REPORT

LITHIC LANDSCAPE OF THE UPPER SUSITNA RIVER BASIN, CENTRAL ALASKA RANGE

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ABSTRACT

An important component of assessing lithic technological organization in the past is understanding the location, quality, and nodule size of knappable raw materials on the landscape. Geologic reports can provide some information, but they often lack detail on lithic materials of interest to archaeologists. What is needed is an on-the-ground assessment specifically focused on knappable lithics in a study area. This report presents the results of a lithic raw material survey in the upper Susitna River basin in the central Alaska Range. This study assessed lithic raw material sources available in the upper Susitna basin by consulting geologic maps and systematically documenting and sampling knappable lithic raw materials in drainages throughout the study area. The research goal is to provide an initial description of knappable lithic raw materials in the upper Susitna basin that can be compared with archaeological assemblages from the region. This study provides a baseline for evaluating the lithic landscape of the upper Susitna River basin and evaluating hunter-gatherer lithic technological organization and land-use patterns. Lithic landscape studies focused on physical properties of locally available lithic materials in Interior Alaska are an invaluable first step in working toward a comprehensive understanding of prehistoric hunter-gatherer land-use patterns.

INTRODUCTION

Lithic technological organization studies are concerned with understanding human strategies employed during stone-tool manufacture, use, transport, and discard, as well as strategies used to obtain lithic raw materials for stone-tool production (Andrefsky 2009; Nelson 1991; Shott 1986). A crucial aspect of this approach is conducting a lithic survey to better understand the types, quantity, and quality of locally available raw materials. Understanding the lithic landscape informs interpretations of local versus nonlocal lithic raw material procurement, which has important implications for interpreting mobility, economic organization, and land-use patterns (Andrefsky 1994; Binford 1980; Burke 2006; Garvey 2015; Horowitz 2018; Surovell 2009). Lithic raw material surveys can also provide important information on lithic variability (e.g., variations in color, texture, structure, and chemistry) within a single source (Luedtke 1992).

Advances in geochemical sourcing of lithics in Interior Alaska have provided important data on sources and distribution (Coffman and Rasic 2015; Cook 1995; Goebel et al. 2008; Gore 2021; Lawler 2019; Reuther et al. 2011). While geochemical sourcing typically provides detailed, replicable, and comparable data on lithic source characteristics, geochemical analysis is often limited by budgetary constraints and time required for analysis; two factors that often result in characterization of a limited selection of raw material types (Agam and Wilson 2018; Luedtke 1992). In addition, many types of nonvolcanic lithics are difficult to characterize geochemically because of variability within a source (Shackley 1998). To counter these issues, lithic analysts commonly use macroscopic approaches to categorize the physical properties (e.g., rock type, color, texture, and nodule size) of lithic raw material types (Luedtke 1992; Odell 2004:28). There are sometimes issues with interobserver variation and replicability in macroscopic lithic descriptions (Luedtke 1992; Milne et al. 2009; Parish and Durham 2015). However, increased replicability can be accomplished with training (Agam and Wilson 2018), and the strongest visual comparisons are made using multiple descriptors (Odell 2004:28).

This study utilizes a macroscopic approach to characterize physical characteristics of lithic in the upper Susitna River basin in the central Alaska Range (Fig. 1). A detailed description of the geomorphic history of the upper Susitna River basin after the Last Glacial Maximum can be found in Blong (2019). The Susitna River basin plays an important role in understanding the initial settlement of Southcentral Alaska. The upper and middle Susitna River provides evidence for early forays into Southcentral Alaska from settlements in the Nenana and Tanana river basins north of the Alaska Range, suggesting the Susitna basin was a primary pathway for settlement of Southcentral Alaska (Blong 2018; Wygal 2010; Wygal and Goebel 2012; Wygal and Krasinski 2019). Long-term archaeological

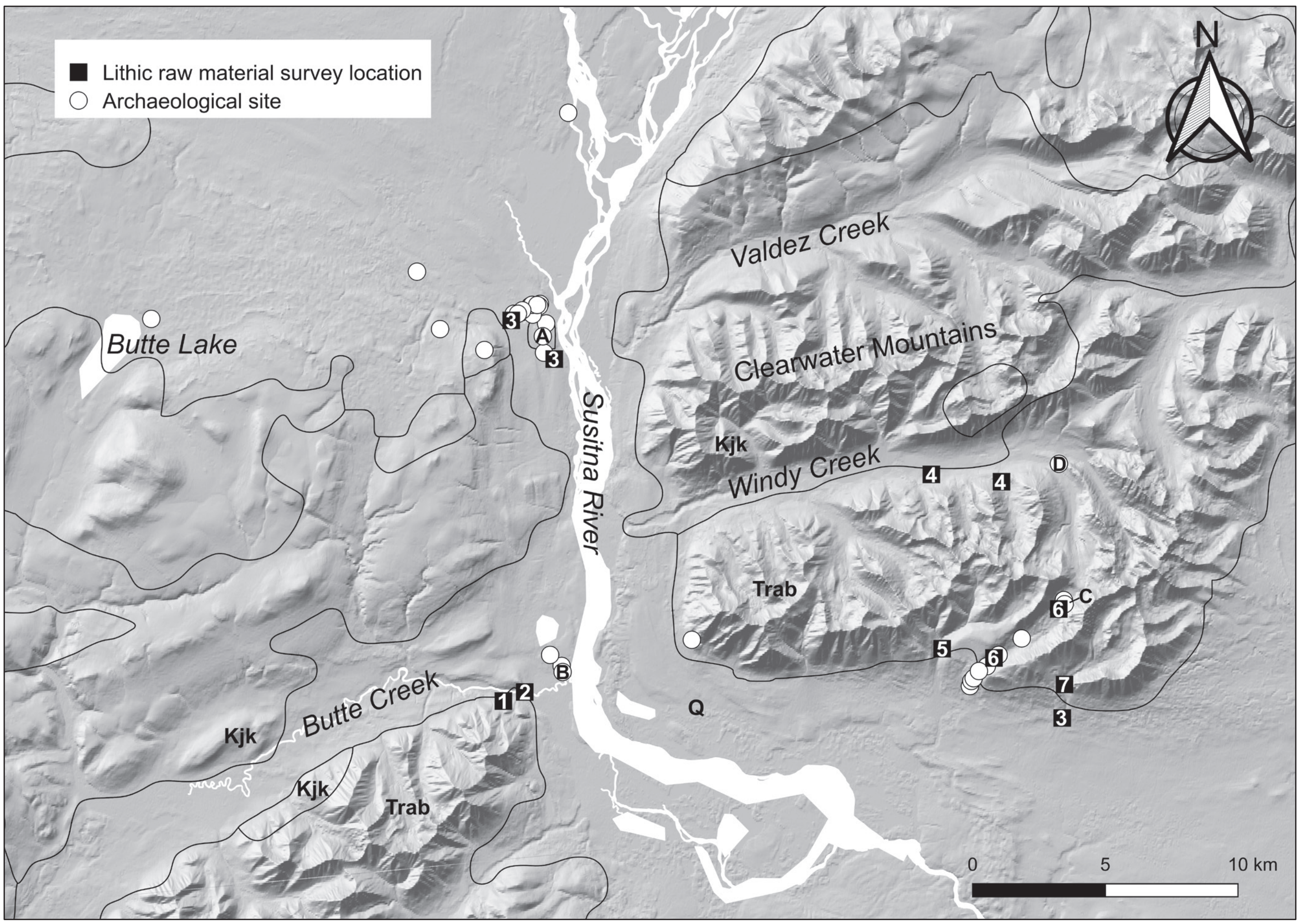

Figure 1. Map of the upper Susitna River basin study area showing lithic raw material survey locations, prehistoric archaeological sites, and the geologic formations mentioned in the text. Lithic raw material survey locations include: (1) Butte Creek RM1, (2) Butte Creek RM2, (3) Quaternary gravels, (4) Windy Creek, (5) Raft Creek, (6) Alpine Creek, (7) Waterfall Creek. Archaeological sites mentioned in the text include: (A) Susitna River 3, (B) Butte Creek 1, (C) Alpine Creek 8, (D) Windy Creek 1. Geologic formations include: (Trab) Amphitheatre Group (Smith 1981), (Kjk) Kahiltna assemblage (O'Neill et al. 2001), (Q) Quaternary surficial deposits (Smith 1981; Smith et al. 1988). Note that lower elevations (< 1,000 masl) in the study area are mantled with a variety of surficial deposits not shown here with the exception of Q.

research in the Upper Susitna basin as part of the Alaska Range Uplands Project has identified a human presence in the region starting at the Pleistocene–Holocene transition and continuing through the historical period (Blong 2011, 2016, 2017, 2019). The goal of this study is to establish the lithic landscape of the upper Susitna basin and provide information on the presence and quality of knappable lithic raw materials in the study area. These data are important for assessing lithic technological organization strategies employed by hunter-gatherers in the upper Susitna basin over time.

METHODS

This study assessed lithic raw material sources available in the upper Susitna basin by consulting geologic maps and systematically documenting and sampling knappable lithics located in drainages throughout the study area. This approach has been applied in previous studies to identify locally available lithic raw material sources in Interior Alaska (Blong and DiPietro 2014; Gore 2021; Graf and Goebel 2009). Samples of lithic types were collected in the field and used as a comparative reference collection for provenance analysis of lithic material from archaeological contexts in the region.

This study used a suite of physical characteristics to describe each lithic sample. All physical descriptions were made on freshly broken rock surfaces with color assessed using the *Munsell Rock Color Book* (Munsell Color 2012). Lithic texture was assigned to one of three texture categories: macrocrystalline (texture visible to the naked eye), microcrystalline (texture visible at 10x), and cryptocrystalline (texture visible at 40x). Texture characteristics are used here as a qualitative measure of mechanical properties and overall knapping quality of lithic raw materials (cf. Luedtke 1992). Nodule size was measured using a linear dimension; this measurement was used to assign nodules to pebble, cobble, and boulder classes (Wentworth 1922). Size-class data provide information on the available package size of lithic raw materials in the study area. Cortex type was scored as either primary (geologic) cortex or secondary (stream-rolled) cortex (Luedtke 1992:154).

Lithic type was assessed using rock identification guides (e.g., Proctor et al. 1989). Lithic raw material types were further separated based on color and composition. Rock genesis can be complicated, and further analyses (e.g., thin section, geochemical analysis) are needed to confirm these groups. The physical characteristics of lithic types were compared with stone artifacts from archaeological contexts in the study area to better understand local and nonlocal raw material transport as a component of lithic technological organization (e.g., Blong 2017).

UPPER SUSITNA RIVER BASIN LITHIC LANDSCAPE

The lithic landscape of the upper Susitna study area consists of stream-rolled gravels available in secondary outwash, moraine, alluvial, and dike deposits, as well as primary geologic lithic raw material outcrops, many of which contain potentially knappable lithic raw materials (Kachadoorian et al. 1954; Mooney 2010; Smith 1981; Smith et al. 1988). Lithic raw material resources are described here for the Clearwater Mountains in the eastern portion of the study area, the Butte Creek drainage in the western portion of the study area, and Quaternary surficial deposits commonly found in lower-lying areas of the upper Susitna basin (Table 1).

CLEARWATER MOUNTAINS

The Clearwater Mountains are broadly composed of two main sequences of metamorphosed bedrock: Late Triassic age low-grade metavolcanic rocks of the Amphitheatre Group (Trab), overlain by pre–Upper Jurassic fine-grained sedimentary rock varying in metamorphism from argillite to layered gneiss in the Kahiltna Formation (Kjk) (O'Neill et al. 2001; Smith 1981). A review of geologic literature suggested several potential sources of knappable lithic raw material in the Clearwater Mountains. Formations in the southern portion of the range south of Windy Creek are broadly composed of metabasalt and metasedimentary rocks of the Amphitheatre Group. The Amphitheatre Group contains subgroups of tuffaceous metasedimentary rocks, cherts, metabasalts, and carbonaceous argillites. The most common rock type described in this formation is a grayish-olive and grayish-red metabasalt and basaltic andesite, characterized by generally fine-grained textures (felsitic, aphanitic, and porphyritic), with phenocrysts and recrystallized minerals in the rock matrix.

There are sedimentary and metasedimentary subformations of the Amphitheatre Group that include a pale-olive or greenish-gray tuffaceous argillite, a medium-gray or gray-black fine-grained argillite, a dark carbonaceous argillite and chert formation, and a medium-gray to light-brownish-gray argillaceous limestone. Often these

Table 1. Lithic raw material survey results. See Figure 1 for sampling locations.

Survey Location	Raw Material Type	Munsell Rock Color	Texture[1]	Nodule Size[2]
Raft Creek	Metavolcanic	Grayish Red (5R 4/2)	MA to MI	PE to CO
	Metasedimentary	Medium Dark Gray (N4)	MA to MI	PE to BO
	Metasedimentary	Dark Gray (N3) to Medium Dark Gray (N4) with White (N8) banding	MI	PE to CO
	Quartzite	Medium Bluish Gray (5B 5/1)	MA	PE to CO
Waterfall Creek	Metavolcanic	Dark Greenish Gray (5GY 4/1)	MA to MI	PE to CO
	Metasedimentary	Dark Gray (N3)	MI	PE to CO
	Metasedimentary	Medium Dark Gray (N4)	MI	PE to CO
	Metasedimentary/quartzite	Dark Greenish Gray (5GY 4/1)	MA to MI	PE to BO
	Metasedimentary/quartzite	Grayish Green (5G 5/2), Pale Olive (10Y 6/2)	MI	PE to CO
	Metasedimentary	Medium Bluish Gray (5B 5/1)	MI	PE to CO
	Metasedimentary	Light Bluish Gray (5B 7/1) to Dark Greenish Gray (5G 4/1)	MI	PE to CO
	Metachert (Fig. 4C)	Moderate Reddish Brown (10R 4/6)	CCS	PE
	Chalcedony (Fig 4B)	Medium Dark Gray (N4)	MI	PE
Alpine Creek	Metasedimentary/quartzite	Dark Greenish Gray (5GY 4/1)	MA to MI	PE to BO
	Metasedimentary	Dark Greenish Gray (5GY 4/1)	MA to MI	PE to BO
	Chalcedony (Figs. 4A and 10C)	Grayish Black (N2) with Yellowish Gray (5Y 8/1) banding	MI	PE to CO
	Metasedimentary/quartzite	Dark Greenish Gray (5G 4/1)	MI	PE to BO
	Metasedimentary/metachert (Fig. 10B)	Dark Greenish Gray (5G 4/1)	CCS	PE to BO
	Metasedimentary/tuffaceous argillite (Fig. 3)	Pale Olive (10Y 6/2), Dark Greenish Gray(5GY 4/1)	MI to CCS	PE to BO
	Metabasalt	Grayish Red (10R 4/2), Pale Olive (10Y 6/2)	MI	PE to BO
	Metabasalt	Grayish Red (5R 4/2)	MI	PE to BO
	Metasedimentary	Dark Greenish Gray (5G 4/1)	MI	PE to BO
Windy Creek	Metasedimentary (Fig. 5)	Dark Gray (N3)	MA to MI	PE to BO
Butte Creek 1	Chalcedony	Medium Dark Gray (N4)	MI	PE to CO
	Basalt/metabasalt (Fig. 7B)	Dark Gray (N3)	MA	PE to BO
	Metachert (Fig. 7C)	Light Olive Gray (5Y 6/1)	MI	PE to BO
	Chalcedony (Fig. 7A)	Dark Gray (N3), Moderate Yellowish Brown (10YR 5/4)	MI	PE to BO
Butte Creek 2	Argillite (Fig 8B)	Dark Gray (N3)	MI	PE to CO
	Chalcedony	Medium Gray (N5)	MI	PE to CO
	Chalcedony (Fig. 8A and 10A)	Light Olive Gray (5Y 6/1), Dark Gray (N3)	MI	PE to CO
	Chalcedony	Grayish Black (N2), Light Olive Gray (5Y 6/1)	MI	PE to CO
	Metasedimentary/silicified siltstone	Grayish Black (N2)	MI	PE to CO
	Chalcedony (Fig. 10D)	Light Gray (N7) to Light Olive Gray (5Y 6/1)	MI	PE to CO
	Chalcedony	Light Brownish Gray (5YR 6/1)	MI	PE to CO
Quaternary gravels	Chalcedony (Fig. 9B)	Medium Dark Gray (N4)	MI	PE to CO
	Quartzite (Fig. 9A)	Pale Yellowish Brown (10YR 6/2)	MI	PE to CO
	Metachalcedony (Fig. 9C)	Medium Dark Gray (N4)	MI	PE to CO
	Metasedimentary (Fig. 9D)	Dark Gray (N3)	MI	PE to CO

1 MA: macrocrystalline; MI: microcrystalline; CCS: cryptocrystalline.

2 BO: boulder; CO: cobble; PE: pebble.

rock types contain recrystallized minerals from low-grade metamorphism (Mooney 2010; Smith 1981). Additionally, Kachadoorian et al. (1954:10) describe "white to bright red-brown and green" chert, interbedded with volcanic rock and argillite, in bedrock formations in between Raft and Corkscrew Creeks.

We conducted a lithic raw material survey of three drainages on the southern flank of the Clearwater Mountains: Raft Creek, Waterfall Creek, and Alpine Creek. Our survey focused on lithic materials found upslope from Quaternary moraine deposits related to the glaciation of the broader Susitna drainage (Smith 1981). The results presented here therefore represent lithic material in local ground moraine complex deposits originating from bedrock formations in the upper portion of the drainages (Smith 1981). Our survey identified several knappable-quality sedimentary, metasedimentary, and metavolcanic lithic raw material types. Material textures are cryptocrystalline, microcrystalline, or macrocrystalline, and package sizes range from pebble to boulder size classes. We surveyed two locations in the Alpine Creek drainage and found the same raw materials were represented at both locations, but in larger package sizes higher in elevation (Fig. 2).

The materials collected for this study broadly match published descriptions of rock types found in the Triassic period Amphitheatre Group. The most common type encountered is a pale-olive or greenish-gray tuffaceous argillite exhibiting low-grade metamorphism (Fig. 3). Our survey did not find abundant chert in the Raft Creek drainage as described in Kachadoorian et al. (1954), although we did collect a reddish-brown metachert exhib-

Figure 2. Metasedimentary/tuffaceous argillite cobble in ground moraine deposits comprised of Amphitheatre Group rocks in the upper Alpine Creek drainage. Flake removals on this cobble are likely anthropogenic, although given the depositional setting, natural battering or flaking may have occurred.

Figure 3. Dark greenish-gray microcrystalline metasedimentary/tuffaceous argillite cobble collected from the upper Alpine Creek drainage.

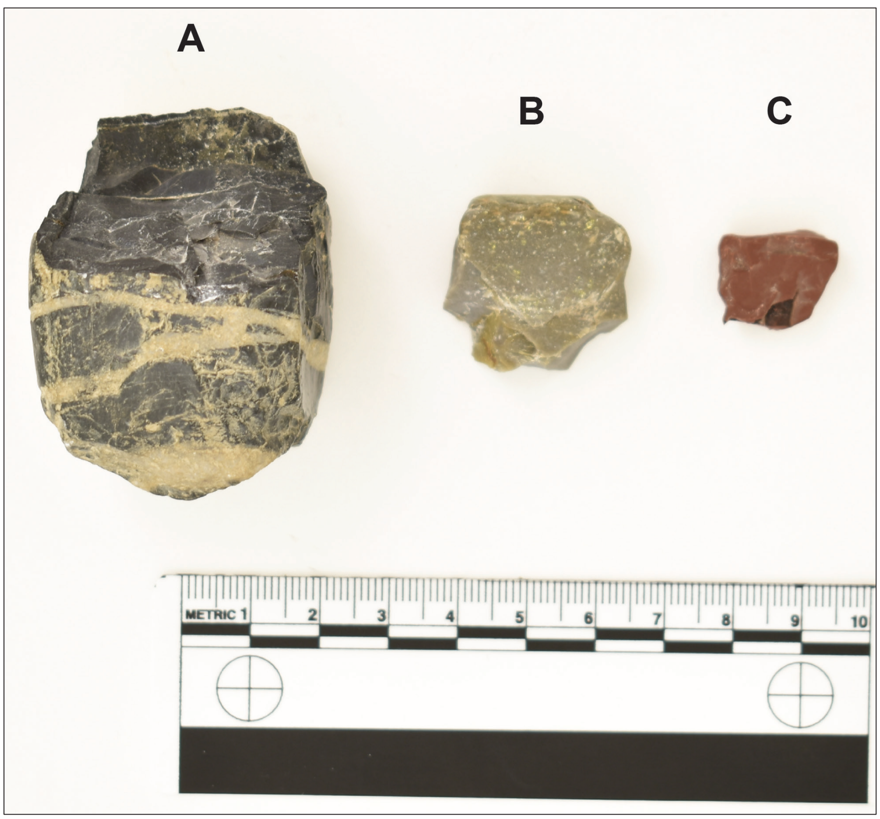

Figure 4. Lithic raw material collected from the southern Clearwater Mountains: (A) grayish-black microcrystalline chalcedony with yellowish-gray banding from the Alpine Creek drainage; (B) medium-dark-gray microcrystalline chalcedony pebble from the Waterfall Creek drainage; (C) moderate-reddish-brown cryptocrystalline metachert pebble from the Waterfall Creek drainage.

iting low-grade metamorphism in the adjacent Waterfall Creek drainage (Fig. 4C). Chalcedony (Figs. 4A, 4B) and metachert from this survey area were recovered in smaller package sizes, although they may occur in larger package sizes higher in elevation. These data indicate that knappable material of usable size is readily available in these drainages, but it is sometimes coarser-grained and of variable texture from nodule to nodule as a result of metamorphic processes. Cryptocrystalline rock types tend to occur in smaller package sizes, with the exception of dark greenish-gray metachert and tuffaceous argillite cobbles and boulders in the upper Alpine Creek drainage.

In the central portion of the Clearwater Mountains, north of Windy Creek and south of Valdez Creek, potentially knappable lithic raw material is described in the dominant Kahiltna Formation argillite unit containing fine-grained grayish-black mudstones with subchoncoidal fracture properties (O'Neill et al. 2001; Smith 1981). The geologic literature also describes knappable volcanogenic metasedimentary rocks, greenish to gray argillite, black carbonaceous argillite, olive to greenish-gray metatuff, black and gray banded argillite, and minor quantities of green, white, and black chert, characterized by finely crystallized quartz and impurities of chlorite (Mooney 2010; Smith 1981). We conducted lithic surveys at two locations in the Windy Creek drainage, sampling Quaternary ground moraine complex deposits derived from the Amphitheatre Group and Kahiltna Formation. Our survey identified just one type of knappable material, a dark-gray metasedimentary rock with macrocrystalline to microcrystalline texture, available in cobbles in the exposed gravels of the Windy Creek drainage (Fig. 5). This material may be from Kahiltna Formation. We did not locate any chert during our survey. This suggests that lithic raw material resources in this drainage are limited to variable quality metasedimentary rock.

Geologic formations in the northern Clearwater Mountains (north of Valdez Creek) are characterized by a large belt of phyllite, schist, and gneiss metamorphic rock types, and coarse-grained granodiorite and quartz diorite, some of which have been metamorphosed (Smith 1981). We did not conduct a lithic raw material survey of the Valdez Creek drainage or the northern portion of the Clearwater Mountains, but the geologic literature suggests that this area may not have significant sources of knappable material.

BUTTE CREEK DRAINAGE

Butte Creek drains Butte Lake into the Susitna River and is the primary drainage of the northeastern Talkeetna Mountains in the study area. The rugged mountains south of lower Butte Creek are part of the Amphitheatre Group described in the southern Clearwater Mountains. In this portion of the study area, the Amphitheatre Group consists broadly of metavolcanic, coarse-grained intrusive volcanic, as well as fine-grained clastic and carbonate formations. In addition, interbedded shale, siltstone, sandstone, marl, and pebble conglomerate formations also occur (Smith et al. 1988). The Kahiltna Formation in the same mountains south of lower Butte Creek contains conglomerate, sandstone, and siltstone formations (O'Neill et al. 2001). Potentially knappable lithics reported in this area include aphanitic gray-olive to gray-green metabasalt and basaltic andesite, dark-gray argillite and siltstone, and tan, gray, white, pink, and light-green chert (Smith et al. 1988).

We conducted lithic raw material surveys at two locations near lower Butte Creek. Butte Creek RM1 represents a small, steep tributary of Butte Creek primarily draining Amphitheatre Group formations described as containing chert and argillite. Butte Creek RM2 represents exposed gravels within Butte Creek, representing material from the entire Butte Creek drainage, including material from the Amphitheatre Group and Kahiltna Formation (Fig. 6). Our survey identified several knappable-quality raw materials at these two locations. At Butte Creek RM1, we collected knappable-quality chalcedony (Fig. 7A), basalt (Fig. 7B)—most of which appears to have undergone low-grade metamorphism—and metachert (Fig. 7C), ranging in texture from microcrystalline to macrocrystalline, and observed in pebble- to boulder-size nodules. This material matches the description of rocks found in the Amphitheatre Group formation; however, our survey did not collect the diversity of chert types described in the geologic literature (O'Neill et al. 2001; Smith et al. 1988).

Figure 5. Dark-gray microcrystalline metasedimentary cobbles from the Windy Creek drainage.

At Butte Creek RM2, we collected knappable-quality chalcedony (Fig. 8A) and argillite (Fig. 8B). Chalcedony from Butte Creek ranged in color from grayish black to light-olive gray often within the same nodule, indicating natural variability in the geologic source. This material ranged in texture from microcrystalline to macrocrystalline and was observed in pebble- to boulder-size nodules in the drainage. These data indicate that knappable material of usable package size is readily available in these drainages but is sometimes coarser-grained and of variable quality as a result of low-grade metamorphism.

QUATERNARY SURFICIAL DEPOSITS

Unconsolidated Quaternary surficial deposits related to the Wisconsin glaciation of the Susitna basin blanket the study area at elevations below 1000 m asl, consisting primarily of glacial drift, often reworked and deposited as alluvium along rivers and streams (Smith 1981; Smith et al. 1988; Wahrhaftig 1960, 1965). These deposits were sampled at three locations: a lateral moraine on the southern

Figure 6. Exposed gravels in Butte Creek nearby Butte Creek RM2 comprised of rock from the Amphitheatre Group and Kahiltna Formation.

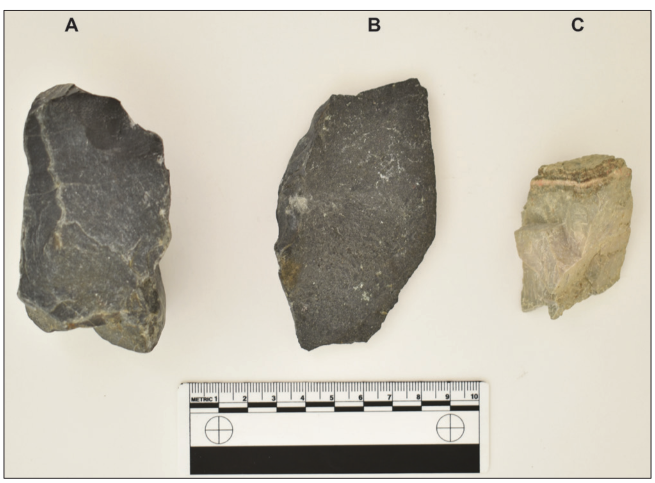

Figure 7: Lithic raw material collected from a small tributary of Butte Creek (RM1): (A) dark-gray microcrystalline chalcedony cobble; (B) dark-gray macrocrystalline metabasalt cobble; (C) light-olive-gray microcrystalline metachert cobble.

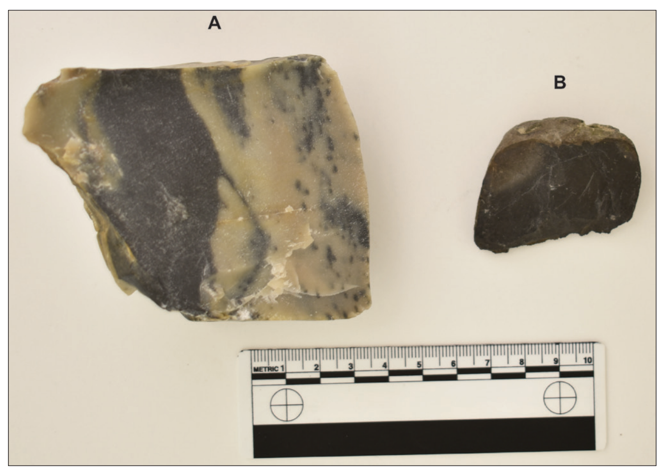

Figure 8: Lithic raw material collected from exposed gravels in Butte Creek (RM2): (A) light-olive-gray and dark-gray microcrystalline chalcedony cobble; (B) dark-gray microcrystalline argillite cobble.

slope of the Clearwater Mountains nearby Waterfall Creek and at two locations with exposed late Wisconsin till cobble beds on the western side of the Susitna River. At these sampling locations we collected knappable-quality quartzite (Fig. 9A), chalcedony (Fig. 9B) metachalcedony (Fig. 9C), and metasedimentary (Fig. 9D) lithic raw materials. These materials were microcrystalline texture and in pebble- to cobble-sized nodules. The Quaternary gravels are variable and likely represent material from local sources as well as more distant sources in the Talkeetna Mountains and southern Alaska Range, the sources of the Wisconsin-age glaciers that covered the study area.

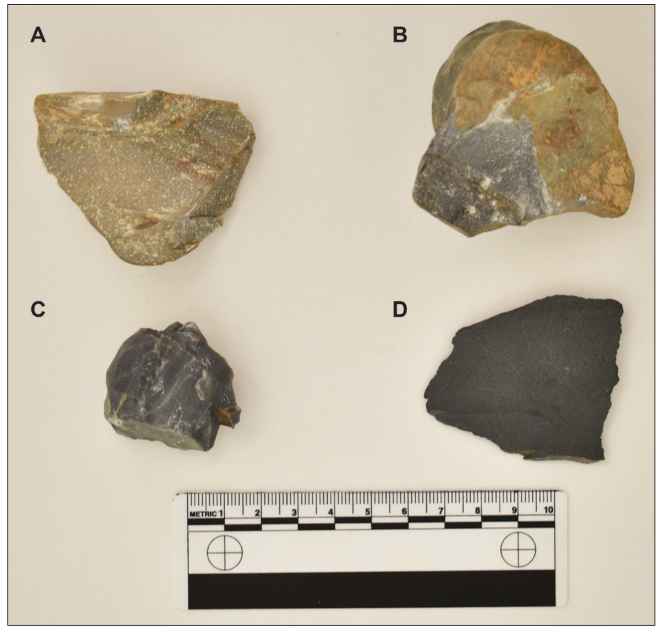

Figure 9. Lithic raw material collected from Quaternary surficial deposits: (A) pale-yellowish-brown microcrystalline quartzite cobble, (B) medium-dark-gray microcrystalline chalcedony cobble, (C) medium-dark-gray microcrystalline metachalcedony pebble, and (D) dark-gray microcrystalline metasedimentary cobble.

DISCUSSION

Lithic raw material survey of the upper Susitna River basin identified relatively abundant amounts of knappable lithic material. Lithic raw materials can be found in cobble- to boulder-sized nodules suitable for knapping. For the most part, this material is microcrystalline to macrocrystalline in texture, indicating the overall moderate quality of available lithic materials. The Clearwater Mountains are the only source of cryptocrystalline lithic raw material that we encountered in our survey. The majority of knappable material in the study area appears to be from the Amphitheatre Group formation that comprises a significant portion of the southern Clearwater Mountains and northeastern Talkeetna Mountains. The Amphitheatre Group occurs along the Talkeetna Fault, and the lithic materials presumably related to this formation have evidence for recrystallization from low-grade metamorphism. Several additional knappable raw materials collected in the study area appear to have undergone low-grade metamorphism. As a result, much of the knappable-quality material in the study area is of variable quality from one nodule to the next and from one location to the other. Despite several geologic reports identifying cherts occurring in various geologic formations in the study area, our survey found little evidence for abundant chert resources. The minor amounts of chert we collected were typically poorer quality as a result of low-grade metamorphism. However, the lithic survey undertaken for this study was limited to drainages that were accessible by road or one-day hike from a road, so it is possible that additional resources remain undocumented.

There are two raw material types found in our survey that were consistently used for stone-tool production in the upper Susitna throughout the Holocene. Chalcedony from the Waterfall Creek and Butte Creek drainages can be found in grayish-black, dark-gray, medium-dark-gray, light-olive-gray, and light-brownish-gray nodules, but it is often found with darker and lighter colors banded or "speckled" in the same nodule (Fig. 10A). Lithic artifacts made on this type of chalcedony comprise more than half of the lithics analyzed from early through late Holocene contexts at Susitna River 3 (HEA-455, n = 5,770). This type of chalcedony also comprises more than half of the lithics analyzed from the middle and late Holocene context at Butte Creek 1 (HEA-499, n = 853). This type of chalcedony was frequently used for stone-tool production in the upper Susitna basin, even though it has microcrystalline texture and is therefore of moderate quality for flintknapping (Blong 2016). The Alpine Creek drainage is dominated by various types of knappable metasedimentary lithic materials primarily occurring in dark-greenish-gray nodules (Fig. 10B). Similar types of lithic material are present in artifact assemblages across the upper Susitna basin. The cryptocrystalline metasedimentary/tuffaceous argillite in the Alpine Creek drainage was used extensively for stone-tool production at Holocene archaeological sites in the Alpine Creek and Windy Creek drainage. For example, late Holocene lithic assemblages from Alpine

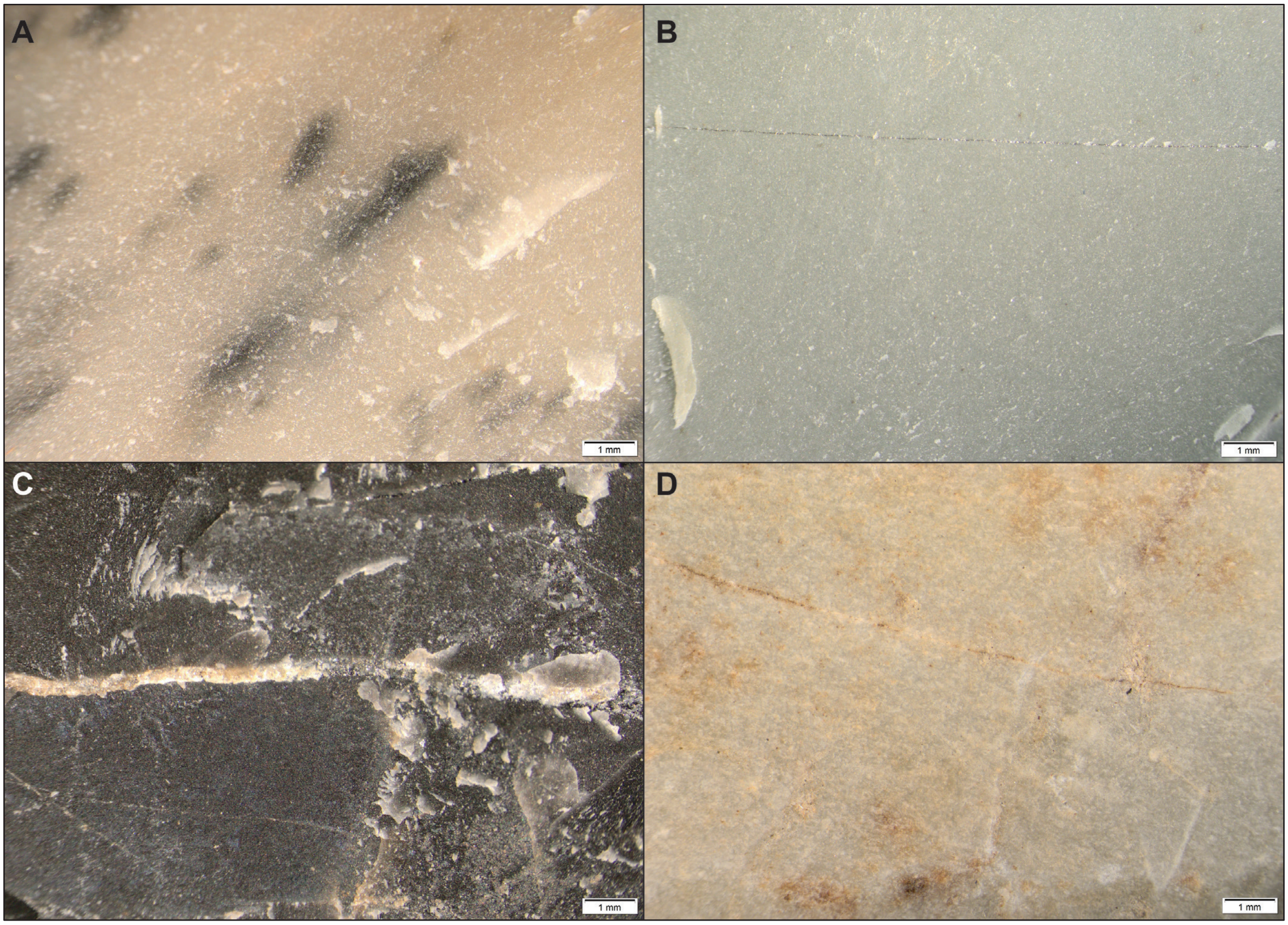

Figure 10. Lithic raw materials collected in the Upper Susitna River basin that are common to archaeological assemblages in the study area: (A) light-olive-gray microcrystalline chalcedony with grayish-black "speckles" from Butte Creek RM2; (B) dark-greenish-gray cryptocrystalline tuffaceous argillite from Alpine Creek; (C) grayish-black microcrystalline chalcedony with yellowish-gray banding from Alpine Creek; (D) light-gray to light-olive-gray microcrystalline chalcedony from Butte Creek RM2. Images at 10x magnification.

Creek 8 (HEA-460, *n* = 1306) and Windy Creek 1 (HEA-505, *n* = 241) consist of more than 90% of this material (Blong 2016). Other knappable materials found in lithic assemblages in the study area incude grayish-black microcrystalline chalcedony from Alpine Creek (Fig. 10C) and light-gray to light-olive-gray microcrystalline chalcedony (Fig. 10D) from Butte Creek RM2.

Recent geochemical analysis of knappable material in the Tangle Lakes formation nearby the Tangle Lakes (approximately 75 km east of the upper Susitna basin) suggests that material targeted by prehistoric people here is primarily meta-tuff and a chert-like metamorphosed material (Lawler 2019). Lawler (2019) notes issues linking this material to formations outside of the Tangle Lakes region. However, based solely on physical characteristics this material is likely similar to the metasedimentary/tuffaceous argillite and metachert material from the Clearwater Mountains described in this study. Future research should apply the analytical techniques in Lawler (2019) to material collected in the upper Susitna basin to investigate whether similar types of lithic raw materials were targeted by prehistoric people across the southern Alaska Range.

Studies such as this, which are focused on documenting lithic resources, are critical for evaluating current models explaining the initial settlement of eastern Beringia and North America. For example, Potter et al.'s (2017) hypothesis that North America was colonized via an interior route utilizes obsidian sourcing data to evaluate early land-use patterns in eastern Beringia. Establishing conveyance zones for nonobsidian lithic raw material can provide additional insight into land-use patterns during the initial settlement of the region and may provide a more detailed perspective on regional settlement patterns, for example the initial settlement of the central Alaska Range (Blong 2018).

CONCLUSION

The results of this study provide a baseline for evaluating the lithic landscape of the upper Susitna River basin. Understanding the lithic landscape of a study area is an important first step in evaluating hunter-gatherer lithic technological organization and human land-use patterns. The lithic landscape of the upper Susitna River basin consists of accessible and frequently encountered knappable lithic raw materials commonly found in cobble- to boulder-sized nodules. However, these materials are often microcrystalline to macrocrystalline in texture and have undergone low-grade metamorphism, so they are of moderate quality for stone-tool production. This study and similar studies focused on physical properties of locally available lithic raw materials in Interior Alaska are an invaluable first step in developing a comprehensive understanding of the prehistoric lithic landscape. The lithic raw materials described here should be targeted for geochemical or petrographic analysis in future studies and integrated into regional sourcing studies. It is only by building a database of lithic raw material resources that we can more accurately assess hunter-gatherer land-use patterns and settlement models for eastern Beringia.

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