The Klutlan Glacier Expedition 1971

by John Birks

Plate 1. The 1971 Klutlan Glacier Expedition group with, from left to right, Fletcher Driscoll, Mel Whiteside (kneeling) John Wright, Richard 'Red' Watson, John Birks, Andy Wright, Herb Wright (kneeling), and Platt Bradbury. Photo: Platt Bradbury

In June-July 1971 I was a member of an expedition organised and led by Herb Wright to the Neoglacial ice-cored moraines of the Klutlan Glacier on the dry continental side of the St Elias Mountains in the south-west of the Yukon Territory, Canada. The St Elias Mountains straddle the boundary between Alaska and the Yukon. The 1971 expedition (**Plate 1**) consisted of Herb Wright (leader and glacial geology), J Platt Bradbury (limnology), Melbourne ('Mel') C Whiteside (limnology), Richard ('Red') A Watson (geomorphology and philosophy of science), Fletcher G Driscoll (hydrology and glacial geology), John Wright (field assistant), Andy Wright (then aged 16, field assistant), and myself (botany and plant ecology). Fletcher returned in 1972 with George Jacobson (plant ecology) to complete hydrological and ice-wastage measurement and soil-development studies. The scientific results of the 1971 and 1972 expedition were published in a dedicated special issue of *Quaternary Research*[(1)] with papers by Wright on the origin, wastage, and vegetational and landscape development of the surge moraines of the Klutlan Glacier[(2)], Driscoll on the formation of the surge moraines[(3)] and the wastage of the ice-cored moraines[(4)], Watson on landscape development on the

moraines[5], Birks on the present flora, vegetation, and succession on the moraines[6] and on modern pollen assemblages and recent vegetation history[7], Jacobson and Birks on soil development on the moraines[8], Whiteside, Bradbury and Steve Tarapchak on the limnology of lakes on the moraines[9], and Bradbury and Whiteside on the palaeolimnology of two lakes on or near the glacier[10]. In addition Birks published about the modern pollen rain and vegetation in the St Elias Mountains[11]. The reader interested in the scientific findings can consult these publications.

In this account I try to answer various questions, all admittedly from my own personal viewpoint.

1. Why did we go there?

2. How did I get there?

3. What did I do in the field?

4. Were there any adventures ('Herbventures')?

5. Did anything go wrong?

6. Why was it such a special experience?

7. Was it worthwhile?

1. Why did we go there?

Just why did we go the 90 km^2 area of ice-cored Neoglacial moraines at the terminus of the Klutlan Glacier in the middle of nowhere (*Appendix 1*)? The idea of studying these moraines arose from the work of Vern Rampton, a doctoral student supervised by Herb at the University of Minnesota under the auspices of the Geological Survey of Canada. Vern had studied, amongst other aspects, the Neoglacial ice-cored moraines of the Klutlan Glacier[12]. The Klutlan Glacier (**Plate 2**) rises in the Ice Field Ranges of the magnificent St Elias Mountains in Alaska and the Yukon. The Glacier flows east and then north into the valley of Generc River, a tributary of the White River in the Yukon River drainage basin[2]. The lowest 12 km of the glacier are completely covered by rock debris across the entire 7-km breadth of the valley and this debris is covered by spruce forest or shrubs over all but the youngest part (**Plate 3**). The terrain is pock-marked with numerous thaw depressions and small lakes (**Plate 4**) and is locally trenched by discontinuous streams and other features of ice wastage[2] (see Appendix 1).

In Minnesota many lake-sediment cores show a basal layer (so-called 'trash layer') containing coarse plant detritus of terrestrial origin beneath many metres of deep-water lake mud[13]. Such trash layers often contain wood, needles, and cones of larch and spruce, and seeds and fruits of woodland herbs[14]. They also contain abundant diatoms characteristic of moist soils and shallow supra-glacial pools that are so well preserved that they must have experienced very little, if any, transport prior to deposition[15, 16]. These trash layers are the North American equivalent of 'Allerød mull' from Denmark described by Hartz[17] and are interpreted as a deposit formed *in situ* by soil development and plant growth on buried dead-ice and then buried at the bottom of the kettle-hole as the ice-block melted.

Plate 2. The Klutlan Glacier and a medial moraine being moved into the ice-cored moraine terminus. Photo: John Birks

Plate 3. The Klutlan Glacier and its ice-cored moraine complex. Photo: John Birks

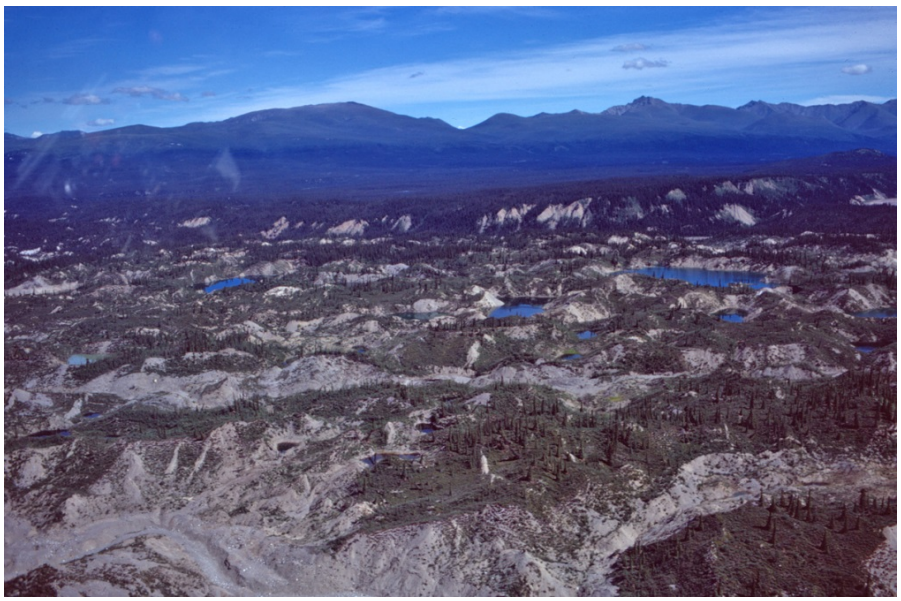

Plate 4. Klutlan moraines III and IV full of channels and small lakes and supporting willow scrub with scattered spruce trees. Photo: John Birks

The Klutlan Glacier and its ice-cored moraines were thought to be a modern analogue for the down-wastage, landform development, vegetational succession, and lake ontogeny on late Wisconsin moraines in Minnesota[2]. Herb wrote a successful short (7 pages) grant application to the National Science Foundation (GB 29063) that supported the expeditions and some of the laboratory studies. All the papers arising from the expedition were published as a special issue of *Quaternary Research* in 1980, edited by Herb[1]. The Klutlan studies provided strong confirmation[18] for the hypothesis about how 'trash layers' were formed as presented by Florin and Wright[16]. In addition, the various studies provided detailed data from which the succession and landscape development could be described and interpreted and a relative time-scale constructed for the various stages in the sequence.

2. How did I get there?

All the expedition members were based in the USA except me, so the plan was that we would all meet up in Edmonton, Alberta late on June 29. Herb had instructed me (on 10 June 1971) "As for excess baggage, put as much as you can in your pockets and briefcase or send some in advance as air freight (cheaper than excess baggage). Bring your own tent." He also wrote "We shall attempt to stay at a kind of mini-hotel at the airport, although there may not be room for us all there. You should inquire if a bed has been saved for you."

I flew from London to Edmonton via Toronto. In those days, I could do a day's fieldwork existing on one Mars bar for lunch, so as we were going to be in the field for 30 days, I bought 30 Mars bars at Heathrow airport and put them in my hand-baggage along with Hulténs's massive *Flora of Alaska and Neighbouring Territories*. At the airport, the security officer opened my hand-baggage and when he saw all my Mars bars, he commented, "But sir, they do provide food on the flight." I did not reply "but Prof. Wright does not always provide food in the field!" When I finally reached Edmonton, Herb met me at the airport and simply said "I have got a bed for you for tonight." I thought this was very thoughtful of him. We reached the *one* room that Herb had booked – I indeed had the bed, and everyone else was sleeping on the floor!

Next day we flew from Edmonton to Whitehorse, Yukon that lies on the Klondike Gold Rush Trail of '98. On the flight, I was sitting next to a young geologist who was a field assistant to Vern Rampton that season. Vern was accompanying us to the Klutlan Glacier for the first day. The young geologist nicely asked "Excuse me sir, but how does an Englishman get mixed up with this lot?", pointing at some of my rather scruffy, long-haired and bearded American colleagues. We arrived in Whitehorse mid-afternoon and we all squeezed into one room in the main hotel. Whitehorse describes itself as "Where frontier action … and living is fun. Exciting frontier city, friendly intelligent people, a city of opportunity, a good place to raise a family." A long evening with Platt and Mel in one of the bars did little to convince me that the people were friendly or intelligent or that Whitehorse was a good place to raise a family! It was a pretty rough place, at least in 1971. After we started to relax after our flight, Herb announced that he was going out to buy the food for the expedition, I have never seen people like Red, Platt, and John move so quickly – they were experienced 'HEW warriors' and knew from previous experience that Herb never bought enough suitable decent food for wilderness conditions and certainly not enough for eight people over four weeks.

Plate 5. *Dryas drummondii*, an attractive pioneer plant that has nitrogen-fixing nodules and grows on glacial gravel and outwash on moraines K-II and K-III. Photo: John Birks

Plate 6 (right). *Hedysarum mackenzii*, another attractive nitrogen-fixing pioneer plant on rocky slopes on moraine K-II. Photo: John Birks

Plate 7. *Epilobium (= Chamerion) latifolium*, a beautiful plant of open habitats on moraines K-II, K-III, and K-IV. Photo: John Birks

Plate 8. *Crepis nana*, an attractive dwarf pioneer plant on moraine K-II. Photo: John Birks

Plate 9. *Cyprepedium passerinum*, an elegant and elusive lady-slipper orchid that I have only seen once since. Photo: John Birks

On 1 July we all set off to Haines Junction to join the Alaska Highway and then drove to the Kluane Lake Arctic Institute Research Station where I saw for the first time plants such as the yellow *Dryas drummondii* (**Plate 5**), the tall purple *Hedysarum mackenzii* (**Plate 6**), the beautiful *Epilobium latifolium* (**Plate 7**), and the diminutive *Crepis nana* (**Plate 8**), plants that I was going to become very familiar with in the next four weeks. After buying some (dreadful!) expedition dried food at Kluane Lake, we travelled onto the Pickhandle Lake helicopter take-off point. It took several trips to get everyone and our equipment to our camp-site on moraine K-IV (see below for details of the moraines), where we would be camped for 15 days. Whilst waiting for my flight I explored the forest around the 'helipad' and was overwhelmed to find the magnificent lady-slipper orchid *Cypripedium*

passerinum (**Plate 9**). The helicopter flight in was disappointing as conditions were poor – low cloud, poor light, and much turbulence – so I saw little of the Glacier and its moraines. Fortunately it was the only day with low cloud; all other days, the weather and lighting were superb.

3. What did I do in the field?

Before I relate what I did in the field, it is useful to explain how the moraines were formed and how we numbered them. The moraines were attributed by Rampton[(12)] to surging of the Klutlan Glacier and its tributaries, mainly the Nesham Glacier that is a right-side tributary of the Klutlan[(3)], which deposited lobes of contorted medial moraines on the Klutlan surface (*Appendix 1*; **Plate 2**). As these lobes were carried down the Klutlan Glacier, they gradually bent around to become transverse moraines across the valley. In this way, they were stacked against the terminus formed by previous surge lobes. The oldest moraine, the Harris Creek Moraine (HCM), is more than 600 years old (based on tree-ring counts of the multiple-generation spruce forest that covers it) and less than 1200 years old, the age of the White River volcanic ash that was incorporated by the ice forming the oldest moraine (**Plates 10, 11**). Successively younger moraines were termed Klutlan (K-) V (**Plate 12**), IV (**Plates 13, 14**), III (**Plates 15, 16**), II (**Plates 17, 18**), and I (**Plates 19, 20**). All the moraines had ice-cores, and spectacular features such as trees split into two (**Plate 21**), ice-cliffs (**Plate 22**), and recent ice-collapse features forming a trash-layer (**Plate 23**) were common[(5)].

Plate 10. Aerial view of the Harris Creek Moraine and its spruce forest. Photo: John Birks

Plate 11. Harris Creek Moraine spruce forest. Photo: John Birks

Plate 12. Klutlan moraine K-V spruce forest. Photo: John Birks

Plate 13. Aerial view of Klutlan moraine IV. Note the scattered spruce trees. Photo: John Birks

Plate 14. Klutlan moraine IV with scattered spruce trees. Photo: John Birks

Plate 15. Aerial view of Klutlan moraines III and IV. Photo: John Birks

Plate 16. Klutlan moraine III with extensive *Salix* scrub and young spruce trees. Photo: John Birks

Plate 17. Aerial view of Klutlan moraine II. Photo: John Birks

Plate 18 (right). Klutlan moraine II with abundant nitrogen-fixing *Hedysarum mackenzii*. Photo: John Birks

Plate 19. Aerial view of Klutlan moraine I that is almost without vegetation. Photo: John Birks

Plate 20. Klutlan moraine I with almost no vegetation. Note the ice-cored features. Photo: John Birks

Plate 21. A *Picea glauca* tree on K-IV or K-V split into two by the frozen soil melting and separating. Photo: John Birks

Plate 22. A large ice-cliff on K-V undercut by a basal stream. The debris sands within the glacier dip steeply upglacier beneath a mantle of debris on which forest is growing. Photo: John Birks

Plate 23. A spectacular ice-collapse feature on K-IV, showing how a trash-layer is formed. A wonderful modern analogue for Kirchner Marsh in its very earliest days. Photo: John Birks

I spent 15 days examining the flora, vegetation, bush or tree ages (by ring counting), and soils in 116 4×4 m plots (relevés). I collected a total of 369 vascular plant specimens, 68 mosses, 12 liverworts, and 18 lichens for subsequent determination. The vascular plants and lichen specimens are deposited in the Herbarium, University of Bergen and the National Museum of Natural Sciences, Ottawa. The bryophyte specimens are in the Herbarium of the Royal Botanic Garden, Edinburgh. I also collected flowers from 214 species for modern pollen reference collections. These slides are (or were) in the Pollen Laboratory at Minnesota, the Botany School at Cambridge, and the Department of Biology at the University of Bergen. I also collected 56 surface samples and associated vegetation data from lake or pond mud or moss pollsters, which were augmented by 23 surface-mud samples collected by Platt and Mel to provide representative modern pollen assemblages for the major vegetation types on the moraines and the surrounding mountains. These collections, data, field and subsequent pollen and soil analyses formed the basis for four publications[*(6-8, 11)*].

The party as a whole cored the sediments of five lakes on HCM, three on K-V, two on K-IV, one on K-III, and one on the upland to the east of the glacier. I did detailed pollen analysis of the upland site (Gull Lake, **Plate 24**) and three of the HCM sites (Heart Lake, **Plate 25**; Triangle Lake, **Plate 26**; Cotton Pond, **Plate 27**)[*(7)*]. The other eight lakes contained very sparse and poorly preserved pollen[*(7)*].

Plate 24. Gull Lake, our site on the uplands. Photo: John Birks

Plate 25. Heart Lake on the Harris Creek Moraine (HCM). Platt is in the boat. Photo: John Birks

Plate 26. Triangle Lake on the HCM. *Left* Herb and John Wright trying to launch. *Right* The lake. Photos: John Birks

Plate 27. Core extrusion at Cotton Pond on the HCM. Herb and Platt are doing the sampling. Note the saw that Herb brought so that we could cut down two trees and construct a raft and the ubiquitous yellow rope! Photo: John Birks

Besides working in the field (not always easy because of the lack of any detailed map or there only being one set of the aerial photographs of the Glacier; because of occasional encounters with grizzly bears and a timber wolf; because of innumerable encounters with mosquitoes and midges, and because of the ease with which I could get lost in the featureless white spruce forest on HCM, K-V, and K-IV), I also spent time pressing, labelling, and drying my plant collections, and making preliminary vegetation tables so that I could identify any obvious gaps in my vegetation sampling (*Appendix 2*).

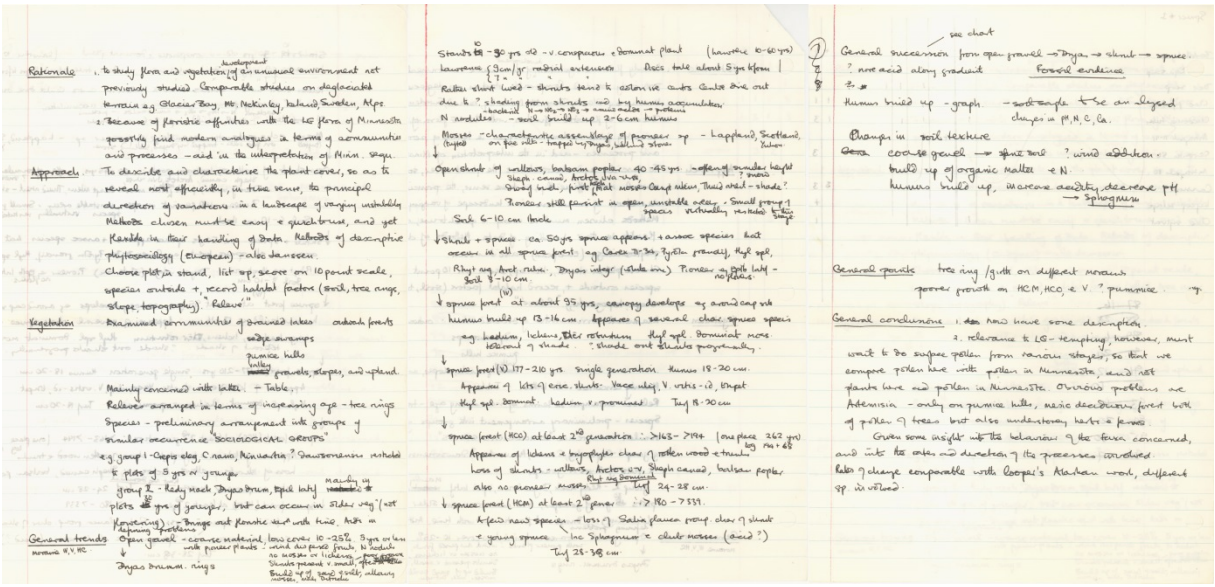

Plate 28. My three pages of notes for my camp-fire seminar.

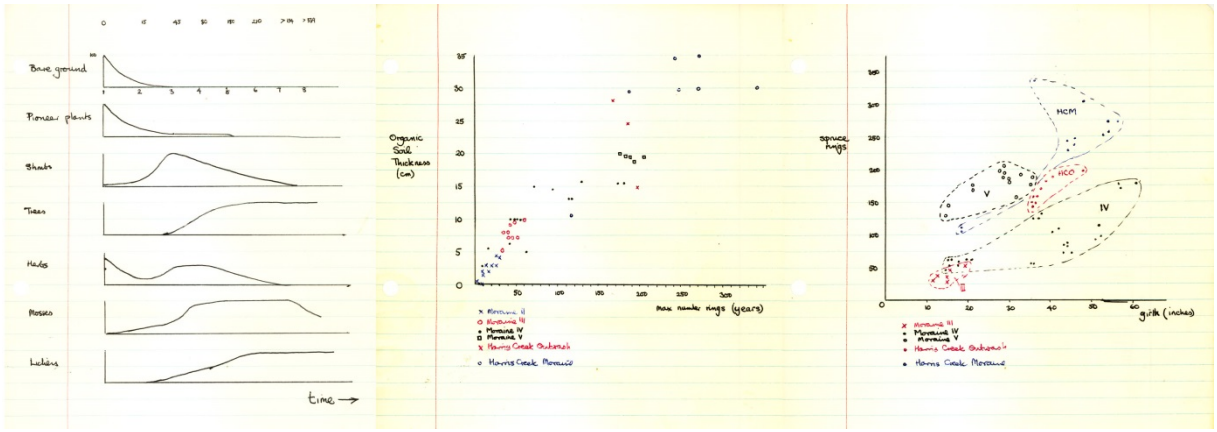

Plate 29. My three graphs for my camp-fire seminar.

After about two weeks at our camp on K-IV, Herb suggested that we should give 'camp-fire seminars' on our results to date. Being keen and conscientious in 1971 (I was 26 and only two years on since getting my PhD – things have changed a little with age!), I prepared three pages of notes and three graphs for my camp-fire seminar on 12 July (**Plates 28, 29**; *Appendix 2*). Herb asked if I had collected any data from the outwash-plain forests. I replied no, because it was impossible to work there as they are heavily infested with mosquitoes. Next morning Herb asked where I was going, and I said I was going to the interesting and species-rich mountain slopes on the upland above the Glacier. Herb said that **we** are going the HCM outwash-plain forests to collect the missing vegetation data. So we went together and I recorded six vegetational plots[(6)] whilst Herb tried to keep me free of mosquitoes. When I looked up at him, his face and hands were streaming with blood. Never has so much blood been sacrificed for six vegetation plots (see Fig. 4D in Birks 1980[(6)] and **Plate 30** for one such terrible vegetation stand).

Plate 30. Harris Creek Moraine outwash-plain forest. Photo: John Birks

On 17 July, the plan was to move from K-IV to the eastern edge of moraines K-II and K-III. In reality, the only suitable camping site we found was on the upland adjacent to these moraines. The original plan was that the helicopter pilot, a Japanese man who was very proud of the fact that he had flown his helicopter for many many more hours than the average helicopter pilot (a bit worrying for a statistically-minded palaeoecologist!), would ferry the party and our equipment in several journeys. Herb was concerned about the cost so kept adding coring rods, equipment, tents, etc. on one side of the helicopter whilst the pilot kept removing stuff as being too heavy from the other side! The net result was that Herb got to fly up the glacier and got a great view of the fantastic moraine system whilst the rest of us trekked from our old camp to our new camp, carrying coring rods, tents, and other equipment.

After several days working on K-I (not much botany), K-II, and K-III, I felt I could spend some time exploring the flora and vegetation of the nearby mountains in the St Elias range. This was my first exposure to the rich Beringian flora and I remember rushing down to camp late on 22 July suffering from taxonomic indigestion and reaching for my Hultén flora almost immediately to sort out what all the *Saxifraga, Draba, Potentilla, Castilleja*, and *Pedicularis* were. I saw over 165 species that day, 90 of which I had never seen before. There are still several 'gems' fixed in my memory from that day – *Papaver macounii* and *P. lapponicum* (**Plate 31**), *Gentiana algida* (**Plate 32**), *Synthyris borealis*

(**Plate 33**)*, Pedicularis oederi* (**Plate 34**), *P. kanei* (**Plate 35**)*, Lagotis glacua* (**Plate 36**)*, Saxifraga hirculus* (**Plate 37**)*, Claytonia sarmentosa* (**Plate 38**), and *Campanula lasiocarpa* (**Plate 39**). Next day Herb accompanied me up the slopes to about 3000 m to see what I was so excited about. As we moved slowly upwards, we started to talk about how we had selected our subject to study. I explained that I disliked animal dissection and hence zoology, and physics and chemistry, so botany chose itself for me; it also involved a lot of fieldwork. Herb said that he was undecided between studying history, music, or geology. He was worried that as you learnt more about a subject, you would enjoy it less and less. As he never wanted his passion for music to be lessened, he chose geology which he quickly turned into landscape history and he discovered how enjoyable it was as he learnt more and more about it.

Plate 31. *Papaver macounii* (left) and *P. lapponicum* (right) on 'Camp Mountain'. Photos: John Birks

Plate 32. *Gentiana algida* on 'Camp Mountain'. Photo: John Birks

Plate 33. *Synthyris borealis*, 'Camp Mountain'. Photo: John Birks

Plate 34. *Pedicularis oederi*, Beartooth Plateu, Wyoming, 1998. The Yukon material was in fruit in July 1971. This is probably the most widespread *Pedicularis* in the world. Photo: John Birks

Plate 35. *Pedicularis kanei*, Murphy Dome, Alaska, 1995. The Yukon material was in fruit and shrivelled up in July 1971. Photo: John Birks

Plate 36. *Lagotis glauca*, 'Camp Mountain'. Photo: John Birks

Plate 37. *Saxifraga hirculus*, upland near Gull Lake. A very rare plant today in Europe due to habitat loss. Photo: John Birks

Plate 38. *Claytonia sarmentosa*, 'Camp Mountain'. Photo: John Birks

Plate 39. *Campanula lasiocarpa*, 'Camp Mountain'. Photo: John Birks

4. Were there any adventures ('Herbventures') on the trip?

Yes, of course! It was impossible for a Herb trip not to have some adventures and misadventures. Late in the trip, Mel (**Plate 40**) and Platt asked Herb where was the rifle that we had to have in this wilderness area. Herb told them and they got the rifle out of its box. They then asked where the ammunition was, and Herb answered quietly "Ammunition? They never said we had to have any ammunition." Similarly, for the emergency radio that Mel tried to use, no batteries had been bought by Herb. Some of the corings were minor adventures as Herb forgot to bring the rubber boat on one day, but he had a wood-saw with him. Platt, Herb, and I cut down two spruce trees, lashed them together with Herb's endless supply of yellow rope (**Plate 27**), and Platt and I set forth on Cotton Pond to extract a sediment core. Our first attempt was thwarted when Platt started laughing and the log-raft tipped over! Herb, sitting safely on the shore, simply said "keep the corer vertical" (it was a plastic-tube corer). Platt and I got a reasonable core on our second attempt that was used for the pollen analysis[7]. The paper does not quite give all the details of the coring. It simply says "A core 20-cm long was obtained from under water 1.5 m deep in the pond center with a plastic-tube corer".

Plate 40. Mel in pensive mode thinking how can I make Herb's radio function without batteries? Photo: John Birks

Plate 41. Platt and John Wright improvising to make Mexican tortillas using reindeer antlers, a boat seat, and boat pump as 'kitchen' equipment. Photo: John Birks

Because Herb always travelled light, basic cooking equipment was usually missing. Platt improvised one evening to prepare delicious Mexican tortillas using a set of caribou antlers as a stand, the wooden seat of our rubber boat as a platform, and the boat's pump as a rolling-pin (**Plate 41**).

Red Watson left his home in St Louis with two rucksacks – one containing his clothes, toiletries, etc. and the other an expedition library of paperbacks. When we reached Whitehorse, only one rucksack arrived: the expedition library. After about a week of dragging boats, coring rods, and the like around, Andy Wright told his father that he had had enough and was not going out any more. He stayed in camp and explored Red's library. After quickly devouring the three or four thrillers and adventure books, Andy started to read and greatly enjoy books by, for example, Jane Austen, Charles Dickens, Edgar Allen Poe, Leo Tolstoy, Arthur Conan Doyle, Agatha Christie, George Orwell, and Robert Louis Stevenson. Andy later told me that he had never read such books before – three cheers for Red's expedition library!

We continued our camp-fire seminars until near the end of the expedition. They ranged over a wide variety of semi-philosophical topics such as the end of the Pleistocene, why classify, is palaeoecology a science, and what are the hidden assumptions of palaeoecology and geology: topics that are as pertinent (and unanswerable) today as they were in 1971. One heated and lengthy discussion resulted from me finding a dead duck on the glacier with the coprophilous moss *Voitia nivalis* growing on its skull (**Plate 42**). As a keen bryologist who had never seen *Voitia* before, I was excited by it. Red pulled me up – how do you know that the duck was dead before *Voitia* colonised it, or how can you establish that the *Voitia* moss did not kill the duck? I learnt a huge amount from Red and his philosophical way of reasoning and I owe much of my interest in the history and philosophy of science to these discussions with Red in 1971 and also with Ed Cushing in 1970 and later years[(19)].

Plate 42. The controversial dead duck – had it died before the moss had colonised the duck or had the moss killed the duck?! Photo: John Birks

On another occasion, Platt and Red had a good joke at my expense. They asked if I had seen any pine trees as they had found pine cones on the ground. I said no in worried tone, so they said I had to go and find them tomorrow. The so-called pine cones (**Plates 43, 44**) turned out to be the root parasitic member of the Orobanchaceae *Boschniakia rossica* doing a good job at mimicking pine cones! I have subsequently seen plants of this amazing genus several times in China, Bhutan, and the Altai.

Plate 43. The habitat of *Boschniakia rossica* in spruce forests on K-V. Photo: John Birks

Plate 44. *Boschniakia rossica* on moraine K-V. Photos: John Birks

5. Did anything go wrong?

Despite the Herbventures, nothing serious went wrong, thanks to the ingenuity and resourcefulness of Red, Platt, Mel, Fletcher, and of course, Herb and his sons John and Andy.

The only thing that caused problems was that we had all underestimated the roughness of the moraine surfaces. Walking on loose stones and rocks all day and every day tested our boots to their limit and beyond. Herb's 'Tuf' field boots, that had already seen better days, quickly fell apart. He was continually repairing them with bits of wire and cord. He even turned some tin cans into toe caps! My own boots, which had done good service in Lapland in 1965, Scotland 1966-1969 and the European Alps and on Mallorca in 1969, fell apart on the last day on Klutlan and are buried somewhere in the outflow channel near our second camp.

On 27 July we left the Klutlan Glacier by helicopter and reached the Kluane Lake Arctic Institute Research Station where we spent the night. It was a glorious night with cloudless skies and we simply rolled out our sleeping bags on a nice grassy area and went to sleep. We were sharply awoken early the next morning by the sound of bush planes revving up – we had camped right next to the gravel runway! Herb spent much of the day trying to sell back unused expedition food to the Research Station. The rest of us, rather naughtily, started to get flights back to the Twin Cities by any possible means. I felt a bit guilty about this but Platt said, "Forget it John, he has done it to us many times before". I got back to St Paul at about the same time as John and Andy who had travelled a different route to mine. I had flown as a stand-by passenger across Canada via Calgary. I finally reached Winnipeg early in the morning of 30 July where I had to go through US customs at 06:00 for a flight to the Twin Cities. The observant customs official discovered my copy of Hultén's *Flora of Alaska* in my hand-baggage and asked me where I had been and did I have any plant material with me? I replied, truthfully, no (as I had left all the specimens with Herb). The official then insisted that I empty my rucksack which by then mostly comprised dirty and somewhat niffy clothes plus two Mars bars! He was mystified as to how I came to have Mars bars 'Made in England'. I explained and he rapidly lost interest in me! On reaching the Twin Cities, I soon settled down to a comfortable bed in Herb and

Rhea's home in the St Anthony Park area of St Paul. In the next few days I worked on my notes and went to see Ed Cushing, Donna Amundsen, and others at the Limnological Research Center (LRC). About two days after we got back, Herb telephoned to say that he was at the Twin Cities airport and could we come and get him. Platt, Mel, John, and I went and met Herb with his 'two items of checked-in baggage'. He had managed to get everything – boat, coring rods, plant collections, water and sediment samples, cores, etc. – into sacks and tied them together. It took all four of us to lift them and to get them out to the pick-up truck and back to the LRC. On meeting us, Herb simply and quietly asked "have you sorted out your field data?" I stayed in the Twin Cities until 2 August and then flew back to England. Meanwhile, Bill Watts arrived from Dublin on 4 August and he and Herb then went coring in Tennessee and Florida.

6. Why was it such a special experience?

The Klutlan Glacier trip was a great experience because of the varied mix of people that Herb had invited to come along – this led to wonderful discussions, exciting camp-fire seminars, and a great sense of camaradie. Herb gave everyone an excellent piece of advice – bring your own tent (**Plate 45**) – as it is valuable to be able to be by oneself at times and also to reduce disturbance by snoring!

Plate 45. My tent on K-IV, a place to retreat to after lengthy camp-fire seminars. Photo: John Birks

In our four weeks on the Klutlan Glacier, the only signs we found that humans had been there before were some plastic Japanese rice packets that we found on the upland and lower slopes of the St Elias Mountains – these presumably had been left behind by a Japanese climbing expedition in 1965. The only other indications that there were other people on Earth in July 1971 were the sad sights of large US troop transporter flights, usually in the early evening, en route to south-east Asia and the Vietnam war.

7. Was it worthwhile?

Extremely so! Not only scientifically (as shown by the *Quaternary Research* special issue) but also socially and intellectually. I learnt a huge amount about the philosophy of science from Red (**Plate 46**), expedition cooking from Platt (**Plate 41**), survival in wilderness areas from Mel and John, and expedition leadership from Herb (**Plate 47**).

This expedition, plus my first botanical expedition to Swedish Lapland in 1965 and to the European Alps in 1969, both with Hilary, started our 'adventure botany' bug that still seriously infects us both. Since the Klutlan expedition in 1971, Hilary and I have been on 74 botanical expeditions ranging from Patagonia to Alaska, Washington to Colorado, Greenland and Svalbard to Cyprus and Crete, Turkey to Kazakhstan, the Yunnan, Bhutan, and Nepal, South Africa and Lesotho to Kenya and Ethiopia, and Australia to South Island, New Zealand.

Plate 46. Red at Gull Lake. Photo: John Birks

The Klutlan Glacier 1971 expedition (**Plates 48-51**) was a really great trip for me[19] and also, I think, for Herb – he often reminisced about it, whilst he never talked about our Minnesotan winter coring trips. Maybe the Klutlan expedition was one of his favourites. It was certainly one of mine.

Plate 47. Herb wondering where do we go? Photo: John Birks

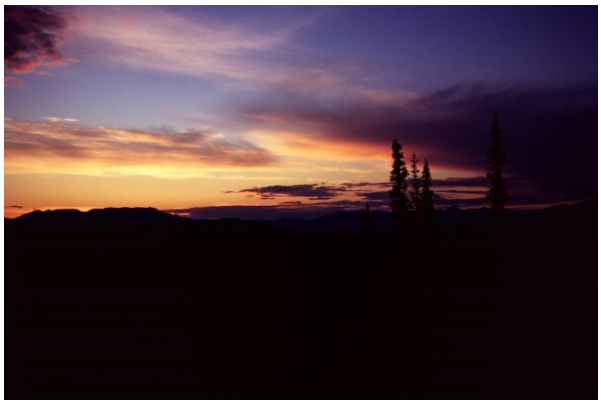

Plate 48. Evening sun at K-IV. Photo: John Birks

Plate 49. The Klutlan Glacier and a medial moraine being pushed into the terminal moraine complex viewed from the upland above our second camp. Photo: John Birks

Plate 50. Aerial view of the Klutlan Glacier south of the ice-cored moraines. Photo: John Birks

Plate 51. The St Elias Mountains, Yukon and Alaska, still largely unexplored botanically. Photo: John Birks

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Appendix 1. Aerial photographs (A15728-122, A15728-80, A15728-63) taken in 1967 by the Canadian National Air Photo Library showing the various moraines (Harris Creek, K-V–K-1), ice, and proto-moraines being formed as a result of surges of the Klutlan Glacier and its tributaries (see [2, 3] for details).

Appendix 2. The top of the massive plant-quadrat (relevés; 2m × 2m) data table I made during the expedition to help identify gaps in my vegetation sampling. The plots (columns) are arranged by age into open gravel (5 years), *Dryas drummondii* rings (9-30 years), open scrub (40-45 years), shrub–spruce (51-81 years), and spruce (96->339 years). The species (rows) are arranged by their order of appearance. Some of the plant names were my tentative field names (e.g. *Ditrichium, Bryum, Minuartia ? daws, Salix glauca* 40*, Salix glauca* 44). The numbers in the tables are Domin cover-abundance values with + signifying a taxon immediately adjacent to the plot. See Table 2 in [6] for the final table and full plant names. I used this table in my camp-fire seminar.