2*	*-26.6*	
porcellanite		*11.1*	*-21.4*	*-.7*	
non-volcanic glass		*-7.2*	*19.4*	*-7.5*	
White R. Group		*7.8*	*-10.3*	*-7.3*	
plate chalcedony		*3.6*	*-3.8*	*-4.8*	
obsidian		*1.2*	*-1.1*	*-2.0*	
Swan R. chert		*-.6*	*1.8*	*-.7*	
Rainy Buttes silic wood		*.8*	*-1.1*	*-.7*	
coarse local stones		*9.4*	*-8.4*	*-14.8*	
Total	N	232601	59803	28449	320853
	%	72.5%	18.6%	8.9%	100.0%

Table 12.10. Cross-tabulation of flake type for Scattered Village and two sites in the Heart region, controlling for raw material type. Data include counts (top), percentages (middle), and standardized cell residual values (bottom). Cell residual values >+1.0 are shaded.

Flake Type	Smooth Gray TRSS 32MO31 Period 1-4 AD 1550-1700	Smooth Gray TRSS 32MO26 Period 2-3 AD 1575-1725	Smooth Gray TRSS 32MO291 Period 1-3 AD 1415-1460	Smooth Gray TRSS Total	Knife River Flint 32MO31 Period 1-4 AD 1550-1700	Knife River Flint 32MO26 Period 2-3 AD 1575-1725	Knife River Flint 32MO291 Period 1-3 AD 1415-1460	Knife River Flint Total
shatter/chunk	55	29	37	121	30	19	3	52
bipolar	8	0	0	8	11	2	0	13
biface thinning	12	10	8	30	21	16	2	39
blade	1	0	0	1	1	0	0	1
other simple	239	117	118	474	91	33	25	149
other complex	164	94	132	390	107	31	31	169
shatter/chunk	*11.5%*	*11.6%*	*12.5%*	*11.8%*	*11.5%*	*18.8%*	*4.9%*	*12.3%*
bipolar	*1.7%*	*.0%*	*.0%*	*.8%*	*4.2%*	*2.0%*	*.0%*	*3.1%*
biface thinning	*2.5%*	*4.0%*	*2.7%*	*2.9%*	*8.0%*	*15.8%*	*3.3%*	*9.2%*
blade	*.2%*	*.0%*	*.0%*	*.1%*	*.4%*	*.0%*	*.0%*	*.2%*
other simple	*49.9%*	*46.8%*	*40.0%*	*46.3%*	*34.9%*	*32.7%*	*41.0%*	*35.2%*
other complex	*34.2%*	*37.6%*	*44.7%*	*38.1%*	*41.0%*	*30.7%*	*50.8%*	*40.0%*
shatter/chunk	*-.2*	*-.1*	*.4*		*-.4*	*1.9*	*-1.6*	
bipolar	*2.2*	*-1.4*	*-1.5*		*1.1*	*-.6*	*-1.4*	
biface thinning	*-.5*	*1.0*	*-.2*		*-.6*	*2.2*	*-1.5*	
blade	*.8*	*-.5*	*-.5*		*.5*	*-.5*	*-.4*	
other simple	*1.2*	*.1*	*-1.6*		*-.1*	*-.4*	*.8*	
other complex	*-1.4*	*-.1*	*1.9*		*.3*	*-1.5*	*1.3*	
Total N	479	250	295	1024	261	101	61	423
Total %	46.8%	24.4%	28.8%	100.0%	61.7%	23.9%	14.4%	100.0%
Chi-Square =	20.940	DF = 10	p = .02151		22.660	DF = 10	p = .01207	

Mass analysis data regarding small-to-large flake ratios and percentage cortex in G4 flakes are provided for each site and for the three most abundant raw material types (original categories are collapsed according to the procedures described above) in Table 12.12. This information is perhaps better understood in the form a scatterplot, as shown in Figure 12.3. What is apparent is that there is very little difference, from site-to-site, in terms of how these three raw materials were being reduced. This is indicated by the tight clustering of plot data according to raw material type. The most apparent difference among sites occurs in a moderately lower flake ratio for woods/chalcedonies for site 32MO291. This suggests more use of percussion reduction in this stone type, and/or use of slightly larger pieces of raw material in this stone type at site 32MO291. Overall, it appears that the raw material itself strongly condition the specific reduction strategies applied to each stone type, regardless of specific village or temporal context. Important factors that varied from stone to stone and that were relatively constant across sites probably included both package or raw cobble size and shape, as well as distance to source.

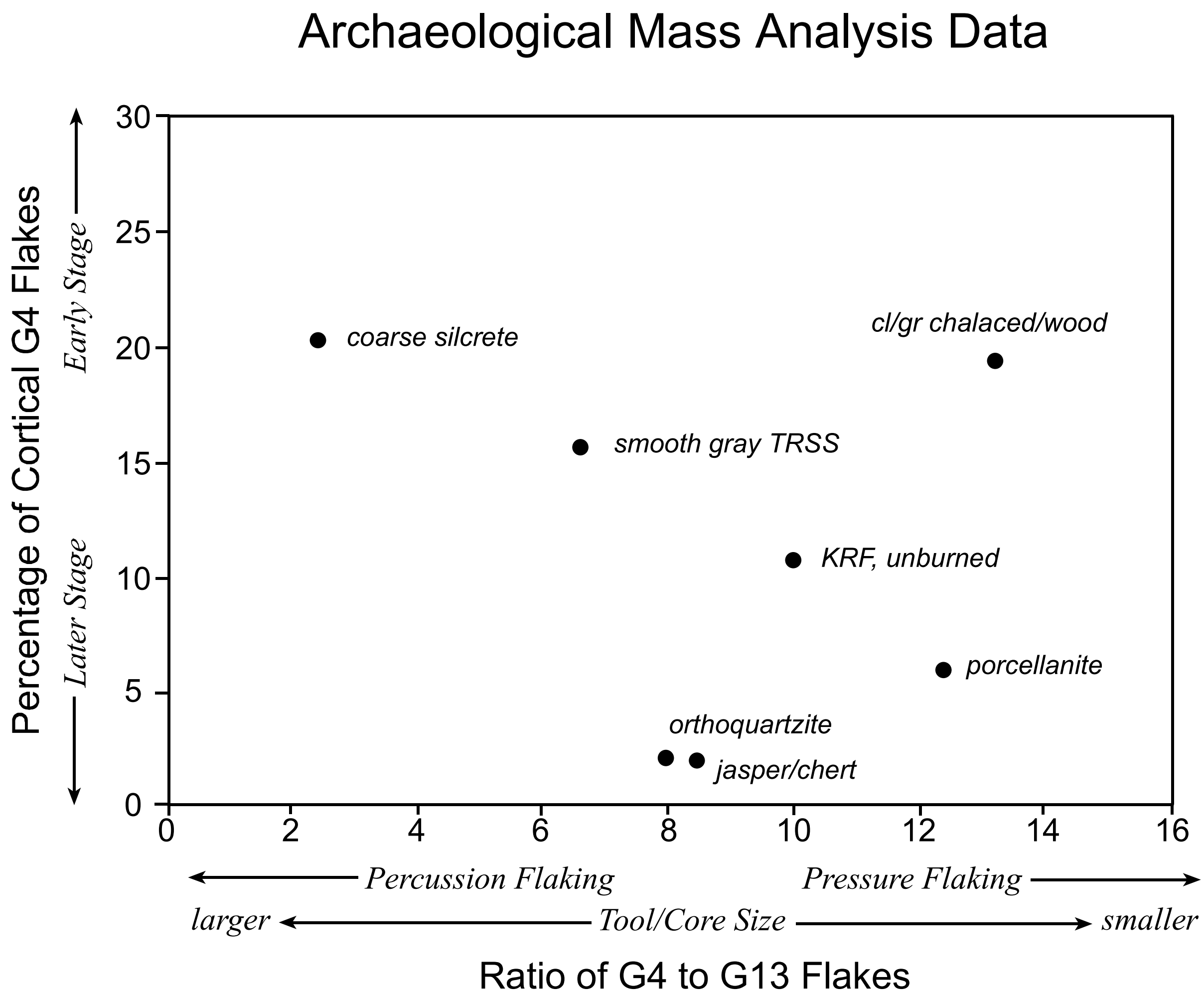

Figure 12.3. Mass analysis data for Scattered Village (MO31) and two comparative sites (MO26 = Slant Village; 32MO291) and for the near-local raw materials.

Table 12.11. Mass analysis data for Scattered Village and two Heart region sites, by raw material type.

	G4-G13 Flake Ratio			Percent G4 Cortical Flakes		
Raw Material Type	32MO31 Period 1-4 AD 1550-1700	32MO26 Period 2-3 AD 1575-1725	32MO291 Period 1-3 AD 1415-1460	32MO31 Period 1-4 AD 1550-1700	32MO26 Period 2-3 AD 1575-1725	32MO291 Period 1-3 AD 1415-1460
Knife River flint	9.97	9.61	9.71	10.7	9.1	12.4
Smooth Gray TRSS	5.59	5.55	5.12	15.7	13.0	10.8
Woods/Chalcedonies	13.18	12.27	10.65	19.4	18.0	21.0

Stone Tools

The stone sample consists of 4,237 individual artifacts. Accounting for multifunctional occurrences that were observed and recorded for these specimens, the stone tool database contains 4,646 stone tool records or discrete functional occurrences. That is, 409 additional instances were recorded in which a single specimen was used for a secondary, tertiary, or quaternary purpose. In this data set, 251 occurrences or 5.4% of the sample involve size grade G4 specimens. Several of these very small, G4 specimens come from contexts that were sample-sorted in the lab, meaning that only a fraction of the recovered G4 waterscreen debris was examined for stone tools. When a multiplier is used to estimate the total number of stone tool occurrences from sampled G4 contexts (see Appendix B), an additional 129 G4 artifacts are added to the data set. Thus, the final data set subjected to analysis consists of 4,237 specimens with 4,646 observed functional occurrences, reflecting an estimated 4,775 functional occurrences when sampled contexts are accounted for.

Pre-Plains Village Age Stone Tools

The first step in the analysis was to isolate coded stone tool occurrences that are better considered associated with or deriving from components that predate the primary Plains Village age occupation at the site. This can be done by noting information about recovery context, stone tool morphology, and stone tool patination that may be a good indicator of non-village association or age. Three tools come from contexts that were determined, on the basis of depth and stratigraphy, to underlie and predate the primary village occupation. One of these is a sub-rounded cobble of local, weathered sandstone with a thick carbonate rind on one surface. This specimen (Cat No. 1796) was found in level 12 in Square 516NE570 in Block 1, slightly below the pre-village A horizon in that area. One face of the cobble is abraded, but the abraded surface resembles other areas on the cobble cut by a shovel. While this specimen has been recorded as a simple abrading stone, it is possibly only a recently damaged natural cobble. The excavation records note the presence of some natural gravel at this depth.

A second tool in possible previllage context is a very small (size G3) utilized Knife River flint flake found in level 15 in Square 516NE569 in Block 1. The flake is heat treated but unpatinated, and there is nothing remarkable about it that would indicate a previllage age. The specimen is no larger than several flakes that occur throughout various levels of the deep tests in Block 1 (Table 12.3). It is felt that the flaking debris could easily have trickled down from village deposits into these deeper contexts, and the same may be true of this tool.

A third tool was found in excavation level 11 in Square 516NE506 in Block 2 (Cat No. 1977), also at an elevation slightly below the previllage A horizon in that area. This is a definite tool, a simple percussion flaked chopper made of dark micaceous metamorphic rock (coded as basaltic). It lacks carbonate encrustation. It was recovered from the uppermost level that was designated as being subvillage in context, and in a level that produced 20 small flakes that could reflect only trickle-down from village contexts (Table 12.3). Excavation records make no mention of this artifact, although the village midden had been penetrated by this depth and the goal of digging this unit was to explore for previllage artifacts. The chopper bears three clear sets of shovel cut marks, as it was repeatedly contacted as shovel skimming continued in the square. Excavation records do indicate that at the base of this level the outline for a new postmold was recognized (F77), at a depth at least 10 cm below the base of village midden. The postmold extended 23 cm further below this point of recognition. It is possible that the chopper came from the unrecognized fill of the postmold; it is also possible that it is truly previllage in age.

Evidence for a previllage age cultural origin for these three tools is therefore problematic in each case. Each is coded as belonging to Period 5, the previllage analytic unit. Despite questions about association, they will remain coded in this manner to isolate them from definite village period artifacts.

Six projectile points found in the village deposits are potentially previllage in age based primarily on their morphology (Figure 12.4a-f). One of the six was reused by villagers, based on differential patination, and the remaining five show no evidence of use by village occupants other than their context. It is unknown if these artifacts were originally deposited in previllage age geologic contexts within the site and were inadvertently incorporated into the village middens, or if they were collected elsewhere by village inhabitants and brought to the location. Thus, it is not clear if some of these specimens reflect previllage age, Plains Archaic components at the location.

The reused specimen is a moderately patinated arrowpoint (Figure 12.4f) that appears to conform to the Plains Side-notched type (Kehoe 1966). One blade margin has been reworked by unifacial flaking that lacks patination. This specimen was found in level 1 of Square 516NE506 in Block 2, in a context that would normally be assigned to Period 1. A second small dart point (Figure 12.4e) was also found in Block 2, within the fill of Feature 68 assigned to Period 4. This appears to be a small, shallowly side-notched dart point, based on thickness and reduction technology, that resembles a Samantha point (Kehoe 1973) or diminutive version of a Besant point usually considered to be Late Plains Archaic or Plains Woodland in age. Two other specimens are corner-notched dart points that may be variants of Pelican lake points (Kehoe 1973). A complete point made of KRF (Figure 12.4c) was found in level 7 of Square 516NE570 in Block 1, at a depth that was penetrating the previllage A soil horizon. This artifact was not plotted but could have been in place in the A horizon. A second burned fragmentary point made of chert (Figure 12.4d) was found in level 1 in Square 498NE473 in Block 4 in a context assigned to Period 2. A dart point made of KRF (unpatinated) and with an expanding stem (Figure 12.4b) was found in the fill of pit Feature 132 assigned to Period 1. This artifact was reused as a cutting tool apparently by the makers of the point. Finally, an Archaic dart point resembling the Middle Plains Archaic Duncan/Hanna series (Figure 12.4a) was found in level 5 of Square 497NE472 in Block 4 in a context assigned to Period 2. This is an unpatinated KRF specimen. If its age based on typology is correct (Middle Plains Archaic), it probably is older than the previllage A soil horizon (radiocarbon dated as younger than ca. 1350 BC), meaning that it was probably scavenged at some other location and brought to the village.

Seventeen additional, otherwise nondescript artifacts, exhibit patination ranging from light (1) to pronounced and eroded (4) in intensity and occur in various village-age contexts scattered throughout excavated areas. Pertinent data are listed for these specimens in Table

12.12. These 17 artifacts are assumed, based on patination, to be previllage in age and to have become incorporated into the village contexts through some combination of processes. They were found in village contexts that have variously been assigned to Period 1, 2, and 3. Ten of the 17 specimens exhibit evidence of having been reused or recycled by village residents, based on unpatinated flake scars overlapping patinated surfaces. The majority of these originally functioned as flake tools or were simply flake blanks; bifacial cutting tools, freehand cores, and scrapers are also represented.

Table 12.12. Summary data on patinated, previllage age artifacts found in village contexts, Scattered Village (32MO31), 1998 excavations.

Artifact Number	Size	Raw Material Type	Patin. Inten.	Technology	Function	Use-Phase	Recy -cled	Period
1167. 2003	2	KRF	1	flake tool	flake blank	1	yes	2
1314. 3001	3	KRF	1	tabular piece	cutting/slicing	4	no	2
1744. 2002	2	silic. wood	2	pat. uniface	hide scraper	4	no	3
1886. 2004	2	clear/gr chal.	2	flake tool	flake blank	3	yes	2
2016. 2015	2	silic. wood	1	flake tool	cutting/slicing	4	yes	2
2016. 3024	3	silic. wood	2	small biface	light cutting	3	no	2
2531. 3003	3	KRF	2	flake tool	flake blank	4	yes	1
2554. 2019	2	KRF	3	flake tool	cutting/slicing	4	no	1
2554. 2026	2	KRF	1	flake tool	cutting/slicing	3	no	1
2554. 2035	2	KRF	2	flake tool	cutting/slicing	4	yes	1
2573. 3001	3	clear/gr chal.	4	flake tool	cutting/slicing	4	no	2
2586. 2002	2	silic. wood	1	large biface	bif. cutting	4	yes	3
2705. 3005	3	KRF	1	tabular piece	cutting/slicing	4	yes	1
2709. 2005	2	KRF	3	large biface	bif. cutting	4	yes	3
2786. 3001	3	KRF	1	flake tool	cutting/slicing	3	no	2
2826. 2003	2	KRF	3	freehand core	core	4	yes	2
2894. 2043	2	KRF	1	freehand core	core	4	yes	1

In summary, there is extremely little firm evidence, in the form of definite stone tools in definite previllage context, for cultural components that predate the major village age occupations at Scattered Village. Three specimens from apparent previllage contexts either have dubious cultural modification or some question about context. Chronologically earlier artifacts do occur, based on either projectile typology or degree of patination intensity, but only in very low frequency (total of 23 specimens in a tool sample numbering over 4,700 specimens). The 26 artifacts discussed here have been assigned an apparent previllage age or period association in the database, and they will be excluded from further analyses of stone tools that focus specifically on specimens that can be assigned to Periods 1 – 4 based on context.

Collection Description, Raw Material, and Technology

Analysis of the village age stone tool collection began by evaluating the integrity and possible significance of a small subset of tools designated as being from mixed or uncertain time period contexts (coded as Period = 0). There are 131 specimens in this group, reflecting only 2.8% of the village tool sample. The importance of this inquiry relates to the fact that nearly all

such specimens derive from the "fluffy" sediment unit in excavation Block 3. What we are really interested in knowing is whether there is anything unusual or distinctive about the artifact content of this sediment unit that might warrant continued analysis as a separate entity. The most probable interpretation of this unit is that it is some type of a mixed or redeposited composite of materials derived from other nearby areas within the site. Based on this hypothesis, we predict that its stone tool content will be little different from the aggregate of tools assigned to Periods
1-4 in surrounding contexts.

We tested this by cross-tabulation and chi-square analysis of temporal classification (TP0 versus collapsed TP1-4) according several tool variables: size grade, technological class, functional classifications, use-phase classification, recycling, raw material type, burning, and heat treatment. These tests revealed no significant difference in the first six tool variables, and a significant higher relative frequency of burning and heat treatment in the TP0 sample as compared to other periods combined. We narrowed the test to include only artifacts from excavation Blocks 1 and 3, meaning those in closest physical proximity to the "fluffy" sediment unit in Block 3. In this case, the first seven of the eight tool variables show no significance difference according to Period 0 versus Periods 1-4 (combined), and only heat treatment showed a significantly higher occurrence in Period 0. From this we conclude that the aggregate of stone tools from the "fluffy" sediment unit and assigned to Period 0 differs negligibly from a composite of artifacts from all time periods. This finding supports the idea that the fluffy unit contains an aggregate of redeposited artifacts from nearby locations. On this basis, we hereafter exclude the 131 stone tools assigned to Period 0 from all of the following analyses, and we confine further study to the 4,617 stone tool occurrences that have been assigned to any of Periods 1 through 4 for the site. This set hereafter constitutes the "village stone tool sample."

A significant portion of the village stone tool sample is burned; burning was recorded in 19.8% of the collection. When only raw materials are considered in which burning is most consistently detectable (KRF and various chalcedonies), a much higher fraction -- some 26% of the collection -- is burned. More than 58% of the sample is substantially fractured or fragmented, and fragmentation is most common in patterned bifacial tools (Table 12.13). The high degree of fragmentation is typical for artifacts found in village contexts. The most abundant general artifact forms are patterned bifaces, flake and tabular tools, irregular bifaces, and non-chipped tools (ground stone). Patterned flake tools (end scrapers) occur in lower frequencies, and tested raw material pieces and cores form the smallest general tool classes.

Detailed information about stone tool technology and raw material content is presented in Tables 16 and Table 12.15 for the 4,617 occurrences for the village tool sample. These tables present the full data array for chipped as well as ground stone tools and all of the raw materials present in the collection. As a general breakdown, the collection is comprised of about 87% chipped stone implements and 13% modified by pecking, grinding, abrasion or percussion in the absence of flaking. The data tables are organized to elicit some information about patterning between technology and raw material types. The upper part of each table provides data on near-local fine siliceous stones used predominantly for chipped stone artifact, and the first six categories that include flints, silicified sediment, chalcedonies, and woods dominate the sample

Table 12.13. Frequency distribution of general artifact classes represented in stone tools according to completeness classification, Scattered Village (32MO31), 1998 excavations.

General Artifact Class		Completeness or Portion: complete	nearly complete	distal end	proximal end	medial frag.	indet. end	margin frag.	other frag.	Total
tested raw mat.		9	33			11	32	28		113
core w/flk removal		15	21			5	26	25		92
irreg. biface/tool		196	235		3	36	224	72	1	767
patterned biface		97	85	205	145	221	149	448		1350
end scraper form		139	33	36	3	34		34		279
flake/tabular tool		363	194	90	123	131	81	449		1431
non-chipped tool		481	23	1		6	27	47		585
Total	n	1300	624	332	274	444	539	1103	1	4617
	%	28.2	13.5	7.2	5.9	9.6	11.7	23.9	.0	100.0

(ca. 77% of the whole sample). Coarse silcrete is isolated in the tables, as it is a relatively abundant stone used for heavier chipped tools. The middle part of the table presents data on the 12 exotic stone types that occur in chipped implements; collectively, these comprise more than 9% of the sample. This list of exotic types, and their relative abundance, fairly closely parallels the exotic material represented in chipped stone flaking debris (see Table 12.2). One deviation is in the two most common classes. In flaking debris, orthoquartzite is about twice as abundant as combined jasper/cherts; among stone tools, the opposite pattern prevails. This clearly indicates that these two stones are being reduced in different manners and to different degrees on-site, and this possibility will be explored below. The only material type to occur in tools and not flaking debris is antelope chert, in the form of a single retouched tabular piece (Table 12.14).

Raw materials that are dominant in non-chipped stone tools are grouped in the lower part of the table. Clinker is the most abundant of these, occurring in unpatterned grinding tools; clinker is formed is coal burn locations in western North Dakota, or farther west, but can be procured locally as float in the Missouri River. Three stone types occur more commonly in patterned ground stone tools than in unpatterned tools: scoria, silt/lime/mudstone, and coarse, porous sandstone. Of these three, the porous sandstone is almost certainly an exotic, procured at an unknown location. This type of sandstone has a consistent presence in patterned ground stone abrading tools in nearly all Plains Village sites, yet its actual source has not been pinpointed to my knowledge. Scoria is also probably exotic, found in the same locations that produce porcellanite. Most of the remaining stone types among non-chipped implements are local in origin. The compact sandstone crops out directly upslope from the site. Metaquartzite, granitic, basaltic, shist, and quartz rocks are available in glacial deposits that drape the upland setting very near the site, and also probably occur in gravel bars along the Heart River. Silt/lime/mudstones and concretions can probably be obtained from bedrock sources not far from the site.

Looking specifically at technological composition, we can note that unpatterned flake tools (generally retouched and utilized flakes) form the largest single technological class (over 23% of the sample). High relative abundance for unpatterned flake tools is typical of Plains Village assemblages.

Table 12.14. Technological class frequency according to raw material type for village stone tools, Scattered Village (32MO31), 1998 excavations.

	Tool Technological Class												
Raw Material	small thin patterned biface	large thin patterned biface	small irregular biface	patterned flake tool	unpatterned flake tool	radial break tool	retouched tabular piece	large bifacial core tool	nonbipolar core/tool	bipolar core/tool	unpatterned ground stone	patterned ground stone	Total
Knife River flint	270	331	60	161	516	1	165	1	97	341	1	0	1944
smooth gray TRSS	139	90	24	10	279	0	20	4	30	42	1	0	639
silicified wood	120	51	25	39	59	0	113	1	41	87	0	1	537
yel./lt. brn. chal.	62	41	6	11	43	0	18	0	16	38	1	0	236
clear/gray chal.	61	19	3	2	16	0	7	0	4	10	1	0	123
dark brn. chal.	8	6	0	11	25	0	1	0	1	9	0	0	61
coarse silcrete	0	4	8	0	11	0	3	9	12	3	2	0	52
orthoquartzite	30	13	0	4	47	0	2	0	0	5	0	0	101
jasper/chert	16	5	0	6	10	0	0	0	2	10	0	0	49
yellow dendritic ch	0	0	0	2	6	0	0	0	1	6	0	0	15
red dendritic chert	4	1	1	12	15	0	0	0	0	11	0	0	44
other dendritic	9	10	1	14	21	0	1	0	2	20	0	0	78
porcellanite	24	10	0	2	25	0	0	0	2	3	0	0	66
moss agate	12	5	1	2	2	0	0	0	1	1	0	0	24
White R. group	4	3	0	5	3	0	0	0	0	7	0	0	22
nonvolcanic glass	2	1	0	0	3	0	1	0	1	1	0	0	9
plate chalcedony	1	1	0	0	0	0	3	0	2	0	0	0	7
Rainy Buttes wood	3	1	0	0	0	0	0	0	0	0	0	0	4
obsidian	1	0	0	0	2	0	0	0	0	0	0	0	3
Swan River chert	0	0	1	0	0	0	1	0	0	0	0	0	2
Turtle V. qtzite	0	0	0	0	0	0	1	0	1	0	0	0	2
antelope chert	0	0	0	0	0	0	1	0	0	0	0	0	1
coarse porous ss	0	0	0	0	0	0	0	0	0	0	5	6	11
quartz	0	0	0	0	0	0	0	0	1	0	1	0	2
shist	0	0	0	0	0	0	0	1	0	0	1	0	2
hematite	0	0	0	0	0	0	0	0	0	0	3	0	3
silt/lime/mud stone	0	0	0	0	0	0	1	0	1	1	1	5	9
fossil/concretion	0	0	0	0	0	0	1	0	0	0	10	0	11
scoria	1	0	0	0	0	0	0	0	1	0	1	17	20
other	0	0	0	0	1	0	0	0	0	1	12	6	20
basaltic	0	1	0	0	0	0	0	0	0	1	19	1	22
compact sandstone	0	0	0	0	0	0	0	1	1	0	38	6	46
granitic	0	0	0	0	0	0	1	0	1	0	49	7	58
metaquartzite	0	0	0	0	0	0	0	0	2	3	65	5	75
clinker	0	0	0	0	0	0	0	0	0	0	318	1	319
Total N	767	593	130	281	1084	1	340	17	220	600	529	55	4617
%	16.6	12.8	2.8%	6.1%	23.5	.0%	7.4%	.4%	4.8%	13.0	11.5	1.2%	100%

Table 12.15. Percentage distribution across raw material type according to technological class for village stone tools, Scattered Village (32MO31), 1998 excavations.

	Tool Technological Class												
	small thin patterned biface	large thin patterned biface	small irregular biface	patterned flake tool	unpatterned flake tool	radial break tool	retouched tabular piece	large bifacial core tool	nonbipolar core/tool	bipolar core/tool	unpatterned ground stone	patterned ground stone	Total
Knife R flint	35.2%	55.8%	46.2%	57.3%	47.6%	100.%	48.5%	5.9%	44.1%	56.8%	.2%	.0%	42.1%
sm gr TRSS	18.1%	15.2%	18.5%	3.6%	25.7%	.0%	5.9%	23.5%	13.6%	7.0%	.2%	.0%	13.8%
silicif wood	15.6%	8.6%	19.2%	13.9%	5.4%	.0%	33.2%	5.9%	18.6%	14.5%	.0%	1.8%	11.6%
yel./ltb. chal.	8.1%	6.9%	4.6%	3.9%	4.0%	.0%	5.3%	.0%	7.3%	6.3%	.2%	.0%	5.1%
clear/gr chal.	8.0%	3.2%	2.3%	.7%	1.5%	.0%	2.1%	.0%	1.8%	1.7%	.2%	.0%	2.7%
dark br chal.	1.0%	1.0%	.0%	3.9%	2.3%	.0%	.3%	.0%	.5%	1.5%	.0%	.0%	1.3%
coarse silcrete	.0%	.7%	6.2%	.0%	1.0%	.0%	.9%	52.9%	5.5%	.5%	.4%	.0%	1.1%
orthoquartzite	3.9%	2.2%	.0%	1.4%	4.3%	.0%	.6%	.0%	.0%	.8%	.0%	.0%	2.2%
jasper/chert	2.1%	.8%	.0%	2.1%	.9%	.0%	.0%	.0%	.9%	1.7%	.0%	.0%	1.1%
yellow dend	.0%	.0%	.0%	.7%	.6%	.0%	.0%	.0%	.5%	1.0%	.0%	.0%	.3%
red dend	.5%	.2%	.8%	4.3%	1.4%	.0%	.0%	.0%	.0%	1.8%	.0%	.0%	1.0%
other dend	1.2%	1.7%	.8%	5.0%	1.9%	.0%	.3%	.0%	.9%	3.3%	.0%	.0%	1.7%
porcellanite	3.1%	1.7%	.0%	.7%	2.3%	.0%	.0%	.0%	.9%	.5%	.0%	.0%	1.4%
moss agate	1.6%	.8%	.8%	.7%	.2%	.0%	.0%	.0%	.5%	.2%	.0%	.0%	.5%
White R gp	.5%	.5%	.0%	1.8%	.3%	.0%	.0%	.0%	.0%	1.2%	.0%	.0%	.5%
nonvolcanic	.3%	.2%	.0%	.0%	.3%	.0%	.3%	.0%	.5%	.2%	.0%	.0%	.2%
plate chal	.1%	.2%	.0%	.0%	.0%	.0%	.9%	.0%	.9%	.0%	.0%	.0%	.2%
Rainy Buttes	.4%	.2%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.1%
obsidian	.1%	.0%	.0%	.0%	.2%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.1%
Swan R chert	.0%	.0%	.8%	.0%	.0%	.0%	.3%	.0%	.0%	.0%	.0%	.0%	.0%
Turtle Val	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.5%	.0%	.0%	.0%	.0%
antelope chert	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.0%	.0%	.0%	.0%	.0%
coarse ss	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.9%	10.9%	.2%
quartz	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.5%	.0%	.2%	.0%	.0%
shist	.0%	.0%	.0%	.0%	.0%	.0%	.0%	5.9%	.0%	.0%	.2%	.0%	.0%
hematite	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.6%	.0%	.1%
silt/lime/mud	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.5%	.2%	.2%	9.1%	.2%
fossil/concret	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.0%	.0%	1.9%	.0%	.2%
scoria	.1%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.5%	.0%	.2%	30.9%	.4%
other unclass	.0%	.0%	.0%	.0%	.1%	.0%	.0%	.0%	.0%	.2%	2.3%	10.9%	.4%
basaltic	.0%	.2%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.2%	3.6%	1.8%	.5%
compact ss	.0%	.0%	.0%	.0%	.0%	.0%	.0%	5.9%	.5%	.0%	7.2%	10.9%	1.0%
granitic	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.5%	.0%	9.3%	12.7%	1.3%
metaquartzite	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.9%	.5%	12.3%	9.1%	1.6%
clinker	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	60.1%	1.8%	6.9%
Total N	767	593	130	281	1084	1	340	17	220	600	529	55	4617
%	16.6%	12.8%	2.8%	6.1%	23.5%	.0%	7.4%	.4%	4.8%	13.0%	11.5%	1.2%	100%

Next most common are small thin, patterned bifaces (mostly arrowpoints and hafted perforators), large thin patterned bifaces (generally more specialized cutting, sawing, and fabricating tools), and, surprisingly, bipolar tools (at an unusually high 13% of the sample). The bipolar class includes any chipped object with bipolar fracture, including cores as well as punches, wedges, and chisels. The bipolar objects greatly outnumber nonbipolar (freehand percussion) cores and tools, a relatively unusual circumstance in most collections studied to date. The functional composition of the bipolar class will be explored in more detail later. Retouched tabular pieces are relatively common in the collection (more than 7% of the sample), and this fact is attributable in large measure to linkage with specific raw material types.

When multiple raw materials are available for production of stone tools, and when these materials occur in packages of different size and shape, there is almost always a strongly patterned relationship between reduction technology and raw material type. Similarly, distance to material source generally affects reduction behavior. Such is the case at Scattered Village. These patterns are expressed more fully by data in Table 12.16 that provide a cross-tabulation analysis of the technological classification in chipped stone tools only and raw material classification. For this data array, all coarse local stones (coarse silcrete being the dominant type) are collapsed into a single group, and all subclasses of jasper/chert are combined. The chi-square value for the table is predictably high and significant, reflecting both the large total table N and the strength of the expected relationships. Highlighted cell residual values point toward the most significant relationships (Table 12.16) between reduction method and material type, and one can even focus on negative cell residuals as information of avoidance of certain technologies with certain material types. To better focus on patterns, material types in Table 12.16 are grouped according to near-local or exotic source locations.

Knife River flint is the dominant stone among chipped stone tools. Although it is used frequently for production of artifacts by virtually all reduction technologies, it occurs relatively more commonly in bipolar objects, large thin patterned bifaces, and patterned retouched flake or unifacial tools. As many bipolar objects consist of recycled patterned bifaces and unifaces, it is probable that KRF was initially selected only for production of the unifacial and bifacial tools. This possible relationship, due to recycling behavior, can also be seen in the exotic stone jasper/chert and White River group silicates, which have both a high occurrence of bipolar technology as well as large thin patterned biface technology. Among other common, near-local fine-grained stones, there are some commonalties and some contrasts in prevalent reduction strategies. Smooth gray TRSS, the second most common stone type among chipped tools, is highly represented among unpatterned flake tools, and to a lesser degree among small thin patterned bifaces. Given that most thin patterned biface tools are made on thin flake blanks, there is probably a correlation between these classes that relates to core reduction behavior applied to this stone type. Curiously, negative cell residuals indicate that smooth gray TRSS was avoided in application of bipolar reduction, patterned uniface production, and retouched tabular pieces. The latter probably has to do with the form in which this material was procured and entered the site – likely in the form of larger equidimensional cores or flakes from such cores.

Table 12.16. Cross-tabulation of stone tool technological class according to raw material type for village chipped tools, Scattered Village (32MO31), 1998 excavations. Counts (top), percentage (middle) and standardized cell residual values (bottom; value >+1.0 shaded).

	Tool Technological Class										Total
	small thin patterned biface	large thin patterned biface	small irregular biface	patterned flake tool	unpatterned flake tl	radial break tool	retouched tabular piece	large bifacial core tool	nonbipolar core/tool	bipolar core/tool	
Knife River flint	270	331	60	161	516	1	165	1	97	341	1943
smooth gray TRSS	139	90	24	10	279	0	20	4	30	42	638
silicified wood	120	51	25	39	59	0	113	1	41	87	536
clear/gray chalcedony	61	19	3	2	16	0	7	0	4	10	122
yel./lt. brn. chalcedony	62	41	6	11	43	0	18	0	16	38	235
dark brn. chalcedony	8	6	0	11	25	0	1	0	1	9	61
jasper/chert	29	16	2	34	52	0	1	0	5	47	186
orthoquartzite	30	13	0	4	47	0	2	0	0	5	101
porcellanite	24	10	0	2	25	0	0	0	2	3	66
moss agate	12	5	1	2	2	0	0	0	1	1	24
White River group	4	3	0	5	3	0	0	0	0	7	22
plate chalcedony	1	1	0	0	0	0	3	0	2	0	7
nonvolcanic glass	2	1	0	0	3	0	1	0	1	1	9
Rainy Buttes wood	3	1	0	0	0	0	0	0	0	0	4
obsidian	1	0	0	0	2	0	0	0	0	0	3
Swan River chert	0	0	1	0	0	0	1	0	0	0	2
Turtle Valley quartzite	0	0	0	0	0	0	1	0	1	0	2
antelope chert	0	0	0	0	0	0	1	0	0	0	1
local coarse stones	1	5	8	0	12	0	6	11	19	9	71
Knife River flint	35.2%	55.8%	46.2%	57.3%	47.6%	100%	48.5%	5.9%	44.1%	56.8%	48.2%
smooth gray TRSS	18.1%	15.2%	18.5%	3.6%	25.7%	.0%	5.9%	23.5%	13.6%	7.0%	15.8%
silicified wood	15.6%	8.6%	19.2%	13.9%	5.4%	.0%	33.2%	5.9%	18.6%	14.5%	13.3%
clear/gray chalcedony	8.0%	3.2%	2.3%	.7%	1.5%	.0%	2.1%	.0%	1.8%	1.7%	3.0%
yel./lt. brn. chalcedony	8.1%	6.9%	4.6%	3.9%	4.0%	.0%	5.3%	.0%	7.3%	6.3%	5.8%
dark brn. chalcedony	1.0%	1.0%	.0%	3.9%	2.3%	.0%	.3%	.0%	.5%	1.5%	1.5%
jasper/chert	3.8%	2.7%	1.5%	12.1%	4.8%	.0%	.3%	.0%	2.3%	7.8%	4.6%
orthoquartzite	3.9%	2.2%	.0%	1.4%	4.3%	.0%	.6%	.0%	.0%	.8%	2.5%
porcellanite	3.1%	1.7%	.0%	.7%	2.3%	.0%	.0%	.0%	.9%	.5%	1.6%
moss agate	1.6%	.8%	.8%	.7%	.2%	.0%	.0%	.0%	.5%	.2%	.6%
White River group	.5%	.5%	.0%	1.8%	.3%	.0%	.0%	.0%	.0%	1.2%	.5%
plate chalcedony	.1%	.2%	.0%	.0%	.0%	.0%	.9%	.0%	.9%	.0%	.2%
nonvolcanic glass	.3%	.2%	.0%	.0%	.3%	.0%	.3%	.0%	.5%	.2%	.2%
Rainy Buttes wood	.4%	.2%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.1%
obsidian	.1%	.0%	.0%	.0%	.2%	.0%	.0%	.0%	.0%	.0%	.1%
Swan River chert	.0%	.0%	.8%	.0%	.0%	.0%	.3%	.0%	.0%	.0%	.0%
Turtle Valley quartzite	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.5%	.0%	.0%
antelope chert	.0%	.0%	.0%	.0%	.0%	.0%	.3%	.0%	.0%	.0%	.0%
local coarse stones	.1%	.8%	6.2%	.0%	1.1%	.0%	1.8%	64.7%	8.6%	1.5%	1.8%
Knife River flint	-5.2	2.7	-.3	2.2	-.3	.7	.1	-2.5	-.9	3.1	
smooth gray TRSS	1.6	-.4	.8	-5.2	8.2	-.4	-4.6	.8	-.8	-5.4	
silicified wood	1.8	-3.1	1.9	.3	-7.1	-.4	10.1	-.8	2.2	.8	
clear/gray chalcedony	7.8	.3	-.5	-2.2	-2.9	-.2	-1.0	-.7	-1.0	-1.9	
yel./lt. brn. chalcedony	2.6	1.1	-.6	-1.3	-2.5	-.2	-.4	-1.0	.9	.5	
dark brn. chalcedony	-1.1	-1.0	-1.4	3.3	2.1	-.1	-1.8	-.5	-1.3	.0	
jasper/chert	-1.1	-2.2	-1.6	5.8	.3	-.2	-3.7	-.9	-1.6	3.7	
orthoquartzite	2.5	-.5	-1.8	-1.1	3.8	-.2	-2.2	-.7	-2.3	-2.6	
porcellanite	3.2	.1	-1.5	-1.2	1.7	-.1	-2.4	-.5	-.8	-2.2	
moss agate	3.5	.8	.3	.3	-1.8	-.1	-1.4	-.3	-.3	-1.4	
White River group	-.1	-.1	-.8	2.8	-1.2	-.1	-1.4	-.3	-1.1	2.1	
plate chalcedony	-.3	.0	-.5	-.7	-1.4	.0	3.1	-.2	2.6	-1.0	
nonvolcanic glass	.2	-.3	-.5	-.8	.4	.0	.3	-.2	.7	-.3	
Rainy Buttes wood	2.6	.5	-.4	-.5	-1.0	.0	-.6	-.1	-.5	-.8	
obsidian	.6	-.7	-.3	-.5	1.3	.0	-.5	-.1	-.4	-.7	

Table 12.16. Cross-tabulation of stone tool technological class according to raw material type for village chipped tools, Scattered Village (32MO31), 1998 excavations (concluded). . Counts (top), percentage (middle) and standardized cell residual values (bottom).

		Tool Technological Class										Total
		small thin patterned biface	large thin patterned biface	small irregular biface	patterned flake tool	unpatterned flake tl	radial break tool	retouched tabular piece	large bifacial core tool	nonbipolar core/tool	bipolar core/tool	
Swan River chert		-.6	-.5	3.7	-.4	-.7	.0	2.0	-.1	-.3	-.5	
Turtle Valley quartzite		-.6	-.5	-.3	-.4	-.7	.0	2.0	-.1	2.7	-.5	
antelope chert		-.4	-.4	-.2	-.3	-.5	.0	3.2	-.1	-.2	-.4	
local coarse stones		-3.4	-1.7	3.8	-2.2	-1.6	-.1	.0	19.6	7.7	-.5	
Total	N	767	593	130	281	1084	1	340	17	220	600	4033
	%	19.0%	14.7%	3.2%	7.0%	26.9%	.0%	8.4%	.4%	5.5%	14.9%	100%

Silicified wood was strongly preferred for production of retouched tabular pieces. This is a clear indication of the form in which it was procured and entered the site. This stone also shows a relatively high occurrence in non-bipolar cores, small irregular bifaces, and small thin patterned bifaces. Interestingly, clear/gray chalcedony, which can closely resemble wood, is very strongly selected for small thin patterned biface production and little else. This suggests that these two materials entered the site in different forms, and that separation of these material types is warranted. Yellow/light brown chalcedonies are differentially used for small and large thin patterned biface production, and dark brown chalcedonies are preferentially used for patterned and unpatterned flake tools.

The more commonly occurring exotic stones also show interesting, selective reduction technologies. The selection of jasper/cherts and White River group materials for large thin patterned biface tools and bipolar tools has already been noted. Orthoquartzite has a different pattern, being selectively used for unpatterned flake tools and for small thin patterned bifaces. As with smooth gray TRSS, there is probably a linkage here that harks back to production of thin flake blanks suitable for such tools from large complex freehand cores. Porcellanite is used in a similar fashion, and moss agates are selectively used for small thin patterned biface tools. Plate chalcedony is predictably used for production of retouched tabular implements, again due to the suitability of the natural stone for such purposes. The remaining high cell residual values for exotic stone types are largely a product of small sample size in the rarer stone varieties.

Data regarding input blank form are summarized according to stone tool technological class and according to the most common raw material types in chipped stone tools in Table 12.17 and Table 12.18, respectively. Nearly 1,700 tools, comprising more than 36% of the tool sample are indeterminate regarding input blank form, meaning that they are so small or so completely altered by reduction that the original form of the raw material pieces cannot be identified. Among the remaining artifacts, approximately 42% are fabricated on cobbles, pebbles, or otherwise nuclear, cortex-bearing pieces (Table 12.17). About 49% are made of flakes of various kinds. Simple and complex flakes dominate the sample; tools made on bifacial thinning flakes and bipolar flakes each number only 36 and comprise less than 3% of the sample in which flake type can be determined. Tools made on blade are quite rare (n=2). Tools that occur on other tool forms (i.e., that are effectively recycled from another tool) together make up about 9%

of the sample in which blank form can be determined. The vast majority of these are items of bipolar technology, or instances in which bipolar percussion is applied to a tool previously fabricated by another technology (Table 12.17).

Table 12.17. Frequency and percentage data for input blank form (excluding indeterminates) according to stone tool technological class, Scattered Village (32MO31), 1998 excavations.

	Stone Tool Technological Class												
Input Blank Form	small thin patterned biface	large thin patterned biface	small irregular biface	patterned flake tool	unpatterned flake tool	radial break tool	retouched tabular piece	large bifacial core tool	nonbipolar core/tool	bipolar core/tool	unpatterned ground stone	patterned ground stone	Total
tabular pebble/	12	12	22	8			30	8	50	18	11	7	178
cobble > 10 mm	5.4%	9.6%	25.3%	3.6%			10.4%	47.1%	34.7%	5.0%	3.1%	29.2%	6.1%
thin plate < 10 mm	75	91	57	24	8		247	2	73	86	4	4	671
	33.9%	72.8%	65.5%	10.9%	.7%		85.5%	11.8%	50.7%	24.0%	1.1%	16.7%	23.0%
subrounded/								1	3	1	169	11	185
rounded cobble								5.9%	2.1%	.3%	47.2%	45.8%	6.3%
blocky/angular			1				1	4	14	4	144	1	169
cobble			1.1%				.3%	23.5%	9.7%	1.1%	40.2%	4.2%	5.8%
fire-cracked rock				1					2		27	1	31
				.5%					1.4%		7.5%	4.2%	1.1%
other non-bp flake	97	15	1	98	239		1		1	28			480
	43.9%	12.0%	1.1%	44.3%	22.2%		.3%		.7%	7.8%			16.4%
simple flake	20	1	3	47	362		1	1		11			446
	9.0%	.8%	3.4%	21.3%	33.6%		.3%	5.9%		3.1%			15.3%
complex flake	9	1		33	347			1		7			398
	4.1%	.8%		14.9%	32.2%			5.9%		2.0%			13.6%
biface thinning flake	1				35								36
	.5%				3.2%								1.2%
bipolar flake				5	31								36
				2.3%	2.9%								1.2%
blade/bladelet					2								2
					.2%								.1%
shatter	1		1	1	28		3						34
	.5%		1.1%	.5%	2.6%		1.0%						1.2%
unpatt biface										5			5
										1.4%			.2%
unfin patt biface	1				1					27			29
	.5%				.1%					7.5%			1.0%
finish patt biface	4	3		2	5					43			57
	1.8%	2.4%		.9%	.5%					12.0%			2.0%
unpatt flake tool/	1	1		2	6	1	2			69			82
tabular piece	.5%	.8%		.9%	.6%	100.0%	.7%			19.3%			2.8%
patt flake tool		1	1		1					45	1		49
		.8%	1.1%		.1%					12.6%	.3%		1.7%
non-bp core or frag					1		1			13	2		17
					.1%		.3%			3.6%	.6%		.6%
bipolar core/object			1		12		3		1	1			18
			1.1%		1.1%		1.0%		.7%	.3%			.6%
	221	125	87	221	1078	1	289	17	144	358	358	24	2923
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 12.18. Cross-tabulation of raw material type by input blank form for chipped stone tools and determinate blank form only, Scattered Village (32MO31), 1998 excavations. Data are counts (top), % (mid), and standardized cell residuals (bottom) (values>2.0 shaded).

	Raw Material Type									
Input Blank Form	krf	smooth gray trss	silicified wd.	clear/gray chal.	yel./lt. brn. chal.	dark brn. chal.	jasper/chert all	orthoquartzite	all porcellanite	local coarse	Total
tab pebble/cobble > 10 mm	53	41	32	3	2	2	2	0	1	19	155
thin plate < 10 mm	294	26	253	12	57	4	2	3	2	5	658
subrounded/rounded cobble	0	0	0	0	0	0	0	0	0	5	5
blocky/angular cobble	7	3	2	0	1	0	2	0	0	9	24
fire-cracked rock	1	0	0	0	0	0	0	0	0	2	3
other non-bp flake	227	90	27	8	19	10	57	23	7	2	470
simple flake	211	112	26	6	20	11	18	17	10	8	439
complex flake	178	118	15	6	15	11	19	19	9	2	392
biface thinning flake	15	9	2	0	1	0	2	5	2	0	36
bipolar flake	18	5	4	0	0	4	3	0	2	0	36
blade/bladelet	1	0	0	0	0	0	0	0	1	0	2
shatter	19	8	3	0	2	0	0	0	0	2	34
unpatt biface	4	1	0	0	0	0	0	0	0	0	5
unfin patt biface	13	7	3	0	2	0	0	1	1	1	28
finish patt biface	31	5	3	3	4	1	5	3	2	0	57
unpatt flaketool/tabular piece	50	3	11	1	3	2	11	0	0	0	81
patt flake tool	28	0	4	0	2	1	8	0	1	0	44
non-bp core or frag	6	2	5	0	1	0	1	0	0	0	15
bipolar core/object	14	0	1	2	0	0	1	0	0	0	18
tab pebble/cobble > 10 mm	4.5%	9.5%	8.2%	7.3%	1.6%	4.3%	1.5%	.0%	2.6%	34.5%	6.2%
thin plate < 10 mm	25.1%	6.0%	64.7%	29.3%	44.2%	8.7%	1.5%	4.2%	5.3%	9.1%	26.3%
subrounded/rounded cobble	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	9.1%	.2%
blocky/angular cobble	.6%	.7%	.5%	.0%	.8%	.0%	1.5%	.0%	.0%	16.4%	1.0%
fire-cracked rock	.1%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	3.6%	.1%
other non-bp flake	19.4%	20.9%	6.9%	19.5%	14.7%	21.7%	43.5%	32.4%	18.4%	3.6%	18.8%
simple flake	18.0%	26.0%	6.6%	14.6%	15.5%	23.9%	13.7%	23.9%	26.3%	14.5%	17.5%
complex flake	15.2%	27.4%	3.8%	14.6%	11.6%	23.9%	14.5%	26.8%	23.7%	3.6%	15.7%
biface thinning flake	1.3%	2.1%	.5%	.0%	.8%	.0%	1.5%	7.0%	5.3%	.0%	1.4%
bipolar flake	1.5%	1.2%	1.0%	.0%	.0%	8.7%	2.3%	.0%	5.3%	.0%	1.4%
blade/bladelet	.1%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	2.6%	.0%	.1%
shatter	1.6%	1.9%	.8%	.0%	1.6%	.0%	.0%	.0%	.0%	3.6%	1.4%
unpatt biface	.3%	.2%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	.2%
unfin patt biface	1.1%	1.6%	.8%	.0%	1.6%	.0%	.0%	1.4%	2.6%	1.8%	1.1%
finish patt biface	2.6%	1.2%	.8%	7.3%	3.1%	2.2%	3.8%	4.2%	5.3%	.0%	2.3%
unpatt flaketool/tabular piece	4.3%	.7%	2.8%	2.4%	2.3%	4.3%	8.4%	.0%	.0%	.0%	3.2%
patt flake tool	2.4%	.0%	1.0%	.0%	1.6%	2.2%	6.1%	.0%	2.6%	.0%	1.8%
non-bp core or frag	.5%	.5%	1.3%	.0%	.8%	.0%	.8%	.0%	.0%	.0%	.6%
bipolar core/object	1.2%	.0%	.3%	4.9%	.0%	.0%	.8%	.0%	.0%	.0%	.7%
tab pebble/cobble > 10 mm	-2.3	2.8	1.6	.3	-2.1	-.5	-2.1	-2.1	-.9	8.4	
thin plate < 10 mm	-.8	-8.2	14.8	.4	4.0	-2.3	-5.5	-3.6	-2.5	-2.5	
subrounded/rounded cobble	-1.5	-.9	-.9	-.3	-.5	-.3	-.5	-.4	-.3	14.8	
blocky/angular cobble	-1.3	-.6	-.9	-.6	-.2	-.7	.7	-.8	-.6	11.7	
fire-cracked rock	-.3	-.7	-.7	-.2	-.4	-.2	-.4	-.3	-.2	7.5	
other non-bp flake	.5	1.0	-5.4	.1	-1.1	.5	6.5	2.6	-.1	-2.6	
simple flake	.4	4.2	-5.1	-.4	-.6	1.0	-1.0	1.3	1.3	-.5	
complex flake	-.4	6.2	-5.9	-.2	-1.2	1.4	-.3	2.4	1.2	-2.3	
biface thinning flake	-.4	1.1	-1.5	-.8	-.6	-.8	.1	3.9	2.0	-.9	
bipolar flake	.3	-.5	-.7	-.8	-1.4	4.1	.8	-1.0	2.0	-.9	
blade/bladelet	.1	-.6	-.6	-.2	-.3	-.2	-.3	-.2	5.6	-.2	
shatter	.8	.9	-1.0	-.7	.2	-.8	-1.3	-1.0	-.7	1.4	
unpatt biface	1.1	.2	-.9	-.3	-.5	-.3	-.5	-.4	-.3	-.3	
unfin patt biface	.0	1.0	-.7	-.7	.5	-.7	-1.2	.2	.9	.5	
finish patt biface	.8	-1.5	-2.0	2.1	.6	.0	1.2	1.1	1.2	-1.1	

Table 12.18. Cross-tabulation of raw material type by input blank form for chipped stone tools and determinate blank form only, Scattered Village (32MO31), 1998 excavations (concluded). Data are counts (top), % (mid), and standardized cell residuals (bottom).

	Raw Material Type										
Input Blank Form	krf	smooth gray trss	silicified wd.	clear/gray chal.	yel./lt. brn. chal.	dark brn. chal.	jasper/chert all	orthoquartzite	all porcellanite	local coarse	Total
unpatt flaketool/tabular piece	2.0	-2.9	-.5	-.3	-.6	.4	3.3	-1.5	-1.1	-1.3	
patt flake tool	1.6	-2.7	-1.1	-.8	-.2	.2	3.8	-1.1	.4	-1.0	
non-bp core or frag	-.4	-.4	1.7	-.5	.3	-.5	.2	-.7	-.5	-.6	
bipolar core/object	1.9	-1.8	-1.1	3.1	-1.0	-.6	.1	-.7	-.5	-.6	
	1170	430	391	41	129	46	131	71	38	55	2502
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Although virtually all raw materials reflect much diversity in blank form and the nature of the blank form that was utilized for stone tools, there is clear tendency for certain material types to be more commonly correlated with certain blank types (cell residual analysis in Table 12.18). Smooth gray TRSS is more commonly input as tabular pebbles and simple and complex flakes. In contrast, silicified woods and yellow/light brown chalcedonies are more commonly input in the form of thin tabular plates. As might be predicted, all common exotic stones are input in the form of flakes of some kind (fewer nuclear pieces); jasper-chert is especially well represented in tools recycled (mostly bipolar) from other tool forms.

It is useful to combine technological information learned from stone tools with that gleaned from study of flaking debris using flake typology and mass analysis data (data in Table 12.4, Table 12.5, Table 12.8, and Table 12.16-Table 12.18). Tool and flake data are consistent in indicating a selection of KRF for large thin biface production and bipolar percussion. This indicates that these percussion operations are occurring on-site with KRF, while the relatively low incidence of cortical G4 flakes indicates that initial stages of cobble reduction probably occurred in off-site locations. Much of the core reduction occurring in smooth gray TRSS yielded predominantly simple flakes that fed into the production of arrowpoints and unpatterned flake tools. In contrast, little on-site work occurred with orthoquartzite and porcellanite (as indicated in part by the lack of nuclear pieces in these stones), yet bifacial thinning and complex flakes of these stones were brought into the site and were used as blanks for production of the same kinds of tools as was smooth gray TRSS. Flake type data and mass analysis data indicate that local woods and chalcedonies were used for a diverse array of reduction operations, and tool data support this generalization, with the only common denominator being a strong tendency to use all of these stones for small patterned biface (arrowpoint) production. Debris from jasper-chert, the most common exotic stone, shows up predominately in the form of complex flakes, while it occurs selectively as tools in the form of patterned unifaces and bipolar objects (many are end scrapers recycled in bipolar fashion). Complex flakes are probably imported as blanks for scrapers, and then eventually find their way into the site deposits as both scrapers and punch/wedge/chisels.

Functional Class Descriptions

The 4,617 functional occurrences in the tool collection are classified among approximately 60 more specific functional classes. For purposes of discussion and description, these 60 functional classes are collapsed into 12 more generalized functional groups, as shown in Table 12.19. A few functional classes that have a patterned technology, such as small and large thin bifaces, are recognizable in unfinished form or were commonly broken or rejected during the manufacturing process. Such unfinished items (in use-phase classes 1 and 2) comprise about 17% of the total tool sample. The remaining 83% of the sample consists of items that passed through a manufacturing process and were at one time usable (use-phase classes 3 or 4, Table 12.24). More specific statements about manufacture, technology, and reasons for rejection or failure can be made according to specific functional class discussions.

Projectile Points

All projectile points in the village study collection are thought to be arrowpoints. A small number of dart points in the collection (Figure 12.4a-e) have already been discussed in the treatment of possible previllage age components at the site. Arrowpoint artifacts are quite numerous (n=708), comprising nearly 31% of the study sample (Figure 12.4 – Figure 12.6). The manufacturing sequence for these specimens is well represented in the sample, and conforms closely to the model presented for Plains Village arrowpoints in general in Ahler (1992). A small number of partially shaped, still usable arrowpoint blanks occur (Figure 12.4g-m), and specimens broken or discarded during manufacture due to various kinds of failure comprise nearly 54% of the total arrowpoint sample (Figure 12.4n-cc).

Among unfinished arrowpoints in use-phase class 2, the most common reason for failure is a bend break or lateral snap break across the preform (56% of 380 specimens). Other common reasons for failure include perverse fractures (e.g., Figure 12.4p), burning, overshot flakes (Figure 12.4v), crescentic edge breaks, and material flaws. Several nearly finished arrowpoints broke during notching (Figure 12.4x-cc). Among finished, discarded arrowpoints in use-phase class 4, the most common failure type is the lateral snap or bend break (53% of 287 specimens). Impact fractures occur on 30% of the specimens (Figure 12.5bb,ee,ff), and burning is the next most common failure type. Only 1.1% of discarded arrowpoints are recycled into other tool forms. There is a single example of recycling by bipolar percussion in an unfinished preform; seven arrowpoints were recycled by reflaking into other tool forms or reuse for non-projectile purposes (Figure 12.6r-w).

Two hundred twelve technologically finished arrowpoints, complete enough for morphological classification, occur in the sample (Table 12.20). Five morphological variants occur. The sample is dominated by Plains Side-Notched arrowpoints (82% of the sample), distinguished by deep U-shaped notches that occur relatively far removed from the basal corners (Kehoe 1966, 1973:47-78) (Figure 12.5k-ff). Next most common are other side-notched forms that vary a great deal in specific morphology and do not conform to any named morphological

Table 12.19. Frequency distribution of specific and generalized functional class occurrences for stone tools according to use-phase class, Scattered Village (32MO31), 1998 excavations.

Generalized Functional Class and Specific Functional Class			Use-Phase Class 1 - unfinished usable	2 - unfinished non-usable	3 - finished usable	4 - finished non-usable	Total n	%
Projectile Points								
1b	arrowpoint	*n*	10	380	31	287	708	15.3%
	Subtotal	*%*	*1.4%*	*53.7%*	*4.4%*	*40.5%*		*30.60%*
Delicate Precision Tools								
2	perforator/drill			2	11	31	44	1.0%
3	lt duty bifacial cutting tool				6	13	19	.4%
19	slotting/grooving tool				1		1	.0%
30	graver/incising tool				6	3	9	.2%
	Subtotal	*n*		*2*	*24*	*47*	*73*	*1.60%*
		%		*2.7%*	*32.9%*	*64.4%*		
Coarse Scraping, Wood Working								
5	basal scraper/grinder				6	5	11	.2%
17	transv. scraper -- hard material				5	9	14	.3%
27	steep-edge h-d scraping/adzing				4	3	7	.2%
32	wood working ax				1		1	.0%
53	edge- or corner-ground tool				7	2	9	.2%
71	wood working adz				2		2	.0%
	Subtotal	*n*			*25*	*19*	*44*	*0.90%*
		%			*56.8%*	*48.2%*		
Hide Scrapers								
6	transv. scraper - soft material				64	148	212	4.6%
13	lateral scraper – soft material				2	6	8	.2%
16	transv. scraper - abrasive mat’l				6	9	15	.3%
20	misc. transv. scraper			3	2	40	45	1.0%
	Subtotal	*n*		*3*	*74*	*203*	*280*	*6.10%*
		%		*1.1%*	*26.4%*	*72.5%*		
Heavy Duty Bifacial Cutting Tools								
4	transverse cutting tool					1	1	.0%
7	bilat. hvy-duty 1 bif cutting tool				1	4	5	.1%
10	unilateral hvy-duty 1 cutt tool				6	11	17	.4%
12	bifacial cutt tool -- hard mat’l				1	6	7	.2%
15	misc. bifacial cutting tool		2	327	10	223	562	12.2%
	Subtotal	*n*	*2*	*327*	*18*	*245*	*592*	*12.90%*
		%	*0.3%*	*55.2%*	*3.0%*	*41.4%*		

Table 12.19. Frequency distribution of specific and generalized functional class occurrences for stone tools according to use-phase class, Scattered Village (32MO31), 1998 excavations (continued).

Generalized Functional Class and Specific Functional Class			Use-Phase Class				Total	
			1 - unfinished usable	2 - unfinished non-usable	3 - finished usable	4 - finished non-usable	n	%
Expedient Cutting and Flake Tools								
8	exped, multi-purpose bif tool			46	28	54	128	2.8%
11	stone saw					5	5	.1%
18	denticulate tool				8	21	29	.6%
22	util flake -- saw/slice hard material				50	53	103	2.2%
23	util flake -- variable material				307	914	1221	26.4%
45	spokeshave				1	3	4	.1%
66	flake ridge plane					1	1	.0%
68	point wear radial tool				1		1	.0%
54	generalized flake tool		2			1	3	.1%
	Subtotal	*n*	*2*	*46*	*395*	*1052*	*1495*	*32.30%*
		%	*0.1%*	*2.5%*	*21.3%*	*76.1%*		
Heavy Core-Tools								
9	hvy-dty ripping-sawing tool					1	1	.0%
14	hvy-duty chopping/pounding				9	12	21	.5%
46	core tool - unknown function				11	8	19	.4%
	Subtotal	*n*			*20*	*21*	*41*	*0.90%*
		%			*48.8%*	*51.2%*		
Non-Bipolar Cores and TRM								
21	freehand core				12	79	91	1.9%
31	tested raw material				47	59	106	2.3%
	Subtotal	*n*			*59*	*138*	*197*	*4.20%*
		%			*29.9%*	*70.1%*		
Bipolar Cores and Tools								
21	bipolar core				2	1	3	.1%
25	core/punch/wedge/chisel				160	160	320	6.9%
26	punch/wedge/chisel				161	117	278	6.0%
28	bipolar hammer/anvil stone				12	4	16	.3%
28.1	bipolar hammer only				4	1	5	.1%
28.2	bipolar anvil only				6	0	6	.1%
	Subtotal	*n*			*345*	*283*	*628*	*13.50%*
		%			*54.9%*	*45.1%*		

Table 12.19. Frequency distribution of specific and generalized functional class occurrences for stone tools according to use-phase class, Scattered Village (32MO31), 1998 excavations (concluded).

Generalized Functional Class and Specific Functional Class			Use-Phase Class 1 - unfinished usable	2 - unfinished non-usable	3 - finished usable	4 - finished non-usable	Total n	%
Ground Stone, Abrasive, Hammering Tools								
24	whetstone				23	10	33	.7%
29	hammerstone/pounder				46	10	56	1.2%
33	simple abrading tool				270	26	296	6.4%
34	simple grooved abrading tool				35	4	39	.8%
35	complx grind/crush tool - mano				6	1	7	.2%
36	grind/crush anvil - metate				0	2	2	.0%
37	simple burnisher				31	6	37	.8%
40	unmodified manuport				4	1	5	.1%
48	shaft smoother				7		7	.2%
49	reamer				1		1	.0%
	Subtotal	*n*			*423*	*60*	*483*	*10.40%*
		%			*87.5%*	*12.4%*		
Nonutilitarian, Decorative								
47	non-utilitarian, uncertain funct		1	1	10	8	20	.4%
50	smoking pipe			1			1	.0%
51	bead				11	5	16	.3%
52	pigment source				2	1	3	.1%
60	disk/tablet – gaming piece		3		3	10	16	.3%
62	copper-stained flake				1		1	.0%
72	symbolic weapon tip			1	1	1	3	.1%
	Subtotal	*n*	*4*	*3*	*28*	*25*	*60*	*1.20%*
		%	*6.7%*	*5.0%*	*46.7%*	*41.7%*		
Other Miscellaneous								
56	practice piece and miscellaneous				2	1	3	.1%
74	chipped marble-like object				4	8	12	.3%
99	unknown due to fragmentation			1			1	.0%
	Subtotal	*n*		*1*	*6*	*9*	*16*	*0.40%*
		%		*6.3%*	*37.5%*	*56.3%*		
	Total	n	18	762	1448	2389	4617	100.0%
		%	0.4%	16.5%	31.4%	51.7%	100.0%	

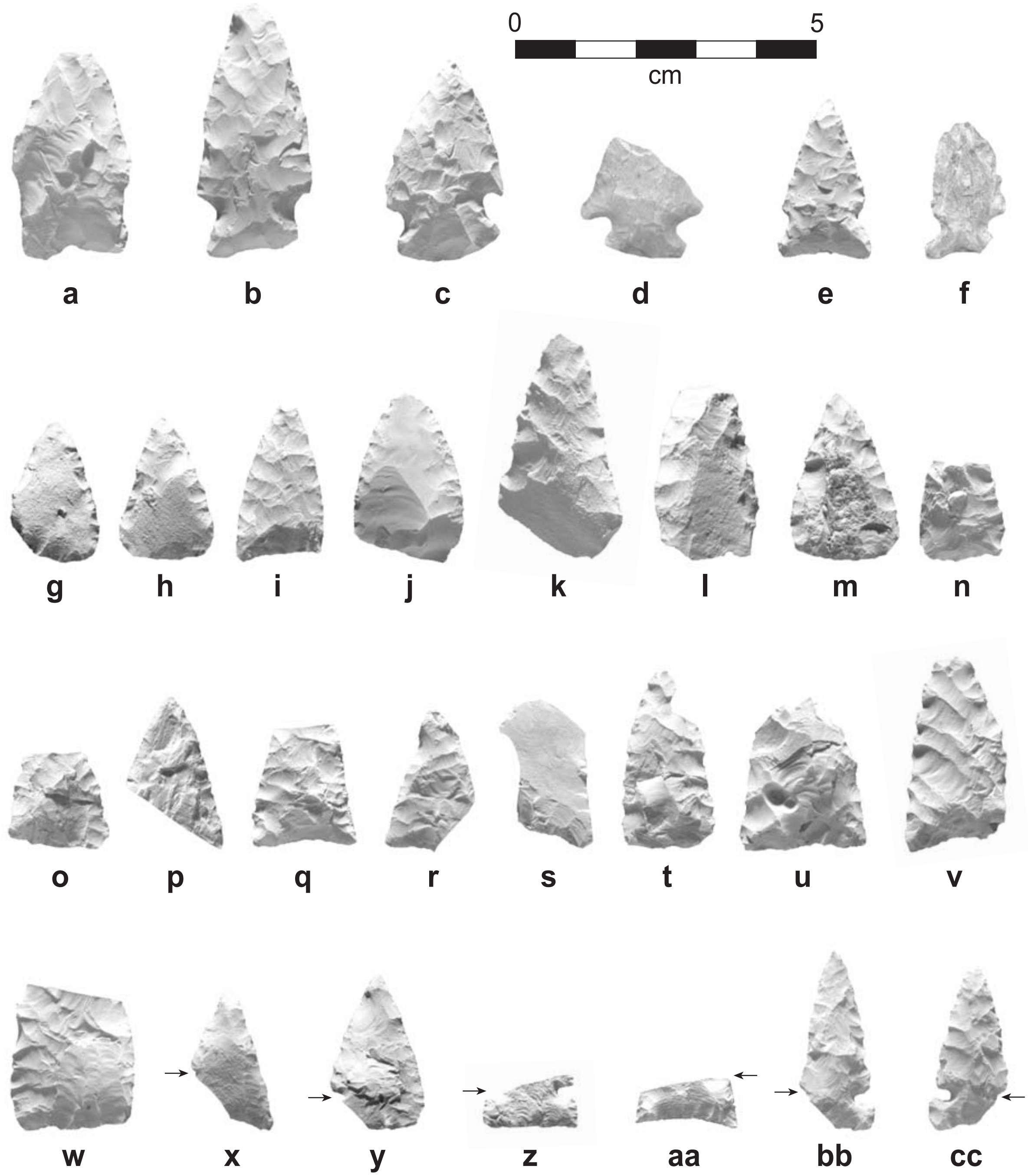

Figure 12.4. Chipped Stone Tool Photographs, Scattered Village. a-f: pre-Plains Village sage projectile points; g-m: use-phase class 1 arrowpoints (unfinished blanks); n-cc: use-phase class 2 (broken, unfinished) arrowpoints, with x-cc broken during notching.

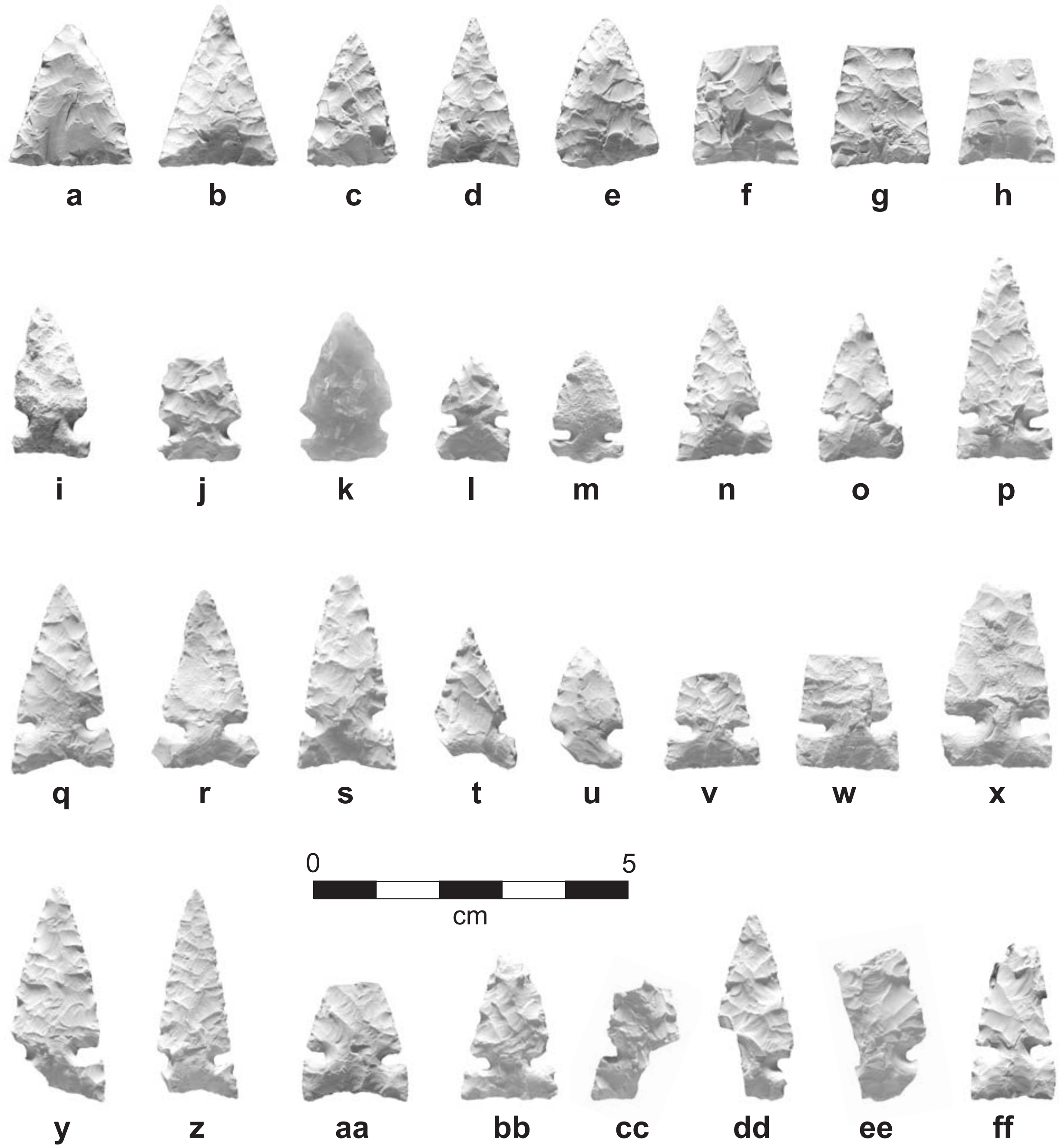

Figure 12.5. Chipped Stone Tool Photographs, Scattered Village. a-e: use-phase class 3 (usable) isosceles triangular arrowpoints; f-h: use-phase class 4 (broken during use) isosceles triangular arrowpoints; i-j: Prairie Side-Notched arrowpoints; k-ff: Plains Side-Notched arrowpoints, with k-r being use-phase class 3 and s-ff being use-phase class 4.

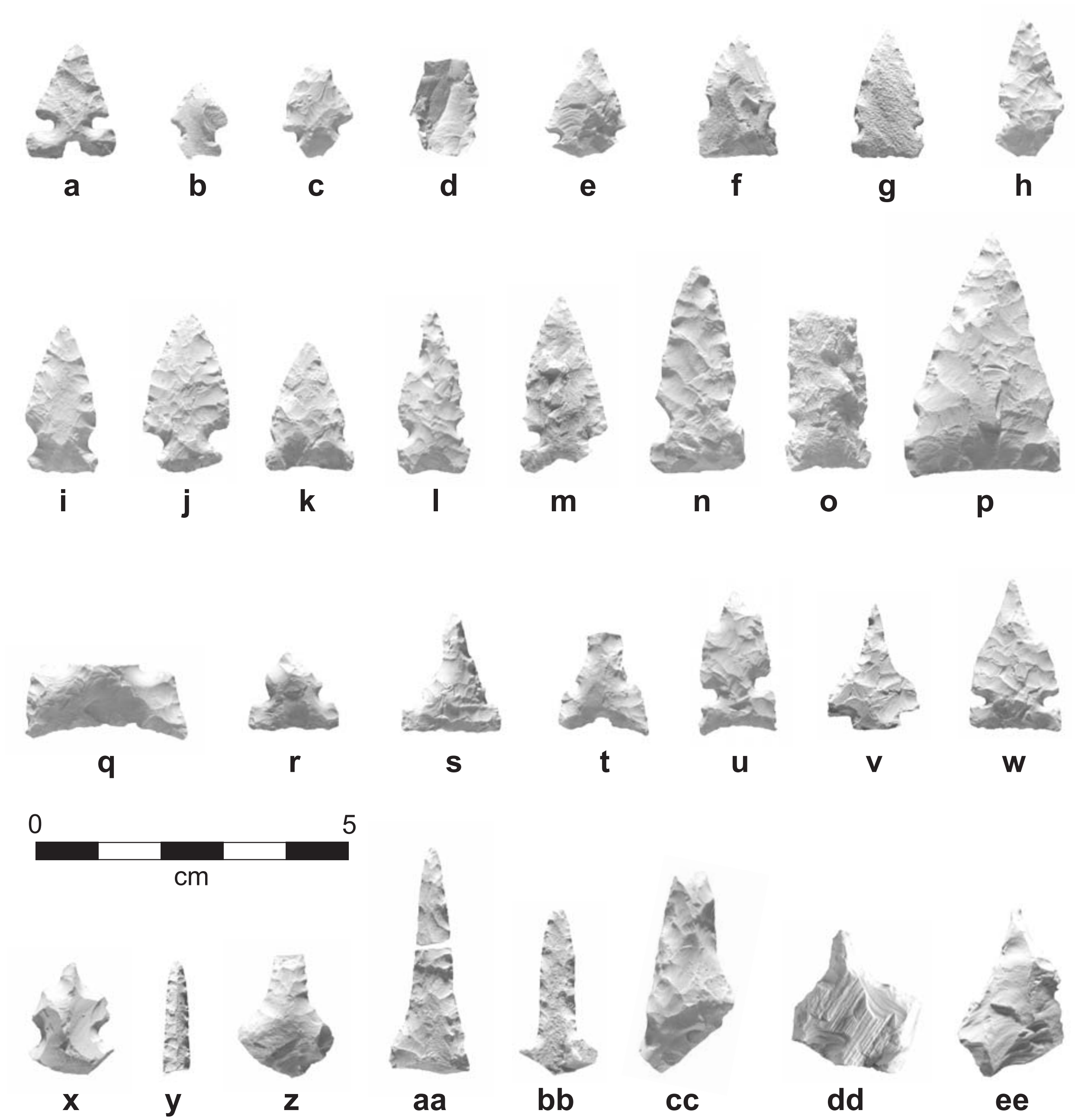

Figure 12.6. Chipped Stone Tool Photographs, Scattered Village. a: tri-notched arrowpoint; b-o: side-notched arrowpoints of other, unclassified morphology; p,q: oversized side-notched point or lance tip; r-w: side-notched arrowpoints recycled into perforators; x-ee: other perforators and drills, hafted and unhafted.

Table 12.20. Morphological classification of arrowpoints, Scattered Village (32MO31), 1998 excavations.

	Morphological Class	Use-Phase Class: 1 - unfinished usable	2 - unfinished non-usable	3 - finished usable	4 - finished non-usable	Total	Finished Percent Classi-fiable
2	triangular symmetrical	5	20			25	
		20.0%	*80.0%*				
3	triangular asymmetrical		5			5	
			100.0%				
5	ovoid pointed	3	2			5	
		60.0%	*40.0%*				
11	ovoid pointed fragment	1	21			22	
		4.5%	*95.5%*				
12	triangular/rectangular fragment		53			53	
			100.0%				
13	pointed fragment	1	101		62	164	
		.6%	*61.6%*		*37.8%*		
15	indeterminate fragment		150		72	222	
			67.6%		*32.4%*		
171	Prairie Side-Notched arrowpoint				2	2	0.9%
					100.0%		
172	Plains side-Notched arrowpoint		28	17	128	173	81.6%
			16.2%	*9.8%*	*74.0%*		
173	Isosceles Triangular arrowpoint			7	8	15	7.1%
				46.7%	*53.3%*		
174	Tri-Notched arrowpoint			1		1	0.5%
				100.0%			
175	Other Notched arrowpoint			6	15	21	9.9%
				28.6%	*71.4%*		
Total		10	380	31	287	708	100.0%
		1.4%	*53.7%*	*4.4%*	*40.5%*	*100.0%*	

type (ca. 10% of the sample; Figure 12.6b-o). Several of these show only the barest degree of modification from a simple flake blank (Figure 12.6b-g), and others are substantially shaped by into unusual forms (Figure 12.6h-o). Unnotched isosceles triangular points make up a small minority of the sample (ca. 10%; Figure 12.5a-h). Points of this form typically dominate Coalescent tradition sites of the same age in South Dakota, but usually have a minor occurrence in North Dakota Plains Village sites. Two Prairie Side-Notched points occur in the sample (Figure 12.5i,j), being characterized by more open notches and notches often placed closer to the basal corners (Kehoe 1966, 1973:47-78). Arrowpoints of this form are characteristic of Late Woodland and Initial Middle Missouri complexes in the Dakotas. A single tri-notched arrowpoint occurs in the study sample (Figure 12.6a).

Chi-square analysis indicates that there is no significant change in arrowpoint morphology through time in the site study sample. Heat treatment was commonly practiced in arrowpoint manufacture, being most evident in fine-grained glassy stones that exhibit a substantial change in luster and ripple marks upon heat application. Among combined KRF, all chalcedonies, and silicified woods in arrowpoints, definite heat treatment occurs in 47.1% of the sample (total n=493), and possible heat treatment is recorded for an additional 7.7% of the sample. Incidence of heat treatment shows a clear and significant increase through time, with definite occurrence increasing steadily from 34.1% in TP4 to 57.7% in TP1 (data presented in following section).

Delicate or Small Precision Tools

A modest number of artifacts in four distinct functional classes are placed in this general functional group. Most common, at about 1% of the site sample, are *perforators and drills*. Most of these have very delicate, bifacially flaked tips. About one-third of these have been reworked on the distal ends of side-notched arrowpoints (Figure 12.6r-w), while the remainder are made directly on flake blanks (Figure 12.6x-ee). The symmetry of many of these specimens indicates that they are intended to have been hafted. Another 19 artifacts are classified as *light duty bifacial cutting tools* and are placed in this general functional group (Figure 12.7a-k). These artifacts are defined based on very light intensity edge rounding and smoothing indicating cutting of soft materials. Most of these are very delicate tools intended to be hafted. Several consist of arrowpoints reused as cutting tools (based on use-wear) (e.g., Figure a,b,d,e), while others resemble arrowpoints in size and technology but probably never functioned as projectiles judging from marked asymmetry (e.g., Figure 12.7c,f,g,h,i). A small number of *graving or incising tools* were identified in the study sample, based on the occurrence of a delicate, unifacially flaked graver tip. A single *slotting, grooving tool* with a stout, beak-like unifacially flaked working tip was identified in the tool sample. The near-absence of beak-like stone tools in the study sample is important, given the relatively high occurrence of groove and split fabrication technology in the production of bone and antler artifacts (chapter by Ahler and Falk, this volume).

Patterned, Sturdy Bifacial Cutting Tools

Larger and generally stronger tools manufactured by patterned bifacial thinning (involving percussion and pressure) are organized in four more specific and one very general functional class. The most common specific functional class is the *heavy-duty unilateral cutting tool*, characterized by fairly intensive rounding and smoothing use-wear along only a single lateral margin (e.g., Figure 12.7o,q). These artifacts are inferred, based on wear distribution, to have been laterally hafted along margin with the opposite margin being the exposed cutting edge of the tool. These tools were used as knives or saws to work wood or other material generally softer than bone. Several *heavy-duty bilateral cutting tools* also occur in the collection, these having similar wear on both lateral margins (e.g., Figure 12.7l,p). A small number of bifacial cutting tools used on hard material also occur in the sample, these being identified by coarser abrasive use-wear indicative of contact with bone, antler, or material of similar or greater hardness (e.g., Figure 12.7m,n,r). A single bifacial tool with a working edge oriented at right angles to the long axis or dimension of the tool (a *transverse cutting tool*) occurs in the sample. The most general functional variant in this overall group is the *generalized bifacial cutting tool*.

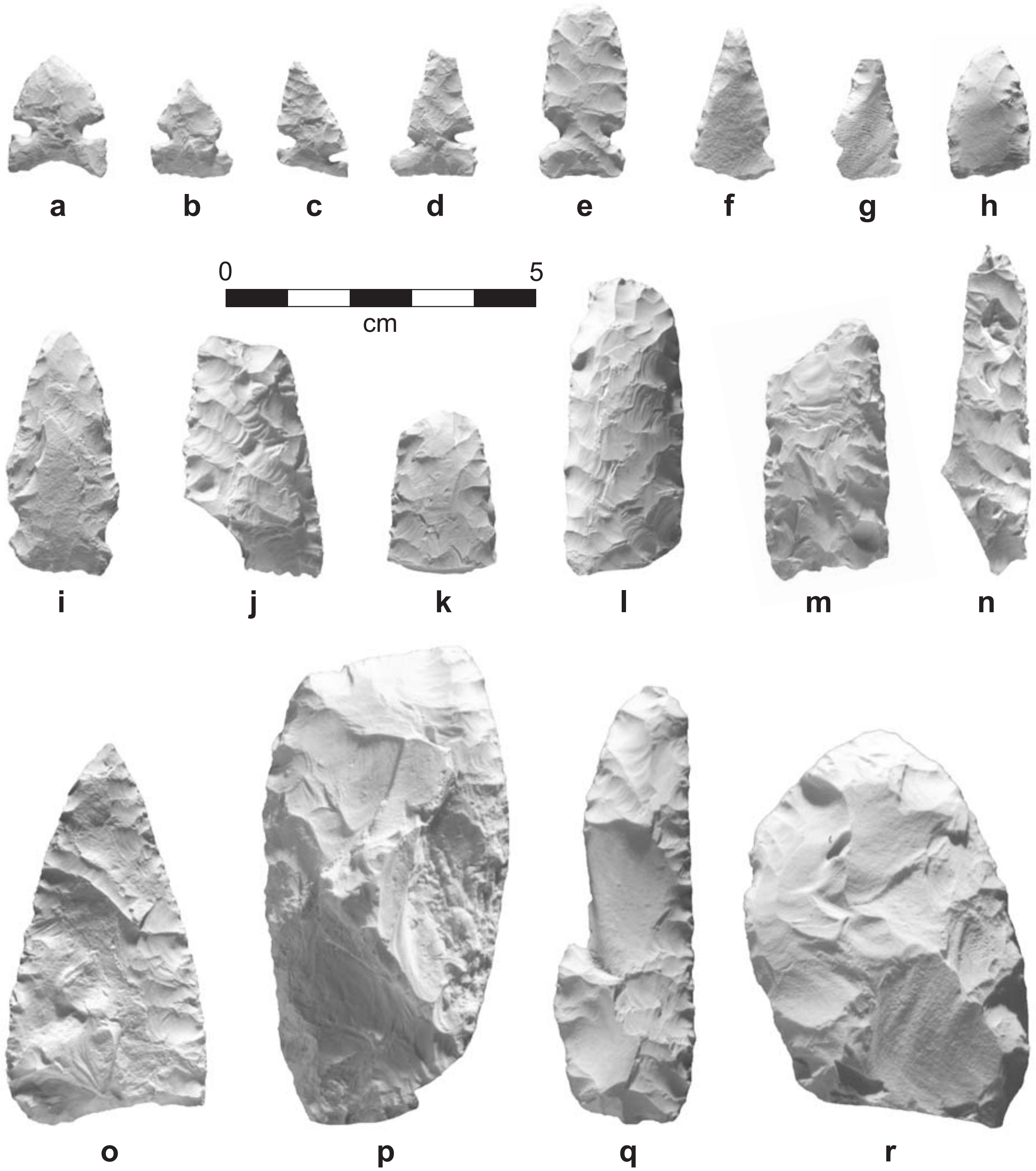

Figure 12.7. Chipped Stone Tool Photographs, Scattered Village. a-k: light duty bilateral cutting tools, (functional class 3); l,p: heavy duty bilateral cutting tools used on soft material (fc7); o,q: heavy duty unilateral cutting used on soft material (fc10); m,n,r: heavy duty cutting tool used on hard material such as bone (fc12).

These implements lack sufficient wear or are insufficiently complete to be classified according to any of the previous, specific functional variants (Figure 12.8f-l). We also use this functional class to accommodate large thin patterned bifaces that were broken and discarded during manufacture (Figure a-e). Five such bifaces were found in a floor or subfloor cache (Feature 27) within the house in Block 3 (Figure 12.8b,f,j). Evidence of on-site manufacture of bifacial cutting implements, in general, is abundant; more than 55% of such artifacts were discarded in use-phase 2 or prior to completion and use (Table 12.19).

Coarse Scrapers and Wood Working

Six specific functional variants are placed in this general group that is intended to accommodate implements used in a variety of fairly specialized scraping, planing, and adzing tasks that involve wood, bone, and other fairly resistant materials. Together these implements make up less than 1% of the total tool sample (Table 12.19). *Transverse scrapers used on hard materials* (generally, bone or antler) are the most numerous specific functional variant. These tools have the typical form of the unifacially flaked end scraper, and working edge use-wear that indicates scraping contact with very resistant work material (Figure 12.9a). From use-wear, it is clear that they were used on something other than hide. Next most abundant are *basal (transverse) scraper/grinders*. Typically, these tools have an elongated form, flaked or shaped lateral margins, and a transverse margin that bears very distinctive use-wear (the upper margin in Figure 12.9b-d). Wear indicates a holding position about 45 degrees to the face of the work material, and back and forth motion across the tool edge, with extensive abrasion usually developing from the presence of grit in the contact area. Ochreous or black mineral-like residues are common on the working edge. Two other functional classes have similar shapes and wear dispositions but differ in apparent work material. *Steep-edged heavy-duty scraping and adzing tools* are frequently core tools that have faceting and smoothing wear indicative of repeated motion against moderately soft work material, perhaps plant material on a soft but firm platform. *Edge or corner ground tools* are, similarly, usually large core tools but exhibit strongly faceted and abrasively ground wear facets from contact with material as hard as stone (worn edge fragments of such tools are shown in Figure 12.9f,g). Two *wood working adzes* occur in the collection, these having unifacially flaked margins that were pushed into the work material in a planing fashion (Figure 12.9h). A single *wood working ax* occurs, this being a rather crudely shaped fully grooved ax (Figure 12.9e) found in salvaged Feature 175 that contained a large number of other fully functional, apparently cached items.

Hide Scrapers

Hide scrapers occur in two morphologies. The less common form is often not very systematically shaped, but usually is a bifacially retouched tabular piece (Figure 12.10a) or elongated patterned biface on which one straight to slightly convex margin was the working edge. These tools are classified as *lateral scraping tools used on soft material*, and they are interpreted to be hand-held implements used to scrape softened, fresh, or moist hide. Lateral scrapers comprise a very small fraction (ca. 3%) of tools classified as hide working tools (Table 12.19). The more common hide working tool form is the ubiquitous unifacially flaked, patterned

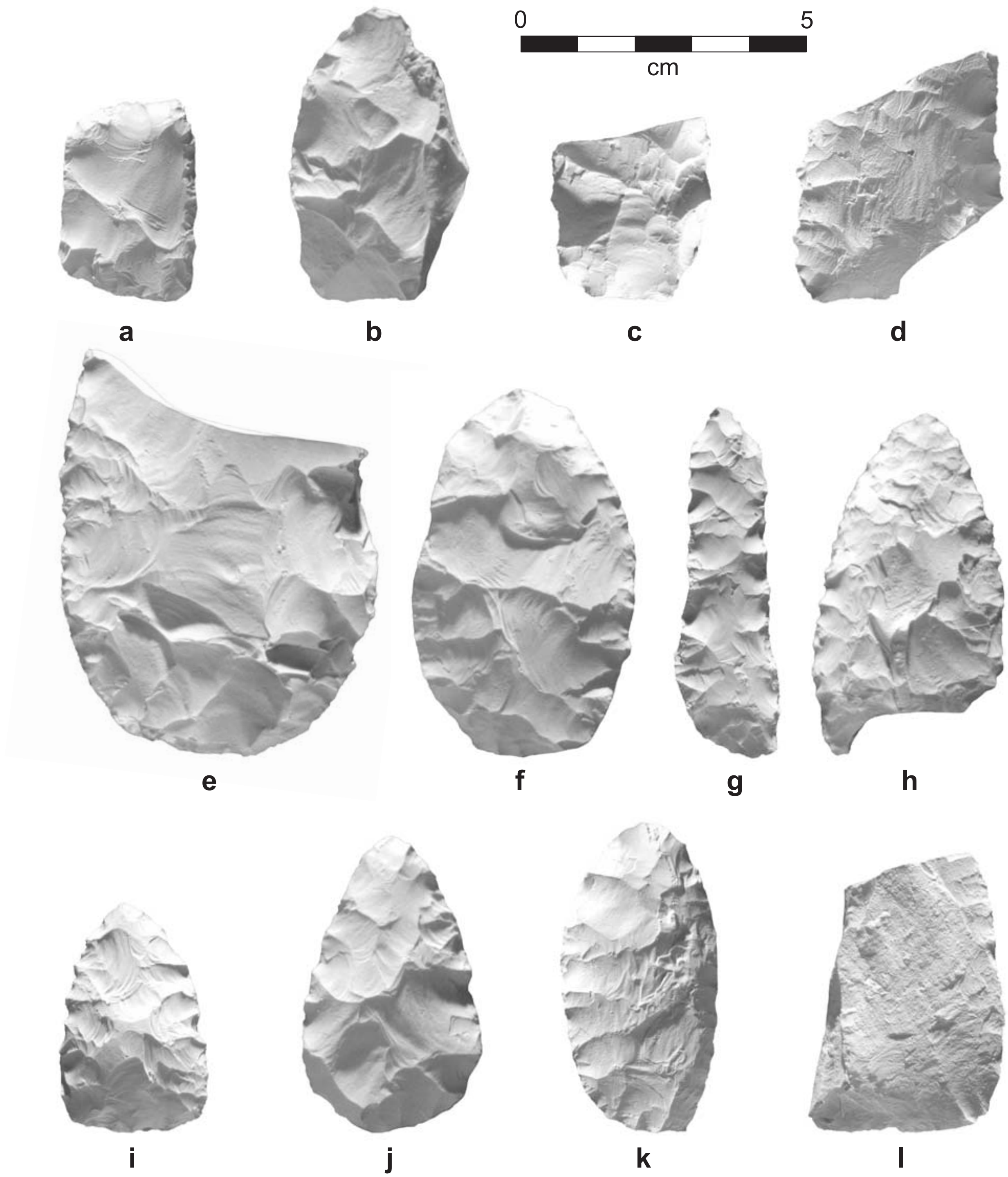

Figure 12.8. Chipped Stone Tool Photographs, Scattered Village. a-e: generalized bifacial cutting tools in use-phase classes 1 and 2 (interrupted during manufacture); f-l: generalized bifacial cutting tools in use-phase classes 3 and 4 (usable or discarded after use); b,f,j: tools in Feature 27, an artifact cache in the floor of a house in Block 3.

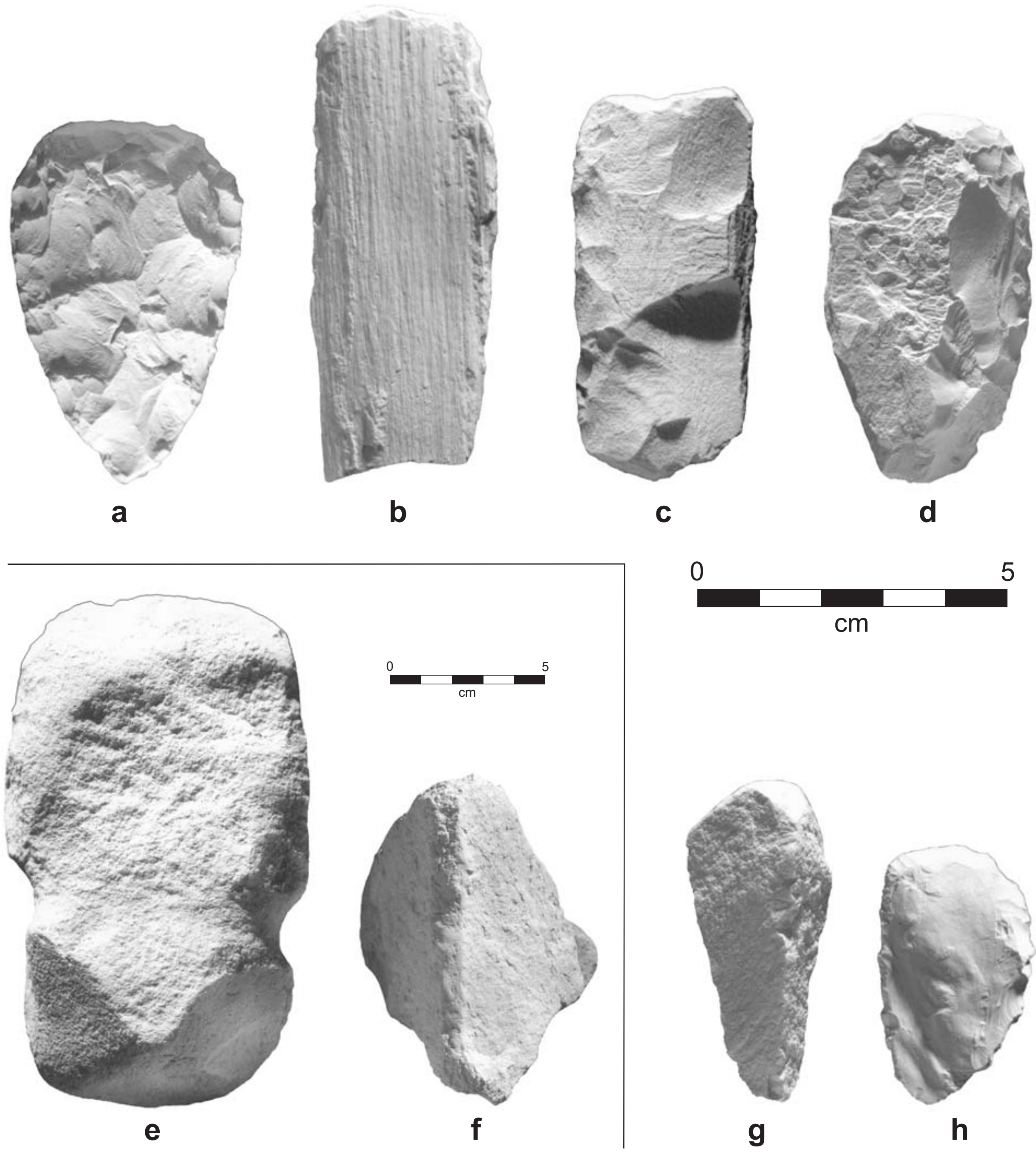

Figure 12.9. Chipped and Ground Stone Tool Photographs, Scattered Village. a: patterned scraper used on hard material such as bone or antler; b-d; basal or transverse scraper-grinders, with working edge up; e: axe or wood working tool; f,g: edge- and corner-ground tools on fire-cracked rock pieces; h: wood working adz, with working edge up.

end scraper (Figure 12.10b-q). Such artifacts are abundant in the site, comprising nearly 6% of the full tool sample. Unifacial end scrapers are further classified according to three functional variants based on use-wear as well as degree of fragmentation. If the working edge can be observed, the implements are either classified as *scrapers used on abrasive material* (based on fairly advanced edge faceting and striations, with matte surface texture) or scrapers used on soft material (based on absence of wear or wear consisting of edge rounding and smoothing). Based on current understanding of bison hide processing technology (Jodry 1999:235-248), we would characterize the first group as dry hide scrapers or more accurately as scrapers likely used in the latter, tanning stages of hide preparation. Alternately, the second group of tools would be *scrapers used on soft material*, or wet hide scrapers-tools most likely involved in hide preparation steps that preceded the final tanning stages. It can be noted that the dry hide scrapers (or tanning tools; functional class 16) are relatively uncommon in the collection, in comparison with number of implements placed in functional class 6. These proportions are far different that what occurs in some Plains Village sites, and further study of hide scraper use-wear may reveal strong differences in bison hide processing behavior between villages and village groups. Finally, we can note the presence of functional class 20, *miscellaneous transverse scraper* category, that is used for fractured or recycled end scrapers on which it is not possible to examine the original working edge.

Unifacial end scrapers were hafted implements that were fairly continuously resharpened until they reached a critical shortness that allowed no further retouch within the haft and required disposal and replacement. Thus, unbroken scrapers can be classified as both usable, use-phase 3 tools, as well as exhausted, use-phase 4 tools, based on overall length. Based on the distribution of scraper length in previous Plains Village studies, we used 29.0 mm as the critical length separating useful from exhausted, unbroken scrapers. Within the site as a whole, exhausted complete end scrapers are about equally abundant as usable, complete end scrapers. Usable, unbroken scrapers are relatively more common in pit features. Feature 175, a large salvaged pit, produced a total of 16 unbroken hide scrapers (15 of these are shown in Figure 12.10c-q), and among these, 11 are non-exhausted, usable implements (Figure 12.10c-m). This strongly suggests that these were useful tools stored within this cache pit.

Expedient Cutting Tools and Flake Tools

A large variety of expedient cutting tools and flake tools occur within the site study sample (9 functional classes listed in Table 12.19), and overall, this general class comprises nearly one-third of all stone tools in the site. Four functional classes dominate the sample. Most abundant are *utilized and retouched flakes used to cut and slice variable work materials* (Figure 12.11l-n). These include unifacially and, occasionally, bifacially modified flakes as well as tabular pieces that exhibit fairly regular edge modification and a lack of irregular edge damage. These are thought to have been used to slice, scrape, plane, and whittle a wide range of work material, and rarely do they show use-wear in sufficient intensity to discern direction of motion or tool penetration. Large flake removals on such specimens are considered to reflect intentional retouch, while smaller and diminutive flake removals may simply be utilization damage from scraping or shearing contact with harder work materials. Another common functional variant is

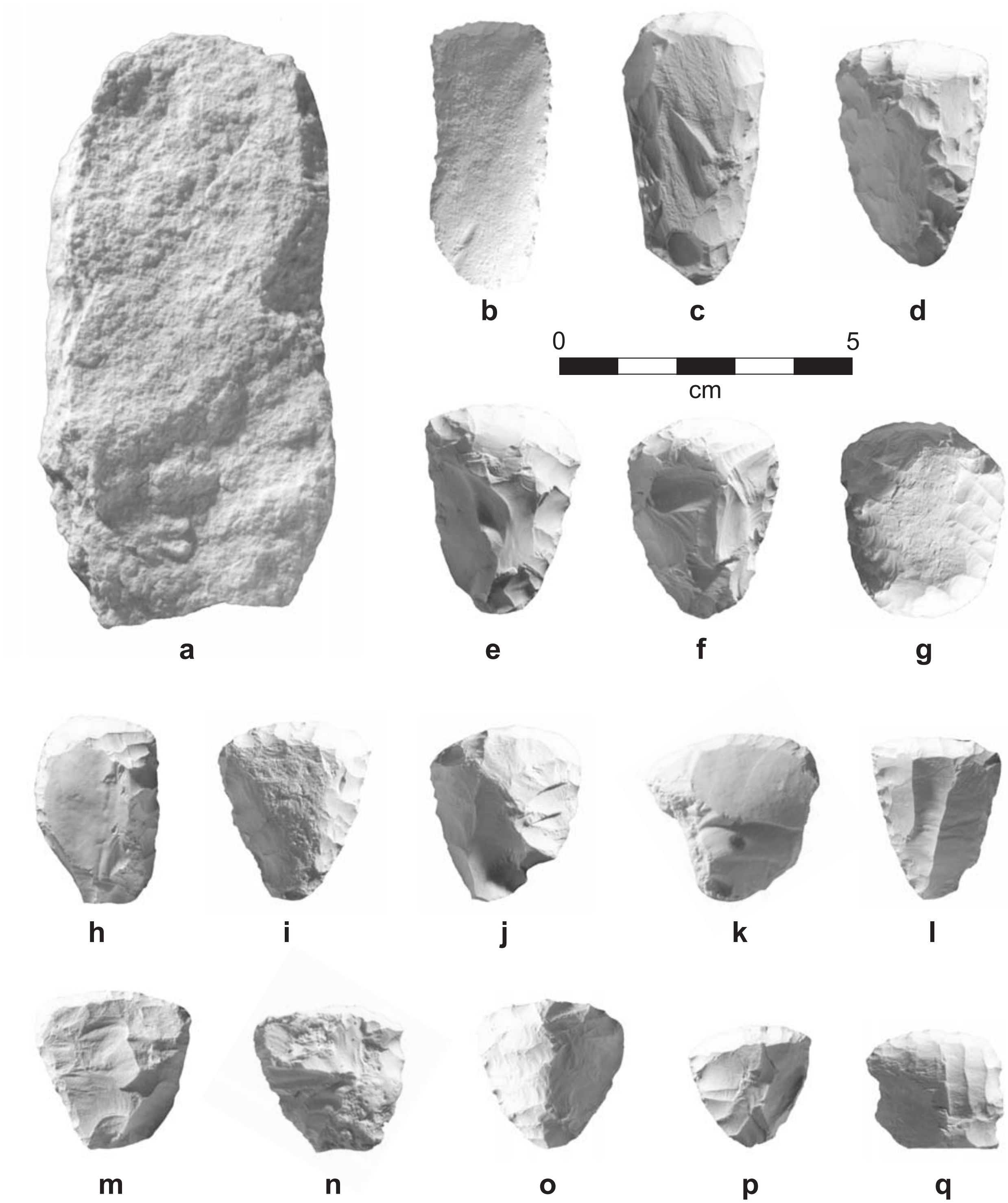

Figure 12.10. Chipped Stone Tool Photographs, Scattered Village. a: lateral scraper used on soft material (probably wet hide); b-q: patterned transverse scrapers used on soft material (probably wet hide), all except (b) are from Feature 175.

the *utilized flake used to slice or saw hard materials*. This tool is identified by use-wear consisting of irregular flaking wear, usually in the absence of more regular marginal modification or retouch (Figure 12.11j,k). This type of wear develops from sawing contact with hard material such as bone or antler. A third flake or retouched tabular tool variant is the *denticulate*, identified by intentional retouch that forms a jagged, saw-like margin (Figure 12.11e-i). These are thought to have been used for sawing into materials of variable hardness and composition. The final major contributor to this general functional group are *expedient or general purpose bifacial cutting tools.* Typically, these are relatively small bifaces manufactured by unpatterned percussion retouch designed mostly to create a tool edge but not to thin the implement (Figure 12.11a-d). Use-wear on these implement is extremely variable, from frequently absent to locally intense. These are thought to have been quickly made implements used for a fleeting purpose, ranging from sawing to cutting, scraping, scoring, and perforating tasks with a wide range of work materials. Five more specific flake tool functional classes are included in this general functional group. Together, they comprise of only 14 tool occurrences. *Stone saws* are flakes used to saw a slot or groove in another piece of stone. *Spokeshaves* are retouched flakes with a distinctly concave retouched margin, presumed to be used to plane or scrape dowel-like work material (perhaps wood, antler, or bone). One flake had a *ridge used to plane* wood or other resistant material. Another flake tool consists of a *radial break tip* used for point contact to bore or slot some work material. Three *generalized flake tools* include two exotic, orthoquartzite flake blanks with transport wear but no use wear, apparently stored at the site for future use, and also one nondescript flake tool recycled onto another tool form.

Heavy Core-Tools

A small number of heavy core-tools occur in the site sample. *Chopping and pounding tools* typically exhibit a bifacially flaked edge with severe crushing damage at the flaked margin. One such implement in the site sample (Figure 12.12a) has a bifacially flaked, narrow end, suggesting that it might have been hafted for use. Another category includes what we call *core-tools of unknown function*. Typically, these are heavy implements with a small number of flakes removed by direct bifacial or unifacial percussion from a limited part of one margin. These typically lack use-wear, and are frequently made of coarse stone that negates the likelihood of flaking for production of useful flakes. Hence, we place them in a class with unknown purpose. One such implement is shown in Figure 12.12b; the face of this implement was used as a hammer or anvil for bipolar percussion flaking. One *heavy-duty ripping/sawing tool* occurs in the sample, this characterized by percussion flaking that produced a grossly jagged margin, and use-damage on the projecting edge margin indicating sawing contact with hard material such as bone. This could be an expedient butchering tool.

Non-Bipolar Cores and Tested Raw Material

All artifacts in this general class are nuclear pieces modified by freehand percussion flaking (as opposed to bipolar percussion). *Freehand cores* exhibit three or more flake removals that can be considered substantial in size relative to the overall size of the material piece. Typically, flake removals are unpatterned and opportunistic (Figure 12.12c-j). No obviously

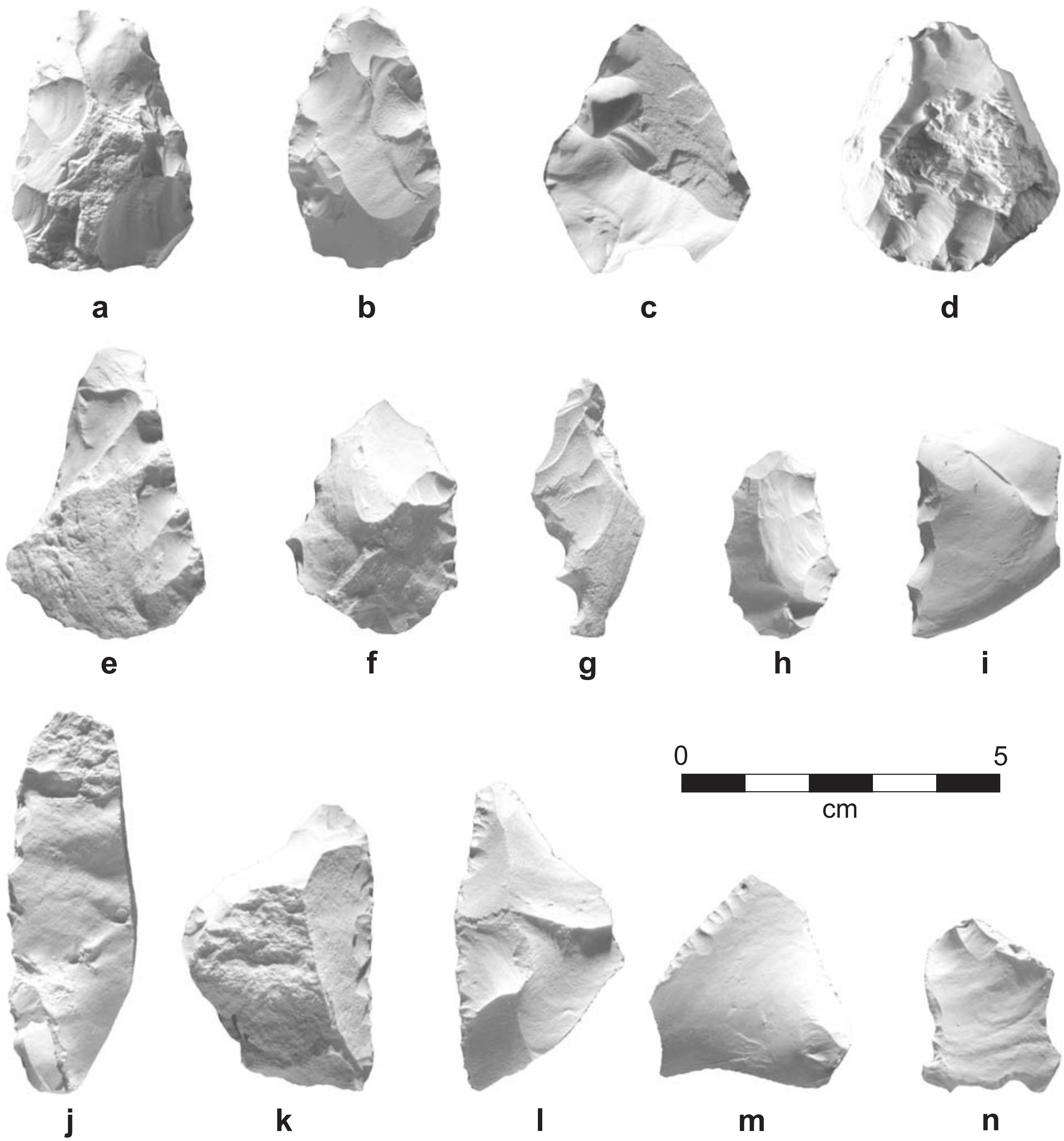

Figure 12.11. Chipped Stone Tool Photographs, Scattered Village. a-e: expedient unpatterned bifacial tools used on variable materials; f-i: denticulate flake tools; j,k: utilized flakes used to saw/slice hard material. l-n: utilized and retouched flakes used to cut and slice variable materials.

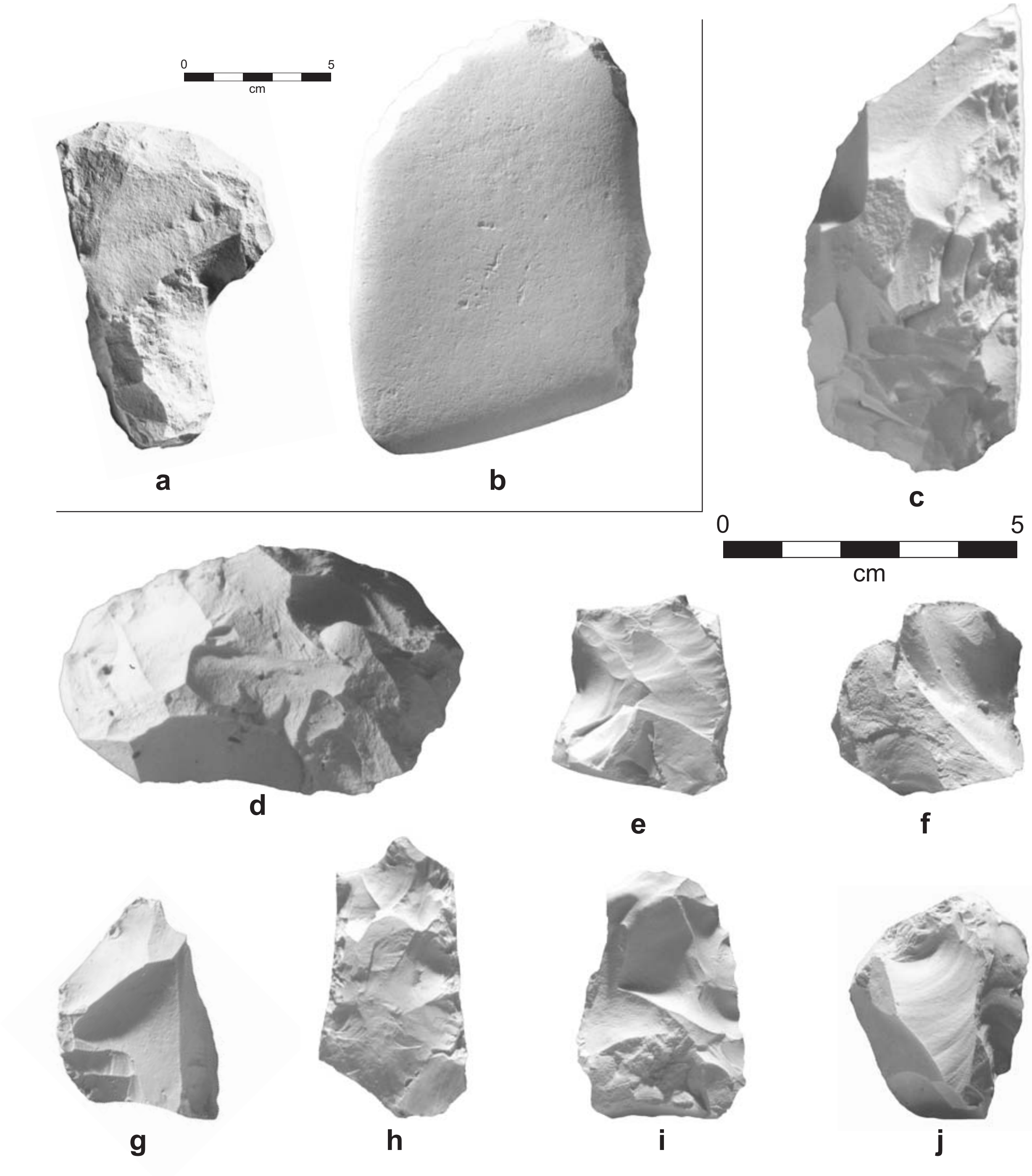

Figure 12.12. Chipped Stone Tool Photographs, Scattered Village. a: chopping/pounding tool; b: core tool of unknown function and bipolar hammer/anvil; c-j: direct freehand percussion cores.

prepared blade nor lenticular cores occur in the sample. *Tested raw material* included a nuclear piece modified by one or two, non-substantive flake removals apparently intended to open and inspect the quality of the stone, or by a lateral snap or bend break that left more than 50% of the original piece intact (the lesser part of such a broken pebble or cobble would be classified as shatter flaking debris). These two categories occur in approximately equal abundance in the site collection (Table 12.19).

Bipolar Cores and Tools

Items with evidence of bipolar percussion are relatively common in the collection, making up more than 13% of the tool sample. These consist of a few items that were either the percussion hammers or anvils involved in bipolar work, or, most abundantly, the chipped, nuclear lithic pieces that show evidence of characteristic splintering, bipolar fracture. Bipolarized, nuclear pieces are placed in three classes, based on the degree of "core-ness" or non-core-ness. Only three *bipolar cores* are identified, and these are relatively large items with large flake removals and a shape suggesting that use as a punch, wedge, or chisel would have been unlikely. Most common are bipolar *core/punch/wedge/chisels* that, based on size and form, could either be nuclear pieces involved in bipolar flake production, or could have been used as an intermediary tool (Figure 12.13a-f). Nearly as common are items we have classified simply as non-cores, but as *punch/wedge/chisels*, based primarily on size not conducive to flake production, and frequently on knowledge that the beginning size of the piece when bipolar fracture started was simply too small for useful flake production. The great majority of these are items that have been recycled by bipolar percussion from some tool form or type originally fabricated by non-bipolar technologies (Figure 12.13g-u). Among the 278 items in this functional class, the most common input blank forms are unpatterned flake or tabular tools (n=69), patterned flake tools (end scrapers; n=46), finished patterned bifaces (n=43), indeterminate non-bipolar flake (n=28), unfinished patterned biface (n=24), thin plates (n=24), and one simple non-bipolar flake. Examples of such artifacts made on patterned bifaces and end scrapers are shown in Figure 12.13g-j and Figure k-u, respectively.

In the discussion of flaking debris, we explored and rejected the concept that bipolar percussion was used primarily in the site for production of bipolar flakes. This was based on the relatively low frequency of bipolar flakes, in any size range, in the site sample. The data from the classification of bipolar nuclear pieces support the idea that bipolar percussion was used overwhelmingly in punching, wedging, and chiseling operations and was not particularly involved in flake production. This interpretation is particularly supported by the high frequency of application of this technology to relatively small, already existing tool forms. The question remains regarding what these tools were specifically used for. The study of bone and antler artifacts indicates that bipolar punches were involved in the fabrication of many bone tools and implements (especially split rib tools and scapula hoes). Antler and bone artifact production by groove and splinter technique was also relatively common in the site, yet unifacially beak-like tools designed for grooving tasks are nearly absent among stone tools. A likely alternative is the use of sharply pointed bipolar splinters (both nuclei as well as flakes), such as those shown in

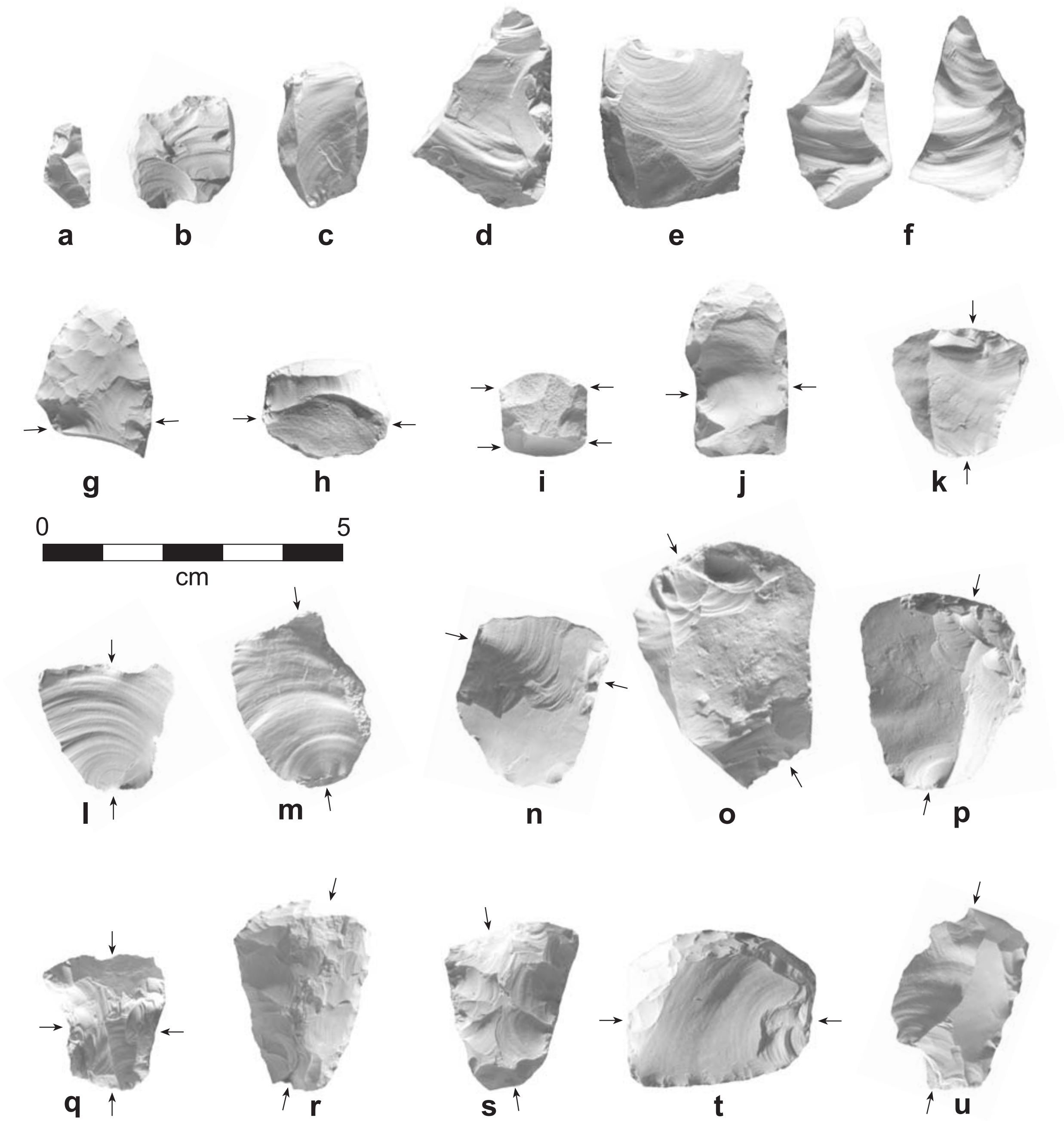

Figure 12.13. Chipped Stone Tool Photographs, Scattered Village. a-f: bipolar core/punch/wedge/chisels; g-j: bipolar punch/wedge/chisels made on recycled patterned bifaces, showing placement of bipolar force; k-u: bipolar punch/wedge/chisels made on recycled transverse (end) scrapers, showing placement of bipolar force; k-p: ventral scraper faces; q-u: dorsal scraper faces.

Figure 12.13a,d,e,f, as grooving and slotting tools. If such was the case, such usage produced so little use-wear that we did not identify these as slotting/grooving tools during our microscopic examination.

We also identified a modest number of bipolar hammer and anvil implements in the collection (27 altogether). Bipolar percussion produces a characteristic, localized pitting on both the hammer and the anvil surface. Where possible, we attempted to distinguish anvil from hammer in bipolar production, based on artifact size (a hammer should fit in one hand) and shape. The size of the implement in Figure 12.12b indicates that it may have served most suitably as an anvil, while the pitting near one end of the cobble in Figure 12.16i indicates that it was likely used as a hammer. Many implements could be either hammer or anvil, such as artifacts shown in Figures 12.14f and 12.15a-d,g,h. The frequency of bipolar technology, and particularly the abundant use of bipolar punch/wedge/chisels, is an unusual feature of the Scattered Village site that sets it aside from most other village settlements previously studied in North Dakota.

Ground Stone, Abrasive, Hammering Tools

This large and inclusive general functional group includes 10 specific, utilitarian functional classes (Table 12.19). *Whetstones* consist of platforms, tabular pieces, or a piece of fire-cracked rock with a flat surface that exhibits spatially localized abrasion and grinding wear (Figure 12.14a-c). These are thought to be a stationary platform against which another, probably smaller item was moved for purposes of grinding, shaping, or sharpening. *Hammerstone/ pounders* used in freehand percussion operations (not bipolar) occur in several forms. Least common are grooved mauls; two occur in the sample (both made of metaquartzite; figure 12.15e,f) and a third was stolen after it was exposed on the floor of the burned house in Block 8. Several fairly symmetrical or patterned hammerstones also occur in combination with manos and pitted bipolar percussion tools (Figure 12.14f, Figure 12.15a-d). The entire perimeter of the circular tool has been used for pounding, as have the ends of the elongated mano (Figure 12.15a). More expedient hammerstones, in the form of waterworn cobbles with percussion marked ends, are quite abundant in the collection. Some occur in combination with burnishing stones (Figure 12.16d,g,i,j) and some do not (Figure 12.16b,c,e,f,k). A small number of highly *specialized or patterned crushing/grinding tools* in the form of *manos* and *metates* occur in the sample. The manos are predominantly circular in form and, as noted previously, occur in combination with pounding surfaces and pitted bipolar percussion tools (Figure 12.14f, Figure 12.15a-d). Fragments of two metates occur. One is shaped and roughened or sharpened by systematic pecking and pitting (Figure 12.14d), as is common is such tools in Southwestern Puebloan contexts. This artifact is made of an unusual coarse sandstone, possibly exotic to the area. The second metate fragment is less patterned and shaped, and is made from the local sandstone (Figure 12.14e). It also shows scratch marks from contact with a sharp or pointed stone object (use as a whetstone).

Simple or expedient burnishing tools are relatively common (n=37). For the most part, these consist of pebbles or cobbles with smoothing concentrated on one or both faces (Figure

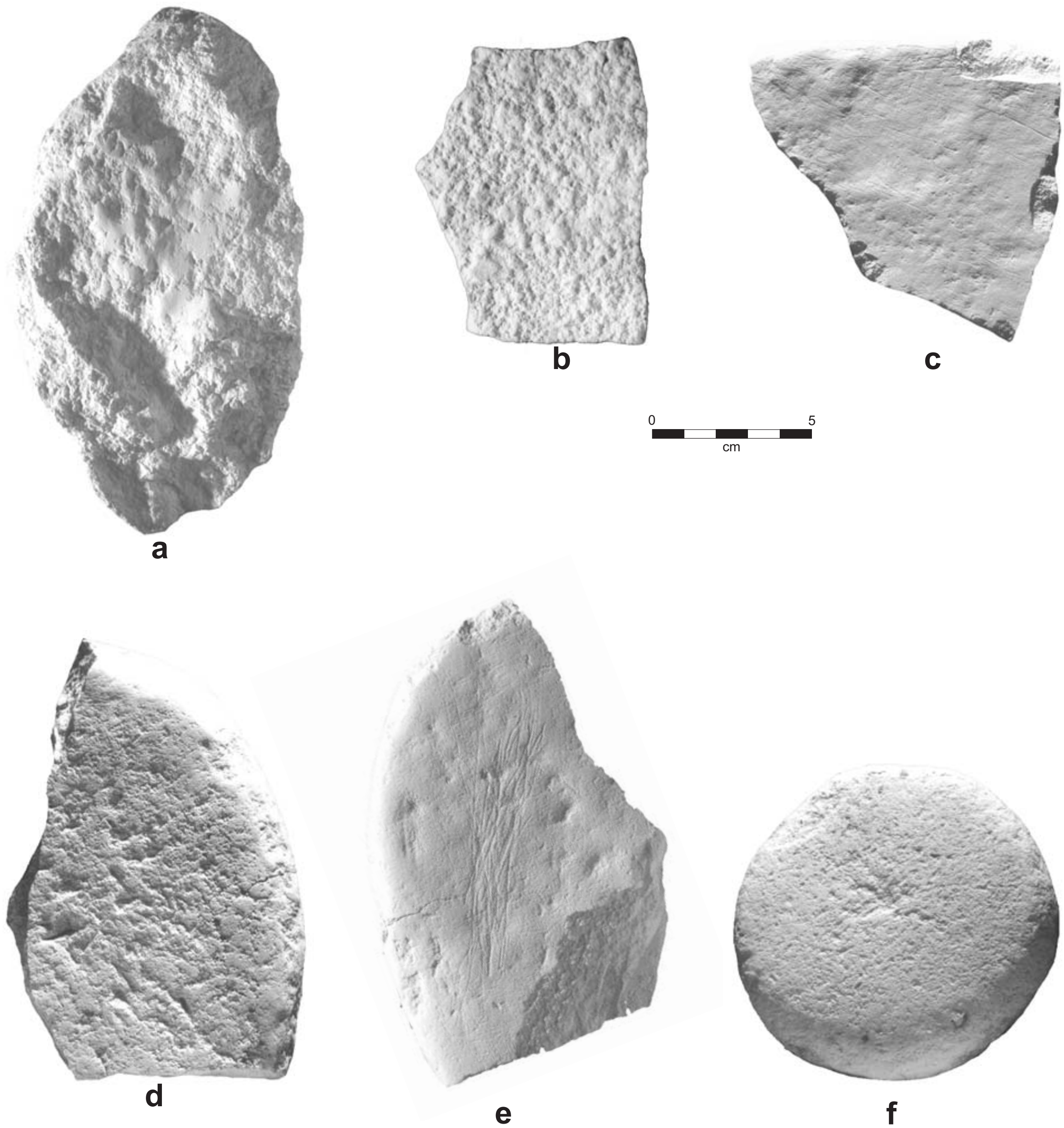

Figure 12.14. Ground Stone Tool Photographs, Scattered Village. a-c: whetstones or grinding/sharpening platforms; d: metate fragment; e: combination metate fragment and whetstone (note scratches); combination mano, hammerstone, and bipolar hammer/anvil.

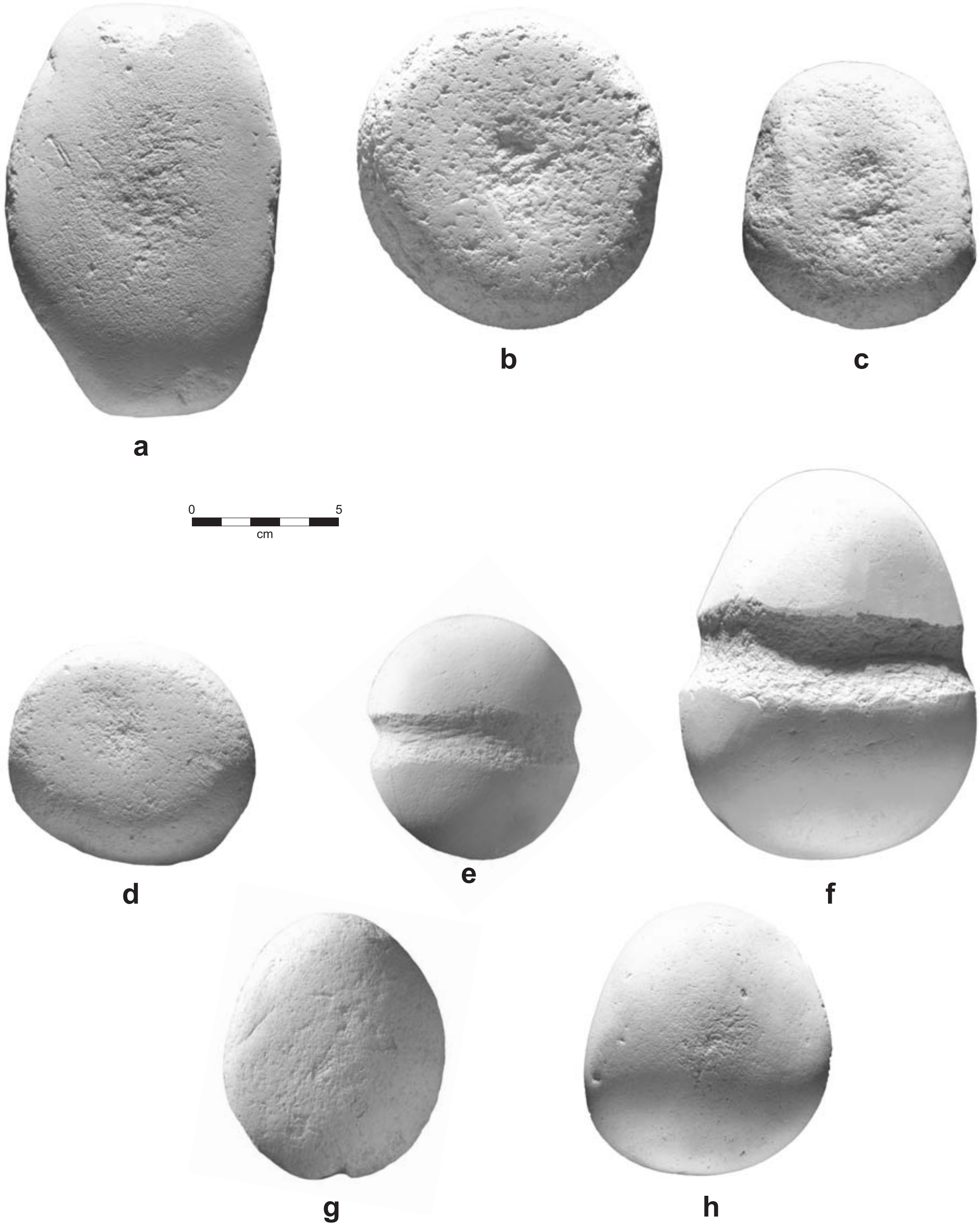

Figure 12.15. Ground Stone Tool Photographs, Scattered Village. a-d: combination mano, hammerstone, and bipolar hammer/anvil; e-f: grooved maul or hammerstone; f-h: combination hammerstone and bipolar hammer/anvil.

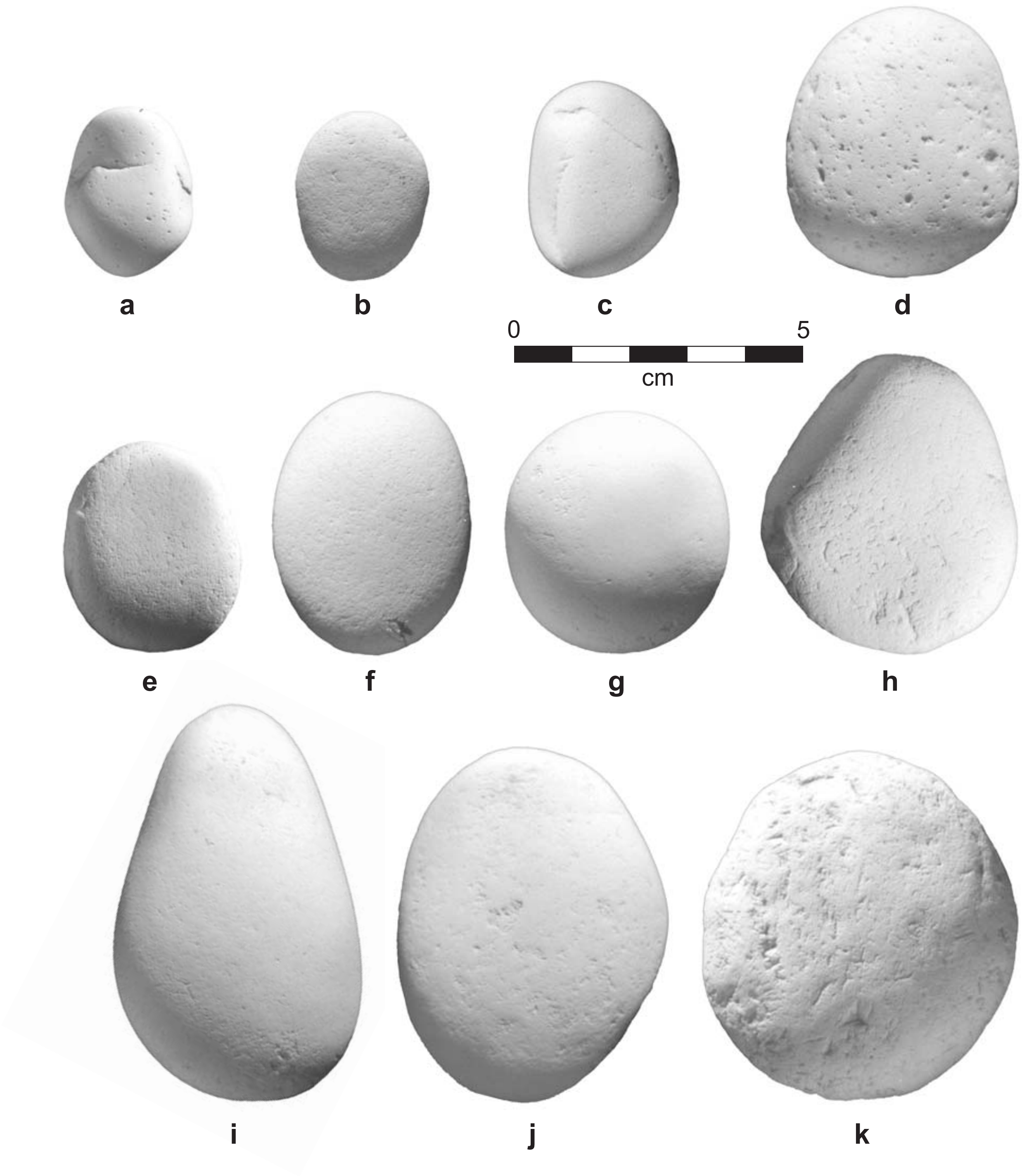

Figure 12.16. Ground Stone Tool Photographs, Scattered Village. a-f,h,k: hammerstones; d,g: combination hammerstone and burnishing tools; i,j: combination hammerstone, burnishing tool, and bipolar hammer/anvil.

12.16a,d,g,i,j). *Simple abrading tools* are the most abundant specific functional variant in this general class, making up about two-thirds of the specimens in this general group (Figure 12.17a). A variant of this tool is an *abrading stone with grooves*, used perhaps to sharpen an awl or shape an elongated object (Figure 12.17b). About 95% of these two classes of abraders are made on clinker (Figure 12.17a); local sandstone (Figure 12.17b) and granitic rocks comprise about 3%, and the remaining 2% are made on coarse, porous sandstone that is probably exotic to the site. A small number of artifacts identified as *shaft smoothers* occur in the sample. One form is systematically fashioned from the coarse, non-local sandstone and has a relatively narrow (<1 cm) groove aligned with the long axis of the piece (Figure 12.17c-e). Based on the diameter of the groove, these could be interpreted as arrowshaft smoothers. A second type of shaft smoother is made on the local sandstone. Typically, the deeply worn grooves in this tool are ca. 1-1.5 cm in diameter (Figure 12.17f-h), indicating use for specialized abrasion of an object larger than an arrow shaft. A single conical, tapered *reaming tool* made of clinker occurs in the sample (Figure 12.19d). The remaining tools in this general functional group consist of a small number of *manuports*, or unmodified stones that because of their unusual size and/or raw material, are thought to have been intentionally transported onto the site. One of these is metaquartzite, and the remainder are flakeable stones thought to have been imported for chipped stone tool production.

Nonutilitarian, Decorative, or Recreational Items

Several categories of artifacts occur in this general functional group which, altogether, comprises little more than 1% of the site sample (Table 12.19). *Shaped discs or tables*, interpreted to be *gaming pieces*, are relatively common (n=16). Finished items typically have a clearly shaped circular or subrectangular form; incised lines emanating from a point in the center occur on one face only (Figure 12.18c-h). Three partially shaped but unground items are interpreted as partially manufactured gaming pieces. Ten of these objects are made from scoria, red in color, and the remainder are made from a variety of fine-grained stones more locally available. These are interpreted as gaming pieces because of the clear bifacial aspect to each artifact, and the clear contrast between the decorated and undecorated face (analogous to heads and tails in a coin). Such artifacts are readily useful in a game of chance in which such items are tossed onto the ground and the outcome is determined by the facial aspects of how the pieces land. Similar artifacts occur in bone and shell in the Scattered Village collection.

Stone beads also occur in the sample, in two forms. One is a patterned artifact shaped by grinding and perforated by drilling, with such specimens usually made from scoria (n=4) and local mudstone/siltstone (n=1) (Figure 12.18o-m). The second, and more common form (n=11), are selected but unaltered concretions having a donut or tubular form (Figure 12.18n-v); these are thought to be expediently selected or collected items that would have served as simple ornaments. The beads from Scattered Village contrast with the stone beads from Slant Village. In the latter site, all of the stone beads are patterned and intentionally shaped, and no beads made on natural concretions occur. Further, the Slant Village beads are all made on a yellow silt or clay stone that was carved then heated to induce a change to red color (Ahler et al. 1997:322).

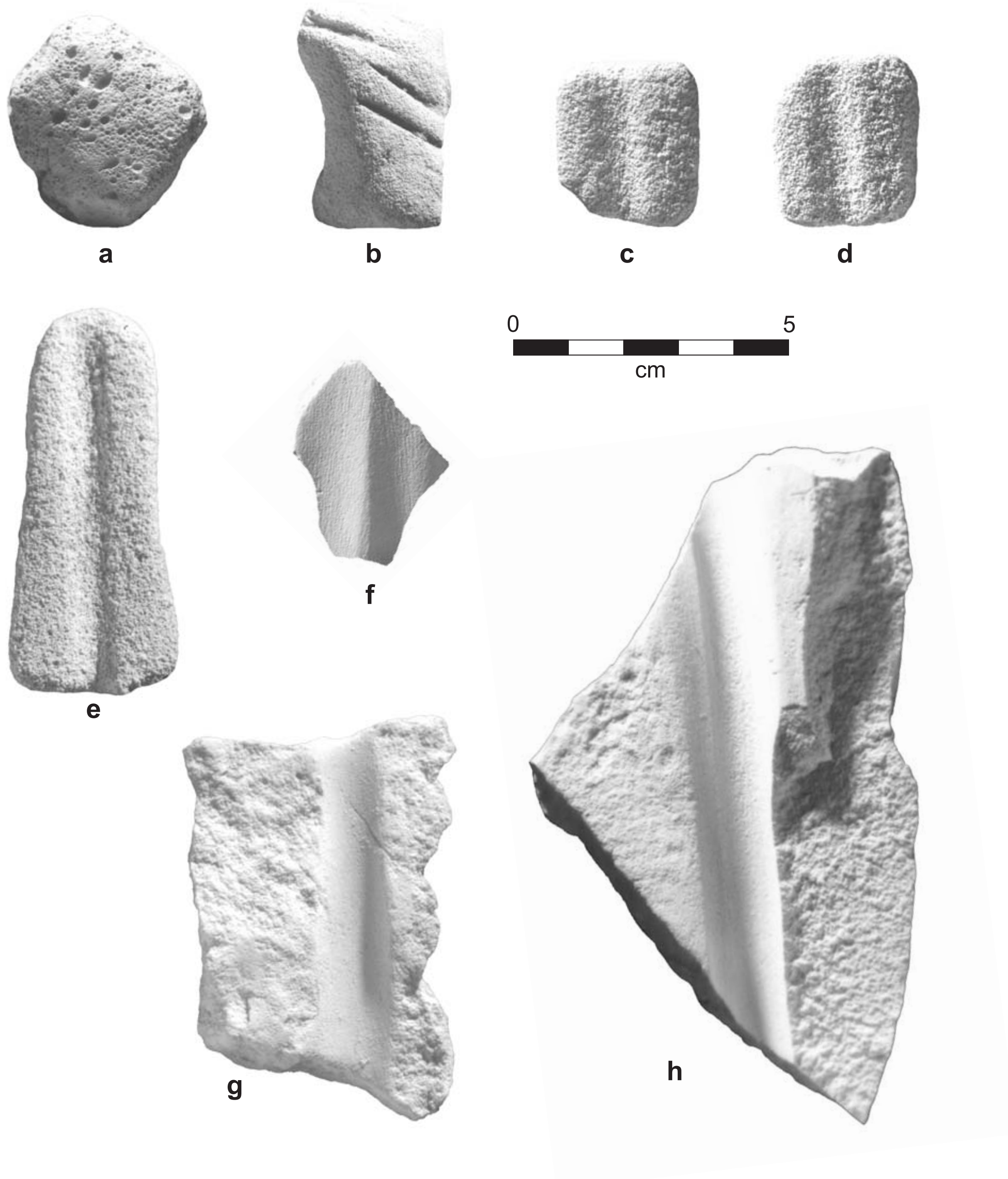

Figure 12.17. Ground Stone Tool Photographs, Scattered Village. a: simple ungrooved abrading tool (clinker); b: simple grooved abrading tool; c-e: shaft smoothers for small diameter shafts, made on exotic sandstone; f-h: shaft smoothers for large diameter shafts, made on local sandstone.

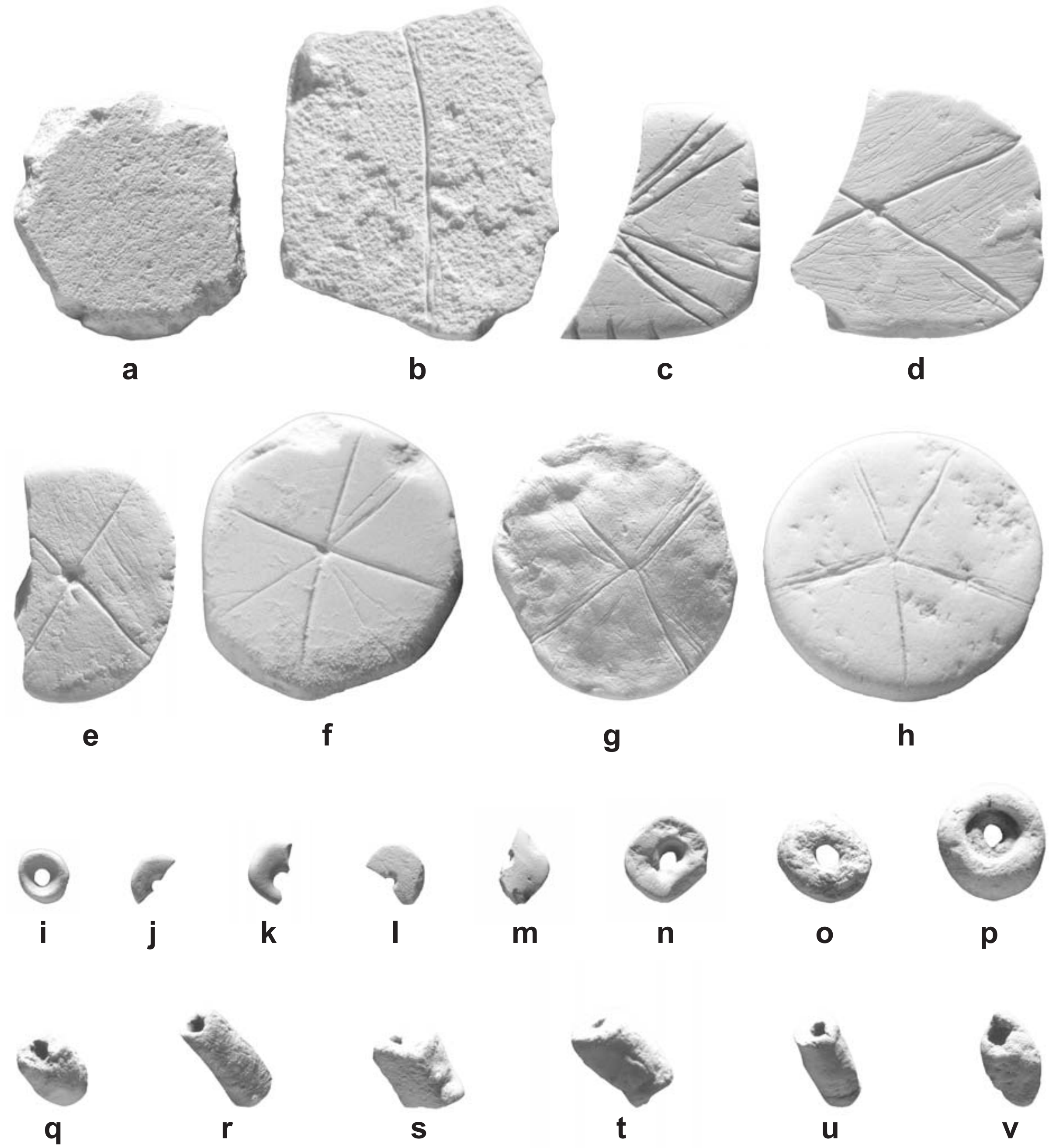

Figure 12.18. Ground Stone Tool Photographs, Scattered Village. a-h: patterned disk or tablets (gaming pieces) in use-phase classes 1 (a,b), 3 (f-h), and 4 (c-e); i-m: drilled stone beads; n-v: concretions apparently used as stone beads.

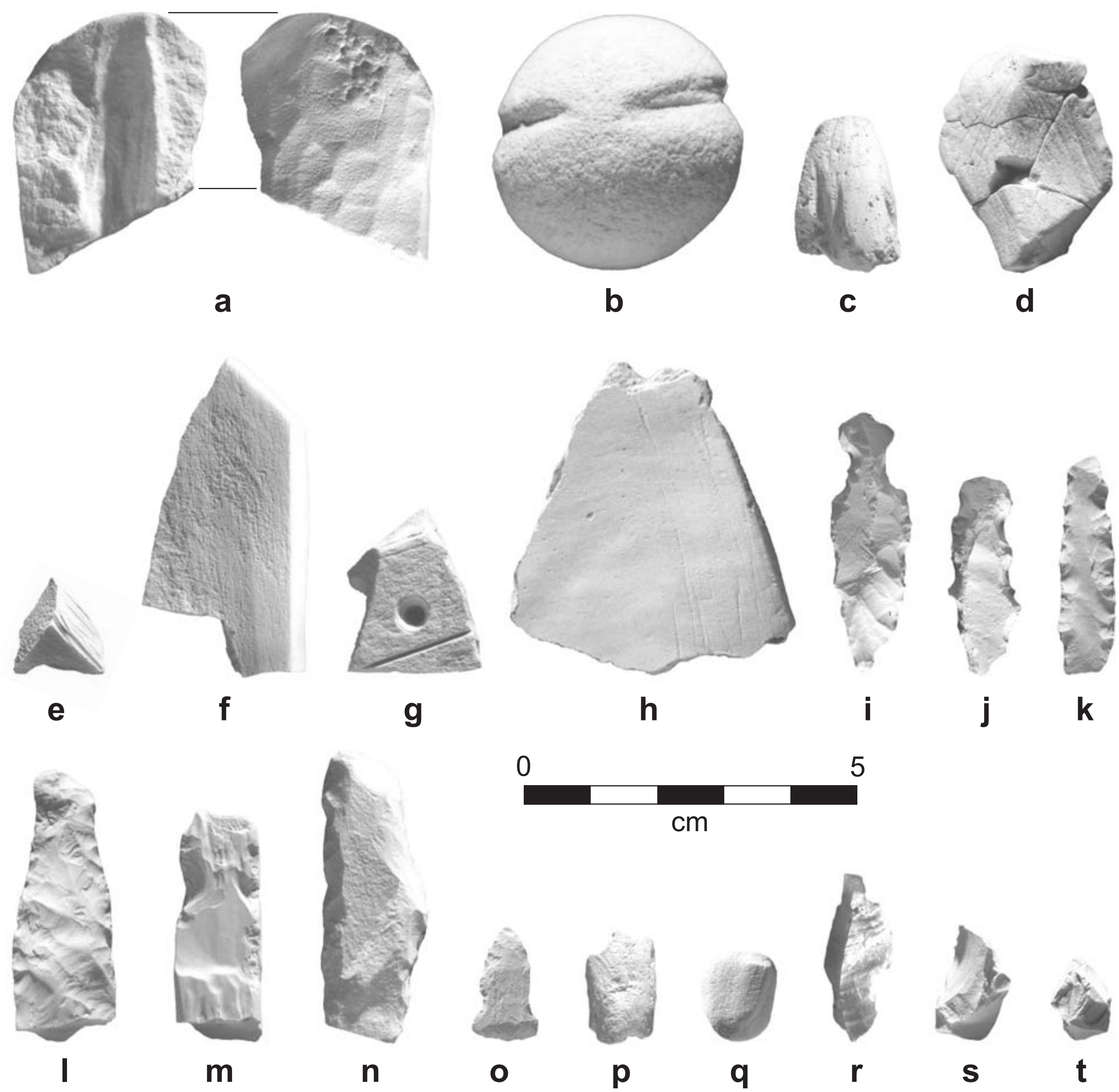

Figure 12.19. Ground Stone Tool Photographs, Scattered Village. a: carved stone pipe, broken during manufacture; b: grooved sphere (net weight?) (in surface collection); c: clinker reamer; d,e: worked hematite; f-h,p,q: nonutilitarian items of uncertain function made by grinding; i-o: nonutilitarian items of uncertain function, made by flaking and abrading; r: copper stained flake; s,t: chipped marble-like objects.

One fragment of a *smoking pipe* occurs in the sample (Figure 12.19a). The specimen was apparently broken during manufacture; it is made of a soft siltstone. The exterior has been carved with a sharp stone or metal tool, and a hole is partially carved or gouged out of the interior. One spherical item with a partially encircling groove is interpreted as a possible *net* *weight or bola stone* (Figure 12.19b). This artifact is a surface specimen and is not included in the village study sample. Three pieces of abraded hematite, red ochre, or otherwise iron-rich stone occur in the sample (Figure 12.19d,e). One bipolar flake stained with copper oxide occurs in the sample (Figure 12.19r). Three chipped, patterned artifacts classified as *symbolic weapon tips* occur in the sample (Figure 12.6p,q). These artifacts have the shape of an oversized Plains Side-Notched arrowpoint, but are about three times normal size for such artifacts. Several *nonutilitarian items of uncertain function* occur in the sample. Half of these are ground, shaped, cut and/or drilled pieces of soft stone of various kinds (scoria, sandstone, mudstone, unidentifiable rock, etc.). Several of these may be manufacturing residue from fabrication of larger artifacts, or are simply too fragmentary for interpretation (Figure 12.19f-h,p,q). Ten other objects are made of stones more commonly flaked such as KRF, moss agate, and silicified wood. These are generally crudely flaked into an elongated form, often are also partially ground and polished after flaking, and frequently have a constriction near one end apparently intended as a tying place for suspension as a pendant (Figure 12.191-n).

Miscellaneous

A small number of miscellaneous items occur in the site sample (Table 12.19). Three artifacts are classified as possible *practice pieces*, being small core-like objects bearing repeated, non-productive percussion plows and partial flake removals. These are possibly the work of novice flint knappers. A larger number of somewhat similar, *chipped marble-like objects* occur. These are uniformly very small in size and are practically equidimensional, having been flaked by freehand percussion from several directions and reduced to a small, multifaceted nucleus (Figure 12.19s,t). Unlike the practice pieces, these extremely small but highly worked specimens are not necessarily the work of unskilled knappers. The purpose or origin of these specimens remains an enigma.

Change Through time

We examined changes in stone tool technological classification, functional classification, raw material composition, recycling behavior, and heat treatment according to the four defined time periods for the village study sample. This was conducted largely through cross-tabulation of pertinent class frequencies by time period, along with chi-square and standardized cell residual analysis.

Data regarding the temporal distribution of stone tool technological classes are shown in Table 12.21. For simplicity, we show percentage and cell residual data and omit cell frequency data. Significant differences in tool technology occur by time period. At least one general time trend occurs, as well as a few punctuated patterns specific to single time periods. The most distinct time trend is the gradually decreasing relative abundance of large thin patterned bifaces that drop steadily from 17% of the collection to 11% of the collection across the four time periods. Other patterns of note have to do primarily with the distinctive make-up of the assemblage in TP1, the most recent time unit. Unpatterned flake tools are notably less common

Table 12.21. Technological class in all stone tools by time period, Scattered Village (32MO31), 1998 excavations. Percentage data at top, standardized cell residuals at bottom; residual values >1.0 shaded.

Technological Class	Time Period: 1. later postcontact	2. early postcontact	3. late precontact	4. early precontact	Total N	Total %
patterned sm. thin biface	15.9%	17.5%	15.9%	15.4%	767	16.6%
patterned large thin biface	10.9%	12.5%	14.9%	17.1%	593	12.8%
unpat. sm-med. biface	3.1%	2.4%	3.1%	3.7%	130	2.8%
patterned unifacial tool	6.4%	5.9%	6.2%	5.9%	281	6.1%
unpatterned flake tool	18.2%	25.1%	26.8%	26.1%	1084	23.5%
lg. thick bifacial core-tool	.1%	.5%	.4%	.5%	17	.4%
radial break tool	.0%	.0%	.0%	.0%	1	.0%
retouched tabular piece	7.6%	7.3%	7.9%	6.1%	340	7.4%
non bipolar core/tool	5.7%	4.4%	5.2%	3.2%	220	4.8%
bipolar core/core tool	17.4%	12.1%	8.1%	11.7%	600	13.0%
unpatterned ground tool	12.8%	11.3%	10.5%	9.5%	529	11.5%
patterned ground tool	1.8%	.9%	1.0%	1.0%	55	1.2%
patterned. sm. thin biface	-.7	1.1	-.5	-.6		
patterned large thin biface	-1.9	-.4	1.5	2.4		
unpat. sm-med. biface	.6	-1.1	.4	1.0		
patterned unifacial tool	.5	-.4	.1	-.2		
unpatterned flake tool	-4.0	1.6	1.8	1.1		
lg. thick bifacial core-tool	-1.3	.7	.2	.4		
radial break tool	-.5	.8	-.4	-.3		
retouched tabular piece	.4	-.2	.5	-.9		
non bipolar core/tool	1.6	-.9	.5	-1.5		
bipolar core/core tool	4.4	-1.1	-3.6	-.7		
unpatterned ground tool	1.5	-.2	-.7	-1.2		
patterned ground tool	2.0	-1.1	-.5	-.4		
Total N	1335	2160	712	410	4617	4617

in that time period (very high negative cell residual value of –4.0), and bipolar cores and tools, non-bipolar cores and tools, and both patterned and unpatterned ground stone tools are particularly common in TP1.

Data on tool function provide an alternate and slightly different perspective on changes in tool composition through time. For this analysis, we have chosen to deal with the specific functional classes, rather than collapsed or generalized classes, to pinpoint as clearly as possible details in temporal patterns. Table 12.22 provides summary percentage data for each specific functional class, with cells having associated cell residual values of >+2.0 or greater shaded for emphasis. We chose a higher level of residual value emphasis in order to focus only on non-trivial and stronger patterns or non-random frequency distributions. General time trends of note, characterized by gradually increasing or decreasing percentage values as well as a high cell residual in TP1 or TP4, include a gradual decrease in generalized bifacial cutting tools through

Table 12.22. Functional class percentage data by time period, Scattered Village (32MO31), 1998 excavations. Dashed lines separate general functional classes (See Table 12.19). Cells with standardized residual values >2.0 are shaded.

	Time Period					
Functional Class	1. later postcontact	2. early postcontact	3. late precontact	4. early precontact	Total N	Total %
projectile point	14.1%	16.4%	14.6%	15.1%	708	15.3%
perforator/drill	1.0%	1.1%	1.0%	.2%	44	1.0%
lt duty bif cutting tool	.8%	.1%	.6%	.5%	19	.4%
slot/groove tool	.0%	.0%	.1%	.0%	1	.0%
graver/incising tool	.2%	.3%	.0%	.0%	9	.2%
transv-edged cutting tool	.0%	.0%	.0%	.0%	1	.0%
bilat. bif cutting tool	.0%	.2%	.1%	.0%	5	.1%
unilat. bif cutting tool	.4%	.1%	.4%	1.5%	17	.4%
bif cut tool hard material	.1%	.0%	.4%	.5%	7	.2%
misc. bif cutting tool	10.3%	11.9%	13.9%	16.3%	562	12.2%
basal scraper	.3%	.2%	.1%	.2%	11	.2%
tv. scraper-hard mat.	.2%	.3%	.4%	.5%	14	.3%
hv-duty adzing tool	.1%	.1%	.3%	.0%	7	.2%
woodworking ax	.1%	.0%	.0%	.0%	1	.0%
edge ground tool	.1%	.2%	.1%	.5%	9	.2%
wood working adz	.0%	.0%	.1%	.0%	2	.0%
transverse scraper - soft	5.4%	4.1%	4.5%	4.9%	212	4.6%
lateral scraper - soft	.2%	.2%	.1%	.0%	8	.2%
tv. scpr - abrasive	.1%	.5%	.6%	.0%	15	.3%
misc. transv. scraper	.9%	1.1%	.7%	1.0%	45	1.0%
exped. cutting tool	3.0%	2.5%	2.8%	3.2%	128	2.8%
stone saw	.3%	.0%	.0%	.2%	5	.1%
denticulate tool	.4%	.5%	1.1%	1.2%	29	.6%
ut. flk,irreg. wear	.7%	2.7%	2.7%	3.7%	103	2.2%
ut. flk,reg. wear	22.7%	28.0%	29.6%	24.9%	1221	26.4%
spokeshave	.2%	.0%	.1%	.0%	4	.1%
gen. flake tool	.0%	.0%	.0%	.5%	3	.1%
flake ridge plane	.0%	.0%	.0%	.0%	1	.0%
point wear radial tool	.0%	.0%	.0%	.0%	1	.0%
hv-dty sawing tool	.1%	.0%	.0%	.0%	1	.0%
hv-dty chopper tool	.4%	.6%	.3%	.5%	21	.5%
core tool-unkn fnct.	.7%	.3%	.6%	.0%	19	.4%
core	2.4%	1.9%	2.2%	1.0%	94	2.0%
tested raw mat.	2.6%	2.0%	2.7%	2.0%	106	2.3%
bip.core/punch/wedge/chisel	10.9%	6.2%	3.8%	3.7%	320	6.9%
bipolar punch/wedge/chisel	6.4%	5.9%	4.4%	8.0%	278	6.0%
bipolar hammer/anvil	.7%	.1%	.1%	.5%	16	.3%
bipolar anvil only	.2%	.0%	.1%	.0%	5	.1%
bipolar hammer only	.1%	.2%	.1%	.0%	6	.1%

Table 12.22. Functional class percentage data by time period, Scattered Village (32MO31), 1998 excavations. Dashed lines separate general functional classes (See Table 12.19). Cells with standardized residual values >2.0 are shaded. (concluded)

	Time Period					
Functional Class	1. later postcontact	2. early postcontact	3. late precontact	4. early precontact	Total N	Total %
whetstone	1.0%	.6%	.6%	1.0%	33	.7%
hammerstone/pounder	2.3%	.9%	.7%	.2%	56	1.2%
simple abrader tool	4.9%	7.0%	7.6%	5.9%	296	6.4%
grooved abrader tool	1.2%	.6%	.7%	1.2%	39	.8%
complex grinding tool	.4%	.1%	.0%	.0%	7	.2%
complex anvil	.1%	.0%	.0%	.0%	2	.0%
simple burnisher tool	1.6%	.6%	.3%	.0%	37	.8%
unmodified manuport	.1%	.1%	.0%	.2%	5	.1%
shaft smoother	.1%	.2%	.1%	.0%	7	.2%
reamer	.0%	.0%	.0%	.0%	1	.0%
nonutilitarian item	.7%	.3%	.4%	.0%	20	.4%
smoking pipe	.0%	.0%	.1%	.0%	1	.0%
pendant/bead	.2%	.5%	.0%	.5%	16	.3%
pigment source	.1%	.0%	.0%	.0%	3	.1%
patterned disk/tablet	.4%	.3%	.3%	.2%	16	.3%
ochre-stained flake	.1%	.0%	.0%	.0%	1	.0%
symbolic weapon tip	.0%	.1%	.0%	.0%	3	.1%
practice piece	.1%	.0%	.0%	.0%	3	.1%
chipped stone marble	.2%	.3%	.3%	.0%	12	.3%
unknown, fragmentation	.0%	.0%	.0%	.2%	1	.0%
Total N	1335	2160	712	410	4617	4617

time, a three-fold increase in bipolar core/punch/wedge/chisel tools through time, and increases in several abrading and grinding implements through time. It is of interest to note that bipolar punch/wedge/chisel tools (primarily those that are recycled from another implement) do not particularly increase in relative abundance through time, while other bipolar core/tools do. Among the ground or non-chipped tools that are more common later in time are hammerstones, complex grinding tools (manos), and simple burnishing tools (Table 12.23).

Data regarding raw materials in chipped stone tools by time period are summarized in Table 12.23. This tabulation is limited to chipped stone to simplify the presentation a bit. Knife River flint has a peak occurring in the earliest time period (TP4) and exhibits a general decrease in occurrence in later periods. TP4 is also marked by the only occurrence of obsidian and a relative high occurrence of non-volcanic natural glass (both materials with far western source locations). Smooth gray TRSS has punctuated high incidence in TP2. There are few other patterns except for a suite of exotic materials that have a relatively higher occurrence in the latest TP1: jasper/chert, White River silicates, and plate chalcedony (all with distant sources to the southwest), as well as Turtle Valley quartzite and antelope chert (rare materials). Thus, TP4

Table 12.23. Raw material type for chipped stone tools by time period, Scattered Village (32MO31), 1998 excavations. Percentage data top, standardized residuals bottom; cells with standardized residual values >1.0 shaded.

	Raw Material Type	Time Period: 1. later postcontact	2. early postcontact	3. late precontact	4. early precontact	Total N	Total %
28	KRF	48.5%	45.6%	50.3%	56.7%	1943	48.2%
1	smooth gray TRSS	13.2%	18.8%	12.1%	15.0%	638	15.8%
52	silicified wd.	13.6%	12.9%	15.9%	10.1%	536	13.3%
8	clear/gray chal.	2.3%	3.6%	2.9%	2.7%	122	3.0%
9	yel./lt. brn. chal.	6.4%	5.2%	7.6%	4.4%	235	5.8%
10	dark brn. chal.	1.6%	1.5%	2.1%	.3%	61	1.5%
6	jasper/chert	6.1%	4.1%	3.3%	4.6%	186	4.6%
4	orthoquartzite	2.8%	2.1%	2.9%	3.0%	101	2.5%
17	porcellanite	1.7%	2.2%	.6%	.3%	66	1.6%
53	moss agate	.4%	.7%	.8%	.3%	24	.6%
7	White River sil.	1.1%	.5%	.2%	.0%	22	.5%
40	nonvol. nat. glass	.2%	.3%	.0%	.5%	9	.2%
11	plate chalcedony	.4%	.1%	.2%	.0%	7	.2%
29	Rainy Buttes sw	.1%	.2%	.0%	.0%	4	.1%
18	obsidian	.0%	.0%	.0%	.8%	3	.1%
5	Swan River chert	.0%	.1%	.2%	.0%	2	.0%
59	Turtle V. orthoqtzite	.2%	.0%	.0%	.0%	2	.0%
54	antelope chert	.1%	.0%	.0%	.0%	1	.0%
2	local coarse	1.4%	2.3%	1.1%	1.4%	71	1.8%
28	KRF	.2	-1.6	.8	2.3		
1	smooth gray TRSS	-2.2	3.2	-2.4	-.4		
52	silicified wd.	.3	-.5	1.8	-1.7		
8	clear/gray chal.	-1.4	1.4	-.2	-.3		
9	yel./lt. brn. chal.	.8	-1.2	1.9	-1.2		
10	dark brn. chal.	.2	.1	1.1	-1.9		
6	jasper/chert	2.4	-1.0	-1.5	.0		
4	orthoquartzite	.6	-1.1	.6	.6		
17	porcellanite	.1	2.0	-2.0	-2.0		
53	moss agate	-.7	.5	.6	-.8		
7	White River sil.	2.3	-.4	-1.3	-1.4		
40	nonvol. nat. glass	-.3	.4	-1.2	1.3		
11	plate chalcedony	1.4	-.7	-.1	-.8		
29	Rainy Buttes sw	-.1	.8	-.8	-.6		
18	obsidian	-.9	-1.2	-.7	5.2		
5	Swan River chert	-.8	.1	1.2	-.4		
59	Turtle V. orthoqtzite	1.9	-1.0	-.6	-.4		
54	antelope chert	1.3	-.7	-.4	-.3		
2	local coarse	-.9	1.7	-1.2	-.6		
	Total N	1140	1896	630	367	4033	100.0%

stands apart to some degree with higher use of KRF and far western material, and TP1 is marked by an apparent increase in use of exotic materials with distant southwestern sources. Overall, however, changes in resource use through time are not marked, and general patterns are maintained through the history of the site.

Frequency distribution of raw materials in non-chipped or ground stone tools was tabulated separately. Two patterns are apparent that are to some degree correlated with tool type and technology more than with use of alternate resources. TP4 (early) is marked by relatively high incidence of local sandstone as well as scoria. TP1 (latest) has higher incidence of several stones used in production of both patterned as well as unpatterned ground stone tools: basaltic, granitic, coarse sandstone, silt/mudstone, metaquartzite, and other/unclassifiable. To a large degree the latter occurrences are closely linked to the fact that hammerstone, grinding tools, and burnishing stones are relatively more common in TP1, as well (Table 12.22).

Table 12.24. Heat treatment in small thin patterned bifaces and fine grained raw materials by time period, Scattered Village (32MO31), 1998 excavations. Cells with standardized residual values >+2.0 are shaded for emphasis.

		Time Period				
Heat Treatment		1. later postcontact	2. early postcontact	3. late precontact	4. early precontact	Total
absent	n	53	124	44	29	250
	%	*38.7%*	*47.0%*	*50.6%*	*64.4%*	*46.9%*
	resid.	*-1.4*	*.0*	*.5*	*1.7*	
possibly present	n	8	25	6	0	39
	%	*5.8%*	*9.5%*	*6.9%*	*.0%*	*7.3%*
	resid.	*-.6*	*1.3*	*-.1*	*-1.8*	
definitely present	n	76	115	37	16	244
	%	*55.5%*	*43.6%*	*42.5%*	*35.6%*	*45.8%*
	resid.	*1.7*	*-.5*	*-.4*	*-1.0*	
Total	n	137	264	87	45	533
	%	100.0%	100.0%	100.0%	100.0%	100.0%

The incidence of recycling behavior, a curious feature that occurs in relatively high frequency at Scattered Village, was examined through time. Overall, about 5.6% of the tool samples occur as recycled specimens (n=259). Chi-square analysis indicates no significant difference in the frequency of such tools through time.

Finally, the incidence of intentional heat treatment in chipped stone tools was examined through time. This study was restricted to fine-grained stone types in which heat treatment is readily detectable (KRF, all chalcedonies, silicified woods, and moss agate). Heat treatment is most evident in large thin patterned bifaces (mostly cutting tools) and small thin patterned bifaces (mostly arrowpoints). Among large patterned bifaces, 21.6% exhibit definite heat treatment and 2.9% exhibit possible heat treatment (total N=453 specimens). Chi-square shows there to be no significant change in these values through time. To the contrary, heat treatment in small thin patterned bifaces shows a marked and steady increase in occurrence through time, as the data in Table 12.24 demonstrate. Overall, 46% of such specimens exhibit definite heat treatment, but this value increases from 36% to 56% during the course of village occupation.

In summary, some changes in stone tool production, technology, and use occur during the period of occupation at Scattered Village, but most of these changes are not marked and the stone tool assemblage remained relatively homogeneous through time. Some of the changes in raw material procurement, for example, seem to reflect pulses in the use of specific type of stone during what were probably relatively brief periods of time. These may reflect what are essentially sampling variation, due to sporadic or stochastic inclusions of materials from specific tool making and using events into the locations that we happened to excavate.

Intersite Comparisons

The most specific intersite comparisons are between Scattered Village and nearby Slant Village (32MO26), a documented Mandan settlement. More general comparisons involve data from these two sites as well as relevant data from two Hidatsa settlements at Knife River (Lower Hidatsa, 32ME10, and Big Hidatsa, 32ME12). More specifically, we will used the combined village data set from Scattered (AD 1550-1700); data from Periods 2 and 3 as reported for Slant Village (ca. AD 1575-1725, Ahler et al. 1997); data from Periods 50, 61, and 62 from Lower Hidatsa (AD 1525-1700, Ahler and Weston 1981, Ahler and Toom 1993); and data from Periods 61 and 62 from Big Hidatsa (AD 1600-1700, Ahler and Swenson 1985, Ahler and Toom 1993). Computerized data from all of these excavations are utilized in this study.

Comparisons between Scattered and Slant Villages focus on stone tool raw material, technology, specific functional classes, generalized functional classes and a few other variables. We are most interested in isolating similarities and contrasts in stone tool content because Slant Village is a documented Mandan settlement and the ethnic affiliation of Scattered Village is to be determined. In all of the following comparisons the total tool counts are quite high, and therefore chi-square analysis consistently tells us that the content of the village assemblages are statistically significant at the p=.001 level or greater. We do not bother to provide the chi-square results, but instead focus on standardized cell residual values (expressed as Z-scores with a mean of zero and standard deviation of 1.0) and percentages as a basis for evaluating differences between assemblages.

Comparative data on raw material in stone tools is arrayed in Table 12.25. For greater clarity in discerning patterns of variation between sites, table contents are sorted in order of decreasing standardized residual values for Slant Village, which has the smaller assemblage and therefore the more extreme residual values. Because the residual values are imbalanced due to unequal total tool counts by site, we suggest focus on residual values >+2.0 for Slant and >+1.0 for Scattered. The most marked differences between assemblages regarding near-local stones involves a high occurrence of smooth gray TRSS for Slant and a correspondingly high occurrence of silicified wood and yellow-brown chalcedony for Scattered. These contrasts are very strong. TRSS is about twice as abundant at Slant, and the woods/chalcedonies area about

Table 12.25. Comparison of stone tool raw material type frequency between Scattered Village (32MO31) and Slant Village (32MO26). Data sorted by standardized cell residuals, with values >+1.0 shaded.

	Slant Village			Scattered Village			
Raw Material Type	Count	% within site	Std. Residual	Count	% within site	Std. Residual	Total
smooth gray TRSS	276	28.0%	9.1	639	13.8%	-4.2	915
silt/lime/mudstone	10	1.0%	3.6	9	.2%	-1.7	19
plate chalcedony	7	.7%	2.9	7	.2%	-1.3	14
nonvol nat. glass	8	.8%	2.9	9	.2%	-1.3	17
catlinite	2	.2%	2.8	0	.0%	-1.3	2
basaltic mat.	10	1.0%	1.8	22	.5%	-.9	32
coarse yel. TRSS	18	1.8%	1.6	52	1.1%	-.7	70
swan river chert	1	.1%	.7	2	.0%	-.3	3
quartz	1	.1%	.7	2	.0%	-.3	3
KRF	428	43.5%	.5	1,944	42.1%	-.2	2,372
obsidian	1	.1%	.4	3	.1%	-.2	4
coarse sandstone	3	.3%	.3	11	.2%	-.2	14
clear/gray chal.	26	2.6%	.0	123	2.7%	.0	149
dark brn. chal.	12	1.2%	-.2	61	1.3%	.1	73
fossil/concretion	2	.2%	-.2	11	.2%	.1	13
clinker	66	6.7%	-.2	319	6.9%	.1	385
antelope chert	0	.0%	-.4	1	.0%	.2	1
Turtle Valley quartzit	0	.0%	-.6	2	.0%	.3	2
shist	0	.0%	-.6	2	.0%	.3	2
white river sil.	3	.3%	-.7	22	.5%	.3	25
hematite	0	.0%	-.7	3	.1%	.3	3
Rainy Buttes sw	0	.0%	-.8	4	.1%	.4	4
orthoquartzite	16	1.6%	-1.0	101	2.2%	.5	117
compact sandstone	5	.5%	-1.3	46	1.0%	.6	51
granitic mat.	6	.6%	-1.6	58	1.3%	.7	64
other, unknown	0	.0%	-1.9	20	.4%	.9	20
scoria	0	.0%	-1.9	20	.4%	.9	20
metaquartzite	7	.7%	-2.0	75	1.6%	.9	82
moss agate	0	.0%	-2.1	24	.5%	.9	24
jasper/chert	22	2.2%	-2.4	186	4.0%	1.1	208
porcellanite	3	.3%	-2.6	66	1.4%	1.2	69
yel./lt. brn. chal.	20	2.0%	-3.7	236	5.1%	1.7	256
silicified wd.	32	3.2%	-6.8	537	11.6%	3.1	569
Total	985	100.0%		4,617	100.0%		5,602

three times as abundant in Scattered Village. This indicates a very strong difference in use of near-local resources, as was discussed regarding flaking debris. The data suggest that residents of Slant were much more reliant on resources approximately due south of the village, while residents of Scattered probably relied much more heavily on resources directly within the Heart River drainage due west of Scattered (see Figure 1.1 and Figure 12.1 in this chapter). Regarding exotic or less commonly occurring stones, high occurrences of silt/lime/mudstone, nonvolcanic glass, catlinite, and plate chalcedony are evident for Slant, and high occurrences of jasper/chert and porcellanite are evident for Scattered. Two stones occur only at Scattered – scoria and moss agate. Moss agate was not isolated as a separate type at Slant Village, whereas scoria would have been, had it occurred. The presence of scoria at Scattered and its absence at Slant may therefore be meaningful. Little overall spatial pattern is evident in these contrasts in use of stones from more specific or more distant locations.

Comparisons of stone tool technological classification occur in Table 12.26, and differences between villages are rather striking. Unpatterned flake tools, thick bifacial core tools, unpatterned bifaces, and small thin patterned bifaces are much more abundant in Slant Village. In contrast, patterned flake tools, retouched tabular pieces, and, especially, tools of bipolar technology are markedly more abundant at Scattered Village. The higher occurrence of retouched tabular pieces at Scattered is undoubtedly linked to use of woods and chalcedonies that most commonly occur in the form of tabular plates. Bipolar technology is eight times as common at Scattered Village, and this is undoubtedly a very meaningful difference between settlements. We can comment on this further as we discuss functional classifications.

Table 12.26. Comparison of stone tool technological class frequency between Scattered Village (32MO31) and Slant Village (32MO26). Data sorted by standardized cell residuals, with values >+1.0 shaded.

	Slant Village			Scattered Village			
Technological Class	Count	% within site	Std. Residual	Count	% within site	Std. Residual	Total
unpat. flake tool	392	39.8%	8.2	1084	23.5%	-3.8	1476
lg. thick bf core-tool	15	1.5%	4.0	17	.4%	-1.8	32
unpat. sm-med. bf	46	4.7%	2.7	130	2.8%	-1.2	176
patt.sm.thin bf	200	20.3%	2.3	767	16.6%	-1.1	967
non b-plr core/tool	62	6.3%	1.8	220	4.8%	-.8	282
patt. ground tool	14	1.4%	.5	55	1.2%	-.2	69
patt.lg.thin bf	108	11.0%	-1.4	593	12.8%	.6	701
unpat. ground tool	94	9.5%	-1.5	529	11.5%	.7	623
beveled flk tool	35	3.6%	-2.8	281	6.1%	1.3	316
ret. tabular piece	3	.3%	-7.4	340	7.4%	3.4	343
b-plr core/core tool	16	1.6%	-8.9	600	13.0%	4.1	616
	985	100.0%		4616	100.0%		5601

Comparison of detailed functional class frequencies between villages is shown in Table 12.27. Again, we have sorted the table contents by cell residual values to clarify the primary differences between the sites. Slant Village is most distinguished by high occurrences of heavy duty bilateral cutting tools (FC7), utilized snap break tools, cores, projectile points, and utilized flakes with regular edge modifications (FC23). Most of these are classes with few occurrences, and the distinctions between collections may be in part attributable to minor decisions made by analysts regarding tool classification based on use-wear. For example, the decision regarding whether to place a tool in class 7 (heavy-duty bilateral cutting) versus 15 (generalized bifacial

Table 12.27. Comparison of functional class frequency between Scattered Village (32MO31) and Slant Village (32MO26). Data sorted by standardized cell residuals, with values >+2.0 shaded.

	Slant Village			Scattered Village			
Functional Class	Count	% within site	Std. Residual	Count	% within site	Std. Residual	Total
bf cutting tool	16	1.6%	5.9	7	.2%	-2.7	23
core	48	4.9%	4.6	94	2.0%	-2.1	142
ut. snap break plane	5	.5%	4.4	0	.0%	-2.0	5
spokeshave	6	.6%	3.2	4	.1%	-1.5	10
projectile point	198	20.1%	3.1	708	15.3%	-1.4	906
ut. flk,reg. wear	322	32.7%	3.1	1,221	26.4%	-1.4	1,543
ut. flk,irreg. wear	39	4.0%	2.8	103	2.2%	-1.3	142
hv-dty sawing tl	3	.3%	2.7	1	.0%	-1.3	4
slot/groove tool	3	.3%	2.7	1	.0%	-1.3	4
hv-dty adzing tl	6	.6%	2.5	7	.2%	-1.1	13
bilat.bf.cutting tl	5	.5%	2.4	5	.1%	-1.1	10
exped. cutting tl	43	4.4%	2.4	128	2.8%	-1.1	171
tv. scpr-hard mat.	8	.8%	2.1	14	.3%	-1.0	22
edge ground saw	1	.1%	2.0	0	.0%	-.9	1
notched flake	1	.1%	2.0	0	.0%	-.9	1
rolled flake	1	.1%	2.0	0	.0%	-.9	1
unknown, fragmented	2	.2%	2.0	1	.0%	-.9	3
grooved abrader tl	15	1.5%	1.8	39	.8%	-.8	54
pendant/bead	7	.7%	1.5	16	.3%	-.7	23
tv. scpr-abrasive	6	.6%	1.2	15	.3%	-.6	21
woodworking ax	1	.1%	1.1	1	.0%	-.5	2
core tool-unkn fnct.	7	.7%	1.1	19	.4%	-.5	26
smoking pipe	1	.1%	1.1	1	.0%	-.5	2
unilat.bf cutting tl	6	.6%	1.0	17	.4%	-.4	23
ochre-stained flake	1	.1%	1.0	1	.0%	-.5	2
hv-dty chopper tl	7	.7%	.9	21	.5%	-.4	28
denticulate tool	8	.8%	.6	29	.6%	-.3	37
cmplx grinder tool	2	.2%	.3	7	.2%	-.2	9
lateral scraper	2	.2%	.2	8	.2%	-.1	10
simple burnisher tl	8	.8%	.0	37	.8%	.0	45
practice piece/marble	3	.3%	-.1	15	.3%	.0	18
basal scraper	2	.2%	-.2	11	.2%	.1	13
transv. cutting tl	0	.0%	-.4	1	.0%	.2	1
reamer	0	.0%	-.4	1	.0%	.2	1
flake ridge plane	0	.0%	-.4	1	.0%	.2	1
radial brk pointed tool	0	.0%	-.4	1	.0%	.2	1
complex anvil	0	.0%	-.6	2	.0%	.3	2
wood working adz	0	.0%	-.6	2	.0%	.3	2
pigment source	0	.0%	-.7	3	.1%	.3	3
gen. flake tool	0	.0%	-.7	3	.1%	.3	3
symbolic weapon tip	0	.0%	-.7	3	.1%	.3	3

Table 12.27. Comparison of functional class frequency between Scattered Village (32MO31) and Slant Village (32MO26) (concluded). Data sorted by standardized cell residuals, with values >+2.0 shaded.

	Slant Village			Scattered Village			
Functional Class	Count	% within site	Std. Residual	Count	% within site	Std. Residual	Total
perforator/drill	6	.6%	-.9	44	1.0%	.4	50
stone saw	0	.0%	-.9	5	.1%	.4	5
simple abrader tl	55	5.6%	-.9	296	6.4%	.4	351
manuport	0	.0%	-.9	5	.1%	.4	5
nonutilitarian item	2	.2%	-.9	20	.4%	.4	22
misc.transv.scpr	6	.6%	-1.0	45	1.0%	.5	51
whetstone	4	.4%	-1.0	33	.7%	.5	37
cmplx grinding tl	0	.0%	-1.1	7	.2%	.5	7
graver/incising tool	0	.0%	-1.3	9	.2%	.6	9
edge ground tool	0	.0%	-1.3	9	.2%	.6	9
hammerstone/pndr	6	.6%	-1.5	56	1.2%	.7	62
patt disc or tablet	0	.0%	-1.7	16	.3%	.8	16
lt dut bilat cutting tool	0	.0%	-1.8	19	.4%	.8	19
b-plr hammer	1	.1%	-1.8	27	.6%	.8	28
tested raw mat.	12	1.2%	-1.9	106	2.3%	.9	118
misc. bf cutting tl	77	7.8%	-3.3	562	12.2%	1.5	639
lt.duty tv. scpr	15	1.5%	-3.9	212	4.6%	1.8	227
punch/wedge/chisel	11	1.1%	-5.6	278	6.0%	2.6	289
core/punch/wedge/chisel	7	.7%	-6.7	320	6.9%	3.1	327
Total	985	100.0%		4,617	100.0%		5,602

cutting tool) is based largely on intensity of use-wear, which must to some degree be subjectively determined. Three differences, though, involving cores, utilized flakes, and arrowpoints, are based on fairly recognizable and abundant tool classes, and reflect true differences in activities between the sites.

From the perspective of Scattered Village, four functional classes are particularly more common: bipolar core/punch/wedge/chisels, bipolar punch/wedge/chisels, hide scrapers used on soft material (FC6), and generalized bifacial cutting tools. The two bipolar tool classes are easily recognized and are ten and five times more abundant, respectively, in Scattered Village. Hide scrapers used on soft or wet hides are three times as common at Scattered, and generalized bifacial cutting tools are twice as common. All of these are common artifact classes in most villages, and reflect truly significant behavioral differences between these two sites. In summary, it appears that occupants of Slant were much more involved in core reduction and manufacture and use of arrowpoints and simple flake tools. Occupants of Scattered spent much more time making and using bipolar implements, bifacial cutting tools, and working of fresh hides. To some degree, the retouched and utilized flakes at Slant may be a functional tradeoff for the

bifacial cutting tools at Scattered. Interpretation of differences regarding bipolar tools offers a challenge. Through study of flaking debris, and from the paucity of bipolar flakes, we can safely say that few of the bipolar objects at Scattered Village are true cores. This is reflected in the classification of many of these objects as punches, wedges, or chisels (FC26) based in part on recycling. FC26 items are also relatively abundant at Slant Village when compared to FC25 specimens (possible cores), suggesting that the bipolar technology played a similar role in both settlements. It is just that it played a hugely more important role at Scattered Village.

Study of bone and antler artifacts at Scattered indicates that sharp, stout, pointed tools such as bipolar nuclei were heavily involved in fabrication of bone and antler ornaments and tools, while pointed stone chisels or punches (probably in the form of bipolar nuclei) were significant in the fabrication of scapulae hoes and split rib tools. We therefore conclude that the heavy incidence of bipolar specimens at Scattered is indicative of alternate and focused means of bone/antler production at that village that were not emphasized at Slant Village. This reflects a very meaningful difference in tool-making and tool-using patterns between sites.

A more general comparison of tool function between villages is presented in Table 12.28. These data provide a convenient summary of most of the more detailed patterns noted above. For Slant, most prominent differences involve a higher use of expedient flake tools, projectile points, non-bipolar cores, and heavy core-tools. Core and core-tool use may ultimately stem from greater use of smooth gray TRSS lithic material from sources to the south, as this stone probably occurs in large equidimensional chunks conducive to core reduction and core- tool production. Flake tool use, and particularly projectile use, may be the most significant behavioral indicators. For Scattered, the high incidence of bipolar tools and hide scraping tools stands out. As just noted, these reflect significant contrasts in common activities in the sites.

Table 12.28. Comparison of stone tool generalized functional class frequency between Scattered Village (32M031) and Slant Village (32M026). Data sorted by standardized cell residuals, with values >+1.0 shaded.

	Slant Village			Scattered Village			
Generalized Functional Class	Count	% within site	Std. Residual	Count	% within site	Std. Residual	Total
expedient cutting and flake tools	417	42.6%	4.5	1,495	32.5%	-2.1	1,912
projectile point	198	20.2%	3.1	708	15.4%	-1.4	906
non-bipolar cores and trm	60	6.1%	2.2	197	4.3%	-1.0	257
heavy core-tools	17	1.7%	2.1	41	.9%	-1.0	58
coarse scrapers	17	1.7%	1.9	44	1.0%	-.9	61
delicate precision tools	16	1.6%	.1	73	1.6%	.0	89
nonutilitarian,unusual,ceremonial	12	1.2%	-.2	60	1.3%	.1	72
ground st, abrasive,hammering tools	90	9.2%	-1.1	483	10.5%	.5	573
heavy duty bifacial cutting tools	104	10.6%	-1.6	592	12.9%	.8	696
hide scrapers	29	3.0%	-3.4	280	6.1%	1.6	309
bipolar cores/tools	19	1.9%	-8.9	628	13.6%	4.1	647
Total	979	100.0%		4,601	100.0%		5,580

Our intersite comparison continues with inclusion of data from the two contemporaneous Hidatsa sites at Knife River. Lower Hidatsa (32ME12) was apparently occupied by the Awatixa subgroup, at the same time that Scattered Village was occupied. Big Hidatsa is linked by tradition to the Hidatsa-proper subgroup, and it is potentially the settlement established by members of the same subgroup after they left the Heart River area. Although our current understanding of chronology has Big Hidatsa and Scattered overlapping in time to some degree, one interpretation of oral traditions would have both sites occupied, in sequence, by the Hidatsa-proper subgroup (people from Scattered moving rather directly to Big Hidatsa).

Table 12.29 provides detailed information on lithic raw material content and comparisons among the four sites. In this comparison, we combined definite silicified wood (type 52), recognized as a specific type only at Slant and Scattered, with clear, light brown and dark brown chalcedonies from all sites, to form a single class chalcedonies/woods. The extremely high cell residual values for each site emphasize, for the most part, different regional settings for each settlement that must have conditioned routine access to the most available local lithic source.

Table 12.29. Comparative distribution of stone tool raw material type among four village sites, showing percentage and standardized cell residual (S. R.) data for each site and total count for all four sites. Data are sorted on cell residual values for Scattered Village. Residual values >+1.0 are shaded.

	Lower Hidatsa		Big Hidatsa		Scattered Village		Slant Village		Total All 4 Sites	
Raw Material Type	%	S.R.	%	S.R.	%	S.R.	%	S.R.	N	%
chalcedonies/woods	3.1%	-12.1	2.7%	-8.6	21.2%	12.9	9.1%	-4.2	1,147	14.1%
jasper/chert	.3%	-6.0	.5%	-3.8	4.0%	5.6	2.2%	-.8	217	2.7%
smooth gray TRSS	.2%	-13.7	.1%	-9.4	13.8%	5.1	28.0%	15.6	919	11.3%
orthoquartzite	.3%	-4.1	.0%	-3.5	2.2%	3.8	1.6%	.3	122	1.5%
compact sandstone	.2%	-2.5	.0%	-2.3	1.0%	2.8	.5%	-.6	54	.7%
other, unknown	.1%	-1.9	.0%	-1.6	.5%	2.7	.0%	-1.8	26	.3%
White River sil.	.0%	-2.3	.0%	-1.6	.5%	2.1	.3%	.0	25	.3%
metaquartzite	.9%	-1.3	.7%	-1.3	1.6%	2.1	.7%	-1.6	104	1.3%
clinker	4.9%	-2.1	4.0%	-2.5	6.9%	2.0	6.7%	.7	502	6.2%
granitic mat.	.8%	-.8	.5%	-1.4	1.3%	1.7	.6%	-1.2	82	1.0%
coarse yel. TRSS	.2%	-2.9	.0%	-2.7	1.1%	1.5	1.8%	3.0	74	.9%
scoria	.2%	-.6	.2%	-.4	.4%	1.4	.0%	-1.8	26	.3%
fossil/concretion	.0%	-1.7	.0%	-1.1	.2%	1.3	.2%	.3	13	.2%
hematite	.0%	-.8	.0%	-.5	.1%	1.0	.0%	-.6	3	.0%
coarse sandstone	.1%	-1.2	.0%	-1.2	.2%	.8	.3%	.9	15	.2%
Rainy Buttes sw	.1%	-.1	.0%	-.7	.1%	.7	.0%	-.8	5	.1%
porcellanite	1.4%	.0	2.6%	2.9	1.4%	.2	.3%	-2.9	114	1.4%
quartz	.1%	.2	.0%	-.6	.0%	-.2	.1%	.7	4	.0%
nonvol nat. glass	.0%	-1.9	.0%	-1.3	.2%	-.2	.8%	4.1	17	.2%
plate chalcedony	.0%	-1.7	.0%	-1.2	.2%	-.3	.7%	4.1	14	.2%
Swan River chert	.0%	-1.0	.2%	2.1	.0%	-.5	.1%	.5	5	.1%
basaltic mat.	.5%	.0	.2%	-1.1	.5%	-.5	1.0%	2.1	43	.5%
catlinite	.0%	-.7	.0%	-.4	.0%	-1.1	.2%	3.6	2	.0%
obsidian	.5%	3.4	.0%	-1.1	.1%	-1.5	.1%	-.4	12	.1%
silt/lime/mudstone	.3%	-.8	1.2%	3.6	.2%	-2.3	1.0%	2.9	34	.4%
KRF	85.9%	16.6	86.8%	11.7	42.1%	-12.6	43.5%	-5.2	4,547	56.0%
Total	1,719		805		4,617		985		8,126	

That is, Slant Village is marked by high occurrence of smooth gray TRSS, that occurs due south of that village; Scattered Village is marked by high occurrence of chalcedonies/woods that we believe occur in abundance in the Heart River drainage due west of the site; and the two settlements at Knife River are marked by an abundance of Knife River flint, from the nearby Knife river and Spring Creek drainages, twice as great as each village near Heart River.

Beyond this, the differences among villages have more to do with use of less common and in most cases exotic raw materials. Scattered Village stands well apart from all of the other sites in this regard, particularly in the high incidence of jasper/cherts, orthoquartzites, White River silicates, and scoria. It is useful to note, however, regarding the first three stones Scattered contrasts much more strongly with the Hidatsa sites at Knife River than with Slant, while with the latter stone (scoria) the contrast is mostly with Slant but not with the Hidatsa sites. Thus, scoria may link Scattered to the Knife River settlements, while various exotic quartzites potentially from sources near the Black Hills link Scattered with Slant Village.

Table 12.30 provides a comparison of technological class frequencies among the four sites. Scattered Village, again, stands well apart from the other three sites in many aspects, and there are few features that link Scattered to the Hidatsa sites at Knife River. Scattered stands well apart from all others in regard to bipolar technology and unpatterned ground stone items. Relative abundance of bipolar artifacts is even lower at the Knife River sites than at Slant Village. On this basis alone, there is little reason to imagine a direct and immediate ancestral relationship between the people at Scattered and the people residing at Big Hidatsa, as Hidatsa-proper oral traditions might suggest. Scattered Village appears to be its own entity, in terms of technology of the tool assemblage.

These broad differences aside, we can note some seemingly minor details that may yet set Scattered apart from the Mandans at Slant Village and may link Scattered and Big Hidatsa Villages. Stone beads occur in some frequency at Scattered, as they do at Slant, but the technology of production and raw materials for each are quite different. At Slant, the beads are carved from soft, yellow silt or mudstone, are heated to alter the color to red, and are perforated by drilling (Ahler et al. 1997:322). At Scattered, no bead production occurs and drilled stone beads are uncommon, and the stone beads are simply opportunistically collected or selected, tubular concretions that may have served as ornaments (Figure 12.18n-v). This mirrors the common occurrence of fossil snails also used as beads and ornaments at Scattered (chapter in this report).

We can also mention two other nonutilitarian artifact types of interest. One is gaming pieces, some of which are made of scoria (Figure 12.18a-h). These items are common at Scattered, absent at Slant, and are common at Big Hidatsa Village (Ahler and Swenson 1985:165-166). Some are made from scoria at both sites, and this stone type is absent at Slant. Another interesting feature is the occurrence of odd nonutilitarian chipped items, some

Table 12.30. Comparative distribution of stone tool technological class among four village sites, showing percentage and standardized cell residual (S.R.) data for each site and total count for all sites. Data are sorted on cell residual values for Scattered Village. Residual values >+1.0 are shaded.

Technological Class	Lower Hidatsa %	Lower Hidatsa S.R.	Big Hidatsa %	Big Hidatsa S.R.	Scattered Village %	Scattered Village S.R.	Slant Village %	Slant Village S.R.	Total All 4 Sites N	Total All 4 Sites %
bipolar core/core tool	1.0%	-10.1	.6%	-7.3	13.0%	12.4	1.6%	-7.0	639	7.9%
unpat. ground tool	7.5%	-3.1	5.8%	-3.6	11.5%	3.5	9.5%	-.3	799	9.8%
patt.lg. thin bif	9.1%	-2.5	6.1%	-4.3	12.8%	3.4	11.0%	-.2	907	11.2%
patt. ground tool	.5%	-2.1	.7%	-.8	1.2%	1.1	1.4%	1.2	84	1.0%
beveled flake tool	5.7%	.0	6.3%	.7	6.1%	1.0	3.6%	-2.8	465	5.7%
patt. sm. thin bif	14.5%	-1.6	11.1%	-3.6	16.6%	.9	20.3%	3.3	1306	16.1%
lg. thick bif core-tool	.5%	-.2	.0%	-2.0	.4%	-1.2	1.5%	4.6	40	.5%
non bipolar core/tool	6.1%	1.6	4.5%	-.9	4.8%	-1.3	6.3%	1.5	422	5.2%
unpat. sm-med. bif	10.2%	10.1	5.5%	.8	2.8%	-6.3	4.7%	-.3	396	4.9%
unpat. flake tool	44.8%	4.8	59.4%	10.0	30.8%	-7.6	40.1%	1.2	3,067	37.7%
Total	1,719		805		4,616		985		8,125	100.0%

apparently intended for suspension, at both Scattered (Figure 12.19i-n) and Big Hidatsa Village (Ahler and Swenson 1985:Figure 4a-c). Such items are also lacking at Slant Village. While the strength and meaning of these parallels between Scattered Village and Big Hidatsa Village are debatable, they none-the-less provide links between these two sites that do not exist between Scattered and the Mandan settlement at Slant Village.

Summary

The full lithic assemblage of stone tools and flaking debris at Scattered Village is diverse and rather unlike any other regional assemblage in terms of technological, functional, and raw material makeup. Lithic raw material usage stands apart in terms of a high focus on chalcedonies and silicified woods thought to occur west of the village, and a relatively strong emphasis on orthoquartzites and jasper/cherts thought to be from exotic sources to the southwest. There is strong contrast in lithic materials present at Slant Village, even though that site is only 10 km distant, indicating that some rather strong forces operated on processes dictating where local resources were acquired. Scattered Village residents appear to have relied on a particular subpart of the regional lithic catchment area, a part quite different from that used by Slant Villagers. Whether other traditional Mandan settlements near Heart River shared this resource suite remains to be determined through future research.

The most remarkable feature in the Scattered Village tool assemblage is the abundant occurrence of objects of bipolar technology, most of which apparently functioned as punches or tools of some kind rather than cores or sources for flakes. This feature is thought to be linked, in part, to use of bipolar objects in fabrication of scapula hoes, antler bracelets, and rib pressure flaking tools that are abundant at Scattered. Similar bone and antler items occur at other villages, but their technology of production seems to be different at Scattered and to have involved use of bipolar stone technology. A minor occurrence of this suite of features is present at Slant Village, and Scattered stands in even greater contrast to the Hidatsa assemblages from Knife River that are practically devoid of bipolar production items. Those assemblages do have markedly greater relative proportions of non-bipolar flake tools of various kinds (retouched and utilized flakes), and it is possible that there is functional equivalency between bipolar objects at Scattered and flake tools at the Hidatsa sites. None-the-less, the technological contrast remains, and it is difficult to argue for a close or direct, ancestral ethnic unit affiliation between Scattered Village and any studied site near the Knife River.

Some interesting contrasts between Scattered and Slant Village and similarities between Scattered and Big Hidatsa village can be found in a few of the ornamental, recreational, and nonutilitarian items that make up a small fraction of all collections. Use of scoria for making ground, ornamental, or recreational items, links Scattered and the Hidatsas, as does the common occurrence of gaming pieces and chipped items shaped for suspension as pendants. Slant Village stands apart in stone materials used to fabricate nonutilitarian artifacts (shaped and drilled siltstone beads, and presence of catlinite). It is difficult to weight the features that lie in relatively uncommon decorative items with what seem to be much broader technological trends that form the foundation of each lithic assemblage. In the end, the stone tool data tell us a lot about what people at Scattered Village were doing, but they leave us less well informed about who they were, where they came from, and where they moved after leaving this site.