REPORT

GLASS CREEK OBSIDIAN SOURCE IN THE TALKEENTA MOUNTAINS: A COMMUNITY-BASED APPROACH TO ARCHAEOLOGY

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ABSTRACT

The Glass Creek obsidian source is located in the southern Talkeetna Mountains near the headwaters of Caribou Creek, a prominent tributary of the Matanuska River. *Ahtnahwt'aene*, the Ahtna and their ancestors, have thrived for many generations here—establishing a trail corridor between *Nataghilen Na'* (Caribou Creek), Glass Creek, and upper *Łtaege' Na'* (Boulder Creek). For millennia, the area has provided caribou, moose, sheep, marmot, parka squirrel, grayling, and trout. It was also a lithic material source for fine-grained chert, basalt, chalcedony, and other lithics. Glass Creek obsidian, as far as we know from archaeological data, was not a preferred toolstone because its internal faults and crystalline inclusions make it generally unsuitable for knapping. To learn more about ancestral stewardship of the Glass Creek trail, Chickaloon Native Village (CNV) sponsored a community-based survey and cultural resources inventory of archaeological sites in continued stewardship of ancestral land. Here, we report on the geochemical composition of the Glass Creek obsidian compared to other obsidian sources in Alaska. We also discuss several archaeological sites discovered along the ancient trails and how the area is remembered by an Ahtna elder, culture bearer, and descendant of the Medicine People.

INTRODUCTION

Glass Creek, in the southern Talkeetna Mountains, has long been known to contain obsidian (Grantz 1960), one of the most sought-after raw materials for stone tool manufacture in the past. But not all obsidian sources are of sufficient quality to fashion durable stone tools. In 2017, Chickaloon Native Village (CNV) initiated a community archaeology trail-monitoring project to locate and identify cultural and natural resources in alpine areas of the Matanuska watershed, including the upper *Nataghilen Na'* (Caribou Creek), Glass Creek, *K'ay' Delghots' Na'* (Purinton Creek), *Łtaege' Na'* (Boulder Creek), *Nay'dini'aa Na'* (Chickaloon River), and *Hwdghel Na'* (Hicks Creek) areas (Kari and Fall 2016; Smith and Kari 2023). These regions had not previously been surveyed for archaeological sites. Among the questions were the nature and location of the enigmatic Glass Creek obsidian. Was there a

distinct source, and what is its geochemical composition? Is it of stone tool quality? How long have Ahtna stewarded the trails of upper Caribou Creek, its tributaries, and its mountain passes?

The Glass Creek canyon is a mystical place, with a stunning waterfall and crystal-clear pools of water flush with trout and grayling. Oral history and radiocarbon dates recovered from ancient Dene archaeological sites near Glass Creek (Table 1) demonstrate Dene have lived and stewarded the area for at least 3500 years, and older sites at Long Lake suggest people were in the Matanuska Valley at least as early as 6500 years ago (Kari and Fall 2016; Townsend 1981). Currently, Dene place names have not been recorded for Glass Creek (Kari and Fall 2016; Smith and Kari 2023). This is expected, as the Ahtna Medicine Men language was not spoken everyday but rather only in particular contexts (Simeone et al. 2019). Further, Ahtna and other Dene languages are and were not as direct as English. In Ahtna, a place name for a mountain creek, like Glass Creek, would have been referenced indirectly. Even obsidian would not have been named directly, but rather described like "shiny stuff" or "medicine man's fingernails." However, these places were known, and an Ahtna name for the trail connecting upper Caribou Creek through the mountains to Chickaloon River trail parallels Glass Creek and features prominently in Ahtna oral tradition as the "Over the Top Trail" (Wilson Justin, pers. comm. August 2021). The English name reported on United States Geological Survey (USGS) maps, Glass Creek, was reported by Orth (1967:371) as "Glass Creek: *stream,* flows E 6 mi. to Caribou Creek, 21 mi. NW of Tahneta Pass, Takleetna [sic] Mts; *BGN 1960*; (map 82)." Orth (1967:371) credits an unspecified 1956 USGS report for the name and its reference to "the beds of volcanic glass found along its valley."

Table 1. Archaeological sites in the upper Caribou, Glass, and Boulder Creeks.

AHRS	Description	Map quad
Upper Caribou Creek		
TLM-00347	Surface lithics, rusted can	TLM A-2
TLM-00348	Surface lithics	TLM A-2
TLM-00349	Surface/subsurface lithics	TLM A-2
TLM-00350	Surface lithics	TLM A-2
TLM-00351	Surface/subsurface lithics and charcoal 3730 ± 30 RCYBP; BETA-601997	TLM A-2
TLM-00352	Worked chert cobble	TLM A-2
Glass Creek		
TLM-00354	Obsidian source	TLM A-2
Upper Boulder Creek		
ANC-04517	Lithic scatter, white chert flakes/ tools	ANC D-3
ANC-04518	Lithic scatter, white chert blades/ flakes	ANC D-3
ANC-04519	Lithic scatter, black basalt flakes	ANC D-3
ANC-04520	Isolate, notched point in trail	ANC D-3
Purinton Trail		
ANC-04361	Lithic scatter, various cherts 3510 ± 30 RCYBP; BETA-501245	ANC D-4
ANC-04362	Large lithic scatter, hearth feature 290 ± 30 RCYBP; BETA-500735	ANC D-4
ANC-04363	Isolate, bifacial flake core	ANC D-4
ANC-04368	Lithic scatter in trail, obsidian flake AOD-11441	ANC D-4
ANC-04369	Biface, chert with chert/rhyolite flakes	ANC D-4
ANC-04474	Lithic scatter in trail, chert	ANC D-4
ANC-04466	Small lithic scatter 2770 ± 30 RCYBP; BETA-501246	ANC D-4
ANC-04472	Lithic scatter, various material types 250 ± 30 BP; BETA-548591	ANC D-4
ANC-04516	Projectile point, basalt	ANC D-4

Note: All radiocarbon dates were on single fragments of charcoal associated with artifacts.

There are several ways to reach Glass Creek. The Caribou Creek trail begins at its confluence with the Matanuska River at the prominent landform *Natsede'aayi*, translating to "rock that stands out." *Natsede'aayi* is a key feature in what Ahtna culture bearers refer to as a collection of slightly variable "Three Sisters" origin stories (Wilson Justin, pers. comm. 2021 and 9 June 2024). The Caribou Creek trail ultimately connects to the broader Knik-Chickaloon-Nelchina trail network. Other secondary trails feed this network, including Hicks Creek trail and upper Boulder Creek trail west of *Tsitna' Tates* (Chitna Pass). *Tsitna' Tates* translates literally to "head stream pass" or "water flows downward stream pass" (Smith and Kari 2023). From Chitna Pass, travelers can follow upper Boulder Creek to its northernmost headwaters west of Deace Peak, where a mountain pass connects with the Glass Creek trail (Fig. 1).

CNV archaeologists have been interested in this area for its potential as a Dene obsidian source. However, reaching Glass Creek proved challenging by off-road vehicles (ORV) with several previously unsuccessful attempts. In 2018, CNV attempted the Hicks Creek Trail but fell short of Glass Creek (Krasinski and Wygal 2023). In 2019, a second ORV attempt up Puritan Creek trail

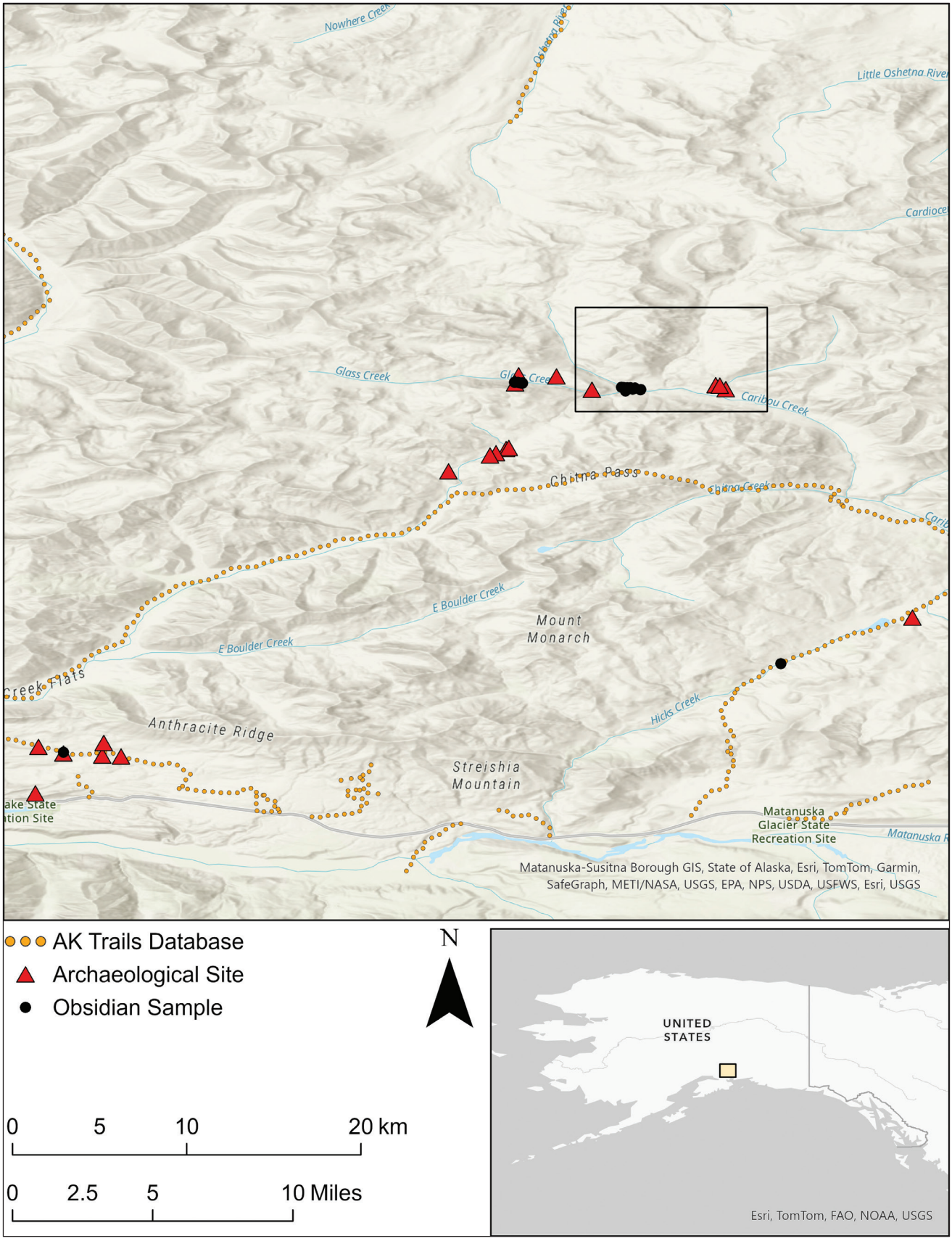

Figure 1. Matanuska Valley and Talkeetna Mountains survey areas with obsidian samples and archaeological sites. Scale 1:260,000. The box is an area of detail shown in Figure 2.

to the headwaters of Boulder Creek west of Deace Peak and Chitna Pass also fell short. In that attempt, our route dropped off into the Glass Creek canyon, making access impossible without climbing gear. However, numerous ancient archaeological sites were found in upper Boulder Creek between the Boulder Creek headwaters and Glass Creek's confluence with upper Caribou Creek (Table 1).

A third attempt was successful in 2021, when CNV archaeologists and elders flew into the Mazuma/Whistler Creek landing strip along Caribou Creek and established a remote field camp. Six archaeological sites and the Glass Creek obsidian source (TLM-0354) were recorded during this community-led outing (Fig. 2). First, we describe the field methods and geochemical composition of the Glass Creek obsidian. Then we contextualize the Dene experience through an Ahtna elder's childhood memories of his elders' teachings while juxtaposing recently recorded archaeological sites and associated radiocarbon dates. Finally, we discuss the natural beauty of the area and its cultural and spiritual importance to Ahtna, including for important social connections, toolstone acquisition, hunting, and berry picking.

Dene have a mastery of knowledge on the geological characteristics of their ancestral landscapes, including Glass Creek and Caribou Creek. Ahtna language is distinct and preserves traditional knowledge about materials such as copper ore, ochre, fossils, and toolstone (i.e., stone used as or shaped through flaking or grinding into implements). Ahtna understandings of their geological contexts were embedded in a sophisticated language structure that includes geographic and technical knowledge that refers to place names. Ahtna landscape and ecological knowledge is likewise appreciated for its complex symbolism, including geographic and travel information and reciprocal exchanges (Kari 2019; Kari and Fall 2016). Glass Creek and neighboring areas throughout the Talkeetna Mountains and Matanuska Valley are far more significant than traditional subsistence activities imply.

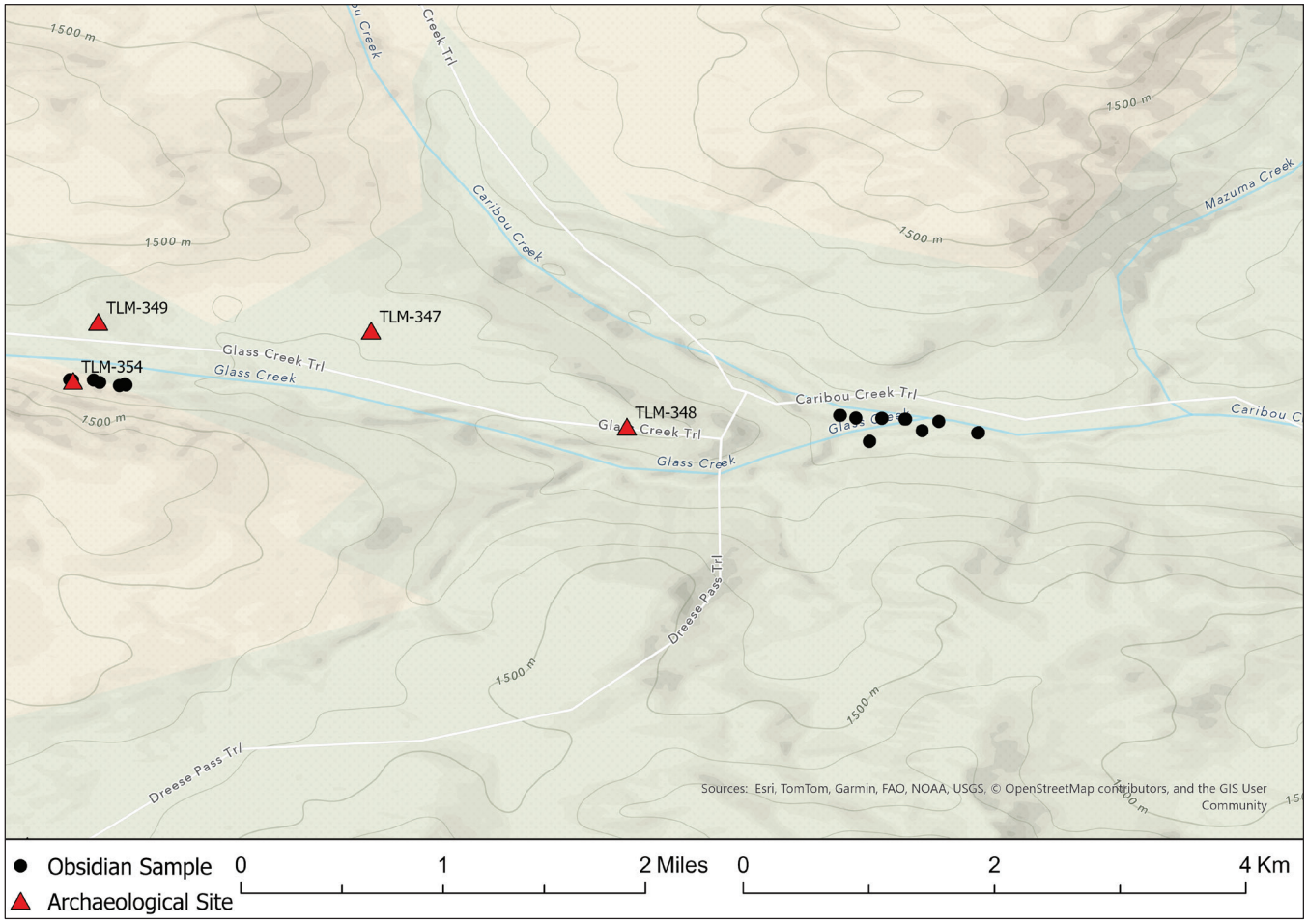

Figure 2. Glass Creek obsidian source (TLM-0354), ancient Dene trails, archaeological sites, and obsidian cobbles observed during the 2021 survey. Scale 1:36,000.

ENVIRONMENTAL CONTEXT

Upper Caribou Creek and Glass Creek are characterized by alpine tundra, including crowberry, lichen, and dense patches of dwarf birch and willow along major drainages and south-facing slopes. Stands of young spruce creep upslope from down the valley (Viereck et al. 1992). At higher elevations rocky outcrops with steep slag colluvium separate beautiful rolling meadows, low shrub alpine tundra with forbs, and a variety of alpine berries, lichens, sedges, and flowers such as the abundant mountain avens or *Dryas* spp., *Diapensia* spp., and *Cassiope* spp. A diverse array of fauna live in the area, although these species are distributed unevenly. Bear (*Ursus americanus* and *U. arctos horribilis*), moose (*Alces alces*), Dall sheep (*Ovis dalli*), and mountain goat (*Oreamnos americanus*) are common (Capps 1927). Today caribou tend to appear in smaller numbers during the late summer to winter seasons (Douglas Wade, pers. comm. June 2021).

GEOLOGY

Jurassic formations are exposed in the Talkeetna arc and comprise a variety of igneous gabbroic, dioritic, tonalitic, volcanic, and sedimentary rocks, as well as basaltic to andesitic lavas, silicic pyroclastics, and graywackes (Cole et al. 2006). Specifically, Caribou Creek is characterized by a thick sequence of undifferentiated mafic to felsic subaerial lava flows and related hypabyssal intrusive rocks of Paleocene to Miocene age (Nelson 1994). Shallow intrusions and thin basalt flows within the Matanuska Valley represent an episode of magmatism within the forearc region that occurred in response to slab window volcanism, a unique example where gaps in subducted plates allow the upwelling of asthenospheric mantle; it occurred in a forearc setting and links early Tertiary magmatism to the regional tectonic events that shaped southern Alaska (Cole et al. 2006:141–142).

Sedimentary rocks of early to late Cretaceous age at Caribou Creek are assigned to the Matanuska Formation. Coal deposits of a discontinuous nature and of varying thickness are exposed along Mazuma Creek in the study area (Nelson 1994; Waring 1936), and the nearby Castle Mountain Fault has brought to the surface Upper Cretaceous fossiliferous rock consisting of black shale and indurated sandstone (Nelson 1994). Conglomerates and intrusive igneous deposits are commonplace. River gravels provide a range of high-quality toolstones such as chert, rhyolite, and chalcedony in specific drainages of the southern Talkeetna Mountains. As mentioned in previous surveys, large swaths of the range are devoid of knappable lithics, e.g., the Horsepasture Pass area. In these areas, archaeological sites are sparse (Krasinski and Wygal 2017).

OBSIDIAN SOURCING

Alaska archaeologists have long been interested in documenting obsidian sources and connecting these through geochemical analyses of obsidian artifacts, tools, and debris from archaeological contexts (Clark 1972; Cook 1995; Griffin et al. 1969; Reuther et al. 2011; Schmuck et al. 2022). Since each obsidian source exhibits a distinctive trace element composition and derives from a spatially discrete location, the material acts as a geological fingerprint capable of tying artifacts to a unique place on the broader landscape (Freund 2013; Glascock et al. 2007).

Archaeologists have traced human mobility, trade, and migrations using the geochemical properties of obsidian (Eerkens et al. 2007; Eerkens et al. 2008; Glascock et al. 2007; Reuther et al. 2011). In Alaska, obsidian sources and artifacts recovered from dated archaeological contexts can establish links between specific regions. Among the best-documented obsidian source areas are Batza Téna in Northwest Alaska, stone from which appears frequently in ancient sites across nearly all portions of mainland Alaska and into subarctic Canada (Clark and Clark 1993: Kristensen et al. 2023; Rasic 2016). Similarly, obsidian from the Wiki Peak source area in the Nutzotin Mountains, southeastern Alaska Range, was widely transported throughout the Yukon Territory and Interior Alaska (Cook 1995; Kristensen et al. 2023). Wiki Peak and Batza Téna obsidian are found in the Nenana and Tanana Valleys associated with the earliest known archaeological sites in Alaska, dating to more than 13,000 years ago, and demonstrate early familiarity with geological sources and long-distance transport of the stone (Reuther et al. 2011).

Obsidian provenance studies typically begin with an initial stage focused on identifying, documenting, and characterizing geological sources and comparing these to obsidian artifacts from archaeological contexts. A second stage focuses on developing and testing hypotheses about human behavior or cultural processes and reconstructing ancient trade and transport patterns. In eastern Beringia, obsidian research has a decades-long history, and for some sources and regions the second phase of research is well underway, while in other areas foundational work remains

to be developed. Currently, at least 15 geochemically distinct types of obsidian have been identified in prehistoric archaeological contexts in eastern Beringia (parts of Alaska and the Yukon not glaciated during the last Ice Age), yet only three of these putative sources have been linked to documented geological sources (Cook 1995; Rasic 2016; Reuther et al. 2011:270).

For the Talkeetna Mountains, researchers are in the initial stages of understanding obsidian source localities and ancient Dene trade and trail networks. Further studies may someday better reveal their sophisticated economic and social connections based on the distribution of obsidian artifacts in relation to their sources. Through community-based research, directed and largely funded by Chickaloon Village Traditional Council (CVTC), we apply standard archaeological survey and test excavation methodologies combined with long-standing traditional ecological knowledge preserved for generations by Ahtna culture bearers.

METHODS

ORAL HISTORY

Oral history interviews were conducted with CNV tribal citizens, elders, and knowledge bearers, particularly with Douglas Wade and Rain Wade, son and daughter of Clan Grandmother Katie Wade. These interviews guided fieldwork methodology and survey locations and demonstrated the cultural and spiritual significance of the Glass Creek area. Additional interviews were conducted with Wilson Justin, an Ahtna elder and descendant of the Medicine People Clan from Slana and Nabesna Villages. Interviews were conducted in English, and most were not recorded. Typed notes were taken. Verbal and written consent was sought to publish these oral histories. While culturally some of this information, particularly names of people, is considered *engii* (taboo) to share in print, it was deemed appropriate in this case before it becomes lost to future generations. That is especially true of information gained through primary experience as well as that taught and handed down by other Ahtna elders. During writing, language was checked and revised to ensure care and accuracy in translating complex Ahtna concepts or stories into English for which there are no one-to-one correlates.

PEDESTRIAN SURVEY

Pedestrian survey via transects focused specifically on modern "social" trails likely developed (or maintained) on top of ancient Dene trails. During pedestrian survey, we identified numerous obsidian cobbles in Caribou Creek below its confluence with Glass Creek. Other cobbles were found in Glass Creek both above and below the waterfall. GPS-recorded survey tracks were spaced approximately 2 to 4 meters between crew members. Subsequent walkovers occurred for additional photography and to access new terrain; this strategy facilitated the discovery of additional sites not previously identified. That is, walking trails multiple times resulted in noticeably higher site discoveries. During such wayfinding, footpaths were found to occasionally diverge from well-worn trails to cross creeks or navigate cliffs or canyons. Trails primarily parallel creeks but are not exclusively adjacent, and they often follow ridges, moraines, and terraces positioned well above creek beds. Wetlands were not transected but their perimeters were, especially around ponds and lakes. Once artifacts were located, individual GPS waypoints were averaged for at least one minute to raise confidence and lower margins of error.

FIELD SAMPLING

Systematic pedestrian transects were undertaken of gravel bars along upper Caribou Creek and Glass Creek to identify obsidian in secondary geological contexts and potentially trace these deposits to primary outcrops or beds. GPS waypoints and photographs of all obsidian nodules and boulders observed in transects were collected, but only random samples of obsidian were brought out of the field for analyses. Larger boulders, some the size of a volleyball (Fig. 3), were encountered in the field, and smaller samples were detached from larger nodules using a geological hammer. We collected a sample of pebbles for portable X-ray fluorescence (pXRF) analysis for inclusion in the Alaska Obsidian Database (AOD; Table 2).

OBSIDIAN GEOCHEMICAL ANALYSIS

Obsidian, pitchstone, and perlite are forms of naturally occurring volcanic glass created upon rapid cooling of lavas of rhyolitic/dacitic and rhyolitic/trachytic composition (Heide and Heide 2011). These forms of volcanic glass often co-occur within a geological formation. They vary in water content and degree of devitrification, with obsidian containing the least water content and pitchstone the greatest. Perlite takes on its increased water content long after its formation through the process of devitrification.

These rocks all exhibit some degree of glassy appearance and the property of conchoidal fracture. Obsidian is typically a hard, massive rock with vitreous luster and the most archaeologically relevant material since it is most likely—although not guaranteed—to be suitable for flaked stone tool manufacture. A key macroscopic visual characteristic of pitchstone is a resinous luster. Perlite can be distinguished on the basis of its perlitic texture—a dense pattern of minute, spherical cracking—which results in a brittle nature. The sample of glassy rocks observed from Glass Creek best matches the visual characteristics of obsidian given its glassy luster and the absence of perlitic texture.

Eight samples from Glass Creek were analyzed in 2019 and 2024 using a Bruker Tracer 5i portable XRF analyzer (serial #900F6072) equipped with a rhodium thin window X-ray tube and a 40 mm^2 silicon drift detector providing a resolution of 140 eV at 250,000 counts per second in an area of 8 mm^2. Analyses were conducted at 40 keV and 42 µA using a filter composed of 100 µm Cu, 25 µm Ti, and 300 µm Al in the X-ray path for a 100-second live-time count. Ten elements were measured: potassium (K), manganese (Mn), iron (Fe), gallium (Ga), thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Peak intensities for these elements were calculated as ratios to the Compton peak of rhodium and converted to elemental concentrations using linear regressions derived from the analysis of 15 well-characterized obsidian samples analyzed by neutron activation analysis (NAA) and/or X-ray Fluorescence

Figure 3. Obsidian cobbles along Glass Creek above the falls and just below the source (TLM-354). Obsidian observed as cobbles in the creek bed were highly crystalized, aged, or heavily weathered and not particularly suitable for tool making.

Table 2. Trace element values in parts per million from XRF analyses of geological samples from Glass and Caribou Creeks.

AOD number	Sample ID	Site/locale	Source name	K	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb
AOD-11441	–	ANC-04368	Unassigned	33606	282	8930	65	19	6	85	32	45	159	17
AOD-11442	–	Hicks Trail	Glass Creek (AR)	23768	606	13547	96	18	2	65	57	60	212	11
AOD-16231	A-2021-07-31.01	Glass Creek	Glass Creek (AR)	22211	647	14264	97	18	2	92	51	59	223	10
AOD-16232	A-2021-07-31.02	Glass Creek	Glass Creek (AR)	23700	654	14921	93	18	2	89	54	62	235	11
AOD-16233	A-2021-07-31.03	Glass Creek	Glass Creek (AR)	23922	612	14093	98	19	2	94	54	64	216	11
AOD-16540	B-2021.07-31.01	Glass Creek	Glass Creek (AR)	19982	545	12012	89	19	3	97	58	64	251	11
AOD-16541	B-2021.07-31.02	Glass Creek	Glass Creek (AR)	20043	599	14034	91	19	2	101	66	66	226	13
AOD-16542	B-2021.07-.31.03	Glass Creek	Glass Creek (AR)	25464	546	12541	91	19	3	89	61	68	214	11
AOD-16543	B-2021.07-31.04	Glass Creek	Glass Creek (AR)	21535	566	11356	87	19	2	87	61	67	222	12
AOD-16544	B-2021.07-31.05	Glass Creek	Glass Creek (AR)	20892	599	11915	87	19	2	69	59	57	230	9
AOD-16545	B-2021.07-31.06	Glass Creek	Glass Creek (AR)	21850	723	10270	107	19	2	77	41	80	269	15
Group AR mean	–	–	–	23361	580	12535	91	19	3	86	54	63	223	12
Group AR Standard Deviation	–	–	–	3814	111	1859	10	0	1	11	10	9	27	2

(XRF) and are reported in parts per million (ppm). Source assignments were made by comparing the composition of analyzed samples to a catalog of source samples from northwestern North America (Alaska, Yukon, and British Columbia) and the Russian Far East, specifically Chukotka and Kamchatka (Cook 1995; Reuther et al. 2011). Correlations between artifacts and source signatures were considered meaningful when key elements (Rb, Sr, Y, Zr, Nb) fell within two standard deviations of the mean source values (Hughes 1998).

GLASS CREEK OBSIDIAN

Previous geological surveys of Glass and Caribou Creeks describe tertiary volcanic rocks at the juncture of Caribou Creek and Glass Creek that include "bluish flows and pyroclastic rocks with beds of volcanic glass" in one area and "tuffaceous beds with beds of volcanic glass" in another (Grantz 1960). Geochemical assays of at least two samples from the Glass Creek area have existed in the AOD, having been analyzed by John Cook in the 1990s using NAA (Cook 1995). While these samples have been characterized geochemically, their precise location and geological context were not thoroughly documented. In 2021, CVTC archaeologists, working with tribal citizens, knowledge bearers, and the Chickaloon Cultural Historic Preserva tion Department, identified primary and secondary deposits of obsidian along Glass Creek. In one location obsidian in primary context was documented eroding from a mountain cutbank on the south side of the Glass Creek canyon (Fig. 4) above the waterfall (Fig. 5). Here, multiple lithostratigraphic layers, including rocks of gray, green, and blue hues, overlay the dark black obsidian. Primary obsidian samples associated with this bedrock source were collected, as were samples from secondary contexts along upper Caribou Creek and Glass Creek. Obsidian clasts

Figure 4. Glass Creek canyon and obsidian source (TLM-0354) upstream from the waterfall. Photo from north side of the canyon toward the west or upstream.

Figure 5. Glass Creek waterfall below the obsidian source. Photo from the north bank facing west or upstream.

ranging from pebble to cobble size were observed along upper Caribou Creek and Glass Creek (Krasinski and Wygal 2023) and were subsequently analyzed with pXRF to characterize their trace element composition. The geochemistry of Glass Creek and Caribou Creek geological samples forms a single coherent geochemical "group" (labeled AR) that is distinct from all other known geological sources in Alaska (Fig. 6).

All samples analyzed were similar in visual characteristic such as color, texture, luster, and translucence. Each analyzed sample was larger than the minimum size and thickness necessary to provide valid quantitative measure of trace elements. Considerable variability in the trace element composition of Glass Creek geological samples is evident in the pXRF data and likely reflects the heterogeneity of the whole rock hand samples that were analyzed (as opposed to, for example, powdered and homogenized samples). The analyzed samples include common phenocryst inclusions that likely influenced the results and explain, for example, outlying data points such as AOD-16545. Alternatively, the trace element variability among the analyzed samples may indicate the presence of geological variation in the Glass Creek area, i.e., multiple obsidian flows or deposits. Our admittedly provisional results rely on a small sample of geological specimens, and future research will better define the range of geochemical variation and its underlying causes. At this point the geochemical picture emerging for the Glass Creek source area is of a single if somewhat diffuse source "fingerprint."

Making sense of the Glass Creek obsidian source and its geochemistry is still a challenge because the number of samples has been few and some have only vague provenience information. Thus, our objective was to interview elders about this area and identify a precise location for the obsidian, collect additional samples for the AOD, and report on archaeological sites.

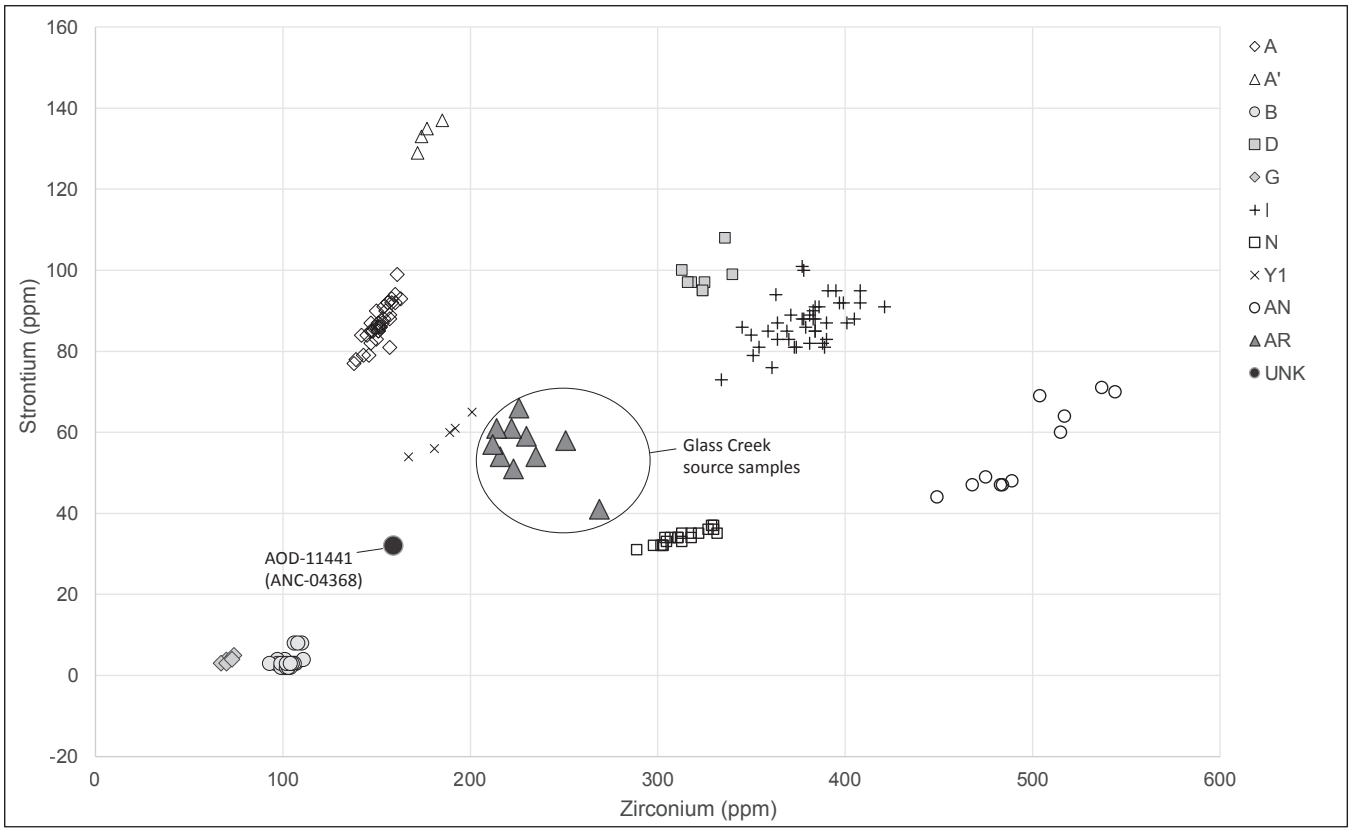

Figure 6. Bivariate plot of trace element compositions for common obsidian sources and geochemical groups for Alaska, including Glass Creek geological source samples. The circle shown is a graphic portraying a confidence interval. Prominent obsidian sources include Batza Tena (Group B), Wiki Peak (A), Okmok (I), and Akutan (AN). Geochemical groups known from archaeological samples but not linked to a known geological source include groups A', D, G, N, and Y1 (see Cook 1995; Rasic 2016; Reuther et al. 2011). Groups Y1 and N plot nearest to Group AR in this biplot but have quite distinctive geochemistry when other trace elements are taken into account.

In prior years, two additional obsidian samples (AOD-11442 and AOD-11441) were collected from ORV trails leading toward the headwaters of Glass and Caribou Creeks, Hicks Lake Trail, Boulder Creek, and Purinton trails. Sample AOD-11442, identified along the Hundred Mile Trail on the south side of Hicks Lake in July 2018, came from the bottom of a large hill separating Hicks Creek on the north side from Pinochle Creek on the south (Fig. 1). Because it was out of geological context and was not in any apparent archaeological context, we assumed that this specimen dropped from a recreational rock collector's ORV as they exited the Caribou Creek area. AOD-11442 (ANC-004368) is a primary cobble with one potential flake scar but otherwise is not considered knapping quality due to the presence of abundant phenocrysts and a hackly rather than conchoidal fracture surface. In color, texture, and geochemical attributes it matches a set of obsidian geological samples collected along Glass and Caribou Creeks.

Only a handful of unique geological specimens are confidently tied to Glass Creek. Confirmed samples were recovered in 2021, including AOD-16233, which is black (N1), opaque, glassy material with common internal fractures and phenocrysts. It crumbles into blocky fragments and is not amenable to controlled flaking. The majority of obsidian cobbles collected from the source thus far are of varying levels of integrity, with most exhibiting common internal fractures, inclusions (phenocrysts), and other flaws that interfere with conchoidal flaking. Overall, cobbles that were well-suited to refined stone tool manufacture were not observed. Locally, the lithic raw material of preference appears to have been high-quality cherts available in stream gravel deposits.

The geochemical signature for Glass Creek obsidian (group AR) is based on only 10 samples and may represent only a portion of the source's variation. The primary deposits of Glass Creek obsidian are within beds of volcaniclastic flows exposed along the steep and unstable north

face of a mountain that is cut by Glass Creek. Obsidian clasts accumulate at the base of this slope and within the stream gravels of Glass Creek. Separate outcrops of similar composition may exist in the vicinity, including the upper reaches of Caribou Creek and lower reaches of nearby Mazuma Creek, and it is uncertain how these deposits vary regarding their trace element geochemistry and suitability for flaked stone tool manufacture. Thus, the geochemistry described here is offered on a provisional basis from a relatively small sample; further analysis could result in additional groupings or may demonstrate a broader range of variation than this preliminary study has revealed. A larger number of geochemical assays from the Glass Creek and upper Caribou Creek drainages would further define the geochemical nature of this source area and may enhance chances of finding archaeological matches.

While we cannot confirm if the Glass Creek obsidian source provided toolstone for Dene, we can say that, to date, no artifacts from archaeological contexts match the Glass Creek (group AR) obsidian among more than 10,000 analyzed archaeological samples from Alaska and the Yukon, including more than 1500 samples from sites in the Talkeetna Mountains and eight adjacent quadrangles. The intersection of several Dene trail systems near the mouth of Glass Creek suggests the area was important for multiple reasons. Oral tradition demonstrates the geographic and geological knowledge of this area as well as the importance of geological materials within a larger social context. It also provides information useful in focusing the search for obsidian sources in the Talkeetna Mountains.

ADDITIONAL SAMPLES

An isolated obsidian flake (AOD-11441), 5 to 7 cm in maximum size with clear striking platform and dorsal flake scars, was found on the surface of archaeological site ANC-04368, in the Purinton Creek ORV trail near its confluence with upper Sawmill Creek (Fig. 7). The primary color of this sample is medium bluish-gray (5B 5/1) with patches of medium dark gray (N4); it is characterized by a hackly fracture surface and many small phenocrysts yet fractures conchoidally and is adequate quality for controlled flintknapping. Based on its color and location, it was hypothesized that this sample could derive from Glass Creek, as this color is visible in the mountain stratigraphy associated with the source. Geochemical analysis indicates sample AOD-11441 is unique and does not match anything else in the AOD from either archaeological or geological contexts, including Glass Creek. Since all obsidian sources are characterized by some geochemical diversity, additional sampling and characterization may refine these results further.

Figure 7. Artifact photos of an obsidian flake (AOD-11441) from archaeological site ANC-04368 along the Purinton Trail, left ventral surface, right dorsal surface. This sample is not from the Glass Creek source and is currently unassigned to an AOD grouping. Table 1. Archaeological sites in the upper Caribou, Glass, and Boulder Creeks

DISCUSSION

Obsidian sourcing is a critical approach to understanding past economies and trade networks, including ancient trail networks. As of this report, Glass Creek obsidian has not been found archaeologically and its use in the past, if it did occur, remains undemonstrated. But as interesting as these science-derived narratives are, it is only one way of knowing the past. Traditional ecological knowledge of CNV and Slana Village provide a far more layered and complex assessment of Glass Creek, its waterfall, and ancient trail network. Although a Dene place name for Glass Creek is not currently known (Kari and Fall 2016), Dene place names are documented in the vicinity and thus demonstrate stewardship and familiarity with the area and its resources. There is good reason for not having an Ahtna name recorded for all geographic features. Conversations with tribal citizens and culture bearers indicate memories of different time depth pertaining to upper Caribou Creek and the trails that intersect there, not all of which have been widely discussed elsewhere.

In the following discussion, the depth of Ahtna wisdom about their ancestral homelands and shared narratives of Ahtna people is substantiated through knowledge of the Glass Creek area, obsidian sources, and connections with medicine men. Wilson Justin, elder and culture bearer from Slana Village, Nabesna, and Chistochina and the son of Nabesna John and Laura Nicoli, is a descendant of "the Medicine People" and retains knowledge from growing up in the Copper River valley. The information here is shared because of the circumstance colonialism imposed on Ahtna culture and the subsequent decline of language among the Ahtna. But Wilson Justin cautions these narratives are difficult to pinpoint in specific detail. At times memories merge and often apply more metaphorically than literally to the Ahtna landscape. In part, this is because tribal clan language has multiple hierarchical levels, which do not translate well into English (Simeone et al. 2019). Ahtna elders often spoke in euphemisms, not as specifically as archaeologists, anthropologists, and linguists would prefer. Information about Medicine People traditionally would not be shared outside of a highly select group of powerful Ahtna who spoke a sophisticated shamanic language that many could not understand or were not party to. According to Wilson Justin, given the context, the following discussion is the best that can be remembered, as memories are akin to looking back into a distant mirror. Yet they are still important ancestral narratives nonetheless.

Wilson Justin did not recall hearing stories specifically about Glass Creek, as it was named in 1956, or the obsidian found there. However, at least three major trails have deep antiquity through this area and intersect at the confluence of Glass Creek with Caribou Creek (Fig. 1). As a result, "old-time stories" from the upper Caribou Creek area are still remembered (Wilson Justin, pers. comm. 9 June 2024). In one narrative, James P. Sinyon (Western Ahtna from the *Udzisyu* [Caribou] Clan around upper Susitna River/Tyone Lake near Cantwell) talked about his mother, who was born down toward Chickaloon/Knik area. James P. Sinyon told Wilson Justin that people went back up that way sometimes when he was young. They called that trail (Glass Creek/upper Caribou Creek) "*the big pass*. It was a rough trail in some places back there. One way went down Caribou Creek and was used to go across to Chitina, another went down the Chickaloon River" (Wilson Justin, pers. comm. 9 June 2024).

Charlie Hubbard (Western Ahtna and descendant of the Medicine People from Cantwell) talked to Wilson Justin about several trails through the mountains, including alpine trails used by Medicine People to acquire special materials. "All of those trails are connected back there, and you had to be careful about which way you chose. Today, the trails are all grown over and hidden. Back then there was more permafrost so the trail would get wider in the muddy sections and were much bigger" (Wilson Justin, pers. comm. 9 June 2024). These narratives indicate the deep interconnections the Dene trails maintained as well as their significance specifically to Medicine People.

Wilson Justin's stepfather, Lee Hancock, talked about a series of camp sites above the waterfall. Wilson Justin was hoping an old container for sacred water could be found but left in place. If a medicine man was healing someone, he would get water from above that waterfall. He would take the container and use it to transport the medicinal water back to where it was needed for the healing ceremony. But the container belonged to the waterfall and had to be returned to it. They would use this water for steam rocks and had a special song to sing. At TLM-0347, an ancient camp site with stone tools, a rusted metal container was observed during our 2021 fieldwork. We assumed this was a Coleman-style fuel can, among a scatter of lithics less than 500 meters north of the Glass Creek waterfall. The site overlooks a western pond along

an ancient Dene trail connecting Caribou Creek to the Chickaloon River trail.

Wilson Justin discussed upper Caribou Creek and Glass Creek in particular as a medicine trail as well as the significance of obsidian and other special raw materials for Dene. The medicine men's repertoire included small obsidian blades and caribou antler for hunting. He had not heard much about Glass Creek specifically but thought it was Medicine People's area back there so others did not go. "[Medicine People] would camp out for many days and prepare their arrows for battle by assembling an arsenal. If enemies saw obsidian in the arrows launched against them, they would realize that these were serious people. They called these obsidian blades Medicine People's fingernails. There were very few Medicine People back then, and if their enemies saw that they had these types of tools, then they would know how much power these people had" (Wilson Justin, pers. comm. 9 June 2024).

Wilson Justin remembered that Ahtna selectively sourced obsidian from the White River toward Kluane Lake. Also, obsidian was recovered on a creek that goes down to the Delta River from north of Paxson Lake before Pump Station 10 on the Richardson Highway. "Fred John used to say there was a big source over by that mine near Cantwell [referring to the Valdez Creek Mine within the Western Ahtna ancestral lands] and they would take it to Paxson Lake to trade. This was Medicine Man fingernail stuff," Wilson Justin recalled (pers. comm. 9 June 2024).

The special nature of obsidian is also reported in Upper Ahtna by Katie John, a knowledgeable and respected Ahtna elder (Kari 1986). In *Tsaał K'aas C'eghaan T'ił'aen'de* (When 'He Trains the Chinook Wind' Made War), an individual named *Tsaał K'aas,* who also belonged to the *'Ałts'en' Tnaey* clan, from the Yukon River headwaters, *Nah'aay* or Nahani, trained with obsidian arrows (Kari 1986:64).

Glass Creek is also relevant for a more thorough contextualization of the "Medicine Men Wars." Three such wars broke out with Chugach coastal groups, and some Ahtna were killed (de Laguna and McClellan 1981; Kari 1986:69). The earliest occurred in the late seventeenth or early eighteenth century in the Upper Ahtna ancestral lands, specifically the upper White River or Kluane Lake area, when a "rogue" medicine man molested a niece without consequence (Simeone et al. 2019:106). In response, the girl's family hired two medicine men to make revenge. The war included the rogue medicine man employing smallpox infected–blankets to the village of *Det'aan Caegge* ("falcon mouth," Platinum Creek) on the upper Nabesna River (Simeone et al. 2019).

During the Medicine Men Wars, the Knik and Eklutna Dena'ina villages sent word of the attacks to Ahtna, as they maintained friendly relationships, bilingualism, and intermarriage (de Laguna and McClellan 1981). As a result, Ahtna from the Copper River valley traveled these trails to join Dena'ina in the fight. During the wars, elders talked about returning to Chitina after fighting down by the coast. They would take that "over summit trail," around Glass Creek, because it was easier to hide up there. That way no one could follow them back to Chitina "because you don't want your enemies to know where you are going" (Wilson Justin, pers. comm. 9 June 2024). "Once in that mountain country, people can disappear and circle back if they need to. Any pursuers would not make it to the end of the pass and would have to turn around. Down in the Matanuska you were on equal footing with your enemy. Up there, the enemy did not know the country and the Ahtna could lose them before returning home" (Wilson Justin, pers. comm. 9 June 2024). Later wars involved trade between Dene nations, including Ahtna ancestral lands (McClellan 1975; Simeone et al. 2019).

Wilson Justin recommends that if one is at the Glass Creek waterfall, do not throw rocks in the creek, because it is a sacred place. Don't jump over the creek. Instead, step in it when you cross over. Listen to those lonesome evening songbirds. When you hear this bird sing, stop and be silent for a while. It means people from the old days [ancestors] are moving past. Stop, have a moment of silence, and let them pass. Wilson has not heard any of these songbirds for at least 30 years, but they have a very soft, trilling low key sound in the evening that goes on for about 30 minutes. "That is how you know the old ones are coming back to see the place they were forced out of. They say up in Glass Creek, there was things like that back where they had those camps" (Wilson Justin, pers. comm. 9 June 2024). Something hit those people and made them disappear, according to Katie John, Wilson Justin's aunt. James P. Sinyon quit going back there because his mother told him not to go there anymore: "Don't go down that old way creek, she said." A place of dramatic endings for people, starvation or epidemic, were sometimes told in a soft way at the end of other stories. Warnings about specific places were rarely discussed otherwise (Wilson Justin, pers. comm. 9 June 2024).

CONCLUSION

An ancient mountain trail parallels Glass Creek, in the headwaters of Caribou Creek, and connects to the headwaters of the Chickaloon River trail. Oral history and ancient Dene sites in the area demonstrate the Glass Creek trail is of cultural and spiritual significance to Ahtna from both the Matanuska and Copper River valleys. It is a Dene circulation feature also connected to Medicine Men activities, the Medicine Men Wars, and obsidian as a material with recognized special properties. A geological obsidian source has been located there, and its geochemical attributes are reported. Thus far, however, no reported obsidian from archaeological contexts, including sites in the vicinity of the source, has been sourced to Glass Creek, probably due to the weathered quality of the obsidian.

Confirming the spatial distribution and geological context of primary and secondary volcanic glass originating from Glass Creek is of interest to archaeologists, CNV, and rock enthusiasts. The very few previously known geological samples reported for Glass Creek also made it challenging to understand this source from a toolstone perspective. While glassy in texture, they were riddled with fractures and inclusions that made controlled conchoidal flaking nearly impossible. Nevertheless, stone sources are culturally significant to Dene, and an obsidian source with higher quality nodules may someday be "rediscovered" in the Talkeetna Mountains.

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