NORTHERN NEWS

An archaeological reconnaissance in the Coronation Gulf region

During July and August 1955 Professor Elmer Harp, Jr., Department of Sociology and Anthropology, Dartmouth College, Hanover, New Hampshire, and Dr. Ralph E. Miller, Professor of Pathology, Dartmouth Medical School, conducted an airborne archaeological reconnaissance of certain areas adjacent to Coronation Gulf. The purpose was to seek traces of prehistoric cultures in the central Arctic which might more clearly link together the early cultures of Alaska with those of the eastern Arctic. This research was supported by a major grant from the American Philosophical Society and a supplementary award from the Research Committee of the Faculty of Dartmouth College.

The trip was made in Miller's aircraft, a Piper Tripacer powered with a 135 h.p. Lycoming engine, and equipped with dual flight controls and Edo 2000 floats. The Piper normally accommodates four passengers, but the two place rear seat was removed to enlarge the stowage space for camping gear, and an auxiliary gas tank was fitted which increased flying time to five hours. By prior arrangement with the Hudson's Bay Company, caches of aviation gas were established at Coppermine and Bathurst Inlet, and Associated Airways, Ltd., of Edmonton, contracted to deposit other caches at Dismal Lakes, Tree River, and Contwoyto Lake. Imperial Oil laid in two steels at Sawmill Bay on Great Bear Lake, and Wardair Ltd. kindly made its Port Radium cache available for emergency use.

The party departed from the Connecticut River at Hanover on July 2, and in near-perfect weather were able to maintain their planned schedule to Coronation Gulf with overnight stops at Bay City, Michigan; Duluth, Minnesota; The Pas, Manitoba; Fort Smith, and Port Radium, Northwest Territories. They reached Coppermine on the morning of July 7, and for the next few days enjoyed the cordial hospitality of Mr. and Mrs. David Wilson of the Federal Day School. Valuable information was obtained from the inhabitants of the settlement, and flights were taken into the surrounding country and up the west coast of Coronation Gulf as far as Locker Point; trips were also made by boat and on foot to Bloody Falls and to "Cemetary" Island, where a trial excavation was begun in one of a series of house pits on a raised beach.

The week of July 11 to 17 was spent in the Tree River area. From base camp, near the former site of Port Epworth on the southeast side of the estuary, air surveys were carried out in the Tree Valley and day-long flights were taken west to Kugaryuak River and north to Hepburn Island. Extensive ground surveys were made on both sides of the Tree estuary, the river itself below the twelve-mile falls, as well as parts of the granite country which bounds the valley on the east.

On July 18 the party flew along the coast to Bathurst Inlet. There Asgar "Red" Pederson of the Hudson's Bay Company was a most helpful and delightful host while investigations were made around the mouth of the Burnside River, the Western River at the southern end of Bathurst Inlet, and on some of the islands extending north to Banks Peninsula. The next camp was set up on July 21 near the mouth of the Hood River in Arctic Sound; although stormbound there for three days, most of the country immediately west of the river was surveyed as far south as the confluence of the James River.

The night of July 25 was spent at Bathurst post and on the next day the

party flew to Contwoyto Lake. There, by invitation, the island tent camp of Associated Airways was used while the embayments of the eastern shore were explored. Particular attention was paid to the numerous eskers including a major esker complex midway on the western shore. The return flight to Bathurst was made on July 31 with a stop of several hours in order to check a series of house rings on a large island in the Burnside River about five miles east of Lake Kathawachaga.

On August 1 the survey returned to Coppermine, following a cross-country route up the James River, out to the Tree estuary for refuelling, and thence along the coast. Once more the gracious hospitality of the Wilsons was accepted. Investigations were extended in the vicinity of the settlement, the mouths of the Rae and Richardson rivers, and for several miles along the north bank of the Rae. The excavation of the house pit on "Cemetary" Island was completed, and the entire coast between Coppermine and Cape Krusenstern was carefully observed on several low-level flights. On one of these a landing was made in order to examine the stone houselike structure on the bluff behind Locker Point.

The party moved inland to Dismal Lakes on August 9 and set up the last major camp of the season at the lower narrows. The weather was unfavourable here, but large areas were scouted from the air and, from suitable landing spots, good ground coverage was obtained around the shores of Dismal Lakes and at Kamut Lake, near the great bend of the Coppermine River.

Finally, on August 20 the first move was made towards home. From Dismal Lakes the party flew westward to Sandy Creek and down the Dease River to Great Bear Lake. Landings were made at the mouth of Sloan River and at Sawmill Bay and then a two-day camp at Fishtrap Lake, a few miles to the southeast. After reconnaissance there, the survey flew out to Fort Smith and thence by much the same route as before to Hanover, arriving on the afternoon of Friday, August 26.

At this time no intensive analysis of the archaeological findings has been made, but certain descriptive formulations can be drawn. The artifacts collected along the coasts must be attributed to modern, or relatively recent Eskimo. Most of the artifacts are of bone, horn, or wood, and are very common types, including arrow points, harpoon heads and fore-shafts, fish spear prongs, fish lures and hooks, barbed dart points, scrapers, blubber pounders, picks, spatulas, various hafts, wood bowls, soapstone lamps and pots, and various elements of dog harness. A number of the projectile points and knives have blades of native copper, and several are of iron. Preliminary inspection indicates that the greatest age is represented in a series of harpoon heads from Cape Hearne which are of Late Thule type.

The interior sites around Dismal Lakes and Kamut Lake suggest much greater antiquity. Two distinct complexes of chipped stone artifacts were found on eskers and raised beaches. One of these, the more common and widespread of the two, consists of large, often coarse and undifferentiated forms of scrapers, and projectile points or blades which seem to resemble closely Yuma and Plainview types. The other is a microlithic complex consisting of lamellar blades, some retouched, minutely flaked end- and side-blades and scrapers. No burins have been distinguished in this material, which came mainly from one site on the north shore of Dismal Lakes. This latter complex is undoubtedly related to that widespread manifestation of similar industries which may, in the New World, stem from the Cape Denbigh Flint Complex of western Alaska. It may also represent some intermediate stage of cultural development in the central Arctic which, although still orientated to inland subsistence patterns, led ultimately to the growth of the Cape Dorset, or other early sea-hunting cultures of the eastern Arctic. More detailed research on these collections may help to clarify some of these postulated relationships.

ELMER HARP, JR.

Russian plans for the Ob' and Yenisey and the Bering Strait

On 3 March 1956 *The Financial Post* (Toronto) published a front page story on the possible effects of the supposed Russian plans to dam the Ob' and Yenisey rivers, and the Bering Strait. The waters of the Ob' and Yenisey are, according to this plan, to be deflected southward to irrigate areas at present short of water, while the Bering Strait plan involves the pumping northwards of very large quantities of Pacific water from the Bering Sea. Certain facts seem wrong with the plan as reported, and with the interpretation of the possible effects. As the whole scheme is on a titanic scale, and will undoubtedly merit more publicity, the following random comments may be of interest.

It has been suggested that if the Ob' and Yenisey rivers were dammed the temperatures in the Arctic Ocean near the mouths of these rivers would decrease, and that the winters of north-western Europe would suffer in consequence. At present when the two rivers reach the Siberian coast they have lost a great deal of heat, and their effect in delaying the freezing of the sea in that region, or of fending off polar pack ice must be small. Moreover, the prevention of so much fresh water from entering the sea would tend to increase the salinity of the water in that region, thus increasing its density and decreasing its stability. This would encourage water from below to rise to the surface; the water underlying the upper Polar or Arctic water in the Arctic Ocean is Atlantic water from the Atlantic Drift (known nearer its source as the Gulf Stream), and this water at the surface would bring warmer not colder conditions.

The damming of the Bering Strait would, according to *The Financial Post* and other reports of this plan, stop "the flow of cold arctic water into the Pacific". What flow? There is no evidence for any southward movement of water through the Bering Strait, only of a northward movement of Pacific water from the Bering Sea. The Russians presumably wish to accelerate this northward flow, and to do so it is necessary to dam the strait in order to stop any back-flow (south) of the water they pump or drive north.

One can only attempt an "educated guess" as to what would happen to the Pacific water pumped into the Arctic Ocean. It would sink below the arctic upper water (as the Atlantic inflow does in the Spitsbergen area), float on top, or mix with the polar water according to the temperature and salinity of the two water types, as density is a function of these two properties. The mean yearly temperature and salinity of the water flowing north through the Bering Strait are about 0°C, perhaps a little higher, and about 32 parts per thousand respectively, values which are fairly close to those normally found in the upper Arctic water in the Arctic Ocean. Since the water to be pumped under the Russian scheme must be Bering Strait water a considerable amount of mixing might be expected. However, the Bering Strait inflow is somewhat warmer than 0°C in summer, while the Polar surface water hardly rises above that figure, and in winter the Arctic Ocean is probably higher in salinity than the Bering Sea water. This suggests that the Bering water would float on top of the Polar water. Again, the Bering water arriving in the Arctic Ocean would lose heat to the air, which would tend to bring the densities closer together and encourage mixing.

To have any significant effect enormous quantities of water must be pumped across the proposed Bering Strait dam. The present inflow from the Bering Sea to the Arctic Ocean is about 0.3 million cubic metres per second, which is only about 1/10 of the inflow from the Atlantic in the region between Iceland and the north of Scotland. Moreover, whereas the average temperature of the Bering Sea inflow is around 0°C, that of the Atlantic inflow to the Arctic Ocean is about 8°C, a very large difference. Because of its high salinity the Atlantic water sinks beneath the water of the Arctic Ocean, and although it has an

important warming effect on the climate of Norway and northwest U.S.S.R., it does not manage to keep the Arctic Ocean itself free of ice.

Another problem concerns the rate at which the water pumped from the Bering Sea would lose heat to the polar air mass above. This air mass is large and comparatively stable, and a very great rise in the heat budget of the Arctic Ocean would be necessary for it to be seriously affected. At present Pacific influence north of Bering Strait extends to about 76°N., the northern limit of the Chukchi Sea; planktonic species are known from that latitude, and the summer limit of ice is farther north in that region than to the east and west of it. Using these data to estimate the effect of increasing the flow of Pacific water through the Bering Strait, if the northward flow were maintained at twice the present natural flow, the area influenced to the same extent as the Chukchi Sea today would be approximately doubled; this assumes that Pacific water stays at the surface, which is probable. If the inflow were three times the present rate, the area influenced would be trebled, and so on until "diminishing returns" reduced the area influenced. If water could be pumped at five times the present natural flow, that is at about 1.5 million cubic metres per second, an increase of 1.2 million cubic metres per second over the present inflow, the southern limit of the polar pack would probably be pushed back only a few tens of miles over a front of about 50 to 60 degrees of longitude. The effect on the polar air mass would not be very great.

The problem of where the Pacific water would go appears to have been overlooked. It has been assumed that the water pumped over the Bering Strait dam would turn westward and hold to the Siberian coast, thus freeing the northern sea-route from ice. There is no good reason for this to happen. The earth's rotation deflects moving bodies of large mass to the right in the northern hemisphere and the rotational force is greatest at the pole, zero at the equator. Thus water entering the Arctic Ocean from Bering Strait would tend to turn east. In fact, the Pacific water turns along the Alaskan coast where it is stopped, for the most part, by pressure from the Arctic Ocean circulation itself; much or most of the Pacific water is then forced north and finally westward in the Chukchi Sea area. From this region the general Arctic Ocean circulation continues in a clockwise direction, but the main current keeps well out from the Siberian coast. Along the Siberian coast and over most of the continental shelf in that region, the current is in the opposite direction, to the east, and is made up of Arctic and *Atlantic* water that comes mainly from the Kara Sea.

An increase in the Pacific (Bering Sea) contribution to the Arctic Ocean would, therefore, probably be felt not along the Siberian coast but along the northwest coast of Alaska as far as Point Barrow, and in the northern part of the Chukchi Sea. The summer ice limit would be pushed north, and if the Pacific contribution were large enough, the warming effect might penetrate a considerable distance across the middle of the Arctic Ocean, where the present current apparently leads across the basin towards northwest Greenland.

The overall effect on the climate in the sea and in the atmosphere would depend on the amount of water pumped over the Bering Strait dam. This would have to be at least as great in quantity as the present Atlantic inflow to have any important effect, and even then it would be in competition with two very large and stable bodies which themselves dominate the northern climate, the polar air mass and the Greenland Ice Cap. It would probably make only a very small impression. Also, it should be remembered that warmer water, and water ice free for longer periods in the year would incerase the moisture in the air, and therefore the precipitation; some of this would fall as snow on the Greenland Ice Cap and the arctic islands of Canada *increasing* the rate at which ice formed.

The two outflows from the Arctic Ocean are: the East Greenland Current, which flows south along the east Greenland coast, and after turning Kap Farvel,

forms part of the West Greenland Current: and the Canadian Current which flows south along the east coast of Baffin Island, and is composed of water which has come through the arctic archipelago. The flow of both these currents would be increased by the present plan.

The present total inflow into the Arctic Ocean is about 3.55 million cubic metres per second, allowing for evaporation from the sea surface. This is shared as outflow by the East Greenland Current, with an approximate transport rate of 2.20 million cubic metres per second, and the Canadian Current with about 1.35 million cubic metres per second. If water were pumped over the Bering Strait dam at five times the present flow, the inflow would be increased by 1.2 million cubic metres per second. This in turn would raise the transport of the East Greenland Current from 2.20 to about 2.95 million cubic metres per second, and the Canadian Current from 1.35 to about 1.80 million cubic metres per second. Both these increases would affect the Canadian waters on the eastern seaboard, and therefore, the climate, because the East Greenland Current becomes part of the West Greenland Current that eventually crosses to the Canadian side of Baffin Bay and the Labrador Sea. The amount of warming would depend on the level of increased Pacific inflow that can be maintained. If the maximum level were five times the present rate, it is possible that the additional heat would be absorbed by the polar air mass, in which case the climate of eastern Canada might become cooler. If the level were ten or fifteen times the present rate, the temperature of the outflow itself might conceivably be raised, and then the climate of eastern Canada might become warmer. This, however is pure speculation.

It is not intended here to guess at the effect of the Bering Strait scheme on the productivity of the waters concerned, although there would undoubtedly be some changes. So much depends on the precise levels at which the pumps could operate that it is useless to go farther along this line of thought at present. There would certainly be a period of confusion before conditions settled down to a new equilibrium. M. J. DUNBAR

Limnological investigations in northern Quebec

From 16 May to 17 September 1955 G. Power and the writer carried out freshwater investigations in the Lac Aigneau district, northern Quebec. The studies were supported by McGill University-Arctic Institute Carnegie Scholarships and by a grant from the Quebec Department of Game and Fisheries. Lac Aigneau, which is part of the Koksoak River system and lies approximately eighty-five miles southwest of Fort Chimo, was reached by chartered plane from Fort Chimo.

Power studied the life history and physiology of the salmonoid fishes. It had been hoped to obtain data on the biology of the sea-run Atlantic salmon (*Salmo salar*) at the northern limit of their range in Canada, but unfortunately only land-locked salmon were found in Lac Aigneau; an extensive series of rapids and falls on the Rivière Aigneau prevented the ascent of sea-run salmon from Larch River to Lac Aigneau. A few sea-run salmon parr were obtained from the Clearwater River, where a limited amount of time was spent. Power, therefore, concentrated on the collection and analysis of brook trout (*Salvelinus fontinalis*), and of land-locked salmon and arctic char (*Salvelinus alpinus*). He used an apparatus for measuring the oxygen requirements of a number of brook trout under field conditions.

The writer was mainly concerned with a general investigation of Lac Aigneau, which included sounding the lake and the taking of temperature, oxygen, and pH determinations periodically throughout the summer. The plankton and bottom fauna were quantitatively sampled, and 19 overnight net sets were made with a standard gang gill net. It is hoped that results from this study will contribute to the knowledge of the productivity and classification of northern lakes and provide further information on the distribution of freshwater organisms.

D. R. OLIVER