University of Nevada, Reno

Late Paleoindian Leporid Processing at the Little Steamboat Point-1 Rockshelter: An Experimental and Archaeological Use-Wear Analysis of Obsidian Flake Tools

A thesis submitted in partial fulfillment of the

requirements for the degree of Master of Arts

in Anthropology

by

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May, 2016

THE GRADUATE SCHOOL

We recommend that the thesis
prepared under our supervision by

MADELINE WARE VAN DER VOORT

Entitled

Late Paleoindian Leporid Processing At The Little Steamboat Point-1 Rockshelter: An Experimental And Archaeological Use-Wear Analysis Of Obsidian Flake Tools

be accepted in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

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May, 2016

ABSTRACT

Human occupation of the Little Steamboat Point-1 (LSP-1) rockshelter in southcentral Oregon began ~9,600 cal BP. Artifacts recovered from the pre-Mazama deposits include a faunal assemblage comprised primarily of leporid remains and a lithic assemblage dominated by informal flake tools. I designed and conducted an experiment using replicated obsidian flake tools to identify leporid processing strategies employed by Early Holocene occupants. I performed hide, carcass, and meat processing tasks with the replicated tools on farmed meat rabbits and documented the microscopic use-wear traces of these activities. I then compared the replicated use-wear with wear present on 35 obsidian flake tools from pre-Mazama deposits and found that hide processing, including both scraping and cutting, was the most common activity performed at the site. Leporid carcass processing was the second most common activity. These results suggest that the occupants of LSP-1 not only consumed and processed leporid carcasses, but also prepared leporid hides for rabbit skin blanket production.

ACKNOWLEDGMENTS

Dr. Geoffrey Smith and the Great Basin Paleoindian Research Unit (GBPRU) provided me with financial support through employment as a Graduate Research Assistant while attending the University of Nevada, Reno (UNR). Dr. Smith offered continuous help, support, and encouragement, and I have benefited immeasurably from his help focusing my ideas and streamlining my writing style. He also invited me to work at the Little Steamboat Point-1 (LSP-1) rockshelter in the summer of 2014 before I began my research in earnest. The UNR Graduate Student Association provided financial support for travel to conferences and grants for three semesters at UNR. Bill Cannon of the Lakeview BLM provided financial and logistical support for fieldwork and laboratory analyses conducted as part of the LSP-1 project. Dr. Geoffrey Cunnar helped to answer my use-wear questions, formulate my experimental design, produced some of my replicated tools, and shared his knowledge about documentation procedures, microscopes, and other information essential to conducting use-wear analysis. Dr. Christopher Morgan took the lead on purchasing the microscope.

Thank you to my committee, Dr. Geoffrey Smith, Dr. Christopher Morgan, and Dr. Nancy Markee, for their feedback and help with this project. Thanks to Craig Skinner at the Northwest Research Obsidian Studies Laboratory for conducting geochemical characterization of many of the artifacts from LSP-1. Thanks are also due to all of the people who worked at LSP-1, especially Evan Pellegrini and Jamie Dexter Kennedy for conducting faunal and macrobotanical analyses, which helped me contextualize my work at the site.

Finally, thanks are due to my family for helping me get to this point and to my husband, Timothy Van der Voort, for supporting me through this process. He produced many of my replicated tools, as well as always making me dinner and keeping me focused. Without him, I would be lost.

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CHAPTER 1

INTRODUCTION

The earliest inhabitants of the Great Basin focused their subsistence strategies on wetland resources (Madsen 2007). Whether termed Paleoindian (the term used herein), Paleoarchaic, or Pre-Archaic, these groups were mobile and operated within large foraging territories (Goebel 2007; Jones et al. 2003, 2012; Smith 2007). Although the Paleoindian toolkit - specifically, large bifacial points similar to those used to hunt megafauna in the Southwest and Great Plains (Frison 1998) - suggests a focus on large game, subsistence data from Terminal Pleistocene/Early Holocene (TP/EH) assemblages suggest that small mammals, fish, birds, and some plant resources were consumed (Eiselt 1997; Grayson 1988; Hockett 2007; Pinson 2007; Rhode and Louderback 2007). Subsequent Archaic lithic assemblages are characterized by technology more focused on seed processing and an even broader diet than Paleoindians (Madsen 2007). The transition between these two lifeways, which appears to have taken place by the end of the Early Holocene (~8,300 cal BP), is difficult to characterize in detail because few TP/EH sites contain well-preserved faunal assemblages (Madsen 2007).

In this study, I examine late Paleoindian resource processing strategies at the Little Steamboat Point-1 (LSP-1) rockshelter (35HA3735) in southcentral Oregon. Through a use-wear analysis of obsidian flake tools from pre-Mazama (>7,700 cal BP) deposits containing a faunal assemblage rich in leporid (i.e., rabbits and hares) remains, I test two hypotheses: (1) leporids were field processed (i.e., low utility portions removed on-site and high utility portions transported offsite) during brief task-specific occupations; and (2) leporids were more fully processed (including hide and meat preparation) by small groups conducting varied activities during somewhat longer stays. To test these hypotheses, I compare a replicated tool assemblage used to process domestic meat rabbits against flake tools from LSP-1. I use the data collected during my experiment to identify evidence of hide, carcass, and meat processing at the site and illuminate how LSP-1 was used within a broader land use strategy.

Paleoindian Lifeways in the Great Basin

Most evidence about Paleoindian lifeways in the Great Basin is derived from near-surface lithic scatters. For example, Jones et al. (2003) reconstructed extensive Paleoindian foraging territories using geochemical data from obsidian and basalt artifacts from different parts of the Great Basin. Later studies, such as Smith (2010) and Jones et al. (2012), reduced those large territories to smaller ones more in line with ethnographic foragers. Yet Paleoindian groups are still cast as "highly mobile travelers" by Jones et al. (2012:364), merely covering less territory than initial estimates implied. The high frequency of sites in valley bottoms suggests that wetland resources were a focus of Paleoindian activity (Beck and Jones 2009; Duke and Young 2007; Elston and Zeanah 2002; Smith 2010; Smith et al. 2013) and research suggests that occupation duration may have been linked to wetland size (Duke and Young 2007; Madsen 2007; Smith et al. 2013).

Western Stemmed Tradition (WST) bifaces typical of Great Basin Paleoindian assemblages are often assumed to have been associated with big game hunting in the same manner as Clovis and late Paleoindian stemmed points on the Great Plains (Duke 2015); however, subsistence remains in the northern Great Basin suggest that early groups relied more heavily on small mammals, birds, and fish associated with marsh resources than large game such as artiodactyls (Pinson 2007). Reliance on artiodactyls (i.e., deer, pronghorn, bighorn) appears to have increased across time and leporids such as rabbits and jackrabbits (i.e., hares) probably contributed more to Paleoindian diet than artiodactyls (Pinson 2007). In Christmas Valley, Oregon, two Early Holocene sites produced abundant leporid bones inside charcoal-filled pit features (Oetting 1994). The first site contained a 2-x-3-m pit with ~14,000 elements (~98 percent of identified remains were leporid) interpreted as the remains of a single hunting/processing event, while the second site had four smaller pits suggesting repeated occupations over several centuries. Oetting (1994) proposed that these sites represent early evidence of rabbit drives, a practice documented by ethnographers (Kelly 1932; Riddell 1960; Wheat 1967; Whiting 1950) throughout the Great Basin.

Evidence of a broad Paleoindian diet is also present in the earliest subsistence remains at Bonneville Estates Rockshelter (BER) in the eastern Great Basin (Hockett 2007). While the BER faunal remains deposited by humans consist of some large mammals (e.g., mountain sheep [*Ovis canadensis*], pronghorn [*Antilocapra americana*], deer [*Odocoileus hemionus*], and black bear [*Ursus americanus*]), they are mostly comprised of small game including jackrabbit (*Lepus* spp.), sage grouse (*Centrocercus urophasianus*), and even grasshoppers (Hockett 2007). Rhode and Louderback's (2007) analysis of plant remains at BER and Danger Cave suggest that site occupants consumed ricegrass (*Achantherum hymenoides*), dropseed sandgrass (*Sporobolus* sp.), goosefoot and saltbush (Chenopodiaceae), mustard family (Brassicaceae), sunflower (Asteraceae) seeds, and cacti (Cactaceae) pads and stems.

TP/EH Resource Processing

Some sites provide information about resource processing techniques along with subsistence remains and elucidate a few basic trends. First, BER and Danger Cave in the eastern Great Basin contain plant remains in the earliest deposits but lack the milling implements common in Early Archaic deposits at those sites (Rhode and Louderback 2007). The BER faunal assemblage includes evidence of systematic sage grouse butchering as well as butchering and marrow extraction from both artiodactyl and leporid remains (Hockett 2007). Sage grouse were butchered by removing the wings and legs with stone tools and snapping the bones at the smaller joints by hand. The lower frequency of axial elements in the assemblage indicates these portions were processed differently from appendicular portions, discarded in an unexcavated part of the shelter, or transported away from the site. Artiodactyl remains consisted of small long bone fragments representative of marrow extraction. Leporid remains consisted of diaphysis cylinders created by removing the proximal and distal ends of long bones to extract marrow. This method was applied to both front and hind limbs. Six diaphysis cylinders bore stone tool cut marks. Additionally, there were ~200 leporid-sized burnt bone fragments (Hockett 2007). The lithic assemblage for the earliest components of the site contains small flakes indicative of tool maintenance and repair, as well as finished bifaces and flake tools made on exotic toolstone transported to the site prior to being discarded there (Goebel 2007).

The Paisley Five Mile Point Caves in the northern Great Basin also produced early evidence of artiodactyl bone marrow extraction (i.e., fragmented long bone) and hide preparation (i.e., buckskin production) (Jenkins et al. 2013). Leporid protein was extracted from utilized flakes and scrapers recovered from early deposits across the site, indicating that small mammal hide processing likely occurred there. Focusing again on Christmas Valley, Oetting (1994:166) described the Buffalo Flat sites there as representing “rabbit driving and processing,” but did not discuss how leporid carcasses were processed. The pit features were associated with debitage, edge modified flakes, biface fragments, pumice abraders, and an obsidian core. Many leporid bones were too fragmentary to identify to species level and the bones were mixed within the charcoal features. No cut marks or diaphysis cylinders were reported. Those sites do not provide enough data to reconstruct leporid processing activities or element transport strategies but, again, do indicate a heavy Paleoindian focus on small game.

Middle Holocene Resource Processing

Two later sites, Camels Back Cave in the eastern Great Basin (Schmitt and Madsen 2005) and Gatecliff Shelter in the central Great Basin (Thomas 1983), provide more extensive information concerning animal processing strategies in the region. Camels Back Cave’s Stratum V dates between ~7,900 and ~7,300 cal BP[1]. It is associated with 5-6 separate occupations containing high densities of *Lepus* remains, with an estimated 100 individuals within the entire stratum (Schmitt et al. 2002). The lithic assemblage is dominated by small flakes and 22 chipped stone tools, five of which were flake tools (Elston 2005). Leporid remains consisted mostly of crania and forelegs, with fewer vertebrae and proximal femora representing higher utility portions. The abundant leporid remains corresponding to only a few occupations suggest a mass capture strategy such as communal drives and/or the use of nets (Schmitt et al. 2002). The difference in skeletal element representation in the assemblage is likely due to human processing and transport strategies. Schmitt and Lupo (2005:169) suggest that these patterns indicate the consumption of low utility appendicular parts at the cave and the transport of high-utility axial portions to a secondary processing site, possibly a base camp or village. The lithic assemblage supports this conclusion: high amounts of small debitage suggest that tool maintenance and resharpening took place while the dearth of bifaces and flake tools suggests that minimal resource processing (i.e., carcass butchering but not hide preparation) occurred.

Gatecliff Shelter's horizons 14 and 15 represent some of the earliest occupations of the site, dating from ~6,100 to ~5,800 cal BP (Thomas 1983:447-454). Horizon 15 contained three hearths interpreted as marking distinct occupations, which also produced one projectile point, two biface fragments, and fewer than 50 flakes including some primary reduction debitage. Horizon 15 also included small mammal bones deposited by non-human agents and 64 artiodactyl bones. All artiodactyl bone fragments large enough to be identified to species were from bighorn sheep. Most of the large bone fragments were from low utility portions of the animals (i.e., lower limbs and skull) and were discarded outside of the shelter's dripline. The discarded bones were not processed for marrow. Thomas (1983:447) contends that the Horizon 15 occupations focused on bighorn procurement, field butchering, and transport of high utility portions away from the site. Horizon 14 contained a larger assemblage showing similar discard patterns. The Horizon 14 lithic assemblage contained small retouch flakes indicating tool maintenance and repair (Thomas 1983:451), while the presence of a few biface fragments, finished knives, and flake tools suggest minimal resource processing took place during that occupation as well.

Importance of the LSP-1 Rockshelter for Understanding Late Paleoindian Resource Processing

The Middle Holocene assemblages at Camels Back Cave and Gatecliff Shelter indicate repeated occupations focused on a single type of resource procurement. Secondary activities at the sites were limited and in both cases large and small game were field processed to optimize transport to another location for more intensive handling (i.e., hide preparation, bone marrow extraction, cooking). Conversely, evidence from the Paisley Caves suggests that large mammal bone marrow extraction as well as small and large mammal hide preparation occurred on-site while evidence from BER suggests that small and large mammal bones were processed for marrow and small game were preferentially transported away from the shelter during the TP/EH (Hockett 2007). The LSP-1 rockshelter offers an opportunity to further study Early Holocene (i.e., late Paleoindian) resource processing because the faunal assemblage is primarily made up of leporid remains and previous analysis indicates a similar element discard pattern to that noted at Camels Back Cave (Pellegrini 2014). In his analysis of the combined Early and Late Holocene faunal assemblages from LSP-1, Pellegrini (2014:118) suggested that the site may have had a similar occupational history as Camels Back Cave and served as “a short-term location where foragers briefly gathered to pursue and process jackrabbits and cottontails.” Use-wear analysis of the pre-Mazama flake tool assemblage from LSP-1 can elucidate the extent to which leporids were processed at the site and determine more precisely how the Early Holocene occupants used the shelter.

Analytical Framework

Functional analyses of artifacts focus on how tools were manipulated and the materials on which they were used. Studies of stone tools are based on the properties of the raw materials, manufacturing techniques, and design characteristics of tools as well as use-wear features, residues, replicative experiments, and ethnographic evidence (Kononenko 2011:4). Prehistoric economic and technological activities can be reconstructed with these types of data, providing otherwise unobtainable information about past lifeways (Kononenko 2011:4).

Lithic tools are traditionally grouped into morphological types that often carry functional connotations (e.g., projectile points, scrapers, axes). These terms imply tools’ functions from their general form with no formal basis in experimental or replicative studies (Odell 1981). For example, in the Great Basin large, formal stemmed bifaces found in valley bottoms are called Great Basin Stemmed (GBS) or Western Stemmed

Tradition (WST) *projectile points* (Lafayette and Smith 2012:141). Recent functional analyses of WST bifaces from both the eastern (Beck and Jones 2009) and northern (Lafayette and Smith 2012) Great Basin suggest that they served not only as weapon tips but also as multipurpose tools for cutting and sawing. The label “projectile point” obscures the possibility that they were multifunctional tools, a possibility only recently supported by testing long held-assumptions via replicative experiments.

Not only are functional analyses essential to understanding the full range of tasks a person performed with a tool in the past, but regional or site-specific functional analyses are essential for properly interpreting the lithic technological organization of past groups (Odell 1981). Experimental archaeology tests functional assumptions about tool use and can provide new insights into past behavior (Ascher 1961). This type of research promotes the investigation of counterintuitive and novel approaches to understanding the past, rather than “simply relying upon probabilistic and inductive extrapolations of existing knowledge” (Outram 2008:1).

Two distinct approaches exist within experimental archaeology. The first involves highly controlled laboratory methods which can reveal the basic scientific principles behind the processes under investigation, such as rendering tar at different, specific temperatures on a burner (Outram 2008). The second employs replicated artifacts or features. This method is also a process of hypothesis testing and not simply an attempt to reconstruct the past. These replicative experiments use authentic or hypothesized materials and/or conditions with the goal of approximating past conditions for more accurate results (Outram 2008). An example of such an experiment is rendering tar over a campfire using hypothesized containers rather than under controlled laboratory conditions in a glass beaker. These approaches are complementary and both are indispensable to developing fully informed arguments about the past.

Use-Wear Analysis

Use-wear analysis is an essential method in functional studies and can provide information on how tools were used by past people. Spurrell (1892) performed the first published replicative experiments with stone tools. He identified a bright polish on Egyptian sickles and conducted a series of replicative experiments aimed at understanding how the polish formed. One of his colleagues suggested that the polish developed in museums after the tools were collected but never tested the assumption. Spurrell (1892) processed bone, wet and dry wood, horn, and ripe straw with replicated tools made on several types of flint to determine the source of this polish. Of those materials, only the straw produced a similar polish to that seen on the artifacts. Spurrell (1892) suggested that any similar polishes were likely caused by cutting cereal grains and that any tools exhibiting the same polish were used for similar functions. He also noted that not all sickles exhibited polish, likely due to either short use episodes or post-depositional weathering (Spurrell 1892). In addition to identifying the worked material through experimentation, Spurrell (1892) used a replicated tool to evaluate the accuracy of ancient drawings depicting sickles in use. He determined that the drawings were stylized to make the reaping action more obvious, when in practice farmers would have performed the task with a different cutting motion than the motion shown in the drawings.

This study was reexamined in the 1920s and 1930s and sparked a debate between some researchers (Hayden and Kamminga 1979). French researchers Andre Vayson and Rene Neuville were unconvinced by Spurrell’s (1892) experiments, while British scholar E. C. Curwen replicated Spurrell’s (1892) earlier results. This debate lapsed after Curwen (1935) produced permanent sickle polish via mechanical experimentation.

In 1934, Sergei Semenov began researching microscopic use-wear on Paleolithic tools (Hayden and Kamminga 1979). Semenov’s (1976) work, *Prehistoric Technology,* was first published in Russian in 1957 and was not available in English until 1964. This study was the first methodical microscopic examination of prehistoric tools and highlighted the utility of use-wear as a method of understanding past tool function (Hayden and Kamminga 1979).

Semenov (1976) focused on evaluating use-wear on artifacts and relegated experimentation to a verification method. He rejected its usefulness as an independent comparative tool (Semenov 1976:1). He criticized experimental approaches for several reasons: (1) their inability to show that a task was carried out in a specific way in prehistory; (2) the likelihood that tools were used for multiple functions; and (3) the difficulty in replicating prehistoric conditions. However, he stated that experimentation could confirm or restrict the range of conclusions based on artifact observations. He also believed that experimental approaches provided an important way to test the mechanical properties of tools, understand the physiology of tool use, and examine tool efficiency (Semenov 1976:2).

Bordes (1969) took Semenov to task for his lack of experimental data concerning stone tool manufacture and use. His main concern was that Semenov’s interpretations were generally based on untested assumptions about how tools were used in the past (Bordes 1969). When Bordes attempted to use a borer the way Semenov described, he found that the grip was awkward and the tool could be more easily used by simply holding it between two fingers. Bordes made it clear that Semenov's critiques of experimental approaches were just as applicable, if not more pertinent, to the underlying assumptions that Semenov himself used. Despite Semenov's early remarks about experimentation, it became clear that replication experiments were essential to fully interpreting use-wear on prehistoric stone tools.

Other researchers have used replicated tools in their experiments. Sonnenfeld (1962) used silicate, quartzite, and slate blades from archaeological assemblages that either lacked macroscopic wear or were reworked to a fresh surface and used to hoe soil. He also used slate from discarded roofing material to fashion experimental hoe blades. Witthoft (1967) indicated that he replicated Curwen's experiments in his own work but provided little information about how he replicated his experimental tools. Hester et al. (1973) performed limited experiments in a use-wear study examining triangular chipped stone tools. They provide no information about the manufacture of their replicas or their experimental methods but did briefly describe the resulting wear patterns.

These early replicative experiments were often unsystematic and poorly documented. In his scathing 1974 paper, Keeley (1974:329-330) pointed out the flaws in these studies including Semenov's "kinematic" assumptions and the use of what he called "direct verification" experimentation. Keeley (1974) suggested that using a deductive experimental framework based on the scientific method was essential to produce correct interpretations and further use-wear analysis as a technique. These warnings were heeded by later researchers and some early problems were already being addressed by new experiments.

Tringham et al. (1974) published the results of an experimental study focused on identifying the mechanical processes involved in the formation of edge damage. They did not present observations or interpretations of specific archaeological assemblages and focused instead on describing the goals, methodology, and results of their experimental program. Tringham et al. (1974) used unmodified flakes of English flint and focused on correctly identifying the directionality of tool use and materials that the tools contacted (i.e., worked materials). Tested directions of tool use included longitudinal (cutting and sawing), transverse (scraping and planning), and twisting (boring) (Tringham et al. 1974). Their experiment included initial microscopic examination of each working edge, as well as further microscopic examination at set stroke intervals (up to 1,000 strokes for each edge) (Tringham et al. 1974). The primary goal of their analysis was to examine and document use-wear formation with low power (>100X) microscopy. Additionally, Tringham et al. (1974) demonstrated that particular edge motions produced particular types of edge damage and that working materials of different hardness (e.g., flesh, skin, bone, plants, stone) produced different types of edge damage. They concluded that the value of low-power use-wear analysis is in its ability to detect *where* a tool was used rather than identifying precisely *how* a tool functioned in the past.

Tringham et al.'s (1974) experiment was the first to directly and systematically evaluate a broad range of variables contributing to use-wear formation without relying on assumptions drawn from an archaeological assemblage. Their landmark paper was an important first step towards dealing with problems in the field (e.g., unsystematic testing, poor method reporting, interpretation based on untested assumptions). In 1977, Conference on Lithic Use-Wear attendees at Simon Fraser University in British Colombia attempted to further address those problems. The main issue that the conference organizers wished to address was the "diversity in techniques, measures, and applications" in use-wear analysis at that time (Hayden and Kamminga 1979:5). Conference papers focused on topics such as the theory, quantification, and characterization of use-wear, fracture mechanics, polish, striations, raw materials, worked materials, tool motion, post-depositional effects, recording, and experimental design (Hayden and Kamminga 1979).

Keeley's (1980) research on use-wear traces on experimental tools represents an example of the kind of study that emerged following the use-wear conference. His experimental program was aimed at establishing a comparative collection of replicated tools used under well-documented conditions for use in later analyses of Lower Paleolithic assemblages (Keeley 1980:15). Keeley (1980) held raw material constant by using only English chalk flint to manufacture the replicated tools. Furthermore, he only worked materials confirmed to have been present through pollen evidence (e.g., birch, sycamore/maple, oak, yew, pine, and spruce wood) or suspected to have been worked in the Lower Paleolithic (e.g., hide, bone, meat, edible plants). He conducted most experiments outdoors on the ground with dirty hands to best approximate past conditions. Additionally, each experiment had a specific purpose or task, including hide working, sharpening a spear, or splitting a long bone. Keeley (1980:15-16) used this task-specific method to recreate particular activities with the replicated tools, rather than producing uniform use-wear, and conducted a large number of experiments with each worked material type to isolate significant patterns of diagnostic wear. He also attempted to isolate wear patterns produced by natural processes and during tool manufacture from wear patterns created during use.

Keeley (1980:16) produced replicated unmodified flake tools through hard-hammer core reduction and retouched others with hard and soft hammer percussors, microscopically examining the retouched edges of each tool before beginning an experiment. He also recorded the maximum length, width, and thickness, material worked, and activity performed with each replicated tool (Keeley 1980:17). He assigned worked materials to the following categories: (1) hardwood; (2) softwood; (3) bone; (4) dry hide/leather; (5) greased hide; (6) fresh hide; (7) meat; (8) vegetable material; (9) dried antler; and (10) softened antler. He created nine activity categories: (1) whittling or shaving with an acute edge angle; (2) plaining or shaving with the ventral surface at a low angle to the worked surface; (3) sawing with bidirectional strokes; (4) cutting using bidirectional strokes and slicing using unidirectional strokes; (5) chopping with the worked surface nearly perpendicular to the tool edge; (6) adzing with the worked surface nearly parallel to the tool edge; (7) scraping; (8) boring; and (9) wedging (Keeley 1980:17-19). He also recorded the edge angle and spine angle, edge outline shape, retouch presence, and kinematics or use method and duration of use for each tool. After he completed each experimental task, he recorded the type and placement of use-wear, direction of linear traces, polish type, striation type, edge damage, and technological effects (Keeley 1980:20-25).

Keeley (1980:82) drew several important conclusions from his experiments. First, he emphasized the importance of using high powered magnification (<100X) to fully examine use-wear patterns, especially since he identified diagnostic polishes formed by certain worked materials. Although some of these polishes may be produced through contact with more than one with worked material, most of the polish types he identified were distinguishable in blind tests. Second, he found that edge angle and depth of edge insertion into the worked material influenced the development of utilization damage (i.e., edge damage). These factors prevented edge damage from being a diagnostic attribute for worked material. Finally, he easily distinguished true use-wear patterns from traces made during manufacturing and depositional processes. Overall, his experiments indicated that deductive experimental programs were an essential first step for all use-wear studies, but that they should also be carefully tailored to address specific research objectives (Keeley 1980:83).

Low Power vs. High Power. The early stages of use-wear analysis saw the development of two distinct approaches. The low power approach focused on identifying used edges and use motion with magnifications of 10-100X (Odell and Odell-Vereecken 1980). Researchers such as Tringham et al. (1974) conducted initial tool scanning at 10-20X and use-wear assessment at 20-40X. Drawbacks of this method included difficulty in distinguishing intentional retouch, manufacturing damage, and the effects of post-depositional processes from true use-wear at low magnification as well as the variety of factors that influence the formation of edge damage such as edge angle and material type, which can generate inconsistent wear patterns.

Odell and Odell-Vereecken (1980) addressed these issues through a blind test using replicated basalt flake tools. They tackled the first concern by identifying intentional retouch as generally larger, more invasive, and more regular than edge damage caused by use-wear. They noted that manufacturing damage was often accompanied by crushing at the point of impact and fresh, unaltered areas between removal scars. Post-depositional scarring was randomly distributed across the surface of the tool and too inconsistent to be mistaken for use-wear. They identified longitudinal use motions (i.e., cutting, sawing, and slicing), transverse use motions (i.e., scraping, planning, and whittling), graving, boring, chopping, projectile use, abrading, and pounding (Odell and Odell-Vereecken 1980). One limitation of their approach was the difficulty in differentiating use motions like slicing, cutting, and sawing, which were grouped into one use motion category. Another limitation of the low power approach was the inability to further identify worked material beyond degree of hardness. Odell and Odell-Vereecken (1980) created four categories of worked materials: (1) soft materials like meat, skin, and tubers; (2) soft-medium materials like coniferous wood; (3) hard-medium materials or hardwoods like oak; and (4) hard materials such as bone and antler.

The high power approach, exemplified by Keeley's (1980) methods, employed higher magnification. Researchers conducted edge scanning at 100X with use-wear identification at 200X (Keeley and Newcomer 1977). Criticisms of the high power approach included the expense of the microscope(s), the need for more than one type of microscope for full implementation, and the time required to analyze each artifact (Odell and Odell-Vereecken 1980). This approach included analysis of more use-wear variables than the low power approach such as edge rounding, striations, and polishes along the used edge.

Keeley and Newcomer (1977) addressed the reliability of the high power approach through a blind test. Keeley correctly identified distinctive polishes diagnostic of working wood, bone, hide, meat, antler, and plants; however, seasoned wood polish and antler polish were difficult to distinguish (Keeley and Newcomer 1977). Bamforth et al. (1990) later tested and affirmed the replicability of diagnostic use polishes to identify worked materials. They suggested that ambiguous use traces can occur under many circumstances, from brief use periods to post-depositional processes, and cautioned against attempting to interpret such traces. They advised that "it is as important for microwear analysts to know when microwear [use-wear] traces cannot provide us with specific information as it is to know when they can" (Bamforth et al. 1990:428). When used properly, the high power approach can identify a used edge, reconstruct use motion, and determine specific worked material.

The low power versus high power debate was resolved with the recognition that "combinations of characteristics are more informative than any individual variable" in use-wear analysis (Lerner et al. 2007:712). Additionally, the combined approaches can provide complementary data essential for conducting comprehensive lithic analyses (Collins 1993; Shea 1992).

Effects of Raw Material. Most early use-wear studies focused on replicating and analyzing cryptocrystalline silicate (CCS) tools made on flint and chert, despite the variety of toolstone represented at many sites. As use-wear analysis matured as a discipline, researchers branched out and studied wear patterns on different raw materials. Greiser and Sheets (1979) conducted an experiment with obsidian, silicified sandstone, quartzite, chert, silicified limestone, and chalcedony. They cut pieces of those materials into wedges of similar size and used them to saw a seasoned oak board. The tools were manipulated mechanically to keep variables other than raw material constant and documented use-wear after 100 and 1,000 strokes. The quartzite, silicified sandstone, and silicified limestone wedges suffered crystal removal resulting in attrition edge damage, while the chalcedony, chert, and obsidian wedges displayed microscarring along their edges. The materials also varied in resistance to attrition, with quartzite and chalcedony being the most resistant and silicified limestone and obsidian being the least resistant (Greiser and Sheets 1979). This study established the significance of raw material type in use-wear development and demonstrated that inferences made from wear patterns on one raw material type should not be automatically applied to other material types.

Vaughan's (1985) study encompassed aspects of CCS raw material variability on use-wear accrual examined with both high and low power approaches. He used replicated artifacts made on three different CCS types of varying crystal size to work different materials including stone, bone, antler, wood, reeds, plants, meat, carcasses, hide, grit, and soil (Vaughan 1985:9). Vaughan (1985:15) conducted his experiments with unmodified and retouched flakes with what he referred to as an "as if approach." He attempted to perform the tests in a realistic manner, "as if" he was performing a real task, but each test had a predetermined duration and wear development was observed at set intervals. He found that edge damage identified via low power analysis alone was not diagnostic of particular use motions or worked materials; however, he also determined that striation and polish formation, identified with high power microscopy, were diagnostic of both use motion and worked materials (Vaughan 1985:45). He also found that the difference in CCS crystal size only influenced the degree of polish development rather than the characteristic features of the polish itself.

Lerner et al. (2007) examined the differences in use-wear formation on artifacts made from different CCS types. Their experiment included three types of chert and one silicified wood sample. They used flakes of each CCS type to scrape dry hide and examined them after 10, 20, and 60 minutes of use. They found that use-wear development was influenced by the raw materials' surface hardness and microtopography. Hard raw materials with regular surfaces developed invasive, homogenous edge rounding while soft raw materials with irregular surfaces developed variable use-wear patterns (Lerner et al. 2007).

Other analysts began experimenting with use-wear formation on obsidian tools. Spear (1980) conducted a study with obsidian flakes similar to that conducted by Tringham et al. (1974). He used 12 unmodified obsidian flakes to work materials native to Easter Island including sugar cane, bamboo, *toromiro* wood, chicken bone, and domestic bovid bone (substituted for human bone). He performed transverse motions such as scraping and shaving, and longitudinal, or sawing, motions on each worked material. He examined each edge before beginning the tasks and again after 10, 100, and 500 strokes at 60X and 120X magnification. He found that *toromiro* wood, chicken bone, and cow bone classified as "hard" materials, characterized by microflaking consisting of step and hinge fractures. Bamboo and sugar cane were "soft" materials, characterized by feather-terminating microflaking along the used edge. Edges used transversely had microflaking on only one face, while the longitudinally used edges had wider microflake distributions along both sides of the edge. Spear's (1980) study suggested that edge damage accrues similarly on both flint and obsidian replicated flakes.

Lewenstein (1981) published a more intensive study of obsidian use-wear formation. She began with a collection of 165 replicated prismatic obsidian blades produced through indirect percussion using a chest punch. She scraped animal hides and removed fish scales, sawed jute, cotton, bone, hide, pine, and ironwood, and whittled pine and fir (Lewenstein 1981). She used each tool until its edge was exhausted (i.e., when it was no longer suitable for the task). She examined the replicas at 40X magnification, noting microflake scars, striations, edge rounding, abrasive polish or dulling on both sides of the tools. She found that microflaking, striations, polish or dulling, and edge rounding were the most reliable indicators of use-wear on the obsidian blades; edge damage alone was not distinctive enough to be considered diagnostic (Lewenstein 1981).

In her use-wear study, Hurcombe (1992) followed protocols established for investigating CCS use-wear formation but adapted them for studying obsidian use-wear formation. She focused on various worked materials, use state, use action, and use duration to more completely understand use-wear formation on obsidian flakes (Hurcombe 1992:38). She separated worked materials into six broad categories: (1) hard plant materials; (2) soft plant materials; (3) carcasses; (4) hides; (5) other animal materials; and (6) materials from non-use contexts (Hurcombe 1992). She recorded the material state (e.g., dry, fresh, soaked), use action, and duration of use (2, 5, 10, 20, or 60 minutes). Her approach was similar to Vaughan's (1985) "as if" method, compromising between systematic and replicative investigations (Hurcombe 1992:29). She found that striations associated with polish were the best indicators of use motion on obsidian tools. Actions with higher force and speed resulted in more diagnostic striations (Hurcombe 1992:48-49). She concluded that use material was most closely related to polish intensity, polish texture, polish edge relief, and extent of attrition, but location of polish and striations could be used as supplemental indicators (Hurcombe 1992:50).

In 1995, Aoyama published a study investigating the differences between CCS and obsidian use-wear formation focused on the southeast Maya lowlands (Aoyama 1995). This project involved 151 experiments with obsidian from different geochemical sources and 116 experiments with chalcedony and agate, and included worked materials such as grasses, plants, wood, bamboo, locally available plant foods, hide, bone, antler, snail shell, soil and stone. He used 100X magnification to identify wear locations on tool edges and recorded most instances of use-wear at 200X or 500X. He identified 11 use-wear patterns related to worked material type for both CCS and obsidian tools. Additionally, he saw no differences in use-wear formation on obsidian tools from different geochemical sources. These experiments provided a contextual framework to interpret random samples of Late Classic artifacts from two different structures at Copán, in western Honduras. He found that the most common activity at the first structure was cutting or sawing and the most common worked materials were meat and hide. At the second structure, the most common activity again was cutting or sawing, but the most common worked materials were plants and wood. These results provided information about where different tasks were carried out within the site, and allowed a more detailed reconstruction of the function of the structures within the site as a whole (Aoyama 1995).

Kononenko (2011) also designed and implemented a replicative experimental program using obsidian. She provided use-wear data on the widest range of worked materials published to date, along with a comprehensive set of photographs showing identified use-wear traces. Her experiments were designed to document use-wear development, assess tool efficiency, and provide a comparative collection to aid in interpretations of prehistoric obsidian artifacts (Kononenko 2011:15). Most replicated tools were unmodified flakes, but some were retouched stemmed tools made from flake blanks. The tools were used on three general categories of materials: (1) plants; (2) soft elastic materials; and (3) hard dense materials. She also noted the state of the use-material, or moisture content. Tools were generally used in transverse and longitudinal motions, although some included rotational motion (Kononenko 2011:17-18). The experiments were task focused but each tool was used for a predetermined length of time. She examined the experimental use-wear with a stereomicroscope ranging from 6X to 50X to identify edge scarring, surface alterations, striations and some residues (Kononenko 2011:13). She then examined the working edges with a metallurgical microscope ranging from 100X to 1,000X. The majority of identification, analysis, and interpretations of used tool edges, use motion, and worked materials were made with this instrument. Her results provided sets of diagnostic wear variables for each use material category (Kononenko 2011:38). Within these categories, she identified use action and duration of use for each tool (Kononenko 2011:20).

Lafayette (2006; Lafayette and Smith 2012) conducted a replicative experiment using obsidian bifaces. She hafted 18 replicated WST points (six Windust, six Haskett, and six Parman) and used nine of the replicas as projectiles thrown at a fresh mule deer carcass and nine as knives to butcher the deer. She noted the macroscopic damage patterns and examined the edges of each point with low power microscopy (30X to 120X) for striations, dulling, and crushing to distinguish diagnostic patterns of wear associated with the two experimental functions (Lafayette 2006). She then compared use-wear on the replicated tools to use-wear on WST points from northern Great Basin sites and concluded that most points from archaeological contexts were used for multiple purposes.

Finally, Setzer (2012) examined differences in use-wear on tools made on two different obsidian types. She found that use-wear development visible at low power magnifications was significantly different between two Italian obsidian geochemical types for eight of 11 recorded attributes (Setzer 2012). These results indicate that use-wear formation may vary by geochemical type and as such, wear generated via replicative experiments using one type of obsidian may not be directly comparable to use-wear observed on tools made from other obsidian types, especially under low power magnification. However, this finding is in direct contradiction to Aoyama's (1995) conclusions concerning use-wear development on differing geochemical types in central America under high power magnification. These conflicting results suggest that more research should be conducted on the differing characteristics of obsidian geochemical types. This discrepancy also suggests that in some instances, using different geochemical types may influence the outcome of a replicative study.

Ethnographic Background

In addition to replicative experiments, ethnographic data are another important source of information in functional studies. LSP-1 is located in Warner Valley, Oregon, within the ethnographic territory of the Northern Paiute. Kelly (1932:70) considered it part of the *Gidü'tikadü* or "groundhog eater" band territory, which also included Surprise

Valley, California and Long Valley, Nevada. However, Stewart (1939) assigned Warner Valley to *Kidütökadö* or "woodchuck eater" territory (Figure 1.1). These ethnographers seem to only differ in the transcription and translation of the group's name. Additionally, Fowler and Liljeblad (1986:463) used *Kidütökadö*, which translates to "marmot eaters." Regardless of the English translation, the three names refer to a single Northern Paiute band.

The *Kidütökadö* territory included over 8,000 km^2 spanning south-central Oregon, northeastern California, and northwestern Nevada. In 1873, the *Kidütökadö* population consisted of 150 people (Stewart 1939). According to *Kidütökadö* consultants, the area was previously inhabited by the Klamath, who ethnographically occupied northern California and southern Oregon. At that time, the *Kidütökadö* lived east of Steens Mountain (Kelly 1932:72) but drove the Klamath farther west and claimed the territory. Ethnographically, the *Kidütökadö* inhabited the majority of Warner Valley, especially around Plush and Adel. The farthest north winter camp was near Plush; however, Kelly (1932:72) indicated that the *Kidütökadö* summer territory also included northern Warner Valley.

Kelly's (1932) *Ethnography of the Surprise Valley Paiutes* is the principal source of ethnographic data on the *Kidütökadö* (Fowler and Liljeblad 1986:456). She spent the summer of 1930 conducting fieldwork with ~40 tribal members living at Fort Bidwell in Surprise Valley (Kelly 1932:67). Seven *Kidütökadö* members and six residents affiliated with other bands provided her with information. Although these consultants were no longer living a traditional lifeway, most of them remembered the old ways (Kelly 1932:69). Traditional *Kidütökadö* subsistence pursuits were similar to other Great Basin

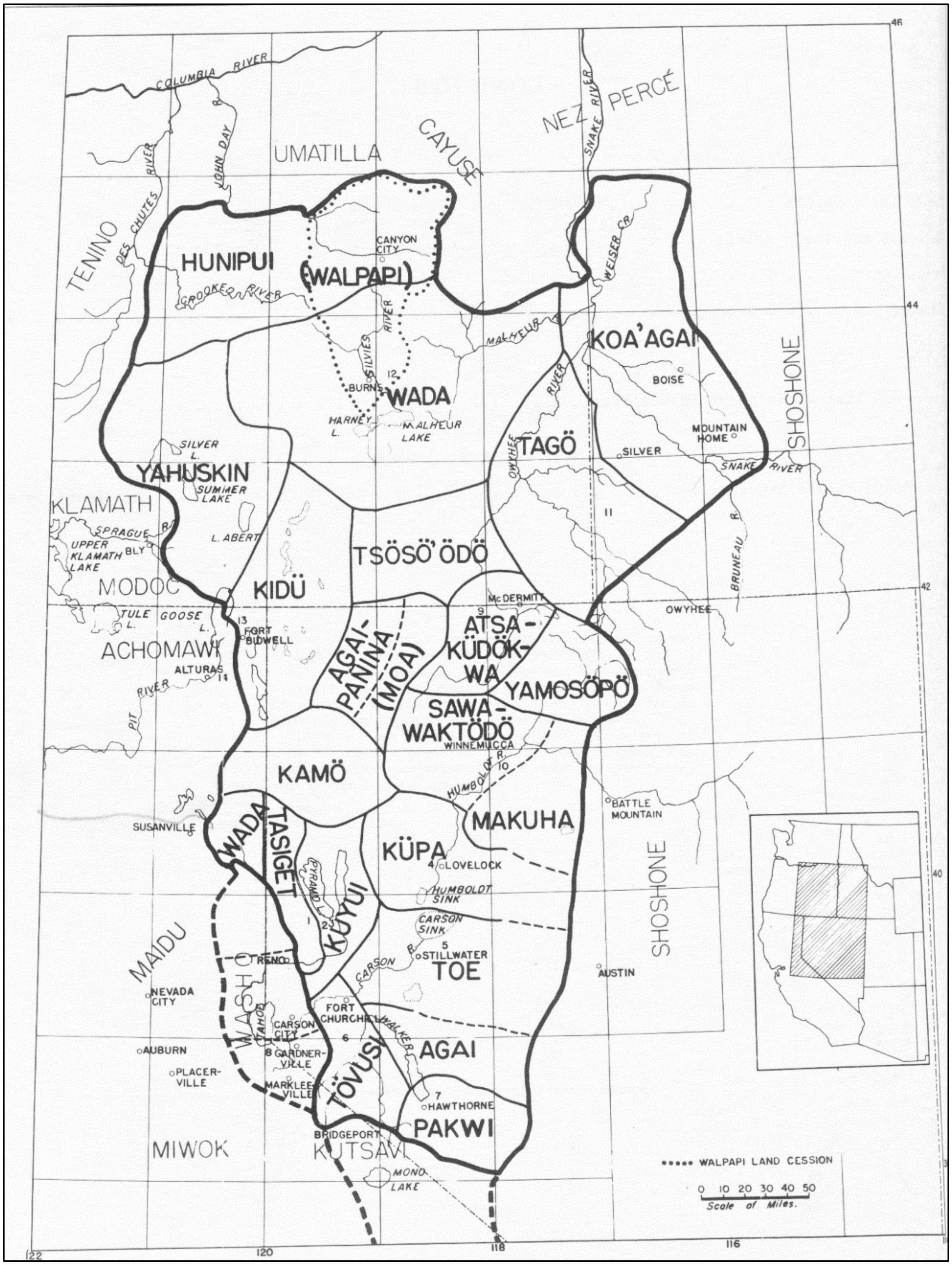


Figure 1.1. Map of Northern Paiute band territories. (Adapted from Stewart 1939).

Paiute groups, consisting of relatively constant seasonal foraging. Since there were few resources in the northern Great Basin that produced a surplus yield suitable for stockpiling, especially in the *Kidütökadö* territory, families needed to hunt and gather on a continual basis to feed themselves and cache enough food for the winter (Kelly 1932:75). A typical yearly schedule began in the early spring when people focused on fishing in creeks and streams until the snow melted enough to travel. A group of two or three households moved to the hills, where they subsisted on cached food from the previous summer and began gathering early root crops (Kelly 1932:76). These groups moved through their territory in search of root crops to eat immediately and hoped for enough to store for winter. They wandered to promising areas with no specific destinations in mind. They exploited both upland resources (e.g., epos roots) and lower wetland resources (e.g., camas roots). In the late summer, *Kidütökadö* families harvested ripe berries and seeds in valley bottoms. As the summer turned to fall, plant foods died and/or went dormant, and people turned to animal foods as hunting became the central subsistence pursuit (Kelly 1932:76).

Although *Kidütökadö* groups spent summers focusing on plant resources, hunting remained an important part of summer subsistence. As Nellie Townsend, a Paiute interpreter, said, “they hunted every day, all year” (Kelly 1932:76). *Kidütökadö* hunters took deer, antelope, and rabbits throughout the year due to their perennial availability. They pursued sage hen and grouse only in the spring, and groundhogs, porcupines, and squirrels in early to mid-summer. Mid-summer brought crickets and larvae in large enough quantities for gatherers to profitably collect. In late summer and fall, hunters focused on antelope, deer, wildcat, waterfowl, and rabbit drives (Kelly 1932:77).

With winter approaching, *Kidütökadö* families returned to their winter camps which comprised of five or six households. They relied on food cached in these places to make it through the winter (Kelly 1932:77-78). The *Kidütökadö* had several established "wintering grounds" (Kelly 1932:78); these areas received less snowfall and had more resources available in the winter (e.g., spring water and firewood). Some families stayed at one camp throughout the winter but most families provisioned two winter campsites. When food stores dwindled in one camp, they moved to the second camp. Winter hunting from these camps included the pursuit of perennial game as well as bear, wildcat, and otter. These seasonally pursued animals had their highest fat content and thickest fur in the winter. Families at winter camps also held communal antelope and rabbit drives (Kelly 1932:78).

Hunting was primarily a male activity, while women gathered and processed plant foods (Kelly 1932:79). *Kidütökadö* groups clearly divided labor based on gender, yet this division was flexible when necessary. Women aided in communal drives, waterfowl harvests, and even set small game traps. Men helped women during insect harvests and occasionally ground seeds for them. Men constructed all of their own hunting equipment, including sewing quivers and manufacturing nets. Women fabricated basketry, twisted bark fiber, prepared food, provisioned the camp with firewood and water, and performed most sewing tasks. Both men and women participated in house construction, hide processing, and rabbit skin blanket production (Kelly 1932:79).

Rabbit Procurement and Consumption

Although rabbit hunting traditionally occurred year-round in *Kidütökadö* territory, groups hunted jackrabbits with nets in communal drives during the fall and early winter (Kelly 1932:88). Nets were ~2 ft. (~0.6 m) high and consisted of mesh large enough to allow a rabbit's head to fit through but small enough to keep the head trapped behind the ears. The nets were ~120 m long and most drives used several nets aligned straight or in a semicircle in a valley bottom. Men and women drove the rabbits into the nets a few at a time. The resulting rabbit yield was usually divided evenly among the participants. If they collected an unusual surplus, the net owners received a larger share. Other *Kidütökadö* rabbit hunting techniques included using dogs, shooting with a bow-and-arrow, and snaring with nooses. They preferred cottontails for meat and usually caught them with snares (Kelly 1932:88).

When the *Kidütökadö* consumed a fresh rabbit, they skinned and cleaned it before roasting it in a pit oven (Kelly 1932:93). They dried carcasses for winter storage. They pulverized rabbit vertebrae with any attached meat and mixed the ground bone with fat, which extended its storage life. They ate this mixture plain or prepared it as a soup (Kelly 1932:94).

For three Northern Paiute bands in western Nevada including the *Aga'idökadö* or "trout-eaters" who lived near Walker Lake, the *Kuyuidökadö* or "cui-ui-eaters" who lived near Pyramid Lake, and the *Toedökadö* or "cattail-eaters" who lived near Carson Lake, communal rabbit hunts began in November (Fowler and Liljeblad 1986:463-464; Wheat 1967:14). A rabbit hunt captain notified nearby groups of an upcoming rabbit drive by sending out messengers. He made a large fire at his campsite to guide people in from the hills where they were harvesting pine nuts. They used rabbit nets ~1 m high made of 5-cm mesh that extended over 50 m. They set the nets up through the brush and supported them with sticks and branches. Men wielding sticks and bows formed a line and drove the rabbits ahead of them into the nets. Older men stayed near the net to collect the rabbits and keep the net standing upright. Afterwards, hunters skinned the rabbits and cut the fresh hides into long ribbons. The assembled group ate some of the meat immediately and dried the rest to store for winter. Dried carcasses were boiled whole or ground to a powder for soup. The entire carcass was consumed, including the bones (Wheat 1967:14).

Rabbit Skin Blankets

The *Kidütökadö* along with many other Great Basin and California groups had a unique method of processing rabbit skins for traditional rabbit skin blanket production that differed significantly from other hide processing techniques (Kelly 1932:136). Men and women both produced traditional rabbit skin blankets woven from long cords of furred rabbit hide. Kelly (1932:136) described the production process, which began with a person cutting one rabbit hide “round and round” into one long strip. They doubled this strip back on itself then attached this doubled strand to five other skins cut in the same manner, interlocking them in a long chain. The fabricator twisted the rabbit skin chain into one long strand, stretched it, and let it dry. Then they tightly wrapped these rabbit skin strands around two posts and wove the strands together, using sagebrush twine or leather thongs as weft material (Kelly 1932:137). A rabbit skin blanket of this type required 25-50 rabbit skins to manufacture and the blanket was large enough for two people (Kelly 1932:136-137).

Wheat (1967) provides a descriptive, step-by-step account of rabbit skin blanket production in western Nevada. She documented the process as Jimmy George demonstrated how he constructed a rabbit skin blanket (Wheat 1967:75-77). This process is similar to the *Kidütökadö* method. Jimmy George first carefully skinned each rabbit to keep the pelt in one piece by only cutting the skin around the paws. He pulled the intact skin off the body and over the rabbit's head. This technique removed the skin from the entire face of the animal, including the ears. He held a knife between his teeth to cut the skin into a single 3-5 m spiral strip. He tied one end of the strip through the eyehole on the opposite end, forming a long circle from one rabbit hide. He linked enough hides together to form a rabbit hide chain at least 12 m long. He anchored the chain to a tree and whirled it with a stick into a thick rabbit fur rope using a Western rope-making technique. The skin curled inward, leaving the rabbit fur facing outward. He hung the rope to dry, after which he snapped off the hard, dried ears. To make the blanket, he wrapped the rope around a willow loom (probably two willow posts) and wove the rabbit skin rope together with strings or rags. According to Wheat (1967:77) it took 40 rabbit skins to produce a child-sized blanket while a man-sized blanket required 100 rabbit skins (Figure 1.2).

Figure 1.2. Traditional Western Nevada rabbit skin blanket (Wheat 1967:74).

Other Rabbit Products

Northern Paiute groups made several types of tools and ornaments from rabbit bones. The *Kuyuidökadö* of Pyramid Lake made sharpened fishhooks of rabbit bone for throwing lines as well as rabbit bone gorge hooks (Fowler and Bath 1981:183; Fowler and Liljeblad 1986:442). The *Kidütökadö* used rabbit scapulae as spoons and sharp rabbit bone splinters as tattoo needles (Kelly 1934:98, 115). They also roasted rabbit feet in hot coals to dry out the bones, which they made into beads (Kelly 1934:117). The *Wadadōkadō*, or “wada-eaters,” who lived near Honey Lake, made bi-pointed septum pins from rabbit bone to wear on special occasions (Riddell 1960:46; Stewart 1939).

Importance of Rabbits in Ethnographic Society

Rabbits were an essential resource for the Northern Paiute and most groups throughout the Great Basin. One of Kelly's (1932:106) *Kidütökadö* consultants, Daisy Brown, said, "in the old days they had no wikiup. When it was snowing they just kept on traveling. Some froze to death because they had no rabbit skin blankets." This statement demonstrates the necessary and central role rabbits played in ethnographic Great Basin groups' survival. Wheat (1967:74) makes a similar observation, noting that "rabbit skin blankets were vital to the life of every Paiute Indian… In the winter they could mean the difference between life and death." In a recent test of the thermal properties of rabbit skin blankets, Yoder et al. (2005:63) found that a rabbit skin blanket reproduction "outperform[ed] their modern counterparts in basic heat retention." These results show that rabbit skin blankets are warmer than modern cold weather gear and further supports how essential this piece of clothing was to winter survival. Additionally, these pieces of cold weather gear allowed individuals to supplement their stored food with freshly hunted meat, travel between campsites, and conduct other outdoor activites in the harsh winter months. Western Nevada Paiutes wore their robes all day during winter and slept in them at night, even in summer (Wheat 1967:74). With such heavy use, it is surprising that these blankets lasted for three years, as reported by Lowie (1939:327) from his work with the Washoe.

The rabbit skin blanket had a distinct manufacturing process compared to the methods of processing and preparation applied to all other mammal skins, large or small. The importance of durable, warm clothing for surviving Great Basin winters likely spurred the investment of effort needed to elaborate sewn hide clothing into a woven rabbit skin robes. Most other hide garments made prior to the adoption of Plains-style garb were very simple. The rabbit skin blanket was the only textile woven with mammal hide; the specialized technique for processing and weaving rabbit hides into blankets allowed the rabbit fur strips to hold still air within the blanket, thus providing extremely effective insulation (Yoder et al. 2005). According to one consultant, a bear hide blanket was the only blanket warmer than a woven rabbit skin blanket (Whiting 1950:27).

Rabbits provided a stable food source in many areas with few other dependable resources, especially in the arid valleys of the northern Great Basin where the *Kidütökadö* and *Wadatika* lived (Kelly 1932; Whiting 1950). The *Wadadika*, also translated as "wada-eaters," bordered *Kidütökadö* territory to the northwest in Harney Valley near Malheur Lake (Whiting 1950:16). Additionally, rabbits served as the main source of animal skins for groups in western Nevada (Wheat 1967) as well as a source of raw material for tools and personal adornment items.

Communal rabbit drives were a prime opportunity for small family groups to congregate and interact with other tribal members. The *Kidütökadö* held most of their dances during the fall communal drives, and called dances during rabbit hunts "*kamü'nik*" (Kelly 1932:178). The *Wadatika* had several opportunities for population aggregation throughout the year, although the bulk of dances and games took place during the wada harvest in the late summer (Whiting 1950:20). These dances continued through the fall during the large rabbit and antelope drives. During the low-activity winter months, they held smaller rabbit drives within their winter camp communities, which provided social activity and a chance to supplement food supplies (Whiting 1950:20). The *Wadadōkadō* held a round dance, called the Rabbit Dance, on a winter day after a fruitful communal rabbit hunt (Riddell 1960:77). In western Nevada, rabbit drives were large gatherings of families summoned by the rabbit drive leader (Wheat 1967:14). While these groups held several types of communal events, rabbit drives were a chance to interact with other people, dance, gamble, and enjoy other forms of entertainment (Fowler and Liljeblad 1986:453). In addition, Wheat (1967:14) specifically stated that "rabbit drives often became courting time for the Paiutes."

Steward (1970:45) described the economic importance of rabbits. The Beatty Shoshoni traded rabbit skin blankets to the Owens Valley Paiute in return for buckskins, which were difficult to obtain locally. Despite the presence of bead currency in both of these areas, rabbit skin blankets were an important trade commodity. In Great Smokey Valley, rabbit skin ropes were used as standard currency and could be easily exchanged for other goods (Steward 1970:45).

Summary

Improved understanding of resource processing techniques can help answer questions about changes in settlement strategies, resource utilization, approaches to resource procurement, and other issues important to understanding the transition from a late Paleoindian land use pattern to an Archaic land use pattern at the end of the Early Holocene. Use-wear analysis has the potential to inform our understanding of how early sites were used and the activities performed at each location. When these activities are defined and understood, they can inform larger patterns of land use and mobility.

Replicative experiments are an essential resource for identifying artifact function, as are other lines of evidence such as ethnographic research. These types of data can provide deeper understanding about leporid processing strategies at LSP-1 and how the site was used within a regional context. My research aids in understanding resource procurement strategies and group organization for the late Paleoindian and Early Archaic periods in the northern Great Basin. The following chapters describe the materials and methods used for the replicative experiments and archaeological assemblage that make up this study, the results of these analyses, and my interpretations and evaluation of the previously stated hypotheses.

CHAPTER 2

MATERIALS AND METHODS

In this chapter, I describe the archaeological and replicated materials and methods used in this analysis. First, I provide background and contextual information about Little Steamboat Point-1 rockshelter, including stratigraphic, radiocarbon, and lithic data, as well as previous macrobotanical and faunal analyses of the site. I also describe the lithic assemblage included in my archaeological analysis. Second, I describe the replicated materials used in my experiments, my experimental procedures for carcass, hide, and meat processing activities, as well as the documentation procedures I employed for the analysis of both archaeological and replicated assemblages. Finally, I discuss my hypotheses and expectations for the results of this study.

The Little Steamboat Point-1 Rockshelter (35HA3735)

Oregon's Warner Valley contains a record of human occupation dating back to the TP/EH (Smith et al. 2014, 2015). This record includes the Little Steamboat Point-1 (LSP-1) rockshelter (35HA3735) (Figure 2.1), where cultural deposits began accumulating during the Early Holocene. The site is situated ~60 m above the valley floor beneath a welded tuff formation (Figure 2.2). The shelter (Figure 2.3) was formed by the wave action of Lake Warner during the Terminal Pleistocene (Smith et al. 2012). It lies within the ethnographic territory of the *Kidütökadö* Northern Paiute band (Kelly

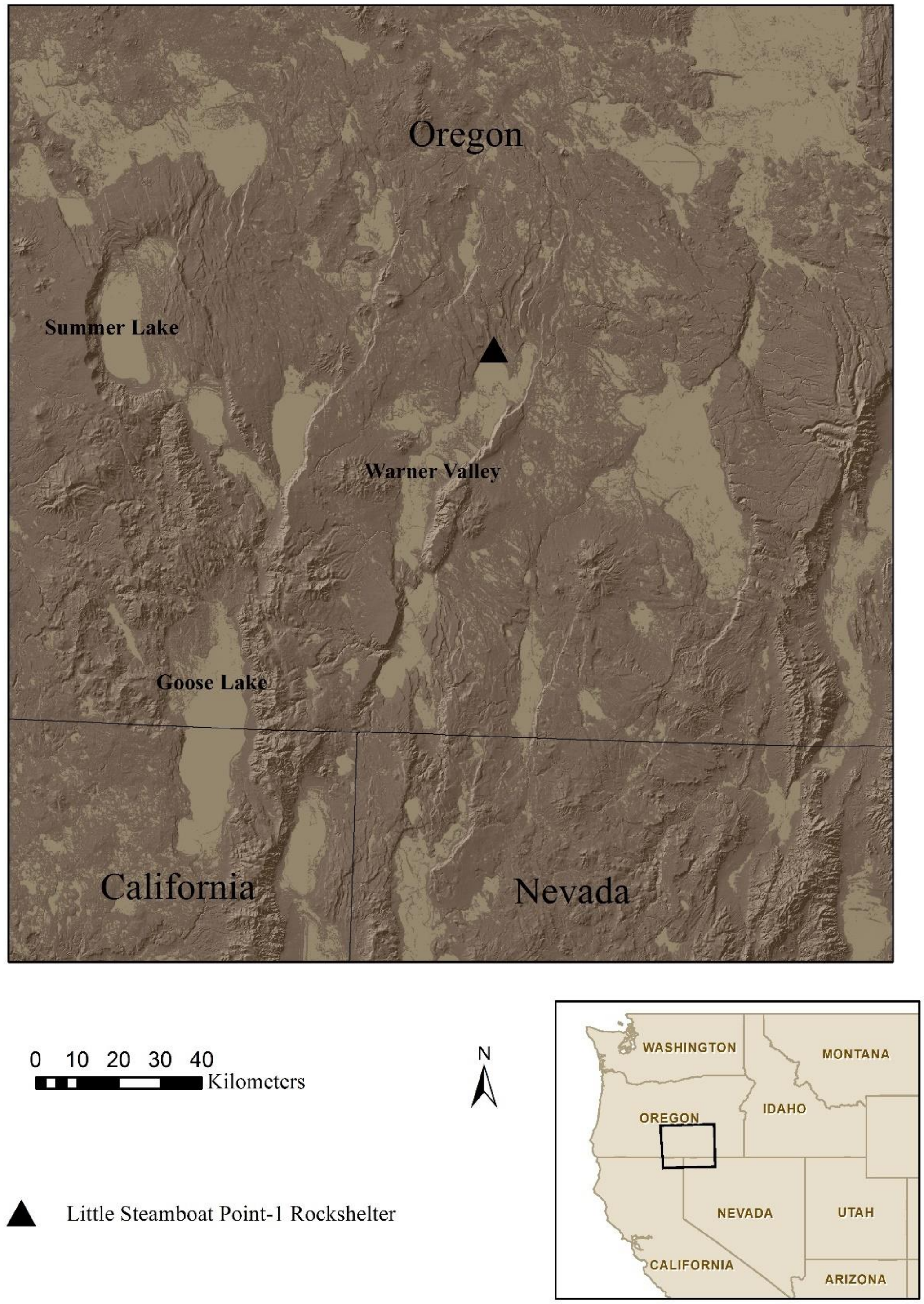


Figure 2.1. The location of LSP-1 and major lake basins in south-central Oregon.

Figure 2.2. Overview of the LSP-1 rockshelter during 2014 fieldwork.

Figure 2.3. The LSP-1 rockshelter at the conclusion of the project in 2015.

1932). Work at LSP-1 began in 2010 under the direction of Dr. Geoffrey Smith (Great Basin Paleoindian Research Unit [GBPRU], University of Nevada, Reno [UNR]) and was supported by Bill Cannon of the Lakeview District of the Bureau of Land Management. Over the course of six field seasons crews excavated ~23 m^2 of deposits, generally to depths of ~125-150 cm below surface at which point sterile deposits were encountered.

Sediments and Stratigraphy

The rockshelter contains stratified deposits consisting of 10 distinct strata (Figure 2.4) comprising three major sediment packages, defined along what is referred to as the E99 profile (Figure 2.5) (Smith et al. 2014). The upper package consists of Late Holocene alluvial deposits of interfingering coarse- and fine-grained sediments separated by a thin aeolian sand layer (strata II, IV, and III, respectively). Cattle manure (Stratum I) overlies these strata on the surface of the deposits.

The middle package is made up of Stratum V, which is comprised of massive, poorly-sorted fan gravels mixed with fine to very fine sand, and a discrete lower layer of massive, silty, very fine aeolian sand (Stratum VI). Aeolian deposits of Mazama tephra occurs in small pockets within the middle of Stratum V in portions of the deposits (Smith et al. 2014). This package likely accumulated as the valley desiccated during the terminal Early Holocene (Smith et al. 2015; Weide 1975) and sediment blew into the shelter. The lower sediment package consists of two coarse gravel layers (strata VII and IX) alternating with two black sand layers (strata VIII and X). Strata VII and IX were

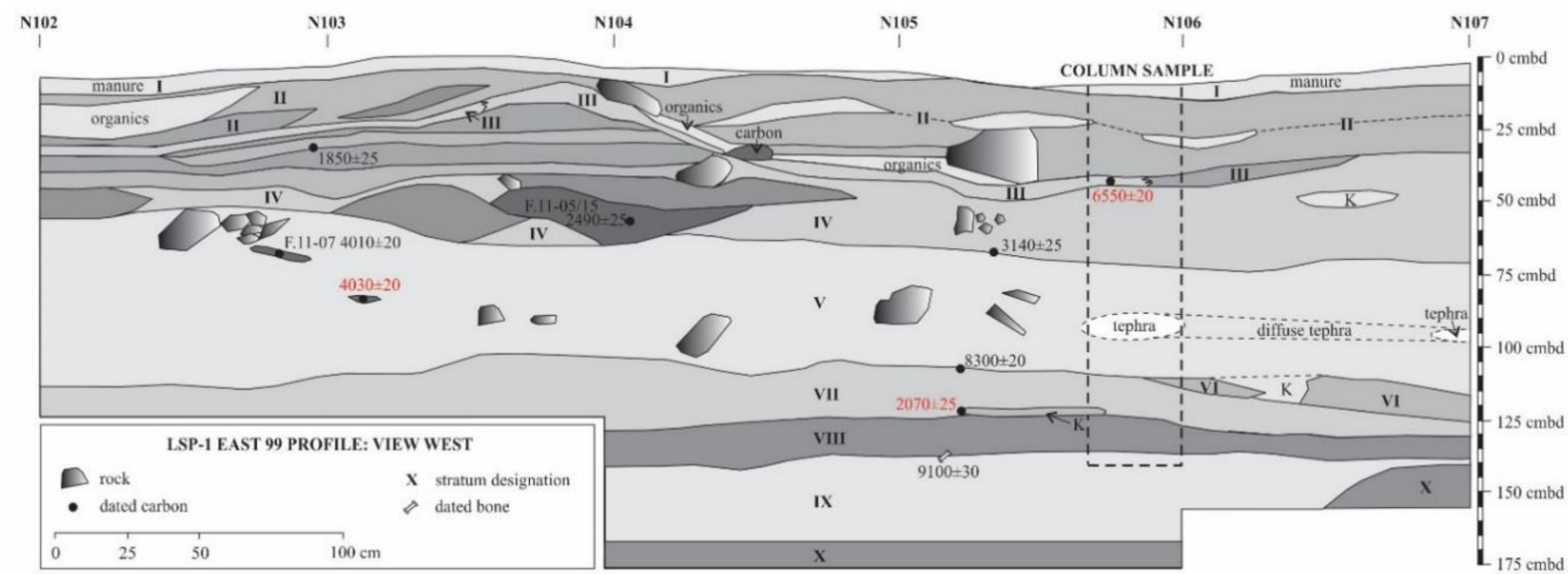


Figure 2.4. The E99 profile with locations of radiocarbon-dated samples taken from the profile face. Suspect dates are shown in red.

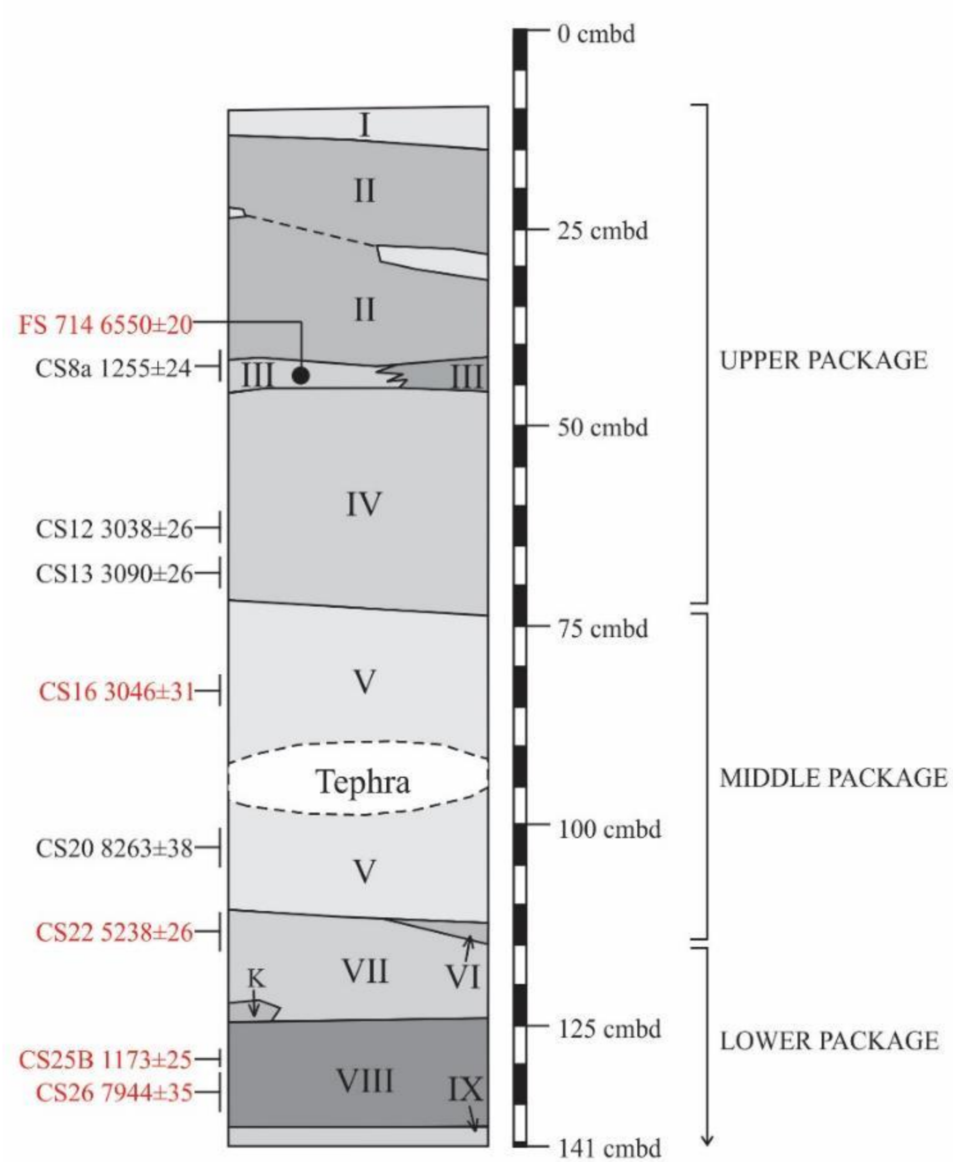


Figure 2.5. Close-up of Kennedy and Smith's (2015) column sample with depths of radiocarbon-dated charcoal and plant fragments. Suspect dates shown in red.

deposited when gravels stored against the welded tuff formation initially unloaded and strata VIII and X formed from weathering of the formation itself. The lower black sand layer represents the initial sedimentation of the shelter as Lake Warner dropped below the shelter at the end of the Pleistocene (Smith et al. 2014).

Radiocarbon Dating

The earliest radiocarbon date from a hearth feature 125 cm below datum (cmbd) suggests that occupation began ~8700±30 ^{14}C BP (9,735-9,550 cal BP) (Smith et al. 2014)[2]. Although there is some vertical mixing indicated by a few out-of-sequence dates obtained on small isolated charcoal fragments, the majority of the dates support the general age estimates of each sediment package (Kennedy and Smith 2016). Recently, directly dated *Callianax* (formerly *Olivella*) shell beads also support the general sequence (Smith et al. 2016). Table 2.1 presents all radiocarbon dates obtained on material from LSP-1 to date listed by depth below datum; these indicate that the lower part of the middle sediment package contains Early Holocene cultural deposits. As noted above, pockets of Mazama tephra were encountered ~100-110 cmbd in the western portion of the site's deposits, supporting the age estimates provided by the radiocarbon dates listed in Table 2.1.

The reversals in the radiocarbon sequence are mostly due to dates taken on small isolated charcoal fragments, some of unidentified species and some with provenience specific to level only (e.g., FS 714, CS16, CS22, CS2B, and CS26). The remaining suspect dates include samples taken from known disturbance areas such as rodent burrows and woodrat nests (e.g., FS 421, FS 427, FS 715). Dates taken on samples from features and larger artifacts such as *Callinax* shell remain in proper sequence. Additionally, the projectile points from the site were recovered in expected stratigraphic sequence (Van der Voort 2015b) and provide further support for the integrity of the pre-Mazama deposit.

Table 2.1. Radiocarbon Dates from LSP-1 Arranged by Depth. Bolded Dates are AMS Dates on *Callianax* Shell Beads and Suspect Dates are Shown in Red.

Sample ID/ Lab #	FS #/ Accession #	Excavation Unit	cmbd	Stratum	Material	^{14}C age	2σ cal BP	Comments	Reference
UGA-16803	712	N102E99	33	IV	Unidentified charcoal	1850±25	1,865-1,716	-	Kennedy and Smith (2016)
D-AMS 0010590	CS8A	N104E99	41-44	III	*Artemesia* charcoal	1255±24	1,277-1,088	Column sample	Kennedy and Smith (2016)
UGA-15595	714	N105E99	45	III/IV	Unidentified charcoal	6550±20	7,490-7,425	-	Kennedy and Smith (2016)
D-AMS 0010587	n/a	N104E99/100	50	II/III	*Juniperus* seeds	1013±29	976-803	Feature 11-14 (hearth)	Kennedy and Smith (2016)
21830	**3191**	**N107E99**	**51-56**	**IV/V**	***Callianax* shell**	**4560±25**	**4,618-4,273 [a]**	-	**Smith et al. in press**
UGA-18235	1293	N101E103	52	n/a	Catlow Twine textile	1790±20	1,813-1,625	Feature 14-10 (pit)	Smith et al. (2016)
UGA-16800	709	N104E99	57	IV	Unidentified charcoal	2490±25	2,723-2,473	Feature 11-05/15 (hearth)	Kennedy and Smith (2016)
UGA-18237	1298	N102E103	59	n/a	Sagebrush bark bundle	1340±20	1,302-1,190	Feature 14-10 (pit)	Smith et al. (2016)
D-AMS 0010591	CS12	N104E99	61-66	IV	*Artemesia* charcoal	3038±26	3,343-3,166	Column sample	Kennedy and Smith (2016)
Beta-283901	45	N105E99	62	IV	Unidentified charcoal	880±40	915-706	-	Smith et al. (2014)
UGA-18239	1309	N102E103	62	n/a	Sagebrush sandal	1760±20	1,721-1,610	Feature 14-10 (pit)	Smith et al. (2016)
UGA-18236	1297	N102E103	62	n/a	Sagebrush sandal	1860±20	1,865-1,729	Feature 14-10 (pit)	Smith et al. (2016)
UGA-18238	1302	N102E103	66	n/a	Sagebrush sandal	1300±20	1,287-1,183	Feature 14-10 (pit)	Smith et al. (2016)
D-AMS 0010588	n/a	N102E100/101	66	IV	Cordage	3987±26	4,522-4,415	Feature 14-02 (hearth)	Kennedy and Smith (2016)
D-AMS 0010592	CS13	N104E99	66-71	IV	*Artemesia* charcoal	3090±26	3,371-3,231	Column sample	Kennedy and Smith (2016)
UGA-15593	706	N105E99	67	IV/V	cf. Rhus charcoal	3140±25	3,444-3,257	-	Kennedy and Smith (2016)
UGA-16801	710	N102E99	68	V	Unidentified charcoal	4010±20	4,522-4,425	Feature 11-07 (hearth)	Kennedy and Smith (2016)

Sample ID/ Lab #	FS #/ Accession #	Excavation Unit	cmbd	Stratum	Material	^{14}C age	2σ cal BP	Comments	Reference
Beta-317155	n/a	N104E99	72	IV	Unidentified charcoal	2910±30	3,158-2,960	Feature 11-19 (hearth)	Smith et al. (2012)
Beta-406150	1251	N102E102	72	IV	*Salix* charcoal	3160±30	3,450-3,272	Feature 14-06 (hearth)	Smith et al. (2016)
D-AMS 0010589	982	N102E99/100	74-75	IV	*Artemesia* charcoal	3990±26	4,522-4,416	Feature 14-04 (hearth)	Kennedy and Smith (2016)
UGA-18240	1311	N102E103	76	n/a	Sagebrush sandal	1880±20	1,879-1,737	Feature 14-10 (pit)	Smith et al. (2016)
UGA-16859	426	N103E101	81	V	Catlow Twine textile	1200±20	1,180-1,063	Woodrat nest	Smith et al. 2016
D-AMS 0010593	CS16	N104E99	81-86	V	*Artemesia* charcoal	3046±31	3,350-3,170	Column sample	Kennedy and Smith (2016)
UGA-16860	427	N103E102	82	V	Catlow Twine textile	1160±20	1,175-989	Woodrat nest	Smith et al. (2016)
UGA-15260	409	N104E101	82	V	*Bison* femur	4010±25	4,525-4,422	-	Smith et al. (2014)
UGA-14916	431	N103E101	86	V	*Artemesia* charcoal	8350±30	9,462-9,296	-	Smith et al. (2014)
21827	**2104**	**N102E100**	**86-91**	**V**	***Callianax* shell**	**7890±30**	**8,258-7,972** [a]	-	**Smith et al. in press**
UGA-14917	476	N103E101	96	V	*Artemesia* charcoal	4000±25	4,522-4,420	-	Smith et al. (2014)
Beta-306419	158	N102E99	97	V	Unidentified charcoal	8670±40	9,731-9,540	-	Smith et al. (2012)
D-AMS 0010594	CS20	N104E99	101-106	V	*Artemesia* charcoal	8263±38	9,408-9,124	Column sample	Kennedy and Smith (2016)
Beta-287251	48	N105E99	103	V	Unidentified charcoal	8340±40	9,470-9,261	-	Smith et al. (2012)
UGA-15594	707	N105E99	106	V/VII	cf. Rhus charcoal	8300±20	9,422-9,252	-	Kennedy and Smith (2016)
21826 averaged	**1374**	**N104E101**	**107**	**V**	***Callianax* shell**	**8932±17**	**9,477-9,232** [a]	-	**Smith et al. in press**
D-AMS 0010595	CS22	N104E99	111-116	VII	*Artemesia* charcoal	5238±26	6,174-5,921	Column sample	Kennedy and Smith (2016)
21825	**761**	**N105E100**	**111-116**	**V**	***Callianax* shell**	**8870±30**	**9,435-9,119** [a]	-	**Smith et al. in press**
Beta-282809	46	N105E99	120	VI	Unidentified charcoal	8290±40	9,427-9,137	-	Smith et al. (2012)

Sample ID/ Lab #	FS #/ Accession #	Excavation Unit	cmbd	Stratum	Material	^{14}C age	2σ cal BP	Comments	Reference
21829 averaged	**2478**	**N102E102**	**121-126**	**V**	***Callianax* shell**	**8630±21**	**9,142-8,765 [a]**	-	**Smith et al. in press**
21828	**2477**	**N102E102**	**121-126**	**V**	***Callianax* shell**	**9200±30**	**9,815-9,489 [a]**	-	**Smith et al. in press**
UGA-15596	715	N105E99	123	VII	*Artemesia* charcoal	2070±25	2,122-1,951	Rodent burrow	Kennedy and Smith (2016)
PRI-14-069	1130	N107E99	124	VI/VII	*Artemesia* charcoal	8341±27	9,449-9,289	-	Kennedy and Smith (2016)
UGA-15142	n/a	N103E100	125	V	*Artemesia charcoal*	8700±30	9,735-9,550	Feature 13-01 (hearth)	Smith et al. (2014)
D-AMS 0010596	CS25B	N104E99	128-131	VIII	*Artemesia* charcoal	1173±25	1,179-1,000	Column sample	Kennedy and Smith (2016)
UGA-18011	1129	N107E99	131	VIII	*Lepus* ulna	8290±25	9,420-9,143	Presumably non-cultural	Kennedy and Smith (2016)
Beta-297186	47	N105E99	131	VI/VII	Unidentified charcoal	8400±50	9,520-9,301	-	Smith et al. (2012)
D-AMS 0010597	CS26	N104E99	131-136	VIII	*Artemesia* charcoal	7944±35	8,980-8,644	Column sample	Kennedy and Smith (2016)
UGA-15259	716	N105E99	141	VIII/IX	*Sylvilagus* humerus	9100±30	10,293-10,200	Presumably non-cultural	Smith et al. (2014)
Beta-306418	38	N105E99	142	VII	Unidentified charcoal	7310±40	8,186-8,021	-	Smith et al. (2012)

Note. Non-marine shell dates calibrated using OxCal 4.2 (Ramsey 2009) and the IntCal 13 Curve (Reimer et al. 2013).
[a] Regional marine reservoir correction rate of 240±50 developed by Moss and Erlandson (1995) for the Oregon Coast applied for calibrated range.

Technological Analysis and Source Provenance Studies of Lithic Artifacts from LSP-1

The pre-Mazama lithic assemblage consists of 385 tools, including 154 bifaces and biface fragments, one crescent, 199 flake tools, and 31 cores (Table 2.2). Most bifaces and biface fragments are late stage and made on non-local toolstone, suggesting that tool maintenance was more frequent than tool manufacture (Smith et al. 2012). Cores are small and were probably made from small obsidian nodules available at the site. This local source, Buck Spring, comprises a majority of unmodified debitage which tends to be small interior flakes with complex platforms. The lithic assemblage suggests that formal tool manufacture was not a major activity at the site. Additionally, the overwhelming number of edge modified flakes made on local obsidian suggests that occupants expediently used locally available nodules and did not resharpen utilized

Table 2.2. Pre-Mazama lithic assemblage at LSP-1.

Tool Type	**OBS**	**CCS**	**FGV**	**Total**
Stage 2	25	2	6	33
Stage 3	27	-	4	31
Stage 4	13	3	-	16
Stage 5 (Finished)	52	1	5	57
Biface Fragment	15	-	2	17
Total Bifaces	**132**	**5**	**17**	**154**
Crescent	**-**	**1**	**-**	**1**
Edge Modified Flakes	172	7	17	196
Perforators/Gravers	2	1	-	3
Total Flake Tools	**174**	**8**	**17**	**199**
Cores	**29**	**-**	**2**	**31**
Total	**335**	**14**	**36**	**385**

flakes, as most are unretouched. These trends suggest that people occupied the site for repeated, short stays rather than one long occupation (Smith et al. 2012), a possibility that seems more likely when the age ranges of calibrated Early Holocene radiocarbon dates are examined (Figure 2.6).

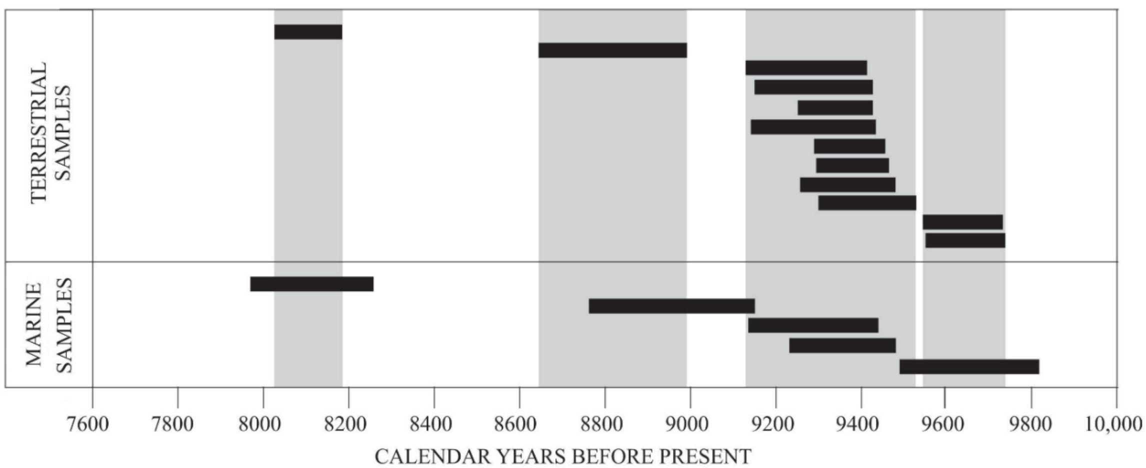


Figure 2.6. Likely Early Holocene periods of occupation at the LSP-1 (vertical gray bars). Black bars represent 2σ calibrated age ranges of radiocarbon dates. Adapted from Smith et al. (in press).

A preliminary geochemical analysis of debitage recovered from the site shows that a variety of geochemical types of obsidian are represented. Table 2.3 shows previous geochemical sourcing data for bifaces and foliate and WST points from LSP-1 and indicates that most obsidian present in Stratum V came from <80 km away (Smith et al. 2012). The farthest source represented in the small sample of sourced artifacts is Paradise Valley, Nevada, ~219 km away. The closest obsidian source to LSP-1 is Buck Spring, which as noted above occurs as small (<5 cm) nodules in the welded tuff formation into which LSP-1 was cut. Larger cobbles of Buck Spring obsidian are available within ~10 km of LSP-1 (Craig Skinner, personal communication, 2012).

Table 2.3. Obsidian Sources by Distance to LSP-1.

Geochemical Type	**Distance from LSP-1 (km)**
Buck Spring, OR[a]	9
Beatys Butte, OR[a]	40
Tank Creek/Big Stick, OR[a]	48
Bald Butte, OR[a]	50
McComb Butte, OR	52
Double O FGV, OR	54
Horse Mountain, OR[a]	54
Wagontire, OR[a]	58
Massacre Lake/Guano Valley, OR	65
Tucker Hill, OR	70
Glass Buttes, OR	75
Warner Valley FGV, OR[a]	79
Badger Creek, NV[a]	120
Buck Mountian, CA[a]	129
Venator FGV, OR[a]	165
Alturas FGV, CA	167
Paradise Valley, NV	219

Note: [a] Geochemical type identified in Smith et al. (2012).

In sum, technological and geochemical analysis of a sample of artifacts indicate that site occupants used and maintained portable toolkits manufactured elsewhere and expediently used local obsidian. Additionally, these expedient tools were generally discarded rather than resharpened after use. The obsidian sources represented indicate that visitors to LSP-1 moved throughout southcentral Oregon and/or had ties to neighboring groups in the region (Smith et al. 2014; Van der Voort 2015a).

Macrobotanical Analysis of the LSP-1 Sediment and Features

Recent analysis of sediment from a column sample in the E99 profile and several hearth features indicate that northern Warner Valley was wetter during the Early Holocene than later times, as evidenced by a low frequency of saltbush (*Atriplex canescens*) seeds and relatively high frequency of Great Basin wild rye (*Leymus cinereus*) and bentgrass (*Agrostis exarata*) seeds (Kennedy and Smith 2016). Saltbush thrives in areas that receive between 20-36 cm of annual precipitation (Ogle, St. John, and Tilley 2012), while Great Basin wild rye prefers 20-51 cm of annual precipitation (Ogle, Tilley, and St. John 2012) and bentgrass seeds require moist soil to germinate (Darris and Bartow 2006). The moisture requirements of these plants indicates that the northern Warner Valley received ~15 cm more precipitation each year than it does today.

Early Holocene features produced only a few types of charred plant remains likely consumed at the site including grasses, cheno-ams, and mustards (Kennedy and Smith 2016). Grasses include bentgrass and Great Basin wild rye, cheno-ams include saltbush and chenopods (*Chenopodium pratericola*), and mustard refers to tansymustard (*Descurainia paradisa*) (Kennedy and Smith 2016). Charred seeds recovered from features within the site reflect taxa whose seeds were stored and consumed ethnographically, and they were probably brought by visitors to LSP-1 to provision themselves during fall and/or winter visits (Kennedy and Smith 2016).

Faunal Remains at LSP-1

Pellegrini (2014) analyzed ~9,500 animal bone and bone fragments recovered from four excavation units along the E99 profile. If the density of faunal remains is relatively uniform across the site, then somewhere in the neighborhood of 50,000 animal bones have been recovered from the total excavated deposits (Geoff Smith, personal communication, 2016). The majority of these remains were unidentified small mammal bones but of the 3,766 specimens identified to taxa, 2,701 were identified as jackrabbit (*Lepus californicus*), 983 as cottontail rabbit (*Sylvilagus audubonii*), and 29 as unidentified leporid (Pellegrini 2014). The total leporid assemblage represents 98.6% of the identified specimens. Pellegrini (2014) demonstrated that the majority of the remains were deposited by humans through age profiles, element distribution, presence of cut marks, signs of marrow extraction, and weathering patterns. Tibiae were the most common element represented in both the *Lepus* and *Sylvilagus* assemblages, with minimum numbers of individuals (MNI) of 30 and 23, respectively (Pellegrini 2014). Based on a paucity of juvenile individuals, Pellegrini (2014) concluded that the site was occupied during the fall or early winter seasons - a finding that is in line with Kennedy and Smith's (2015) conclusion regarding seasonality based on macrobotanical remains.

In a subset of faunal remains from the lower pre-Mazama deposits (110-125 cmbd), Pellegrini (2014: Table 4.12) reported 184 *Lepus* elements, 69 *Sylvilagus* elements, two mule deer (*Odocoileus hemionus*) elements, two bobcat (*Lynx rufus*) elements, one kit fox *(Vulpes macrotis*) element, one spotted skunk (*Spilogale gracilis*) element, one yellow-bellied marmot (*Marmota flaviventris*) element, and one unidentified rodent element. Only the skunk was clearly deposited through non-human processes. While there were more carnivore remains in the pre-Mazama sample than later deposits, both datasets show the same overall trends: (1) the majority of leporid remains represent adult individuals; (2) the prevalence of diaphysis cylinders suggest that the site occupants extracted marrow from leporid long bones; (3) cutmarks, burning, and polishing suggest that some leporids were butchered or skinned and roasted or boiled at the site; and (4) axial portions of leporid skeletons were rare in the assemblage, suggesting that these parts were transported/discarded elsewhere rather than at the site (Pellegrini 2014). Pellegrini (2014) suggests that leporid carcasses were skinned, lower utility portions were cooked, eaten, and discarded (e.g., diaphysis cylinders, skulls), while the axial skeleton and upper appendicular elements were transported to another location or ground into bone meal. Use-wear analysis of the pre-Mazama flake tool assemblage can indicate if rabbit hide processing was also a major activity while the site was occupied - something that the faunal remains alone cannot illuminate. If hide working was an important activity at the site, then the occupants may have produced rabbit skin robes or blankets in preparation for winter.

Archaeological Materials: Pre-Mazama Flake Tools from LSP-1

Since the majority of the radiocarbon dates on features, isolated charcoal fragments, and shell beads recovered from below ~100 cmbd (the depth at which Mazama tephra was encountered in portions of the deposits) returned Early Holocene ages, I limited my use-wear analysis to flakes recovered >100 cmbd to focus on late

Paleoindian lifeways. In addition, because Prasciunas' (2007) experiments with flake cutting efficiency demonstrated that smaller flakes (<5 g and/or <7 cm^2) make poor prehensile cutting tools, I limited my sample to flakes that size or larger. In total, 172 pre-Mazama obsidian flakes were potentially used as tools, but only 37 display unequivocal evidence of macroscopic modification (e.g., retouch flaking, use-wear) and met these criteria. Table 2.4 shows the maximum length, maximum width, mass, and ventral surface area of each flake along with the excavation unit and depth (cmbd) from which it was recovered.

Two tools were excluded from further analysis because the poor quality of the toolstone made use-wear traces difficult to distinguish and incomparable to the replicated tools. Figure 2.7 shows counts of flake tools included in this study recovered from each of the excavation units along with the locations of the two dated Early Holocene hearths encountered at the site.

Generating a Comparative Sample of Obsidian Flake Tools: Replicated Materials

The Replicated Tool Assemblage

I procured several obsidian nodules from Glass Buttes, Oregon in 2014. This toolstone source is approximately 75 km from LSP-1, and excavation at the site recovered one WST point made on this type of obsidian (Van der Voort 2015b). There are many high-quality obsidian sources in the northwestern Great Basin (Hughes

Table 2.4. Pre-Mazama Flake Tool Assemblage.

Accession Number	Maximum Length (mm)	Maximum Width (mm)	Mass (g)	Surface Area (cm^2)	Unit	cmbd
010-39-78	44.7	45.7	16.3	14.9	N105E99	115
010-39-524	40.2	34.3	10.6	13.5	N104/E99	102
010-39-733	67	37	10	16.6	N105/E100	101
010-39-759	49.9	39.3	12.1	16.7	N105/E100	111-116
010-39-819	44.5	33.4	9.9	10.2	N106/E100	101
010-39-856	30.8	41.6	7.9	10	N106/E100	117
010-39-983	40	33.3	6.9	12.1	N103/E100	104
010-39-984*	27	32.1	6.6	6.5	N103/E100	106
010-39-1019	45.5	30.7	11.9	7.3	N103/E100	121
010-39-1030	56.1	27.6	14.4	11.6	N103/E100	122
010-39-1375	78.4	35.6	31	20.9	N104/E101	106
010-39-1393	41.1	33.4	5.8	9.9	N104/E101	112
010-39-1507	35.9	24.6	12.3	6.4	N104/E102	101-106
010-39-1597	43.5	36.1	12.4	9.2	N105/E101	111
010-39-1608	44.6	28.4	4.8	9.4	N105/E101	118
010-39-1611	37	50.1	8.8	13.2	N105/E101	118
010-39-1630	40.5	29.8	10.8	10.9	N105/E101	126
010-39-1705	63.3	36.8	16.5	16.1	N105/E102	106
010-39-1737	39.7	21.8	5.4	7.5	N105/E102	121-126
010-39-1787	32.7	45.3	26.4	13.7	N106/E101	107
010-39-1951	48	31.9	5.2	11.9	N106/E99	105
010-39-1958	28.5	56.2	11.8	7.8	N106/E99	109
010-39-1982	43.3	35.2	10.4	9.5	N106/E99	116.5
010-39-2127	51.3	34.7	15.8	12	N102/E100	101
010-39-2142	46.5	37.2	8.2	13.5	N102/E100	109
010-39-2292	47.6	25	8.1	10.4	N102/E101	111
010-39-2427	40.6	32.8	5.1	9.9	N102/E102	105
010-39-2446	47.6	27.5	16.4	12.1	N102/E102	109
010-39-2455	54.4	40.8	11.3	16.5	N102/E102	117
010-39-2465*	65.4	47.3	24.9	22	N102/E102	121
010-39-2674	59.9	20.7	10.7	8.9	N104/E102	115.5
010-39-2695	63.2	28.3	18.7	12.1	N104/E102	126-131
010-39-2846	50.5	22.1	7	7.6	N106/E98	101
010-39-2860	43.4	26.1	7.2	9.9	N106/E98	109.5
010-39-3342	36.8	39.9	14.1	14.7	N107/E100	111
010-39-3358	39.6	34.8	16.6	11.3	N107/E100	125
010-39-3411	48	46.3	35.7	22.6	N102/E102	110
Mean	**46.4**	**34.7**	**12.6**	**12.1**	**-**	**-**
Range	**27-78.4**	**20.7-56.2**	**4.8-35.7**	**6.4-22.6**	**-**	**-**

Note: * indicates flakes excluded from microscopic analysis.

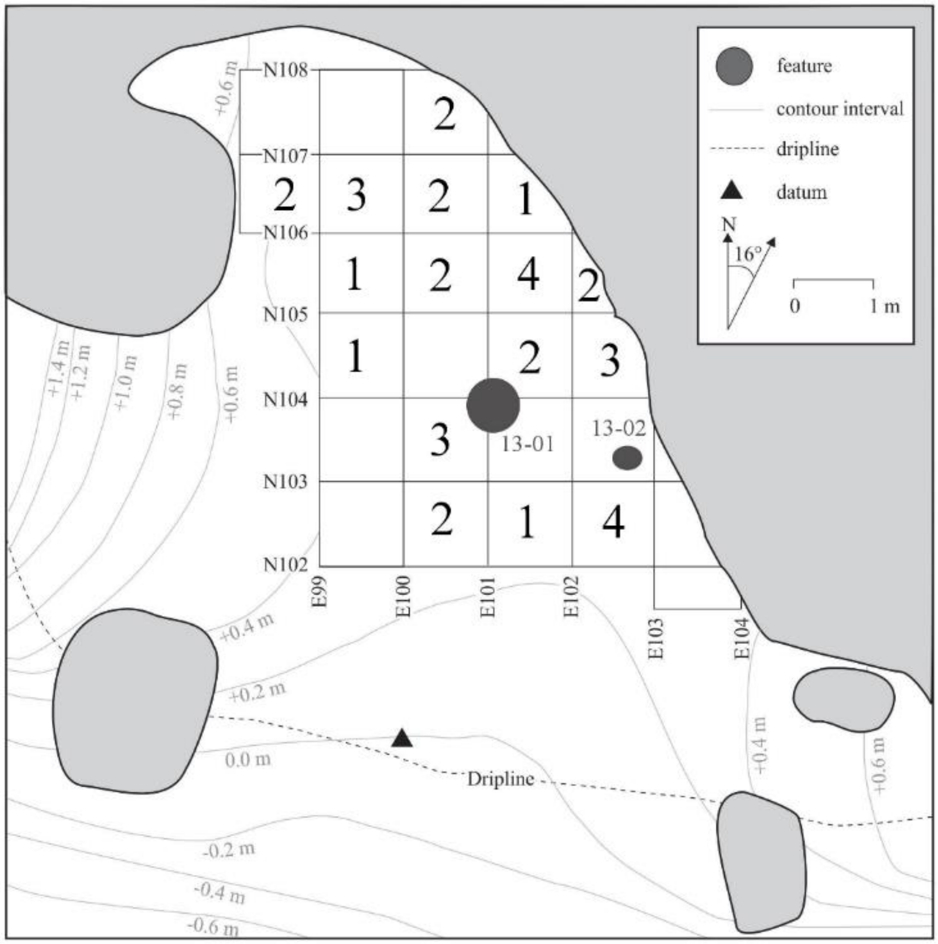


Figure 2.7. Planview map of LSP-1 with locations of Early Holocene features and count of flake tools per 1-m^2 unit analyzed in this study.

1986; Young 2002; Smith 2010) and with an abundance of good-quality toolstone available in the region, the majority of the archaeological assemblage should contain tools made on comparable material. In fact, only 2 tools in the archaeological assemblage were made on low quality obsidian that was visually incomparable to my replicated assemblage. Geoffrey Cunnar (Western Cultural Resources Management, Inc.) and Timothy Van der Voort reduced the Glass Buttes nodules via hard-hammer percussion into a number of flakes from which I selected 15 specimens that met the size and weight criteria identified by Prasciunas (2007). I used these flakes as replicated tools in my experiment. Replicated flakes were stored individually in plastic bags after production to ensure they retained pristine edges prior to use. All replicated tools were selected from core reduction flakes and some possessed cortex on the dorsal surface.

The replicated tools (Table 2.5) are on average slightly longer and heavier than the artifacts from LSP-1. The mass distribution of the archaeological and replicated tools is not normally distributed according to a Kolmogorov-Smirnov and a Shapiro-Wilk test of normality ($p < .001$) and a non-parametric Man-Whitney *U* test indicates that the masses of the two samples are significantly different ($U = 151.5$, $Z = -2.545$, $p = .011$). The ventral surface area of the replicated tools was also larger on average (Table 2.5) than the artifacts. The surface area distributions were also not normally distributed based on Kolmogorov-Smirnov ($p = .009$) and Shapiro-Wilk tests of normality ($p < .001$). A non-parametric Man-Whitney *U* test indicated that the surface area of the replicated tools differed significantly from the artifacts ($U = 58$, $Z = -4.434$, $p < .001$).

There are two differences between the samples that contribute to these dissimilarities. First, some of the artifacts are made on biface thinning flakes, which are generally smaller and lighter than the core reduction flakes I used as replicated tools. I chose flakes which looked like they would be easier for me to work with, as I am a novice butcher. Second, some of the flake tools are broken while all of the replicated tools are intact. I chose larger, intact flakes to ensure that each tool would develop as much distinctive wear as possible along the edge. This allowed me to more confidently identify use-wear attributes distinctive of each processing task.

Table 2.5. Replicated Tool Measurements.

Replicated Tool No.	**Maximum Length (mm)**	**Maximum Width (mm)**	**Mass (g)**	**Surface Area (cm^2)**
3	64	40	25	16.4
5	44.6	34.6	8.8	13.7
6	93.6	46.9	56	34.7
7	71.8	27.5	15.5	14.9
8	71	30.8	27.4	20.1
9	67.2	46.4	29.2	24.1
10	74.4	40.4	29.9	28.3
11	86	41.3	30.2	30.3
12	68.7	35.7	11.1	19.5
13	51.2	26.4	10.8	10.5
14	45.9	46.7	8.2	17.8
15	84.2	34.4	8.7	20.8
16	78.8	39.5	27.8	23.3
17	87.8	31.9	18	23
18	66	44.8	13	21.6
Mean	**70.7**	**37.3**	**21.9**	**21.3**
Range	**44.6-93.6**	**26.4-46.9**	**8.2-56.0**	**10.5-34.7**

Initial Documentation Procedure for Replicated Tools

I photographed, measured, and microscopically documented each replicated flake before using it for any experimental task. I documented manufacturing wear patterns and any unusually edge modifications on each replicated flake using digital images captured using a Luxo Midas digital microscope at 40X magnification for low power documentation. I also scanned tool edges with an Olympus BHM at 100X and 200X magnification to take photographs and notes about visible manufacturing wear and unusual aspects of flake edges before beginning any replicated tasks. This initial documentation process ensured that I did not mistake non-use related marks and surface alterations for use-wear traces in the final documentation after completion of the replicated tasks.

Leporid Processing Experiments

After I documented each replicated flake, I used them to butcher rabbits to generate use-wear data that I could compare to flakes from LSP-1. Before beginning my experiments, I worked with Dr. Geoffrey Cunnar at WCRM for a semester learning about different aspects of use-wear analysis and de-hairing a deer hide with CCS and obsidian flake tools. Since the ethnographic data I researched was scant concerning the specific details of rabbit butchery, I researched modern rabbit butchering techniques on various hunting and cooking websites, in the *Joy of Cooking* (Rombauer et al. 2006:525) and I read other experimental and archaeological butchering descriptions (Goodrich 2013; Hockett 2007; Jobson 1986). Additionally, I've personally observed the process of butchering deer. I purchased three domestic meat rabbits (*Oryctolagus cuniculus*) from Diamond Mountain Ranch in Greenville, California. Ranch owner Jeff Miller dispatched the rabbits and we removed the heads and internal organs at the ranch with modern tools. Each rabbit weighed ~2 kg after these parts were removed. These domestic rabbits are consistent with the size and weight of black-tailed jackrabbits in the Great Basin, which weigh 1.5-3 kg (Larrucea 2011).

I defined butchering activities using three general categories: (1) hide processing; (2) carcass processing; and (3) meat processing (described below) to identify the extent and types of leporid processing that took place at LSP-1 during the terminal Early

Holocene. I used five replicated flakes for skinning, scraping, and slicing hides, five flakes for disarticulating the carcasses, and five flakes for deboning the carcasses and cutting meat. I used the tools for varying periods of time (5-13, 21-41, and ≤60 minutes) as well as to complete particular tasks. Some tasks took longer to complete at first (e.g., my first time skinning a carcass) and I could complete other tasks (e.g., removing the feet) more quickly after practice. Each replicated flake was unhafted and held in my bare hand (i.e., without gloves). Table 2.6 shows the butchering activity category, use motion (i.e., cutting/sawing vs. scraping), and use duration for each replicated tool.

I took photographs throughout the process by myself and with the help of Andrew Hoskins (UNR).

Hide Processing. The first aspect of hide processing consisted of removing the hide from the carcass in a process referred to as *skinning*. I used the tools with a unidirectional longitudinal motion to accomplish this task (Figure 2.8). Hide processing also included defleshing the hide with a downward scraping movement, or a unidirectional transverse motion (Figure 2.9). The last aspect of hide processing was slicing it into strips, which consisted of bidirectional longitudinal motion, or cutting (Figure 2.10).

Carcass Processing. These activities consisted of disjointing, or appendicular disarticulation (Figure 2.11). This process consisted of bidirectional longitudinal motions, or sawing through meat and tendons at the joints. Disjointing included foot removal at the ankles, leg removal at the shoulders and hips, as well as disarticulation at the elbows and knees.

Table 2.6. Experiments.

Replicated Tool Number	Task Category	Task	Motion	Duration (Minutes)
3	Hide Processing	Defleshing hide	Unidirectional Transverse (Scraping)	255
5	Carcass Processing	Disjointing feet and legs	Bidirectional Longitudinal (Sawing)	73
6	Hide Processing	Defleshing hide	Unidirectional Transverse (Scraping)	128
7	Carcass Processing	Disjointing feet	Bidirectional Longitudinal (Sawing)	10
8	Hide Processing	Cutting hide into strips	Bidirectional Longitudinal (Cutting)	21
9	Hide Processing	Removing skin	Unidirectional Longitudinal (Skinning)	41
10	Hide Processing	Defleshing	Unidirectional Transverse (Scraping)	7
11	Carcass Processing	Disjointing legs	Bidirectional Longitudinal (Sawing)	12
12	Meat Processing	Deboning/ cutting meat	Bidirectional Longitudinal (Cutting)	40
13	Meat Processing	Deboning/ cutting meat	Bidirectional Longitudinal (Cutting)	13
14	Carcass Processing	Disjointing feet and tail	Bidirectional Longitudinal (Sawing)	5
15	Meat Processing	Deboning	Bidirectional Longitudinal (Cutting)	37
16	Carcass Processing	Disjointing all joints and cutting spinal cord	Bidirectional Longitudinal (Sawing)	21
17	Meat Processing	Cutting meat	Bidirectional Longitudinal (Cutting)	24
18	Meat Processing	Deboning/ cutting meat	Bidirectional Longitudinal (Cutting)	31

Meat Processing. Lastly, meat processing activities included deboning the disarticulated pieces, removing the backstrap from the axial portion of the carcass, and cutting the meat into small cubes (Figure 2.12). Deboning consisted of a bidirectional longitudinal motion used to cut meat away from the bone. I also used a bidirectional longitudinal motion to cut the meat into smaller pieces. Although cutting and sawing use the same general motion, the sawing motion used in carcass processing required application of more pressure on the tool to separate the joints. After each activity, I gently rinsed each flake in warm water, patted it dry, and returned it to its storage bag.

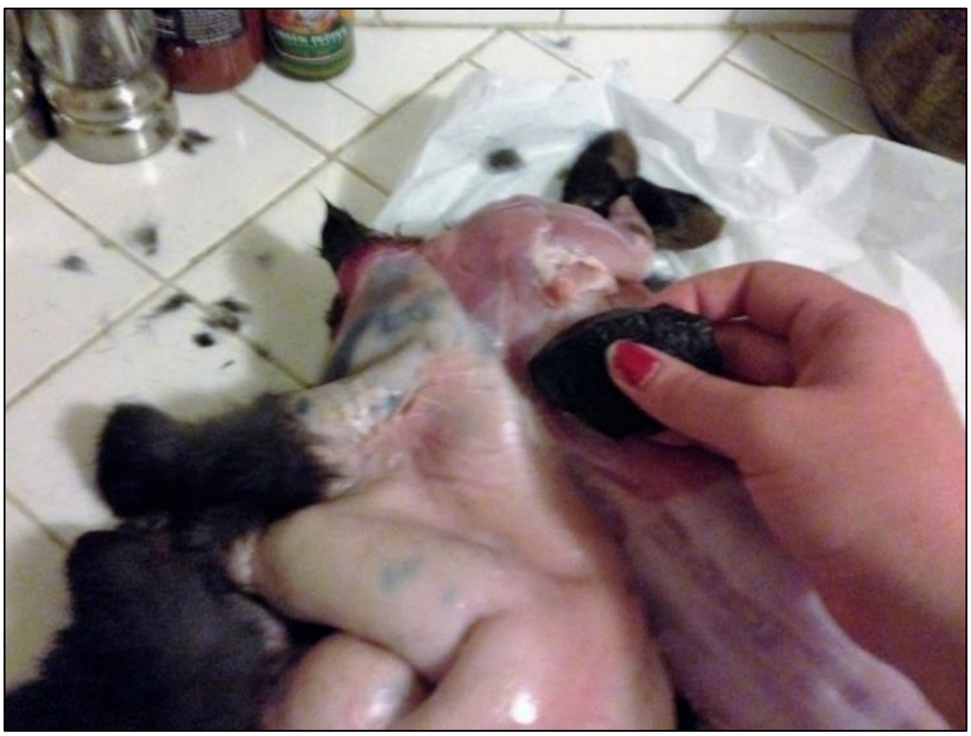


Figure 2.8. Example of carcass skinning (RT 9).

Figure 2.9. Example of scraping/defleshing hide (RT 10).

Figure 2.10. Example of slicing hide (RT 8).

Figure 2.11. Example of a disjointed (quartered) rabbit carcass (RT 11).

Figure 2.12. Example of a deboned carcass (RT 12 and RT 13).

Analyzing the Replicated Flake Tools and LSP-1 Flakes: Documenting Use-Wear Patterns

Following Kononenko's (2011) protocol for documenting use-wear on obsidian flake tools, I traced and drew the ventral and dorsal side of each replicated tool and artifact on a sheet of graph paper. I included the artifact's accession number or replicated tool number (RT) and a brief description of the activity for which replicated flake tools were used (Figure 2.13). After preparing the recording sheet and before microscopic examination I gently washed each artifact and replicated tool with mild soap and water and patted it dry. I then wiped each one with isopropyl alcohol on a cotton pad, rinsed it with plain water, and dried it again.

I used an Olympus BHM reflected light microscope with 10X, 20X, and 50X infinity corrected objectives to scan the ventral and dorsal edges of each replicated flake tool and artifact at 100X magnification. When I encountered use-wear traces, I observed them at 200X and occasionally 500X to more closely record and classify the wear types. I marked a photo point (pp) on the recording sheet corresponding to the examined edge and captured digital images of the wear traces with an Infinity 2 Lumenera microscope camera. I used the accompanying Infinity Analyze software to save the photographs. Each pp often corresponded with several numbered photographs at 100X, 200X, and/or 500X magnification, which I noted on the recording sheet. I also noted the type(s) of use-wear I observed in each photograph.

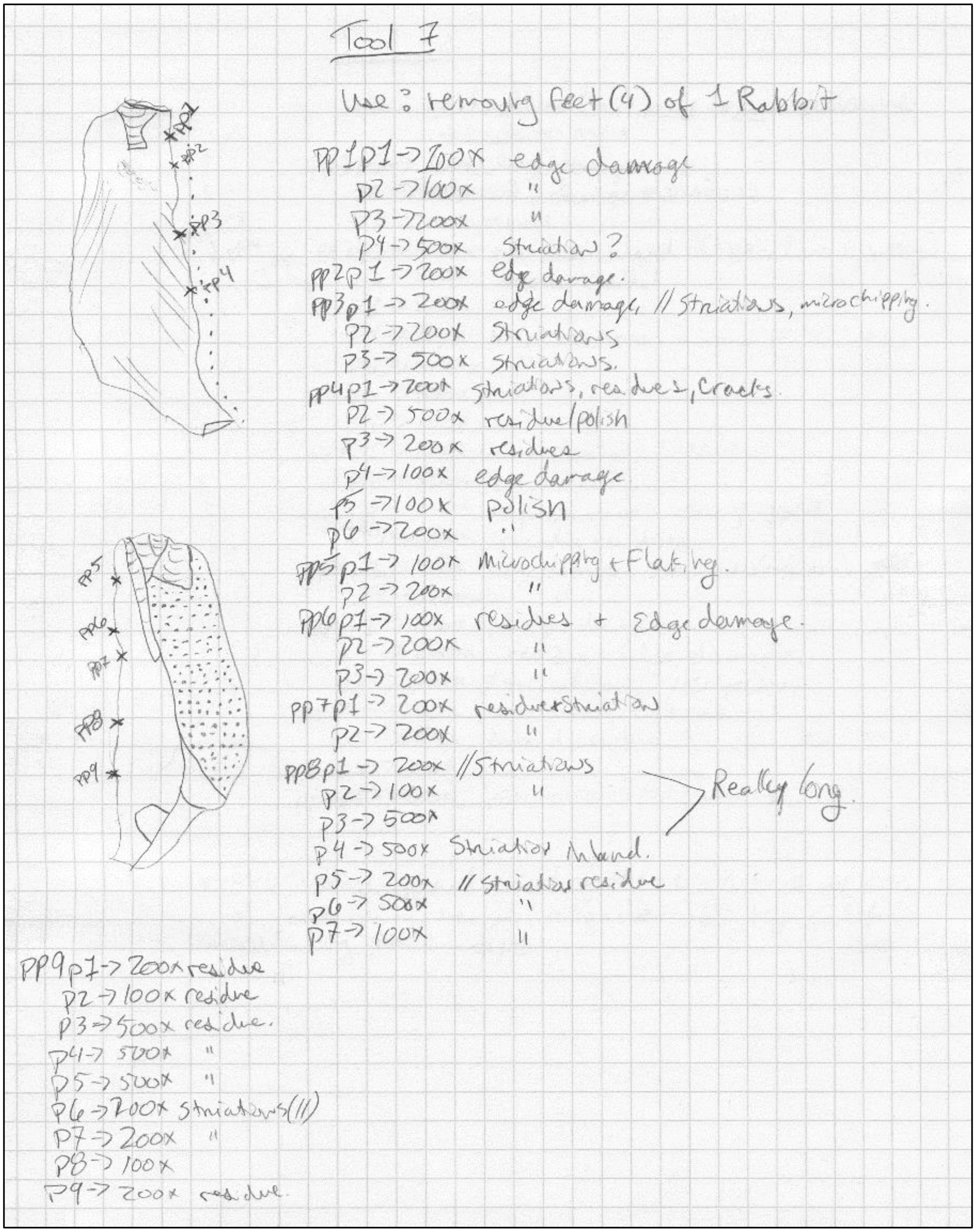


Figure 2.13. Example of a recording sheet used in the study.

Use-Wear Variables

I classified evidence of use-wear following Kononenko (2011) and Hurcombe (1992). Edge damage, or scarring, refers to small flake scars that are sometimes macroscopically visible. These were recorded based on their termination type as well as their distribution, orientation, size, and shape. Termination types included bending, feather, step, and hinge, while the size category included small (<2 mm), medium (2-3 mm), and microflaking (only visible under the microscope) (Kononenko 2011:7).

Striations are the most important variable in determining tool use motion (Kononenko 2011:7). This type of wear is formed when particles such as dust, grit, or small fragments of the tool are trapped between the tool and the worked material. I recorded four main types of striations: (1) *sleeks* had straight sides and smooth bottoms (Figure 2.14); (2) *rough bottom striations* had irregular bottom surfaces and straight or irregular sides (Figure 2.15); (3) *intermittent striations* were composed of small, round distinct points of damage arranged linearly along the surface (Figure 2.16); and (4) *flaked striations* were associated with edge damage caused by removing flakes from the edge of the tool (Figure 2.17) (Hurcombe 1992:37; Kononenko 2011:7-8). Linear use-wear features that did not fit easily into any of these categories were recorded individually. In addition to striation type, striation orientation was categorized as parallel, perpendicular, or diagonal to the working edge. Striation frequency was noted as few, frequent, or dense based on the prevalence of each striation type.

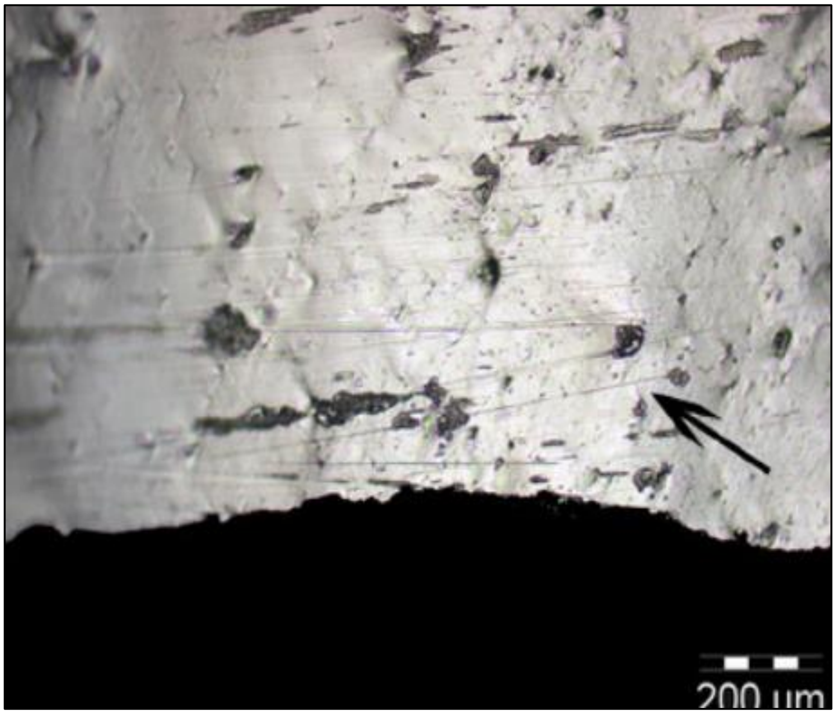


Figure 2.14. Example of sleek striations (Kononenko 2011:162).

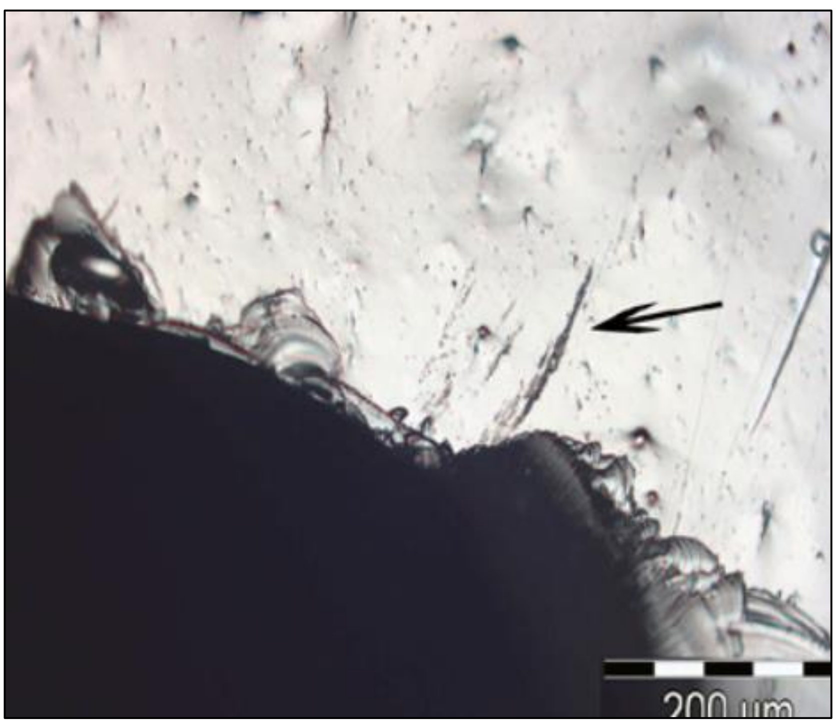


Figure 2.15. Example of a rough bottom striation (Kononenko 2011:165).

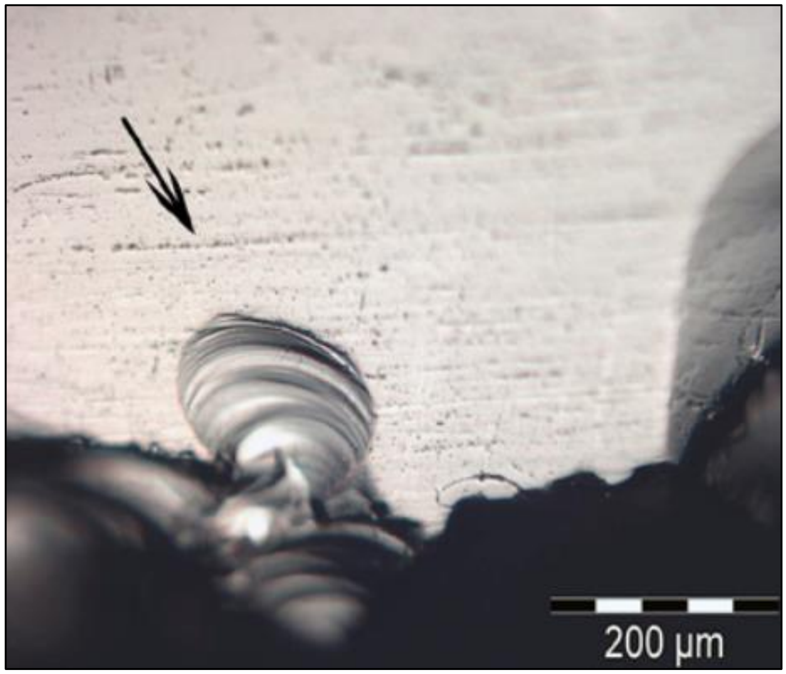


Figure 2.16. Example of intermittent striations (Kononenko 2011:161).

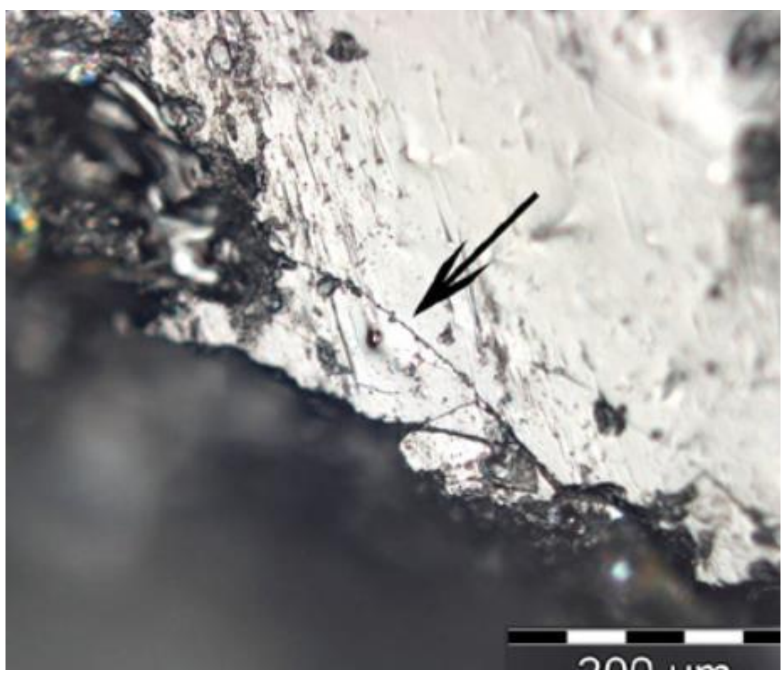


Figure 2.17. Example of a flaked striation (Kononenko 2011:182).

Edge rounding or attrition is the degree of smoothing and dulling of the edge, which is exacerbated by the presence of grit or sand (Kononenko 2011:8). Obsidian is brittle and prone to this type of wear. I recorded the degree of severity using an ordinal scale with the following categories: (1) *slight* (dull but visible edge; Figure 2.18); (2) *medium* (dull, very rounded edge; Figure 2.19); (3) and *intensive* (flattened, abraded edge; Figure 2.20). Other distinctive characteristics (e.g., edge irregularities) were noted on a case by case basis.

Polish formation is the least understood process in use-wear analysis. Kononenko (2011:8) defines it as "surface alteration from abrasive roughening through smoothing to a highly reflective gloss" (Figures 2.21 and 2.22). Fullagar (1991) described four stages of polish formation. Stage 1 is a very light polish with slight edge stabilization and slight edge rounding with a rough, sugary texture compared to a freshly fractured surface. Stage 2 is a light polish consisting of an abraded surface with polished, leveled peaks, deepening cracks, and granular impaction in depressions. Material is physically removed from the tool surface and most soft materials (e.g., meat) do not cause polish formation past this stage. Stage 3 is a developed polish on higher peaks through an extensive stable polished surface, extension of subsurface cracks, and gradual removal of surface defects. It can be distinctive of worked material, such as wood, plant-working, bone, and hide-working. Stage 4 is well-developed polish typified by an extensively polished surface to a completely polished, featureless surface. Stage 4 polish is called *sickle sheen* when formation is due to processing siliceous plant material. I recorded the location, stage, and distribution of polish.

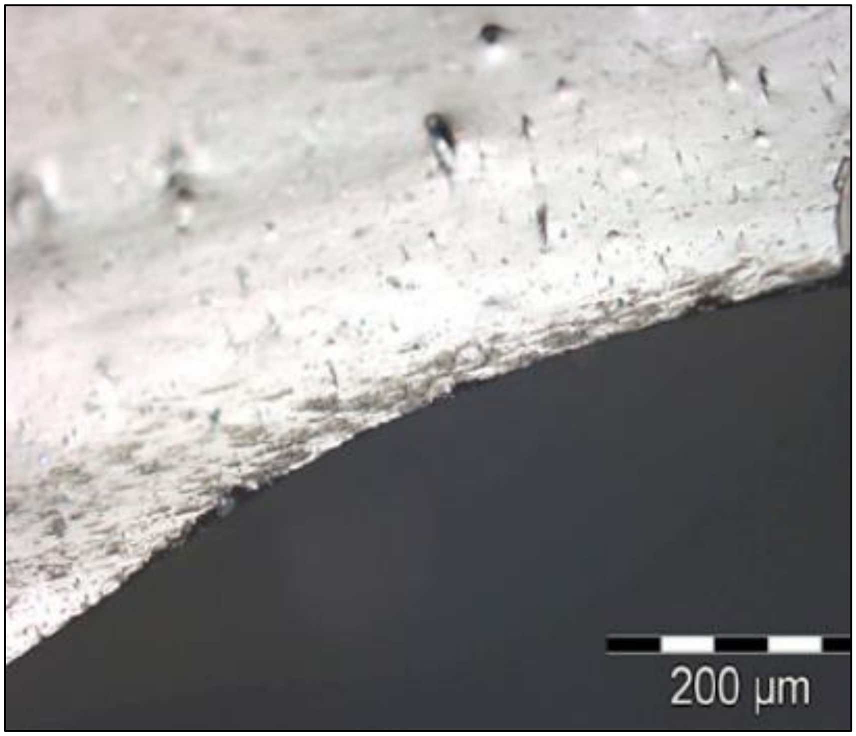


Figure 2.18. Example of slight edge rounding. From Kononenko (2011:182), cutting green leaves and stems of Pandanus palm for 105 minutes.

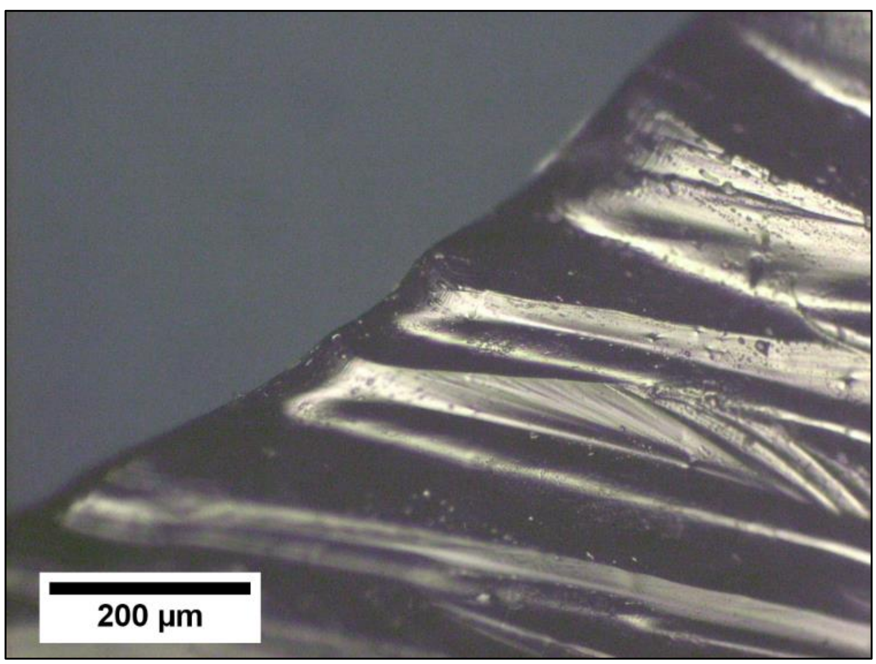


Figure 2.19. Example of medium edge rounding. RT 3 (photo point 4 photo 1 [pp4p1]).

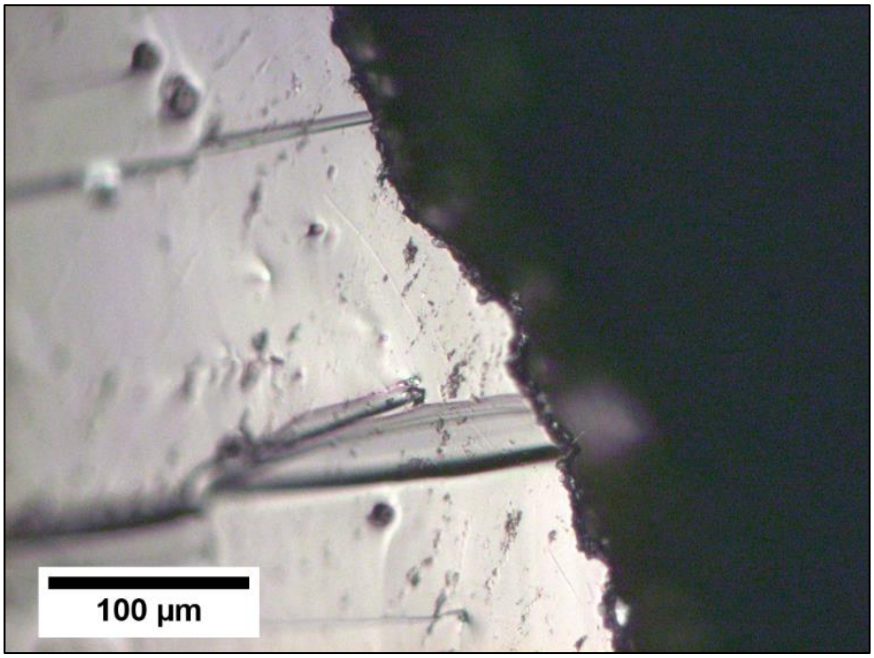


Figure 2.20. Example of intensive edge rounding/attrition. RT 5 (pp15p1).

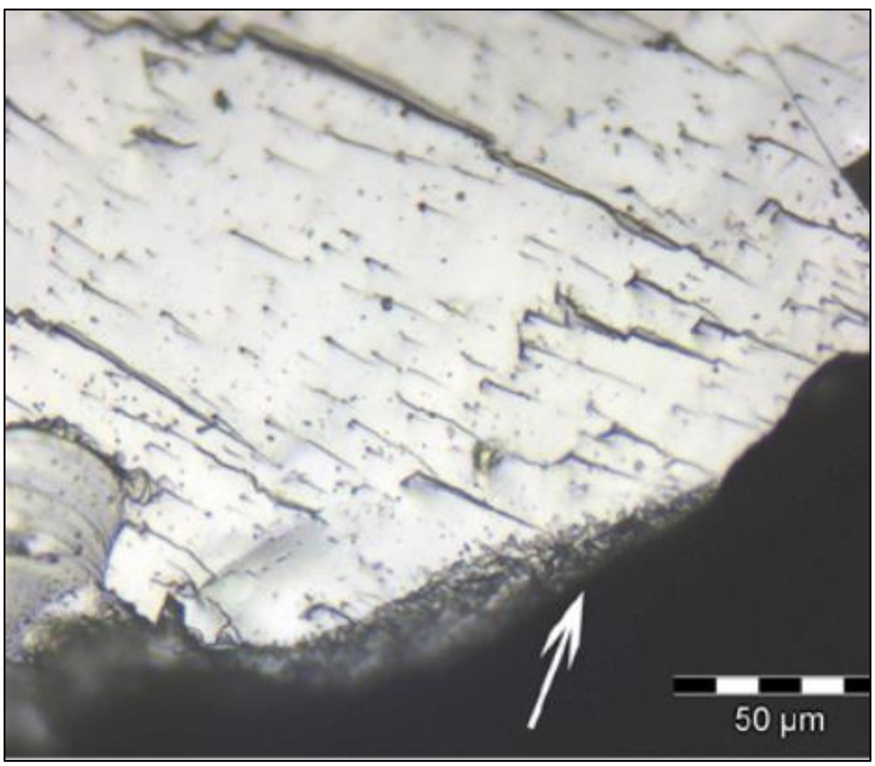


Figure 2.21. Polish from shaving human face (Kononenko 2011:188).

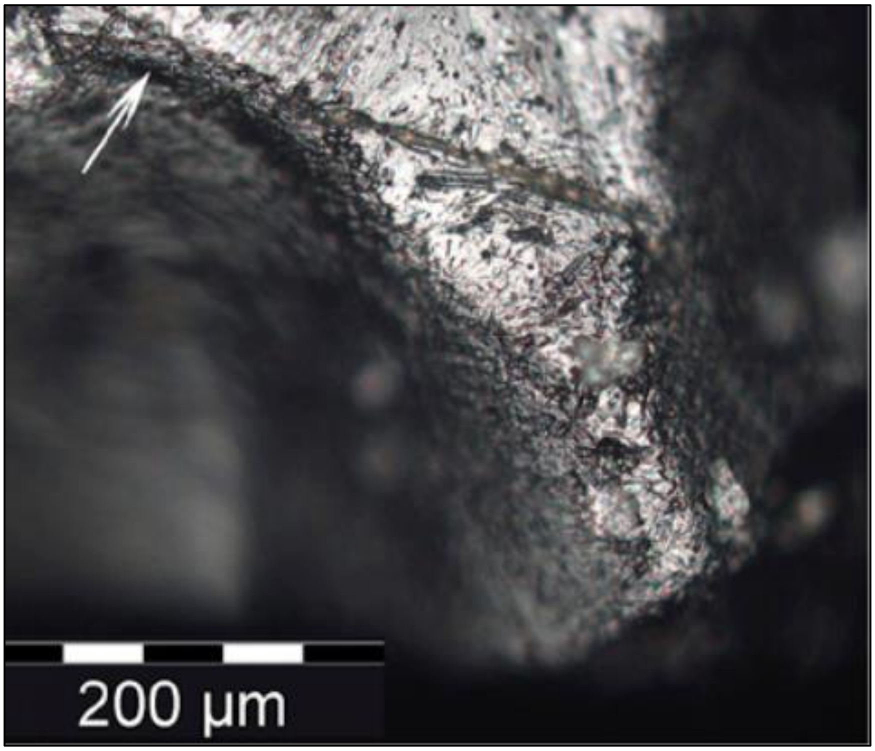


Figure 2.22. Polish from sawing hard wood (Kononenko 2011:214).

The final variable recorded was the presence and description of any residues. Non-use related residues usually appear in isolated instances on the tool away from the edge, while use related residues can be smeared on the surface or trapped in crevices near the working edge of the tool (Kononenko 2011:9). Residues are often deposited slightly inward from the tool's edge and may include plant remains such as phytoliths and starches, animal remains such as blood, and inorganic remains such as ochre or hafting mastic (Kononenko 2011:5). I recorded the presence and location of any residue, along with a brief description of its visual characteristics.

Hypotheses and Expectations

As outlined above, Pellegrini's (2014) analysis of a sample of fauna from LSP-1 led him to conclude that leporid processing was a major activity at the site. While he offered several possible scenarios (e.g., field processing for transport elsewhere, hide removal for rabbit skin blanket production) that could account for the trends noted in the faunal sample, these ideas represent hypotheses that warrant further testing. As a logical outgrowth of Pellegrini's work, I developed two hypotheses that can be tested through a comparison of the use-wear formed on replicated tools with the use-wear identified on flakes from LSP-1 (Table 2.7).

Table 2.7. Hypotheses.

Hypothesis 1	**Expectation**	**Use-Wear Evidence**
Leporid carcasses prepared for transport by removing low utility portions; other processing (hide, meat) occurred elsewhere	Mostly carcass processing; limited meat and hide processing	Carcass Processing: limited, discrete polish formation on highest parts of surface close to edge, numerous sleek and intermittent striations, intensive edge rounding, edge damage/scarring
Hypothesis 2	**Expectation**	**Use-Wear Evidence**
Leporid carcasses and hides fully processed in the shelter	Significant carcass and hide processing; some meat processing	Hide Processing: bright, well-developed, smooth polish, sleek and rough bottom striations, folded residue Meat Processing: bright, well-developed, smooth polish, occasional sleek striations and edge rounding, patchy clusters of rounded residue particles parallel to edge

Hypothesis 1

LSP-1 was a short-term, task-specific camp where Early Holocene groups brought rabbits and hares collected on the valley floor and removed lower utility portions of the carcasses (i.e., heads, lower appendages) prior to transporting higher utility portions (i.e., bodies) to a nearby residential camp. This hypothesis would be supported if most of the obsidian flake tools from the pre-Mazama deposits showed substantial evidence of carcass processing and minimal evidence of hide and/or meat processing. Use-wear generated by carcass processing displayed on the flake tools should include a rough, bright, or dull polish that is slightly rounded that only forms on the highest parts of the surface (Hurcombe 1992:46). Polished areas should be limited, discrete, and close to the edge. Striations should be numerous and include sleeks and intermittent types. Other types of use-wear may be present occasionally (Hurcombe 1992:47). Some areas should have intensive edge rounding and others areas should have edge damage and scarring.

Hypothesis 2

LSP-1 was a small residential camp where a wider range of activities including leporid carcass processing, consumption, and hide preparation took place. As part of these activities, rabbit skin blankets or robe production may have occurred in advance of the winter months. This hypothesis would be supported if the pre-Mazama flake tools showed substantial evidence of hide/carcass processing as well as some evidence of meat processing. Use-wear generated by hide processing should include bright, well-developed, smooth polish along the working edge (Hurcombe 1992:45). Striations should consist of sleeks of varying width and depth, with narrow, deep sleeks the most common. Rough bottomed striations and some edge rounding should be visible, as well as filamentous residues and "sub-angular bumpy-textured shapes" that "appeared to be folded or wrinkled" (Hurcombe 1992:45). Tools used for meat processing should display a weakly developed, bright, slightly smooth polish with few striations (Hurcombe 1992:43). If striations do occur, they should be narrow, deep sleeks. Edge rounding should occur only occasionally due to accidental contact with bone. Patchy clusters of rounded residue particles in a band parallel to the edge on these tools should be observable (Hurcombe 1992:44).

Summary

The LSP-1 rockshelter in Oregon's Warner Valley contains cultural deposits dating to the Early Holocene in the lower portion of Stratum V. Geochemical sourcing data show that the majority of toolstone represented the site is from nearby sources, with only a few examples of toolstone from distant sources (>100 km). Recent macrobotanical analysis indicates that some plants were consumed at the site and faunal analysis suggests that leporids were processed and consumed. Based on his analysis of fauna from the site, Pellegrini (2014) suggested that different activities may have contributed to the accumulation of leporid bones at the site and I developed two hypotheses capable of being tested through a use-wear analysis of obsidian flake tools from the site's pre-Mazama deposits: (1) LSP-1 served as a short-term, task-specific site where rabbits and hares were field processed in advance of transport to a residential base; and (2) LSP-1 served as a small residential base where rabbits and hares were processed and consumed and the hides from those taxa were prepared for rabbit skin robe or blanket production. I described the materials and methods used in an experiment designed to generate use-wear on replicated tools used for specific activities (e.g., hide processing, carcass processing, and meat processing) under controlled conditions. I also described the sample of obsidian tools from Early Holocene deposits that I analyzed to identify the activities for which they were used and outlined my expectations for associated use-wear patterns based on my experimental design. In the next chapter, I present the results of my replicated experiment (i.e., the types of wear generated on the tools used for different activities) as well as my comparison of use-wear patterns on the replicated tools and LSP-1 flake tools. These results will allow me to evaluate the hypotheses outlined above.

CHAPTER 3

RESULTS

In this chapter, I report the results of my use-wear analysis of replicated tools and pre-Mazama flake tool assemblage from LSP-1. First, I present the results of my replicative experiments and identify attributes indicative of hide, carcass, and meat processing. Second, I present the results of my analysis of the LSP-1 flake tool assemblage and the types of diagnostic wear present on those artifacts, what types of material they contacted, and the manner in which they were used. Photographs of the use-wear on both replicated tools and artifacts are presented in the Appendix. Finally, I discuss the activities that took place at the site based on the use-wear results.

Replicated Tools

Hide Processing

I used Replicated Tool (RT) 3 to deflesh rabbit hide for 255 minutes. I used the tool with a transverse motion (i.e., scraping) against a wooden board. The resulting use-wear includes discontinuous feather and stepped scarring, few parallel sleek striations, dense perpendicular rough bottom striations, flaked striations, medium and intensive edge rounding, stage 2 polish, folded grainy residue particles, shiny patchy residues, and small residue spots.

I used RT 6 to deflesh rabbit hide for 128 minutes. I used this tool with the same transverse scraping motion as RT 3. RT 6 displayed continuous and discontinuous feathered and step scarring, few parallel sleek striations, dense diagonal and perpendicular rough bottom striations, few perpendicular intermittent striations, intensive edge rounding, stage 1 polish, and folded grainy particle residues.

I used RT 8 for cutting one rabbit hide into strips for 21 minutes in a bidirectional longitudinal motion (i.e., cutting). This task created continuous feathered scarring, perpendicular sleeks, frequent parallel rough bottom striations, no edge rounding or polish, and patchy shiny residue.

I used RT 9 to remove the skin from one rabbit carcass for 41 minutes with a unidirectional longitudinal motion. This task resulted in discontinuous step scarring, few parallel sleek and rough bottom striations, slight edge rounding, stage 2 polish, folded grainy particle residue, and rough patchy residue.

I used RT 10 to deflesh rabbit hide for 7 minutes with a transverse scraping motion. This task resulted in discontinuous feather scarring, diagonal sleek striations, dense perpendicular intermittent striations, flaked striations, medium to intensive edge rounding, stage 1 polish, folded grainy particles residue, shiny and rough patchy residue, and small residue spots.

These hide processing tasks produced a suite of distinctive attributes that include discontinuous scarring (Figure 3.1), sleek and rough bottom striations (Figure 3.2), edge rounding (Figure 3.3), early polish stages (Figure 3.4), folded grainy particle residue (Figure 3.5), and patchy residue (Figures 3.6 and 3.7). The orientation of the striations

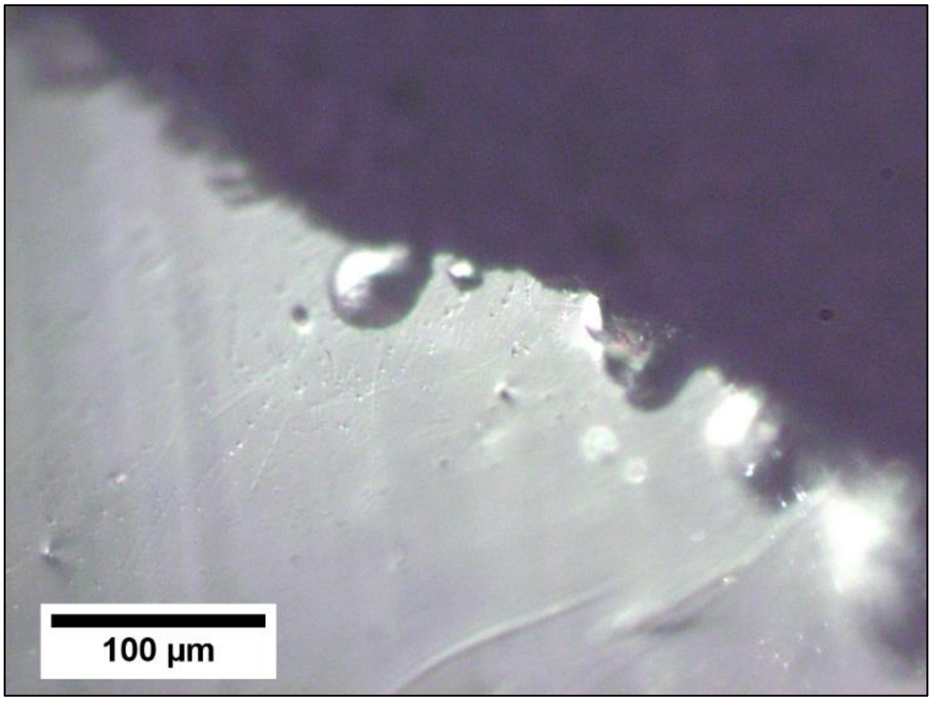


Figure 3.1. Discontinuous scarring on RT 6 (pp7p1).

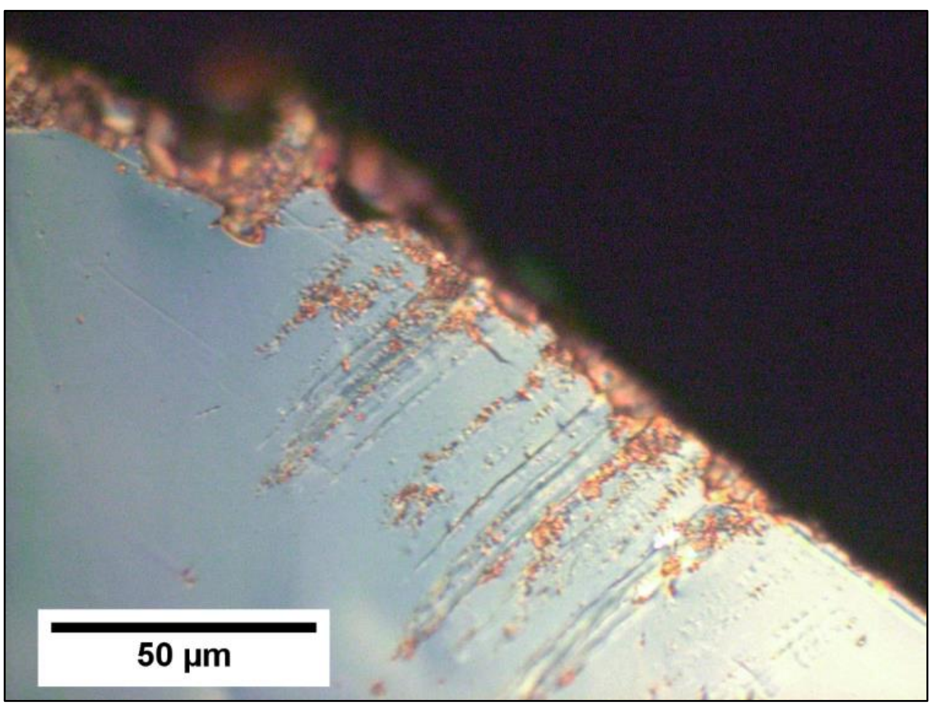


Figure 3.2. Sleeks and rough bottom striations on RT 3 (pp1p1).

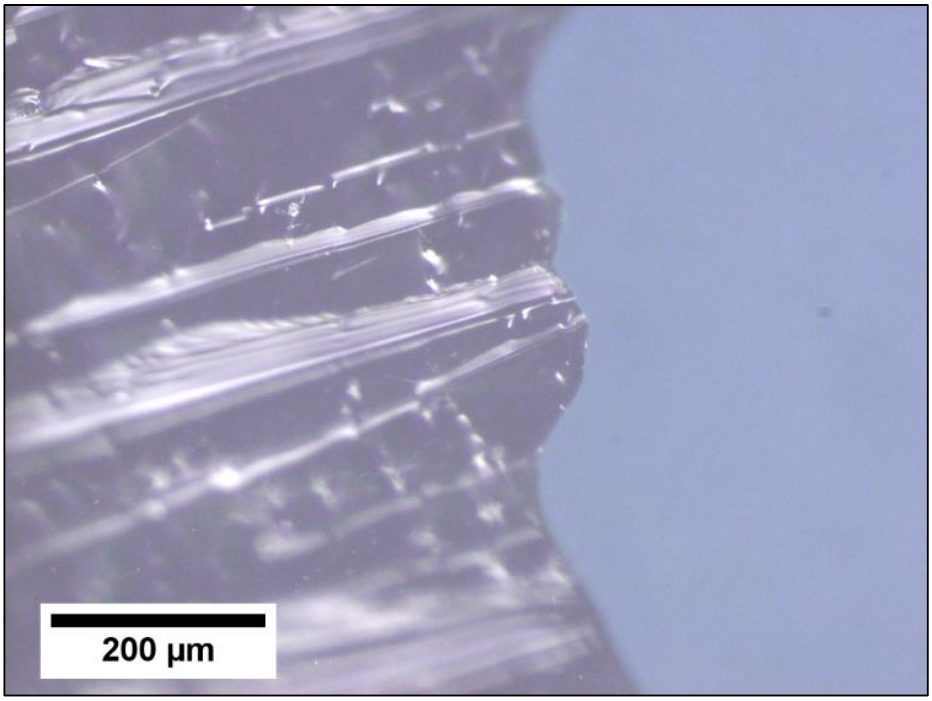


Figure 3.3. Medium edge rounding on RT 10 (pp7p1).

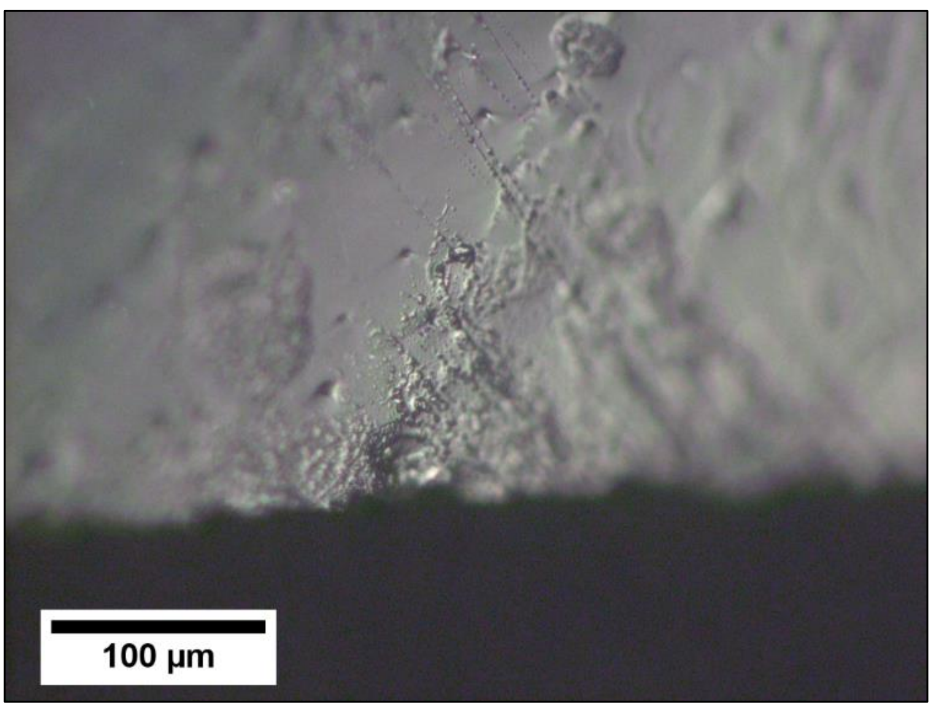


Figure 3.4. Stage 1 polish on RT 10 (pp10p2).

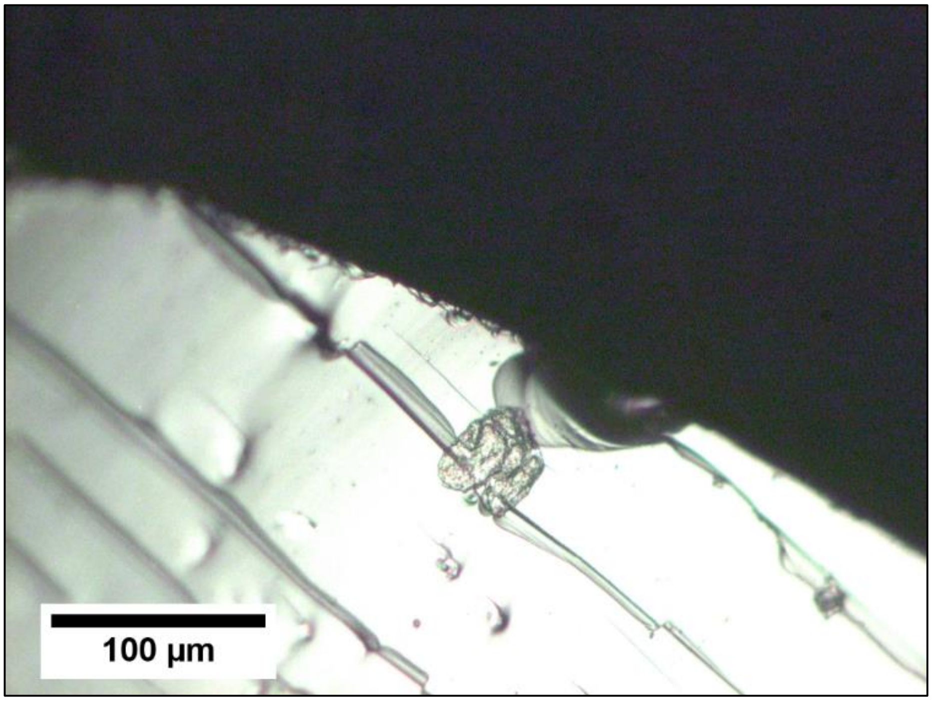


Figure 3.5. Folded grainy particle on RT 5 (pp10p2).

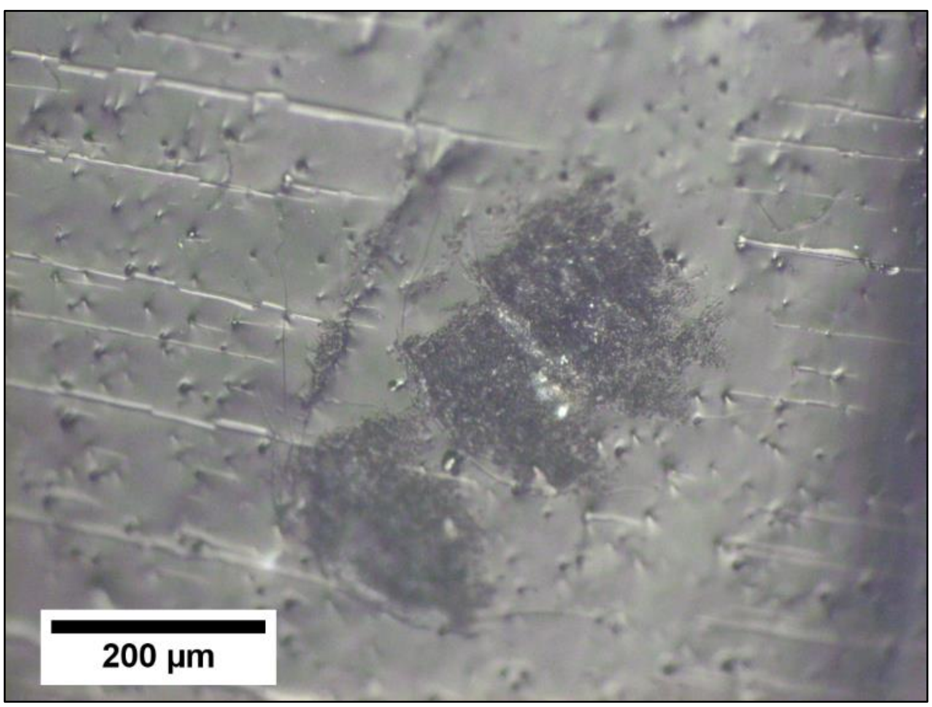


Figure 3.6. Rough patchy residue on RT 9 (pp2p5).

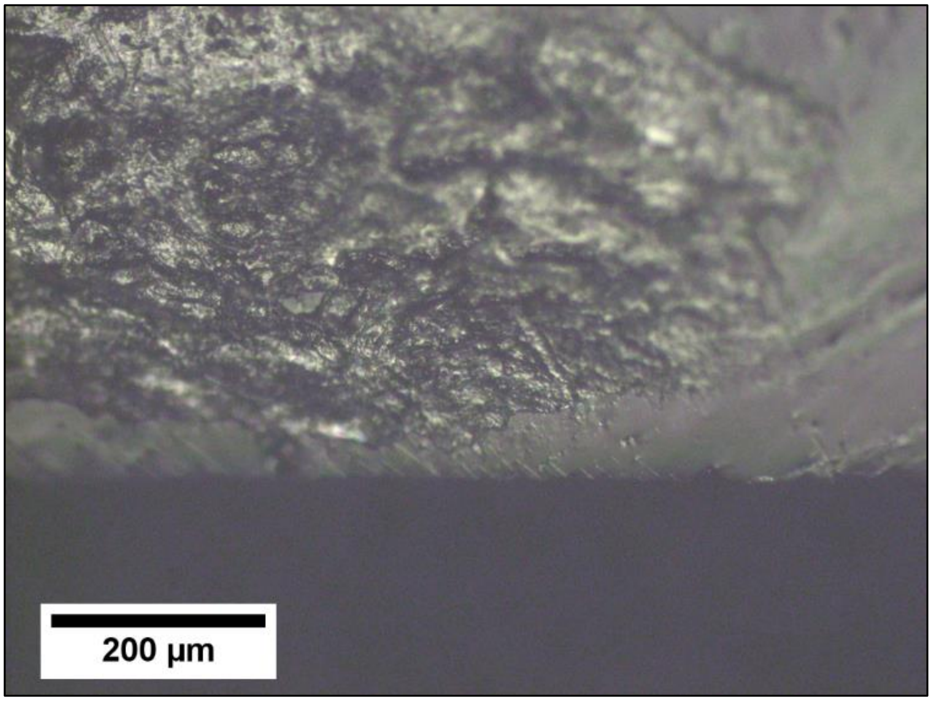


Figure 3.7. Shiny patchy residue on RT 10 (pp2p2).

indicates direction of tool motion, with mostly parallel striations diagnostic of longitudinal cutting motion and dense perpendicular striations diagnostic of transverse scraping motions.

Carcass Processing

I used RT 5 to remove the feet and limbs of one rabbit for 73 minutes with a longitudinal (i.e., sawing) motion. This task produced continuous feathered scarring, perpendicular and parallel sleek and intermittent striations, flaked striations, intensive edge rounding, stage 3 polish, folded grainy particle residue, rough patchy residue, and residue spots.

I used RT 7 to remove the feet of one rabbit for 10 minutes with a sawing motion. This task produced continuous feather and step scarring, parallel sleek and intermittent striations, flaked striations, stage 4 polish, folded grainy particles, a parallel residue band, and rough patchy residue.

I used RT 11 to remove the limbs of one rabbit and remove the backstraps from the axial skeleton for 12 minutes with a longitudinal motion. This task produced continuous feathered scarring, perpendicular and parallel sleek striations, parallel intermittent striations, flaked striations, intensive edge rounding, no polish formation, and rough patchy residue.

I used RT 14 to remove the feet and tail of one rabbit for 5 minutes with a longitudinal motion. This task produced continuous feather and step scars, diagonal intermittent striations, flaked striations, intensive edge rounding, stage 1 polish formation, folded grainy particle residue, shiny patchy residue, and small residue spots.

I used RT 16 to remove the limbs, sever the joints, and saw through the backbone of one rabbit for 21 minutes with longitudinal motions. This task resulted in continuous step scarring, parallel sleek, intermittent and flaked striations, medium edge rounding, stage 3 polish formation, folded grainy particle residue, and rough patchy residue.

In sum, carcass processing tasks generated a use-wear pattern characterized by continuous feather and step scarring (Figure 3.8), sleek, and intermittent striations (Figure 3.9), flaked striations (Figure 3.10), edge rounding, late stage polish formation (Figure 3.11), folded grainy particle residue, and patchy residue. The presence of continuous scarring, absence of rough bottom striations, presence of intermittent

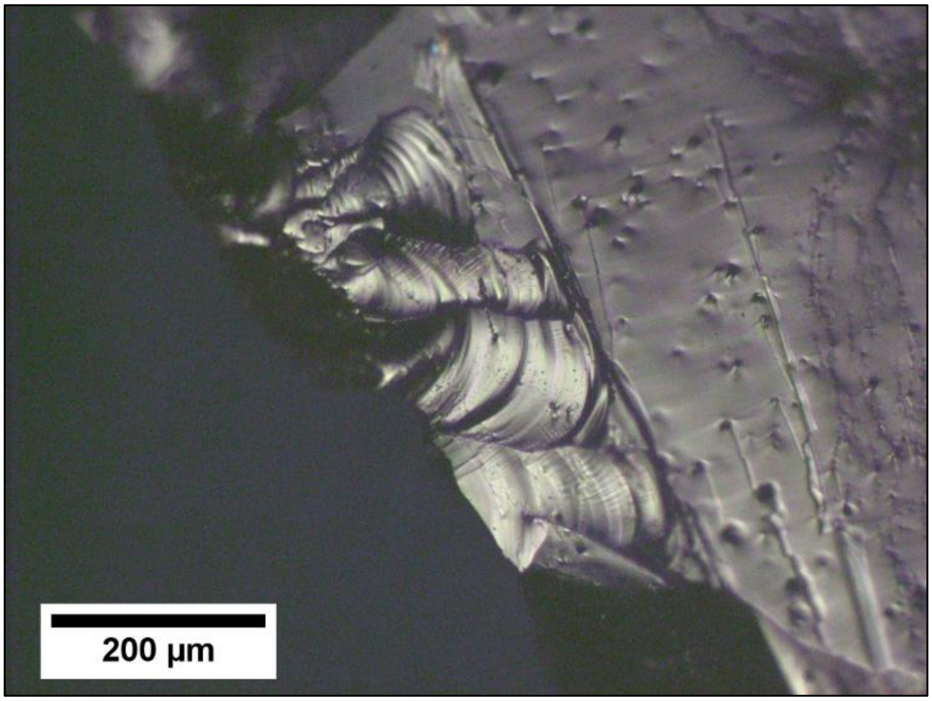


Figure 3.8. Continuous scarring on RT 11 (pp2p2).

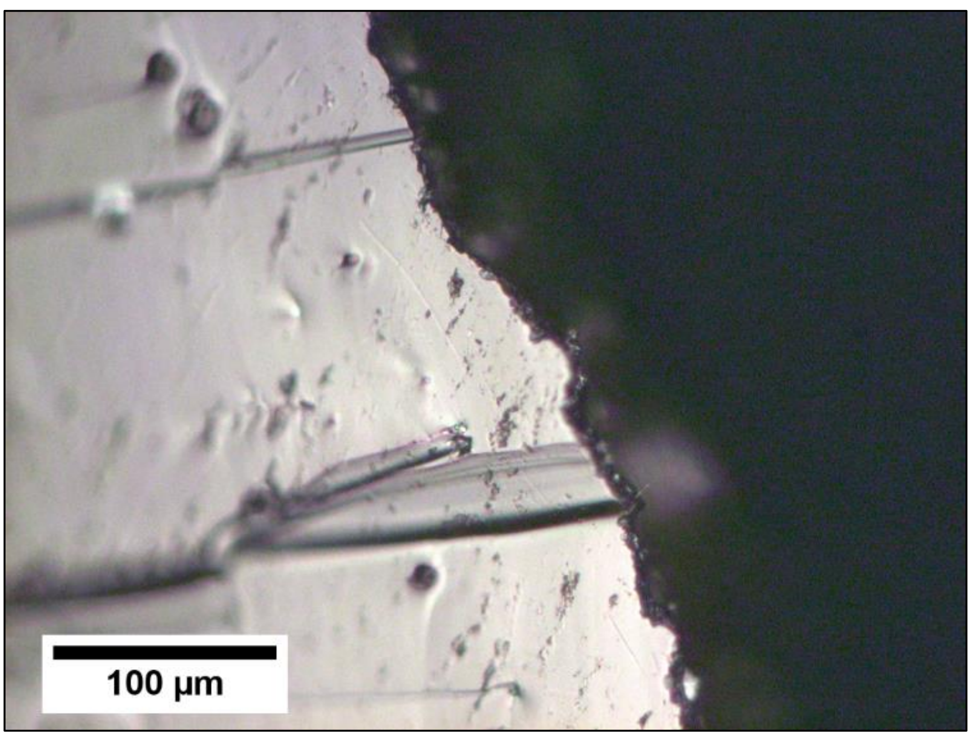


Figure 3.9. Sleek and intermittent striations; intensive edge rounding on RT 5 (pp15p1).

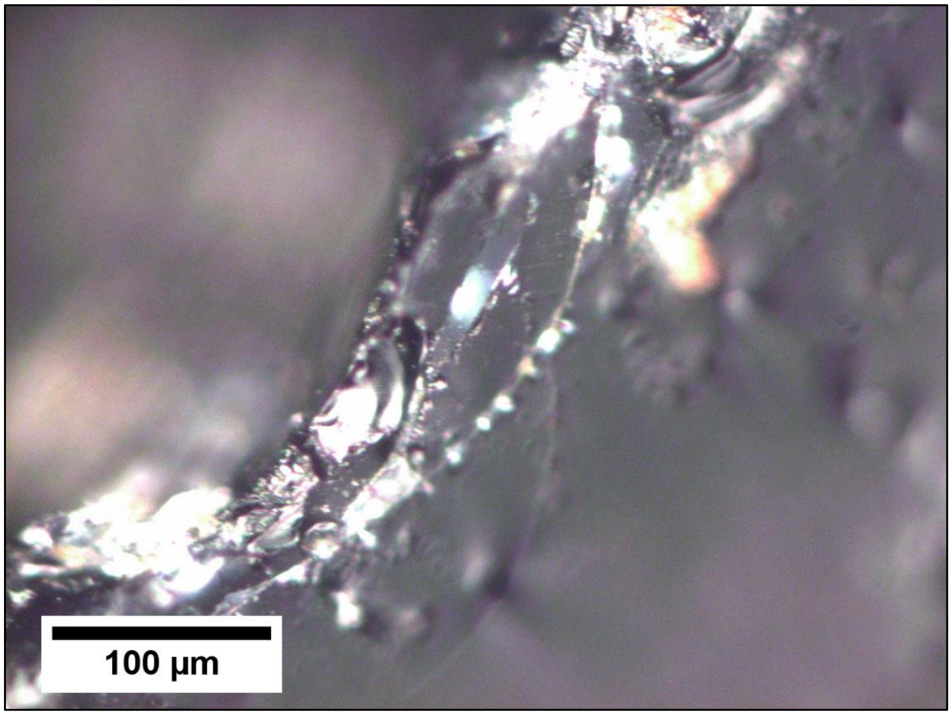


Figure 3.10. Flaked striations on RT 14 (pp1p2).

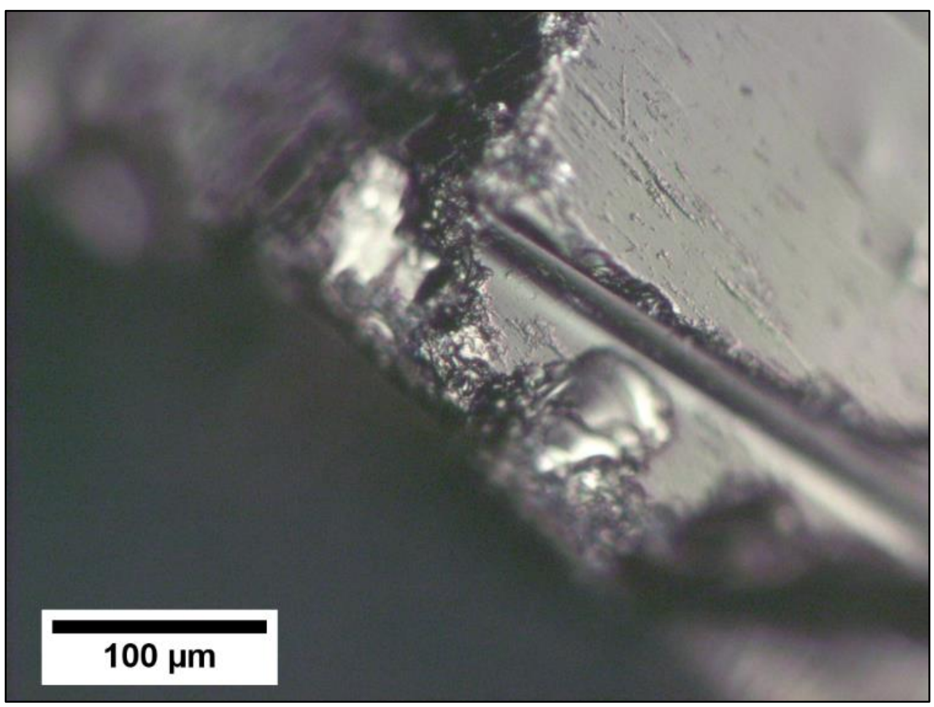


Figure 3.11. Late stage polish and parallel intermittent striations on RT 16 (pp6p2).

striations, and presence of late stage polish makes this pattern distinctive from use-wear traces created during hide processing activities. Additionally, the frequency of parallel striations of either type indicates longitudinal motion.

Meat Processing

I used RT 12 to cut meat for 40 minutes with a longitudinal motion. This task produced continuous sections of feather and step scarring, parallel sleek, rough bottom and intermittent striations, no edge rounding or polish formation, folded grainy particle residue, parallel residue band, shiny patchy residue, and small residue spots.

I used RT 13 to cut meat for 13 minutes with a longitudinal motion. This task produced continuous sections of feather scarring, perpendicular rough bottom and intermittent striations, parallel residue band, and shiny patchy residue.

I used RT 15 to cut meat for 37 minutes with a longitudinal motion. This task produced continuous sections of feather and step scarring, parallel rough bottom, intermittent, and flaked striations, no edge rounding or polish formation, folded grainy particle residue, parallel residue band, and rough patchy residues.

I used RT 17 to cut meat for 24 minutes with a longitudinal motion. This task generated areas of continuous step scarring, perpendicular sleek and rough bottom striations, flaked striations, no edge rounding or polish formation, folded grainy particle residue, and small residue spots.

Finally, I used RT 18 to cut meat for 31 minutes with a longitudinal motion. This task produced areas of continuous step scarring, parallel intermittent striations, flaked striations, medium edge rounding, stage 3 polish formation, and small residue spots.

Meat processing activities generated a distinctive set of use-wear attributes consisting of the presence of continuous feather or step scarring, the presence of rough bottom, intermittent and/or flaked striations, the low occurrence of edge rounding or polish formation, and the presence of folded grainy particle residue, a parallel residue band (Figure 3.12), patchy residue, and residue spots. These features are distinctive from carcass processing due to the low occurrence of edge rounding and polish formation, the presence of rough bottom striations, the more frequent occurrence of a residue band parallel to the working edge, and the frequent presence of all four types of residue. These features are also distinctive from hide processing due to the occurrence of continuous rather than discontinuous scarring, frequent presence of intermittent striations, and low occurrence of edge rounding and polish formation. The striation orientation for meat processing activities was less indicative of use motion than carcass and hide processing activities.

In my experimental carcass and hide processing activities, I noticed that carcass processing tools became dull more quickly than hide and meat processing tools. This point is important, because it suggests that carcass processing tasks should be amplified when they occur in conjunction with hide processing tasks. Conversely, hide processing tasks should be minimized in the same situation. Since carcass processing tools become dull more quickly than hide processing tools, processing the hides and carcasses of 10 rabbits should produce significantly more tools used on carcasses than tools used on hides. Stated another way, fewer hide processing tools may be used to process more rabbit hides, while it takes more hide processing tools to process fewer rabbit carcasses.

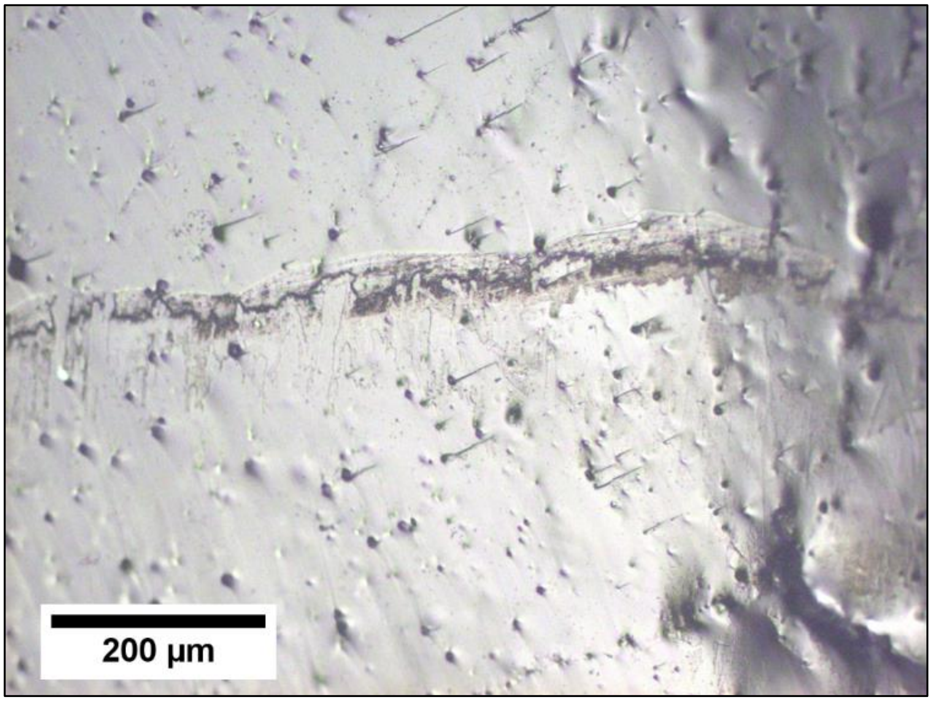


Figure 3.12. Parallel residue band on RT 12 (pp2p7).

Summary

Fully processing an animal is a continuum of worked materials and use motions. Occasionally, some replicated tools had overlapping use-wear traces, although the majority showed a set of characteristic traces when used for one processing task. These traces are distinctive enough to determine the materials with which obsidian flake tools contacted. Use-wear traces of the most recent task are often the only traces left on a tool's edge if it was used so heavily that previous use-traces were obliterated; however, if more than one tool edge was used for more than one activity, or a tool was used for more than one light task, traces of both tasks may be identified.

Hide processing traces consist of discontinuous feather and step scarring, sleek and rough bottom striations, edge rounding, early stage polish formation, folded grainy particle residue, and patchy residue. Carcass processing traces consist of continuous feather and step scarring, sleek, intermittent, and flaked striations, edge rounding, late stage polish formation, folded grainy particle residue, and patchy residues. Meat processing traces consist of continuous feather and step scarring, occasional presence of all striation types, occasional presence of edge rounding and polish formation, folded grainy particle residues, the presence of a parallel residue band, patchy residue, and residue spots. Two types of residues are present on almost all of the replicated tools: folded grainy particles and patchy residues. Additionally, striation orientation is indicative of tool use motion for hide and carcass processing activities but equivocal concerning meat processing tools. Table 3.1 summarizes the use-wear traces identified in the replicated tool assemblage. The striation orientation label indicates the most frequent striation type observed on each tool.

Table 3.1. Summary of Use-Wear Analysis of Replicated Tool Assemblage.

RT #	Processing Task	Mode of Use	Duration (minutes)	Scarring		Striations				Edge Rounding			Polish Stage				Residues			
				1	2	1	2	3	4	1	2	3	1	2	3	4	FGP	Band	Patchy	Spots
5	Carcass	Sawing	73	c		+		pl	+			+			+		+		+	+
16	Carcass	Sawing	21		c	+		pl	+		+				+		+		+	
11	Carcass	Sawing	12	c		+		pl	+			+							+	
7	Carcass	Sawing	10	c	c	pd		pl	+							+	+	+	+	
14	Carcass	Sawing	5	c	c			dg	+			+	+				+		+	+
3	Hide	Scraping	255	d	d	+	pd		+		+	+		+			+		+	+
6	Hide	Scraping	128	d	c	+	pd	+				+	+				+			
10	Hide	Scraping	7	d		+		pd	+		+	+	+				+		+	+
9	Hide	Skinning	41		d	+	+			+				+			+		+	
8	Hide	Cutting	21	c		+	pl												+	
12	Meat	Cutting	40	c	c	+	pl	+									+	+	+	+
15	Meat	Cutting	37	c	c		pd	pd	+								+	+	+	
18	Meat	Cutting	31		c			pl	+		+				+					+
17	Meat	Cutting	24		c	+	pd		+								+			+
13	Meat	Cutting	13	c			pd	pd										+	+	

Key: Scarring 1 = feathered, 2 = stepped, c = continuous, d = discontinuous; Striation 1 = sleeks, 2 = rough bottoms, 3 = intermittent, 4 = flaked, pl = parallel, pd = perpendicular, dg = diagonal; Edge Rounding 1 = slight, 2 = medium, 3 = intensive; FGP = folded grainy particle.

The Pre-Mazama Assemblage of Flake Tools

Table 3.2 presents the results of my analysis of 35 pre-Mazama flake tools from LSP-1. I assigned a tool to a processing task based on the characteristic attributes of each processing category which I previously identified using the replicated tool assemblage. If all or most of the observed use-wear attributes on a pre-Mazama flake were consistent with a processing category, I assigned the tool to that category. When a pre-Mazama tool had a majority of attributes inconsistent with any replicated processing category, I assigned the tool to an 'other' classification. This group contained all of the tools that had use-wear patterns that did not match my experimental leporid processing results.

Hide Processing Tools

Eight artifacts (733, 983, 1030, 1507, 1597, 1611, 1787, and 3342) possess attributes consistent with replicated leporid hide processing activities. The majority of replicated tools used for hide processing showed discontinuous scarring, sleek and rough bottom striations, edge rounding, early polish stages, folded grainy particle residue, and patchy residue. The striations on tools used transversely had perpendicular orientations, while striations on tools used longitudinally had parallel orientations.

Artifact 733 showed continuous feather and step scarring, sleek and parallel rough bottom striations, intensive edge rounding, stage 3 polish, folded grainy particles, patchy residues, and an unidentified residue. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the parallel striations indicate that it was used longitudinally.

Artifact 983 showed continuous step scarring, sleek and parallel rough bottom striations, intensive edge rounding, folded grainy particle residue, and unidentified residue. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the parallel striations indicate it was used longitudinally.

Artifact 1030 showed discontinuous feather scarring, sleek, perpendicular rough bottom, and flaked striations, intensive edge rounding, folded grainy particle residue, patchy residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the perpendicular striations indicate it was used transversely.

Artifact 1507 showed continuous feather scarring, sleek, perpendicular rough bottom and parallel intermittent striations, medium edge rounding, stage 3 polish, folded grainy particle residue and residue spots. Most aspects of this pattern matched replicated hide processing tools and the frequency of parallel and perpendicular striations indicate it was used both longitudinally and transversely.

Artifact 1597 showed discontinuous and continuous feather scarring, sleek, parallel and perpendicular rough bottom, and intermittent striations, intensive edge rounding, stage 2 polish, folded grainy particle residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the parallel and perpendicular striations indicate it was used both longitudinally and transversely.

Artifact 1611 showed discontinuous feather scarring, diagonal sleek striations, perpendicular rough bottom striations, intensive edge rounding, stage 4 polish, and folded grainy particle residue. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools, and the frequency of perpendicular striations indicate it was used transversely.

Artifact 1787 showed discontinuous feather scarring, sleek, perpendicular rough bottom, and flaked striations, intensive edge rounding, stage 2 polish, folded grainy particle residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the perpendicular striations indicate that it was used transversely.

Artifact 3342 showed discontinuous feather scarring, sleek, perpendicular rough bottom striations, medium edge rounding, stage 2 polish, folded grainy particle residue, patchy residue, and spot residue. Most aspects of this pattern matched the use-wear observed on the replicated hide processing tools and the perpendicular striations indicate it was used transversely.

Carcass Processing Tools

Four artifacts (856, 1737, 2446, and 2846) possess attributes consistent with the replicated tools used to process leporid carcasses. The majority of replicated carcass processing tools showed continuous feather and/or step scarring, sleek, intermittent, and flaked striations, edge rounding, late stage polish formation, folded grainy particle residue, and patchy residue.

Artifact 856 showed continuous feathered scarring, sleek and parallel intermittent striations, intensive edge rounding, stage 1 polish, folded grainy particle residue, and patchy residue. Most aspects of this pattern matched replicated carcass processing tools and the parallel striations indicate it was used longitudinally.

Artifact 1737 showed discontinuous feather scarring, sleek, perpendicular rough bottom and perpendicular intermittent striations, intensive edge rounding, stage 3 polish, patchy and spot residue, and one unidentified residue. Most aspects of this pattern matched the use-wear observed on the replicated carcass processing tools and the perpendicular striations suggest it was used transversely.

Artifact 2446 showed continuous feather scarring, sleek, parallel rough bottom, few perpendicular intermittent, and flaked striations, intensive edge rounding, stage 2 polish, folded grainy particle residue, patchy residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated carcass processing tools and the majority of parallel striations indicate it was used longitudinally.

Artifact 2846 showed continuous feather scarring, sleek, few perpendicular rough bottom, and parallel intermittent striations, intensive edge rounding, stage 3 polish, folded grainy particle residue, patchy residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated carcass processing tools and the majority of parallel intermittent striations indicates it was used longitudinally.

Meat Processing Tools

Only one artifact (2142) shows clear evidence of use for meat processing. The majority of replicated tools used to process meat showed continuous feather or step scarring, presence of rough bottom, intermittent, and flaked striations, occasional edge rounding and polish, and presence of folded grainy particle residue, parallel band residue, patchy residue, and spot residues. Artifact 2142 showed continuous step scarring, parallel sleek striations, intensive edge rounding, folded grainy particle residue, and residue spots. Most aspects of this pattern matched the use-wear observed on the replicated meat processing tools and the parallel striations suggest that it was probably used longitudinally.

Multiple Task Tools

Several tools appear to have been used for more than one type of processing based on the presence of multiple diagnostic types of wear. Four tools (78, 1375, 1393, and 2292) showed traces matching replicated carcass processing and hide processing tools.

Artifact 78 had continuous feather and step scarring, sleek striations, parallel and perpendicular rough bottom striations, intermittent and flaked striations, as well as intensive edge rounding, stage 2 polish, and patchy and unidentified residues. Most aspects of this pattern matched the use-wear observed on the replicated carcass and hide processing tools, while the parallel and perpendicular orientation of the striations indicate it was used in both a transverse and a longitudinal manner.

Artifact 1375 showed continuous feather scarring, sleek, perpendicular rough bottom and diagonal intermittent striations, intensive edge rounding, stage 2 polish, folded grainy particle residue, and residue spots. Most aspects of this pattern matched a combination of that observed on replicated carcass and hide processing tools and the perpendicular striations indicate it was used transversely.

Artifact 1393 showed discontinuous feather scarring, continuous step scarring, rough bottom and perpendicular intermittent striations, intensive edge rounding, stage 2 polish, folded grainy particle residue and patchy residue. Most aspects of this pattern matched a combination of wear attributes observed on replicated carcass and hide processing tools and the perpendicular striations indicate it was used transversely.

Artifact 2292 showed continuous and discontinuous feather scarring, sleek, parallel and perpendicular rough bottom, and intermittent striations, intensive edge rounding, stage 3 polish, folded grainy particle residue, patchy residue, and residue spots. Most aspects of this pattern matched a combination of the use-wear observed on replicated carcass and hide processing tools and the majority of parallel striations indicate it was used longitudinally.

Two tools (1958 and 2674) showed evidence of both carcass processing and meat processing. Artifact 1958 showed continuous feather scarring, sleek, perpendicular rough bottom, and parallel intermittent striations, intensive edge rounding, stage 3 polish, and patchy residue. Most aspects of this pattern matched a combination of the use-wear observed on the replicated carcass and meat processing tools and the majority of parallel striation indicates it was used longitudinally.

Artifact 2674 showed continuous and discontinuous feather scarring, continuous step scarring, sleek, perpendicular rough bottom, and parallel intermittent striations, medium edge rounding, stage 2 polish, folded grainy particle residue, a parallel residue band, and residue spots. This pattern matched a combination of the use-wear observed on the replicated carcass and meat processing tools, and the majority of parallel striations indicate it was used longitudinally.

Three tools (759, 2127, and 2455) possessed evidence of both hide and meat processing. Artifact 759 showed continuous feather and step scarring, sleek, perpendicular and parallel rough bottom, and intermittent striations, intensive edge rounding, stage 3 polish, folded grainy particle residue, a parallel residue band, and patchy residues. Most aspects of this pattern matched a combination of use-wear attributes observed on both replicated meat and hide processing and the striation orientations indicate it was used with longitudinal and transverse motions.

Artifact 2127 showed continuous feather scarring, sleek and parallel rough bottom striations, intensive edge rounding, stage 3 polish, folded grainy particle residue, and spot residue. Most aspects of this pattern matched the use-wear observed on the replicated hide and meat processing tools, and the parallel striations suggest it was used longitudinally.

Artifact 2455 showed discontinuous and continuous feather scarring, sleek, perpendicular and diagonal rough bottom, and intermittent striations, intensive edge rounding, stage 1 polish, folded grainy particle residue, residue spots, and an unidentified residue. Most aspects of this pattern matched the use-wear observed on the replicated hide and meat processing tools, and the striation orientations indicate it was used both longitudinally and transversely.

'Other' Tools

Overall, 22 tools had use-wear evidence consistent with that generated on the sample of replicated tools. Of the remaining 14 artifacts, 11 (542, 819, 1019, 1608, 1705, 1951, 1982, 2695, 2860, 3358, and 3411) had use-wear that did not match the types generated by my replicated tool sample. I did not assign tasks or use motions to these artifacts.

Artifact 524 showed continuous feather scarring, discontinuous step scarring, sleek and rough bottom striations, medium edge rounding, stage 4 polish, and no residue. This pattern did not match my replicated wear, suggesting it was used for some other activity.

Artifact 819 showed discontinuous feather scarring, rough bottom and diagonal intermittent striations, medium and intensive edge rounding, stage 4 polish, and unidentified residue. This pattern did not match my replicated tools, suggesting it was used for some other activity.

Artifact 1019 showed continuous feather scarring, sleek, perpendicular rough bottom, and perpendicular intermittent striations, intensive edge rounding, stage 4 polish, and no residue. This pattern did not match any replicated tools, suggesting it was used for some other activity.

Artifact 1608 showed continuous feather scarring, diagonal sleek striations, rough bottom striations, and intermittent striations, medium and intensive edge rounding, stage 2 polish, folded grainy particle residue, residue spots, and several unidentified residues. This pattern did not match any replicated tools, suggesting it was used for some other activity.

Artifact 1705 showed continuous feather scarring, sleek, parallel and perpendicular rough bottom striations, intensive edge rounding, stage 4 polish, folded grainy particle residue, and residue spots. This pattern did not match any replicated processing tools because of the continuous scarring and prevalence of stage 4 polish, suggesting that this tool was used for some other activity.

Artifact 1951 shows discontinuous feather and continuous step scarring, sleek and diagonal rough bottom striations, medium and intensive edge rounding, stage 4 polish, and folded grainy particle residue. This pattern did not match any replicated tools because of the presence of continuous scarring and the prevalence of stage 4 polish, suggesting it was used for some other activity.

Artifact 1982 showed discontinuous feather scarring, sleek, diagonal rough bottom, and intermittent striations, intensive edge rounding, and unidentified residue. This pattern did not match any replicated tools due to the discontinuous scarring and lack of polish formation, suggesting it was used for some other activity.

Artifact 2695 showed continuous feather and step scarring, diagonal sleek striations, medium edge rounding, stage 3 polish, patchy residue, and unidentified residue. This pattern did not match any replicated tools due to the presence of sleek striations and absence of any other striation type, suggesting that it was used for some other activity.

Artifact 2860 showed continuous feather and discontinuous step scarring, diagonal sleek striations, flaked striations, intensive edge rounding, stage 4 polish, folded grainy particle residue, patchy residue, and residue spots. This pattern did not match any replicated tools due to the presence of sleek and flake striations without the occurrence of rough bottom or intermittent striations, suggesting that it was used for some other activity.

Artifact 3358 showed discontinuous step scarring, perpendicular rough bottom striations, intensive edge rounding, stage 4 polish, and patchy residue. This pattern did not match any replicated tools due to the presence of only one striation type and stage 4 polish, suggesting this tool was used for some other activity.

Artifact 3411 showed continuous and discontinuous feather scarring, sleek, diagonal rough bottom, and parallel intermittent sleek striations, intensive edge rounding, stage 3 polish. This pattern did not match any of the replicated tools due to the lack of any residues, suggesting this tool was used for some other activity.

One tool (1630) appears to have been unused, and one tool (2427) was used too lightly to identify the processes for which it was used. Artifact 1630 showed only discontinuous feather scarring. This tool appears to have been retouched but unused after resharpening. Artifact 2427 showed discontinuous feather scarring, perpendicular rough bottom striations, folded grainy particle residue, patchy residue, and residue spots. This pattern is inconclusive as it contains only one type of striation and suggests that this tool was not used long enough to develop a pattern distinctive enough to identify the task.

Table 3.2. Summary of Use-Wear Analysis of Pre-Mazama Flake Tools.

Accession #	Scarring		Striations				Edge Rounding			Polish				Residues					Worked Material	Motion
	1	2	1	2	3	4	1	2	3	1	2	3	4	FGP	Band	Patchy	Spots	Unid.		
78	c	c	+	pl/ pd	+	+			+		+					+		+	Carcass and Hide	Longitudinal, Transverse
524	c	d	+	+				+					+						Other	-
733	c	c	+	pl					+			+		+		+		+	Hide	Longitudinal
759	c	c	+	pd/ pl	+				+			+		+	+	+			Meat and Hide	Longitudinal, Transverse
819	d			+	dg			+	+				+					+	Other	-
856	c		+		pl				+	+				+		+			Carcass	Longitudinal
983		c	+	pl					+					+				+	Hide	Longitudinal
1019	c		+	pd	pd				+				+						Other	-
1030	d		+	pd		+			+					+		+	+		Hide	Transverse
1375	c		+	pd	dg				+		+			+			+		Carcass and Hide	Transverse
1393	d	c		+	pd				+		+			+		+			Carcass and Hide	Transverse
1507	c		+	pd	pl			+				+		+			+		Hide	Longitudinal, Transverse
1597	d/c		+	pd/ pl	+				+		+			+			+		Hide	Longitudinal, Transverse
1608	c		dg	+	+			+	+		+			+			+	+	Other	-
1611	d		dg	pd					+				+	+					Hide	Transverse

Key: Scarring 1 = feathered, 2 = stepped, c = continuous, d = discontinuous; Striation 1 = sleeks, 2 = rough bottoms, 3 = intermittent, 4 = flaked, pl = parallel, pd = perpendicular, dg = diagonal; Edge Rounding 1 = slight, 2 = medium, 3 = intensive; FGP = folded grainy particle.

Accession #	Scarring		Striations				Edge Rounding			Polish				Residues					Worked Material	Motion
	1	2	1	2	3	4	1	2	3	1	2	3	4	FGP	Band	Patchy	Spots	Unid.		
1630	d																		Unused	-
1705	c		+	pd/ pl					+				+	+			+		Other	-
1737	d		+	pd	pd				+			+				+	+	+	Carcass	Transverse
1787	d		+	pd		+			+		+			+			+		Hide	Transverse
1951	d	c	+	dg				+	+				+	+					Other	-
1958	c		+	pd	pl				+			+				+			Carcass and Meat	Longitudinal
1982	d		+	dg	+				+									+	Other	-
2127	c		+	pl					+			+		+			+		Meat and Hide	Longitudinal
2142		c	pl						+					+			+		Meat	Longitudinal
2292	c/d		+	pl/ pd	+				+			+		+		+	+		Carcass and Hide	Longitudinal
2427	d			pd										+		+	+		Inconclusive	-
2446	c		+	pl	pd	+			+		+			+		+	+		Carcass	Longitudinal
2455	d/c		+	pd/ dg	+				+	+				+			+	+	Hide and Meat	Longitudinal, Transverse
2674	c/d	c	+	pd	pl			+			+			+	+		+		Carcass and Meat	Longitudinal
2695	c	c	dg					+				+				+		+	Other	-
2846	c		+	pd	pl				+			+		+		+	+		Carcass	Longitudinal
2860	c	d	dg			+			+				+	+		+	+		Other	-

Key: Scarring 1 = feathered, 2 = stepped, c = continuous, d = discontinuous; Striation 1 = sleeks, 2 = rough bottoms, 3 = intermittent, 4 = flaked, pl = parallel, pd = perpendicular, dg = diagonal; Edge Rounding 1 = slight, 2 = medium, 3 = intensive; FGP = folded grainy particle.

Accession #	Scarring		Striations				Edge Rounding			Polish				Residues					Worked Material	Motion
	1	2	1	2	3	4	1	2	3	1	2	3	4	FGP	Band	Patchy	Spots	Unid.		
3342	d		+	pd				+			+			+		+	+		Hide	Transverse
3358		d		pd					+				+			+			Other	-
3411	c/d		+	dg	pl				+			+							Other	-

Key: Scarring 1 = feathered, 2 = stepped, c = continuous, d = discontinuous; Striation 1 = sleeks, 2 = rough bottoms, 3 = intermittent, 4 = flaked, pl = parallel, pd = perpendicular, dg = diagonal; Edge Rounding 1 = slight, 2 = medium, 3 = intensive; FGP = folded grainy particle.

Summary

Of the 35 analyzed tools from the LSP-1 pre-Mazama assemblage, 22 had use-wear patterns that matched the use-wear on my experimental leporid processing tools. Eight of these tools showed use-wear patterns that suggest they were used for only hide processing tasks. Four tools had use-wear patterns that indicate they were used only for carcass processing tasks, while 4 additional tools displayed evidence of use for both carcass and hide processing activities. Only one tool showed evidence of only meat processing traces. Three tools showed evidence of use for both hide and meat processing tasks, and two tools showed evidence of both meat and carcass processing tasks. Eleven tools showed use-wear patterns unlike the replicated tool assemblage, one tool appears to have been unused, while another was not used long enough for a distinctive pattern to develop.

Artifacts used for only hide processing included two flakes used longitudinally, four flakes used transversely, and two flakes used both longitudinally and transversely. These use motions suggest that leporid hides were both scraped and cut at LSP-1. Three carcass processing tools were used longitudinally while one was used transversely, suggesting that carcasses were disarticulated and that, in one instance, bone tools may have been produced. Only one artifact was identified as used to process meat and it was used with a longitudinal motion. Tools used for carcass and hide processing include one used with both longitudinal and transverse motions, two used with transverse motions, and one used with a longitudinal motion. The two tools used for carcass and meat processing were used with longitudinal motions. Of the three tools used for hide and meat processing, two were used with both longitudinal and transverse motions and one had only evidence of longitudinal motions. I did not reconstruct the use motions of tools used for “other” or inconclusive tasks.

Processing Tasks at the LSP-1 Rockshelter

Of the 35 tools analyzed from pre-Mazama deposits at LSP-1, 63 percent (n=22) had wear that matched the leporid processing use-wear on the replicated tools, 31 percent (n=11) were used for some other task (i.e., had wear that did not match the replicated tools), 3 percent (n=1) were unused, and 3 percent (n=1) could not be tied to a particular task (Figure 3.13). Of the 22 tools used to process leporids, 18 percent (n=4) were used

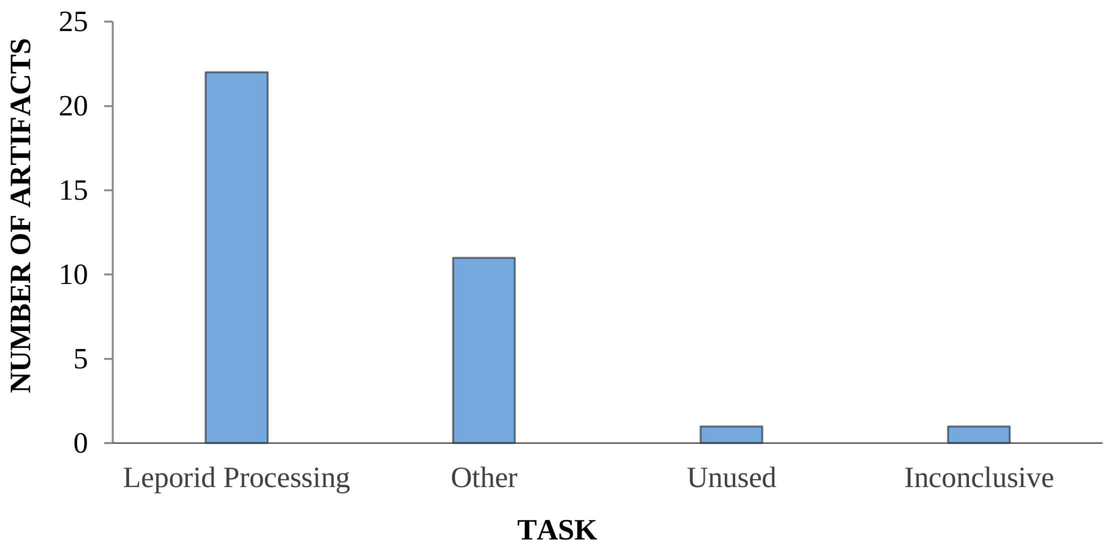


Figure 3.13. General use-wear trends in the pre-Mazama assemblage.

for carcass processing, 36 percent (n=8) were used for hide processing, and 5 percent (n=1) were used for meat processing. Eighteen percent (n=4) of the leporid processing tools had traces of both carcass and hide processing, 14 percent (n=3) had traces of hide and meat processing, while 9 percent (n=2) had traces of meat and carcass processing. These results indicate that leporid processing was a dominant stone tool processing task, but it was not the only processing task that took place in the shelter (Figure 3.14). Additionally, while all three types of leporid processing activities were represented at the site, hide processing was the dominant activity.

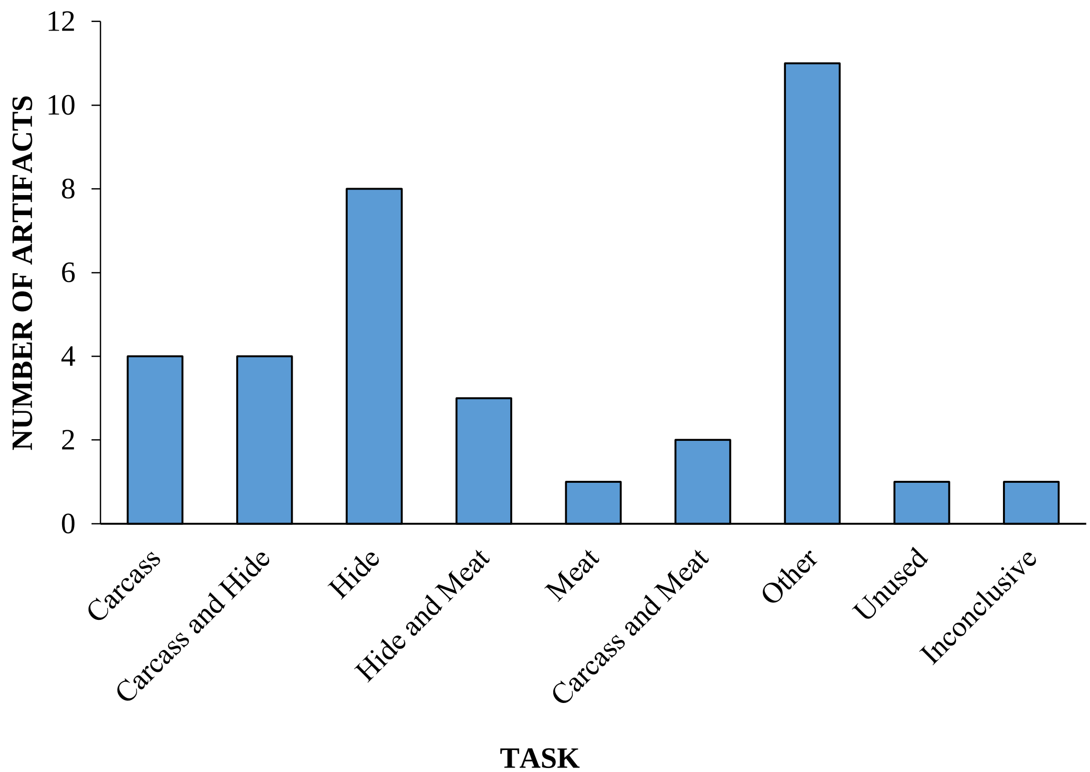


Figure 3.14. Specific use-wear categories within the pre-Mazama assemblage.

Within the tools used for hide processing (n=8), 50 percent (n=4) were used with a transverse motion (i.e., scraping) while 25 percent (n=2) were used with longitudinal motions (i.e., cutting). Twenty-five percent (n=2) were used with both longitudinal and transverse motions. The presence of longitudinal motion traces on hide working tools indicates that hides were both scraped and cut at the site.

The 11 tools in the ‘other’ category suggest that leporid processing was not the only activity that took place at LSP-1 in the Early Holocene. These tools, which make up ~30 percent of the assemblage, may have been used on dry hide, antler, plants, wood, shell, or a number of other available resources I did not include in my processing experiments. Additionally, some of these tools may have been subject to different post-depositional processes, or have reacted differently to the same post-depositional processes that affected the rest of the assemblage. Post-depositional effects include chemical and physical changes an artifact undergoes after initial deposition (Kononenko 2011). Obsidian is specifically vulnerable to these types of alterations which can alter or completely obscure true use-wear traces. Usually, post-depositional alterations are distributed in unpatterned and irregular places across the tool and therefore are not usually confused with use-wear. However, it is possible that some of these traces, such as abrasion patches or striations can occur near the edge and interfere with use-wear analysis. Chemical alterations such as pits etched into the surface can also obfuscate or obliterate use-wear evidence (Kononenko 2011). The ‘other’ category likely contains a combination of both tools used on untested materials as well as some with altered use-wear traces due to post-depositional processes.

Summary

In this chapter I presented the results of the use-wear analysis of the replicated tool sample, which served to identify diagnostic attributes for three activity categories: (1) hide processing; (2) carcass processing; and (3) meat processing. I described the use-wear traces identified on each replicated tool as well as the most common use-wear attributes of the tools used for each activity category. Armed with that knowledge, I examined the pre-Mazama flake tool assemblage from LSP-1 and identified the type(s) of activities for which they were used. In the next chapter, I compare my results to the expectations for the two hypotheses laid out earlier in my thesis and consider them within the broader context of Paleoindian lifeways.

CHAPTER 4

DISCUSSION

In this chapter, I interpret the use-wear results reported in Chapter 3 and evaluate two hypotheses regarding resource processing at LSP-1: (1) occupants used the site to remove low utility portions of leporid carcasses before transporting them elsewhere; and (2) occupants used the site to fully process leporid carcasses and prepare hides. To test these hypotheses, I review the different processing categories and types of tool use represented in the pre-Mazama flake tool assemblage from LSP-1. I discuss the implications of my results within the broader framework of recent models of late Paleoindian land use in the region.

Pre-Mazama Processing Tasks at the LSP-1 Rockshelter

The results of my use-wear analysis suggest that hide processing was a major activity at LSP-1 during the Early Holocene. The consistency in the types of wear generated on the replicated tools and the pre-Mazama flake tools, coupled with the abundance of leporid remains deposited by humans and paucity of artiodactyls in the faunal assemblage (Pellegrini 2014), suggest that small mammals were the main taxa processed. Although the replicated tools were used only on leporids, the types of use-wear I observed are not specific to taxa. I designed my expectations based on data from other researchers (e.g., Hurcombe 1992; Kononenko 2011) who generally classified meat, hide, and bone of any mammal type into these categories. I suspect that processing animals of similar size would show similar wear patterns, while butchering larger animals would result in more intensive use-wear and would likely require larger tools, but still display similar overall use-wear patterns within each processing category.

Hide processing tools were the most abundant type of leporid processing tools in the pre-Mazama assemblage. Eight tools were used only for hide processing, including tools used in a transverse motion for scraping as well as tools used with a longitudinal motion indicative of cutting. Two tools were used in both directions. Only four tools were used for only carcass processing tasks. Since hide processing tools can be used longer than carcass processing tools, these results suggest that significantly more hide processing than carcass processing took place. Ethnographic evidence shows that one of the first steps in rabbit skin blanket production includes cutting the hides into long strips (Kelly 1932:136; Wheat 1967:76). The hide processing traces on the pre-Mazama LSP-1 assemblage clearly indicate that leporid hides were prepared for rabbit skin blanket manufacture since both hide scraping and hide cutting tasks are represented. While use-wear analysis provides mainly task specific data that can be difficult to tie to broader activities that took place in the past, I think the combination of tasks indicated in the hide processing category can be confidently tied to hide preparation for rabbit skin blanket production activities.

The oldest rabbit skin blanket in the Great Basin comes from Gypsum Cave, in southern Nevada, dated by Jennings (1964) to ~12,500 cal BP by conventional dating methods (Hedges 1973). A more recently dated rabbit skin blanket returned a date of ~10,600 cal BP at Spirit Cave, NV where Burial #2 (the Spirit Cave Mummy) was interred with a woven rabbit skin blanket/robe (Tuohy and Dansie 1997). Additionally, recent excavations at the Paisley Caves produced 2 cm-wide strips of leporid hide in the Botanical Lens of Cave 2, which date between ~10,800 cal BP and ~12,600 cal BP (Jenkins et al. 2013). Jenkins and colleagues have interpreted these strips as possible evidence for rabbit skin blanket manufacture. If they are correct, then rabbit skin blankets may have a greater antiquity in the northern Great Basin than in western Nevada and may be coeval with the Gypsum Cave specimen. Unfortunately, LSP-1 has poorer organic preservation than either Spirit Cave or the Paisley Caves and no leporid hides were recovered there. Despite this fact, the use-wear on the LSP-1 flake tools is consistent with that generated by leporid hide processing, suggesting that rabbit skin blanket material preparation and/or production occurred at the site.

Four tools possessed only evidence of carcass processing; of those, three were used with longitudinal motions indicating cutting/sawing and one was used with a transverse motion. This evidence indicates that the tools were used to disarticulate carcasses, an activity that is reflected in the faunal assemblage by cutmarks on some leporid elements (Pellegrini 2014). Additionally, the one flake tool used transversely may have been used to manufacture bone products. Ethnographically, leporid bone was used to make fishhooks, tattoo needles, beads, and septum pins by Northern Paiute groups (Fowler and Bath 1981; Kelly 1934; Riddell 1960). One leporid long bone needle/pin was identified in the LSP-1 faunal assemblage (Pellegrini 2014), further suggesting that leporid bone tools were made and used by the occupants of the site.

One tool showed evidence of only meat processing and was used with a longitudinal motion for cutting. This evidence suggests that deboning and meat cutting occurred at the site, likely as part of food preparation activities. The presence of burned and polished leporid elements in the LSP-1 faunal assemblage also indicate that some leporids were consumed on-site (Pellegrini 2014). Additionally, cutmarks on some axial elements in the leporid assemblage indicate that defleshing bone (i.e., deboning meat) occurred at LSP-1 (Pellegrini 2014).

Nine tools showed evidence of more than one processing task. Four tools were used for carcass and hide processing tasks, reinforcing the likelihood that these were the main leporid processing activities conducted at the site. Three tools were used for both hide and meat processing, and two tools were used for both carcass and meat processing. Tools used for more than one processing task comprise ~40 percent of the sample analyzed, suggesting that multiple processing activities were common and further supporting the conclusion that leporid carcasses were fully processed at the site.

Evaluating the Hypotheses

Hypothesis 1

Hypothesis 1 states that Early Holocene groups used LSP-1 primarily to field process leporid carcasses for transport away from the site to another location. Such behavior should create a lithic assemblage primarily used to remove the lower limbs and skulls (i.e., lower utility portions) from leporid carcasses, as well as a few tools used for skinning and possibly preparing meat to be consumed immediately (Schmitt and Lupo 2005:169). Such an assemblage should be dominated by evidence of tools used to disarticulate bone (i.e., carcass processing), with other processing tasks minimally represented.

The results of my use-wear analysis do not support Hypothesis 1. The artifact assemblage is dominated by leporid processing tools; however, the most well-represented task is hide processing, not carcass processing. In the replicated assemblage, carcass processing tools became dull more quickly than tools used for any other processing task. If carcass processing was the main activity at the site, then this task should have dominated the use-wear evidence. Clearly, it does not. It is conceivable that other types of tools - for example, bifacial projectile points - were used to process carcasses. If this was the case, then my analysis of flake tools would not identify traces of that activity. I do not think this was the case, however, as experiments conducted by Goodrich (2013) indicate that unmodified flake tools are far more efficient for butchering small game than bifacial tools including projectile points. The predominance of hide processing tools in the flake tool assemblage indicates that hide processing tasks represented a considerable portion of the activities conducted at the site, directly contradicting the expectations of Hypothesis 1. Additionally, the relatively high number of tools used for tasks other than leporid processing (~30 percent of the sample) also indicate that Hypothesis 1 should be rejected.

Furthermore, despite Schmitt and Lupo's (2005) interpretation of the Camels Back Cave assemblage as a field processing location, central place foraging models suggest that this may be an anomaly. According to Bettinger et al. (1997:888), field processing should only occur when it "decreases the amount of time it takes to transport useful material to the central place." In the case of jackrabbits, ethnographic evidence suggests that the complete carcass was consumed (Wheat 1967:14) and the importance of rabbit hide bears repeating (Wheat 1967:74). The ethnographic data suggests that the majority of the animal was useful and therefore rabbits were unlikely to have undergone intensive field processing. Most calculations of jackrabbit utility include only cleaned meat weight and ignore the utility of the hide (e.g., Jobson 1986; Simms 1998:68), thereby underestimating the usefulness of the resource as a whole by focusing only on caloric utility. Finally, the ethnographic accounts of rabbit drives indicate that rabbits were skinned and cleaned at a central camp after the conclusion of the hunt, rather than in the field (Wheat 1967:14).

An exception to this meat-focused trend is Schmidt's (1999) interpretation of the Five Feature Site in southeastern Arizona. This site consists of an assemblage of burned portions of lower jackrabbit hind limb elements from at least 75 individuals. This assemblage lacks almost every other leporid skeletal element. The distal portions of the tibiae and radii had spiral (i.e., fresh) breaks prior to being burned. Schmidt (1999) interprets this assemblage as evidence of a communal rabbit drive where jackrabbits were processed by snapping the lower hind leg, using the foot as a fulcrum, and discarding this portion which contains the least amount of meat. She suggests that the site represents "intensive initial processing of jackrabbits, perhaps skinning or hide preparation" (Schmidt 1999:113) after a communal rabbit drive, rather than field processing the carcasses for transport.

Hypothesis 2

The second hypothesis states that Early Holocene groups fully processed leporid carcasses and hides while occupying LSP-1. These activities should produce a flake tool assemblage primarily reflecting carcass and hide processing, with some meat processing. I also expect some of the tools to have been used on other materials not included in my use-wear analysis.

The results of my analysis support Hypothesis 2. Approximately 60 percent of analyzed tools showed use-wear traces matching those on the replicated tools used for leporid processing. The most common use of these tools was hide processing, with carcass processing also well-represented. Just under half of the processing tools in the pre-Mazama deposits at LSP-1 were used for two tasks, further suggesting that the occupants fully processed leporids brought to the shelter, rather than performing a single task such as removing lower-utility portions. Additionally, ~30 percent of analyzed tools bore use-wear traces that did not match the traces identified on the replicated tools, suggesting that they were used for a purpose other than leporid processing.

The abundance of ground stone tools in the pre-Mazama LSP-1 assemblage offers additional support for Hypothesis 2. The pre-Mazama assemblage included 82 complete or fragmented ground stone tools (Table 4.1). Although these tools are more common in the upper (i.e., later) levels of the pre-Mazama deposits, they are still present in small quantities in the lower (i.e., earlier) levels. These tools suggest that plant foods may have been processed at the site beginning with the earliest occupations ~9,650 cal BP. Macrobotanical remains from Early Holocene features and deposits within a column

Table 4.1. Ground Stone Tools from Pre-Mazama Deposits at LSP-1 by 5-cm Level.

cmbd	Intact	Fragment	Total
101-106	11	2	13
106-111	4	7	11
111-116	7	6	13
116-121	5	6	11
121-126	3	11	14
126-131	1	4	5
131-136	1	2	3
136-141	0	4	4
141-146	2	6	8
Total	**34**	**48**	**82**

sample reveal the use of plant foods including cheno-ams, small grass seeds, tansymustard, Great Basin wildrye, and cattail seeds (Kennedy and Smith 2016). These plants were available between early spring and early fall and ethnographic accounts indicate that they were commonly dried and stored for winter use. Seeds at LSP-1 were likely harvested elsewhere and brought to the site as part of the occupants' winter provisions. The ground stone tools may also have been used to process leporids as ethnographic accounts indicate that dried rabbit carcasses were often ground into a powder by the *Kidütökadö* and the western Nevada Northern Paiute bands (Kelly 1932:94; Wheat 1967:14). Without a thorough analysis of the ground stone tools from the site, this remains an unevaluated possibility.

Other taxa represented in the pre-Mazama faunal sample include bobcat, kit fox, and yellow-bellied marmot mandibles with cutmarks suggestive of skinning, as well as two fragments of a mule deer femur broken in a way that suggests marrow extraction occurred (Pellegrini 2014). These remains reveal that although leporids were clearly the main focus of hide processing activities due to their sheer abundance at LSP-1, other fur-bearing animals were also processed at the site. The presence of only two mule deer long bone fragments suggests that the animal was killed and butchered elsewhere and brought to the shelter as stored calories rather than a complete carcass. Binford (1977) observed Nunamiut hunting parties pack marrow bones on trips taken in the autumn and winter because they are less likely to spoil in the cold; this may have occurred at LSP-1 as well.

Geochemical characterization of obsidian tools from the pre-Mazama deposits indicates that many of the discarded tools came from sources >80 km from the site. Additionally, the majority of the debitage at LSP-1 consists of small retouch flakes, indicating that tool maintenance and repair was more common than formal tool manufacture (Smith et al. 2012). Together, these trends indicate that the occupants of LSP-1 used the site for short, repeated stays - a possibility that is reflected in gaps in the calibrated age ranges of Early Holocene radiocarbon dates from the site (see Figure 2.6).

The trend of tool maintenance and repair as the primary lithic reduction activity is similar to both Gatecliff Shelter and BER. The Gatecliff Shelter Horizon 14 lithic assemblage consisted of very small debitage, finished tools, occasional primary reduction flakes, and a single flake tool (Thomas 1983:451). This evidence, along with the faunal remains and hearth feature placement, suggests that the assemblage represents multiple occupations for the primary purpose of "short-term bighorn procurement, field butchering, and transport" of high utility carcass portions (Thomas 1983:454-455). At BER, the predominance of secondary lithic reduction indicates that the occupants transported finished tools produced elsewhere to use during their stay at the shelter (Goebel 2007). Moreover, Goebel (2007:184) suggests that this evidence supports "relatively short, focused stays" at the site. With the addition of faunal and floral analyses from BER, it seems the occupants focused on a range of resources during their stay (Hockett 2007; Rhode and Louderback 2007). Additionally, flake tools made up almost 50 percent of the flaked stone tool assemblage at BER (Goebel 2007). Over half of the LSP-1 pre-Mazama lithic tool assemblage is comprised of flake tools, which is similar to the BER assemblage but different from the Gatecliff Shelter assemblage. The high frequency of flake tools at both LSP-1 and BER attests to the range of activities conducted at both sites.

Approximately 30 percent of the analyzed flake tools from the pre-Mazama deposits did not contain use-wear traces consistent with those present on the replicated tools used to process leporids. These tools with traces of “other” use-wear show no clear clustering or spatial separation from leporid processing tools; both groups seem to have been discarded together (Figure 4.1). Although additional use-wear analyses using replicated tools for a wider range of tasks on more material types may help to identify what those tools were used for, they are beyond the scope of this thesis.

Implications

Hypothesis 1 is based largely on the types and frequencies of taxa and elements in the LSP-1 faunal assemblage reported by Pellegrini (2014). Those data, and similar data from Camels Back Cave in western Utah (Schmitt et al. 2002; Schmitt and Madsen 2005), suggest that those sites represent task-specific occupations similar to Binford’s (1980) notion of logistical field camps. In short, they have been interpreted as places some distance from residential camps where small groups procured and field-processed resources before transporting them home. Conversely, Hypothesis 2 - that leporids were captured, processed, consumed, and converted into clothing or other products at LSP-1 during visits in which a wider range of activities took place - is similar to the type of occupations that researchers have argued occurred at the Paisley Caves (Jenkins et al. 2013) and BER (Goebel 2007; Hockett 2007). At those sites, Early Holocene groups appear to have performed a range of activities such as carcass processing, hide processing, large and small mammal bone marrow extraction, and plant food processing and consumption (Hockett 2007; Jenkins et al. 2013; Rhode and Louderback 2007). In both cases, Goebel (2007) and Jenkins et al. (2013) suggest that occupations were by small residential groups or used as home bases, not by task-specific parties as Thomas (1983:454) argues was the case at Gatecliff Shelter. This TP/EH type of occupation is closer to small residential bases envisioned by Binford (1980). While both residential bases and field camps as well as residential and logistical mobility strategies exist as a continuum and rarely play out perfectly in archaeological cases, they are nevertheless useful for understanding why and perhaps how prehistoric groups used the landscape.

In the northern Great Basin - specifically, Warner Valley - Cannon et al. (1990) proposed a model of seasonal transhumance focused on wetland occupation in the winter and upland occupation in the summer. This model is an expansion of Weide’s (1968, 1974) earlier marshside adaptation model, which suggested that groups in the northern Great Basin mainly exploited wetland resources, with some use of plants and small mammals in the foothills and only occasional use of the uplands for hunting large

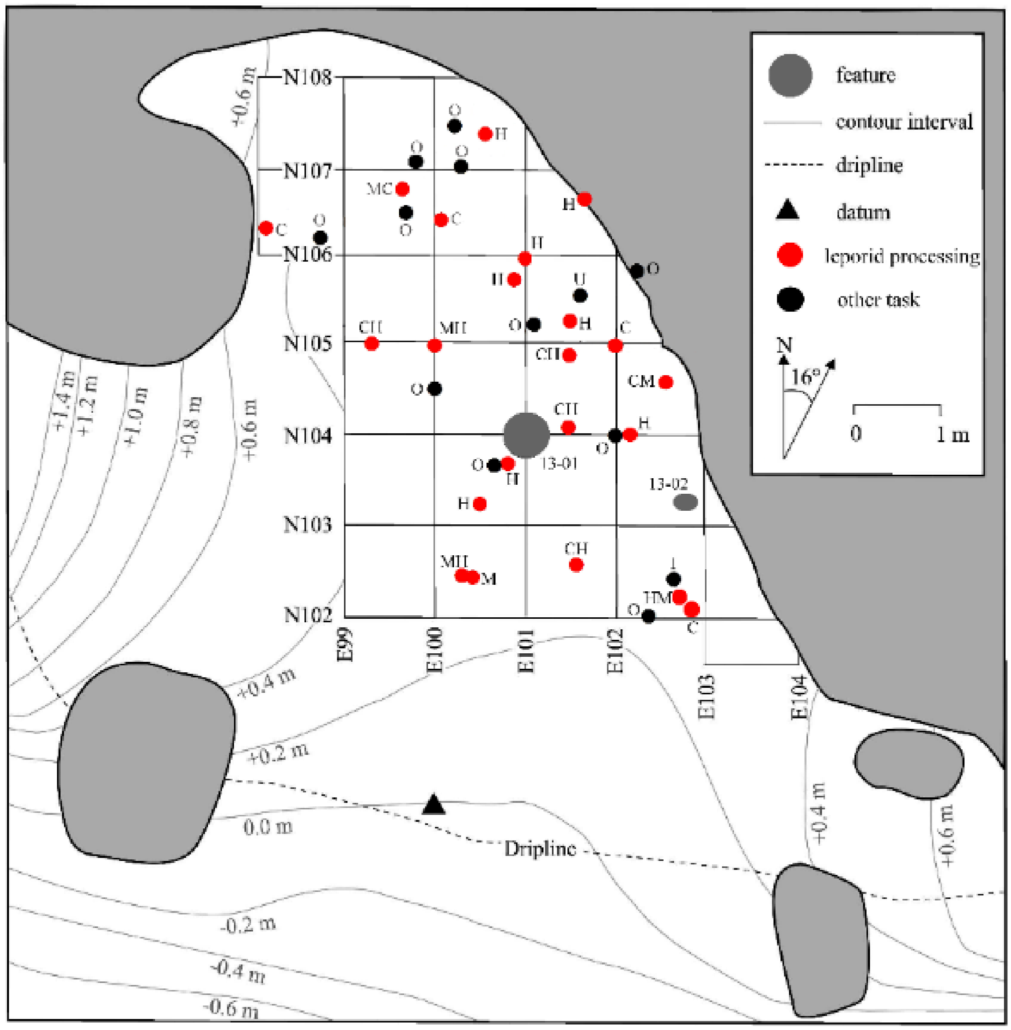


Figure 4.1. Planview map of leporid processing tools and 'other' processing tools. O = other; C = carcass processing; H = hide processing; M = meat processing; I = indeterminate.

mammals. Cannon et al. (1990) and Ricks (1995) expanded this model to include a heavier focus on upland resources based on additional survey and site testing data. They proposed that for the last 7,000 years, groups acquired substantial edible plants from the upland back-slopes that only became available in the spring and summer. Recent work by

Middleton et al. (2014) has yet again expanded this model deeper into the past and suggested that this same type of settlement strategy was in place during the TP/EH.

When considered together with the results of other studies of the LSP-1 record (e.g., Kennedy and Smith 2016; Pellegrini 2014; Smith et al. 2012), my results suggest that a range of activities took place during repeated short-term occupations beginning in the Early Holocene. Small groups, probably family or household units, likely used the shelter in the late fall/early winter while making preparations for the harsh season ahead. They brought with them provisions (e.g., seeds, large game meat/bone, formal tools) procured elsewhere and conducted various activities including tool repair and maintenance, some plant processing activities, leporid carcass disarticulation, meat processing, and hide preparation for rabbit skin blanket production. Based on gaps in the Early Holocene radiocarbon sequence (Figure 2.6), limited hearth features, and the relatively low density of lithic artifacts (Smith et al. 2012; Smith et al. 2016), these stays were brief. These findings lend support to the seasonal transhumance model proposed by Cannon et al. (1990) and Ricks (1995) for the northern Great Basin.

Furthermore, recent research in Warner Valley by Smith et al. (2015) supports Weide's (1975) interpretation of the environmental history of the area. By ~9,650 cal BP, Lake Warner had receded southward, leaving the northern valley desiccated (Smith et al. 2015). These conditions would have fostered an expansion of jackrabbit populations, who prefer open desert habitats with enough space to outrun predators (Schmitt et al. 2002). Stratum VI (Figure 2.4) is very fine silty aeolian sand which probably blew into the shelter after the lake receded and before the sediment in the valley bottom stabilized as vegetation increased. This stratum underlies Stratum V, which contains the majority of the occupation debris at the site. Based on the evidence from LSP-1, groups in the area began focusing more on leporid resources as wetlands disappeared and groups throughout the region adapted to the new climate regime of the Holocene. The Buffalo Flats sites in nearby Christmas Valley (Oetting 1994) show a similar trend in changing resource focus to that suggested in Warner Valley. As leporids became more abundant on the drying landscape, groups began focusing more heavily on small game. Similarly, many of the sites that Pinson (2007) examined reflect a greater focus on leporids than on artiodactyls. Evidence from those sites and the new data from LSP-1 suggest that leporid exploitation in the fall/winter months was an important aspect of seasonal mobility and should be incorporated into current and future models of late Paleoindian adaptation in the northern Great Basin.

CHAPTER 5

CONCLUSIONS

Summary of Research

Paleoindian resource processing strategies are not well-understood due to poor preservation at the majority of TP/EH sites. A few well-preserved cave and rockshelter sites such as BER in eastern Nevada (Hockett 2007) and the Paisley Caves in Oregon (Jenkins et al. 2013) provide some insight into the resource processing activities of the region's early occupants. Those sites show evidence of large and small mammal bone marrow extraction, hide preparation, and seed consumption. Few other sites provide such fine-grained information about resource processing from the TP/EH. More abundant evidence comes from later sites such as Gatecliff Shelter in central Nevada (Thomas 1983) and Camels Back Cave in eastern Utah (Schmitt et al. 2002). Those Middle Holocene sites contain evidence of resource procurement and processing strategies focused on preparing small and large game carcasses for transport.

The frequencies of leporid elements present in terminal Early Holocene deposits at LSP-1 are similar to those present in the Middle Holocene deposits at Camels Back Cave, where occupants briefly used the cave to field process leporids likely procured through mass capture techniques and transported high utility carcass portions away from the site (Schmitt and Lupo 2005). Pellegrini (2014) analyzed a sample of the faunal remains from LSP-1 and suggested that the site occupants used the shelter in a similar manner. However, the LSP-1 pre-Mazama lithic assemblage has a much higher percentage of flake tools than the lithic assemblage at Camels Back Cave, suggesting that more varied activities may have taken place. Evidence from other TP/EH sites (e.g., Paisley Caves [Jenkins et al. 2013], Bonneville Estates Rockshelter [Hockett 2007]) suggest an alternative possibility is that the occupants of LSP-1 conducted various activities and fully processed leporid carcasses including hides. If the occupants did conduct these activities, then the direct evidence (i.e., the hides themselves) did not preserve due to conditions within the shelter. Fortunately, indirect evidence can be analyzed through use-wear analysis of the stone tools used to perform these tasks. The pre-Mazama flake tools from LSP-1 provide an opportunity for more high-resolution data about resource processing decisions by Early Holocene groups.

Use-wear analysis can be used to examine unpreserved perishable technologies and find evidence for the production of such items. I designed a replicative experiment intended to provide a comparative collection of tools used for different leporid processing tasks. I replicated, unmodified obsidian flake tools from a nearby toolstone source location represented in the pre-Mazama lithic assemblage at LSP-1. I used these replicated tools to butcher domestic, free-range meat rabbits of comparable size to the black-tailed jackrabbits found throughout the Great Basin. I used replicated tools to process rabbit hides, carcasses, and meat. Replicated tasks included scraping and cutting hide, disarticulating carcasses, deboning meat, and cutting meat for varying lengths of time with a focus on task completion.

By analyzing the replicated tool collection, I isolated use-wear variables characteristic of each processing task and used these variables to interpret the use-wear visible on the flake tools from LSP-1. The pre-Mazama flake tool assemblage included 22 tools with use-wear similar to the use-wear on the replicated tools used for leporid processing and 11 tools with use-wear unlike the replicated tools. Eight artifacts showed evidence of only hide processing, four artifacts possessed only carcass processing use-wear, while one artifact retained evidence of only meat processing. Four tools displayed both carcass and hide processing use-wear, two tools had both carcass processing and meat processing use-wear, and three tools exhibited both hide processing and meat processing use-wear. Two tools were unused or too lightly used to identify a specific task. The most common leporid processing task represented in the assemblage was hide processing, with carcass processing the second most represented task.

I used these results to evaluate two hypotheses: (1) the main activity conducted at LSP-1 was the removal of lower utility parts of leporid carcasses portions prior to transport; and (2) visitors to LSP-1 conducted various activities, such as leporid hide and carcass processing. As noted above, pre-Mazama flake tools from LSP-1 displayed evidence of various activities including leporid hide, carcass, and meat processing. The hide processing tools indicate that leporid hides were prepared for rabbit skin blanket production, while the other artifacts indicate that bone tool production, meat preparation, and other unidentified tasks also took place at the shelter.

Based on these results, I rejected Hypothesis 1. My results support Hypothesis 2: leporid carcasses and hides were fully processed at the site during Early Holocene occupations. This hypothesis is further supported by several lines of evidence: (1) the abundance of ground stone tools in the assemblage indicating plant processing; (2) macrobotanical remains indicating use of stored provisions (Kennedy and Smith 2016);

(3) the presence of other taxa in the faunal assemblage suggesting occupants processed other fur-bearing animals in addition to leporids (Pellegrini 2014); (4) and the lithic assemblage, which has a wide range of raw material types and minimal detritus from primary tool production (Smith et al. 2012).

Ethnographic information provides additional support for my interpretations of the use-wear data. As outlined in Chapter 1, LSP-1 is located within *Kidütökadö* territory, an area that spanned over 8,000 km^2 and included southcentral Oregon, northeastern California, and northwestern Nevada (Stewart 1939). For the *Kidütökadö* and other groups, rabbits were valued as a source of food, warmth in the form of rabbit skin blankets, raw materials for tool and ornament production, and social interaction via communal rabbit drives. The *Kidütökadö* held communal rabbit drives using nets during the winter and dried and stored whole rabbit carcasses. Often, they dried the axial portions of rabbit carcasses and ground them into a powder to make soup (Kelly 1932:94). Rabbit hides were used to produce rabbit skin blankets and robes (Kelly 1932). Each hide was cut into a long strip, doubled together so the fur was exposed on both sides, and woven together into a large, warm covering (Wheat 1967). Other products were made from rabbit bones including fishhooks, spoons, tattoo needles, beads, and pins (Fowler and Bath 1981; Kelly 1934; Riddell 1960; Stewart 1939).

The abundance of hide processing tools in the pre-Mazama tool assemblage and evidence of hide scraping as well as hide cutting suggests that leporid hides were prepared for rabbit skin blanket/robe production, which may have occurred at the site. As outlined earlier, similar evidence for rabbit skin blanket/robe production has been observed at other TP/EH sites in the region (e.g., Spirit Cave and the Paisley Caves), suggesting that late Paleoindians may have routinely made clothing from leporid hides. Other tools in the LSP-1 assemblage suggest that activities including carcass disarticulation, bone tool manufacture, and leporid meat preparation for consumption also occurred there during the Early Holocene.

Conclusion

My study, along with others (e.g., Kennedy and Smith 2016; Pellegrini 2014; Smith et al. 2012; Smith et al. 2016), suggests that visitors stopped at LSP-1 primarily during the fall/early winter to repair, replace, or fabricate fur products and left with a supply of leporid carcasses. During their occupations, they disarticulated leporid carcasses, processed meat, prepared hides, repaired and maintained obsidian tools, and processed plants. They used some stored resources (e.g., seeds, large game meat/bone) during their stays and used the obsidian nodules available within the walls of the shelter to produce expedient tools. The calibrated radiocarbon date ranges suggest that there were four main periods of occupation between ~9,735 and 8,021 cal BP.

The types of occupation suggested by the results of various LSP-1 studies fit within the model of seasonal transhumance model developed by Cannon et al. (1990) and Ricks (1995) for the northern Great Basin. Again, they have argued that groups in Warner Valley and other nearby basins focused on valley-bottom wetland resources in the winter and moved to the uplands to hunt large game and harvest plant resources in the summer. This pattern, in which rabbits and hares apparently figured prominently, may also be reflected elsewhere in the northern Great Basin, where both local (e.g., Oetting 1994) and regional (e.g., Pinson 2007) studies of late Paleoindian subsistence data highlight the importance of leporids to early groups. Those earlier studies in conjunction with the results from LSP-1 suggest that leporid exploitation for food and fur has a long history in the northern Great Basin and that leporid procurement should be included as a critical part of seasonal mobility models for the region.

REFERENCES CITED

Aoyama, Kazuo
1995 Microwear Analysis in the Southeast Maya Lowlands: Two Case Studies at Copan, Honduras. *Latin American Antiquity* 6(2):129-144.

Ascher, Robert
1961 Experimental Archaeology. *American Anthropologist* 63(4):793-816.

Bamforth, Douglas B., George R. Burns, and Craig Woodman
1990 Ambiguous Use Traces and Blind Test Results: New Data. *Journal of Archaeological Science* 17:413-430.

Beck, Charlotte, and George T. Jones
2009 *The Archaeology of the Eastern Nevada Paleoarchaic, Part 1: The Sunshine Locality*. University of Utah Anthropological Papers No. 126, Salt Lake City.

Bettinger, Robert L, Ripan Malhi, and Helen McCarthy
1997 Central Place Models of Acorn and Mussel Processing. *Journal of Archaeological Science* 24(10):887-899.

Binford, Lewis R.
1977 Forty-Seven Trips: A Case Study in the Character of Archaeological Formation Processes. In *Stone Tools as Cultural Markers*, edited by Richard V. S. Wright, pp. 24-36. Australian Institute of Aboriginal Studies, Canberra.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.

Bordes, Francois
1969 Reflections on Typology and Technology in the Palaeolithic. *Arctic Anthropology* 6(1):1-21.

Cannon, William J., C. Cliff Creger, Don D. Fowler, Eugene M. Hattori, and Mary Ricks
1990 Wetlands and Uplands Settlement-Subsistence Model for Warner Valley, OR. In *Wetland Adaptations in the Great Basin*, edited by Joel C. Janetski and David B. Madsen, pp. 173-182. Museum of Peoples and Cultures, Occasional Papers No. 1, Brigham Young University, Provo, Utah.

Collins, Michael B.
1993 Comprehensive Lithic Studies: Context, Technology, Style, Attrition, Breakage, Use-Wear and Organic Residues. *Lithic Technology* 18(1/2):87-94.

Curwen, E. C.

1935 Agriculture and the Flint Sickle in Palestine. *Antiquity* 9:62-66.

Darris, Dale and Amy Bartow
2006 *Plant Fact Sheet for Spike Bentgrass (Agrostis exarata)*. USDA Natural Resources Conservation Service, Plant Materials Center, Corvallis, Oregon.

Duke, Daron
2015 Haskett Spear Weaponry and Protein-Residue Evidence of Proboscidean Hunting in the Great Salt Lake Desert, Utah. *Paleoamerica* 1(1):109-112.

Duke, Daron G., and D. Craig Young
2007 Episodic Permanence in Paleoarchaic Basin Selection and Settlement. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 123-38. University of Utah Press, Salt Lake City.

Eiselt, B. Sunday
1997 *Defining Ethnicity in Warner Valley: An Analysis of House and Home*. Department of Anthropology Technical Report 97-2. University of Nevada, Reno.

Elston, Robert G.
2005 Flaked- and Battered-Stone Artifacts. In *Camels Back Cave*, edited by Dave N. Schmitt and Dave B. Madsen, pp. 92-119. University of Utah Anthropological Papers No. 125, Salt Lake City.

Elston, Robert G., and David W. Zeanah
2002 Thinking Outside the Box: A New Perspective on Diet Breadth and Sexual Division of Labor in the Prearchaic Great Basin. *World Archaeology* 34(1):103-130.

Fowler, Catherine S., and Joyce E. Bath
1981 Pyramid Lake Northern Paiute Fishing: The Ethnographic Record. *Journal of California and Great Basin Anthropology* 3(2):176-186.

Fowler, Catherine S., and Sven S. Liljeblad
1986 Northern Paiute. In *Great Basin*, edited by Warren L. D'Azevedo, pp. 435-465. Handbook of North American Indians, Vol. 11. Smithsonian Institution, Washington, D.C.

Frison, George C.
1998 Paleoindian Large Mammal Hunters on the Plains of North America. *Proceedings of the National Academy of Sciences of the United States of America* 95(24):14576-14583.

Fullagar, Richard L. K.
1991 The Role of Silica in Polish Formation. *Journal of Archaeological Science* 18(1):1-24.

Goebel, Ted
2007 Pre-Archaic and Early Archaic Technological Activities at Bonneville Estates Rockshelter. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 156-184. University of Utah Press, Salt Lake City.

Goodrich, Justin M.
2013 Experimental Comparison of Projectile Points and Unmodified Flakes for Butchering. *Nevada Archaeologist* 26:37-43.

Grayson, Donald K.
1988 Danger Cave, Last Supper Cave, and Hanging Rock Shelter: The Faunas. *Anthropological Papers of the American Museum of Natural History*, Vol. 66, Pt. 1. New York.
2011 *The Great Basin: A Natural Prehistory*. University of California Press, Berkeley.

Greiser, Sally T., and Payson D. Sheets
1979 Raw Material as a Functional Variable in Use-Wear Studies. In *Lithic Use-Wear Analysis*, edited by Brian Hayden, pp. 289-296. Academic Press, New York.

Hayden, Brian, and Johan Kamminga
1979 An Introduction to Use-Wear: The First CLUW. In *Lithic Use-Wear Analysis*, edited by Brian Hayden, pp. 1-13. Academic Press, New York.

Hedges, Ken
1973 *A Rabbitskin Blanket from San Diego County*. Ethnic Technology Notes No. 10. San Diego Museum of Man, San Diego.

Hester, Thomas R., Delbert Gilbow, and Alan D. Albee
1973 A Functional Analysis of "Clear Fork" Artifacts from the Rio Grande Plain, Texas. *American Antiquity* 38(1):90-96.

Hockett, Bryan S.
2007 Nutritional Ecology of Late Pleistocene to Middle Holocene Subsistence in the Great Basin: Zooarchaeological Evidence from Bonneville Estates Rockshelter. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 204-230. University of Utah Press, Salt Lake.

Hughes, Richard E.
1986 *Diachronic Variability in Obsidian Procurement Patterns in Northeastern California and South Central Oregon*. University of California Publications in Anthropology 17. Berkeley.

Hurcombe, Linda M.
1992 *Use-Wear Analysis and Obsidian: Theory, Experiments and Results*. J. R. Collis Publications, Sheffield.

Jenkins, Dennis L., Loren G. Davis, Thomas W. Stafford, Jr., Paula F. Campos, Thomas J. Connolly, Linda S.Cummings, Michael Hofreiter, Bryan S. Hockett, Katelyn McDonough, Ian Luthe, Patrick W. O'Grady, Karl J. Reinhard, Mark E. Swisher, Frances White, Bonnie Yates, Robert M. Yohe II, Chad Yost, and Eske Willerslev
2013 Geochronology, Archaeological Context, and DNA at the Paisley Caves. In *Paleoamerican Odyssey*, edited by Kelly E. Graf, Caroline V. Ketron, and Michael R. Waters, pp. 485-510. Texas A&M Press, College Station.

Jennings, Jesse D.
1964 The Desert West. In *Prehistoric Man in the New World*, edited by Jesse D. Jennings and Edward Norbeck, pp. 149-174. University of Chicago Press, Chicago.

Jobson, Robert W.
1986 Stone Tool Morphology and Rabbit Butchering. *Lithic Technology* 15(1):9-20.

Jones, George T., Charlotte Beck, Eric E. Jones, and Richard E. Hughes
2003 Lithic Source Use and Paleoarchaic Foraging Territories in the Great Basin. *American Antiquity* 68(1):5-38.

Jones, George T., Lisa M. Fontes, Rachel A. Horowitz, Charlotte Beck, and David G. Bailey
2012 Reconsidering Paleoarchaic Mobility in the Central Great Basin. *American Antiquity* 77(2):351-367.

Keeley, Lawrence H.
1974 Technique and Methodology in Microwear Studies: A Critical Review. *World Archaeology* 5(3):323-336.
1980 *Experimental Deterimination of Stone Tool Uses: A Microwear Analysis*. University of Chicago Press, Chicago and London.

Keeley, Lawrence H., and Mark H. Newcomer
1977 Microwear Analysis of Experimental Tools: A Test Case. *Journal of Archaeological Science* 4:29-62.

Kelly, Isabel T.

1932 *Ethnography of the Surprise Valley Paiute*. University of California Publications in American Archaeology and Ethnology Vol. 31, No. 3. University of California Press, Berkeley.

Kononenko, Nina

2011 Experimental and Archaeological Studies of Use-Wear and Residues on Obsidian Artefacts from Papua New Guinea. *Technical Reports of the Australian Museum, Online* 21:1-244.

Kennedy, Jaime D., and Geoffrey M. Smith

2016 Paleoethnobotany at the LSP-1 Rockshelter, Southcentral Oregon: Assessing the Diversity of Plant Foods in Holocene Diet. *Journal of Archaeological Science: Reports* 5:640-648.

Lafayette, Linsie M.

2006 *Use-Wear Analysis of Great Basin Stemmed Points.* Unpublished M.A. thesis, Department of Anthropology, University of Nevada, Reno.

Lafayette, Linsie M., and Geoffrey M. Smith

2012 Use-Wear Traces on Experimental (Replicated) and Prehistoric Stemmed Points from the Great Basin. *Journal of California and Great Basin Anthropology* 32(2):141-160.

Larrucea, Eveline

2011 Hares of Nevada. Online Nevada Encyclopedia. Electronic document, http://www.onlinenevada.org/articles/hares-nevada, accessed Feburary 1, 2016.

Lerner, Harry, Xiangdong Du, Andre Costopoulos, and Martin Ostoja-Starzewski

2007 Lithic Raw Material Physical Properties and Use-Wear Accrual. *Journal of Archaeological Science* 34:711-722.

Lewenstein, Suzanne M.

1981 Mesoamerican Obsidian Blades: An Experimental Approach to Function. *Journal of Field Archaeology* 8(2):175-188.

Lowie, Robert H.

1939 *Ethnographic Notes on the Washo*. University of California Publications in American Archaeology and Ethnology Vol. 36, No. 5. University of California Press, Berkeley.

Madsen, David B.

2007 The Paleoarchaic to Archaic Transition in the Great Basin. In *Paleoindian or*

Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition, edited by Kelly E. Graf and Dave N. Schmitt, pp. 3-20. University of Utah Press, Salt Lake City.

Middleton, Emily S., Geoffrey M. Smith, William J. Cannon, and Mary F. Ricks
2014 Paleoindian Rock Art: Establishing the Antiquity of Great Basin Carved Abstract Petroglyphs in the Northern Great Basin. *Journal of Archaeological Science* 43:21-30.

Moss, Madonna L., and Jon M. Erlandson
1995 *An Evaluation, Survey, and Dating Program for Archaeological Sites on State Lands of the Northern Oregon Coast*. Department of Anthropology, University of Oregon. Report to the Oregon State Historic Preservation Office, Department of Parks and Recreation, Salem.

Odell, George H.
1981 The Morphological Express at Function Junction: Searching for Meaning in Lithic Tool Types. *Journal of Anthropological Research* 37(4):319-342.

Odell, George H., and Frieda Odell-Vereecken
1980 Verifying the Reliability of Lithic Use-Wear Assessments by "Blind Tests": The Low-Power Approach. *Journal of Field Archaeology* 7(1):87-120.

Oetting, Albert C.
1994 Early Holocene Rabbit Drives and Prehistoric Land Use Patterns on Buffalo Flat, Christmas Lake Valley, Oregon. In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology Since Cressman*, edited by C. Melvin Aikens and Dennis L. Jenkins, pp. 155- 169. University of Oregon Anthropological Papers 50, Eugene.

Ogle, Daniel G., Loren St. John, and Derek Tilley
2012 *Plant Guide for Forwing Saltbush (Atriplex canescens)*.). USDA Natural Resources Conservation Service, Aberdeen Plant Materials Center, Aberdeen, Idaho.

Ogle, Daniel G., Derek Tilley, and Loren St. John
2012 *Plant Guide for Great Basin Wild Rye* (*Leymus cinereus*). USDA Natural Resources Conservation Service, Aberdeen Plant Materials Center, Aberdeen, Idaho.

Outram, Alan K.
2008 Introduction to Experimental Archaeology. *World Archaeology* 40(1):1-6.

Pellegrini, Evan

2014 *The Kammidɨkadɨ of Little Steamboat Point-1 Rockshelter: Terminal Early Holocene and Early Late Holocene Leporid Processing in Northern Warner Valley, Oregon*. Unpublished M.A. thesis, Department of Anthropology, University of Nevada, Reno.

Pinson, Ariane
2007 Artiodactyl Use and Adaptive Discontinuity Across the Paleoarchaic/Archaic Transition in the Northern Great Basin. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and David N. Schmitt, pp. 187-203. University of Utah Press, Salt Lake City.

Prasciunas, Mary M.
2007 Expedient Cores and Flake Production Efficiency: An Experimental Test of Technological Assumptions. *American Antiquity* 72(2):334-348.

Ramsey, Christopher B.
2009 Bayesian Analysis of Radiocarbon Dates. *Radiocarbon* 51(1):337-360.

Paula J. Reimer, Edouard Bard, Alex Bayliss, J. Warren Beck, Paul G. Blackwell, Christopher Bronk Ramsey, Caitlin E. Buck, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M Grootes, Thomas P. Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J. Heaton, Dirk L. Hoffmann, Alan G. Hogg, Konrad A. Hughen, K. Felix Kaiser, Bernd Kromer, Sturt W. Manning, Mu Niu, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Richard A. Staff, Christian S. M. Turney, and Johannes van der Plicht
2013 IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years Cal BP. *Radiocarbon* 55(4):1869-1887.

Rhode, David, and Lisbeth A. Louderback
2007 Dietary Plant Use in the Bonneville Basin During the Terminal Pleistocene/Early Holocene Transition. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 231-247. University of Utah Press, Salt Lake.

Ricks, Mary F.
1995 *A Survey and Analysis of Prehistoric Rock Art of theWarner Valley Region, Lake County, Oregon*. Unpublished Ph.D. dissertation. Department of Anthropology, Portland State University, Portland, Oregon.

Riddell, Francis A.
1960 *Honey Lake Paiute Ethnography*. Anthropological Papers No. 4. Nevada State Museum, Carson City, Nevada.

Rombauer, Irma S., Marion R. Becker, and Ethan Becker
2006 *Joy of Cooking*. Scribner, New York.

Schmidt, Kari M.
1999 The Five Feature Site (AZ CC:7:55 [ASM]): Evidence for a Prehistoric Rabbit Drive in Southeastern Arizona. *Kiva* 65(2):103-124.

Schmitt, Dave N., and Karen Lupo
2005 The Camels Back Cave Mammalian Fauna. In *Camels Back Cave*, edited by Dave N. Schmitt and Dave B. Madsen, pp. 136-176. University of Utah Anthropological Papers No. 125. Salt Lake City.

Schmitt, Dave N., and David B. Madsen (editors)
2005 *Camels Back Cave*. University of Utah Anthropological Papers Number 125, Salt Lake City.

Schmitt, Dave N., David B. Madsen, and Karen D. Lupo
2002 The Worst of Times, the Best of Times: Jackrabbit Hunting by Middle Holocene Human Foragers in the Bonneville Basin of Western North America. In *Colonisation, Migration, and Marginal Areas*, edited by Mariana Mondini, Sebastian Muñoz, and Stephen Wickler, pp. 86-95. Oxbow Press, Oxford, UK.

Semenov, Sergei A.
1976 *Prehistoric Technology*. Harper and Row, New York.

Setzer, Teddi J.
2012 Use-Wear Experiments with Obsidian: A Comparison of the Functionality and Edge Damage on Tools Made from Two Distinct Sources. *Lithic Technology* 37(1):35-46.

Shea, John J.
1992 Lithic Microwear Analysis in Archeology. *Evolutionary Anthropology: Issues, News, and Reviews* 1(4):143-150.

Simms, Steven R.
1987 *Behavioral Ecology and Hunter-Gatherer Foraging: An Example from the Great Basin*. BAR International Series 381. Oxford.

Smith, Geoffrey M.
2007 Pre-Archaic Mobility and Technological Activities at the Parman Localities, Humboldt County, Nevada. In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 139-155. University of Utah Press, Salt Lake City.

2010 Footprints Across the Black Rock: Temporal Variability in Prehistoric Foraging Territories and Toolstone Procurement Strategies in the Western Great Basin. *American Antiquity* 75(4):865-885.

Smith, Geoffrey M., Peter Carey, Emily S. Middleton, and Jennifer Kielhofer
2012 Cascade Points in the Northern Great Basin: A Radiocarbon-Dated Foliate Point Assemblage from Warner Valley, Oregon. *North American Archaeologist* 33(1):13-34.

Smith, Geoffrey M., Alexander Cherkinsky, Carla Hadden, and Aaron P. Ollivier
2016 The Age and Origin of Olivella Beads from Oregon's LSP-1 Rockshelter: The Oldest Marine Shell Beads in the Northern Great Basin. *American Antiquity*, in press.

Smith, Geoffrey M., Emily S. Middleton, and Peter A. Carey
2013 Paleoindian Technological Provisioning Strategies in the Northwestern Great Basin. *Journal of Archaeological Science* 40:4180-4188.

Smith, Geoffrey M., Aaron Ollivier, Pat Barker, Anna J. Camp, David C. Harvey, and Hillary Jones
2016 A Collection of Fiber Artifacts from Southcentral Oregon. *Journal of California and Great Basin Anthropology*, in press.

Smith, Geoffrey M., Donald D. Pattee, Judson Bird Finley, John L. Fagan, and Evan Pellegrini
2014 A Stone Crescent from a Stratified, Radiocarbon-Dated Site in the Northern Great Basin. *North American Archaeologist* 35(3):257-276.

Smith, Geoffrey M., Teresa A. Wriston, Donald D. Pattee, and Danielle C. Felling
2015 The Surface Paleoindian Record of Northern Warner Valley, Oregon, and its Bearing on the Temporal Separation of Clovis and Western Stemmed Points in the Northern Great Basin. *Paleoamerica* 1(4):360-373.

Sonnenfeld, J.
1962 Interpreting the Function of Primitive Implements. *American Antiquity* 28(1):56-65.

Spear, Robert L.
1980 A Brief Discussion of Obsidian Use-Wear Experiments. *Lithic Technology* 9(2):38-39.

Spurrell, F. C.
1892 Notes on Early Sickles. *Archaeological Journal* 49:53-69.

Steward, Julian H.

1970 *Basin-Plateau Aboriginal Sociopolitical Groups*. Reprinted. University of Utah Press, Salt Lake City. Originally published 1938, Bulletin 120, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Stewart, Omer C.

1939 The Northern Paiute Bands. In *Anthropological Records*, Vol. 2, No. 3, edited by Alfred L. Kroeber, Robert H. Lowie, and Ronald L. Olson, pp. 127-149. University of California Press, Berkeley.

Thomas, David H.

1983 The Archaeology of Monitor Valley 2. Gatecliff Shelter. *Anthropological Papers of the American Museum of Natural History* 59(1), New York City, New York.

Tringham, Ruth, Glenn Cooper, George H. Odell, Barbara Voytek, and Anne Whitman

1974 Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. *Journal of Field Archaeology* 1(1):171-196.

Tuohy, Donald R., and Amy J. Dansie

1997 New Information Regarding Early Holocene Manifestations in the Western Great Basin. *Nevada Historical Society Quarterly* 40(1):24-53.

Van der Voort, Madeline W.

2015a *Using GIS to Investigate Mobility: An Example from the Northern Great Basin*. Paper presented at the 44th Annual Nevada Archaeological Association Conference, Wendover, Nevada.

2015b *Analysis of an Early-to-Mid-Holocene Projectile Point Assemblage from Little Steamboat Point Rockshelter, Warner Valley, Oregon*. Poster presented at the 80th Annual Meeting of the Society for American Archaeology, San Francisco, California.

Vaughan, Patrick C.

1985 *Use-Wear Analysis of Flaked Stone Tools*. University of Arizona Press, Tucson.

Weide, David L.

1975 *Postglacial Geomorphology and Environments of the Warner Valley - Hart Mountain Area, Oregon.* Unpublished Ph.D. dissertation, Department of Geography, University of California, Los Angeles.

Weide, Margaret L.

1968 *Cultural Ecology of Lakeside Adaptation in the Western Great Basin.* Unpublished Ph.D. dissertation, University of California, Los Angeles.

1974 North Warner Subsistence Network: A Prehistoric Band Teritorry. *Nevada Archaeological Survey Research Paper* 5:62-79.

Wheat, Margaret M.
1967 *Survival Arts of the Primitive Paiutes*. University of Nevada Press, Reno, Nevada.

Whiting, Beatrice B.
1950 *Paiute Sorcery*. Viking Fund Publications in Anthropology No. 15, edited by Ralph Linton. The Viking Fund, New York.

Witthoft, John
1967 Glazed Polish on Flint Tools. *American Antiquity* 32(3):383-388.

Yoder, David, Jon Blood, and Ried Mason
2005 How Warm Were They? Thermal Properties of Rabbit Skin Robes and Blankets. *Jounral of California and Great Basin Anthropology* 25(1):55-68.

Young, D. Craig
2002 Secondary Obsidian Sources of the Madeline Plains: Paleolandscapes and Archaeological Implications. In *Boundary Lands: Archaeological Investigations Along the California-Great Basin Interface*, edited by Kelly R. McGuire, pp. 75-84. Nevada State Museum Anthropological Papers 24. Carson City.

NOTES

1. Radiocarbon dates uncalibrated in referenced works were calibrated using Grayson (2011) Appendix A and rounded to the nearest 100-year interval.

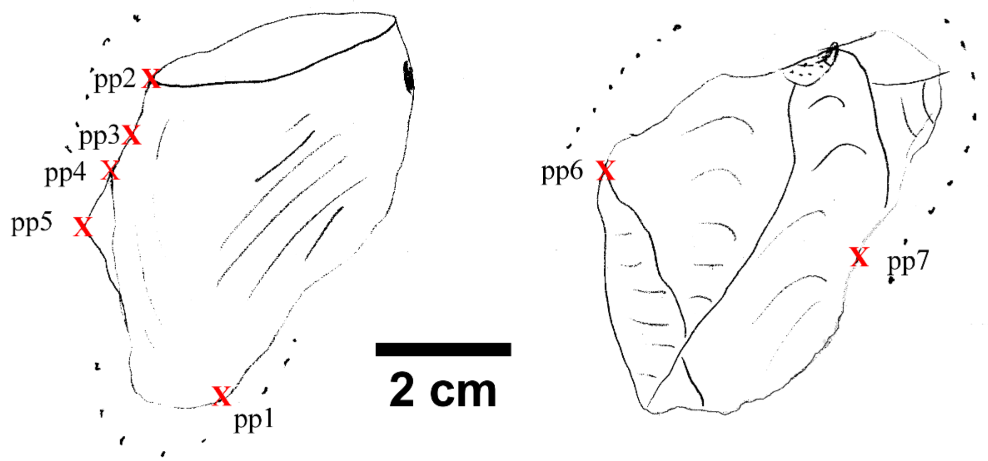
2. All radiocarbon dates for LSP-1 were calibrated using OxCal v.3.2 with the IntCal13 curve and presented as 2σ cal BP ranges.

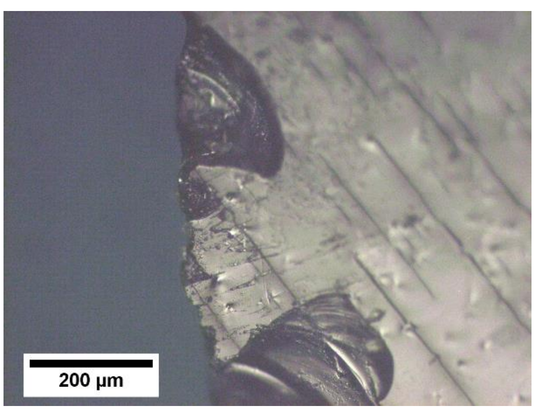
APPENDIX

USE-WEAR PHOTOGRAPHS

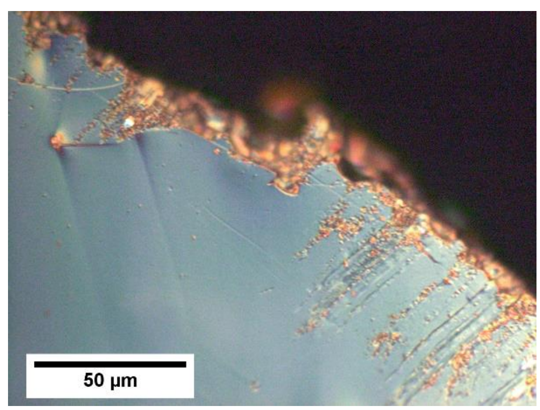
Replicated Tools

Replicated Tool 3. Hide processing (transverse) for 255 minutes.

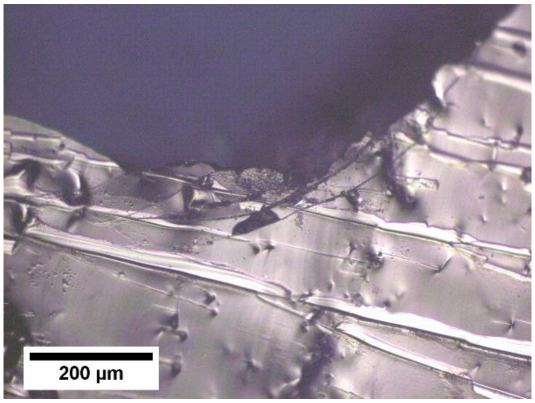




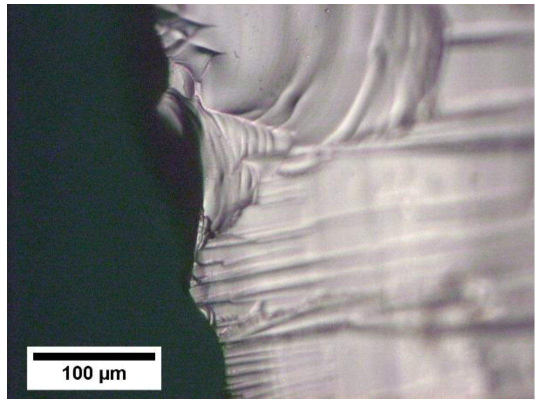
Discontinuous feather and step scarring (pp7p1).



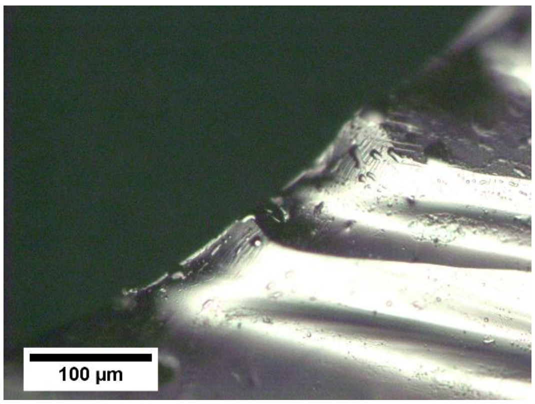
Sleek and rough bottom striations (pp1p1).



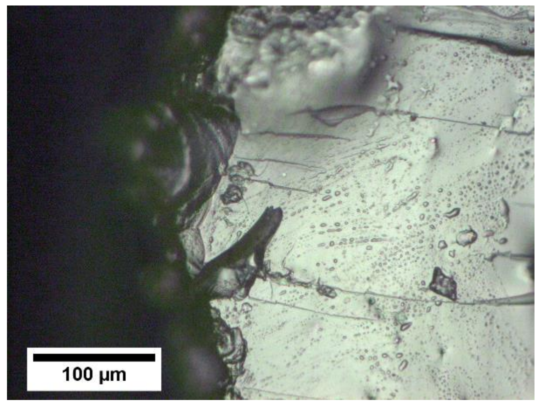
Flaked striations (pp2p2).



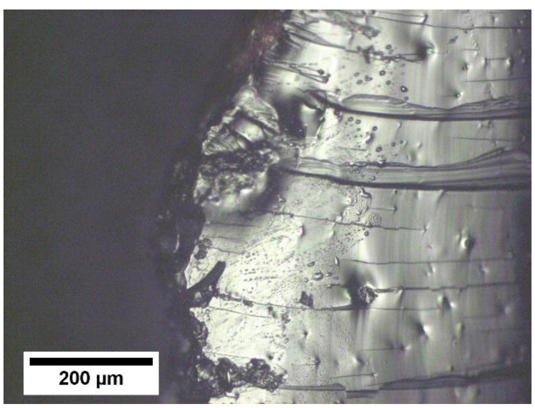
Stage 2 polish (pp3p1).



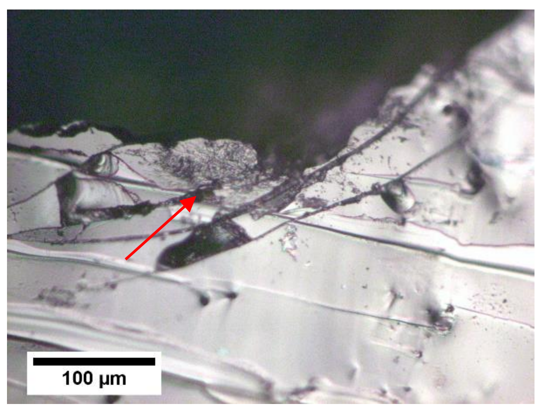
Medium edge rounding (pp4p2).



Folded grainy particle residue (pp5p2).

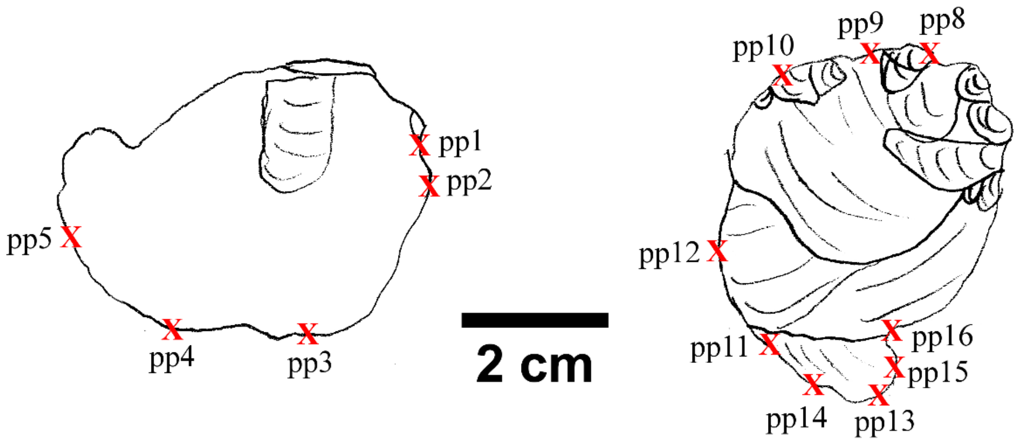


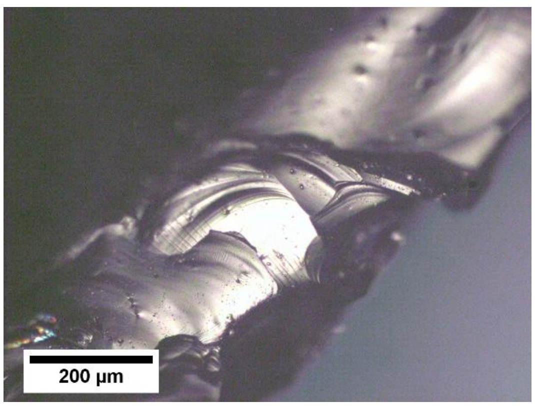
Intensive edge rounding (pp5p1).



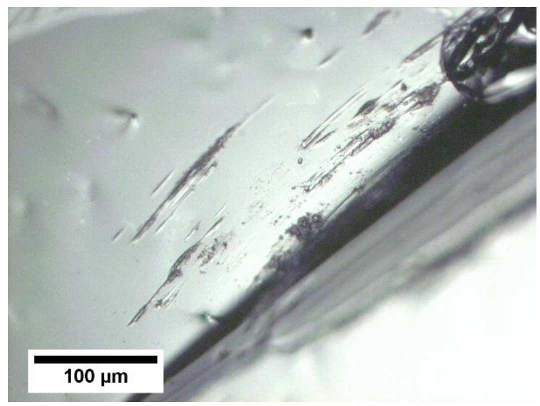
Patchy residue indicated by arrow; spot residues; flaked striations (pp2p1).

Replicated Tool 5. Carcass processing (longitudinal) for 73 minutes.

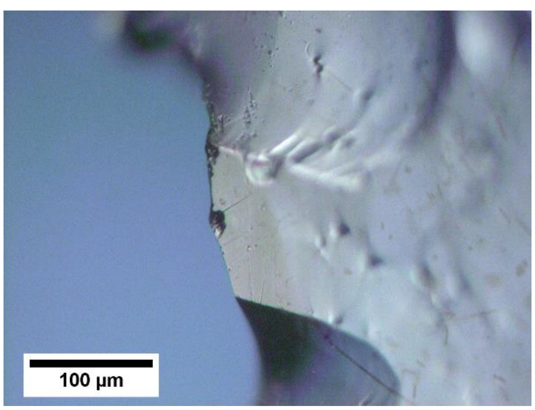




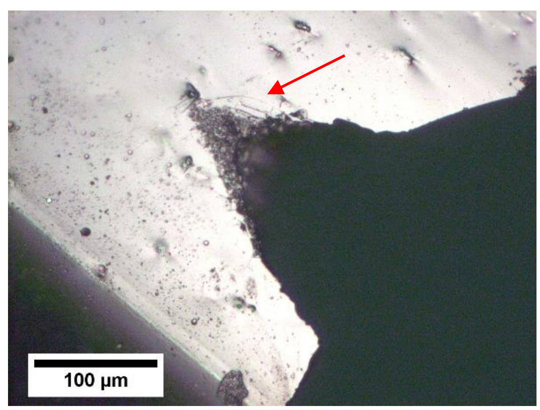
Continuous feather scarring (pp4p1).



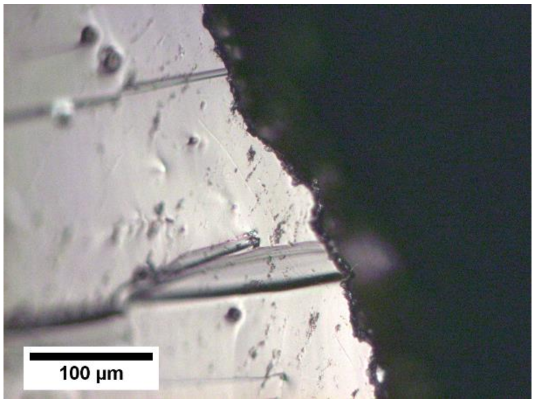
Intermittent striations (pp12p1).



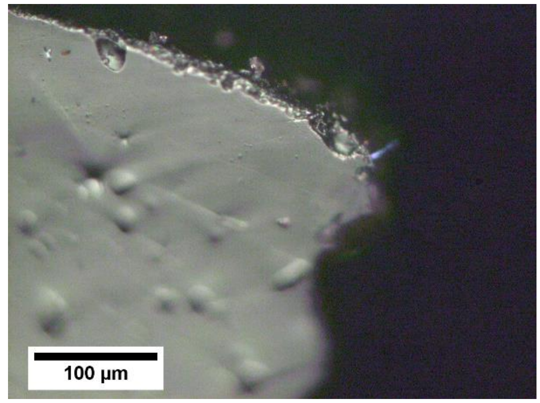
Sleek striations (pp8p4).



Faint flaked striations indicated by arrow; patchy, spot and folded grainy particle residues (pp16p1).

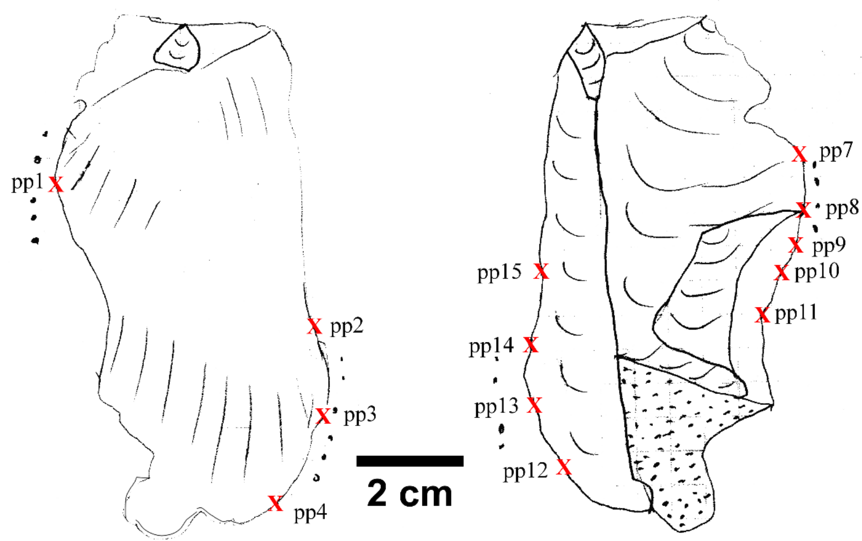


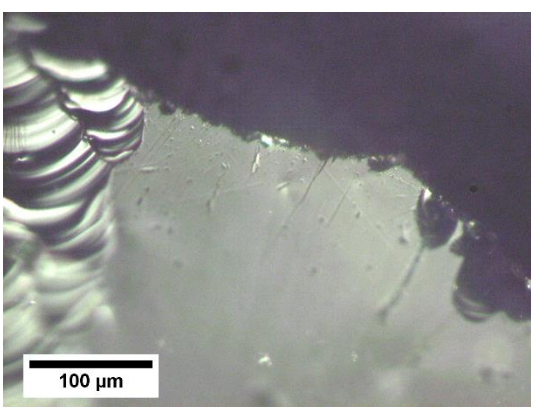
Intensive edge rounding (pp15p1).



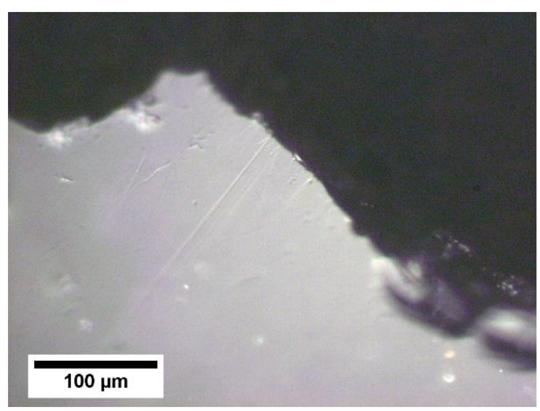
Stage 3 polish (pp8p1).

Replicated Tool 6. Hide processing (transverse) for 128 minutes.

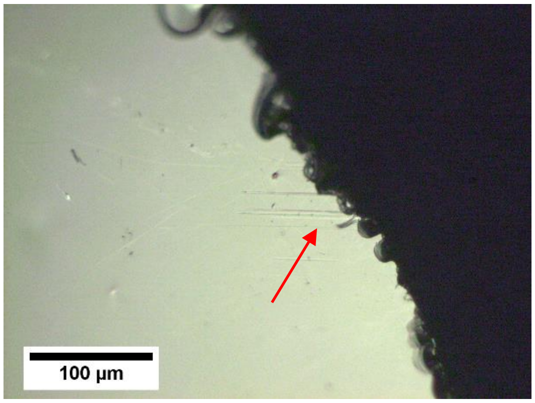




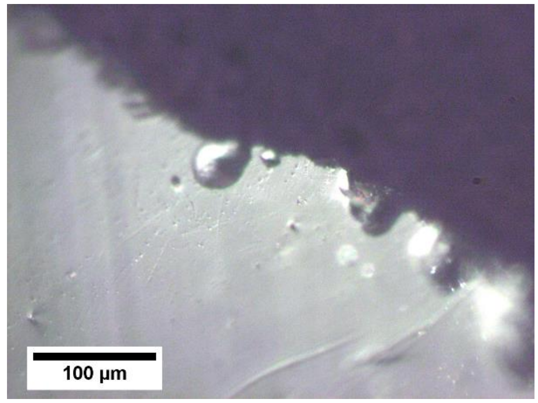
Feather scarring (pp8p1).



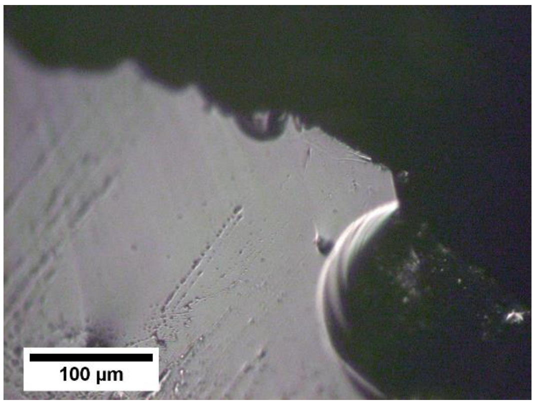
Sleek striations (pp13p1).



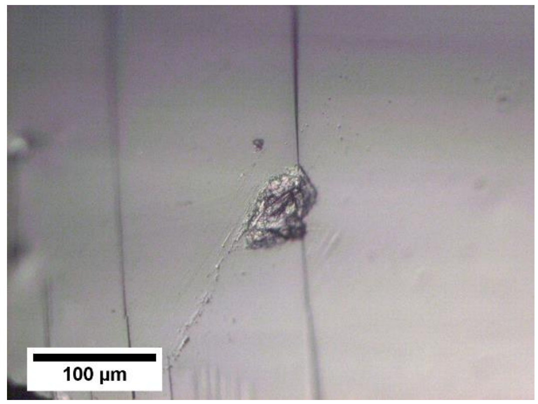
Rough bottom striations indicated by arrow; step scarring (pp9p1).



Stage 1 polish; discontinuous scarring (pp7p1).

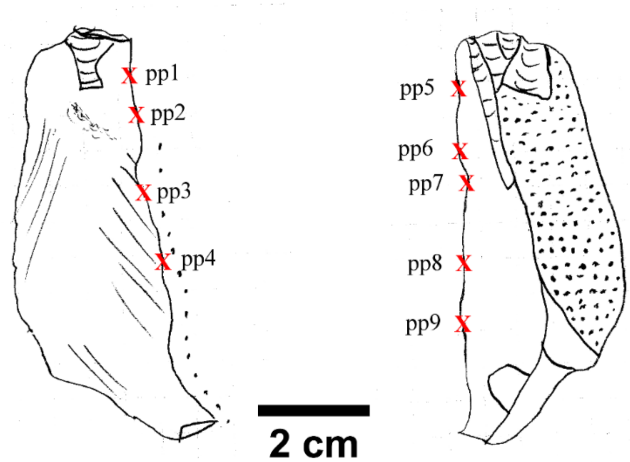


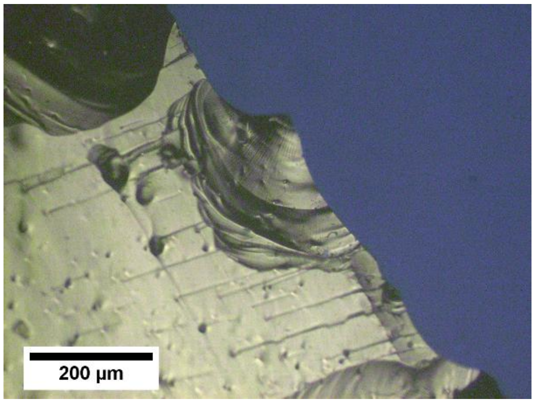
Intermittent striations; intensive edge rounding (pp3p1).



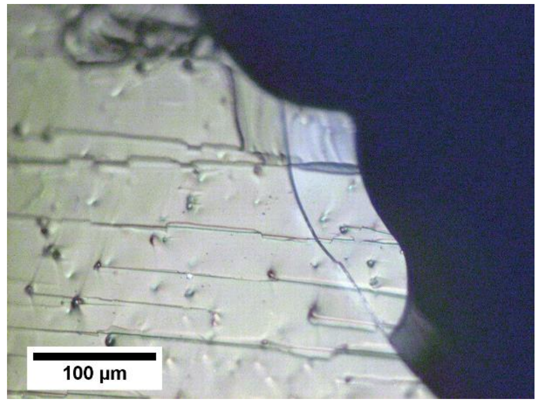
Folded grainy particle residue (pp1p1).

Replicated Tool 7. Carcass processing (longitudinal) for 10 minutes.

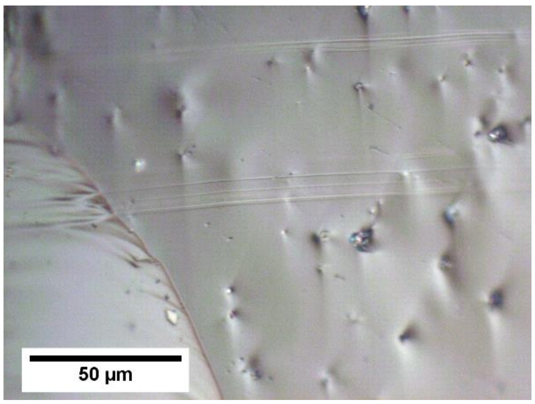




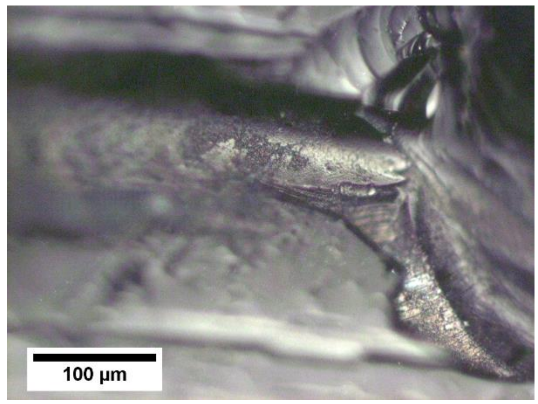
Feather scarring (pp1p1).



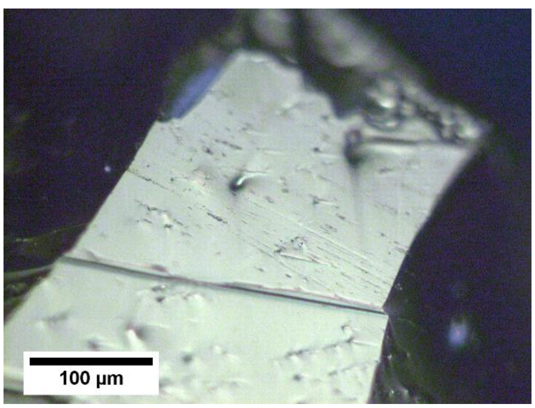
Flaked striation (pp1p3).



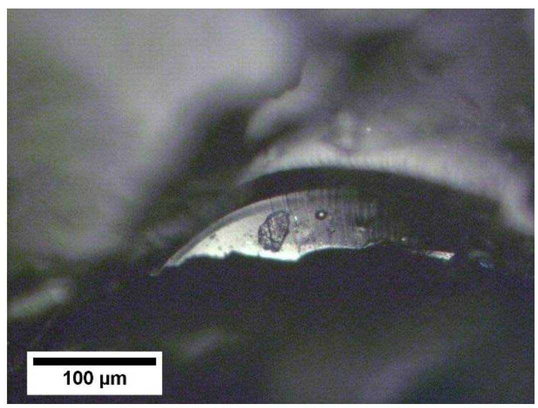
Sleek striations (pp8p3).



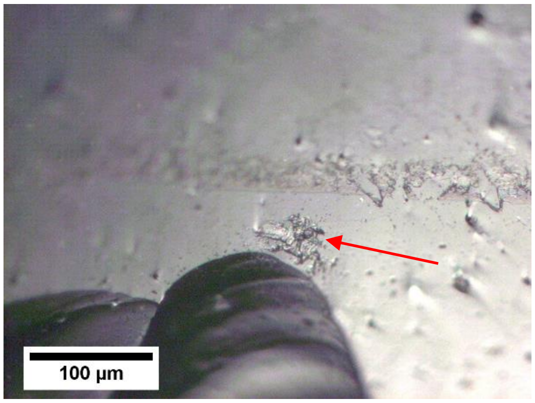
Stage 4 polish (pp4p6).



Intermittent striations (pp3p2).

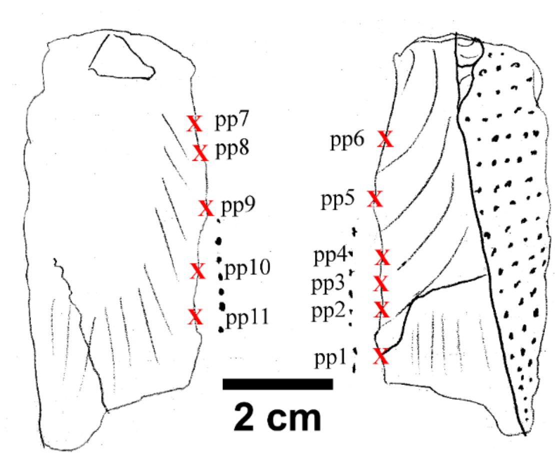


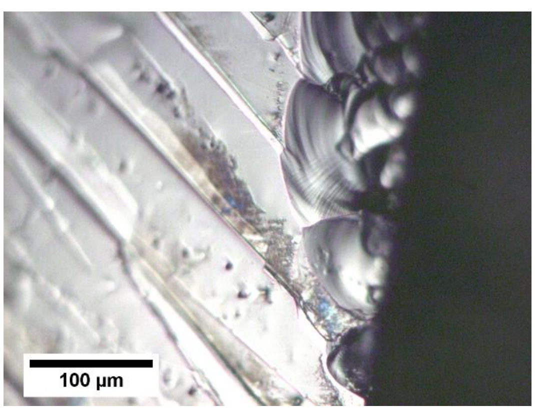
Folded grainy particle residue (pp6p2).



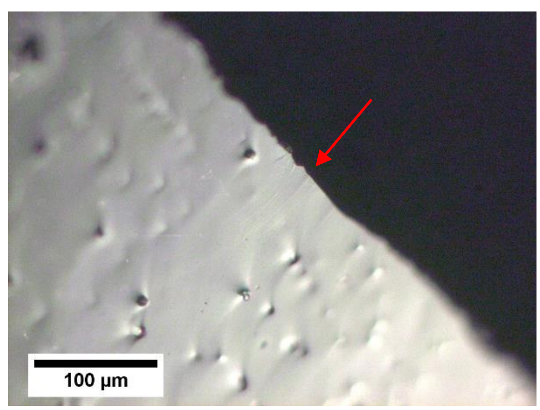
Step scarring; residue band; patchy residue indicated by arrow (pp7p1).

Replicated Tool 8. Hide processing (longitudinal) for 21 minutes.

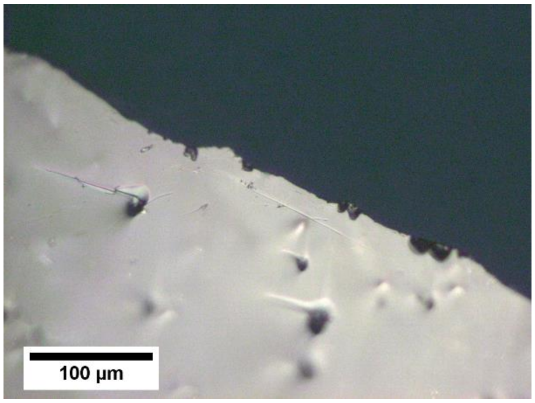




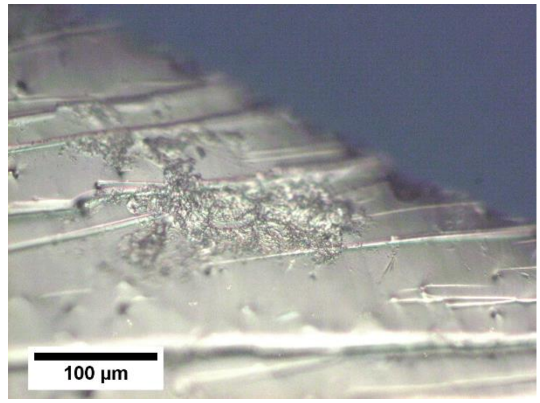
Continuous feather scarring (pp1p2).



Sleek striations indicated by arrow (pp6p1).

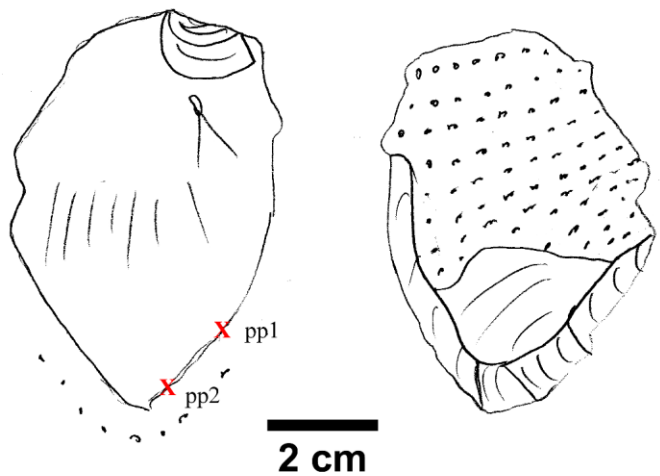


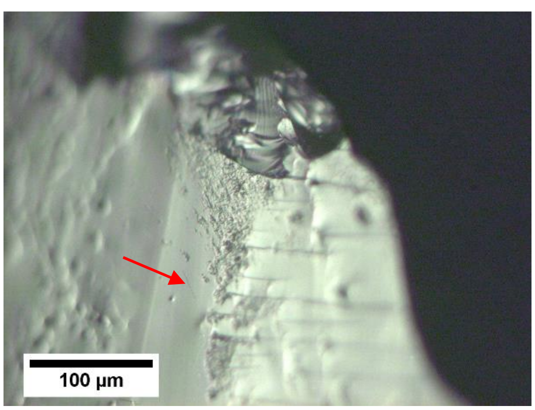
Rough bottom striations (pp3p1).



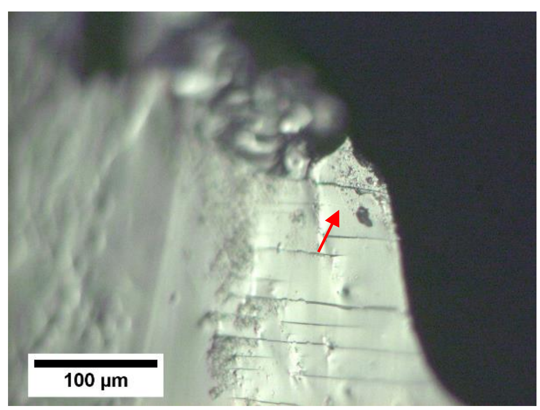
Patchy residue (pp11p1).

Replicated Tool 9. Hide processing (longitudinal) for 41 minutes.

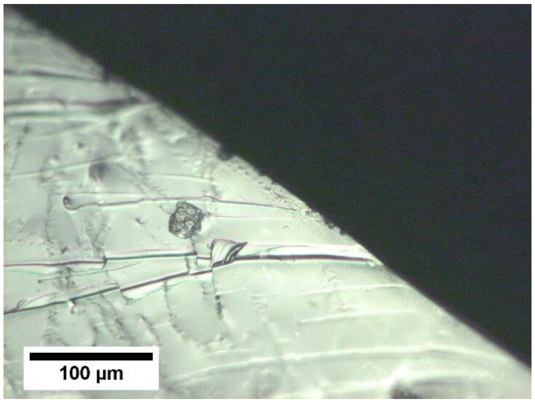




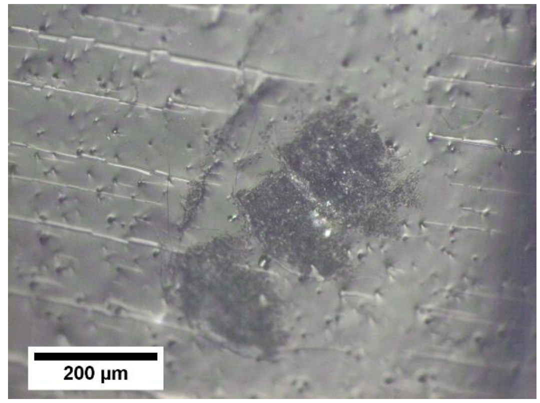
Stepped scarring; stage 2 polish; rough bottom striation indicated by red arrow (pp2p1).



Faint sleek striations indicated by arrow; slight edge rounding (pp2p2).

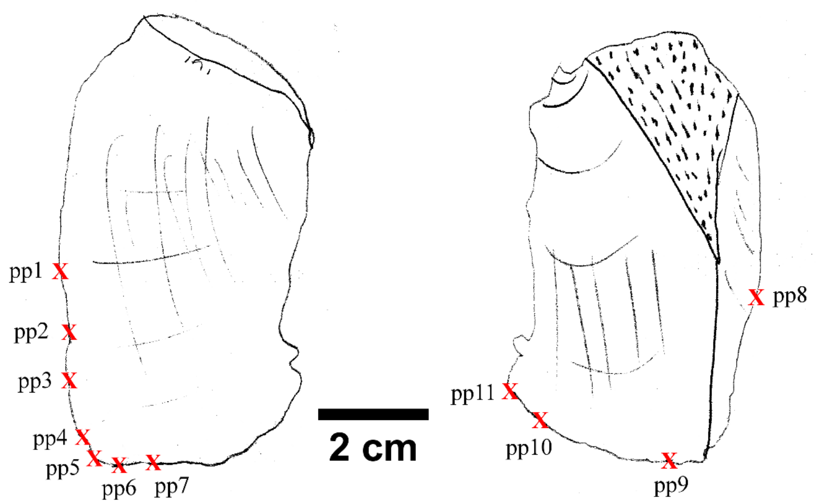


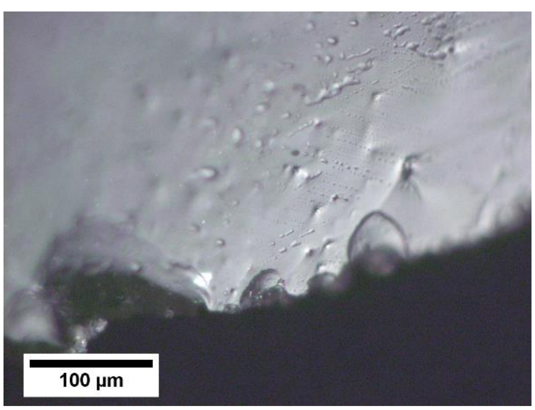
Folded grainy particle residue (pp1p1).



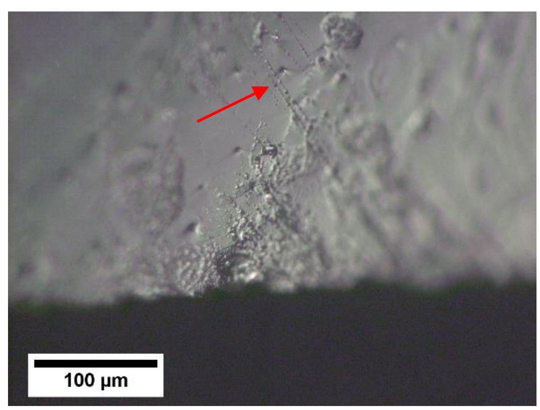
Patchy residue (pp2p5).

Replicated Tool 10. Hide processing (transverse) for 7 minutes.

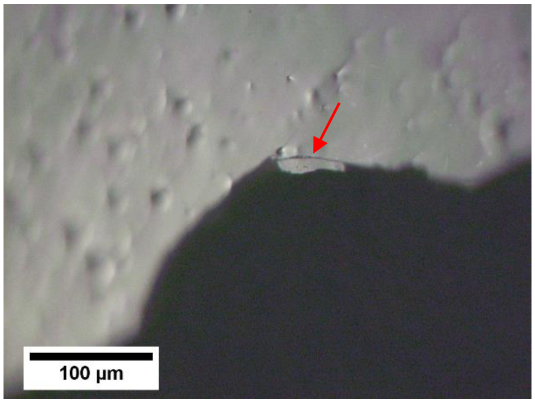




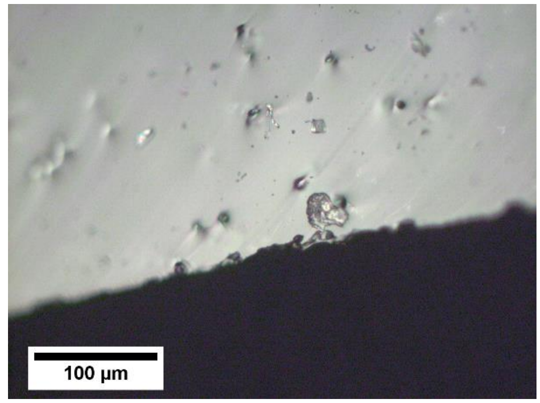
Discontinuous feather scarring (pp9p1).



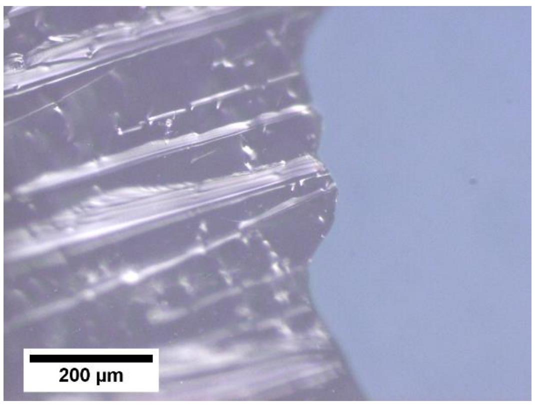
Intermittent striations indicated by red arrow; stage 1 polish (pp10p2).



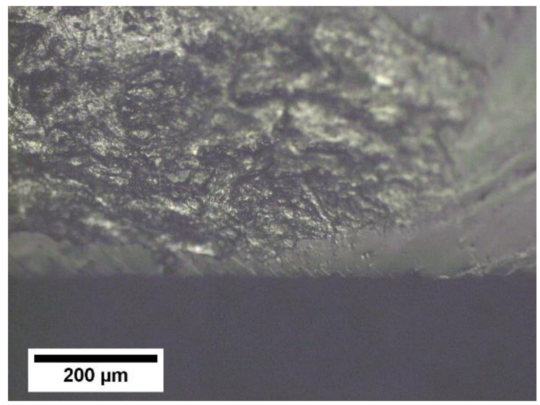
Flaked striation indicated by arrow (pp3p1).



Folded grainy particle and spot residues (pp4p2).

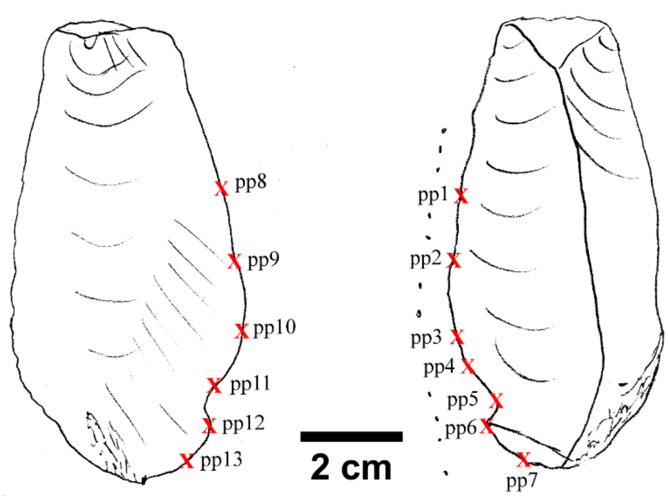


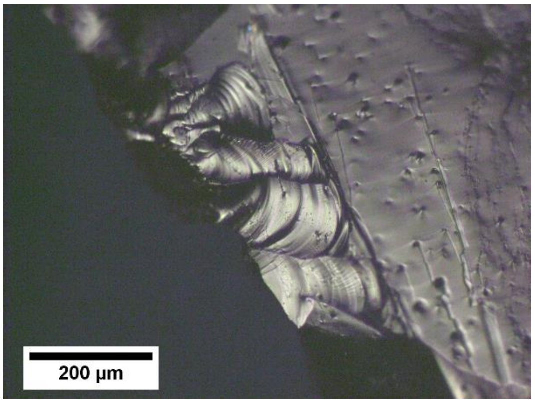
Medium edge rounding (pp7p1).



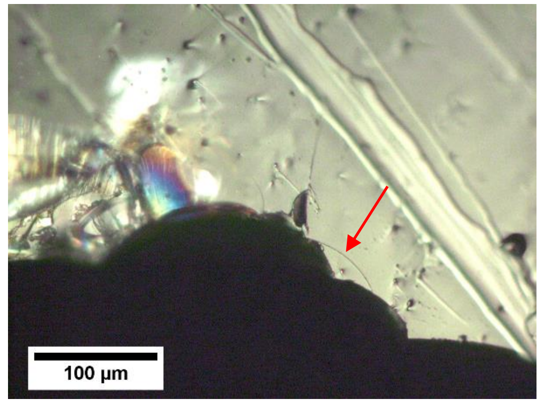
Patchy residue (pp2p2).

Replicated Tool 11. Carcass processing (longitudinal) for 12 minutes.

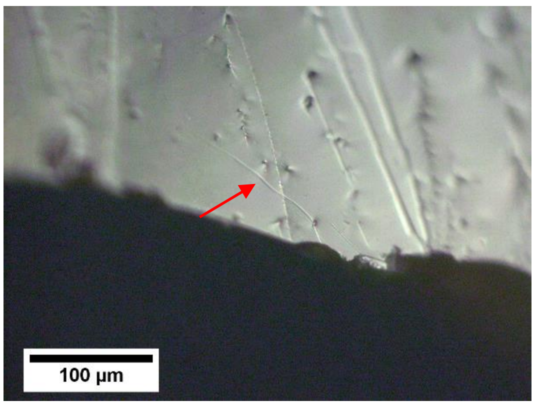




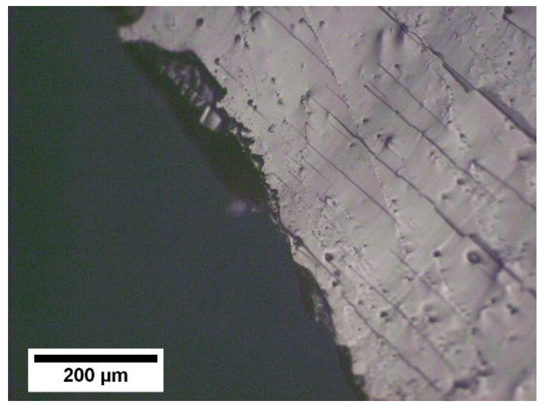
Continuous feather scarring (pp2p2).



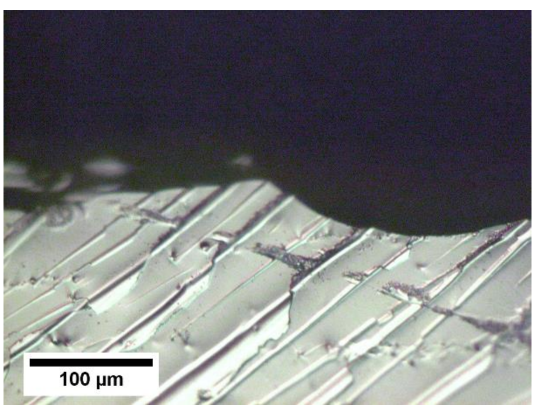
Flaked striation indicated by arrow (pp4p2).



Sleek striations indicated by arrow (pp2p4).

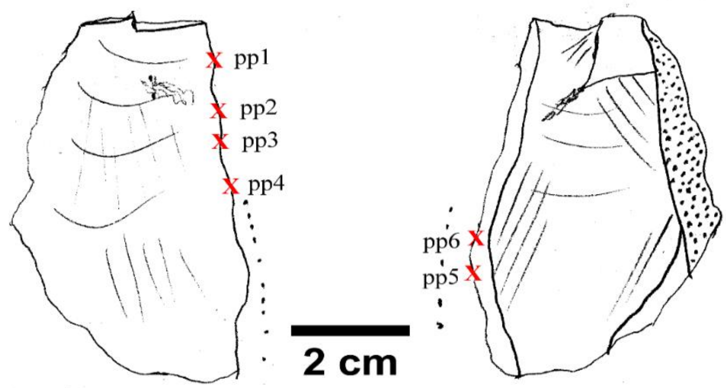


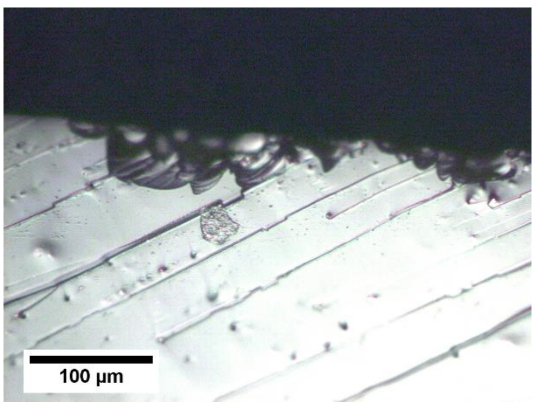
Intensive edge rounding (pp1p1).



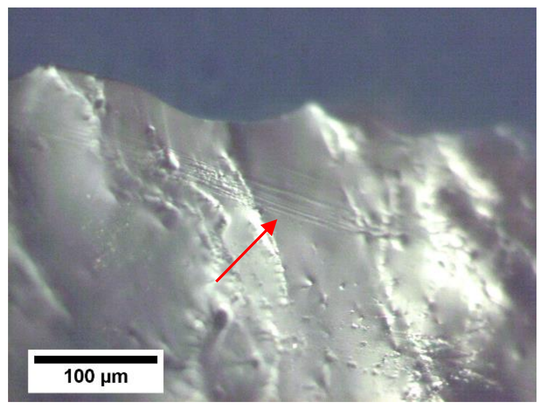
Intermittent striation with patchy residue (pp8p1).

Replicated Tool 12. Meat processing (longitudinal) for 40 minutes.

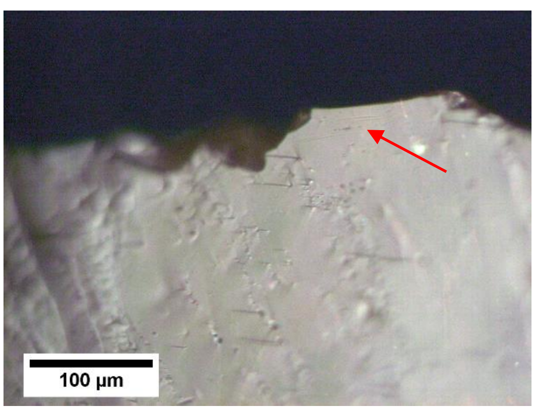




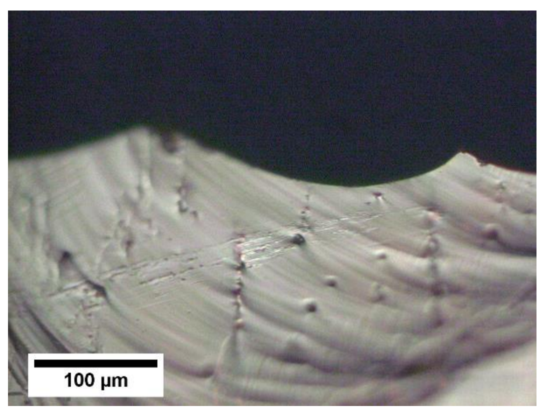
Continuous feather and step scarring; folded grainy particle residue (pp3p1).



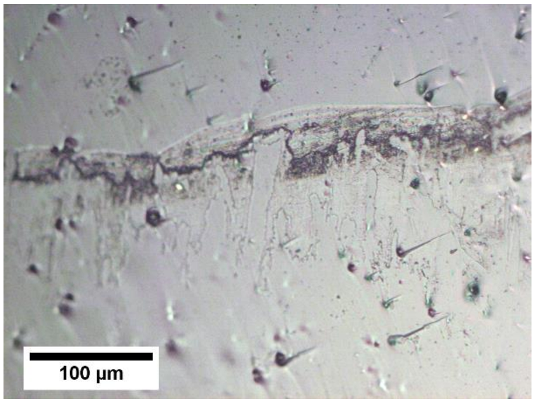
Rough bottom striations indicated by arrow (pp6p5).



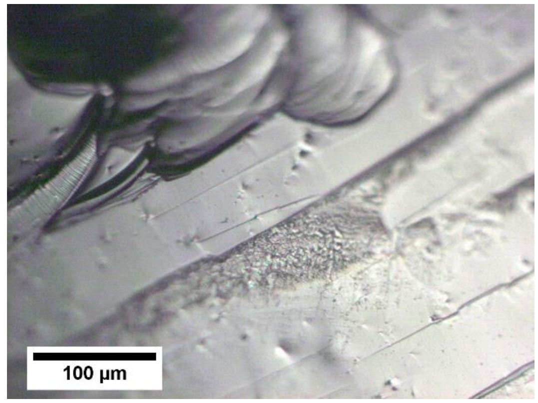
Sleek striations indicated by arrow (pp5p3).



Intermittent striations (pp5p4).

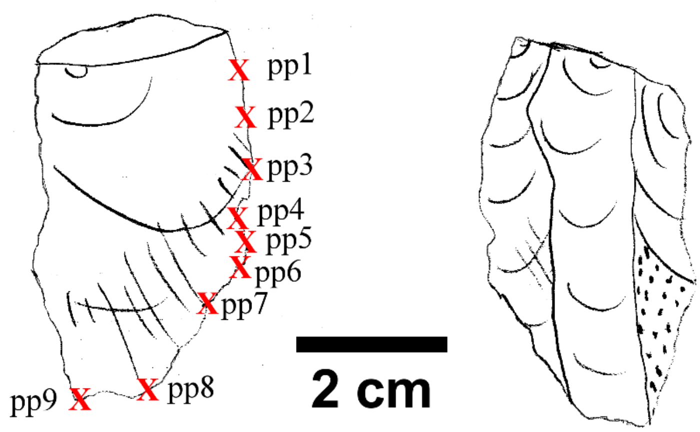


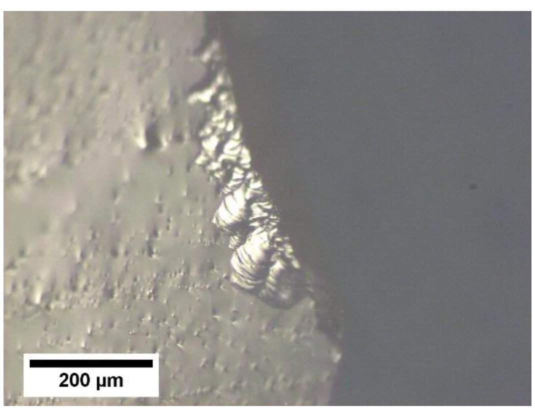
Band and spot residue (pp2p4).



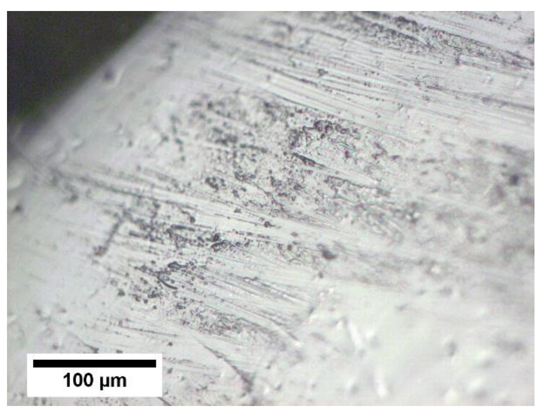
Feather and step scarring; patchy residue (pp4p2).

Replicated Tool 13. Meat processing (longitudinal) for 13 minutes.

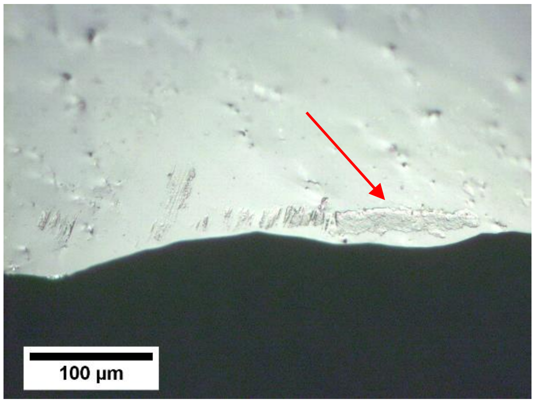




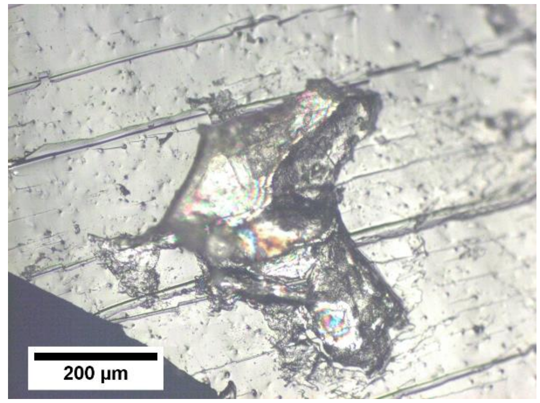
Continuous feather scarring (pp10p1).



Rough bottom and intermittent striations (pp9p2).

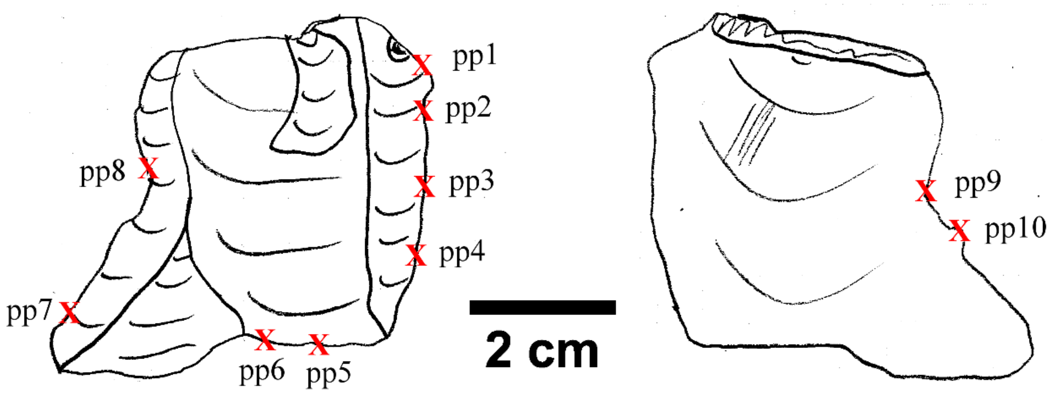


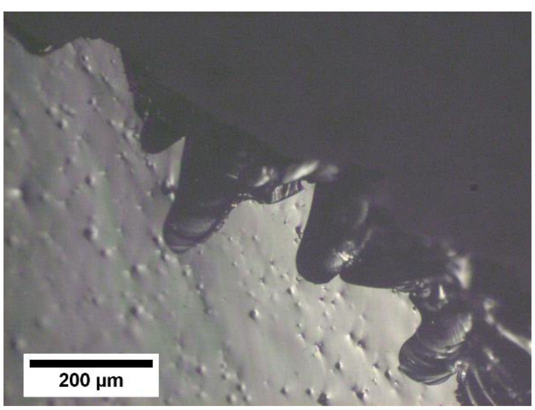
Residue band indicated by arrow (pp1p1).



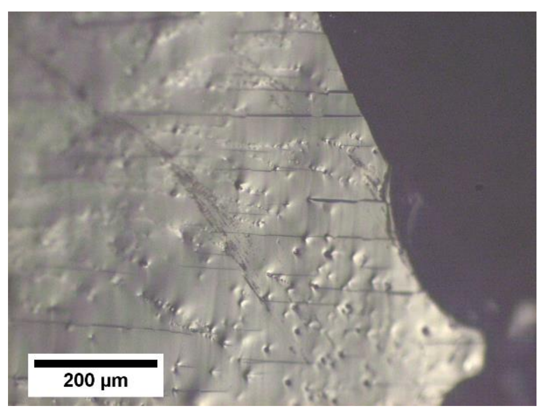
Patchy residue (pp2p2).

Replicated Tool 14. Carcass processing (longitudinal) for 5 minutes.

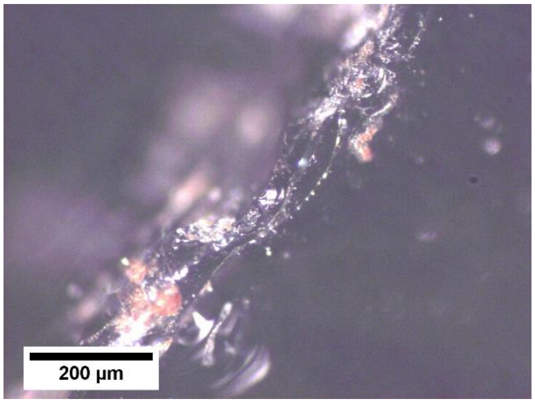




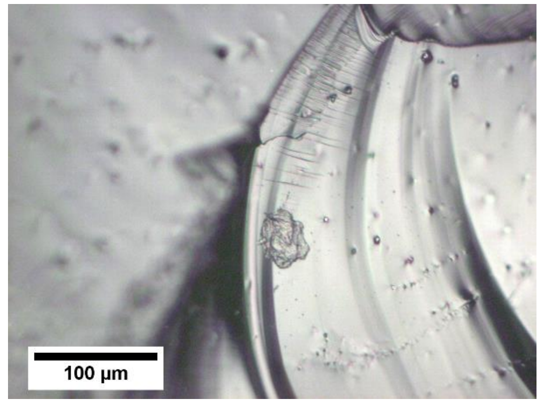
Continuous feather and step scarring (pp2p1).



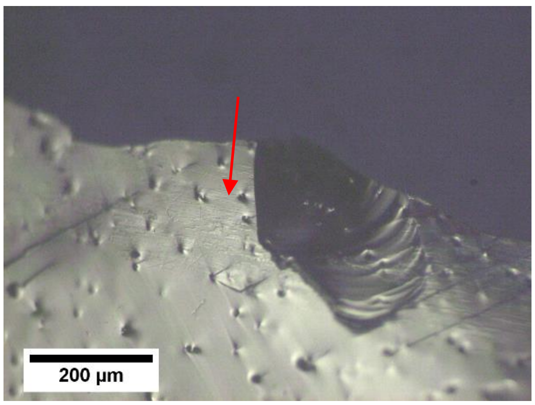
Intermittent striations (pp9p2).



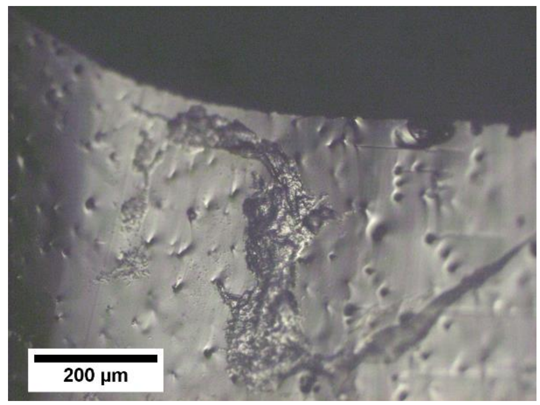
Flaked striations; intensive edge rounding (pp1p1).



Folded grainy particle residue (pp6p1).

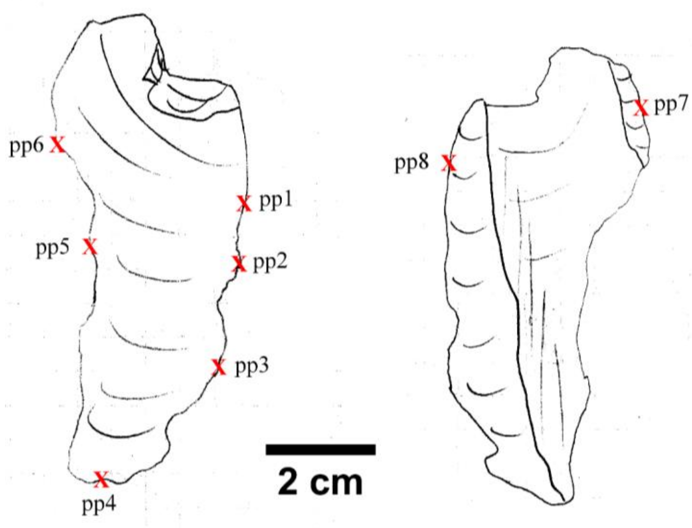


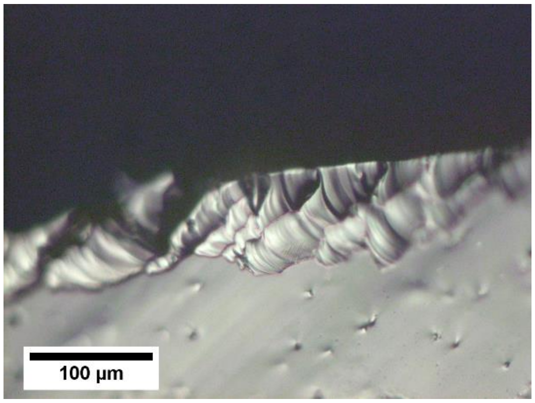
Stage 1 polish indicated by arrow (pp3p1).



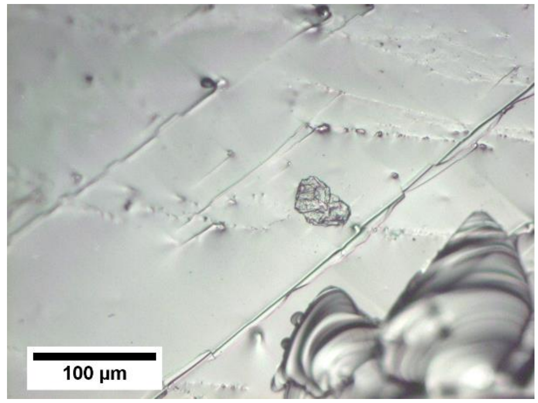
Patchy and spot residue (pp2p2).

Replicated Tool 15. Meat processing (longitudinal) for 37 minutes.

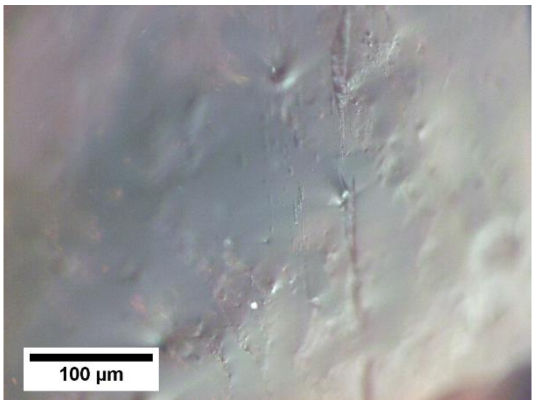




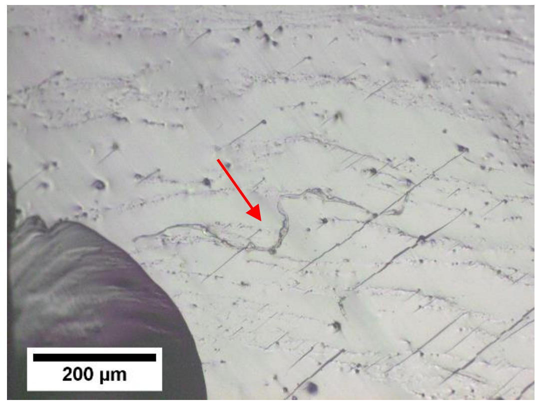
Continuous feathered scarring (pp6p1).



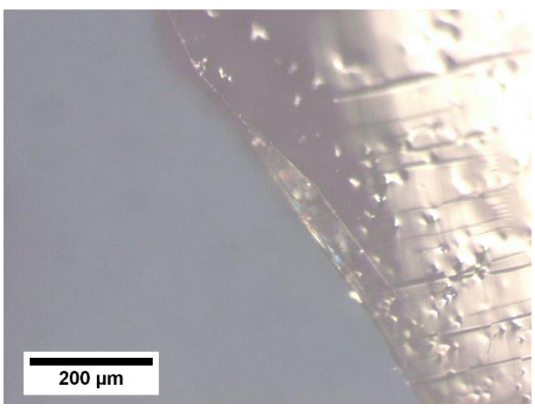
Folded grainy particle residue; step scarring (pp1p3).



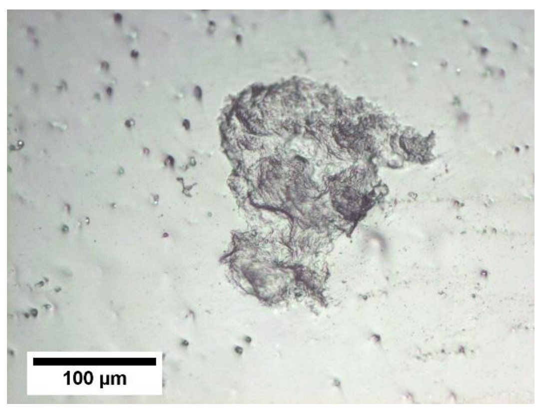
Rough bottom and intermittent striations (pp8p2).



Residue band (pp2p2).

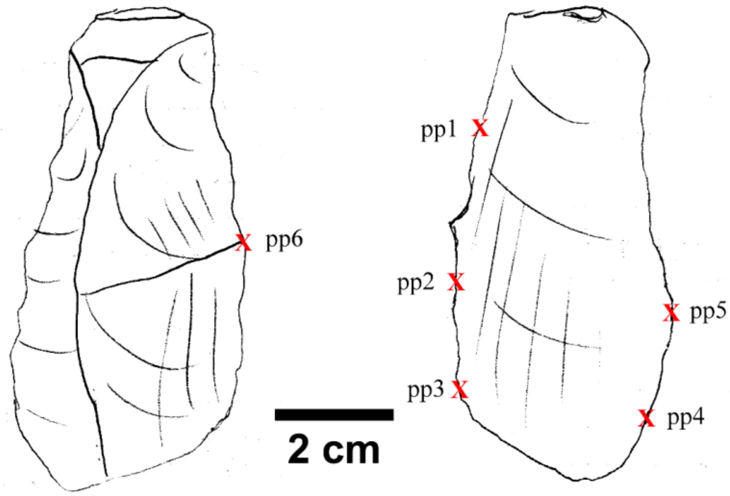


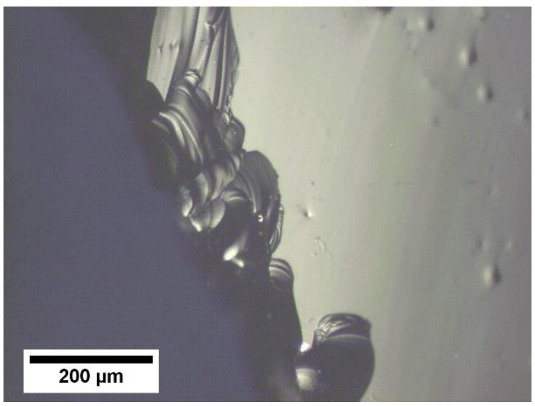
Flaked striation (pp4p1).



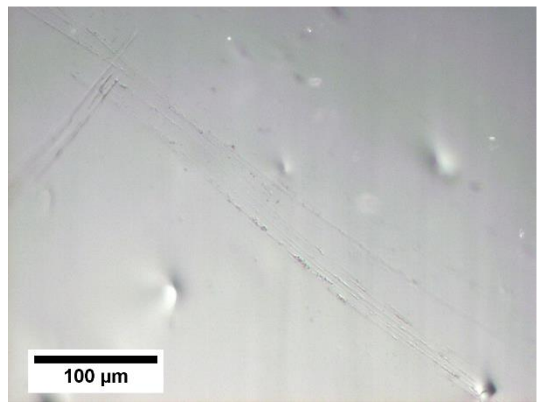
Patchy residue (pp3p2).

Replicated Tool 16. Carcass processing (longitudinal) for 21 minutes.

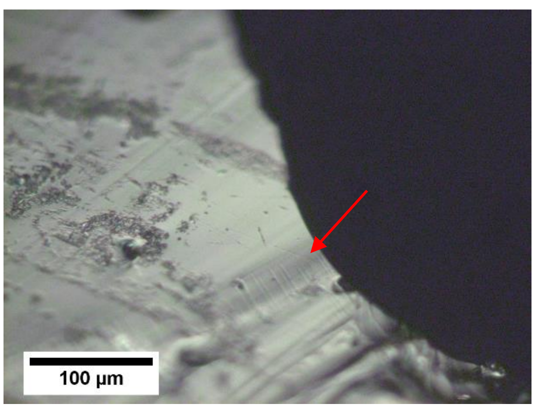




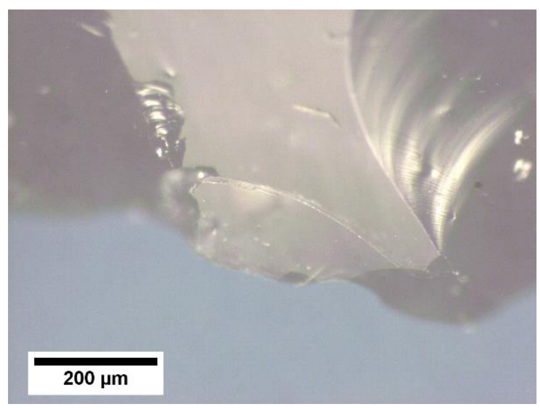
Continuous step scarring (pp4p1).



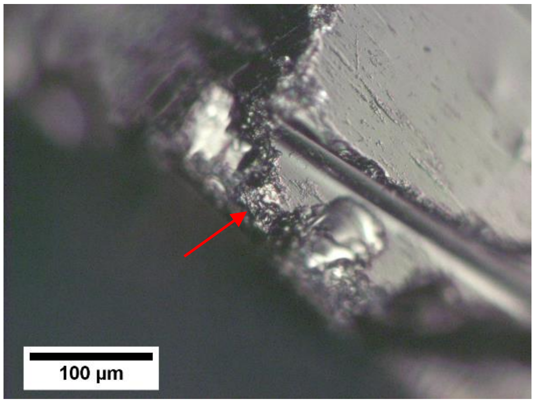
Intermittent striations (pp5p1).



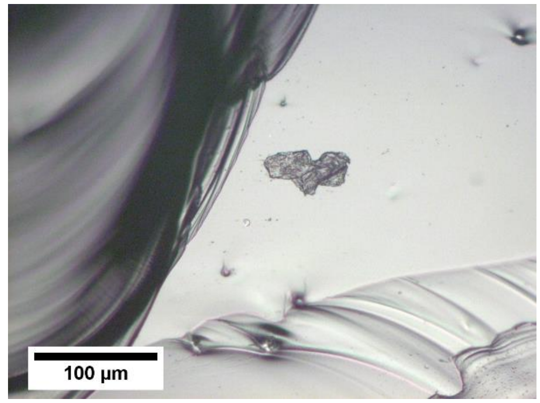
Sleek striations indicated by arrow; patchy residues (pp3p2).



Flaked striation (pp5p2).

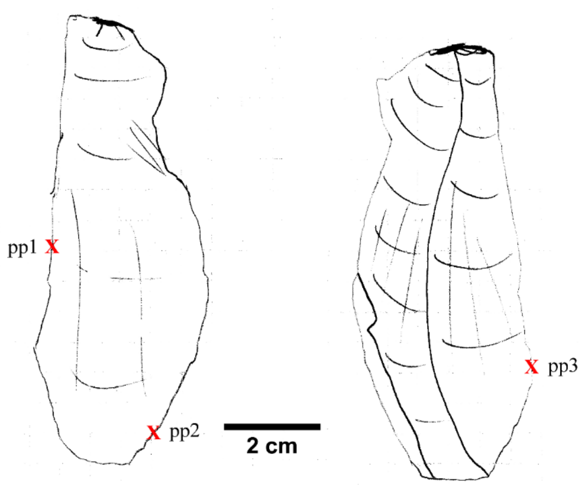


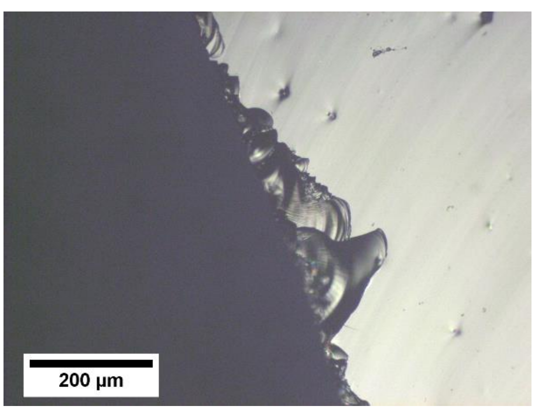
Intermittent striations; medium edge rounding; stage 3 polish indicated by arrow (pp1p1).



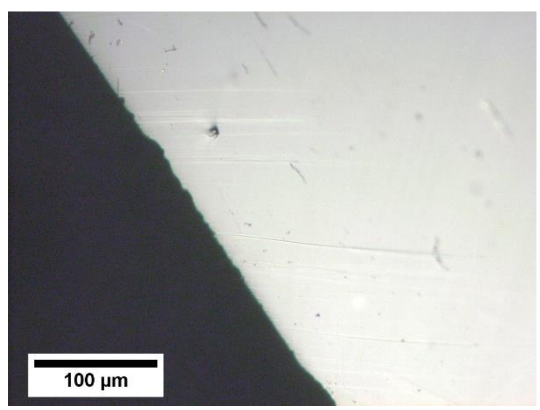
Folded grainy particle residue (pp6p3).

Replicated Tool 17. Meat processing (longitudinal) for 24 minutes.

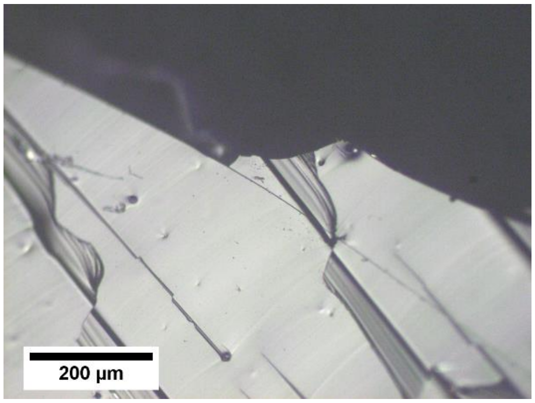




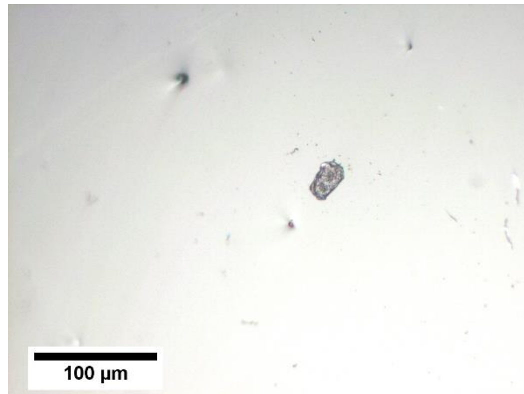
Continuous stepped scarring (pp2p1).



Sleek and rough bottom striations (pp2p2).

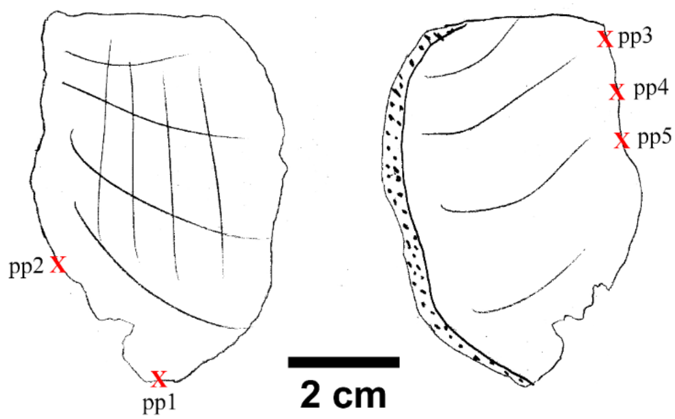


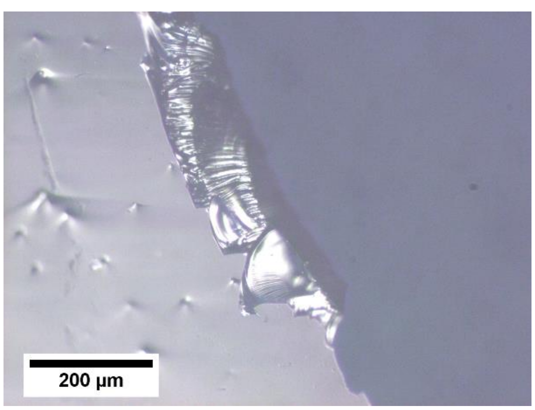
Flaked striation (pp1p2).



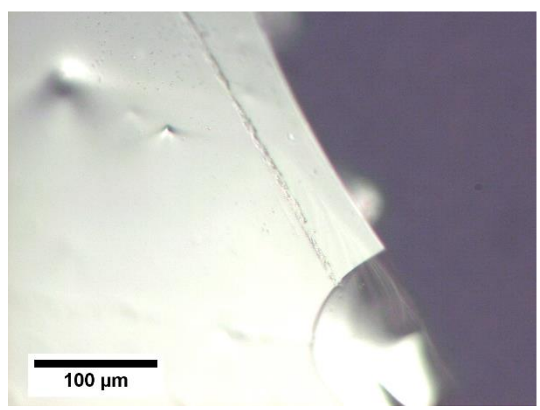
Folded grainy particle and spot residues (pp2p3).

Replicated Tool 18. Meat processing (longitudinal) for 31 minutes.

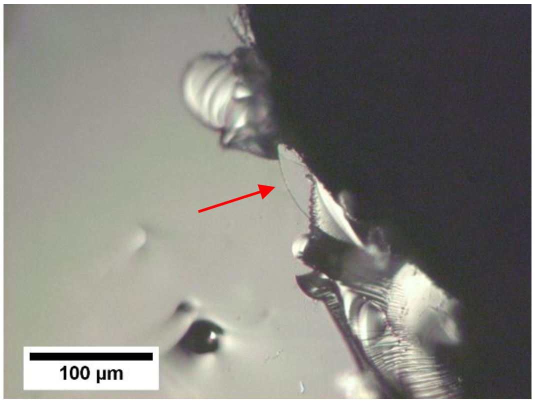




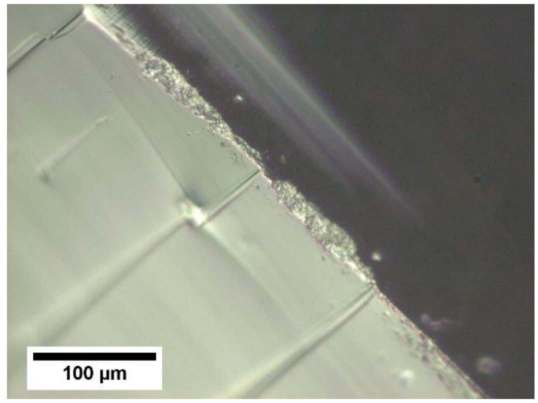
Continuous step scarring (pp4p1).



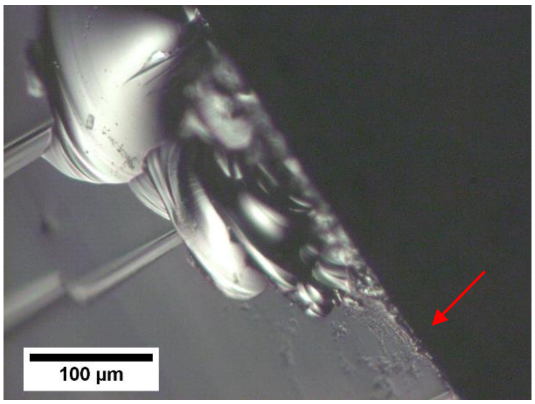
Intermittent striation (pp5p1).



Flaked striation indicated by arrow (pp3p1).



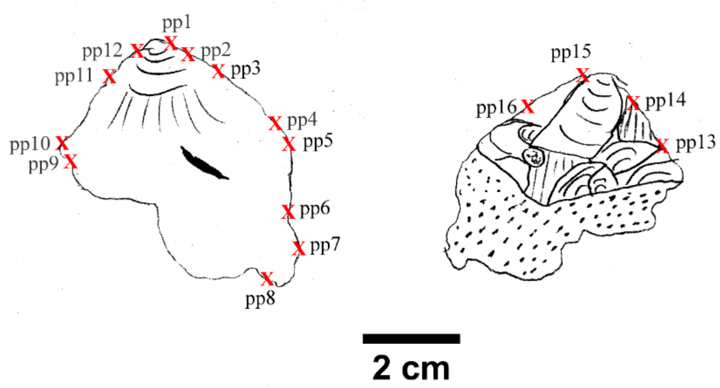
Stage 3 polish (pp1p2).

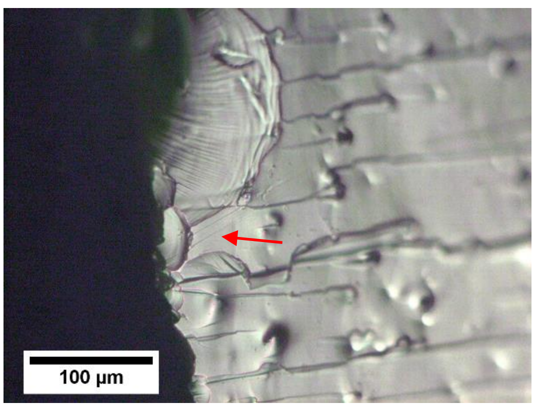


Medium edge rounding indicated by arrow; spot residues (pp1p3).

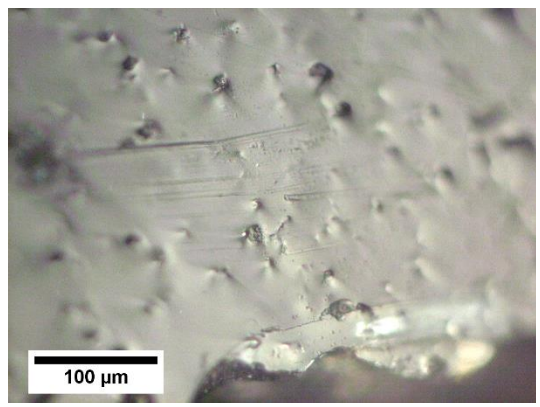
Artifacts

Acc-078. Carcass and hide processing (longitudinal and transverse).

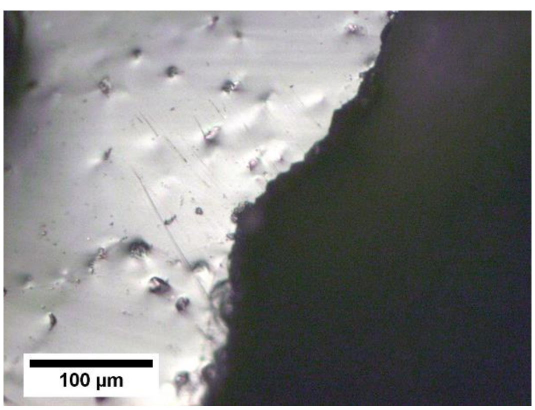




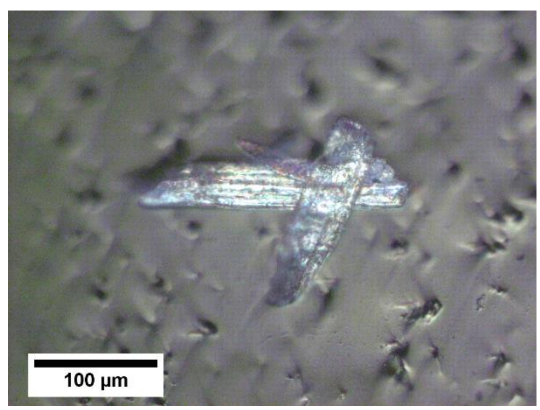
Feather and step scarring; sleek striations indicated by arrows (pp9p6).



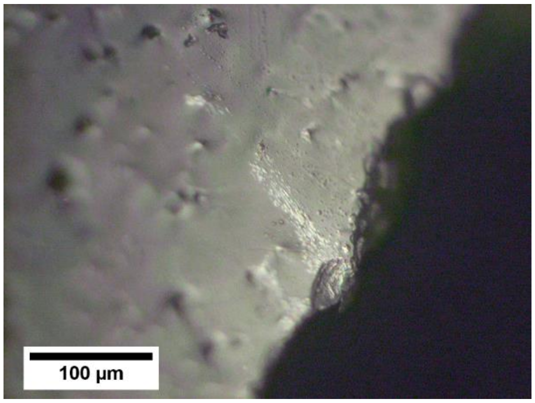
Rough bottom, sleek, and flaked striations (pp6p5).



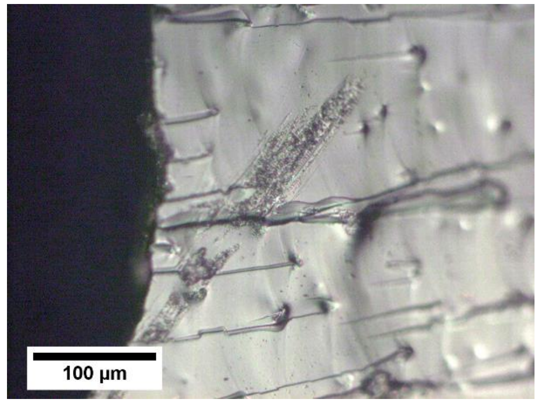
Rough bottom and intermittent striations (pp2p1).



Unidentified residue (pp10p2).

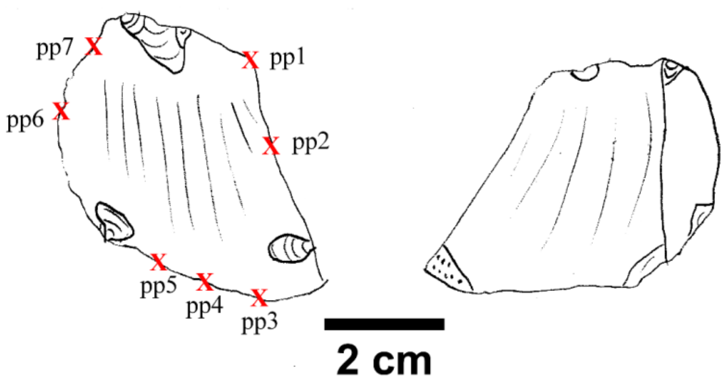


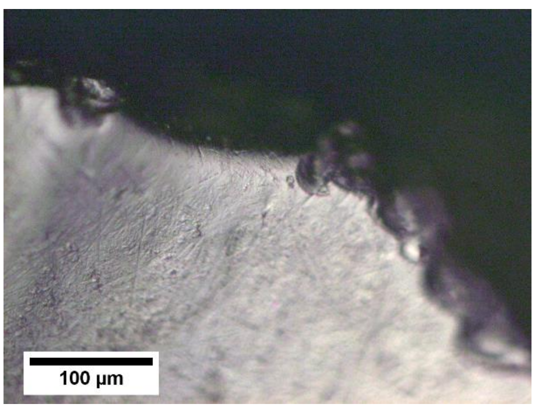
Stage 2 polish (pp6p1).



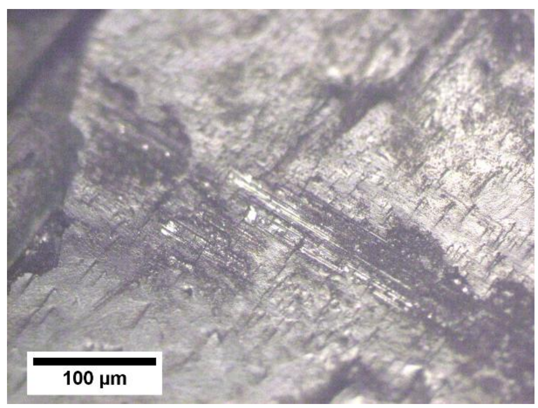
Linear patchy residue (pp9p2).

Acc-524. Other.

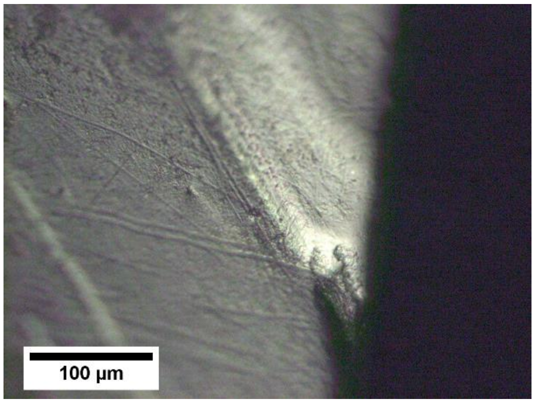




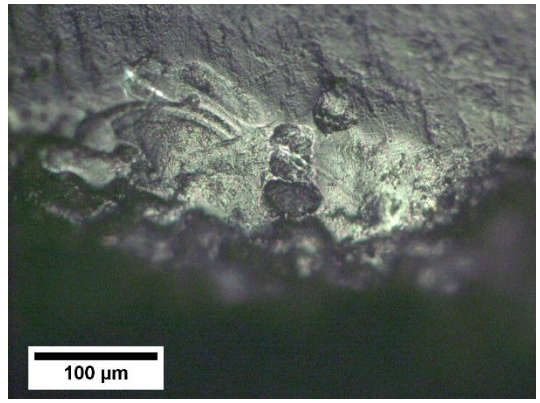
Feather and step scarring; medium and intensive edge rounding; stage 4 polish; sleek striations (pp1p1).



Polish and rough bottom striations (pp7p2).

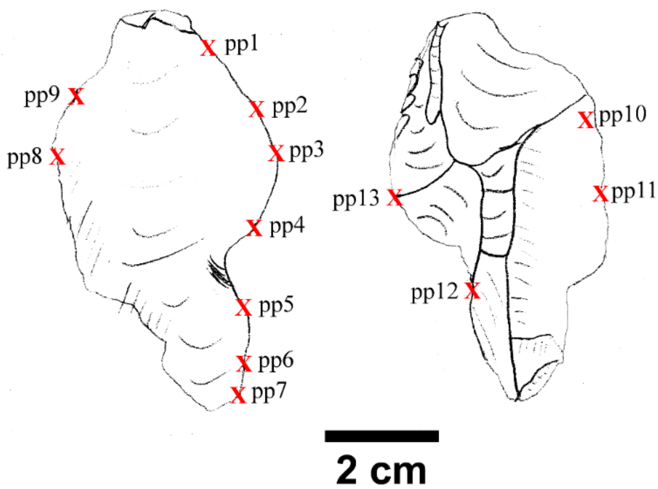


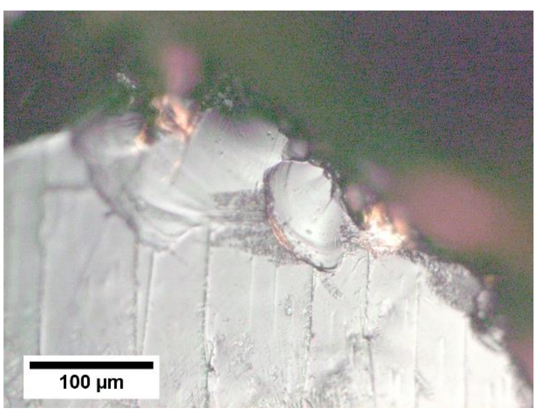
Stage 4 polish and striations (pp2p1).



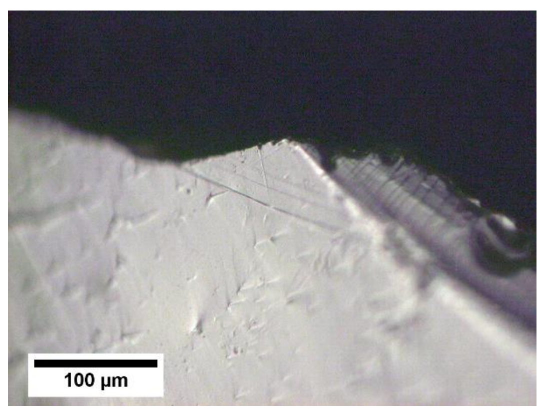
Intensive edge rounding and polish (pp3p2).

Acc-733. Hide processing (longitudinal).

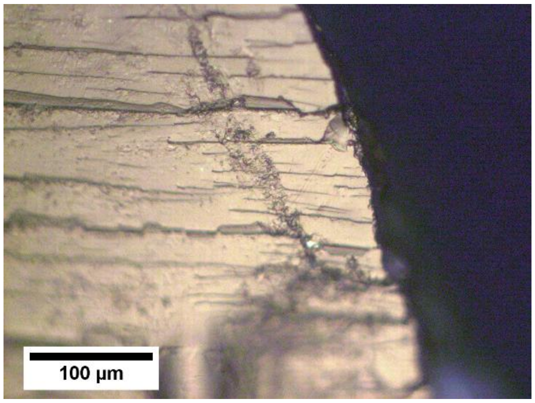




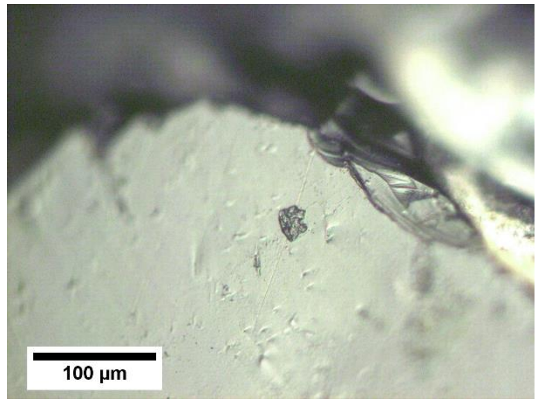
Feather and step scarring; sleek striations; patchy residue (pp11p3).



Rough bottom striations (pp3p3).

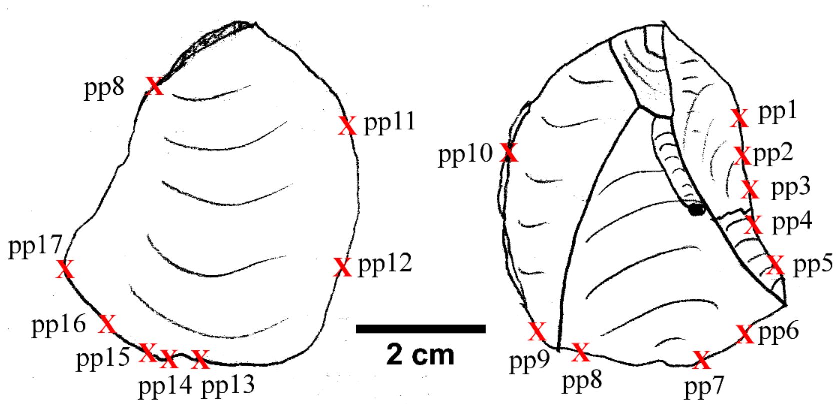


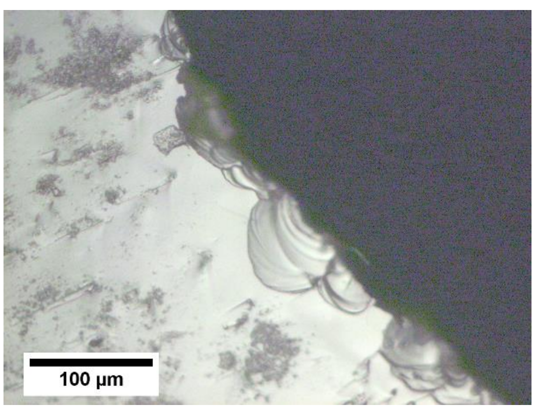
Intensive edge rounding; linear patchy residue (pp4p1).



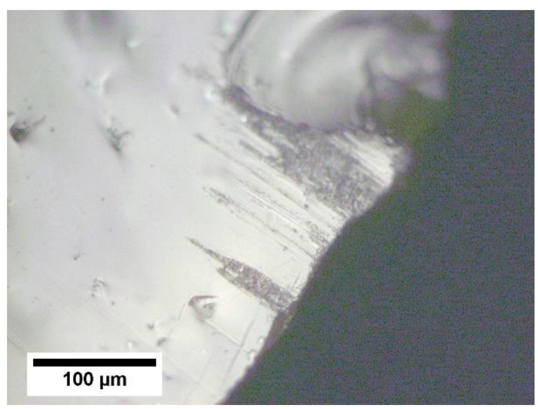
Folded grainy particle residue (pp3p2).

Acc-759. Meat and hide processing (longitudinal and transverse).

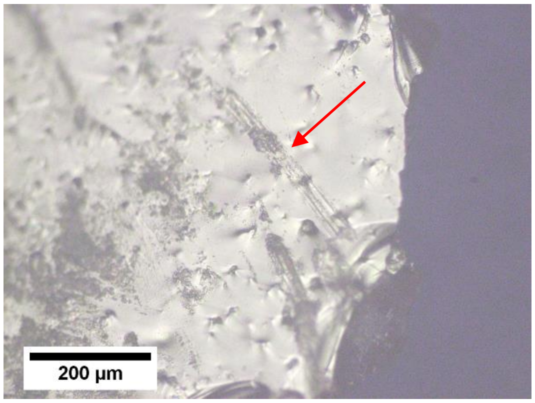




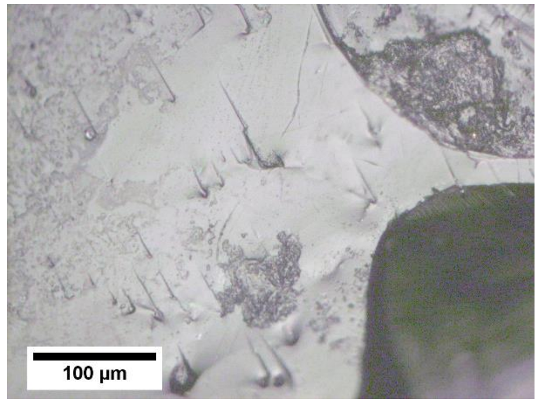
Feather and step scarring; folded grainy particle and patchy residue (pp6p1).



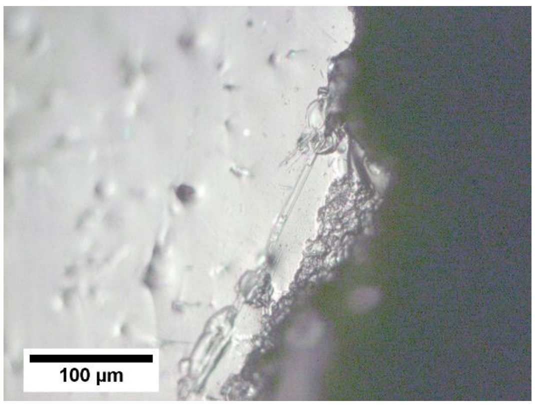
Rough bottom striations; intensive edge rounding (pp13p5).



Intermittent striations (pp8p1).

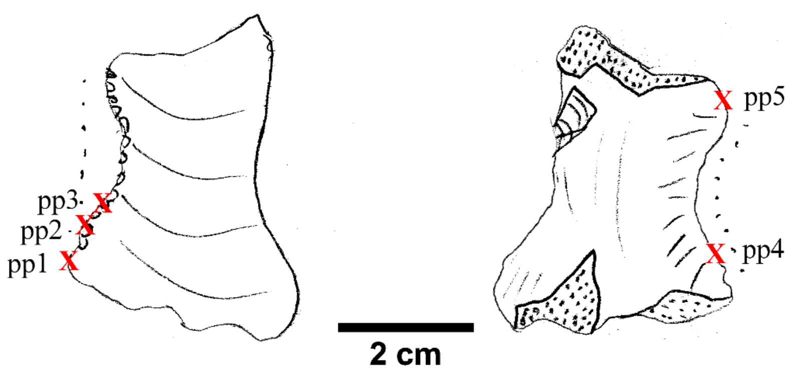


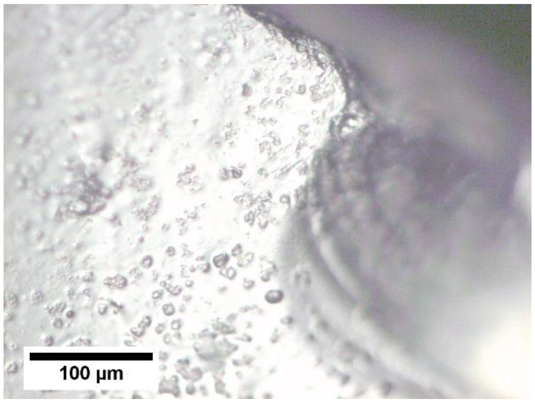
Residue band and patchy residue; parallel striations (pp4p3).



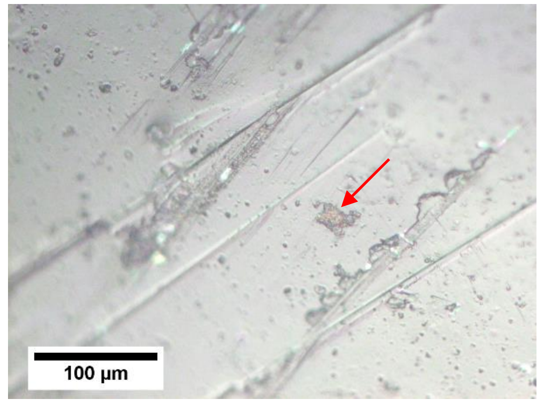
Stage 3 polish (pp15p1).

Acc-819. Other.



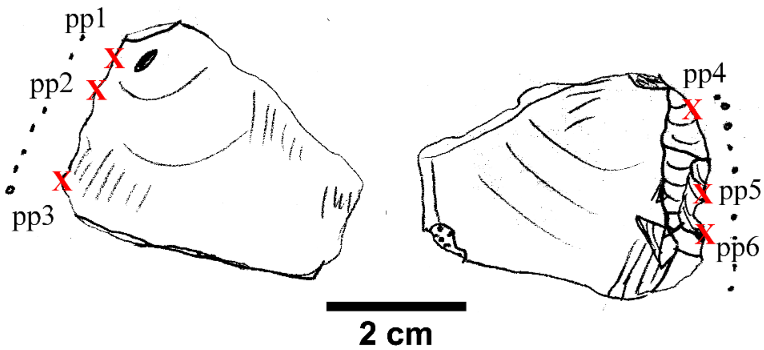


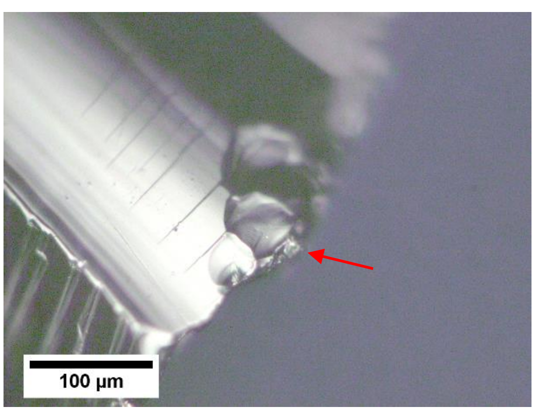
Feather scarring; intensive edge rounding; stage 4 polish (pp1p2).



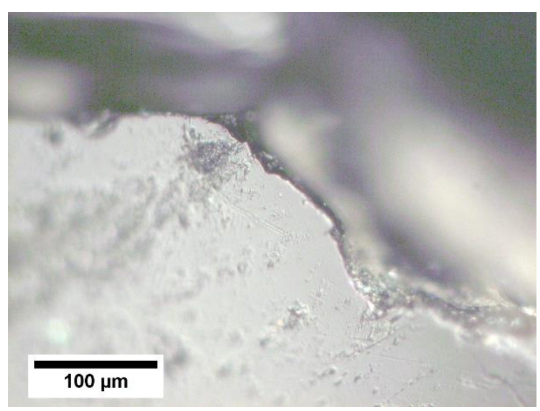
Rough bottom and intermittent striations; unidentified residue indicated by arrow (pp3p4).

Acc-856. Carcass processing (longitudinal).

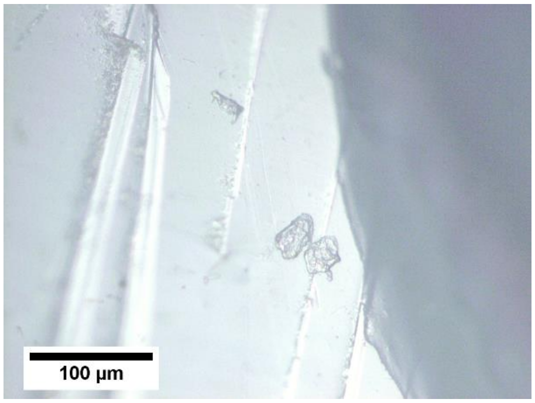




Continuous feather scarring; stage 1 polish indicated by arrow (pp5p2).

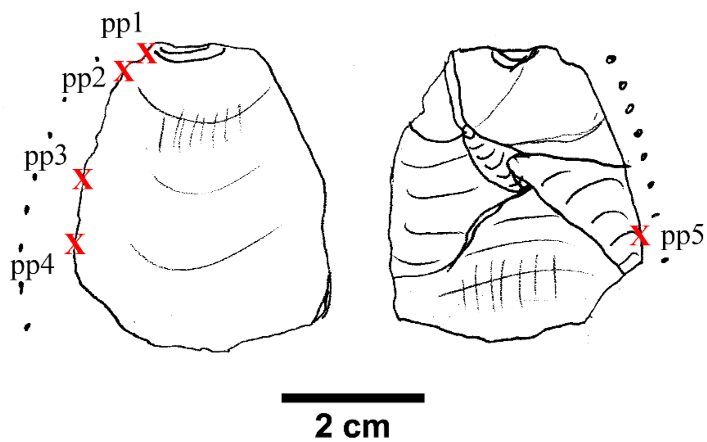


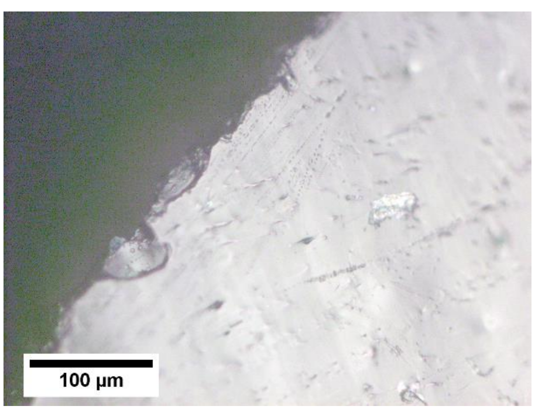
Folded grainy particle residues and parallel sleeks (pp2p2).



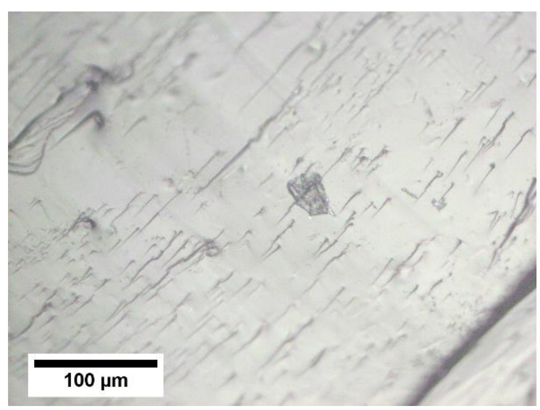
Sleek and intermittent striations; intensive edge rounding; patchy residue (pp3p1).

Acc-983. Hide processing (longitudinal).

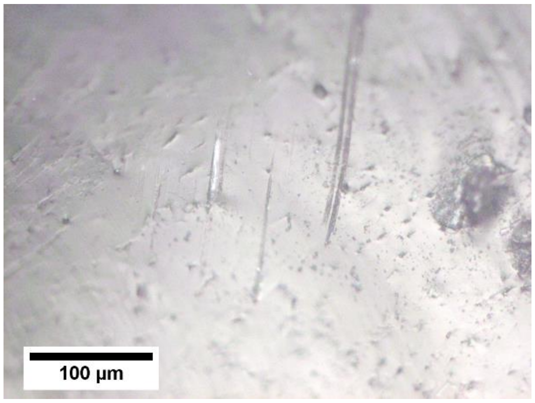




Step scarring; intensive edge rounding; unidentified residue (pp2p1).

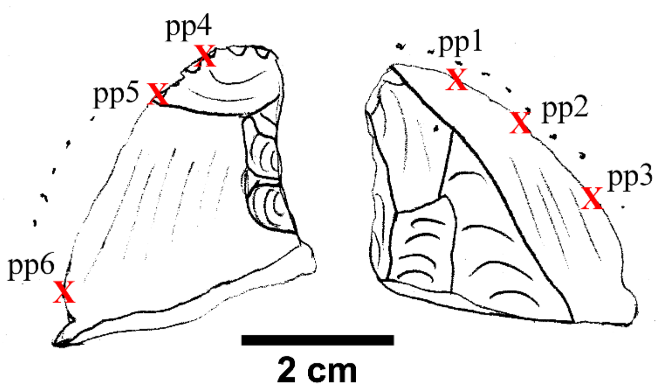


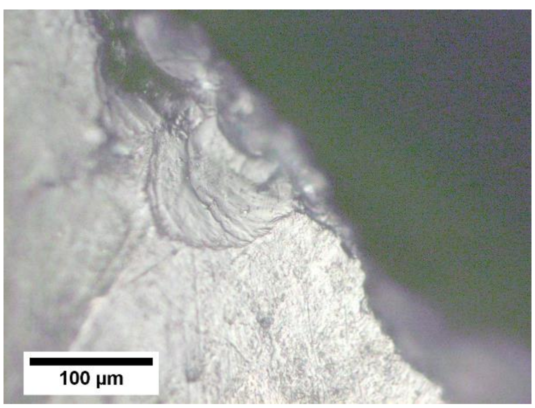
Folded grainy particle residue (pp1p1).



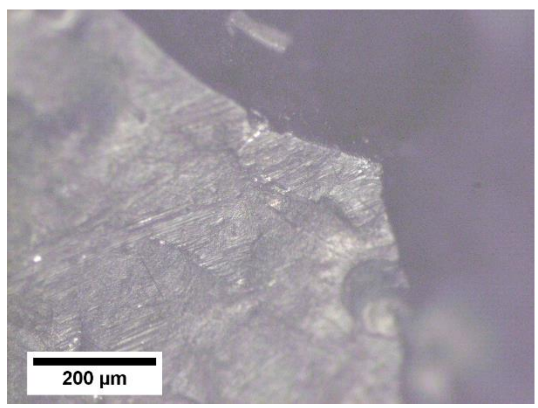
Parallel sleek and rough bottom striations (pp4p1).

Acc-1019. Other.



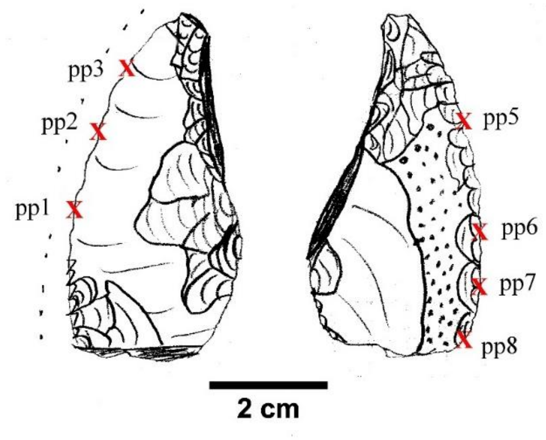


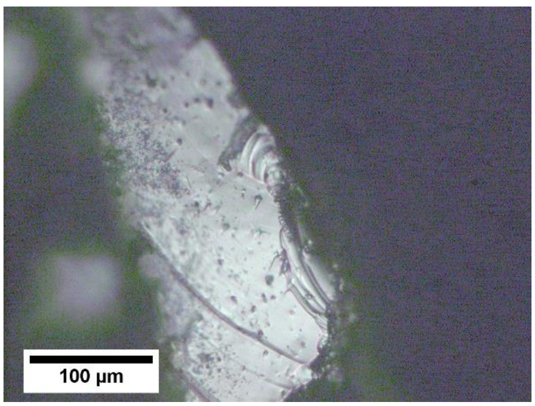
Feather scarring; sleek striation; intensive edge rounding (pp3p1).



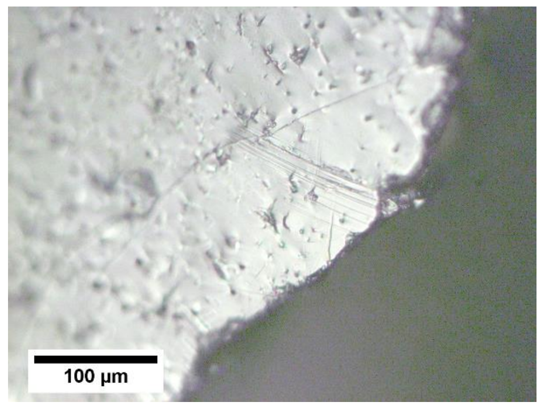
Intermittent and rough bottom striations; stage 4 polish spots (pp5p2).

Acc-1030. Hide processing (transverse).

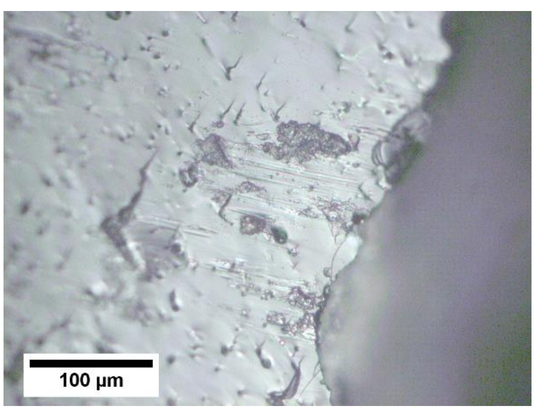




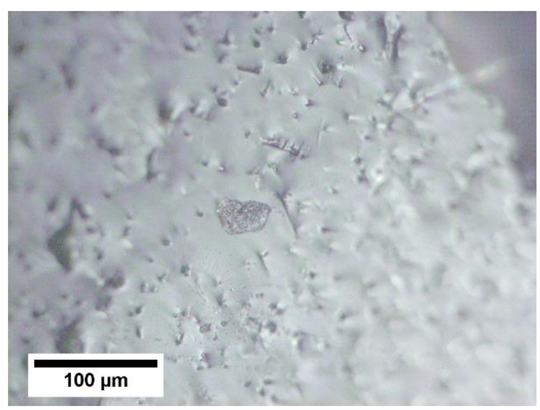
Feather scarring; spot residues (pp5p1).



Sleek, rough bottom and flaked striations; intensive edge damage (pp2p1).

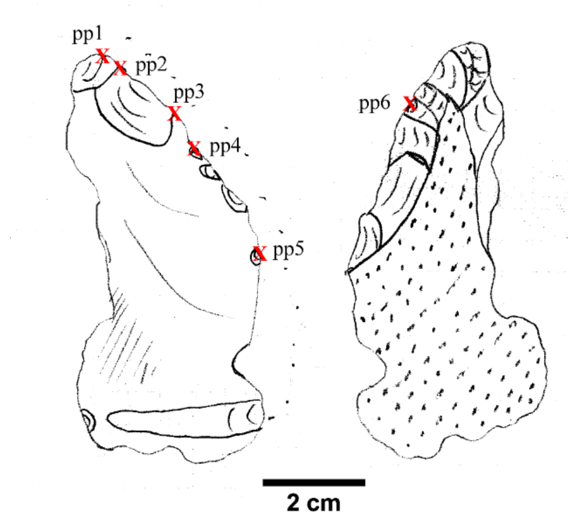


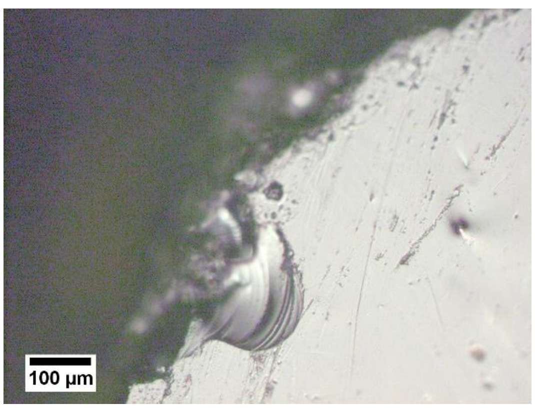
Rough bottom and flaked striations; patchy residues (pp3p1).



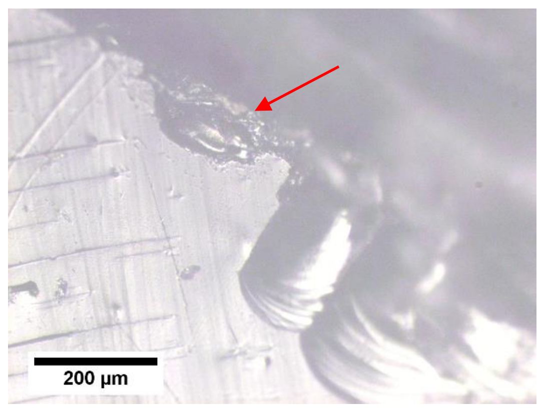
Folded grainy particle residue (pp3p3).

Acc-1375. Carcass and hide processing (transverse).

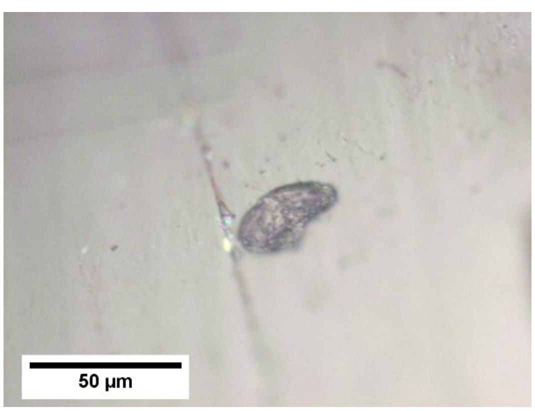




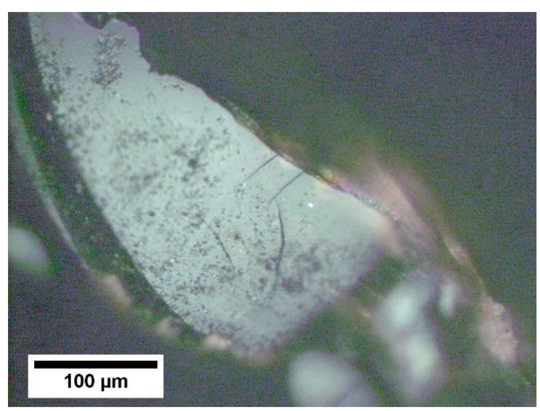
Intensive edge rounding; sleek and intermittent striations (pp6p1).



Continuous feather scarring; rough bottom striations; intensive edge rounding; stage 2 polish indicated by arrow (pp3p2).

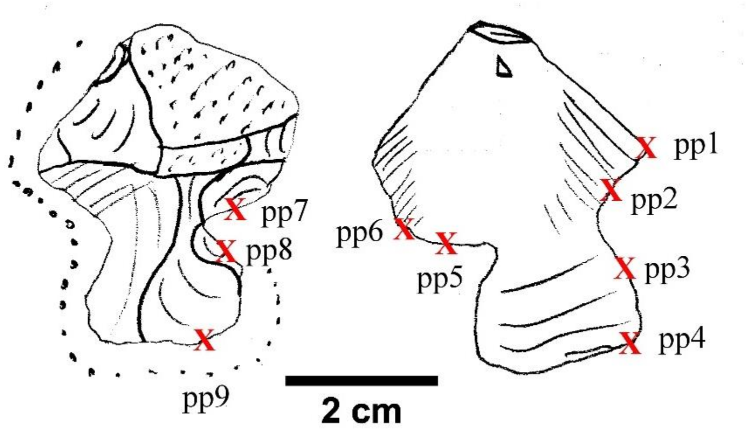


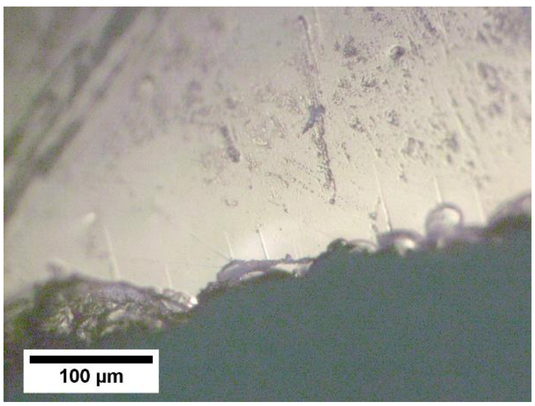
Folded grainy particle residue (pp3p3).



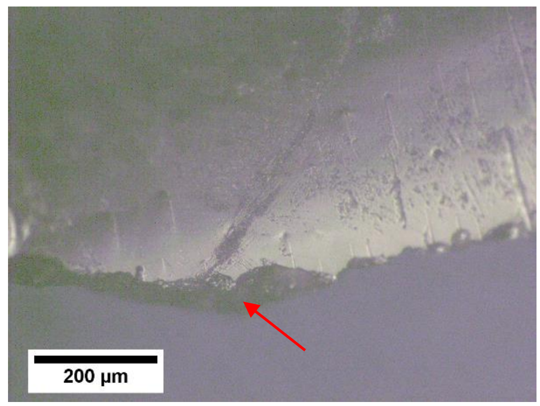
Spot residues (pp1p2).

Acc-1393. Carcass and hide processing (transverse).

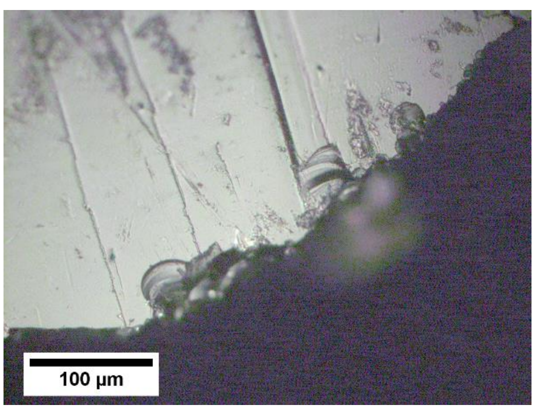




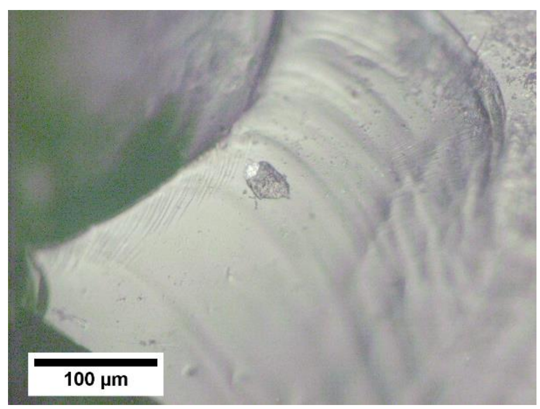
Continuous step scarring; intermittent striations (pp4p1).



Stage 2 polish indicated by arrow (pp4p2).

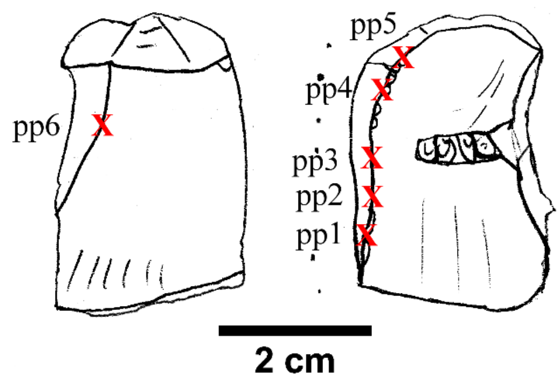


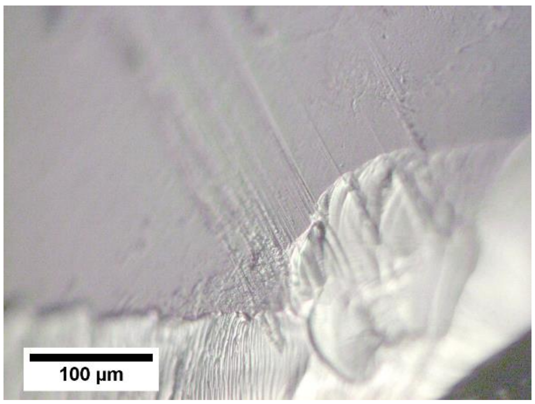
Rough bottom striations; feather scarring; patchy residue; intensive edge damage (pp2p1).



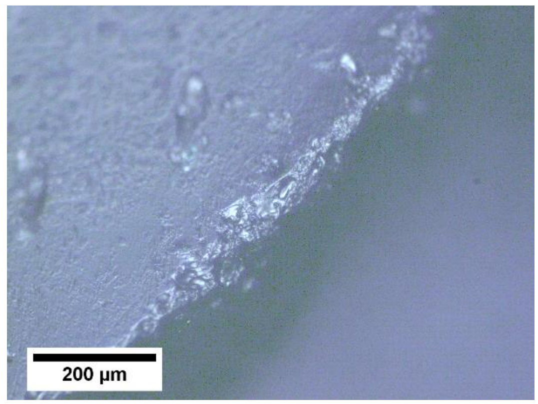
Folded grainy particle residue (pp6p1).

Acc-1507. Hide processing (longitudinal and transverse).

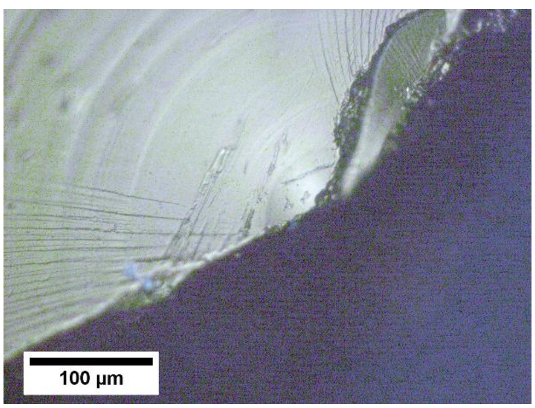




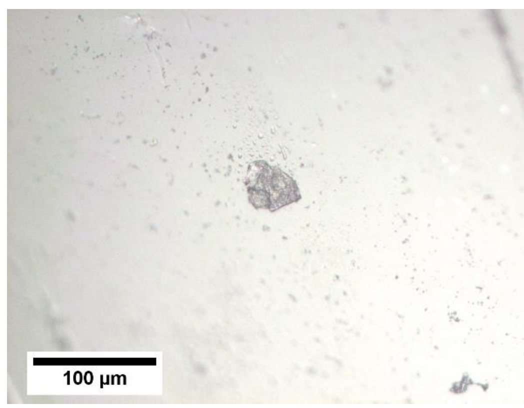
Feather scarring; rough bottom striations (pp4p3).



Medium edge rounding; stage 3 polish (pp1p2).

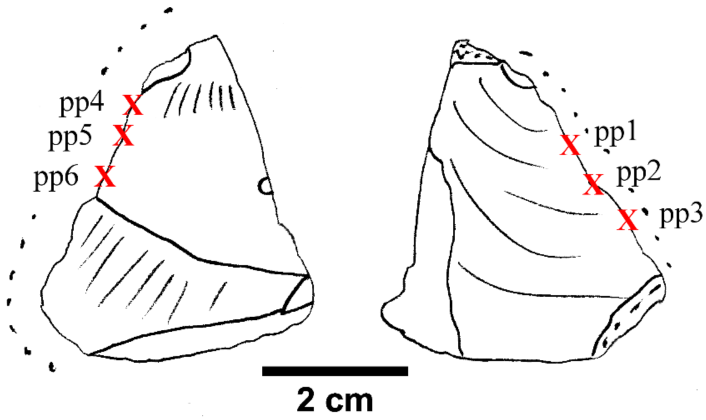


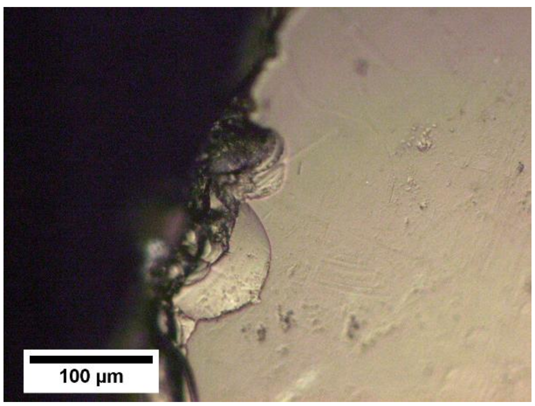
Sleek and intermittent striations (pp3p8).



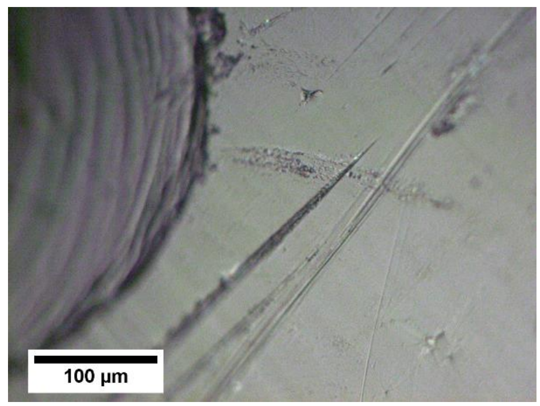
Folded grainy particle residue; residue spots (pp6p1).

Acc-1597. Hide processing (longitudinal and transverse).

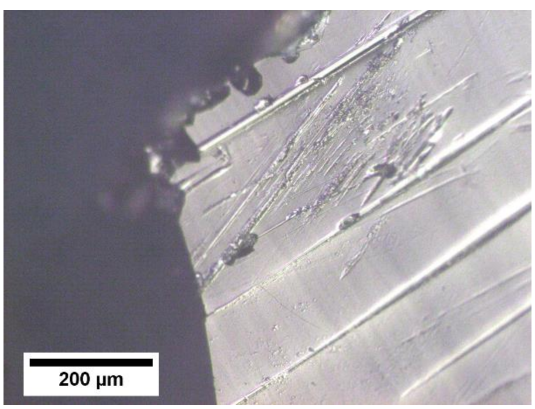




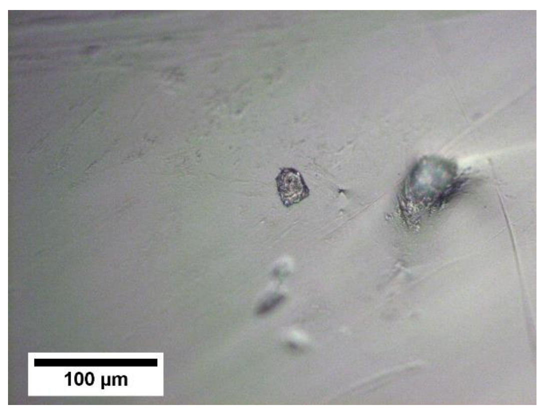
Feather scarring; spot residue (pp6p1).



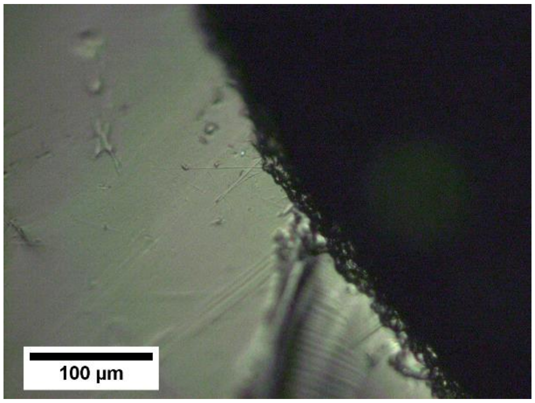
Intermittent, sleek and rough bottom striations (pp5p3).



Sleek and rough bottom striations (pp4p2).

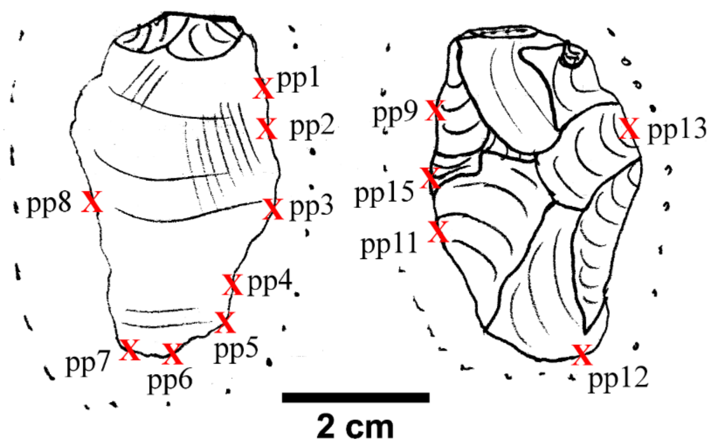


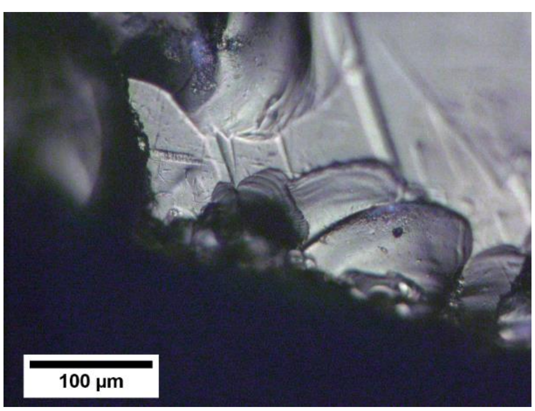
Folded grainy particle residue (pp3p1).



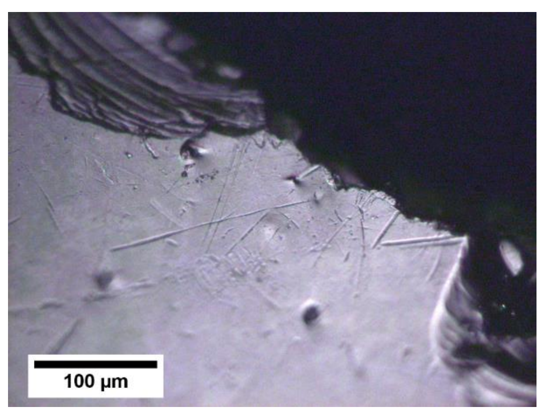
Intensive edge rounding; stage 2 polish; perpendicular striations (pp2p5).

Acc-1608. Other.

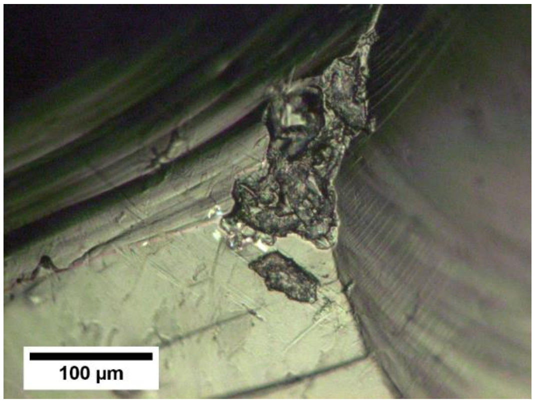




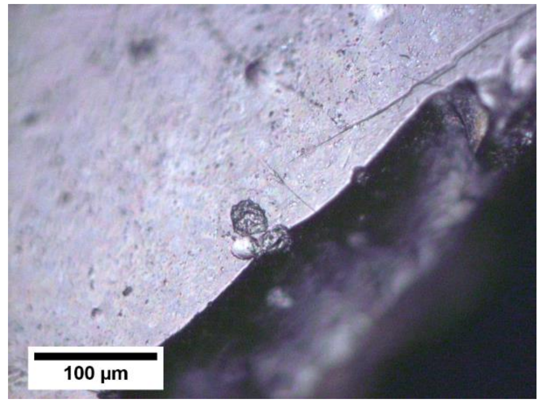
Feather scarring (pp8p1).



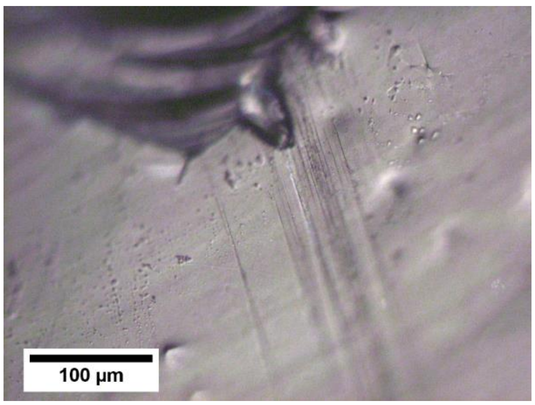
Sleek striations; intensive edge rounding (pp5p3).



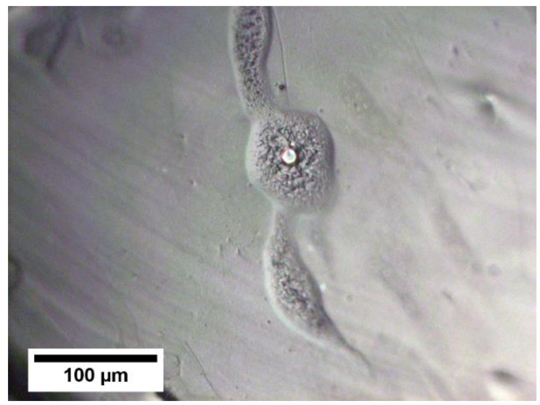
Intermittent striations; stage 2 polish (pp2p5).



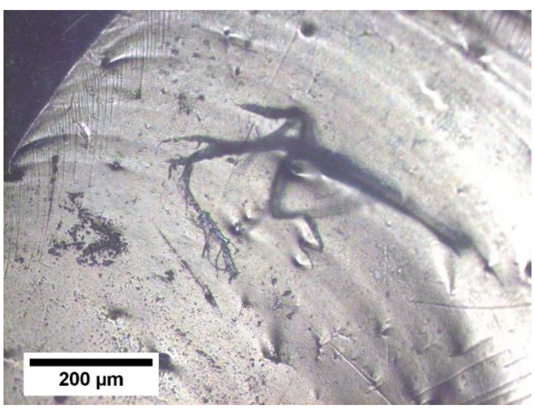
Folded grainy particle residue (pp6p4).



Rough bottom striations; spot residues (pp13p1).

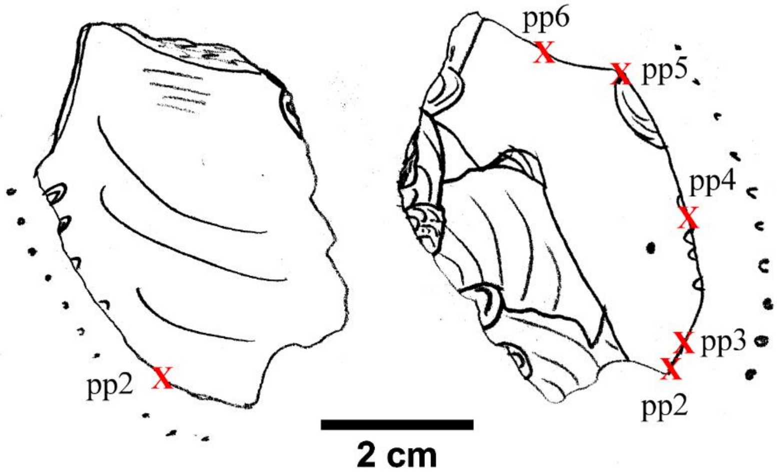


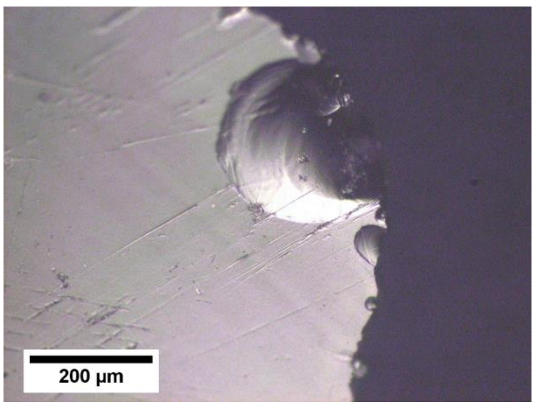
Unidentified residue (pp2p3).



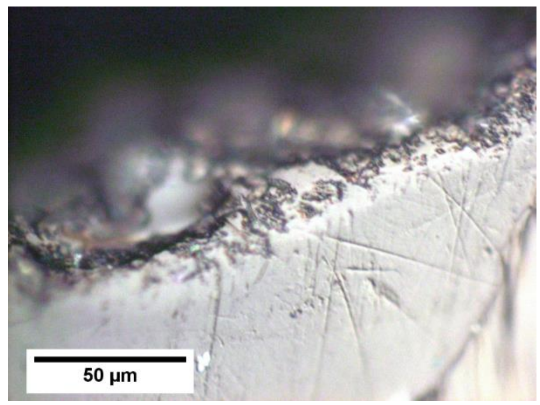
Unidentified residue (pp7p4).

Acc-1611. Hide processing (transverse).

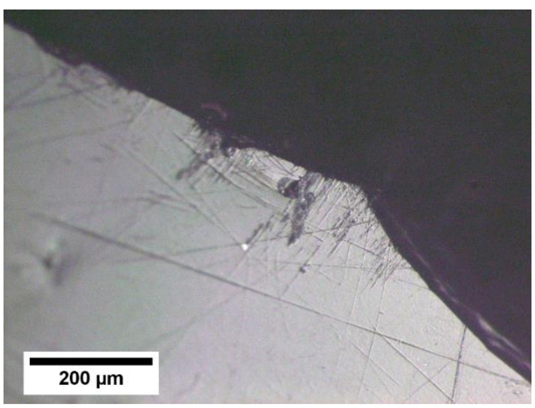




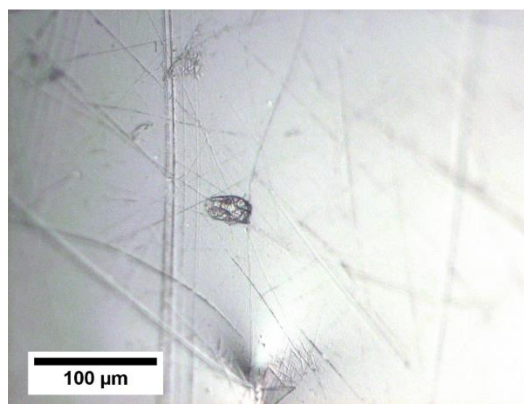
Discontinuous feather scarring; sleek and rough bottom striations (pp1p5).



Intensive edge rounding; stage 4 polish (pp6p3).

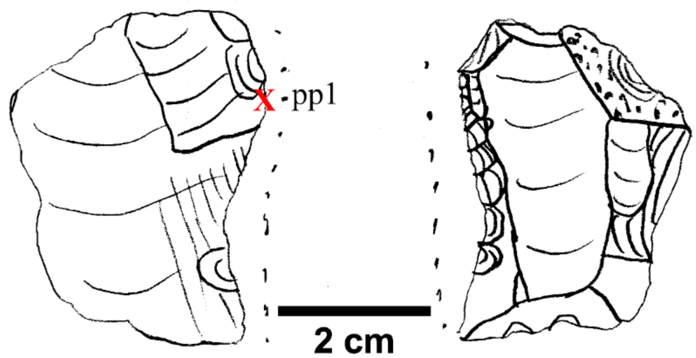


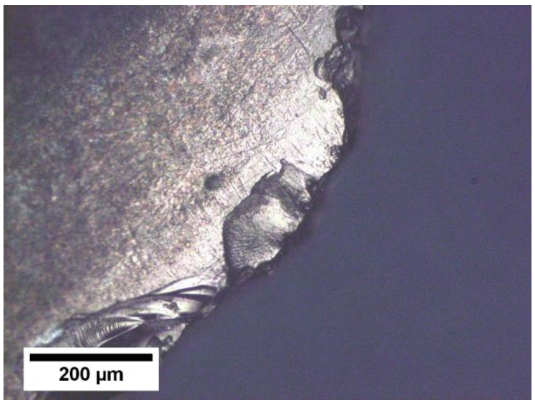
Sleek and rough bottom striations (pp4p5).



Folded grainy particle residue; sleek and rough bottom striations (pp2p2).

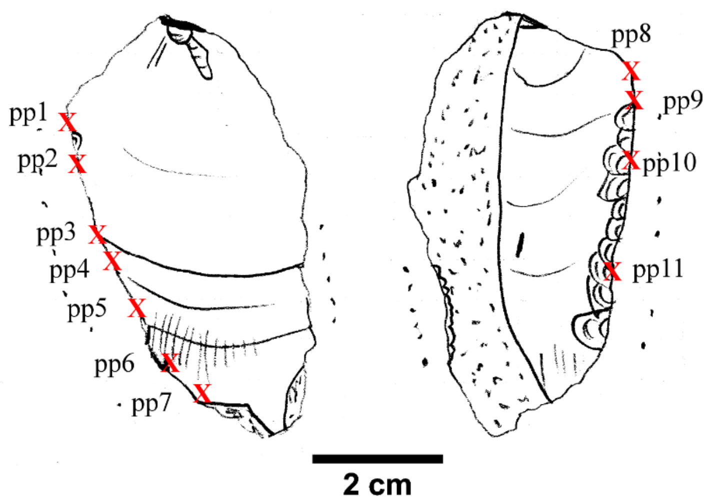
Acc-1630. Unused.
Retouch has obscured use traces, no new use-wear visible.

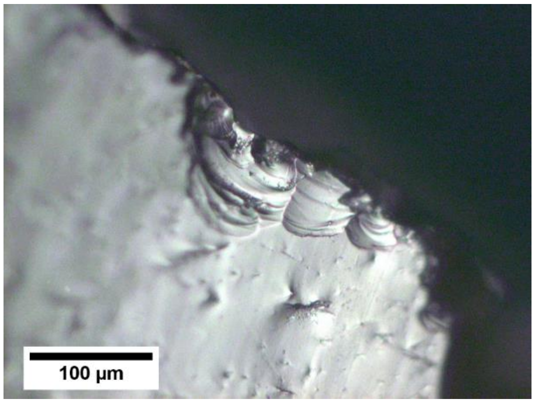




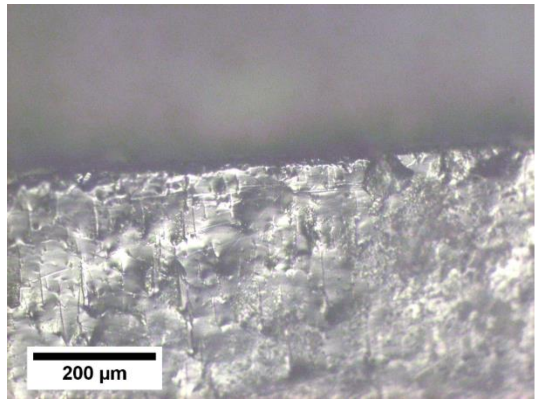
Step scarring (pp1p2).

Acc-1705. Other.

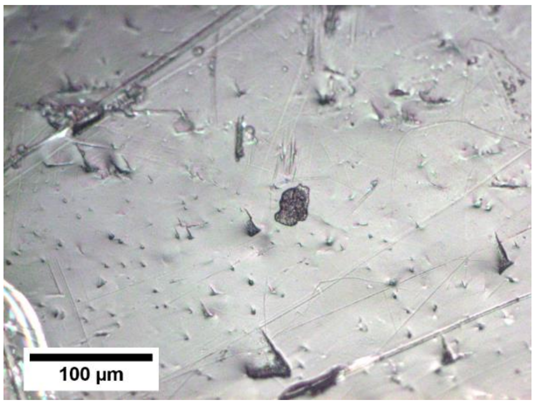




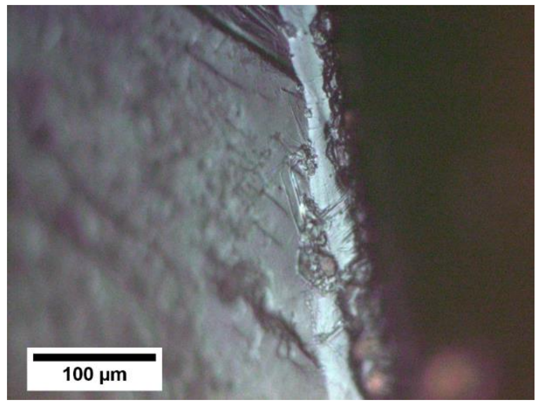
Feather scarring (pp2p1).



Intensive edge rounding (pp6p2).

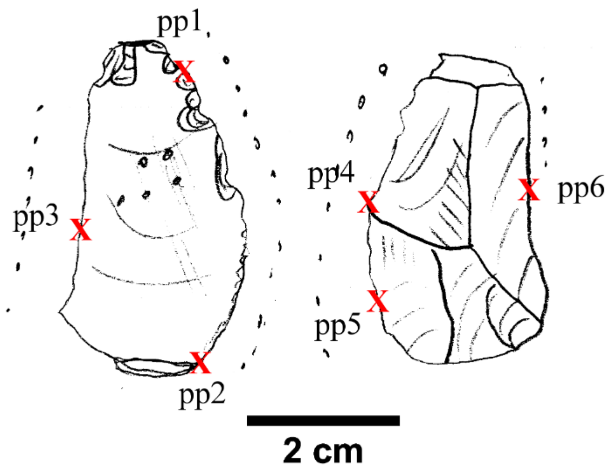


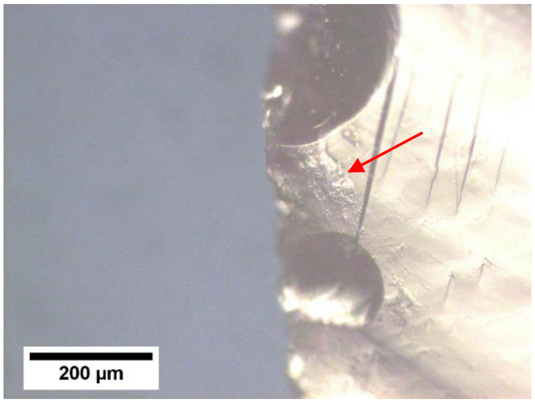
Sleek and rough bottom striations;
folded grainy particle residue (pp7p1).



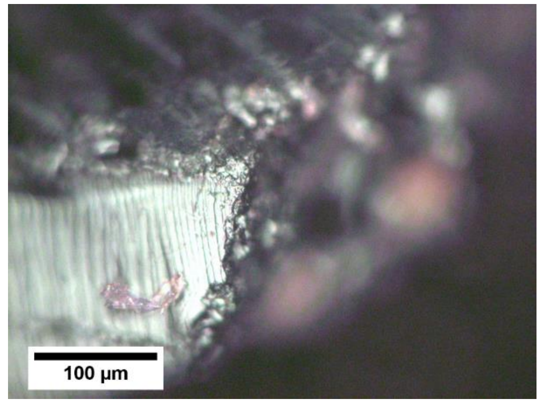
Stage 4 polish (pp8p1).

Acc-1737. Carcass processing (transverse).

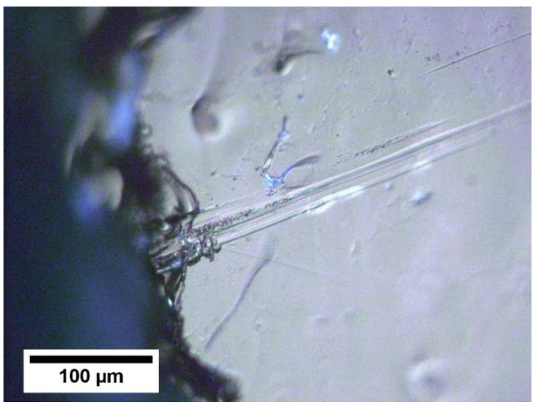




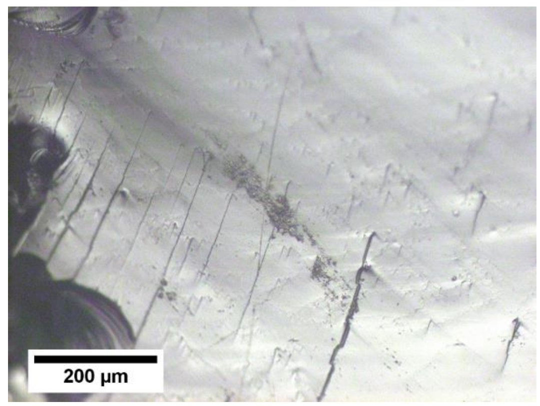
Feather scarring; patchy residue indicated by arrow (pp3p4).



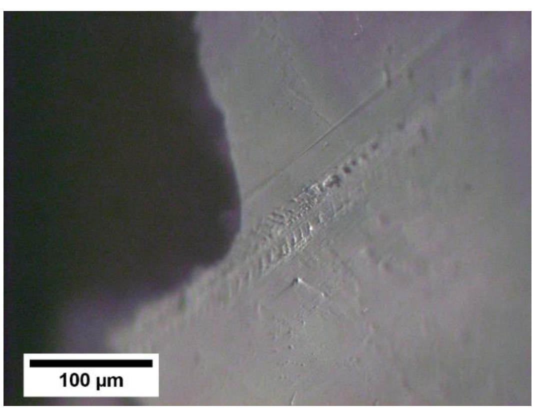
Stage 3 polish (pp2p2).



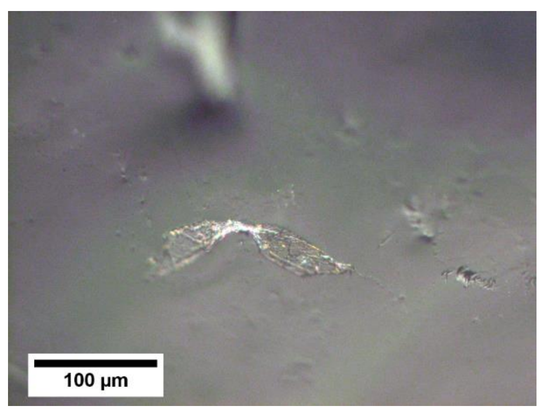
Sleek, rough bottom and intermittent striations; intensive edge rounding (pp4p2).



Spot residues (pp3p5).

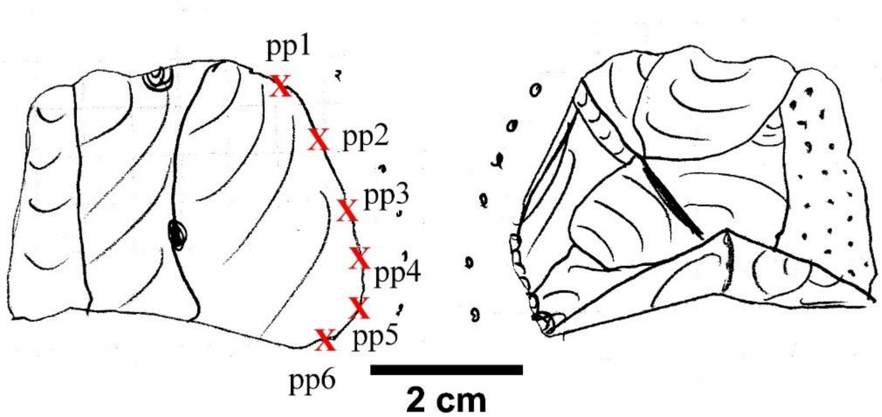


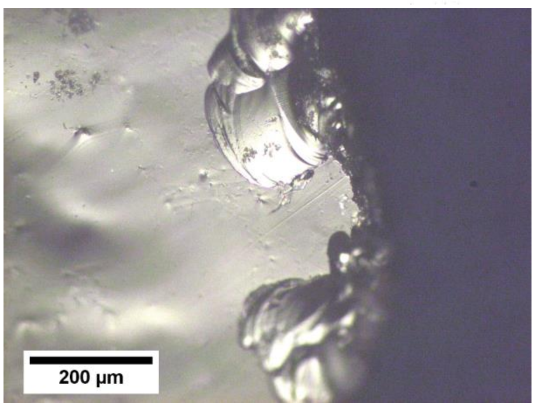
Intermittent and sleek striations (pp6p2).



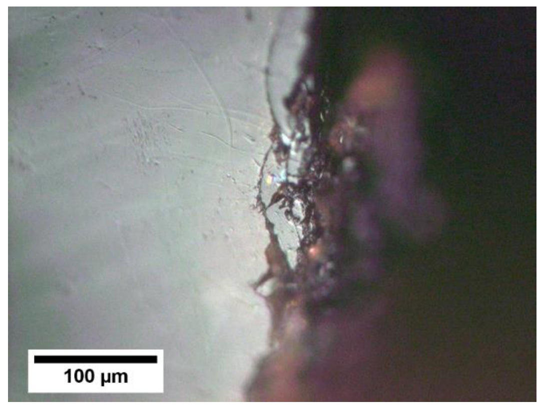
Unidentified residue (pp5p1).

Acc-1787. Hide processing (transverse).

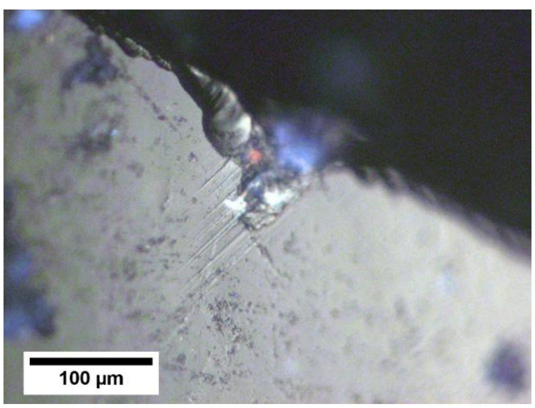




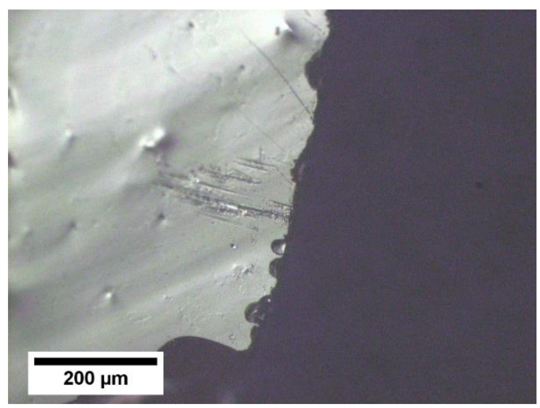
Discontinuous feather scarring; rough bottom striations; spot residues (pp5p3).



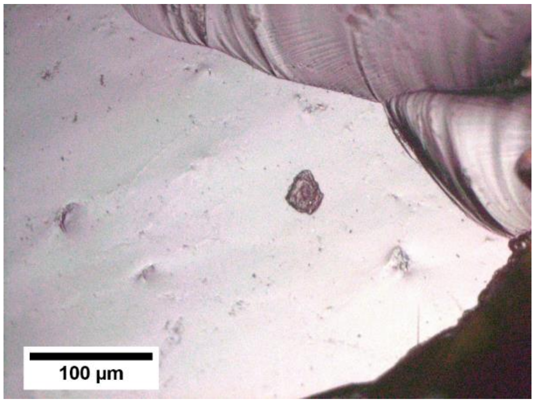
Sleek and flaked striations; intensive edge rounding; stage 2 polish (pp4p2).



Rough bottom striations; spot residue (pp1p2).

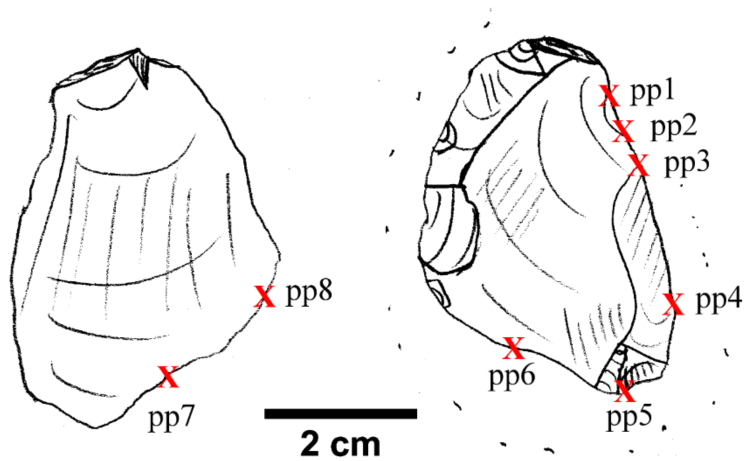


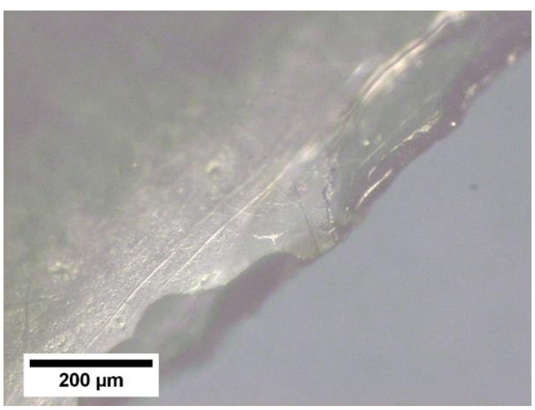
Sleek and rough bottom striations (pp5p3).



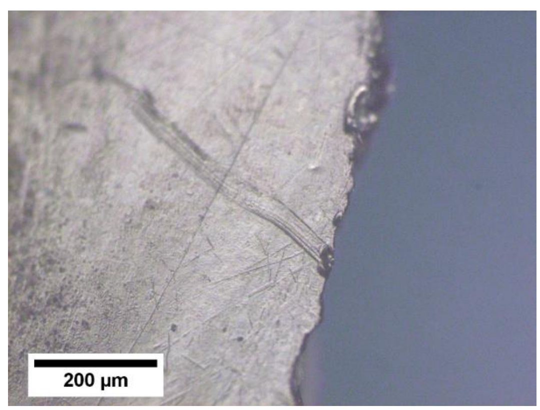
Folded grainy particle residue (pp6p1).

Acc-1951. Other.

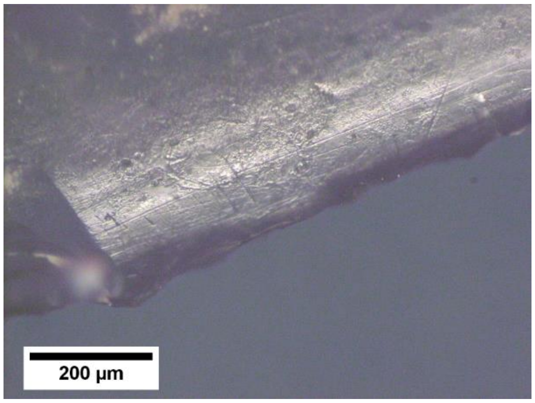




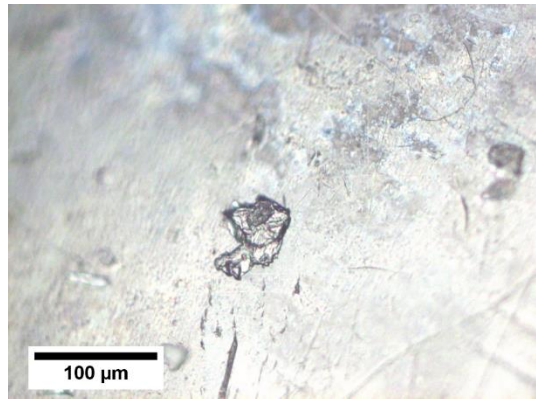
Feather and step scarring, sleek striations (pp5p2).



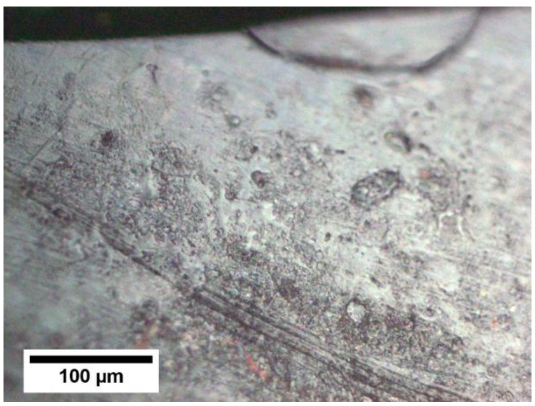
Sleek and rough bottom striations; intensive edge rounding (pp8p2).



Medium edge rounding; sleek striations (pp6p2).

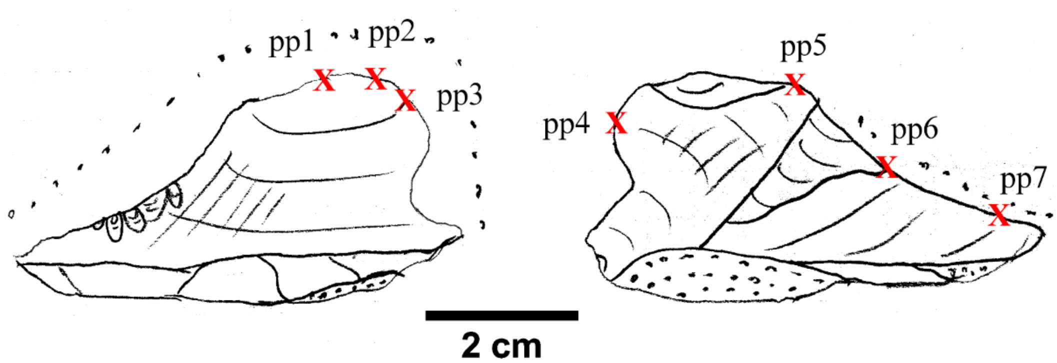


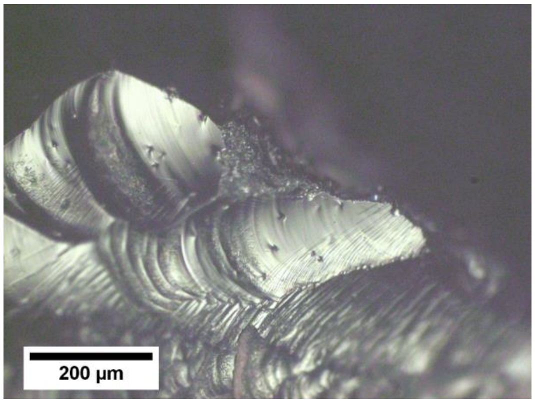
Folded grainy particle residue (pp7p1).



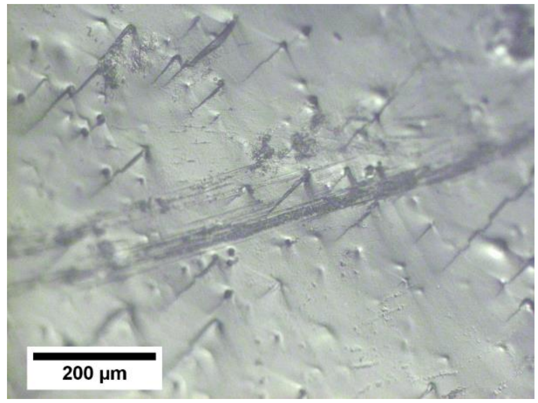
Stage 4 polish; rough bottom striations (pp1p4).

Acc-1958. Carcass and meat processing (longitudinal).

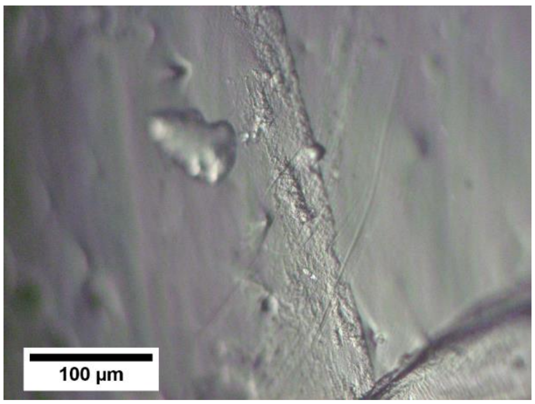




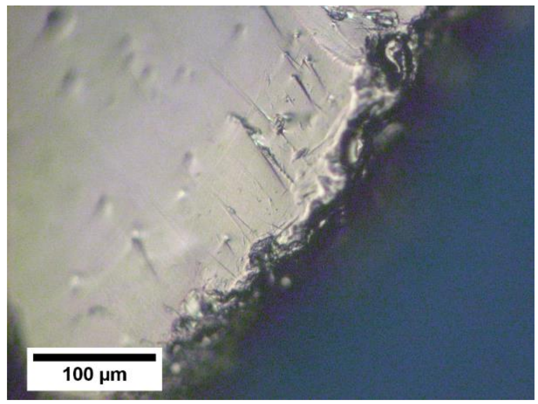
Continuous feather scarring; patchy residue (pp4p3).



Rough bottom and intermittent striations; patchy residue (pp6p3).

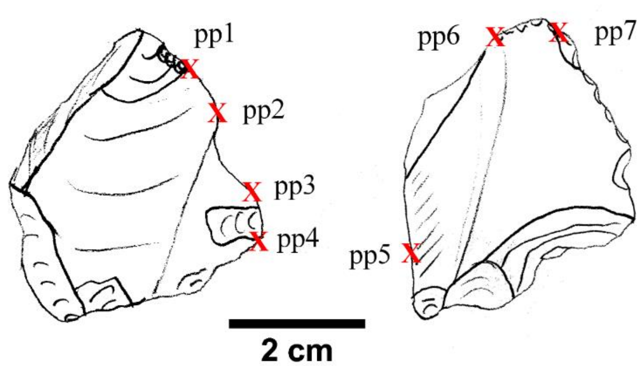


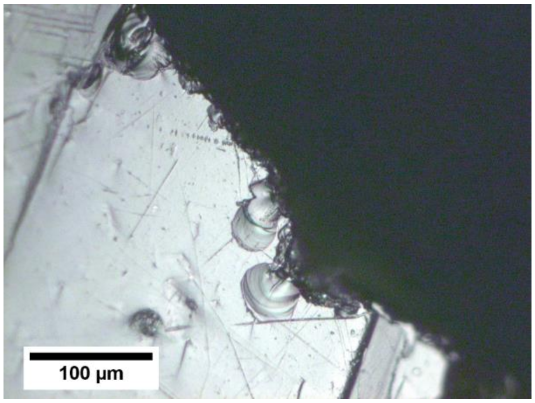
Sleeks and intermittent striations (pp2p3).



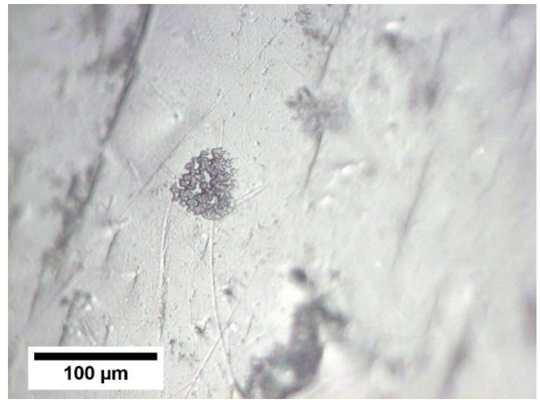
Intensive edge rounding; stage 3 polish (pp5p4).

Acc-1982. Other.



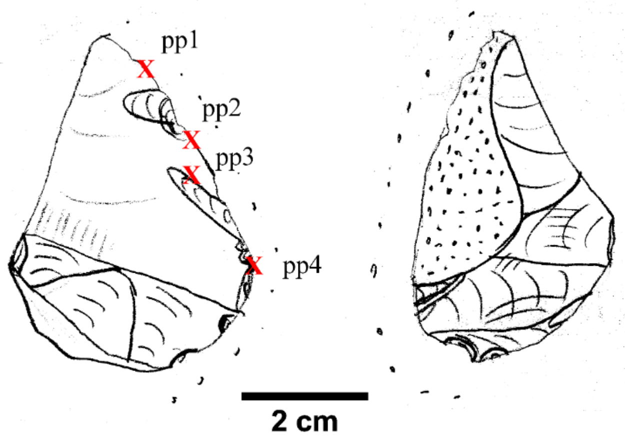


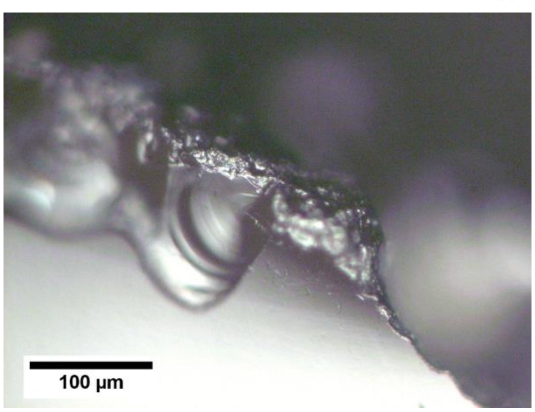
Feather scarring; sleek, rough bottom and intermittent striations; intensive edge rounding (pp5p2).



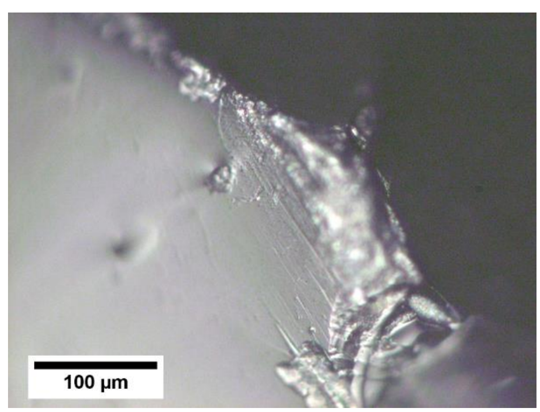
Unidentified residue (pp7p1).

Acc-2127. Meat and hide processing (longitudinal).

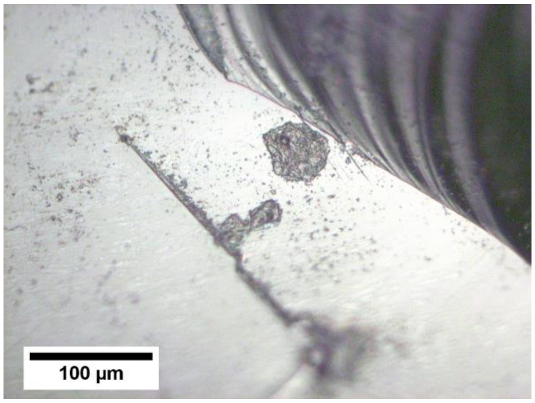




Feather scarring; stage 3 polish (pp1p1).

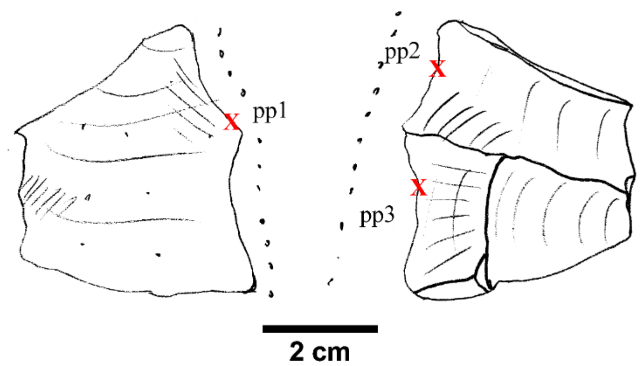


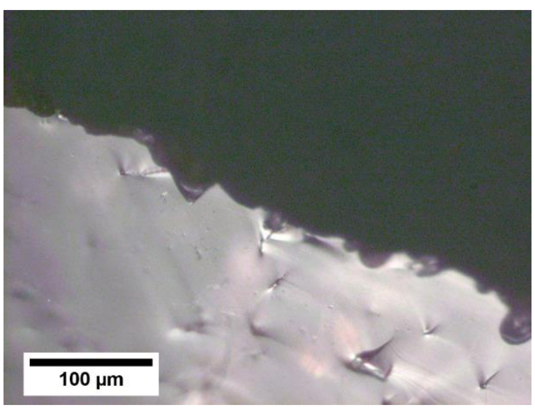
Sleek and rough bottom striations (pp4p2).



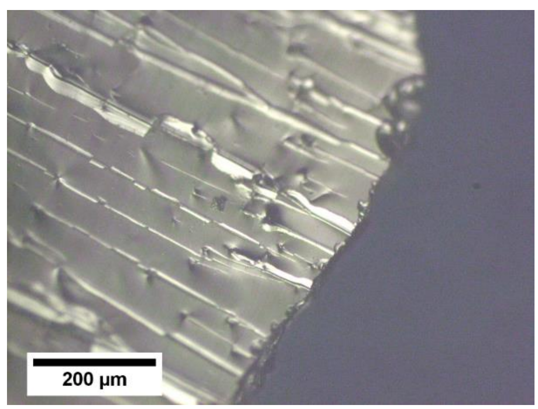
Folded grainy particle residue; residue spots (pp4p4).

Acc-2142. Meat processing (longitudinal).

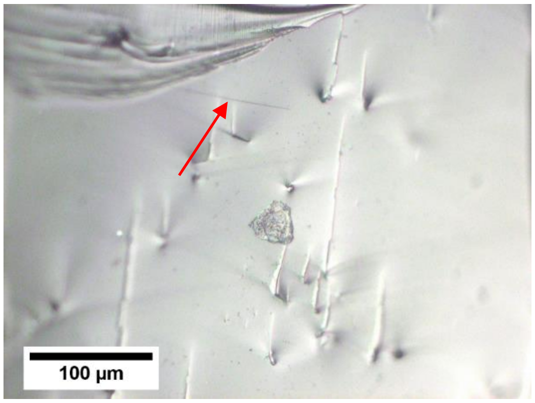




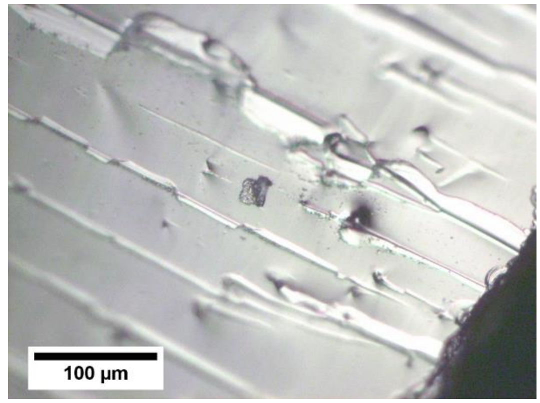
Step scarring (pp3p1).



Intensive edge rounding (pp1p1).

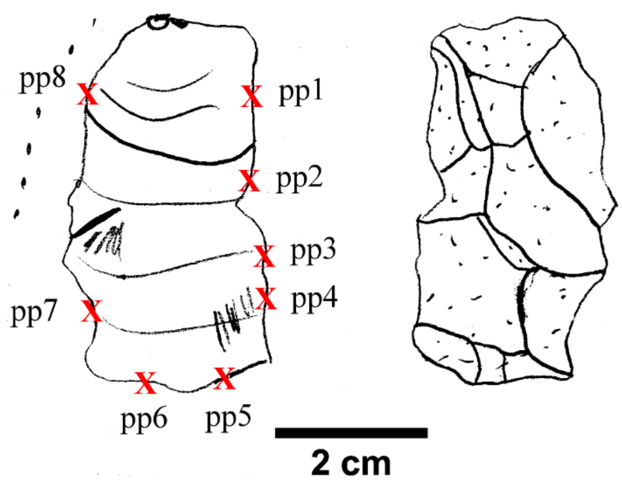


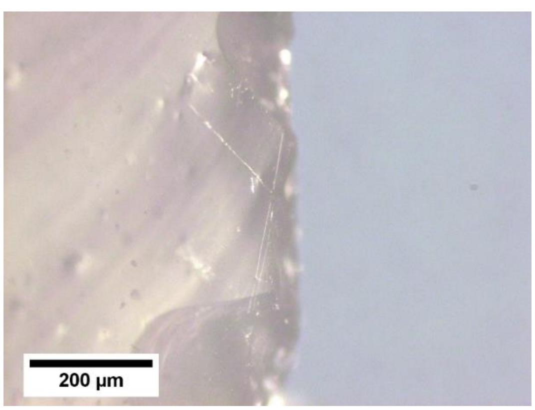
Sleek striation indicated by arrow; folded grainy particle residue (pp2p1).



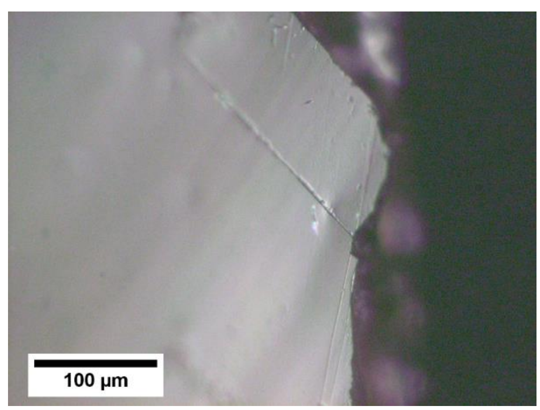
Folded grainy particle; spot residue (pp1p2).

Acc-2292. Carcass and hide processing (longitudinal).

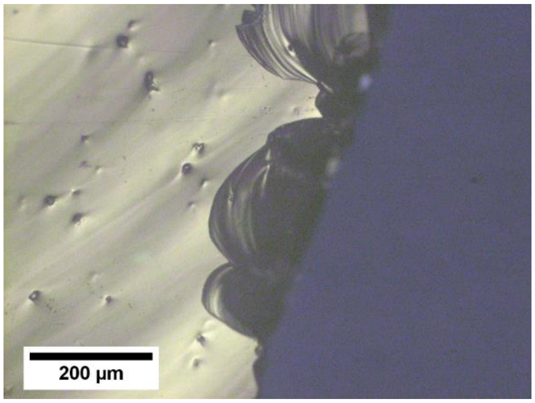




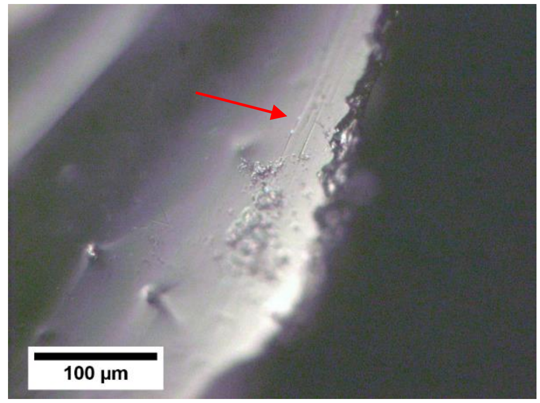
Discontinuous feather scarring; sleek and rough bottom striations (pp1p1).



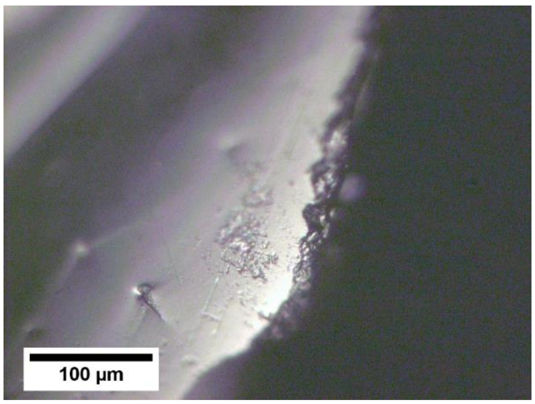
Striations under higher magnification (pp1p2).



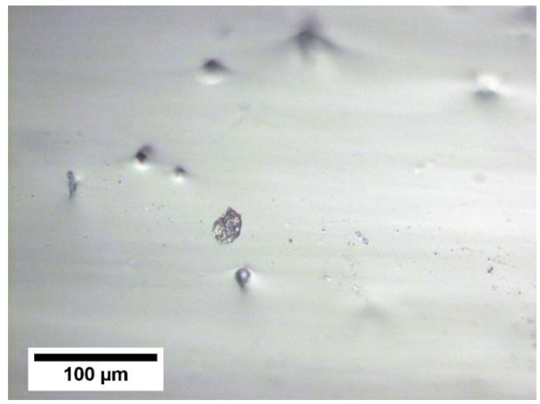
Continuous feather scarring; sleek and intermittent striations (pp3p1).



Rough bottom striations indicated by arrow (pp1p4).

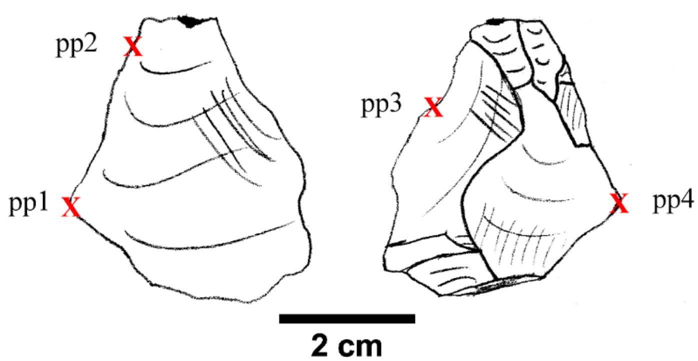


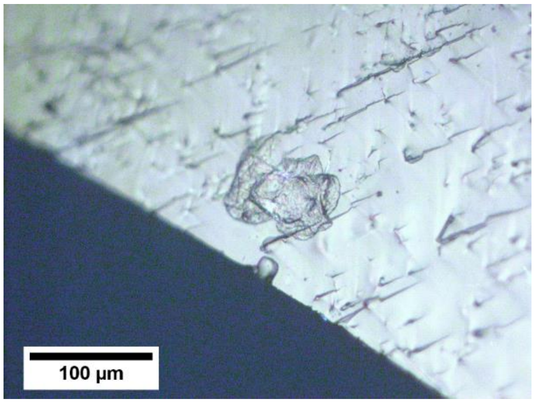
Intensive edge rounding; stage 3 polish; patchy residue (pp1p3).



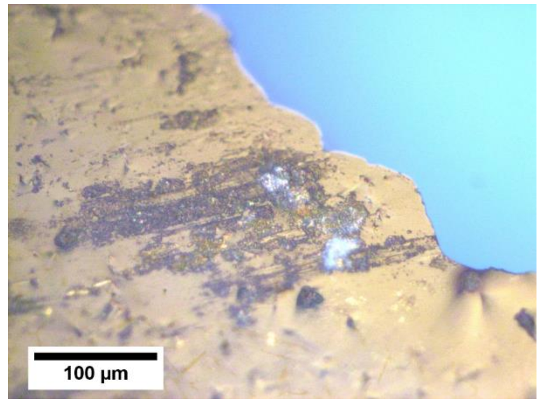
Folded grainy particle residue; spot residue (pp5p1).

Acc-2427. Inconclusive.



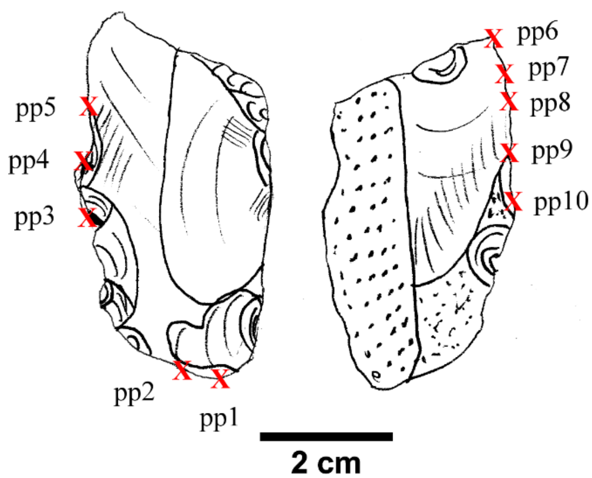


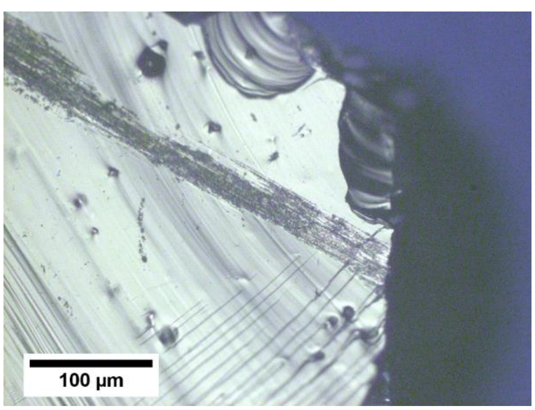
Occasional feather scars; folded grainy particle residue and spot residue; sharp edge (pp3p1).



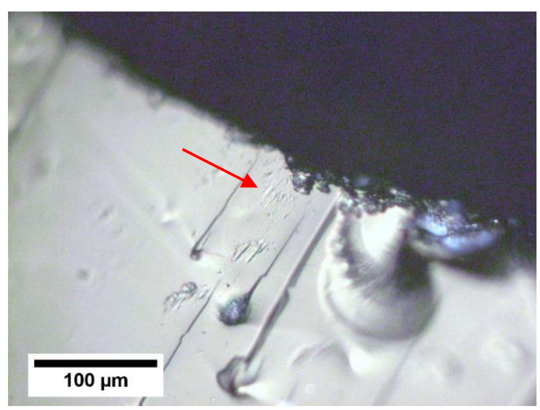
Rough bottom striations; patchy residue (pp4p2).

Acc-2446. Carcass processing (longitudinal).

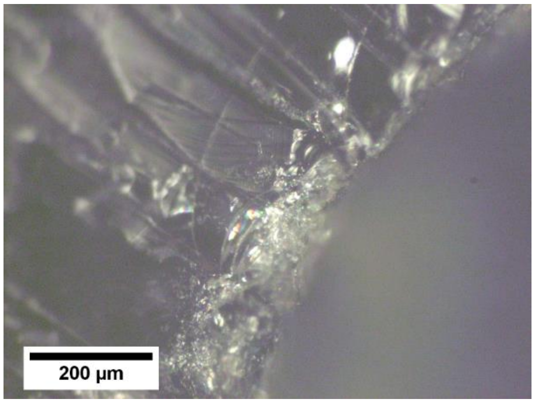




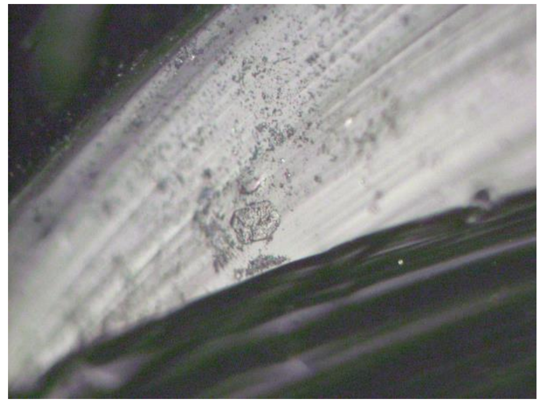
Feather scarring; rough bottom and intermittent striation (pp3p8).



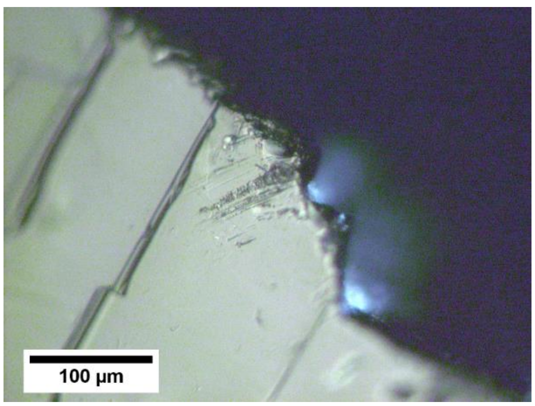
Intermittent striations; intensive edge rounding (pp1p6).



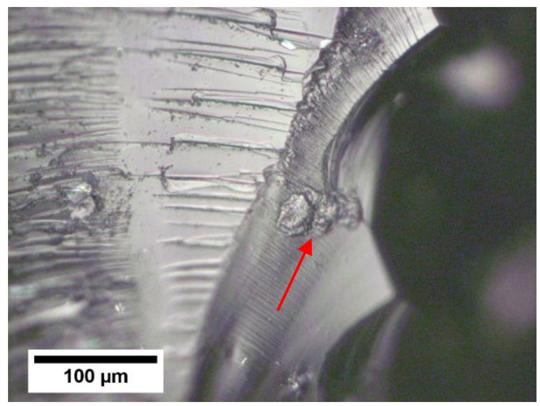
Flake striations; intensive edge rounding (pp9p1).



Folded grainy particle residue; residue spots (pp4p2).

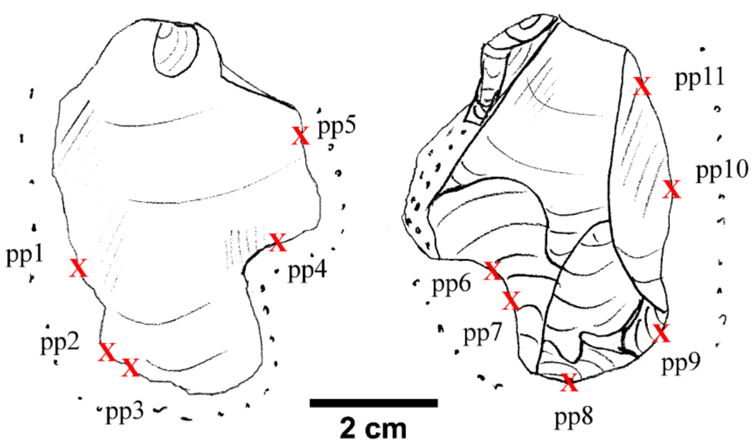


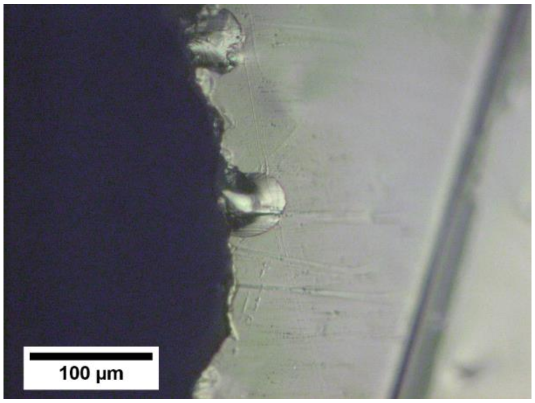
Sleek and intermittent striations; intensive edge rounding; stage 2 polish (pp1p1).



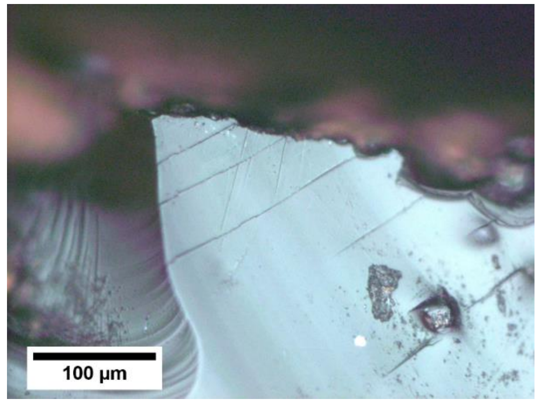
Feather scarring; patchy residue indicated by arrow; residue spots (pp5p1).

Acc-2455. Hide and meat processing (longitudinal and transverse).

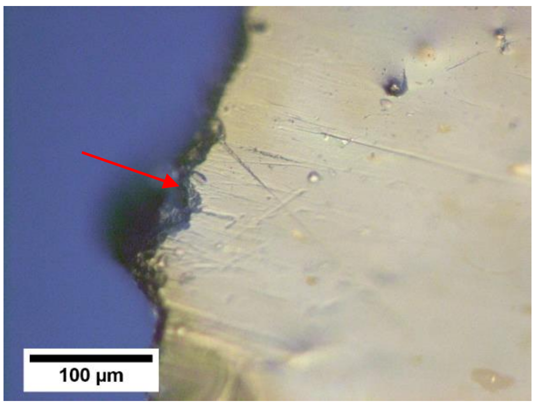




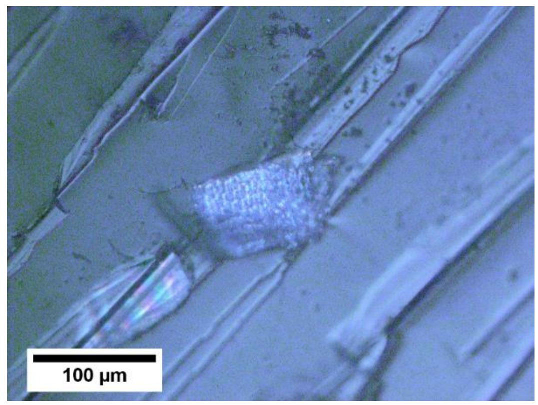
Discontinuous feather scarring; sleek, rough bottom, and intermittent striations; intensive edge rounding (pp11p2).



Feather scarring; sleek striations; intensive edge rounding; folded grainy particle residue; spot residue (pp8p1).

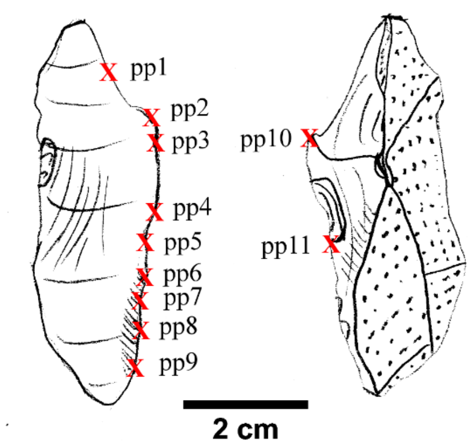


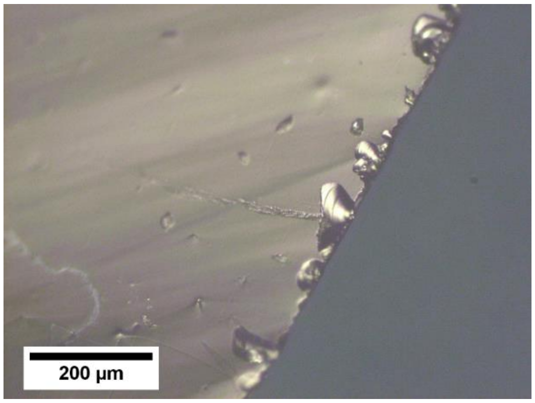
Sleek and rough bottom striations; stage 1 polish indicated by arrow (pp10p3).



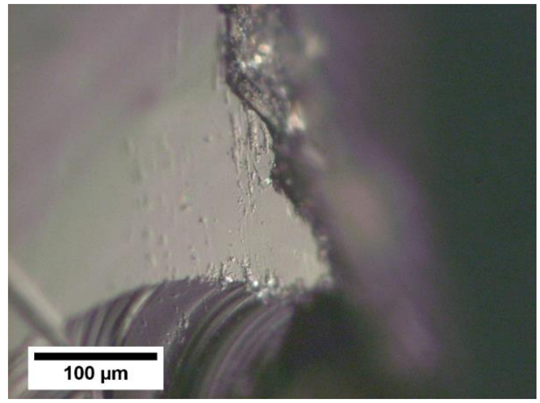
Unidentified residue particle (pp1p2).

Acc-2674. Carcass and meat processing (longitudinal).

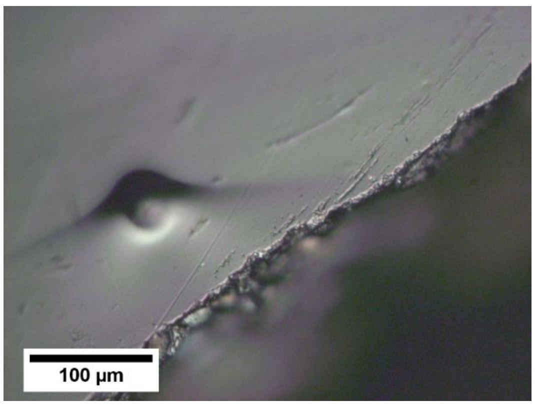




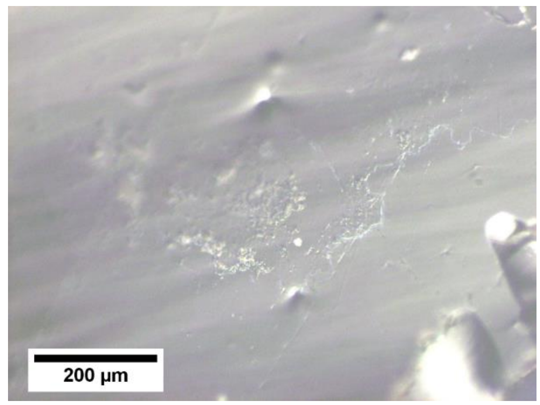
Feather and step scarring; sleek and intermittent striations (pp4p1).



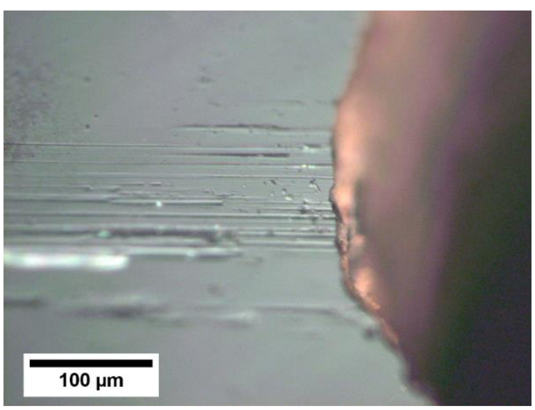
Intermittent striations (pp7p6).



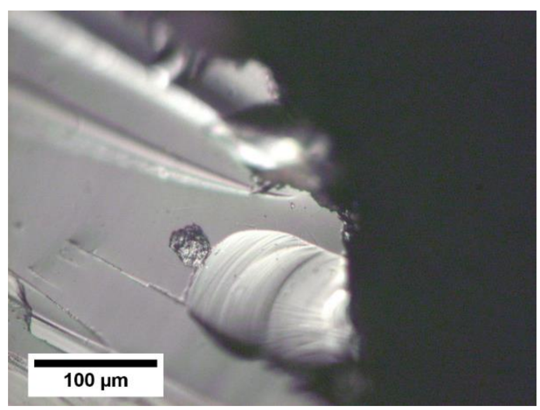
Sleek and intermittent striations; medium edge rounding; stage 2 polish formation (pp4p6).



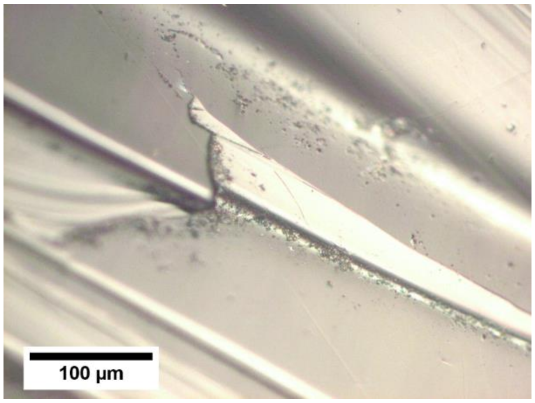
Residue band (pp4p4).



Rough bottom and intermittent striations (pp3p2).

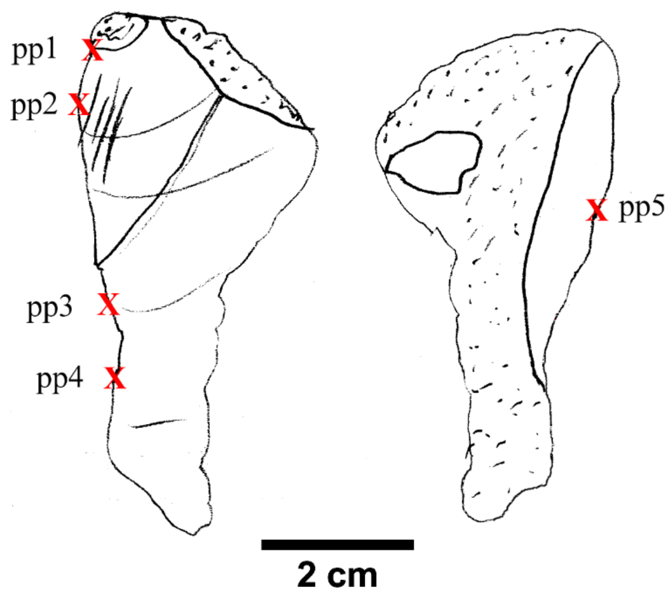


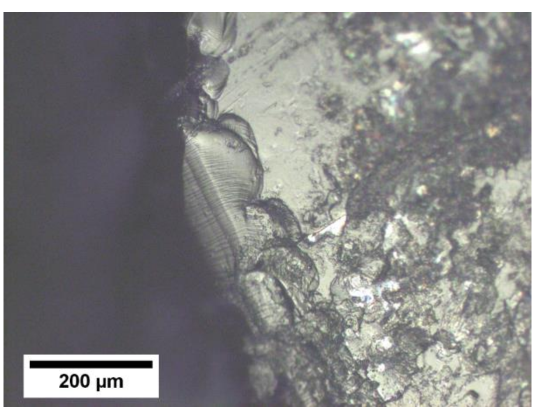
Folded grainy particle residue (pp6p2).



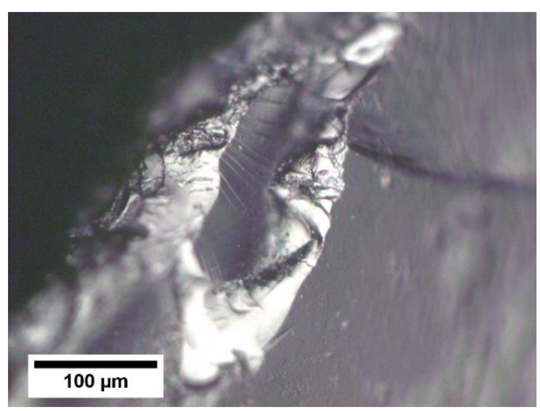
Spot residues (pp8p2).

Acc-2695. Other.

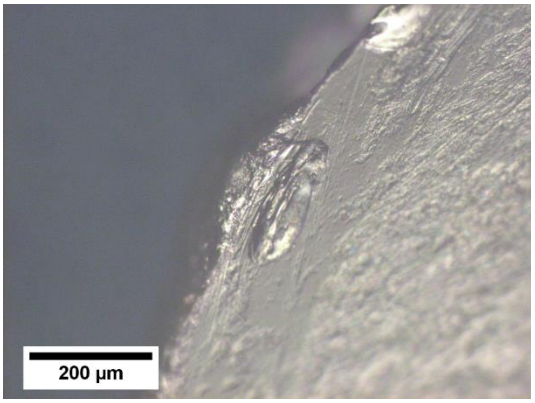




Feather and step scarring; patchy residue (pp4p1).

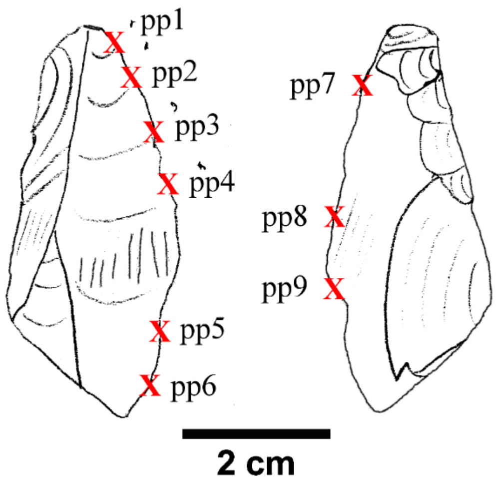


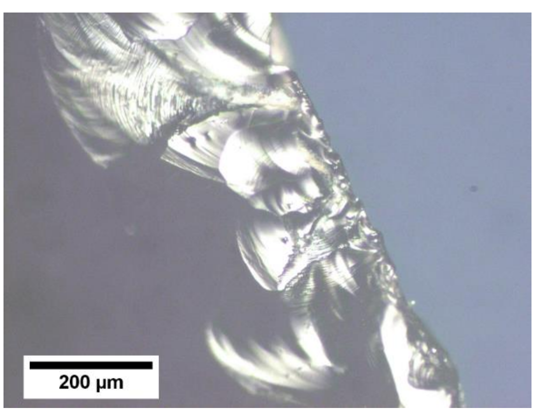
Intensive edge rounding; stage 3 polish (pp2p1).



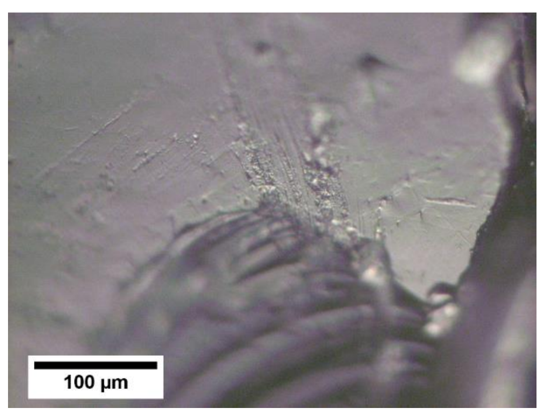
Sleek striations; unidentified residue (pp3p2).

Acc-2846. Carcass processing (longitudinal).

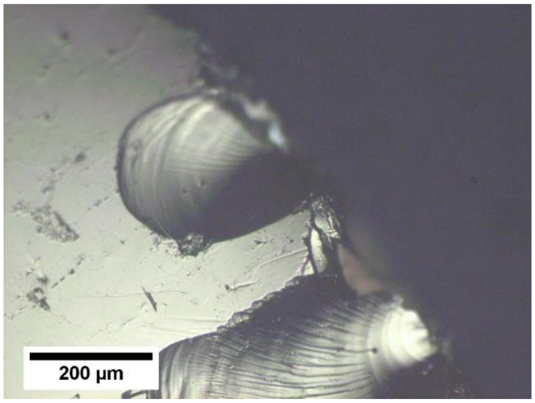




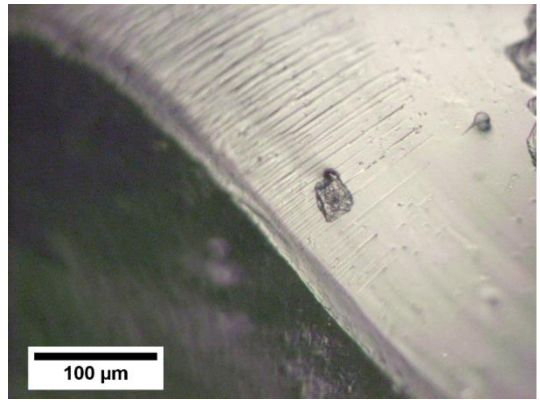
Continuous feather scarring (pp2p4).



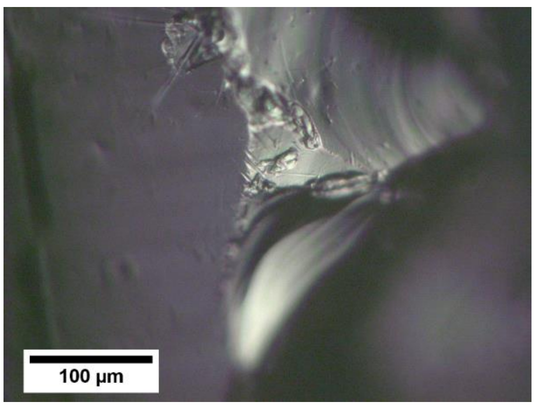
Sleek, rough bottom, and intermittent striations (pp5p2).



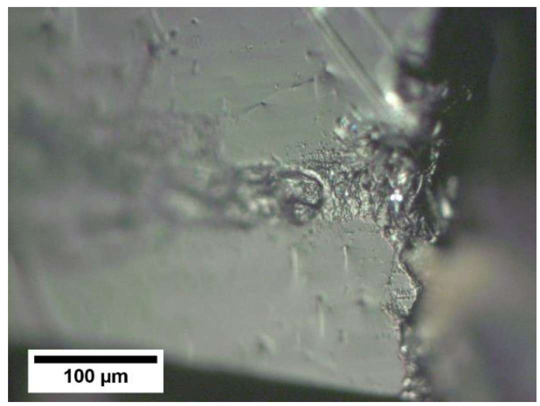
Feather scarring; sleek striations; intensive edge rounding; spot residue (pp2p3).



Folded grainy particle residue (pp9p1).

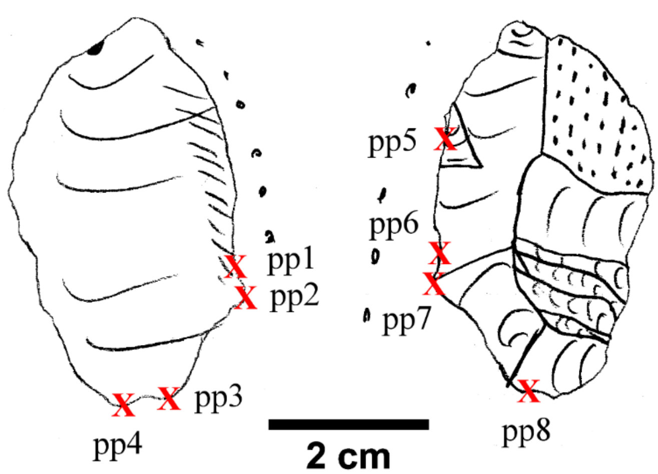


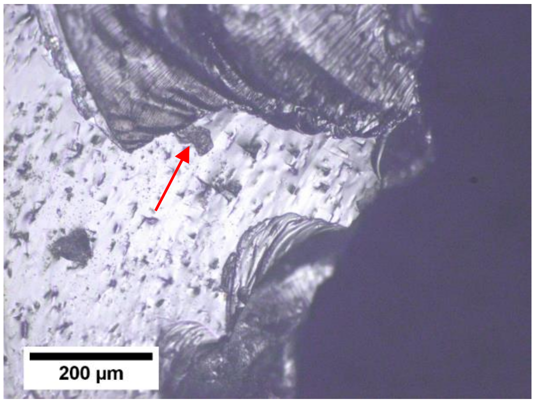
Stage 3 polish (pp3p2).



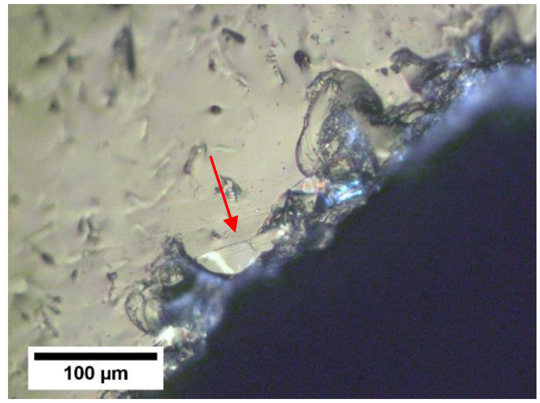
Patchy residue (pp2p3).

Acc-2860. Other.

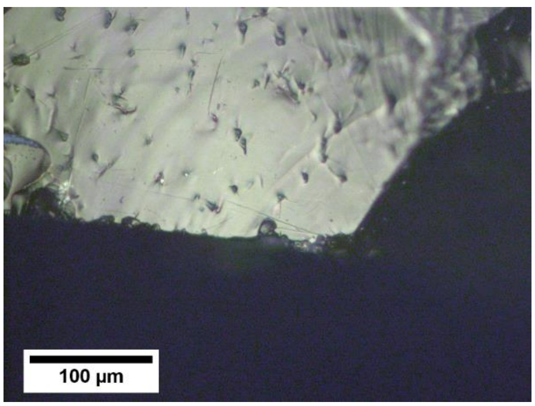




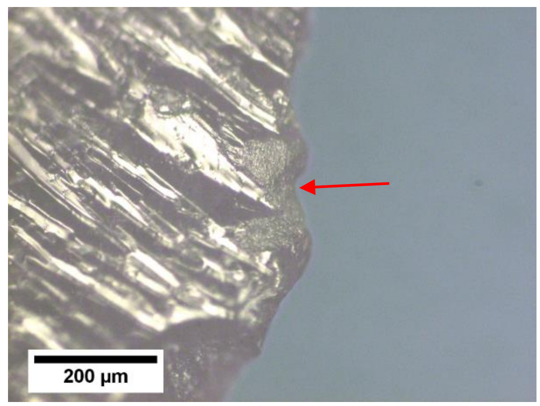
Feather and step scarring; folded grainy particle residue indicated by arrow (pp6p2).



Flaked striation indicated by arrow; intensive edge rounding; patchy residue (pp4p1).

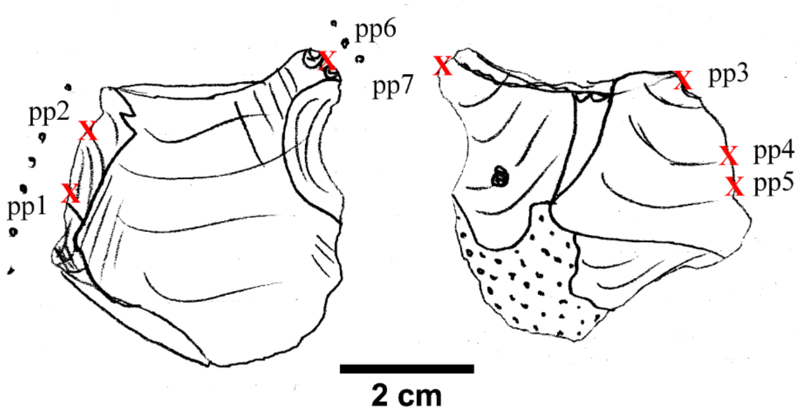


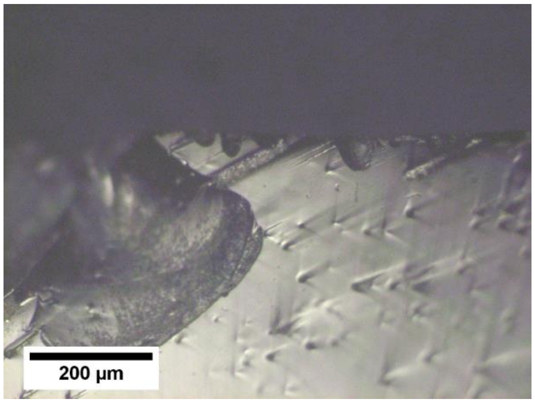
Sleek striations (pp2p1).



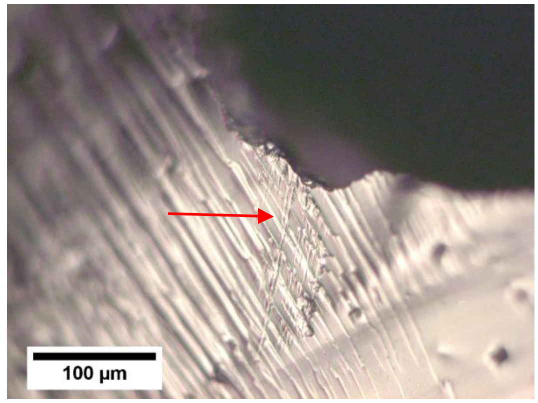
Stage 4 polish indicated by arrow (pp1p2).

Acc-3324. Hide processing (transverse).

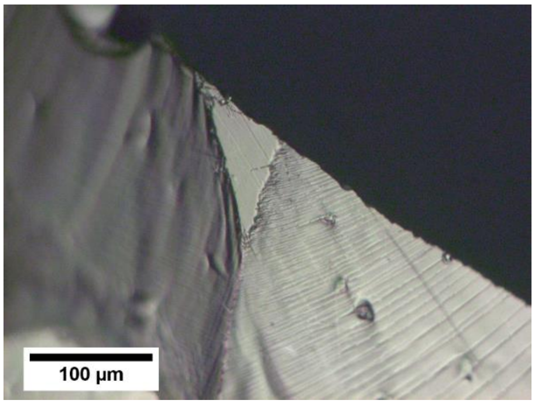




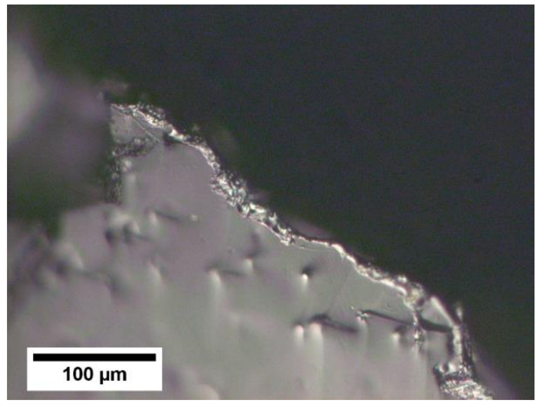
Discontinuous feather scarring; patchy residue (pp1p1).



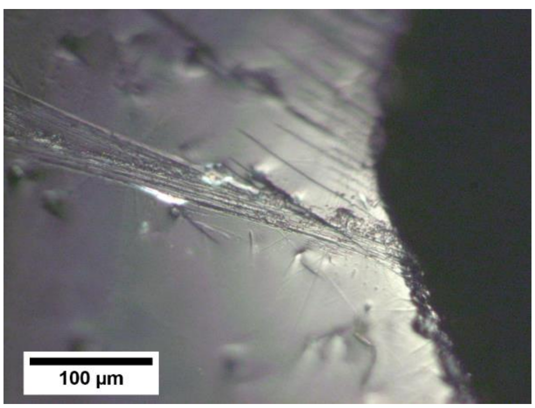
Rough bottom striations indicated by arrow (pp4p1).



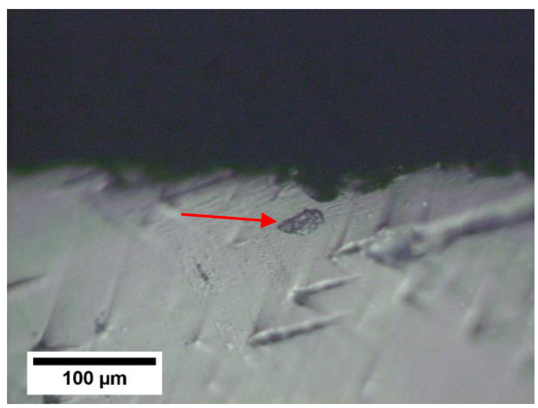
Sleek striations (pp3p1).



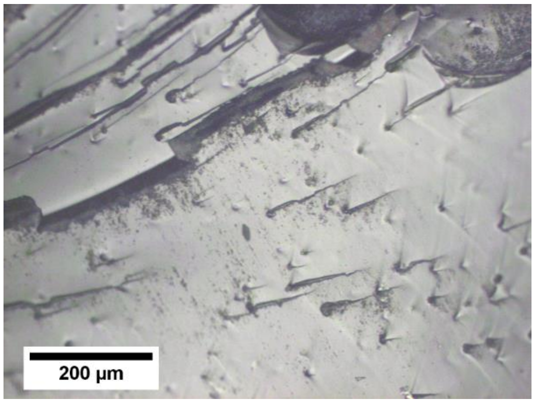
Medium edge rounding; stage 2 polish (pp5p1).



Sleek and rough bottom striations (pp6p1).

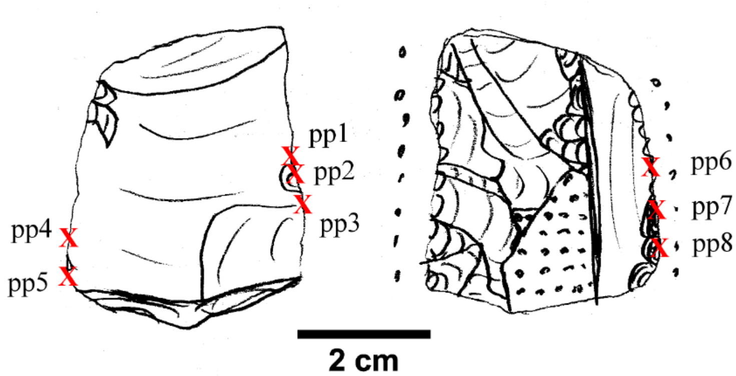


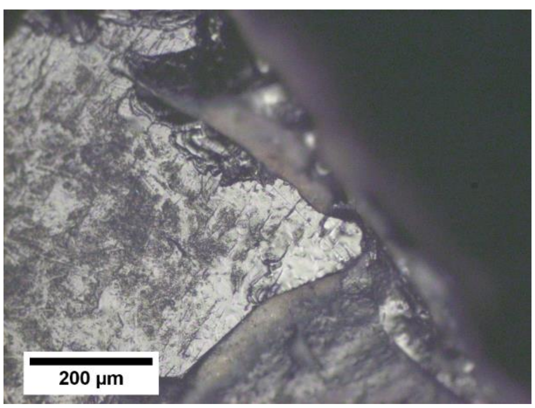
Folded grainy particle residue (pp1p4).



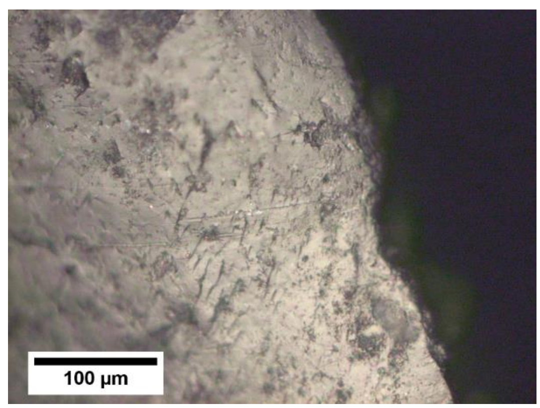
Spot residues (pp1p2).

Acc-3358. Other.

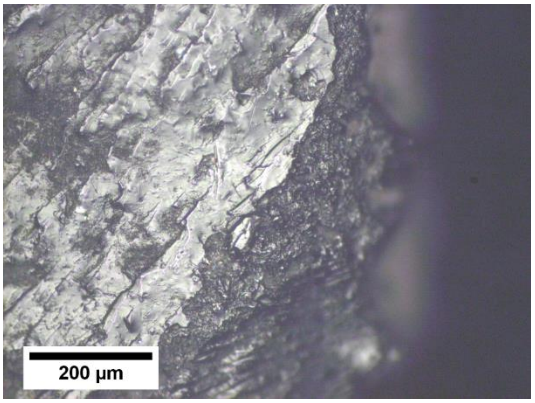




Few step scars; patchy residue (pp5p2).

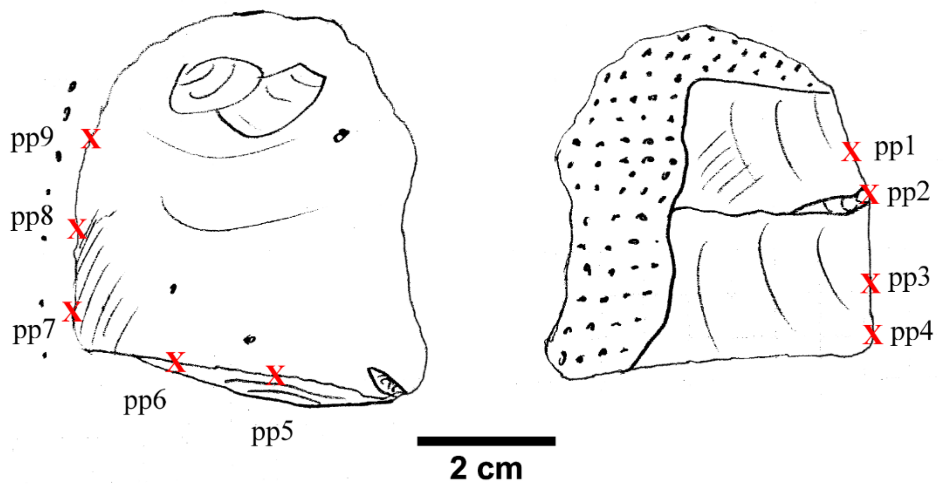


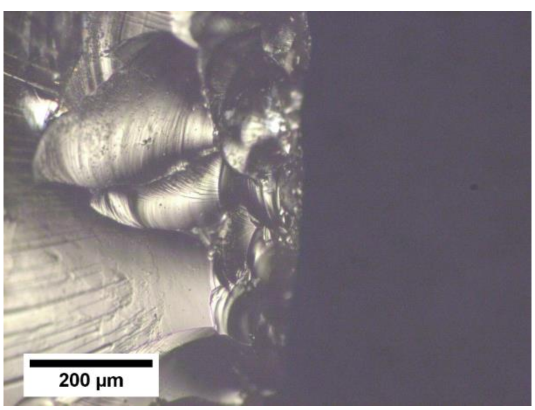
Rough bottom striations; intensive edge rounding (pp7p1).



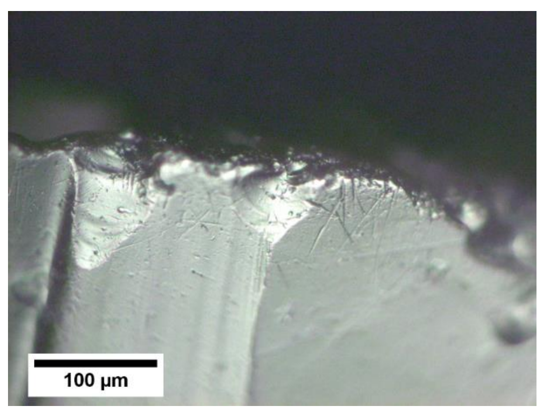
Stage 4 polish (pp4p1).

Acc-3411. Other.

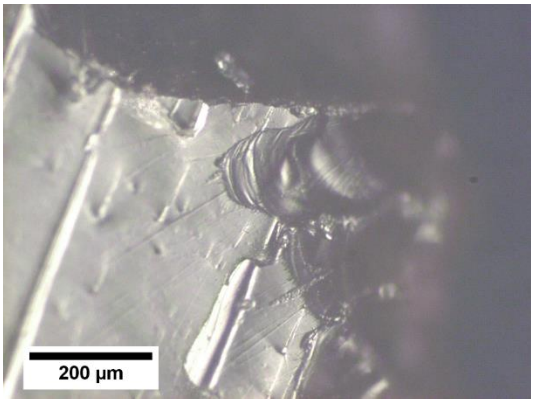




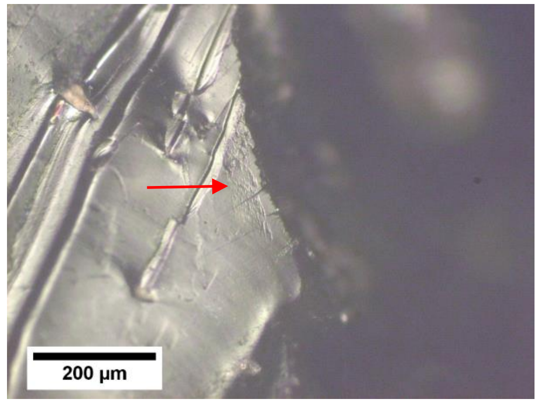
Continuous feather scarring (pp4p3).



Sleek striations; intensive edge rounding; stage 3 polish (pp6p1).



Sleek and rough bottom striations (pp8p3).



Intermittent striations indicated by arrow (pp8p2).