Appendix D
Results of Microwear Analysis

Phase III Investigations for Proposed Roadway Improvements,
Airport and Churchman's Roads:
Microwear Analysis

Analysis performed by Jennifer Rankin

A total of 70 lithic tool artifacts were randomly selected for the analysis of microtraces due to tool use and hafting in this study from Airport/Churchman's Road in New Castle County, Delaware. Of those 70 specimens selected, only 39 proceeded to the next stage of analysis (Table D.1). These artifacts include eight projectile points, six knives and other bifacial tools, 10 scrapers, three gravers, and 12 other unifacial stone tools. Of these tools that proceeded to the next stage of analysis, approximately 80% of the raw material is split between chert and quartz. The remaining 20% is of jasper.

Results of the microwear analysis indicate the function of these tools. The activities represented include: butchery (five points and three bifaces); meat cutting (one scraper, one retouched/denticulate flake, and one unifacial tool); bone/antler working (two graver, one scraper, two unifacial tools); hide scraping/cleaning (one graver, two scrapers, one retouched/denticulate flake, and two unifacial tools); and wood working (one scraper, and two retouched/denticulate flakes). Fourteen specimens are indeterminate, nine of which due to weathering and other post-depositional processes. The remaining five yielded microtraces, but are unidentifiable. Hafting traces are observed on 21 of the 39 tools examined (Table D.2).

Methodology and Analysis Procedures

The microwear analysis used for this study follows a combination of methods in the high-power approach outlined by Keeley (1980), Vaughan (1985), and Juel Jensen (1988, 1994), as well as the low-power approach described by Odell (1977) and Tringham et al. (1974). Modifications of the original stone surface through contact with other materials—such as wood, meat, bone/antler, and plants—can only be observed at this microscopic level. Primary changes resulting from tool use observed at microscopic levels include micropolish, alterations to the surface topography, and reflectivity of the natural stone surface. During the identification of the micropolish, striations and edge wear were also recorded to provide information on contact material, tool motion, and haft arrangement.

Several stages are employed to follow this procedure. First, all tools are scanned at low magnification to characterize the nature of the use traces. A 1x and 3x with 10x oculars (10 and 30 power magnifications) Steromaster binocular microscope was also employed, and each specimen was inspected to check for surviving residues and for the existence of microwear traces. After this stage of analysis, 31 specimens were eliminated from analysis due to low or no indications of use wear, exhibiting heavy chemical weathering and other post-depositional processes. Each archaeological specimen was then digitally photographed and cleaned before a high-power microscopic examination. The cleaning process was to soak each specimen in baths of running, room-temperature water in an ultrasonic cleaner for 15 minutes. The selected archaeological specimens were then subjected to analysis using a Celestron 44108 binocular

microscope with incident-light (halogen lamps) with 4x, 10x, 40x, 100x objectives and 10x, 15x oculars (thus providing and using 40, 60, 100, 150 power magnifications), a higher-powered microscope.

Detailed information on attributes of the micropolish and striations were recorded in order to infer contact material and tool motion. After analysis at URS Corporation laboratories, the artifacts were taken to Temple University's Department of Anthropology and select specimens were examined again with the assistance of Dr. Anthony Ranere. After the analysis was complete, locations of particular wear traces were sketched on a digital photograph of each tool, and attributes were recorded to identify the active tool edge and locations of hafting traces. The identification of microtraces was made in reference to experiments conducted by the author, consultations with Dr. Ranere, and experiments conducted by others in Keeley (1980), Kimball (1989), and Sussman (1985).

Characteristics of Microtraces and Description

According to characteristics described in Keeley (1980), Plisson (1985) and Kimball (1989), microtraces are described by their edge scarring/rounding, striations, extent, texture, contour, brightness, and polish. Edge scarring/rounding characterizes damage to an edge and can indicate the hardness of the material being worked. It can be described as a large deep scalar, small deep scalar, large shallow scalar, small shallow scalar, large stepped, small stepped, and half-moon. Butchery, meat cutting, and hide-working tend to exhibit step-like microfractures. In several instances, edge scarring can only be an indicator of the method of use and edge angle, rather than the material worked. Striations can be used for the identification of tool motion and support evidence of the contact material. The width and depth of striations can relate to the material being worked and the size of hard particle that come in contact with the edge during use. Striations are characterized in the following terms: short, long, wide, narrow, deep, shallow, and none. For example, striations are more common on bone-working than on wood-working implements. Striations on bone are often narrow and deep. In the case of bone sawing, parallel striations to the working edge are a distinguishing feature.

The extent of a microtrace is determined by the type of contact material, the morphology of the working edge, the angle of work, and the duration and intensity of work. The extent is characterized as marginal, moderate, invasive, or spreading/covering. The texture is described by its characterization of coalescent spaces and non-coalescent spaces within a microtrace. It is described as weak, average, dense, or united/smooth. The contour represents the boundary between unmodified and modified surfaces, and described as regularly clear, irregularly clear, unclear, or fuzzy. Polish, supported by brightness, describes the material worked. It can be described as fluid, fluid/grainy, fluid/domed, soft/grainy, soft/smooth, hard/terraced, hard/platy, hard/domed, hard/undulating, or hard/spreading. The brightness is determined by the material worked and is used to further describe certain polish as weak, average/moderate, fairly strong, strong, or icy. A variation of these different characteristics according to the motion and the material worked allow analysis to identify, via comparison, the active or hafted portion of the tool, the motion of the tool, the material penetrated by it, and the relative duration of its utilization (Table D.3). Although the extent, texture, and contour typically describe the morphology of the working edge, motion and duration, they also can be supplementary

indicators of the type of material being worked. However, polish and brightness are the most probable indicators of the material being worked. For example, polish that is described as fluid has often been associated with meat cutting or fresh hide cleaning and polish described as hard is an indicator that bone or antler was been worked.

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Table D.1

Artifact	Butchery	Meat Cutting	Hide Working	Bone/Antler Working	Wood Working	*Totals*	*Unidentified Material*	*Indeterminate (Weathering and Other Factors)*	*Hafting*
Projectile Points (N=8)	5					***5***	*1*	*2*	***7***
Other Bifaces (N=4)	1					***1***		*3*	***4***
Knives (N=2)	2					***2***			***2***
Gravers (N=3)			1	2		***3***			***1***
Scrapers (N=10)		1	2	1	1	***5***	*2*	*3*	***6***
Retouched/Denticulate Flakes (N=8)		1	1	1	2	***5***	*2*	*1*	***1***
Other Unifacial Tools (N=4)		2	2			***4***			***0***
Totals (N=39)	***8***	***4***	***6***	***4***	***3***	***25***	***5***	***9***	***21***

Table D.2

FS	Artifact	Hafting Trace
33	Projectile Point	No
40	Endscraper	Yes
43	Projectile Point	Yes
60	Graver/Retouched Flake	No
60	Notched Flake	No
77	Scraper	Yes
81	Scraper	Yes
259	Utilized Flake	No
315	Scraper	No
318	Retouched Flake	No
401	Projectile Point	Yes
401	Retouched Flake	No
401	Utilized Flake	No
408	Graver Fragment	No
408	Projectile Point	Yes
418	Utilized Flake	No
440	Endscraper Fragment	No
459	Scraper	Yes
474	Projectile Point	Yes
476	Projectile Point/Knife	Yes
476	Projectile Point	Yes
491	Reworked Biface/Scraper	Yes
493	Notched/Retouched Flake	Yes
570	Reworked Point/Scraper	Yes
573	Projectile Point	No
573	Projectile Point	Yes
574	Scraper	No
589	Spokeshave/Graver	No
591	Scraper/Adze	No
592	Scraper	Yes
597	Projectile Point/Knife	Yes
608	Reworked Point/Notched Biface	Yes
610	Scraper	Yes
611	Notched Flake	No
612	Utilized/Denticulate Flake	No
616	Graver	Yes
616	Notched/Denticulate Flake	No
620	Projectile Point	Yes
388/75	Broken Biface	Yes

Table D.3

FS	Artifact	Material	Function
33A.1	Projectile Point	Chert	Butchery
			Macro-Impact Fracture
40D.1	Endscraper	Crystal Quartz	Bone Working
			Indeterminate Material
			Hafting
43.2	Projectile Point	Quartz	Butchery
			Macro-Impact Fracture
			Hafting
60.1	Retouched Flake/Graver	Jasper	Wood Working
			Plant Cutting
			Plant Cutting
60.2	Utilized Flake	Quartz	Meat Cutting
			Meat Cutting
75C/388C	Stemmed Point	Chert	Hafting
77C.1	Scraper	Chert	Wood Planing
			Hafting
81C.1	Scraper	Quartz	Indeterminate Material
			Indeterminate Material
			Hafting
259A.5	Utilized Flake	Crystal Quartz	Hide Working
			Hide Working
315A.1	Scraper	Quartz	Meat Cutting
			Meat Cutting
318D.1	Retouched Flake	Jasper	Wood Working
401A.1	Projectile Point	Jasper	Butchery
			Micro-Impact Fracture
			Hafting
401A.3	Utilized Flake	Chert	Hide Working
401A.4	Utilized Flake	Chert	Meat Cutting
408C.1	Projectile Point	Chert	Macro-Impact Fracture
			Hafting
408B.2	Graver Fragment	Quartz	Hide Working
418B.1	Utilized Flake	Jasper	Bone Working
			Hide Working
440D.5	Endscraper Fragment	Crystal Quartz	Indeterminate - Weathering
459D.1	Scraper	Chert	Hafting
474B.8	Projectile Point	Chert	Butchery
			Micro-Impact Fracture
			Hafting
			Hafting
476C.18	Bifacial Knife	Quartz	Butchery
			Butchery
			Hafting
476C.17	Projectile Point	Jasper	Butchery
			Hafting
491C.1	Reworked Point	Jasper	Hafting
493A.1	Retouched Flake	Chert	Meat Cutting
			Indeterminate Material
			Indeterminate Material
			Hafting
570C.1	Reworked Point	Jasper	Hafting
			Hafting
573D.11	Projectile Point	Chert	Indeterminate Material
			Hafting
			Hafting
573D.5	Projectile Point	Quartz	Macro-Impact Fracture

Table D.3

FS	Artifact	Material	Function
574D.1	Scraper	Crystal Quartz	Hide Working
			Hide Working
589C.1	Spokeshave/Graver	Chert	Bone Working
			Bone Working
			Bone Working
591B.1	Scraper/Adze	Chert	Indeterminate - Weathering
592A.6	Scraper	Quartz	Hide Working
			Hide Working
			Hafting
597A.1	Bifacial Knife	Chert	Butchery
			Hafting
608D.1	Reworked Point	Chert	Butchery
			Antler Working
			Macro-Impact Fracture
			Hafting
610C.1	Scraper	Quartz	Indeterminate Material
			Hafting
611D.1	Notched Flake	Chert	Indeterminate - Weathering
612B.1	Utilized Flake	Crystal Quartz	Wood Working
			Wood Working
616A.2	Denitculate Flake	Jasper	Indeterminate - Material
616B.1	Graver	Jasper	Hide Working
			Hafting
620D.1	Projectile Point	Quartz	Indeterminate Material
			Hafting