An Arrow from the Tsitsutl Glacier, British Columbia

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Abstract. An almost complete arrow found in British Columbia in the early 20th century has been re-discovered in the Royal BC Museum collections. Speculation as to its antiquity was tested by radiocarbon dating, which reveals that the artifact was likely made in the middle of the second millennium AD. The arrow was compared to recent finds of both arrows and darts from glaciers and ice patches. The failure of this specimen to clearly fit the criteria of either of these weapon technologies raises some new questions.

Résumé. Une flèche presque complète trouvée en Colombie-Britannique au début du 20ième siècle a été redécouverte dans les collections du Royal British Columbia Museum. Les spéculations relatives à son antiquité ont été vérifiées par la datation au radiocarbone qui indique que l'objet a été réalisé probablement au milieu du deuxième millénaire de notre ère. La flèche a été comparée aux découvertes récentes de flèches et pointes de dard provenant de glaciers. Le spécimen du musée ne concorde pas de façon claire avec les critères des autres technologies des projectiles analysés et soulève de nouvelles questions.

In 1924, at an elevation over 2,100 meters above sea level, land surveyor John Davidson found an "arrow" eroding out of the Tsitsutl glacier in the Rainbow Mountain Range of Tweedsmuir Park.[1] The park is located approximately 75 km northeast of Bella Coola (Figure 1). The artifact was then taken to the then Provincial Museum (now the Royal BC Museum [RBCM]) where it was put on display. At that time, no anthropologists were employed at the Museum so the specimen was not properly catalogued. After being on display, it was put into the general collection with no associated documentation. There it remained unknown and un-catalogued for 78 years.

Its re-discovery came about in 2002 when archaeologist Katherine Bernick found a newspaper account in the March 15, 1925 edition of the *Vancouver Province*: "Ice gives up Indian arrow—remarkable fine specimen of ancient weapon found in North—is centuries old" (see Appendix A). Bernick discussed this old article with Phillip Hobler (Department of Archaeology, Simon Fraser University) with the result that requests were made to the senior author to find the artifact, if possible, with a view to eventual dating.

Inquiries at the museum revealed that no living past or present staff members knew anything about it. A search produced no documentary evidence, and a first examination of un-documented specimens in the collection did not reveal any such arrow. Only in May of 2003, after an extensive examination of the arrows in the RBCPM collection, was the specimen located with certainty. It had been kept mounted in a proper

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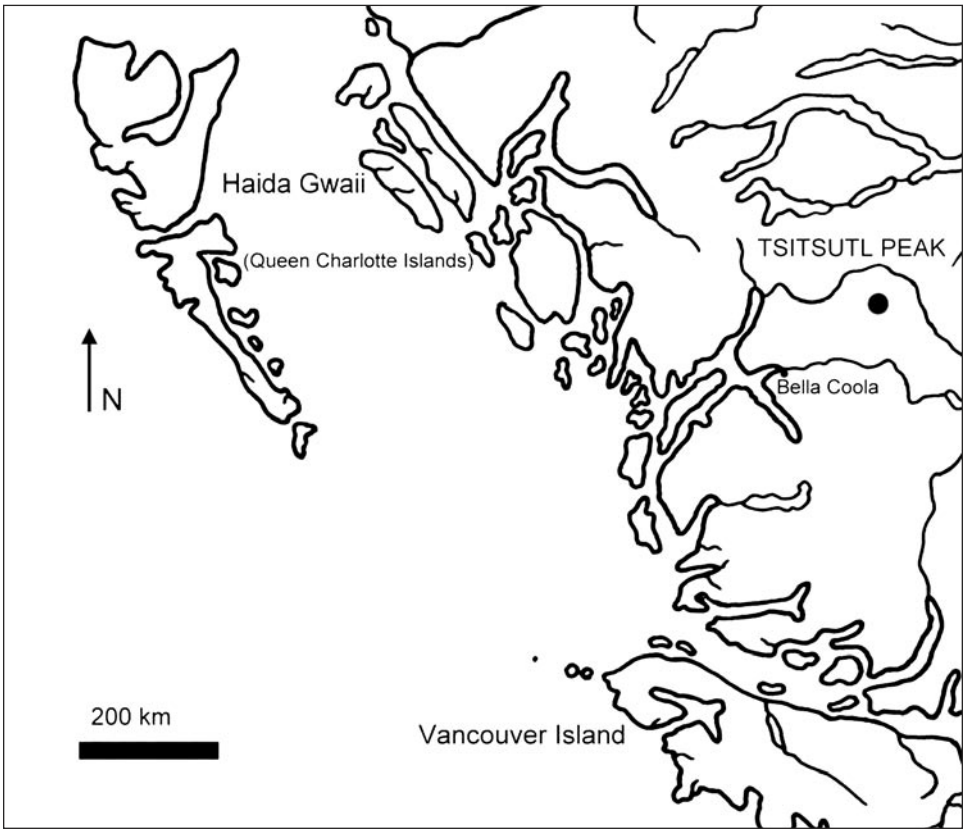

FIGURE 1. Location of Tsitsutl Peak where arrow was found.

container and no chemical preservation had been undertaken.

Subsequently, consultation with Dean Richdale of the provincial Legal Surveys Branch resulted in the finding of John Davidson's original field notebook and survey map (Davidson 1924). This was obviously of interest to us. Davidson began his survey on June 11, 1924, and completed it on October 31 of the same year. His records show that he had a survey datum station established at "Tsi-Tsult," located 2,478 meters above sea level. Since Davidson provided latitude and longitude, it is evident that the "Tsit Tsit Mountain" referred to in the 1925 newspaper article (Appendix A) is a mis-spelling. The present legal name for the area is Tsitsutl Peak.

ARTIFACT DESCRIPTION

The Tsitsutl artifact (RBCPM–20018) consists of a broken wooden shaft to which a flaked basalt side-notched point is fastened at its thicker distal end (Figures 2 and 3). The total length of the projectile is 89.5 cm, of which the shaft makes up 86.2 cm. The shaft is made from a natural round of wood, not a cut stave. The thickness of the shaft is 0.87 cm at the extreme distal end, enlarging to about 1.1 cm at 20 cm from the distal end, and then slowly tapering to 0.71 cm at the proximal end. The

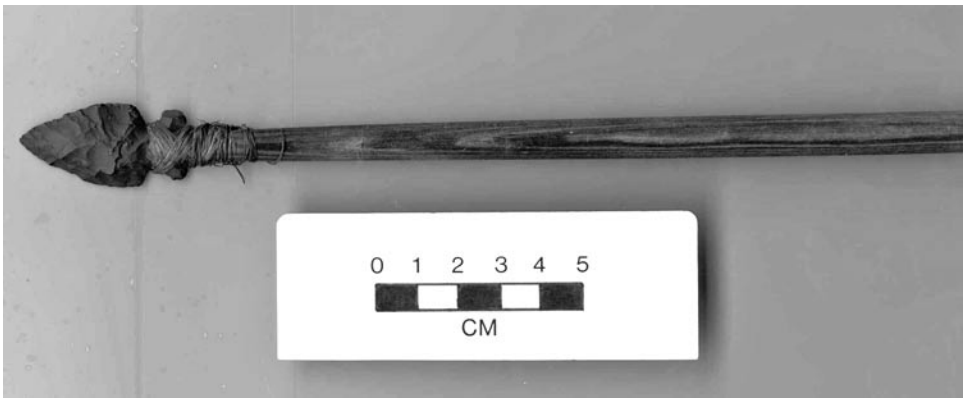

FIGURE 2. Distal end of yew wood arrow shaft with attached stone point.

FIGURE 3. Stone point with original sinew tie holding it to the shaft.

proximal end is broken, with about half the total diameter remaining as a splinter of about 8 cm length.

There is no evidence of fletching at the broken proximal end. If fletching had indeed been present on the original, the shaft would likely have extended at least another 25 cm or so, making the total length about 1.1 to 1.2 meters. The sinew used to bind the stone point to the shaft is in its original form on the point itself. The point is fastened into the split end of the shaft up to the top of the notched area. The sinew circles around the notched area and shaft and then crosses the point base diagonally to circle the shaft below and back up across the last diagonal, around the notched area and back to the shaft.

Farther down the shaft, a loose end has been re-inserted (by Davidson?) under strands of the sinew to secure it. This suggested to us that the sinew was originally tied farther along the shaft. The 1925 newspaper article itself provides some confusing information on the nature of the artifact. It first refers to "an arrowhead and shaft," but later states "it is the only arrow that has been found intact, head, shaft and all …. It was in a state of perfect preservation, except that the strip of hide used in fastening the chipped stone head and the feathers to the cedar shaft was so age worn that it fell away when I picked it up." Does this mean that the original did have attached fletching or is this an assumption made by the finder on observing broken sinew that had slid down the shaft? We cannot say.

The basalt side-notched point has a triangular shape with excurvate sides. It is 4 cm long, 2 cm wide across the shoulders, and 1.7 cm wide across the base. The point is 0.58 cm thick at midpoint in its length. The neck width is 0.9 cm and the notches are about 0.4 cm deep and 0.7 cm wide. The hafting sinew mostly obscures the concave base.

AN ARROW OR A DART?

A review of the arrows in the RBCPM ethnology collection showed that all had much shorter shafts than this specimen. Could this artifact be a dart for use with an atlatl (a throwing board), rather than an arrow? If so, it would presumably be of considerable antiquity as this weapon is not believed to have been in use in recent times in central British Columbia. The closest example of the historic use of atlatl technology to Tsitsutl Peak is a rare eyewitness account among the Sitka Tlingit near Edgecombe harbour on Baranof Island, Alaska. On June 20, 1788, Andrew Taylor observed young boys practicing throwing spears, He implied they were used for seals and fish, but only observed them in use to spear otter from a canoe:

> "They heave the spears with a short piece of wood with a hole in its end which receives the inner end of ye spear, while supported with ye left hand. Thrusting their spear from them ye this short machine with great ease and dexterity with the right hand and sends it with greater force than if twere grasped and thrown by the hands only. We observ'd them kill one otter in a canoe … they kept themselves snug in the canoe. The man who was going to strike barely shew his head over the gunnel of ye canoe & when the otter was near enough he struck him with ease" (Galois 2004: 233).

Fewer than 15 specimens of Tlingit throwing boards exist in museum collections—all collected in the late 18th to early 19th centuries. At present, there is no archaeological evidence for its use in Tlingit territory. On the southern coast, it is assumed that the atlatl weights found from southern Vancouver Island, the Gulf Islands, and the lower Fraser River to some parts of the southern interior (Keddie 1998) date to approximately 2000 BP. No darts have been found in this region, but an antler throwing board from the bottom of Quiltanton Lake, in the Southern Interior, dated to around 1960 BP (RIDDL–1141, uncorrected [Keddie 1988]).

Atlatl dart shafts need to be of strong, flexible wood. The finder of the Tsitsutl weapon identified the wood as "cedar," which on the Pacific Coast would likely refer to "red cedar" *(Thuja plicata)*, but this seems an unsuitable material for this purpose. To test this identification, Ken Marr (Royal British Columbia Museum) removed for examination a small sample from the broken proximal end. The wood proved to be Pacific yew *(Taxus brevifolia)*. Yew is strong and flexible, and we know that in antiquity it was used locally for throwing boards (e.g., Fladmark *et al.* 1987) and for other items required to withstand considerable stress, such as wedges, paddles, digging sticks, bows, and harpoon shafts (Turner 1979: 116–120). The ethnographic literature usually describes arrows being made of other woods, such as Oceanspray *(Holodiscus discolor)* and Saskatoon *(Amelanchier alnifolia)* (Turner 1979: 234–236). Like the shaft length, the type of wood used in this artifact tends to support the supposition that it was made as a dart, not an arrow.

Comparison to the Yukon Ice Patch Artifacts

Darts and arrows found in Yukon ice patches (Hare *et al.* 2004) do not provide a conclusive answer as to the nature of the Tsitsutl glacier specimen. Of eight Yukon dart specimens, the maximum length is 194 cm, but others are closer

to the size of the Tsitsutl specimen. One specimen (JcUu–1:1) is described as an "anomalous artifact" that "may be an arrow dating to about 3700 BP," but does not fit the post-1200 BP period, which represents the florescence of bow-and-arrow technology and the disappearance of atlatl technology. The shaft of JcUu–1:1, is 100 cm long, and is missing the extreme distal end. The incomplete Tsitsutl specimen is 86.2 cm in length, but is most likely to have been 120 cm or more long when complete. This is much larger than the post-1200 BP arrow shaft length range of 52 to 73 cm (medium of 58 cm).

Those studying the Yukon ice patch darts and arrows concluded that "variation in thickness along the length of a dart shaft appears to be a critical design attribute of darts," with "the thickest or heaviest section at the distal end" (Hare *et. al.* 2004: 263). However, they note "a number of darts … are more uniform in thickness." The thickest distal end of a dart shaft was 1.54 cm, with the smallest proximal end of 0.46 cm being smaller than the average proximal end of the arrows. The arrows range in diameter from 1.0 to 0.45 cm. Nine are broadest at mid-shaft and three are almost parallel. The Tsitsutl glacier specimen is 0.87 to 1.1 cm in the distal 20 cm and slowly tapers to 0.71 cm. This overall pattern of the Tsitsutl specimen does not clearly match with that of either the Yukon darts or arrows.

The Tsitsutl stone-point style does not match any of the atlatl dart points from the Yukon. Nor is resolving the functional attribution aided by reference to studies aimed at distinguishing the difference between arrow points and dart points based on point morphology (Nassaney and Pyle 1999; Shott 1997; Thomas 1978) does not place the Tsitstl point strongly in either category. The neck width of the point is closer to the mean size for arrows, but the length, width, and thickness fit more with dart points. Shott's (1997: 86) suggestion that shoulder width is the most important discrimination variable would place the Tsitutl point in the dart class. Thomas (1978: 471) found that atlatl dart size had relatively little effect on the size of the dart tip. In addition, as Nassaney and Pyle demonstrate, some regions may show significant variation in the timing, rate, and direction of the adoption of the bow and arrow (1999: 243). Finally, all of these studies focus on eastern, central, and southern United States artifact assemblages and may not necessarily be accurate for weapon points used in coastal North America.

Given that the Glacier Peak specimen has the general appearance of later period arrowheads and does not conform to the majority of known longer shafted throwing darts, we must assume that it is an arrow.

DATING THE ARTIFACT

Opinion on the age of the Tsitsutl point differed. Although it is similar in size to later arrow specimens, several experienced archaeologists have suggested that it could be a very early point style, perhaps in the 4,000 to 7,000-year range. Clearly, an age determination was in order.

At the Royal BC Museum, samples of both the wooden shaft and of the sinew binding were removed from the artifact for dating. Using a scalpel, a sample of wood was taken from the broken portion of the shaft below the piece removed for wood identification. This recently exposed wood sample from the centre of the shaft would be less likely to be contaminated than the outer portions.

About 5 mm of the loose end of the binding was severed where it had been tucked under the portion still wrapped around the shaft. These two samples were taken to the Simon Fraser University Archaeometry Laboratory for dating.

Microscopic examination of the wood showed it to be in excellent condition. A portion weighing 16.9 mg was then separated, cleaned, and subjected to the usual treatment procedure for wood, which involves consecutive soaking in hydrochloric acid, sodium hydroxide, and then acid again. There were no negative indicators during this process. The binding was also microscopically examined and found to consist of bundled fibres as would be expected for sinew, a collagenous animal fibre. As a consequence, this sample was subjected to the same process used in the lab for extracting collagen from bone, as it should be equally applicable to sinew. In short, this process takes the insoluble collagen in a sample, renders it soluble, and then selects from the solution collagenous molecules with molecular weight greater than 30 kiloDaltons. When freeze-dried, such extracts of well-preserved collagen have a characteristic white foam appearance. In this case, the procedure and the extract were as expected, indicating the binding was indeed collagenous and thus highly likely to be sinew.

The wood and sinew samples were then each placed in a quartz tube with copper oxide and silver powder, the tubes evacuated, sealed, and placed in a 900°C oven for three hours to combust the samples to carbon dioxide. This harsh procedure on very rare occasions fails when the tube leaks and the CO_2 is lost to the atmosphere. Unfortunately, such a failure occurred for the binding sample. As only sufficient binding material had been removed for this one measure, repeating the procedure would have required removal of another sample from the artifact. This was certainly possible, but it turned out to be unnecessary for reasons mentioned below.

The carbon dioxide from the combusted wood was sent to the CAMS Group at the Lawerence-Livermore National Laboratory for radiocarbon dating, and another small piece of the treated wood to Earth and Ocean Sciences, University of British Columbia, for measurement of the wood $\delta^{13}C$ value. The data obtained are given in Table 1. There are no reasons to doubt this result, and so the shaft of this projectile is not of great antiquity. Thus, there is no need to repeat the measure for the binding, as it must then also be recent.

To put this measured age into historical perspective, the online calibration program CALIB (http://radiocarbon.pa.qub.ac.uk/calib/) was used, giving the results shown in Appendix B. The calibration curve is multi-valued in this period, as is seen in the plot in Appendix B. Even so, it is clear that this wood grew within the time span AD 1480–1640. While more detailed statistical statements can be made, this general conclusion is adequate for present purposes. The artifact predates by between one and three centuries the arrival of Europeans on the west coast of Canada.

Table 1. Radiocarbon age data.

SFU Sample #	CAMS #	Carbon conc.	$\delta^{13}C$ (‰)	Radiocarbon age
Dart-1	98185	44.5%	–22.6	335 ± 30 BP

DISCUSSION

Throughout the world, the shafts of both arrows and throwing darts vary enormously. Historic models may not apply when trying to evaluate physical distinctions between atlatl darts and arrows. The senior author has trained actors and experimented in atlatl technology for many years. The lengths of shafts of his more commonly used throwing spears are in the 126–143 cm range. One important variable he has found in examining the efficiency of atlatl technology is the size and strength of the person throwing the dart. We know today there is a general rule that arrows should be longer for longer-armed people. Does size range of ancient dart specimens reflect, in part, the stature of the people using them? How do the size differences of arrows and darts vary with the nature of the animals being hunted?

The age obtained for the Tsitsitl Peak glacier wooden shaft places this artifact into clear chronological context, and there is no present need to remove more of the sinew binding for additional dating. The possibility remains that the stone point itself is of greater age, and was found by the maker and bound to a newly made shaft with newly prepared sinew. Radiocarbon dating cannot help here. We must conclude that the projectile was made only a few centuries old.

Since spear-throwers are not thought to have been in use at so late a time period in British Columbia, we must postulate that our specimen is a very long arrow. Or, if it is truly a dart, we must revise current archaeological understanding of the dating of atlatl technology. This statement can be extended to the projectile point. Either it is truly old, and was re-used millennia after its fabrication, or it is a recent point of a form, which can be confused, with those of much greater antiquity. Some general questions arise from these conclusions. While answering them goes beyond the scope of this report, we nevertheless believe that they are worth posing: 1) The arrows in museum collections may not provide a good comparative basis on which to judge archaeological artifacts. Many were not made for hunting, but made by First Nations in the late 19th and early 20th century for collectors, either anthropologists or antiquarians. For most, the species of wood has not been specifically identified, and even if it has, there remains the question as to whether the maker chose wood appropriate for a functional tool or simply used what was convenient to satisfy the collector. Is there a reason to undertake a comprehensive re-examination of such collections to learn what information can and what cannot be obtained from them?; 2) Our understanding and use of point typologies as chronological indicators in this region may need examination. Are these typologies sufficiently characteristic that all competent observers can uniquely identify a specific type and thus confidently place the artifact into chronological perspective? Or are these typologies so complex that only the initiated few can reliably interpret them?; and 3) What do we really know about the time sequences of ancient British Columbian arrows and darts?

CONCLUSION

It is likely that thousands of ancient artifacts have been eroding out of glaciers over the last century without being observed and documented. Many historic items have also been found eroding from glaciers in recent years—the senior author found a 19th-century alarm clock eroding from the upper reaches of the Athabaska glacier in 1982.

The Tsitsutl weapon was lost during a hiatus in glacial advances that occurred during the period known as the Little Ice Age. It was found during a period of rapid glacial recession that occurred in the Tweedsmuir Park region from the late 19th century to the 1930s (Smith 2000).

Ancient artifact specimens from glaciers and ice patches in North America were brought to the attention of the world with the Kwäday Dän Ts'ínchi discovery in Tatshenshini Park in northwestern British Columbia (Beattie *et al.* 2000); the ongoing ice patch projects of Yukon First Nations (Farnell *et al.* 2003; Hare *et al.* 2004); and work in the Wrangell Mountains of Alaska (Dixon *et al.* 2005). Many darts and arrows have been found in the latter projects. The meter-long ancient projectile found 80 years ago eroding from the Tsitsutl glacier compares in age with a few specimens from the latter projects, but cannot be clearly matched in the same categories.

The Tsitsutl arrow was the first one to be found in a British Columbia glacier. It has been re-located in the collections of the Royal BC Museum. The shaft attached to the stone point is made of yew wood and has been radiocarbon dated to 335±30 BP or approximately the 15th century AD. This projectile was thus in use only a few centuries before the arrival of Europeans in British Columbia.

Studies in high elevation locations are relatively new in British Columbia (Nagorsen and Keddie 1996; Reimer 2000). The Tsitsutl arrow provides archaeology with a rare example of an almost complete Late Period projectile and further proof of the Aboriginal use of high mountain environments.

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NOTE

1. The location is near Tsitsutl Peak at 52 degrees, 43 minutes north. This is not associated with Tsitsutl Mountain at 54 degrees, 40 minutes, or Tzeetsaytsul Peak, also located in Tweedsmuir Park, about 30 km southwest of the location discussed here.

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APPENDIX A

From the *Vancouver Province*, March 15, 1925, p. 4.

"ICE GIVES UP INDIAN ARROW"—"Remarkably Fine Specimen Of Ancient Weapon Found in North"—"IS CENTURIES OLD"

"An arrow—head and shaft—believed to be centuries old, used by the Indians of Central British Columbia long before the white man introduced firearms, has been discovered by John Davidson, government surveyor, residing at 1234 Dunbar Street. The relic has been sent to the Provincial Museum at Victoria, where it is being exhibited as an important link with prehistoric activity in this province.

Mr. Davidson found the arrow at Tsit Tsit, 7000 feet above sea level. Tsit Tsit lies almost due east of Bella Coola, and many miles from civilization, although it is close to the old Indian hunting trail to the Blackwater country that used to be frequently traversed.

BURIED IN GLACIER

'The arrow may be a hundred years old or five hundred years old; it is impossible to say accurately,' said Mr. Davidson. 'It is the only arrow that has been found intact, head, shaft and all, and Indians of the district do not remember ever having seen such a weapon before. I found it lying at the edge of a stream flowing from a big block of melting ice. The arrow had evidently been imbedded in the snow, and had gradually sunk to the bottom and then came to light as the snow thawed. It was in a state of perfect preservation, except that the strip of hide used in fastening the chipped stone head and the feathers to the cedar shaft was so age worn that it fell away when I picked it up. The hide would have been eaten by field mice had the arrow been exposed very long'.

Frank (sic) [Francis] Kermode, curator of the Provincial Museum, believes that the arrow must have been used by a member of a wandering Coast tribe. As cedar was not used by Interior natives."

APPENDIX B

RADIOCARBON CALIBRATION PROGRAM*

CALIB REV4.4.2

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Dart–1
CAMS–98185
Sample Description: Wood from projectile shaft
Radiocarbon Age: 335 ± 30 BP
Calibration data set: INTCAL98.14c

% area enclosed	cal AD age ranges	relative area under probability distribution
68.3 (1 sigma)	cal AD 1494–1528	0.292
	1551–1601	0.507
	1613–1633	0.201
95.4 (2 sigma)	cal AD 1482–1639	1.000

References for calibration dataset:
Stuiver, M., P.J. Reimer, E. Bard, J.W. Beck, G.S. Burr, K.A. Hughen, B. Kromer, F.G. McCormac, J. v.d. Plicht, and M. Spurk (1998a), *Radiocarbon* 40: 1041–1083.
Comments:
* This standard deviation (error) includes the lab error multiplier.