Appendix B:
Analysis of Lithics from the Ts'ishaa Back Terrace

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Introduction

Tseshaht Project co-director Alan McMillan provided initial analysis sheets for 120 items and boxes containing a total of 119 items (one artifact, a large obsidian biface, was held back). Only chipped stone objects are included in this analysis. All came from the earlier component, on the back terrace portion of the site. The materials were unpacked and examined individually for an assessment of cultural origin or lithic technological origin. This followed a similar assessment by Michael Wilson. Several items were deemed to be non-cultural, while several more were thought to be fire-cracked rock. The most questionable items were removed from the analysis and not considered further. Several items removed clearly displayed recent chipping, a few of these with obvious shovel or trowel polish marks. The result was a final total of 96 chipped stone items appraised to be artifacts. Of these, a very few may yet be non-technological; however, the analyst has insufficient familiarity with the geological context of the site, the nature of the native beach rock and the cultural fire-cracked rock, to judge further.

The artifacts were sorted into 17 major classes and 12 raw material types across five major layers (A through E). 53 of these are considered debitage or unmodified lithic raw material, while the other 43 are considered to be tools or intentionally modified (through deliberate retouch or use) lithic materials. The raw material classes assigned by McMillan and Wilson were initially employed, then simplified here for purposes of obtaining general trends within the assemblage. Quantitative measures of all items were taken for maximum length, maximum width perpendicular to the length measure, and maximum thickness. Weights were not taken but volume was calculated as a proxy. The dimensions of the obsidian biface were estimated from a photocopied drawing supplied to the analyst.

Raw Materials

The ten raw material groups and their relative abundance across the entire assemblage are as follows:

Andesite:	10%	(10)
Basalt:	13%	(12)
Diorite:	2%	(2)
Gabbro:	4%	(4)
Gneiss:	17%	(16)
Green Chert:	15%	(14)
Hornfels:	3%	(3)
Metamorphic:	1%	(1)
Obsidian:	2%	(2)
Quartzite:	3%	(3)
Schist:	15%	(14)
Vein Quartz:	16%	(15)
Total :		96

The lithic assemblage is therefore dominated by metamorphic rocks, secondly by igneous rocks, and finally by sedimentary cherts. Two obsidian pieces were recovered, both from Oregon sources: Glass Buttes (the lanceolate biface) and Newberry Caldera (the microblade core ridge flake).

Artifact Classes

The 17 artifact classes employed are basic "lumped" rather than "split" groups, as follows:

1. Biface (n=1): Large bifacially flaked, lanceolate obsidian biface not examined by the analyst but included in this analysis in frequencies of tool types and raw materials.
2. Bipolar Bashed Pebble (n= 3): small pebbles, one each of gneiss, green chert and quartzite, exhibiting bashing at both ends of the longitudinal axis but with no large flake detachments.
3. Bipolar Core (n = 3): small pebbles exhibiting crushing at both ends of the longitudinal axis, with large flakes detached that would have been

suitable for use. Two of these are made of vein quartz and one is of diorite.

4. Bipolar Flake (n=4): Debitage, with no signs of retouch or utilization but with flake scars and/or crushing at opposite ends of the longitudinal axis indicating simultaneous removal. Two exhibit cortex.
5. Chipped Schist (n=11): Small pieces of thin schist with intentional retouch.
6. Chopper (n=3): Large flakes or core fragments with large, rough retouch and large use-wear flakes indicating chopper usage. Two of these are made of andesite, another of gneiss.
7. Cobble Chopper (n=3): Large chopper tools with remnant cobble exteriors, large, rough retouch and large use-wear flakes indicating chopper usage. One of these is made of gneiss, one of andesite, and one of hornfels. Several of the larger items not considered artifacts and therefore removed from analysis may fall into this category.
8. Flake (n=48): This is unmodified debitage, the single most abundant class of artifact. The items are mostly small flakes, a few with obvious cortex; however cortex could not be reliably identified on a large number of these and therefore was not recorded. The largest number (12) are made of vein quartz, with 10 of green chert, 9 each of basalt and gneiss, 3 of andesite, 2 of hornfels, 2 of quartzite, 1 of gabbro.
9. Large Core (n=3): Large items with no obvious use-wear but exhibiting flake removals sufficiently large to have served as tools or tool blanks. Two are of andesite and one of gabbro.
10. Large Retouched Flake (n=4): Large deliberately produced flakes with some retouch. Three of these have some remnant cortex. One is made of diorite, one of gneiss, one of gabbro, and one of basalt.
11. Large Spall (n=1): Large flake spall with evident cortex, made of gabbro. This item appears to have been flaked from a large cobble but may in fact be a fire-spall.
12. Microblade Core Ridge Flake (n=1): This artifact is entirely out of place with the rest of the assemblage, but it is almost certainly a ridge flake produced in the early stages of manufacturing Denali-type (or Campus-type) microblade cores, or it is a biface edge spall removed with a directed longitudinal blow. It is made of obsidian sourced to the Newberry Caldera, but the assemblage contains no microblades or obsidian debitage.
13. Schist Knife (n=3): Pieces of schist intentionally modified to have at least one longitudinal chipped edge and circumferential shaping.
14. Small Core (n=2): Small pebbles with no obvious use-wear but exhibiting flake removals sufficiently large to have served as tools or tool blanks. One each are made of andesite and green chert.
15. Split Cobble Chopper (n=4): Medium-sized cobbles with remnant exterior faces that have been split and then modified into heavy chopping tools, or that have been used sufficiently to produce large flake scars. Two are made of gneiss, one of andesite, and one of a fine-grained metamorphic rock.
16. Split Pebble (n=1): A basalt pebble that has been split but exhibits no obvious simultaneous bipolar crushing. This item may in fact be fire-spalled as well.
17. Utilized Flake (n=1): A single large flake of basalt exhibiting use-wear retouch that is not regular enough to be considered intentional retouch.

Discussion

Apart from the obsidian biface and microblade core ridge flake, the lithic assemblage is unremarkable. Nonetheless, some general patterns may be observed. The most abundant tool raw material is gneiss, followed by vein quartz, then equal amounts of green chert and schist. The schist and gneiss are highly friable rocks so one would expect that the uses to which these were put were relatively light. The tool classes other than one large retouched flake are only found in Layers A through C so it appears that the later occupations were more intensive. In fact only three artifacts in total are found in layers D and E. Frequencies of artifacts decline sharply from top to bottom: Layer A has 59 items, Layer B has 24, Layer C has 11, Layer D has two and Layer E only one.

An interesting trend is for the larger artifacts to be found in the lower levels of the site. As seen in Figure 1, the mean volume (LxWxT) increases sharply from Layer A through B and C. Layer D has higher mean volume than Layers A and B. The meaning of this pattern is unclear to the analyst since the layer assignments may not be consistent across the site. It may indicate, however, that the heavier items are working their way downwards. This certainly calls into question the cultural validity of the lower levels. The lowest two levels

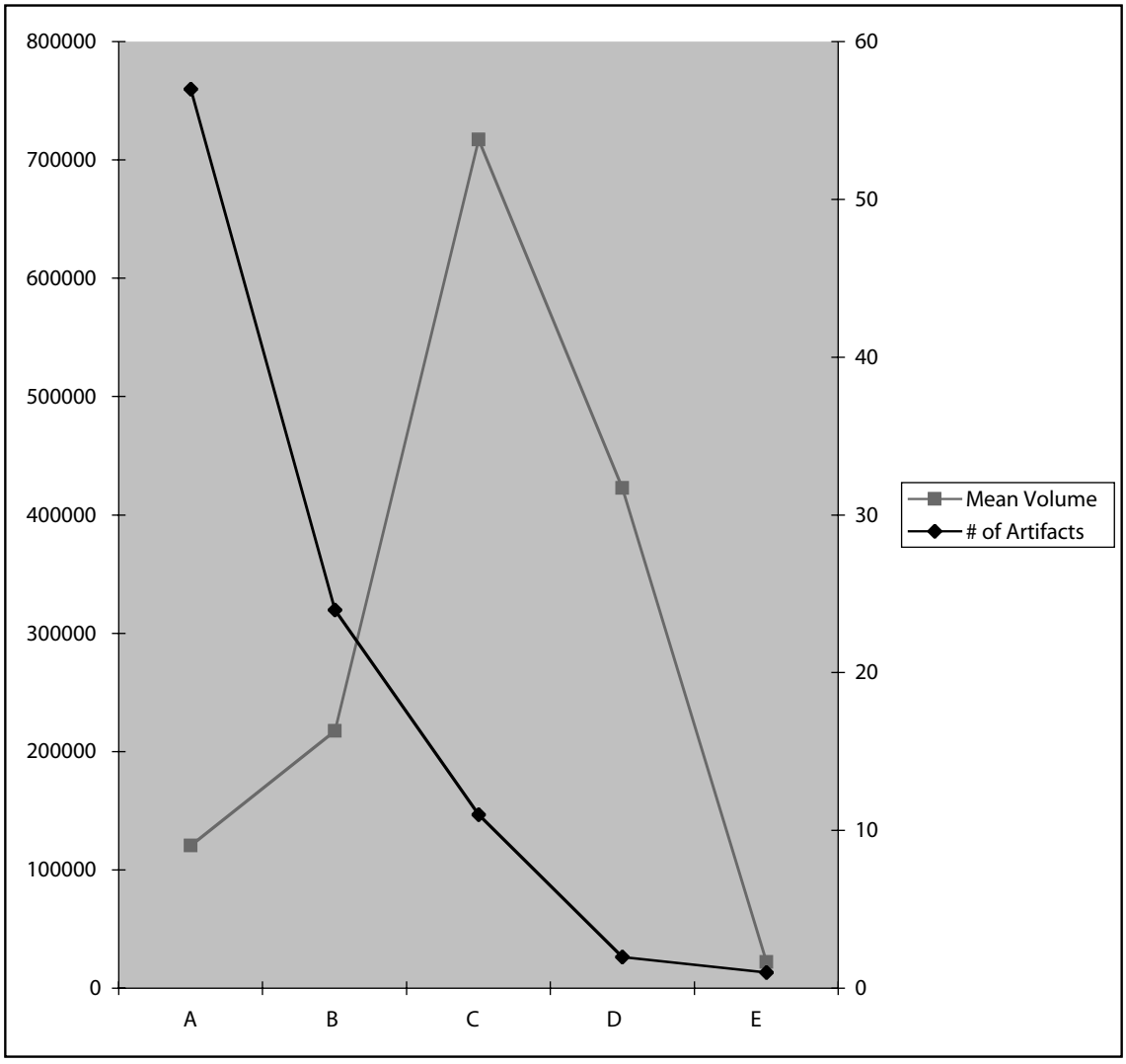

Figure 1. Artifact frequencies and mean volumes by major layers.

contain only three items of gneiss and gabbro so those may be questionable as well.

Some tool/debitage patterns with respect to raw materials are notable (Table 1, Figure 2). First, all of the schist materials appear to be tools or tool fragments, while both obsidian items are tools or tool fragments. Vein quartz and chert are far more abundant in the debitage than in the tool classes. In the other raw material classes frequencies are simply too low to allow reliable generalizations, although andesite is more than twice as common in tools than in debitage (n=7 vs. n=3), basalt three times as common in debitage than in tools (n=9 vs. n=3). Taken at face value, these patterns indicate manufacture and export of quartz, chert and basalt tools, but import of obsidian, andesite and schist tools. There is the possibility, of course, that the obsidian, and site and/or schist manufacturing events took place at the site but at locations other than where the excavation units were placed. Also, as any schist that did not display evidence of chipping was not collected, the debitage for that raw material class would be greatly underrepresented.

Summary

A total of 96 lithic artitacts from Ts'ishaa were analysed. These were sorted into 17 classes of tools (n=43, including cores) and debitage (n=53) across 10 general raw material categories. The most remarkable items in the assemblage are made of obsidian, one being a large lanceolate biface and the other an apparent microblade core ridge flake.

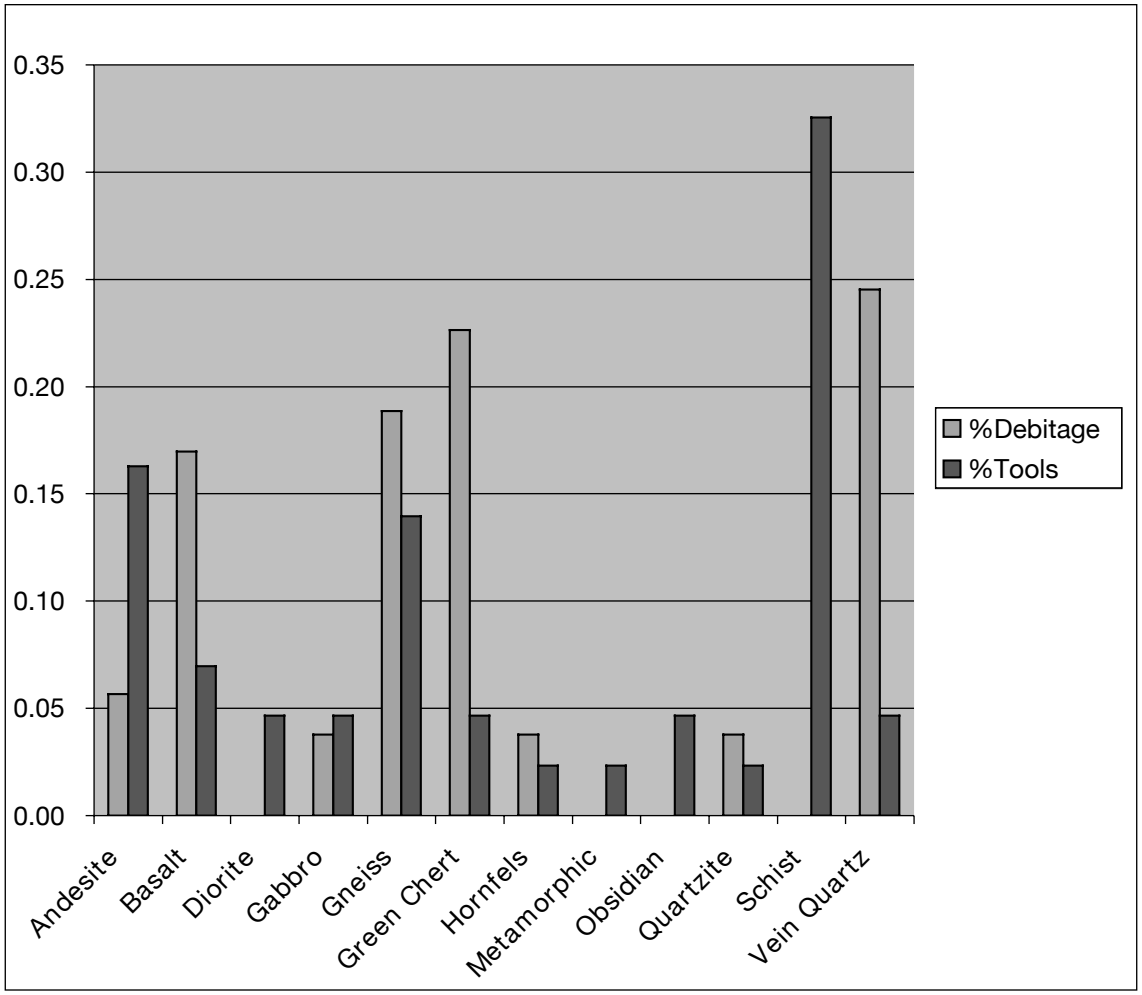

Figure 2. Graphical representation of relative amounts of debitage and tools by raw materials.

No other obsidian artifacts are represented. Other than that the assemblage seems rather typical. The reduction technology includes bipolar flaking of chert, vein quartz and other pebble- sized materials, as well as free-hand percussion of larger rocks. Many of the bipolar cores and flakes may in fact result from their use as "wedges," but use-wear analysis would be necessary to verify that. A trend is apparent for very large artifacts to be found in lower levels, which is perhaps a result of downward gravitational movement through loosely consolidated midden. Possible import/export trends may be present in the form of import of andesite, obsidian and schist tools in concert with export of basalt, quartz, and green chert tools.

Table 1. Frequencies of debitage and tools by raw material types.

Raw Material	#Debitage	#Tools	Total
Andesite	3	7	10
Basalt	9	3	12
Diorite		2	2
Gabbro	2	2	4
Gneiss	10	6	16
Green Chert	12	2	14
Hornfels	2	1	2
Metamorphic		1	1
Obsidian	0	2	2
Quartzite	2	1	3
Schist	0	14	14
Vein Quartz	13	2	15
TOTAL	53	43	96

Table 2. Lithic artifacts examined in this study.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
724	biface	tool	obsidian	6A	127.4	36.1	8.4	38632.8	Glass Buttes, Oregon
930	bipolar bashed pebble	tool	f.g. metamorphic, poss. quartzite	8B	64.5	32.0	13.0	26832.0	
905	bipolar bashed pebble	tool	green chert	4A	39.2	23.3	22.6	20641.9	
771	bipolar bashed pebble	tool	gneiss	4B	21.8	15.1	13.2	4345.2	
745	bipolar core	tool	vein quartz	4A	37.0	32.5	15.9	19119.8	
823	bipolar core	tool	vein quartz	4A	44.7	30.9	19.6	27072.1	
782	bipolar core	tool	f.g. diorite	3A	53.0	44.4	15.4	36239.3	water-rolled
988	bipolar flake	deb	vein quartz	9B	20.5	16.8	5.2	1790.9	with cortex
926	bipolar flake	deb	green chert	8A	22.4	11.5	8.3	2138.1	
968	bipolar flake	deb	green chert	6A	47.2	14.3	7.2	4859.7	
803	bipolar flake	deb	gneiss	5B	70.6	38.6	16.2	44147.6	bipolar, with cortex
453	chipped schist	tool	schist	1A	33.6	21.5	3.3	2383.9	
454	chipped schist	tool	schist	3A	51.9	19.0	9.1	8973.5	chipped and ground
597	chipped schist	tool	schist	4A	52.0	33.4	3.0	5210.4	
733	chipped schist	tool	schist	3A	43.9	31.5	5.0	6914.3	
743	chipped schist	tool	schist	4A	24.7	22.1	3.8	2074.3	
762	chipped schist	tool	schist	5A	89.1	57.2	5.9	30069.5	
766	chipped schist	tool	schist	5A	72.4	44.4	4.9	15751.3	
779	chipped schist	tool	schist	7C	50.2	43.0	2.8	6044.1	utilized
806	chipped schist	tool	schist	5B	56.6	37.6	3.5	7448.6	
807	chipped schist	tool	schist	5B	24.5	17.9	2.1	921.0	
868	chipped schist	tool	schist	1A	42.3	34.5	6.3	9193.9	
817	chopper	tool	gneiss	6A	141.7	132.4	52.7	988708.9	
873	chopper	tool	andesite	9C	176.3	129.0	57.0	1296333.9	
918	chopper	tool	andesite	7A	133.8	116.0	69.7	1081799.8	heavily water-rolled, poss. natural
943	cobble chopper	tool	hornfels	8B	113.8	109.1	54.6	677890.7	heat spalling
897	cobble chopper	tool	gneiss	7C	127.8	115.8	51.0	754761.2	
829	cobble chopper	tool	andesite	2A	131.9	95.9	42.1	532531.7	in cairn over immature burial (F 18)
596	flake	deb	vein quartz	2A	29.8	12.8	6.6	2517.5	
765	flake	deb	vein quartz	5A	18.5	13.1	3.2	775.5	
767	flake	deb	vein quartz	5A	14.0	9.2	3.2	412.2	
813	flake	deb	vein quartz	6B	9.0	7.0	1.7	107.1	
853	flake	deb	vein quartz	1A	13.8	11.0	3.6	546.5	
854	flake	deb	vein quartz	2A	13.8	6.1	3.9	328.3	
870	flake	deb	vein quartz	4A	14.0	10.8	3.6	544.3	
894	flake	deb	vein quartz	7A	18.9	15.0	3.7	1049.0	
915	flake	deb	vein quartz	4A	8.3	8.1	2.3	154.6	
932	flake	deb	vein quartz	4A	16.6	9.1	3.0	453.2	
969	flake	deb	vein quartz	2A	19.2	17.6	3.3	1115.1	
970	flake	deb	vein quartz	2A	16.8	12.8	4.2	903.2	

Table 2 continued.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
949	flake	deb	quartzite	9B	25.6	18.1	3.5	1621.8	
985	flake	deb	quartzite	9B	47.0	17.2	4.3	3476.1	below date of 4080±70
850	flake	deb	hornfels	9B	43.3	31.2	7.1	9591.8	
896	flake	deb	metamorphic, poss. hornfels	6C	60.9	35.0	11.4	24299.1	
738	flake	deb	green chert	3A	12.5	7.2	1.5	135.0	
769	flake	deb	green chert	6A	15.8	11.8	5.0	932.2	water rounded
774	flake	deb	green chert	5B	20.3	13.5	3.6	986.6	
802	flake	deb	green chert	5A	49.4	41.0	14.7	29773.4	
849	flake	deb	green chert	3A	19.9	18.2	7.4	2680.1	water-rolled
862	flake	deb	green chert	2A	23.1	7.8	3.0	540.5	possibly bipolar
864	flake	deb	green chert	4A	18.3	16.0	3.9	1141.9	
885	flake	deb	green chert	4A	17.2	6.9	2.8	332.3	
911	flake	deb	green chert	3B	75.2	27.5	17.9	37017.2	
914	flake	deb	green chert	4A	16.8	7.0	1.7	199.9	
754	flake	deb	f.g. gneiss	6B	69.5	37.7	15.5	40612.3	below date of 3000±70 (in 5B)
778	flake	deb	gneiss	7D	55.5	28.1	19.9	31035.0	
846	flake	deb	gneiss	9B	27.8	19.4	5.1	2750.5	
866	flake	deb	metamorphic, poss. gneiss	10E	45.7	40.3	12.2	22468.9	from dark brown silt-clay at base – date from this level of 4430±80
882	flake	deb	gneiss	3A	23.8	18.7	4.8	2136.3	
890	flake	deb	gneiss	7C	76.7	39.8	13.8	42126.7	
983	flake	deb	gneiss	5A	47.1	16.4	8.2	6334.0	
987	flake	deb	gneiss	7A	54.1	31.7	22.3	38243.8	8A has date of 4080±70
989	flake	deb	gneiss	8A	44.4	41.1	11.3	20620.7	
960	flake	deb	gabbro	6A	35.2	25.9	6.6	6017.1	
744	flake	deb	basalt	4A	49.6	43.3	12.0	25772.2	
775	flake	deb	basalt	5B	27.5	10.5	4.5	1299.4	
818	flake	deb	basalt	7A	37.0	26.9	8.3	8261.0	
884	flake	deb	basalt	4A	29.7	24.9	4.6	3401.8	
886	flake	deb	basalt	4A	36.4	28.8	9.8	10273.5	
887	flake	deb	basalt	4A	21.0	15.4	3.5	1131.9	
901	flake	deb	basalt	4A	33.7	20.4	6.9	4743.6	
946	flake	deb	basalt	8B	30.7	25.8	5.1	4039.5	date of 4080±70 from 8A
986	flake	deb	poss. basalt	9B	43.2	17.4	6.5	4885.9	
312	flake	deb	f.g. igneous, poss. andesite	4B	51.9	40.5	12.3	25854.0	
551	flake	deb	f.g. igneous, poss. andesite	1A	64.1	30.0	13.9	26729.7	
594	flake	deb	f.g. igneous, poss. andesite	6B	96.7	71.1	35.8	246138.2	recent damage
314	large core	tool	gabbro	6C	194.5	184.2	87.6	3138436.4	
804	large core	tool	porphyritic andesite	5B	164.7	141.9	102.5	2395520.3	heavily water-rolled – poss. natural?
852	large core	tool	andesite	12B	152.9	140.6	77.6	1668224.6	

Table 2 continued.

Cat #	Artifact Type	Deb/ Tool	Raw Material	Level Layer	L	W	T	Volume	Comments
808	large re-touched flake	tool	gneiss	5A	123.0	73.1	38.7	347963.3	with cortex
563	large re-touched flake	tool	gabbro	8D	164.9	139.6	35.4	814909.4	with cortex
820	large re-touched flake	tool	f.g. diorite	7C	123.0	74.1	46.2	421080.7	with cortex
899	large re-touched flake	tool	basalt	8C	145.3	105.5	38.1	584040.6	
550	large spall	deb	gabbro	7C	127.7	101.9	59.7	776854.0	
942	microblade core ridge flake	tool	obsidian	8B	39.9	6.7	3.3	882.2	Newberry Caldera, Oregon
742	schist knife	tool	schist	4A	84.7	56.1	5.4	25659.0	
759	schist knife	tool	schist	5A	76.7	59.0	5.6	25341.7	
812	schist knife	tool	schist	6B	71.1	34.2	5.2	12644.4	
827	small core	tool	green chert	7A	23.4	19.0	14.8	6580.1	
916	small core	tool	f.g., poss. andesite	15–17C	31.4	26.6	14.5	12111.0	water-rolled – found in shovel test deep into basal deposit – cultural?
929	split cobble chopper	tool	metamorphic, poss. gneiss	7A	169.7	113.9	56.0	1082414.5	
919	split cobble chopper	tool	andesite	7A	120.5	118.0	51.2	728012.8	
549	split cobble chopper	tool	f.g. metamorphic	7C	143.6	121.5	47.8	833985.7	
758	split cobble chopper	tool	f.g.metamorphic, prob. gneiss	4A	161.0	127.7	55.3	1136951.4	
948	split pebble	tool	fg greenish basalt	9A	80.0	61.8	22.9	113217.6	8A has date of 4080±70
799	utilized flake	tool	f.g. basalt	5A	138.0	66.3	41.7	381530.0	battered end – pick-like – with cortex