The Role of Glacial Lakes in the Pre-Contact Human History of Southwest Yukon Territory: A Late Drainage Hypothesis

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Abstract: Archaeological site KaVn-2, located in the White River valley near Beaver Creek in the southwest Yukon, was first occupied between 10,130 and 10,670 BP, shortly after the area became deglaciated at around 11,000 BP. Despite the early occupation of KaVn-2 just after glacial retreat, and the presence of alpine sites as old as 8360 BP to the south, there are no known valley-bottom sites that have been dated to before 7200 BP. If deglaciation was complete in the area by 10,000 BP, as suggested by glaciologists, then why do we not have evidence for human occupation of the valleys until nearly 3,000 years later? The only known palaeogeographical phenomenon that could account for this void in the archaeological record is a large glacial lake—Glacial Lake Champagne—that occupied the major valleys of the southwest Yukon during deglaciation. Traditional interpretations suggest that this large lake drained between 9000 and 10,000 BP. Data summarized in this article support the hypothesis that Glacial Lake Champagne did not completely drain until well after 10,000 BP, and perhaps not until as late as 7200 BP. Other glacial lakes that formed in the study area within the past 2,000 years may have buried archaeological sites under thick deposits of silt and clay, and raised lake levels may have submerged archaeological sites around Kluane Lake under as much as thirty-five metres of water. Clearly, further research into the history of these lakes is critical to our understanding of the Holocene cultural and natural history of the southwest Yukon. This article describes dynamic hydrological processes that have occurred in the study area over the last 10,000 years and explain implications for the archaeological record.

Introduction

Complex environmental processes and events have occurred in the southwest Yukon (figure 1) over the past 10,000 years. Besides events common to all formerly glaciated areas, such as deglaciation and repopulation by aquatic and terrestrial organisms, in the southwest Yukon there have also been dramatic hydrological events and species extinctions. These events would have had profound consequences to the human occupants of the region and, as a result, direct effects on the archaeological record.

This article explores the paleoenvironmental and archaeological records for the southwest Yukon, and investigates a 3,000 year gap in the archaeological record for which there are no known valley-bottom sites. Valley-bottom archaeological sites (e.g., KaVn-2) that date to before this time gap are located in the northern portion of the study area, and higher elevation sites (e.g., JhVl-1) that date during the time gap have been identified within the study area, yet no sites dating to this time period have ever been identified in the valley bottoms of the southwest Yukon. It is suggested that a large glacial lake that occupied the major valley bottoms may have existed far longer than previously thought and prevented occupation by people (and other terrestrial organisms). This article reviews the sequence of deglaciation and paleoecological change for two regions in the southwest Yukon in order to demonstrate the lack of other barriers to human occupation. It then summarizes data related to dynamic hydrological processes that have occurred, particularly the formation and draining of large glacial lakes, but also changes that have occurred in more recent lakes that would have affected past peoples. Data pertaining to changes in fisheries resources are reviewed, as a source of corroborating information for the hydrological changes and because these fisheries represented a potential subsistence resource for human inhabitants of the area. Key archaeological sites dating to the early time period are then described individually with comments on how they relate to the glacial lake data and the "Late Drainage" hypothesis forwarded in this article. Finally, conclusions drawn from the data are offered and suggestions are made for possible future research directions.

Regional Deglaciation and Paleoecology

Deglaciation was a time-transgressive (i.e., it occurred at different times in different areas) and regionally variable event in the southwest Yukon. The timing and character of deglaciation was largely conditioned by local topography, precipitation, and proximity to unglaciated Beringia, portions of which were located immediately to the north of the study area. The following is a brief discussion of the paleoecology of two sub-regions of the southwest Yukon that illustrate the diversity of environmental conditions prevalent during post-glacial times.

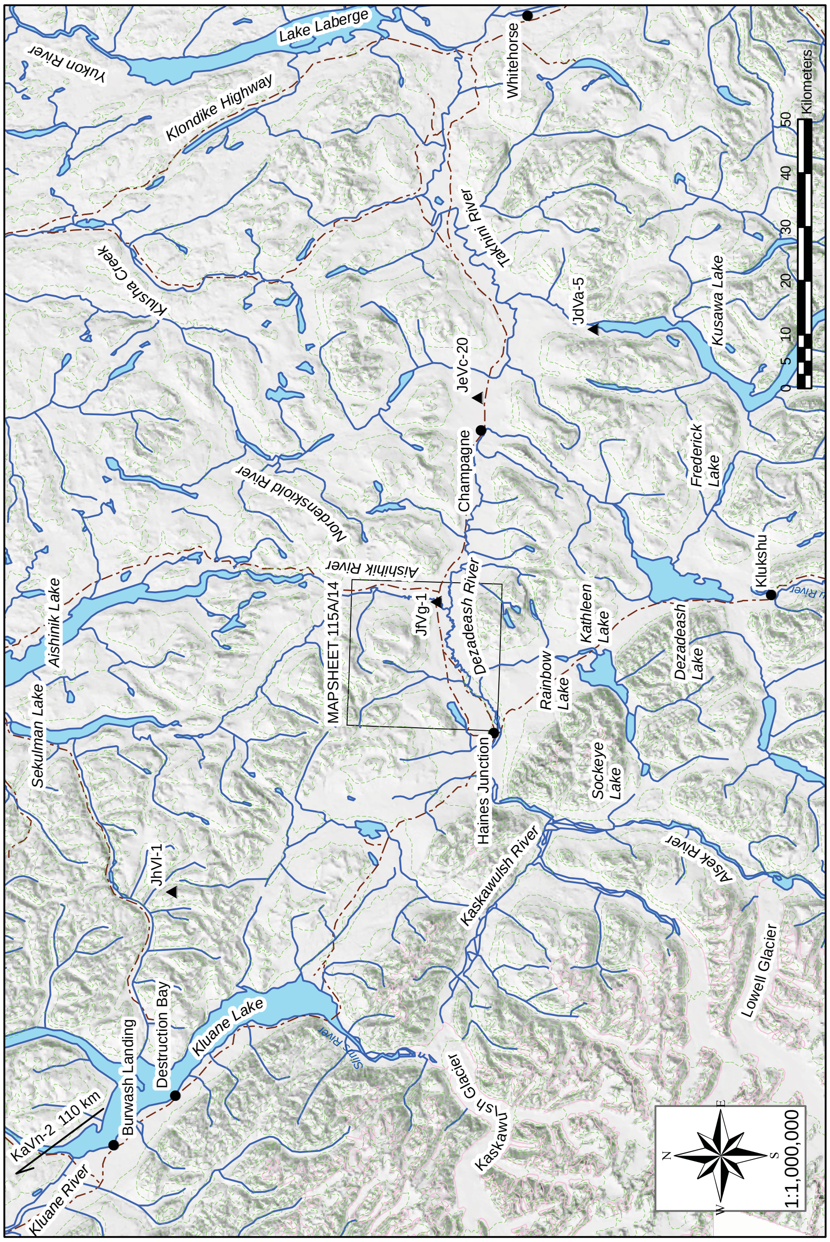

Figure 1. Map of a portion of the study area showing the locations of major communities and roads; modern glaciers, lakes, and streams; and key archaeological sites mentioned in this article. The inset box shows the location of figure 2.

Beaver Creek Area

In the northwestern portion of the study area, around the community of Beaver Creek, the Macauley Glaciation began at around 40,000 BP and lasted until 13,500 BP (Rampton 1971a).[1] Glacial ice was largely derived from a piedmont glacier complex that emanated from the Nutzotin Mountains. Portions of this area escaped the direct effects of the ice but nevertheless were exposed to extreme glacial influences. Deglaciation appears to have been relatively complete by 11,000 BP, as shown by a radiocarbon date on organic materials directly overlying glacial till near the White River Bridge. Pollen cores from Antifreeze Pond (Rampton 1971b), Daylight Coming Out Lake (MacIntosh 1997), and Island Lake (ibid.), all located in the Beaver Creek area, provide paleoecological information.

MacIntosh (1997) divided the post-glacial paleoecology of the Beaver Creek area into the following intervals. A Late Glacial period (13,500–11,000 BP): when vegetation was herbaceous tundra dominated by grasses (*Graminae sp.*), sedges (*Cyperaceae sp.*), willow (*Salix sp.*), and *Artemisia*. Based on the tolerances of the plants represented in the pollen cores during this time period, MacIntosh (1997: 88) inferred a very cold and dry climate with a mean July temperature of 5°C to 7°C. A Late-Glacial-Holocene Transition (11,000–8000 BP): when dwarf birch (*Betula pumila*) colonized the area. Since birch requires a mean July temperature of 9°C, its arrival suggests climatic warming. The Holocene (8000 BP–Present): when spruce (*Pices*) and poplar (*Populus*) arrive. Spruce require only slightly warmer July temperatures than birch so climate may have warmed slightly or stabilized since the preceding period. Alder (*Alnus*) arrived in the region at around 5500 BP and may have heralded an increase in moisture levels. After the arrival of alder and except for fluctuations in the elevation of treeline, vegetation in the study area remained stable.

In 1993, during a highway upgrading project, Pleistocene faunal remains were recovered from buried contexts in the unglaciated area just north of the community of Beaver Creek. In 1994, MacIntosh (1997) recovered and examined thirty-six bones and bone fragments of which only eighteen were identifiable to genus. Twelve of these bones belonged to bison (*Bison*), four to horse (*Equus*), and one each to caribou (*Rangifer*) and mammoth (*Mammuthus*). The stratigraphic context of the remains suggested a late Pleistocene age. A horse bone dated to 20,660 BP that was recovered from a nearby construction-related disturbance by the Yukon Heritage Branch in 1993 (Hare, personal communication 2001) tends to support that assessment. Although these faunal remains provide information on the Pleistocene fauna of the unglaciated portion of the Beaver Creek area, there is a complete lack of data on faunal communities during the post-glacial period for this region. The opposite is true of the Haines Junction area, as will be described below.

Haines Junction Area

During the last glaciation, glacial ice in the Haines Junction area was derived from sources in the St. Elias and Coast Mountain ranges (Jackson et al. 1991). Locally known as the Kluane Glaciation, this period began at approximately 30,000 BP and ended at 12,500 BP. Deglaciation occurred over a span of about 2,500 years and was relatively complete by 9800 BP (Campbell and Rampton 1980; Denton and Stuiver 1967). Melting of the ice was accompanied by widespread loess (windblown silt) transportation from periglacial sources (areas near glaciers) to the valleys where it provided the sediment base for soil development over the next 7,000 years (Morlan and Workman 1980). Based on glacial chronology alone, the Haines Junction area would have become inhabitable by 9800 BP, when glacial conditions in most areas were essentially the same as today (ibid.).

Since the early paleobotanical work of Johnson and Raup (1964) that suggested the southwest Yukon was vegetated predominantly by grassland until forests expanded after the Neoglacial period (a period of climatic cooling beginning at around 3500 BP and continuing until the twentieth century), numerous pollen cores from the region have been studied. Some researchers (Keenan and Cwynar 1991; Lacourse and Gajewski 2000; Stuart et al. 1989) specifically refuted this grassland hypothesis upon which paleobiological and archaeological (e.g., MacNeish 1964; Morlan and Workman 1980; Workman 1973, 1978, 1979) interpretations rested.

Wang and Geurts (1991) reviewed southwest Yukon pollen records to produce a paleobotanical synthesis for the Holocene epoch in the study area. During deglaciation, between 12,500 and 10,000 BP, vegetation consisted of an herb dominated tundra. The next thousand years (10,000–9000 BP) saw a shift to a birch dominated shrub tundra. Spruce arrived between 9000 and 8600 BP, resulting in a spruce forest tundra. Spruce numbers continued to rise until 7600 BP after which time the vegetation composition remained relatively constant. Alder, however, increased in abundance at around 6000 BP. Except for some treeline fluctuations, the vegetation pattern has been stable since 5000–6000 BP. On the basis of paleobotanical data, Keenan and Cwynar (1991) suggested that a period of maximum warmth, from 3°C to 5°C warmer than today, occurred between 11,000 and 9000 BP and contributed to glacial retreat. After this, climate was relatively stable and temperatures gradually cooled until about 4500 BP when an essentially modern temperature regime was reached.

In addition to the large mammals that were present at the time of European contact, wood bison (*Bison bison athabascae*), wapiti (*Cervus elaphus canadensis*), and muskox (*Ovibos moschatus*) existed in at least portions of interior Yukon and Alaska in prehistoric times. Muskox and wapiti remains were found at the Pelly Farm site (KfVd-2), which lies to the north of the study area and may date to between 7500 and 8500 BP (MacNeish 1964: 311, 467). Greer (1986) tentatively identified wapiti remains at the Kusawa Bluff site (JdVa-5), MacNeish (1964) found caribou represented in interior Yukon sites spanning the entire archaeological sequence, and sixteen radiocarbon dates on bison remains from the southern Yukon show that this species was present from 7190 BP to 370 BP (Gotthardt, personal communication 1998; Hare, personal communication 2001). Oral history from Yukon First Nations elders regarding the presence of bison fills the gap from 370 BP to the early twentieth century (Lotenberg 1996).

Early Holocene Archaeology in the Southwest Yukon and the "Late Drainage" Hypothesis

In contrast to the Beaver Creek area, which was inhabited shortly after deglaciation, archaeological sites that predate 7200 BP have not been found in the valley bottoms of the Haines Junction area even though these valley bottoms have received the most survey attention, and alpine sites in the same area document a human presence as early as 8360 BP (JhVl-1 at 1915 m: Hare et al. 2004: 2, 3). This situation presents numerous interpretive problems and raises a fundamental question concerning the events of prehistory: Why would people move into the valleys of the Beaver Creek area shortly after glacial retreat but not occupy the valleys of the Haines Junction area until well after deglaciation?

Although data are scarce due to a lack of research on this critical time period, a few lines of evidence suggest that at least one environmental factor—glacial lakes—may have prohibited occupation of the major valleys of the southwest Yukon until after 7200 BP. To date, this possibility has not been adequately explored and represents a large void in our knowledge of southwest Yukon prehistory. Only coarse-grained information is available on the early post-glacial lakes of the southwest Yukon, but what little is known is summarized below.

Late Pleistocene / Early Holocene Glacial Lakes

Evidence for at least six major glacial lakes and numerous smaller ones (figure 2) has been discovered in the Dezadeash and neighbouring valleys and, at various times, extant lakes had water levels higher than at present

(Campbell and Rampton 1980). The earliest and largest of the major glacial lakes was Glacial Lake Champagne.

Glacial Lake Champagne. Glacial Lake Champagne formed during deglaciation when large volumes of glacial meltwater were impeded from draining to the south or east by glacial ice (Gilbert and Desloges 2005; Hughes et al. 1972). Data concerning this early glacial lake are scarce and sometimes conflicting. The extent and chronology of the lake have not been determined in any detail. It may have been confined to areas west of the Takhini River valley or it could have extended further east and been confluent with glacial lakes that existed in the Yukon River headwaters region.

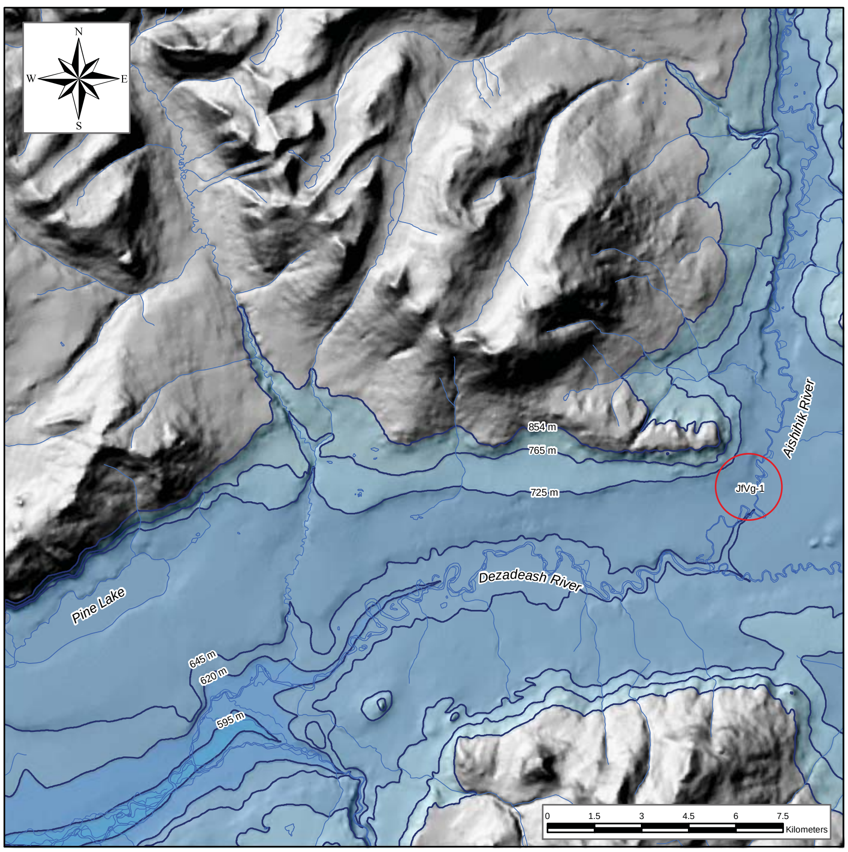

Figure 2. NTS 1:50,000 mapsheet 115A/14 showing the relative shorelines of Glacial Lake Champagne at its various major standstills (854, 765, and 725 m) and Neoglacial Lake Alsek at the maximum elevation of its three major ponding events (645, 620, and 595 m). The location of the Canyon Creek archaeological site (JfVg-1, 681 m) is shown for comparison.

The highest level of Glacial Lake Champagne was 853–854 m as evidenced by strandlines visible in many valleys of the southwest Yukon.[2] Strandlines slightly below this level have also been identified between 810 m and 850 m (Brideau et al. 2004) but it appears that the lake was stable for the longest period of time at elevations of 765 m and 725 m because these strandlines are the most well-developed (Barnes 1997, 2000; Gilbert and Desloges 2005). At its highest levels, the lake probably drained through the Nordenskiold River valley (Hughes et al. 1972; Lindsey et al. 1981; Rampton and Paradis 1981) and possibly Klusha Creek valley (Gilbert and Desloges 2005) and ultimately to the Yukon River.

It is not known whether the different lake levels indicate rapid outburst flooding or gradual draining of the lake. Although the time of drainage has not been determined, Workman (1978) believed that it probably occurred between 9000 and 10,000 BP; and, more recently, Barnes (1997) suggested a time frame of 12,500–10,500 BP but there is no firm evidence for the timing of the draining of Glacial Lake Champagne. In some places the lacustrine silts deposited by this lake are over 60 m thick (Barnes 2000; Kindle 1953; Wheeler 1961), which suggests that the lake was present for a substantial length of time. It seems likely, given the high elevations of alternative drainage routes, that Glacial Lake Champagne did not completely vanish until the Alsek River valley was free of ice and the present drainage pattern became established (Johnson and Raup 1964).

Glacial Lake Sekulman-Aishihik. Aishihik and Sekulman lakes presently drain south to the Pacific Ocean via the Alsek River system, but before the last glaciation these two large lakes drained northward through the Nisling River as part of the Yukon River system (Hughes 1990). Glacial Lake Sekulman-Aishihik formed in the Aishihik basin during deglaciation as both ends of the valley were blocked by glacial ice and sediment. A minimum limiting age of 7170 +/- 140 BP for the drainage of the lake was obtained from an organic layer above glaciolacustrine silt and clay. Drainage reversal apparently occurred during glacial retreat when glacial drift was deposited north of the lake. This drift plug, coupled with extensive erosion of the southern Aishihik lowland during successive Pleistocene glacial advances, reversed the drainage of Aishihik basin.

In addition to Glacial Lake Champagne and Glacial Lake Sekulman-Aishihik, other glacial lakes existed in the areas of Whitehorse and Carcross (Bond 2003), and Kluane Lake may also have been inundated by Glacial Lake Champagne. There is a possibility that these lakes were all confluent for a period of time and effectively covered all of the major valley bottoms. Unfortunately, even less information exists for these other lakes.

Late Holocene Lakes

In many of the glaciated areas of North America, drainage stabilized shortly after deglaciation and remained relatively constant until the present. This quiescence did not characterize the dynamic hydrology of the southwest Yukon. After the establishment of the Alsek drainage and the subsequent draining of Glacial Lake Champagne, drainage was relatively steady for only a few thousand years.

Neoglacial Lake Alsek. The Alsek River has a winding course through narrow valleys as it descends to the Pacific Ocean. Numerous valley glaciers occupy its tributary valleys. During neoglaciation, the Alsek River was repeatedly dammed by the Lowell Glacier (Campbell and Rampton 1980; Clague 1979; Hughes et al. 1972). As a result, three distinct versions of Neoglacial Lake Alsek formed and covered the Alsek and Dezadeash valleys, each to a lesser extent than the lake before. Geological evidence for the existence of these lakes consists of beaches, wave-cut benches, and accumulations of driftwood (Clague 1979). The first Neoglacial Lake Alsek reached a level of 645 m and deposited 25–30 cm of silt on the valley bottom (Johnson and Raup 1964). Campbell and Rampton (1980) suggested a date for this lake of either 2800 or 1250 BP, but the fact that in some places the sediments deposited by the lake lie directly on the eastern lobe of the White River Ash, which dates to approximately 1147 BP (Clague et al. 1995), suggests that the lake formed just after the ash fall (Johnson and Raup 1964). On the basis of dendrochronological (tree-ring dating) evidence, Reyes and Smith (2001) suggest that this lake did not drain until after AD 1611. This lake evidently drained completely, as the sediment it deposited subsequently underwent soil development. After this brief period, a second Neoglacial Lake Alsek filled to 620 m, and deposited 30–35 cm of lacustrine silt (Johnson and Raup 1964). Dendrochronological evidence suggests that this lake drained between AD 1788 and 1832 (Reyes and Smith 2001). A final Neoglacial Lake Alsek reached a height of 595 m (Clague et al. 1982) and only deposited 12–15 cm of lacustrine silt (Johnson and Raup 1964). Dendrochronological work indicates that the final lake filled after AD 1848 (Clague et al. 1982) and drained between AD 1857 and 1891 (Reyes and Smith 2001).

Since these ponding events are fairly recent, oral history can help refine these estimates, as Workman (1978: 43) related:

> Yakutat Tlingit tradition reports that breakage of an ice dam towards the close of the 19th century drowned many people in Dry Bay. A Southern Tutchone also reported that his mother had twice seen the ice break and water rush out in a great flood, the first time about 1842 according to his calculations (de Laguna et al. 1964: 17, 18). There is also a suggestion in Yakutat tradition that the ice blockage of the Alsek was not complete. Dry Bay people returning from the interior would paddle fearfully under the ice where the river had cut through it. Since glaciers in the area seem to have begun to retreat around 1820 the most reasonable chronology would seem to suggest that Lake No. 4 [the second Neoglacial Lake Alsek] drained shortly after that time (the '1842' event of the Tutchone informant?) and the readvance as yet not precisely dated, caused the formation of Lake No.5 [the final Neoglacial Lake Alsek], which could have drained towards the end of the 19th century, to the misery of the people of Dry Bay. Thus the 19th century would seem reasonably to incorporate the draining of Lake No. 4 and the formation and draining of Lake No. 5.

On the basis of this information, and the fact that a man named Glave—who in AD 1890 was the first Euro-Canadian to visit the Southern Tutchone and leave a written record (McClellan 1975)—never mentioned a large lake where Neoglacial Lake Alsek would have been, the chronology can be further refined. This final flood event was also remembered by Kitty Smith, a Yukon First Nations elder, as having occurred shortly after her birth, estimated at around AD 1890 (Cruikshank 2001). Further refinement is necessary in order to properly integrate Neoglacial Lake Alsek into our understanding of the more recent environmental and cultural history of the southwest Yukon.

Kluane Lake. Kluane Lake has also undergone recent drainage changes. After the drainage of Glacial Lake Champagne, of which it may have been a part, and for almost the entire Holocene, Kluane Lake drained southwards to the Pacific Ocean through the Slims and Kaskawulsh rivers as part of the Alsek River system (Campbell and Rampton 1980). During this period the lake level may have been 35 m lower than at present, as evidenced by submerged terrace features (Clague et al. 2006). It was not until the Little Ice Age advance of Kaskawulsh Glacier in the late AD 1600s (Clague et al. 2006; Reyes et al. 2006) blocked the Slims River that Kluane Lake began to drain north as part of the Yukon River system. Before the present northern drainage channel was downcut sufficiently to allow efficient drainage, Kluane Lake rose rapidly to 12 m above the present shoreline, as shown by raised beaches, deep estuaries, and drowned forests (Campbell and Rampton 1980; Clague et al. 2006; Wickstrom 1980). As the new northern outlet incised, the lake level fell to near its present elevation by the late AD 1700s. Even after Kaskawulsh Glacier receded to its present position, the resulting moraine deposit inhibited the resumption of southward drainage and Kluane Lake remains part of the Yukon River drainage system. The drainage of Kluane Lake could reverse again in the future as Kaskawulsh Glacier recedes.

Fish Dispersals in Glacial Lakes

Fisheries resources in the southwest Yukon have likewise undergone considerable changes during the Holocene as a result of the drainage alterations. Fish dispersal data are an important source of information concerning the relationships between early Holocene hydrological systems and their modern counterparts. Fish may also have provided a subsistence resource to people who interacted with these glacial lakes.

Since the area was entirely glaciated, it was not until the formation of Glacial Lake Champagne that fish entered the study area (Lindsey et al. 1981). At this time, much of the region was covered by water. Fish species that had survived glaciation in the Beringian Refugium entered Glacial Lake Champagne via its outlet through the Nordenskiold River to the Yukon River drainage. Most of the extant fish fauna became established at this time. The Yukon River source explains the unusual presence of northern pike (*Esox lucius*), round whitefish (*Prosopium cylindraceum*), and Arctic grayling (*Thymallus arcticus*) in the Alsek, a Pacific drainage system. Inconnu (*Stenodus leucicthys*), broad whitefish (*Coregonos nasus*), and least cisco (*Coregonos sardinella*), present in the Yukon River drainage but not the Alsek, failed to disperse at this time. Inconnu is now present in Kluane Lake, having arrived only after the recent drainage reversal. Bones of northern pike, lake trout (*Salvelinus namaycush*), and burbot (*Lota lota*) were recovered from a Late Prehistoric Period component of the Little Arm archaeological site on the shore of Kluane Lake. This component is believed to date to 600 BP (McAllister 1963) although the basis for this date is not discussed. These fish species are present in both drainages so they cannot be used to test the drainage reversal hypothesis, as could be done with a fossil specimen of inconnu.

After the establishment of the Pacific drainage and the emptying of Glacial Lake Champagne, a number of other species entered the southwest Yukon from the Pacific Ocean; but since the Yukon and Alsek river systems were never again linked by a glacial lake, these species remain in the Alsek system only. Presently, only the eastern tributaries of the Alsek, the Tatshenshini, and Klukshu rivers, contain runs of Pacific salmon (*Oncorhyncus sp.*) and steelhead (*Salmo gairdneri*). At Klukshu, a traditional Southern Tutchone fishing location, three species of salmon (*O. tshawytscha, O. kisutch,* and *O. nerka*) are taken in fish traps (O'Leary 1985). Prior to the recent damming of the western Alsek River by the Lowell Glacier, however, these species also ascended at least as far as Frederick, Kathleen, and Sockeye lakes and possibly as far as Kluane, Aishihik, and Dezadeash lakes (Lindsey et al. 1981). As Workman (1973) noted, though, just because salmon could have reached the headwaters of the western Alsek does not mean that they actually did. Kokanee (*O. nerka*) populations in Frederick, Kathleen, and Sockeye lakes were derived from sockeye runs that became trapped during one of the Lowell Glacier damming events. The effects of this ice dam on the anadromous runs to the western Alsek have not been researched. Rainbow trout (*Salmo gairdneri*) also entered the Alsek drainage from the Pacific Ocean and can be found today only in Kathleen, Rainbow, and Klukshu lakes, as well as the Aishihik River below Otter Falls. Rainbow trout and Kokanee failed to disperse to Kluane Lake while it was part of the Alsek system (Lindsey et al. 1981).

Key Archaeological Sites

KaVn-2 (Moose Lake)

Although numerous sites in central Alaska date to the terminal Pleistocene, only a few such sites have been found in the Yukon. One of these, KaVn-2, is in the southwest Yukon and has an early component dated to between 10,130 and 10,670 BP (Heffner 2001, 2000a, 2000b). It is a valley-bottom site located at an elevation of 705 m. This site provides the earliest known evidence for a human presence in the study area. In fact, this site is one of the oldest in northwestern North America that was not in the ice-free area of Beringia. It was located 1 km within the maximum extent of ice during the last glaciation and only became inhabitable after about 11,000 BP.

The area surrounding KaVn-2 must have been an incredibly dynamic environment during deglaciation, given its close proximity to the glacial front. For example, numerous large glacial meltwater channels are present nearby and served to drain glacial meltwater from the Nutzotin Mountains to the White River. The sand ridge upon which the site sits may have been deposited on the inside bend of one of these large meltwater streams, and glaciofluvial silt derived from those streambeds served to bury the site in loess and preserve it for over ten thousand years.

JhVl-1 (Gladstone Ice Patch)

The Gladstone ice patch is one of the larger and more productive of the southwest Yukon ice patch sites where preserved organic artifacts have been found over the last ten years. It is also the oldest, with wooden atlatl dart shaft fragments radiocarbon dated to 8360 BP (Hare et al. 2004). This is a high elevation (1915 m) archaeological site within the study area that is located well above the maximum level of Glacial Lake Champagne. If the late drainage hypothesis is correct, then this site was in use while the valleys were filled with water and therefore uninhabitable. This site documents a human presence in the higher elevations of the study area a full thousand years before the oldest documented habitation of the valley bottoms.

JfVg-1 (Canyon Creek)

The Canyon Creek archaeological site is the third-oldest dated site in the southwest Yukon, after KaVn-2 and alpine site JhVl-1. It contains a deeply buried cultural deposit consisting of lithic artifacts (made of stone) and bison bone associated with a hearth dated at 7195 BP (Workman 1978: 194, 1974: 94). Canyon Creek lies at an elevation of 681 m. This elevation is well below the highest level of Glacial Lake Champagne (854 m; figure 3). The 7195 BP date from Canyon Creek provides a *terminus ante quem* (the latest possible date) for the lowering of the lake below 681 m but not necessarily for the complete drainage of the lake.

JeVc-20

Archaeological site JeVc-20 is located about 40 km east of Canyon Creek near the community of Champagne (Hammer 1996). This site lies at 707 m and an ancient shoreline of Glacial Lake Champagne is located 6 km northeast of the site at a height between 700 m and 761 m. The basal component (earliest human occupation) of JeVc-20 is dated to 7030 BP and, like Canyon Creek, this site was flooded during the maximum extent of Glacial Lake Champagne but could have been associated with subsequent, lower shorelines of the lake. Hammer (1996) noted that the sediment below the cultural layer consisted of cobbles and beach sand and that the site may have been located on an ancient shoreline of the lake. This situation led Hammer to recognize the possibility that Glacial Lake Champagne may have existed longer than previously thought.

JdVa-5 (Kusawa Bluff)

Further evidence for a late draining of Glacial Lake Champagne comes from the Kusawa Bluff Site. This site is located atop a high bluff (685 m) at the north end of Kusawa Lake at its outlet to the Takhini River (figure 3). The bluff is composed of approximately 50 m of glaciolacustrine silts derived from Glacial Lake Champagne. This deposit is overlain by 4 m of wind-blown loess that contains numerous palaeosols (layer of former soil). Between the lacustrine silt and the loess is a 5 to 10 cm thick pebble-and-sand beach deposit. Cultural materials are present throughout the loess stratigraphy and are mainly associated with the lowermost palaeosol (Heffner 1999a, 1999b). Bison remains recovered from near the base of the loess deposit and probably from the lowermost palaeosol (Greer, personal communication 1999) were dated to 5380 BP and 4490 BP (Greer 1986). The lowermost palaeosol is by far the best developed soil horizon at the site and represents a stable land surface over a significant period of time. Nevertheless, the two radiocarbon dates derived from this layer are relatively late if Glacial Lake Champagne drained between 9000 and 10,000 BP. The stratigraphy at JdVa-5 suggests a later date for the draining of the lake and supports the hypothesis that Glacial Lake Champagne may not have drained until well into the Holocene epoch, perhaps as late as 7200 BP.

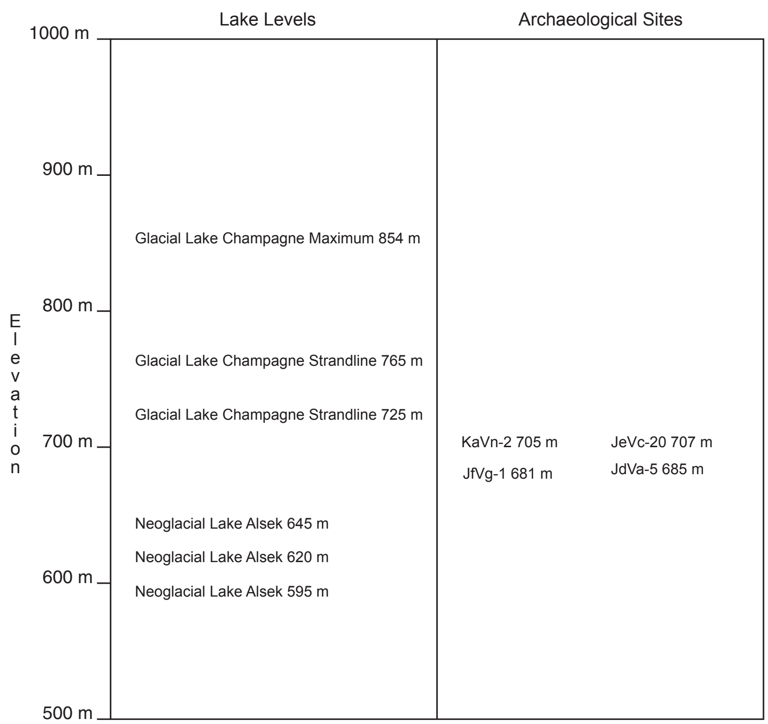

Figure 3. Chart showing the relative elevations of the glacial lakes and key archaeological sites mentioned in the article.

Conclusion

At present, only two radiocarbon dates provide us with a *terminus ante quem* (the latest possible date) for the draining of Glacial Lake Champagne. These dates are 7195 BP from archaeological site JfVg-1 (elevation 681 m), and 7030 BP from archaeological site JeVc-20 (elevation 707 m). It may merely be coincidental that these dates cluster within a 200 year period but it may also indicate that immediately prior to 7200 BP Glacial Lake Champagne drained and the valley bottoms became inhabitable for the first time. We can be certain that the lake drained prior to the inhabitation of JfVg-1 and JeVc-20 but the hypothesis that the lake did not drain until just prior to 7200 BP is based largely on negative evidence. Any dates older than 7200 BP—on archaeological materials, paleontological specimens, or terrestrial organic materials directly overlying glaciolacustrine silts and clays from the valley bottoms within the basin of Glacial Lake Champagne—could push this date back further. Until such evidence is found, however, we must accept the possibility that this lake existed far longer than conventionally thought.

Future Research Directions / Problems

Presently, there is a 2,000 year void in the archaeological record of the southwest Yukon and a 1,000 year time gap between the earliest dated alpine sites and valley-bottom sites. Systematic archaeological survey has never been conducted along the ancient shorelines of Glacial Lake Champagne. Obviously, if sites that predate the draining of the lake are to be found, then elevations above 725 m must be surveyed.

Identifying valley-bottom sites that post-date the draining of Glacial Lake Champagne is complicated in some areas by the existence of Neoglacial Lake Alsek. Sites below the highest shoreline of this lake (645 m) will be buried below 25–30 cm of silt (or more if located under subsequent stands of the lake). Although the archaeological visibility of these sites is compromised, the silt cap likely provides a favourable preservational environment and a useful chronological indicator—sites overlain by glaciolacustrine silt will be older than the lake that deposited the silt.

Kluane Lake presents a special case. For much of the Holocene this lake drained to the south and had a shoreline 35 m lower than at present. With the drainage reversal that occurred in the AD 1600s the lake level rose considerably before stabilizing at its current level. This means any archaeological sites located along the former, lower shoreline of Kluane Lake are submerged in 35 m of water. These sites may be well preserved by the anaerobic environment but are unfortunately inaccessible to archaeologists using conventional methods.

With the aid of GIS (geographic information systems), detailed digital topographic information, and DEMs (digital elevation models), researchers should be able to plot, with reasonable accuracy, past lake shorelines and then conduct targeted archaeological surveys in order to locate archaeological sites that represent the "missing pieces" to the puzzle. To locate the oldest sites, areas around or above the shorelines of Glacial Lake Champagne would need to be surveyed. To locate valley-bottom sites that date to the time period between Glacial Lake Champagne and Neoglacial Lake Alsek will require prospecting in areas that would have been high potential at that time, and testing the deep silt deposits. Finding shoreline sites around lower levels of Kluane Lake would require underwater survey and sampling.

Fortunately, these sites have been preserved by the same environmental factors that prevent their easy discovery. As we begin to locate these sites the data they contain should fill in the gaps that currently punctuate the archaeological record of the southwest Yukon.

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Notes

1. All radiocarbon dates in this paper are presented as uncalibrated radiocarbon years BP (before present = AD 1950).
2. All elevations are expressed as height above sea level.

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