ton, Alberta) for certain information on critical specimens.

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REFERENCES

[1]Williams, R. S. 1901. Contributions to the botany of the Yukon Territory. 2. An enumeration of the mosses collected. *New York Botanical Garden Bulletin,* 2: 105-48.

[2]Steere, W. C. 1953. The systematic position of *Bryobrittonia. American Journal of Botany,* 40: 354-8.

[3]Vitt, D. H. and C. D. Hamilton. 1974. A scanning electron microscope study of the spores and selected peristomes of the North American Encalyptaceae. *Canadian Journal of Botany,* 52 (in press).

[4]Holmen, K. 1960. The mosses of Peary Land, north Greenland. *Meddelelser om Grønland,* 163(2): 1-96.

[5]Kuc, M. 1968-69. Additions to the arctic moss flora. II. Bryophytes and lichens of Good Friday Bay (Axel Heiberg Island, N.W.T., Canada). *Revue bryologique et lichenologique,* 36: 643-53.

[6]Persson, H. 1946. Some Alaskan and Yukon bryophytes. *Bryologist,* 49: 41-58.

[7]Steere, W. C. 1959. Musci. In: Schuster, R., W.C. Steere, and J.W. Thompson. The terrestrial cryptograms of Northern Ellesmere Island. *National Museum of Canada Bulletin,* 164: 77-108.

[8]Brassard, G. R. 1971. The mosses of northern Ellesmere Island, arctic Canada. II. Annotated list of the taxa. *Bryologist,* 74: 282-311.

[9]Savicz-Ljubitzkaja, L. L. and Z. N. Smirnova. 1970. *Handbook of the Mosses of the U.S.S.R.* Leningrad: Academy of Sciences of the U.S.S.R., Komarov Botanical Institute. 824 pp. (text in Russian).

[10]Steere, W. C. 1965. The boreal bryophyte flora as affected by Quaternary glaciation. In: Wright, H. E., Jr. and D. G. Frey (eds.), *The Quaternary of the United States,* Princeton, N.J.: Princeton University Press, pp. 485-95.

[11]Crum, H. 1965. *Barbula johansenii,* an arctic disjunct in the Canadian Rocky Mountains. *Bryologist,* 68: 344-5.

[12]Schofield, W. B. 1972. Bryology in arctic and boreal North America and Greenland. *Canadian Journal of Botany,* 50: 1111-33.

[13]Bird, C. D. 1968. New or otherwise interesting mosses from Alberta. *Bryologist,* 71: 358-61.

[14]Packer, J. G. and D. H. Vitt. 1974. Mountain Park: a plant refugium in the Canadian Rocky Mountains. *Canadian Journal of Botany,* 52: 1393-1409.

A Note on Hot Springs in the Interior of Alaska

Hot springs provide distinct local environments wherever found but are of special interest within the otherwise cold-dominated taiga. Although the areas involved are very small they offer unique biological settings whose study provides interesting insights into the thermal adaptations and the persistence of plant and animal species. Unfortunately, these areas are attractive for local exploitation which usually destroys the sites as natural entities, and most of the larger and more accessible springs have already been modified by such activity. Current interest in geothermal energy may place further pressure on these sites. Accordingly, we have attempted to relocate, and assess the present status of, a number of the 21 hot springs listed for the "Yukon basin" in Waring's classic report of 1917[1].

Dall Hot Springs near Dall Mountain (20 miles northwest of Stevens Village on the Yukon River) was visited by us in June 1971. We landed on Guishiemana Lake and walked southeastwards about 2 miles along the winter haul road to a spot where water at a temperature of 26°C was crossing the road through a culvert. About 250 yards northeast of this point the hot springs had formed a clear basin of about 200 feet across on a sloping hillside. Warm water, ranging in temperature from 37°C to 54°C, bubbled from the ground in several places. The presence of a few old logs indicated that there had once been a structure over one of the warm streams. The soil over much of the area was very unstable. We saw small mammals in the grass, one frog, and the tracks of wolf, bear, and moose. This hot spring had been visited the previous winter by our colleague L. Keith Miller who noted a considerable snow-free area with flowing water when all else in the vicinity was frozen.

Waring reported hot springs near the headwaters of the *Selawik River.* Following the directions of a local pilot, Tony Bernhardt, our

colleague Dr. Robert Dieterich flew us over these headwaters where the springs were easily located in two distinct areas about ¼ mile apart on one of the highest tributaries of the river. Their location was indicated by the presence of large poplar trees *(Populus balsamifera)* in an area where there were only occasional spruce along the stream bottoms and very rare poplar trees elsewhere. The nearest landing point was a lake about 12 miles downstream.

In July 1971 we travelled about 120 miles southward along the Elliot Highway to the *Hutlinana River* and then walked 7 miles upstream to the hot spring. We found a trailer on a mining claim about 100 yards further on across the river in a bulldozed clearing. The spring, issuing a few yards from the west bank at the base of a steep ridge, was still very much as described by Waring as to flow (50 g.p.m.) and temperature (46°C). This hot spring is the source of a small creek which runs through a wooded area for about 100 yards and then into the Hutlinana River, where its heat is quickly dissipated. Local people say that this heat keeps the Hutlinana River open in the winter when one can catch fish there. We found many snails in the warm water. An area of vegetation unique in this area extends about ¼ mile downstream from the outlet of the hot spring. We later learned that a track had been bulldozed to it from Eureka, 11 miles to the west, and in August 1972 we revisited the area with Dr. James Anderson using a 4-wheel-drive pickup truck. We took plants as herbarium specimens, obtained soil samples for microbial analyses, and collected snails.

In August 1971 we flew to *Horner Hot Springs* which is about 1 mile north of the Yukon River, 5 miles below Kokrines which is 5 miles below Tanana. There are in the locality many small springs and seeps which flow into a stream along a quarter-mile stretch. An area of vegetational change on a ridge several hundred yards above the stream, and clearly distinguishable from the air, suggested the presence of heat, but there was no water issuing from the ground there. We saw no evidence of recent activity, but there were numerous relics dating from an earlier period, such as pipes, cans and utensils.

From this point we flew 15 miles north over the *Melozitna Hot Springs,* the area around which is now being developed with an air strip, a house, a greenhouse, a swimming pool, etc. The hot springs themselves present a rather spectacular appearance from the air, flowing as they do over a 20-30 foot high bank on the south side of the river. Fifty miles to the north of Tanana are the *Kilo Hot Springs* on the Kilolitna River which form a distinct area of vegetation in largely treeless surroundings in which we saw the remains of what appeared to be a square log structure — perhaps a pool. The nearest landing point in the area was a lake about 12 miles to the north. About 12 miles to the northeast of this lake are the *Ray River Hot Springs* which are not so impressive, appearing as they do as only a small opening without vegetation on the stream. A few hundred yards downstream on the north bank is a large area of distinct vegetation which may be geothermally related to the springs. Returning to Fairbanks, we flew over the *Tolovana Hot Springs* (20 miles to the southwest of Livengood). Their natural setting appeared to be completely monopolized by a swimming pool.

In July 1972 our colleague Peter Shaughnessy and his wife walked for 2½ days north from Walker Lake to some hot springs on the *Reed River,* reported by Waring and earlier by Stoney[2]. These hot springs appeared as a sloping mud patch about 200 feet long and 50 feet wide, beginning about 150 feet from the Reed River, with a small flow of water along each side of the mud patch, joining near the bottom and flowing on to the river. Water temperatures ranged from 22°C to 38°C. A small piece of rusty metal and an old flat piece of wood were the only signs of human occupation. There were large poplar trees (of sporadic occurrence) in the area, which contrasted with the much smaller ones in the rest of the valley.

Waring and others have reported 5 small springs between the Yukon and Tanana rivers within 150 miles of Fairbanks. Their existence has remained unconfirmed until recently. In September 1972 we carried out a reconnaissance of these springs with the assistance of military helicopter. We hoped that a light snow cover would serve to identify areas of warmer earth. On *Serpentine Creek,* a tributary of the Salcha River, we found a group of large poplar trees which were out of character among the spruce at this altitude. There was no water issuing from the ground, but the absence of snow indicated an obvious geothermal influence. On *Paldo Creek,* another tributary of the Salcha, a large mound with a pothole in the middle was ringed on the river side by deciduous trees, although all the other trees were spruce. We could detect no warm water flowing from it, but the snow appeared lighter among the deciduous trees.

The springs on *Big Windy Creek,* a tributary of Birch Creek, were located in a steep, rock-walled canyon having a little vegetation

on its north slopes. The only real vegetational effect was that produced by some half dozen deciduous trees above a rocky side hill from which the snow had completely melted. Landing was precluded by steep canyon walls. On *Flat Creek*, a tributary of the Charley River, a 20-25-yard-wide snow-free mound gave some suggestion of thermal activity, but no water could be seen draining from it and there was no vegetational effect. It was likewise not possible to positively identify the spring reported to exist near the headwaters of the *Charley River*. A small patch of 6 or 8 deciduous trees on a side hill was seen, but there was no effluence of water and no areas of melted snow. All in all these reported springs in the Yukon-Tanana uplands appear to be of very limited significance.

Although there are no true hot springs on the north slope, a site visited by our colleague, Dr. Brent McCown, in August 1971 is of interest. It was on the *Ivishak River*, north of the Brooks Range, and springs there were easily identified from the air by the presence of large poplars otherwise foreign to the area. The vegetation was striking with regard to the number of species and the amount of growth and reproduction. 18 species were sampled. The area comprised several acres, with one section dominated by 20-foot-high poplars, although most of the ground was covered by low herbs. The water flowed rapidly from the ground in numerous places and eventually coalesced into a small stream. Although the water had a temperature of only 5°C, local pilots reported that the springs remained unfrozen in the winter and attracted large game such as bear and moose. Fish and game biologists have found these springs to be important spots for the rearing of arctic char and grayling.

We have not yet reconnoitered the other hot springs listed by Waring for the Yukon Basin — i.e., those on *Little Minook Creek*, west and north of *Glacier*, on the *Alatna River*, near the *Innoko River*, near *Iditarod*, near *Whitefish Lake*, near the *Tuluksak River*, and on a tributary of the *Little Melozitna* River.

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REFERENCES

[1]Waring, G. A. 1917. Mineral springs of Alaska. *U.S. Geological Survey, Water Supply Paper* no. 418.

[2]Stoney, G. M. 1900. *Naval Exploration in Alaska*. Annapolis: U.S. Naval Institute.

University of Colorado 1973 Field Season in Eastern Baffin Island

A total of ten persons, including members of faculty, graduate students and assistants were involved in the 1973 field season of the University of Colorado in both northern and southern Cumberland Peninsula. The major objectives of the research undertaken were: (a) to study the Quaternary geology and geomorphic processes operating within the Baffin Island National Park and on the Peninsula in general; and (b) to study the energy balance and break-up pattern of the Home Bay fast-ice sheet.

Quaternary geology and geomorphic processes

Previous work by members of the University's Institute of Arctic and Alpine Research (INSTAAR) had been concentrated in the northern fiords of Cumberland Peninsula. During the 1973 field season this research was expanded to include significant portions of the southern part of Cumberland Peninsula and of traverses through the main north-south passes of Pangnirtung Pass and the Padle/Kingnait fiords trough. These areas were last studied geomorphologically during the 1952 expedition of the Arctic Institute of North America led by P. D. Baird[1]. Field work was also carried out on the Tertiary basalts at Cape Dyer during which particular attention was paid to the weathering of the basalts and the vertical and horizontal extent of active ice during the Quaternary glaciations. The basalts were free from Precambrian erratic rocks from the west, and the maximum extent of glaciation appears to be marked by weathered lateral moraines below the lower DEW Line site. Marine shells were found associated with these tills and will be uranium series dated. Investigations in Pangnirtung Pass and the Kingnait/Padle trough to the east revealed thick deposits of "bedded sands". These deposits, which are probably colluviated loesses, are interbedded with thin organic partings and thicker units of peat. The deposits vary between 0.5 m. and 5 m. in thickness. Buried soils were found underlying late- and possibly mid-Wisconsin moraines in Pangnirtung Pass. These together with samples from the buried sands are in process of being radiocarbon dated. Studies in the diffluent valleys (cols at about 600 m. above sea level) leading from Pangnirtung Pass eastward towards the Padle/Kingnait trough suggested that early Wisconsin ice flowed eastward from the Pangnirtung Pass