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Dated ground stone artifacts from Tse'K'wa (HbRf-39), Peace River region, British Columbia

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ABSTRACT

Artifacts made from ground sandstone were recovered from Tse'K'wa (HbRf-39) in the Peace River region of northeastern British Columbia. Two formal types are described: handstones and beveled-edge artifacts. The specimens are dated by stratigraphic position and radiocarbon from 6000 cal BP to recent times. Scans with an optical profilometer of possibly worked surfaces show that they are significantly smoother than unworked sandstone from the local bedrock formation. The shape of the artifacts also supports their identification as deliberately formed artifacts. We suggest that these are tools related to preparation of hides.

KEYWORDS

Ground stone, hide-working, Tse'K'wa, Charlie Lake Cave, Peace River, optical profilometer

1. Introduction

We report a small collection of ground sandstone artifacts from Tse'K'wa (HbRf-39) in the Peace River region of northeast British Columbia. In this paper we describe and provide context for eight specimens, justify their identification as deliberately shaped artifacts, and suggest possible functions.

Tse'K'wa is a stratified archaeological and paleontological site located in the southern boreal forest in the Peace River region of northeast British Columbia (Figure 1). Formerly known as Charlie Lake Cave, Tse'K'wa was excavated in 1974, 1983, 1990, and 1991 (Figure 2). The location, topography, stratigraphy, dating and cultural sequence have been described elsewhere (e.g., Fladmark et al. 1988; Handly 1994; Driver et al. 1996; Testani 2020). Designated a National Historic Site, Tse'K'wa is owned and managed by the Tse'K'wa Heritage Society.

All excavation seasons focused on sediments that accumulated in a 4 to 5 metre deep gully in front of the cave from c.12,000 cal BP to recent times. The stratigraphic sequence has been divided into four major Zones (I through IV), with Zones II, III and IV subdivided into a total of 15 subzones (Handly 1994; Driver et al. 1996). Evidence of human presence is found throughout the sequence, starting with evidence of bison hunting by people using fluted points (Fladmark et al. 1988; Driver et al. 1996; Driver and Vallières 2008) as well as evidence for ritual practices (Driver 1999). Use of the site intensified by 6000 cal BP, with a wide range of vertebrates found in

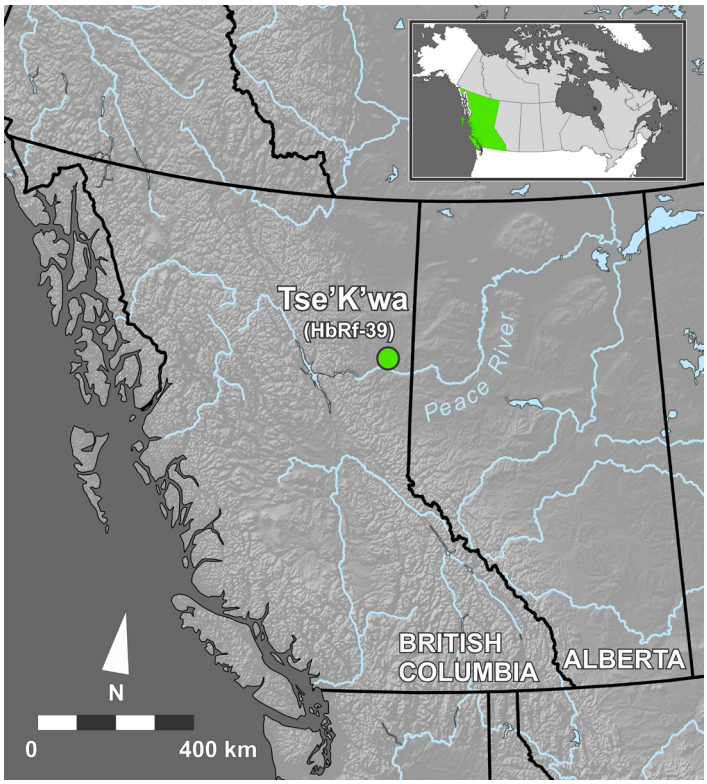

Figure 1. Location of Tse'K'wa (green circle) in northeast British Columbia and the Peace River, which drains east into Alberta.

association with lithics and hearths until recent times (Driver 1988; Testani 2020). Most of the mammals that are found today in the Peace River region are represented in the faunal remains at the site, with the post-6000 BP faunal assemblages dominated by snowshoe hare (Testani 2020). Birds are mainly waterfowl. Quantities of suckers (*Catostomus* sp.) were fished from the local creek, a traditional seasonal activity for Dane-zaa people around the Charlie Lake area (Testani 2020).

2. Discovery of sandstone artifacts

Glacial and glaciolacustrine sediments cover most bedrock throughout the region. At Tse'K'wa the local bedrock is sandstone of the Dunvegan Formation (Hartman 1999), and outcrops as a small escarpment that contains the cave. The gully outside the cave is bounded on its upslope side by bedrock (in which the cave is situated) and on the downslope side by a massive sandstone boulder that broke away from the escarpment prior to 12,000 cal BP. Sediments that filled the gully over the last 12,000 years mainly derived from downslope transport and redeposition of glaciolacustrine sediments that mantle the hillside above the cave and gully. Pieces of bedrock-derived sandstone were

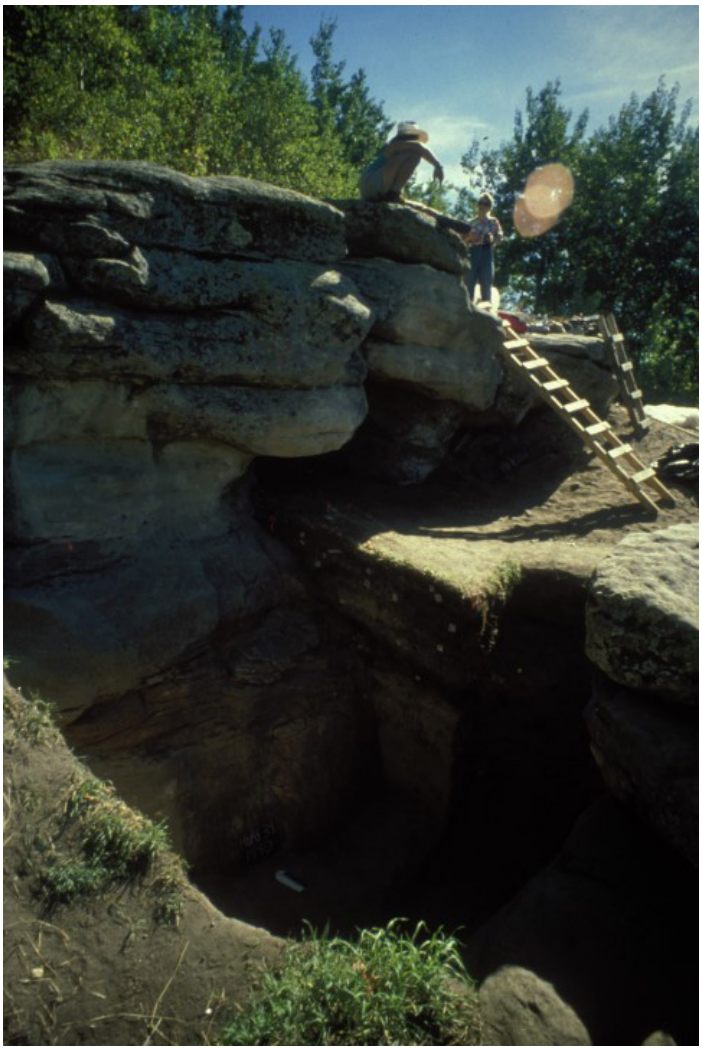

Figure 2. Excavations at Tse'K'wa, 1990 season. Excavations have removed about half the total depth of sediments from the gully. Cave entrance is in shadow to left of ladder. Photograph by J. Driver.

common throughout the sediments in the gully. Sand grains weathered from bedrock also contributed to sediments in the gully (Fladmark et al. 1988).

Excavations in 1990 recovered a sandstone object that was unmistakably shaped by people by surface grinding (Figure 3). Once the presence of ground stone technology had been recognized, crew members inspected fragments of sandstone more carefully for sandstone artifacts, and an additional seven specimens were recovered in 1990 and 1991. It seems likely that a few specimens may have been missed in the 1974 and 1983 excavations and in the 1990 fieldwork prior to the first recognition of ground stone technology at the site.

Figure 3. Complete handstone (HbRf-39:1419). Photograph by R. Doucette.

3. Artifact descriptions

All artifacts are currently (2022) curated at the Department of Archaeology, Simon Fraser University. This small collection can be divided into two basic types (Table 1), with one possibly unfinished specimen that is not classified.

A complete "handstone" (HbRf-39:1419; Figure 3) is the only specimen that is both intact and ground over its entire surface. We use the term "handstone" because it is consistent with Adams' (1988) terminology and does not imply a particular function. The six ground surfaces of the complete specimen form a cuboid. All intersecting surfaces meet at approximate right angles that have been rounded off to varying degrees. Specimen HbRf-39:1934 (Figure 4) appears to be a fragment of a similar handstone of unknown thickness, and displays two ground surfaces that meet at a rounded right angle. HbRf-39:1436 (not illustrated) may be a fragment of a thinner handstone than specimen HbRf-39:1419. It has two parallel ground surfaces that meet a third ground surface at right angles, again with rounded edges where the surfaces intersect.

Table 1. Ground stone artifacts from Tse'K'wa, in stratigraphic sequence. Ages of subzones are taken from Testani (2020:Table 2).

Artifact Number	Context	Age (cal BP) of Subzone	Artifact Type	Length, Width, Thickness (cm)
1930	Unit 33 Subzone IVc	1500 to modern	Irregular slab with ground edge	13.3 x 10.2 x 3.6
1934	Unit 33 Subzone IVc	1500 to modern	Handstone fragment	5.0 x 3.4 x 1.2
1419	Unit 29 Subzone IVb	1500 to 2400	Handstone	8.75 x 5.2 x 3.2
1445	Unit 26 Subzone IVa	2400 to 5400	Beveled-edge	8.4 x 7.3 x 2.5
1436	Unit 27 Subzone IVa	2400 to 5400	Handstone fragment	3.2 x 2.2 x 1.8
1931	Unit 24 Subzone IIIh	5400 to 6800	Beveled-edge	6.0 x 4.2 x 1.1
1932	Unit 24 Subzone IIIh	5400 to 6800	Beveled-edge	9.2 x 7.8 x 1.5
1933	Unit 24 Subzone IIIh	5400 to 6800	Beveled-edge	3.2 x 3.2 x 0.9

Figure 4. Beveled-edge artifacts and fragment of a handstone, oriented with worked margins to the right. Top row, L to R: beveled-edge artifacts HbRf-39:1932, HbRf-39:1445. Bottom row, L to R: beveled-edge artifacts HbRf-39:1931, HbRf-39: 1933; handstone fragment HbRf-39:1934. Note straight profile of worked margins. Photograph by R. Doucette.

Four specimens are described as "beveled-edge" artifacts, made by grinding down the margin of a thin sandstone slab to create a straight edge with a symmetrical beveled cross-section. It appears that no attempt was made to formalize the shape of these artifacts, except to obtain a straight working edge with a beveled cross-section. No other surfaces of these beveled-edge artifacts exhibit modification. It is possible that three specimens (HbRf-39:1931, 1932, 1933; Figure 3) were once part of a single larger artifact. They were found in the same stratigraphic position in the same excavation unit. The colour, texture and thickness of the sandstone pieces are similar, but they cannot be refitted. Specimen HbRf-39:1445 (Figure 4) also displays a beveled-edge, but it is thicker and was found slightly later in the sequence.

One specimen (HbRf-39:1930, not illustrated) is a larger irregular slab with part of one margin ground to create a rounded cross-section. Part of this edge has been damaged (possibly by fire spalling). It is not clear if this is a finished specimen.

4. Evidence for status as artifacts

There are three lines of evidence that support the identification of these objects as deliberately shaped artifacts. First, specimen HbRf-39:1419 (Figure 3) displays a regular sub-rectangular outline that is very unlikely to result from natural processes. The top, bottom, sides and ends occur as paired parallel surfaces, creating a cuboid. The intersections between surfaces are rounded right angles. In other cultural contexts this object would likely be described as a "mano". The fragmentary specimens that are interpreted as broken handstones display some of the above features, including parallel surfaces and rounded right angles where two surfaces meet.

Second, specimens that exhibit a beveled-edge are notable for the straightness of that edge, as can be seen from Figure 4. In addition, the beveled-edge specimens display even wear on two sides, creating a symmetrical beveled cross-section to the smooth, straight edge. As with the handstone, it is difficult to argue that such symmetry is the result of natural processes.

The first and second lines of evidence result from simple visual inspection of the specimens and are essentially describing the perceived symmetry of the handstone and the unusual straightness of the bevelled-edge specimens, coupled with a regular cross-section of the supposedly worked margins of the latter. Visual inspection also suggested that the shaping of sandstone slabs resulted in artificially smoother surfaces. Our third set of evidence derives from detailed examination of two of the supposedly ground surfaces (specimen HbRf-39:1436 and 1445) and an unmodified freshly broken surface of sandstone from the local bedrock. This analysis was conducted at a much smaller scale, analogous to measuring the difference between rough and smooth sandpaper. We used a non-destructive optical profilometer (Bruker Contour GT-K) and calculated the roughness of the three surfaces. In this study, a vertical scanning interferometry (VSI) mode is used to obtain surface information of the height differences greater than 135 nanometres. (An alternative measurement mode is phase-shifting interferometry [PSI], which can be used on smooth surfaces with height difference less than 135 nanometres, but these surfaces were too rough for those measurements.) During measurements, a broadband (white) light source is projected on to the surfaces through the microscope objective lens. The reflective light from the target surface at the focal plane of the objective lens is recorded and compared with the light source at the phase difference to obtain the interference pattern. By moving the objective lens from top to bottom, the focal plane of the objective lens scans the sample surfaces from highest point to the lowest point. A series of images containing interference patterns are taken periodically. The images of interference patterns together with the moving distance of the objective lens provide height information of the scanning surfaces, later to be constructed as a 3D profile of the sample measured. In order to obtain enough information to quantify the roughness difference between the specimens and the unmodified sample, we used a 5X objective lens to scan an area of 0.5 millimetres by 5 millimetres, by stitching 6 scans with an overlap area of 20% to obtain the full map (Figure 5).

The profilometer software calculates spatial roughness based on the data statistics. The Sa (arithmetical mean height) of the supposedly worked surface of specimen HbRf-39:1436 is 54.387 millimetres; specimen HbRf-39:1445 is 39.423 millimetres; and the unmodified sample of freshly broken sandstone is 68.629 millimetres. The Ssk (Skewness) of the measured area on specimen HbRf-39:1436 is 0.047, on specimen HbRf-39:1445 it is 0.058, and on the unmodified sample it is -0.872. The Skewness represents the asperity (roughness) of the surface measured. The higher the absolute value of the skewness, the farther the height distribution is away from the mean height plane. The absolute value of the unmodified sample is more than ten times higher than the value of the artifact specimens. The unmodified sample is significantly rougher than the artifact specimens. Figure 5 shows the surface height maps of the two specimens and the unmodified sample. The surfaces measured on the unmodified sample have large areas of red (hill) and blue (valley), which are the areas far from the average height (shown as green). In contrast, the surfaces measured on specimens HbRf-39:1436 and 1445 have less area involving hills and valleys, which provides a more visual portrayal of the differences in surface roughness between formed artifacts and unmodified sandstone.

5. Discussion and conclusions

In addition to the widespread use of flaked stone, ground stone technology was occasionally employed in the southern Boreal Forest. Data from Tse'K'wa demonstrate that ground stone artifacts were produced for the last 6000 years, at least. Although our sample is very small, there may be at least two discrete artifact types: handstones and beveled-edge artifacts.

Although a strong case can be made to support the identification of these objects (particularly the complete handstone) as deliberately made artifacts, it is difficult to assess their function(s). The complete handstone is similar to one-handed manos used for grinding seeds of cultivated and wild plants in the American Southwest (e.g., Morris 1990). However, this seems an unlikely explanation for the Tse'K'wa specimen. There is little evidence for collecting and grinding seeds in traditional lifeways of Indigenous peoples of the Boreal Forest in northeast British Columbia, and we have no evidence at Tse'K'wa for surfaces on which such grinding might occur, such as portable metates or bedrock depressions. Adams (1988:313-314) briefly summarized ethnographic data that suggest widespread use of handstones in North America for processing hides of larger ungulates (e.g., moose, elk, and deer). Adams notes three features of hide-processing ground stone artifacts that are seen on the Tse'K'wa handstone specimen: oval to rectangular shape; dimensions that reflect one-handed use; made of sandstone.

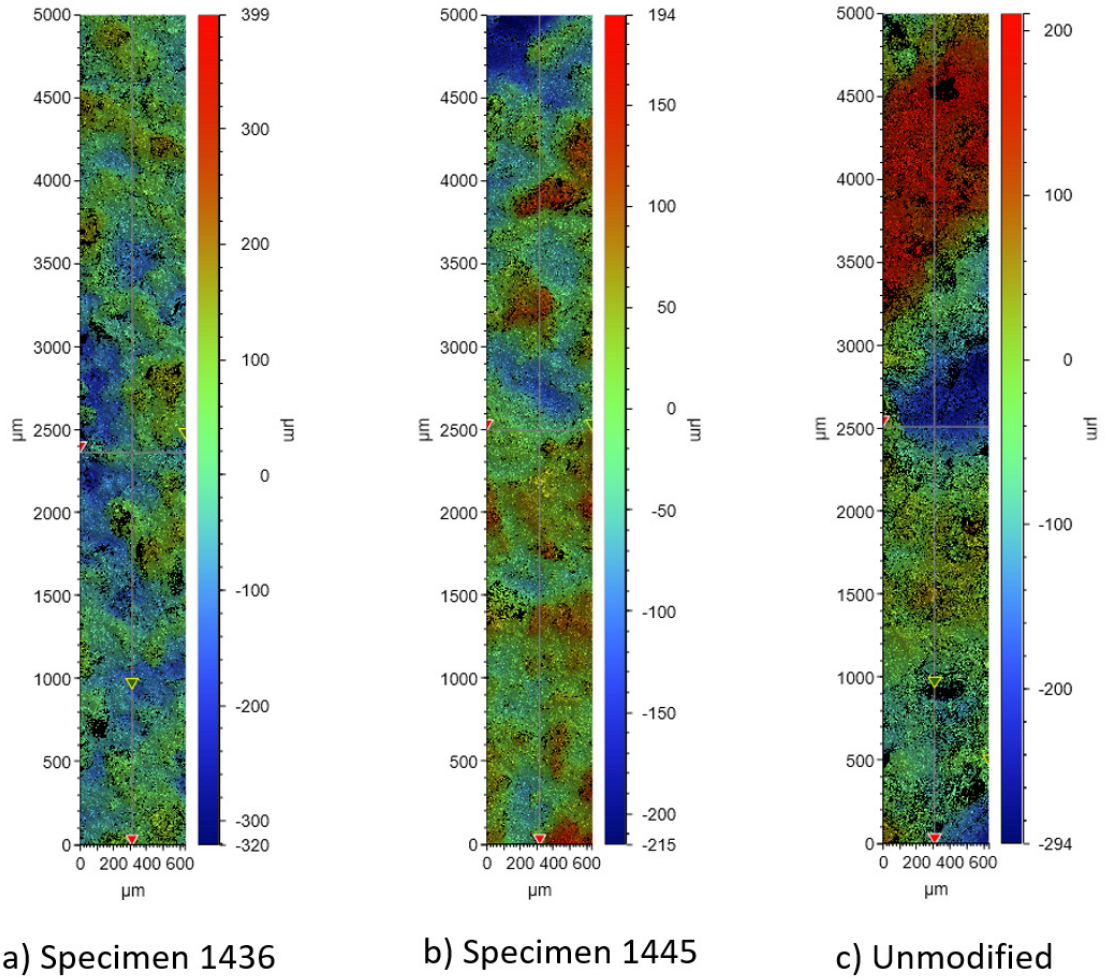

Figure 5. Surface height maps for the 3 surfaces measured in the optical profilometer. HbRf-39:1436 is a fragment of a handstone. HbRf-39:1445 is a beveled-edge artifact. The unmodified specimen is freshly broken local sandstone.

Ethnographic accounts in the southern Boreal Forest of Canada, as well as the more southerly Parkland and Plains, usually refer to flaked stone tools (as well as antler and bone tools) for hide processing (Wissler 1910; Goddard 1916; Kehoe 2005; Reilly 2015). Adams (1988) suggests that handstones were possibly used late in the hide-working process for tasks such as rubbing in brains or grease to keep the hide supple, or to apply pigment to a finished hide. There is some corroborating evidence for the use of smooth (i.e., not flaked) stones for such a purpose. For example, a "greasy mixture" was rubbed into rawhide by Blackfoot women using a smooth stone, in order to soften the hide (Wissler 1910: 63-64; Hungry Wolf 1980: 234). Gilmore (2005: 19) mentions this as a general practice on the High Plains. Baillargeon (2011:17) describes the use of a "hand-sized stone" for this purpose by contemporary North American hide tanners who attempt to follow traditional methods.

We have been unable to find ethnographic or contemporary accounts of possible functions for beveled-edge artifacts. However, we note the widespread distribution of edge-flaked cobbles and cobble spalls, often referred to as "chi-thos", that were also used for hide preparation and are still used today (Albright 1984; Reilly 2015). We suggest that the beveled-edge artifacts from Tse'K'wa may have been a variant of that technology in which locally available sandstone slabs were used in a similar way. However, further research on use-wear would be required to test this hypothesis.

The ground stone artifacts at Tse'K'wa seem to be a rare example of a technology that was employed across the southern Boreal Forest in British Columbia and Alberta. We performed extensive literature searches of published material from the Peace River region, and found no discussion of ground stone technology, and no illustrations of objects that matched the Tse'K'wa specimens. Further research was hampered by our inability to access museum collections during the COVID-19 pandemic. However, the Royal British Columbia Museum catalogue lists two sandstone "abraders" from sites GiRi-4 and GjRa-1 that are located to the south of Tse'K'wa. No illustrations were available online, but these specimens have similar dimensions to those from Tse'K'wa according to the online RBCM catalogue.

This research also demonstrates the potential of an optical profilometer for quantitative analysis of surface roughness. We suspect that there are many applications of this measurement system in archaeology.

Finally, we note that beveled-edge sandstone artifacts and fragments of handstones are not immediately obvious as artifacts, especially where naturally fractured sandstone forms part of the site sediments. Because recognition of specimens in the field is a prerequisite for further analysis in the laboratory, we suggest the following traitsas criteria for retaining sandstone specimens found during fieldwork:

1. Symmetrical overall shape, unlikely to be caused by commonly occurring natural processes such as water transportation;

2. One or more straight edges, especially when combined with an apparently smoother surface on the edge than other parts of the specimen;

3. Surfaces that meet at right angles, again with evidence that the surfaces are smoother than naturally fractured rock;

4. Visual inspection of the specimen suggests that some surfaces are significantly smoother than others.

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