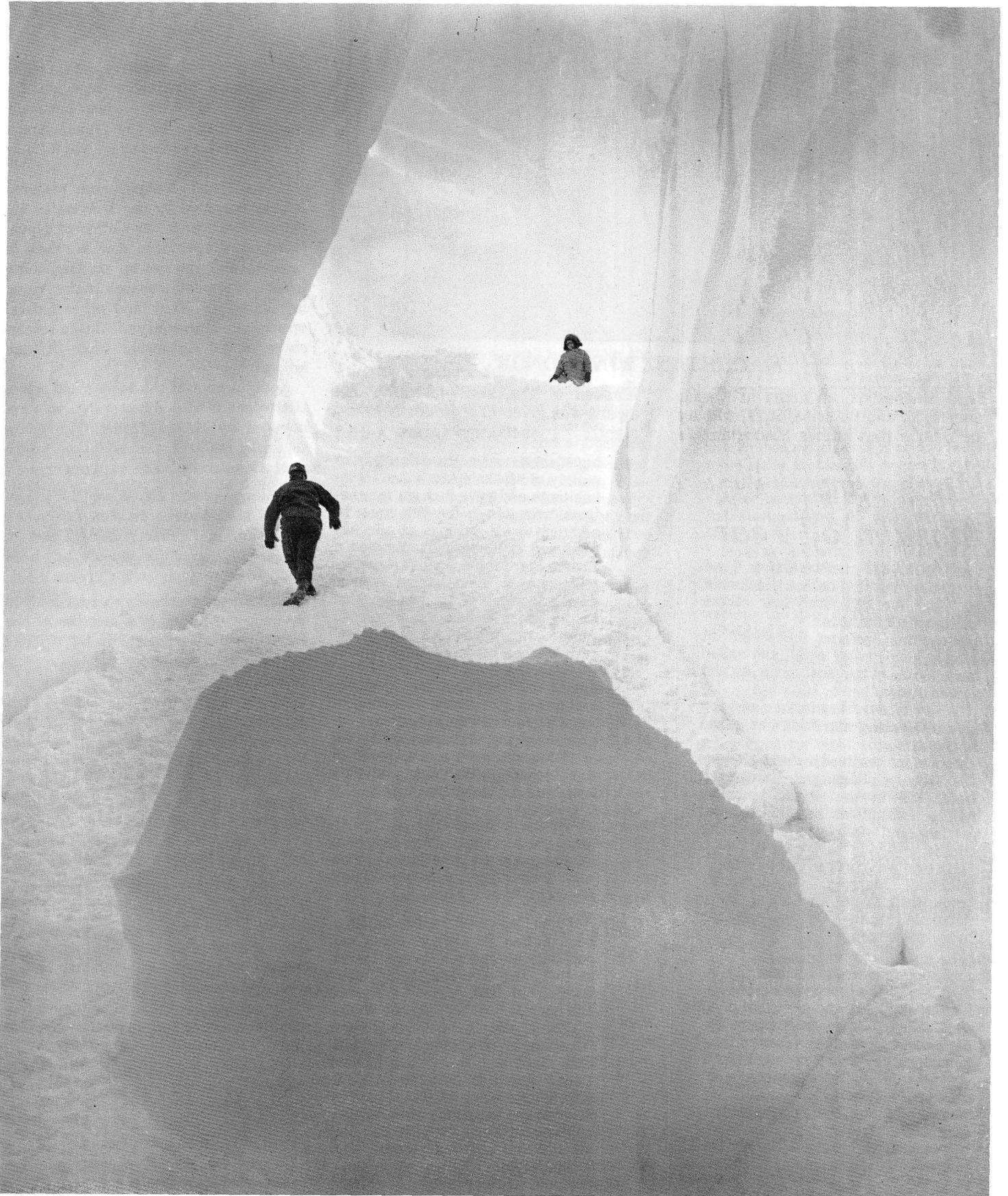


6-77

# THE POLAR TIMES



# **National Oceanic and Atmospheric Administration**

## **The Polar Times**

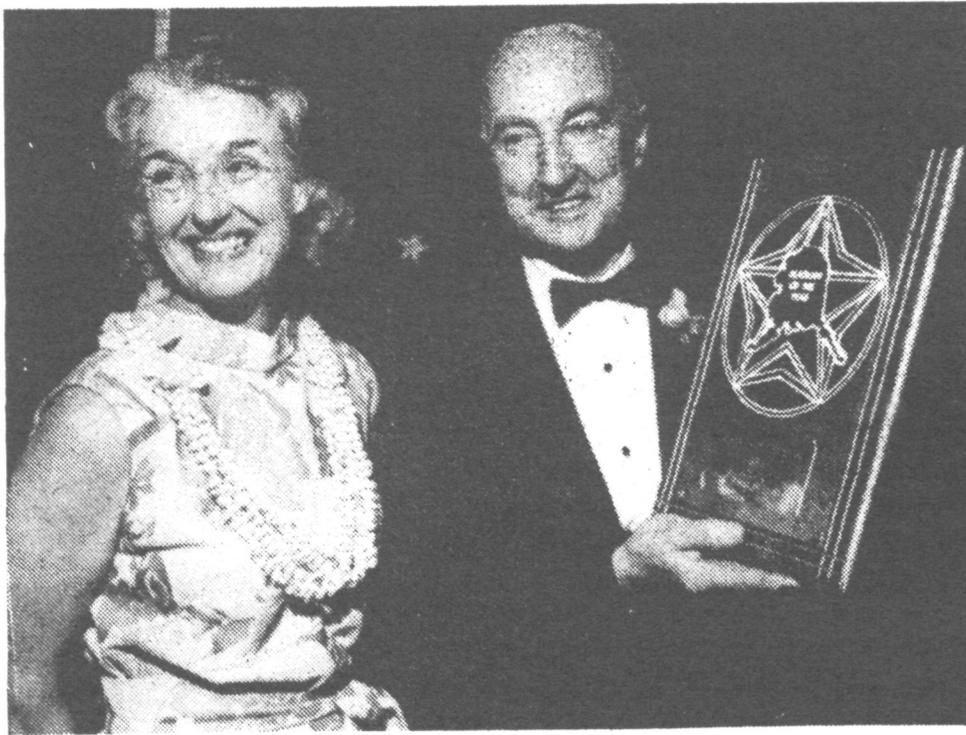
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### MACHETANZ WINS HONOR

Fred Machetanz, an artist in Alaska since 1935, and his wife, Sara, display the plaque that names Machetanz as

Alaskan of the Year for 1977. The award was given at a dinner here last night. *Anchorage Times*, April 2

## Machetanz Alaskan of Year

ANCHORAGE (AP)—Artist Fred Machetanz has been named Alaskan of the Year for 1977 over four others nominated for the honor.

Machetanz received the award at banquet here Friday night, and called himself "one of the most fortunate and blessed of men."

"Where else but in Alaska could you have an evening like this?" he asked the crowd.

Machetanz has lived in the state since 1935. His paintings and lithographs depict life in the north, including hunting expeditions on the ice, dog sledding and portrayals of Alaska's wildlife.

Other nominees were M.R. "Muktuk" Marston of Anchorage; Frank Reed, Sr., of Anchorage; Merle "Mudhole" Smith of Cordova and Lucy Cuddy of Anchorage.

The winners are chosen by a civic electorate group by secret ballot, on which are the names of persons selected from nominations to the Alaskan of the Year Committee. Selections are based on significant contributions to the character and growth of Alaska.

The program notes on Machetanz read as follows:

"Machetanz is considered by many to be the most outstanding liv-

ing Alaskan artist. His paintings are mainly of Alaska's Arctic and its inhabitants and have brought international attention to the 49th state. In addition to his work in oil, he has produced 47 lithographs. He won a Bronze Star for his work in Naval intelligence in the Aleutian Islands during World War II; has lectured for 13 years during the winter on Alaska with movies he made himself. He has made Alaskan movies for Walt Disney, Encyclopedia Britannica and the Territory of Alaska and has taught at the University of Alaska. He received an honorary degree from the University of Alaska in 1973 and served on the board of the Anchorage Historical and Fine Arts Museum for six years."

Proceeds from the event go toward scholarships "for deserving Alaska residents who intend to obtain their higher education within the state."

Other previous recipients have been Robert B. Atwood, editor and publisher of *The Anchorage Times*; in 1967; the late Sen. E.L. "Bob" Bartlett in 1968, former Governor and Secretary of the Interior Walter Hickel in 1969, the late Sen. Ernest Gruening in 1970, former Gov. William Egan in 1971, aviation pioneer Robert Reeve in 1972, the late U.S. Rep. Nick Begich in 1973, Sen. Ted Stevens and longtime native publisher Howard Rock in 1974 (a joint award) and aviation pioneer Noel Wein in 1975.

# Dr. Kelley To Direct Barrow Lab

Dr. John J. Kelley, assistant professor of marine science at the University of Alaska, has been appointed director of the Naval Arctic Research Laboratory (NARL) at Barrow.

NARL is a Navy-owned research facility operated by the University under contract with the Office of Naval Research. It provides a wide range of facilities and services for accomplishing basic and applied research in the Arctic in support of Navy and other federal operations. University of Alaska researchers make intensive use of the laboratory.

Appointment of the 44-year-old scientist to the NARL directorship was announced by Keith Mather, vice chancellor for research and advanced study on the University's Fairbanks campus.

Kelley succeeds Dr. Warren W. Denner as NARL director. Since Denner's departure in October, Gary Laursen, assistant director for science, has been acting director.

Well known to the Fairbanks campus community, Kelley is a member of the Institute of Marine Science faculty. He has been on leave from the University since 1974, serving first as program manager for meteorology and oceanography in the National Science Foundation's Division of Polar Programs in Washington, D.C. and subsequently as the State of Alaska's representative at Boulder, Colorado in the planning of the federal Outer Continental Shelf Environmental Assessment Program.

Kelley is no stranger to the Barrow laboratory. Much of his work on carbon dioxide in the arctic atmosphere—work that gained him national and international recognition—was conducted from the laboratory, said Mather.

The scientist is fully familiar with the scientific work of the laboratory and the logistical support it provides to hundreds of visiting scientists and students each year.

*Now in the North*, a faculty-staff publication, is published four times during the academic year by the University of Alaska.

# The Polar Times

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No. 84

JUNE 1977

## Sites in Alaska Yield A Wealth of Artifacts

WASHINGTON, March 13 (UPI) — More than half a million artifacts, some dating back 10,500 years, have been found by scientists at sites along the path of the trans-Alaska pipeline, an oil company publication reported today.

Flint scrapers, small blades and projectile points were among the artifacts, according to the pipeline company newsletter, "Alyeska Reports." Animal remains and ruins of dwellings were also discovered.

The nature of the sites and the objects found at them suggest that the early inhabitants of Alaska were nomads who depended on the movements of caribou herds and on fish runs, the publication said.

Artifacts found in the Brooks Range suggest that hunters crossed the North Slope yearly, it said. Ancient whale-bone sled runners, along with copper, obsidian and white mink bones, were found hundreds of miles north of their origin, further evidence of a mobile way of life.

A team of 76 archeologists examined more than 300 sites along the 800-mile pipeline.

## ESKIMOS ASK UNIFORMITY ON ARCTIC OIL-GAS RULES

BARROW, Alaska, June 19 (AP)—Eskimos from three nations have called on all governments to establish uniform rules for offshore oil and gas development throughout the Arctic.

The resolution was one of 17 approved Friday by 54 delegates to the First Circumpolar Conference at the close of a weeklong meeting. It also called for an Eskimo-controlled technology assessment program, an Arctic population policy, locally controlled wildlife management and an international Arctic coastal zone management program.

The Eskimos from Alaska, Canada and Greenland also took stands on issues ranging from native land claims to demilitarization of the Arctic.

The question of offshore oil and gas development, raised by Mayor Eben Hopson of Alaska's North Slope Borough, was regarded by most conference participants as the most important.

"Trying to deal with the oil companies alone was an almost impossible task," Mr. Hopson said afterward.

Earlier, the delegates approved work on a charter for an international organization of Eskimos, and they voted down resolution urging international safeguards for Arctic resources and environment.

## ALASKAN OIL STARTS FLOW INTO PIPELINE

By WALLACE TURNER  
The New York Times

PRUDHOE BAY, Alaska, June 20—One hour late, the trans-Alaskan pipeline opened today, unlocking the wealth of oil that lies beneath the tundra of the continent's North Slope.

Oil flowed into the upper end of the pipe at 10 A.M., pushing a "pig," a scraper that will clear debris left over from construction as well as contain the oil in a column behind it.

As Fred Moore, a technician, pushed command buttons, the pig moved slowly out of Pump Station No. 1 of the Alyeska Pipeline Service Company, builder and operator of the 799-mile line.

Explaining the one-hour delay, Mike Jens, the line's northern district superintendent, said of his crew, "They just want to be dammed sure of themselves. I've told them to be careful. If they're uneasy they are to sit back."

Mr. Jens said that one quart of oil had leaked from a flange in the 48-inch pipe connection inside the scraper loading house but that the leak had been stopped by tightening the flange. Outside the pump station, the pipeline is held together by welds.

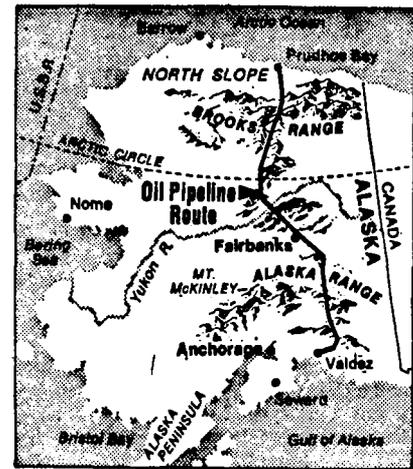
"The pig left the launcher and stopped while they filled with oil behind it," said Charles Champion, director of the Alyeska Pipeline Coordinator's Office. "When the signal showed it had moved outside the building into the pipe, they cheered."

Jack Turner, acting representative of the Secretary of Interior in supervising the construction, said, "Everything went beautiful."

Asked whether champagne had flowed along with the oil, R. E. Johnston, who is with Alyeska, said: "We have a no-liquor rule here on the pipeline. We have no drinking."

The opening was a milestone in the controversial development of the 9.7-billion barrel oilfield discovered here nine years ago. By autumn, 1.2 million barrels a day will be delivered by the pipeline to the tankers at Valdez for a country that in 1976 consumed 17.4 million barrels daily.

It should have been dramatic. Instead, it was only cold beneath the overcast skies as a light wind blew across the brown tundra from the Beaufort Sea, a part of the Arctic Ocean. The most



dramatic event of the day occurred when a bus taking reporters to the pump station lurched off a gravel road and became mired in the tundra as it swerved to avoid a road grader. No one was hurt.

After launching, the pig moved in fits and starts, taking 45 minutes to cover about 200 feet.

Pipeline executives watched and listened as the pressure of oil mounted behind the pig, thrusting it forward. As it moved, a notched steel wheel clanked against the pipe's side, echoing across the gravel pad.

As each series of clanking sounds signaled a forward thrust of a few feet, pipeline workers grinned at each other and asked some of the dozens of reporters present, "What do you think?"

The pipeline represents a \$7.7 billion investment for eight oil companies that own it.

Field production is to reach 300,000 barrels a day soon, and the added pressure will move the scraper at about 1.1 miles an hour or about 26 miles a day.

Something over 30 days will be required to fill the pipe to Valdez, the ice-free port where the oil will be loaded into tankers. Oil company officials have estimated that the first tankers will be loaded around mid-August.

Robert L. McGiff, who will lead the workers tracking the scraper's passage down the pipe, waited with reporters and pipeline workers in the 33 degree temperature. "We'll track the pig by sound and electronics from signals built into it," he said. "That way we'll be following the oil front."

ANCHORAGE, Alaska, June 29 (UPI)—The pumping of Alaska's North Slope oil from Prudhoe Bay to Valdez, Alaska, has been running ahead of schedule, the Alyeska Pipeline Services Company reported today. By Saturday, the oil was expected to be crossing the Yukon River, 350 miles south of Prudhoe Bay and near its halfway point in the 799-mile route.

## Natural Seepage of Oil Found in Alaskan Seas

WASHINGTON, April 24 (UPI)—Waters off Alaska may have natural gas seepages and oil slicks even without drilling in the area, two Government scientists reported today.

Joel Cline of the National Oceanic and Atmospheric Administration and Mark I. Holmes of the United States Geological Survey said that they might have found a naturally occurring gas seepage on the floor of Norton Sound, about 24 miles from Nome.

Mr. Cline said that the possible seepage would not only confirm the richness of the area's natural resources but would also allow scientists to measure the environmental effects of petroleum in Alaskan waters before offshore oil drilling and transportation began.

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# 7.7-Mile Crater Found in Alaska Linked to Meteorite by Geologist

By WALTER SULLIVAN

A study of images transmitted by a Landsat satellite as successive orbits carried it across Alaska has disclosed a heavily fractured bowl 7.7 miles wide that, according to a geologist there, seems to have been caused by the fall of a giant meteorite.

The object, weighing as much as 55 million tons, must have fallen since the latter part of the last ice age (some 100,000 years ago), according to the analysis, presented by P. Jan Cannon of the University of Alaska at Fairbanks in the June 17 issue of *Science*.

In the study, circular features that, it was believed, might have been caused by processes other than impact, such as volcanic activity, were considered ineligible.

On the floor of the bowl, which is 1,600 feet deep, lies a circular two-mile-wide lake, known as Sithylemenkat, meaning "lake in the hills" in Koyukon (one of the Athapaskan languages of the Yukon region).

### Tiny Diamonds Discovered

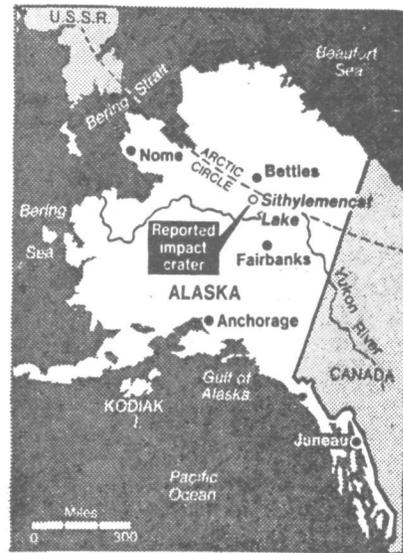
The lake is in the Ray Mountains, midway between the Yukon and Koyukuk Rivers and 55 miles south of Bettles. Efforts to verify the impact origin of the feature have been hampered by its inaccessibility. Surface vehicles could reach it only in winter, when rivers and marshes are frozen and snowcovered—and when there is almost continual darkness.

Elsewhere it has been possible to confirm an impact through the discovery of such telltale features as tiny diamonds, generated from carbon by extreme shock, other shock-generated minerals and conical fracture patterns in the bedrock known as shatter cones.

Landsat images, as well as aerial surveys, have shown a number of vestigial impact craters in recent years, notably in such regions as the high Arctic where there is little vegetation and little burial by sediment. Several have been found in northern Quebec.

Last fall Dr. Robert S. Dietz of the National Oceanic and Atmospheric Administration told how a Landsat image obtained over eastern Siberia had supported the view that El'Gygtgyn Crater there resulted from a meteorite fall.

Because the lake in its center is 550 feet deep, Soviet geologists suspected



The New York Times/June 15, 1977

such an origin, but the lake is irregular in shape. The Landsat image, recorded when snow made the surface uniform in texture, showed a highly circular rim 11 miles in diameter surrounding the lake.

Some years ago it was found that stream samples from the Sithylemenkat region was unusually rich in nickel (as much as 5,000 parts a million). This led to a survey by Alaskan state geologists who found that the high concentrations were in soil and pulverized rock around the basin, yet no parent ore body could be found.

The University of Alaska geologist believes the meteorite to have been the source.

The report on the Alaskan crater suggests that before being filled by erosion of its rim, the crater was 650 feet deeper. Fractures in the rock radiating from the crater's center, as well as features concentric to it are similar to those seen in known impact craters such as the ones at Wells Creek in Tennessee and Meteor Crater in Arizona.

The latter is smaller, being only three-quarters of a mile wide, but is relatively fresh, forming a dramatic scar on the landscape.

Also similar is the Lake Botsumtwi structure in Ghana, six miles wide and 1,600 feet deep. Glassy fragments known as tektites found on the nearby sea floor, some believe, are frozen droplets of molten rock thrown up by that impact.

## Hudson Bay Company Founded Fort Yukon

Alaska's Fort Yukon, population 701, was founded in 1847 as a Hudson's Bay Company trading post on the right bank of the Yukon River at its junction with the Porcupine River.

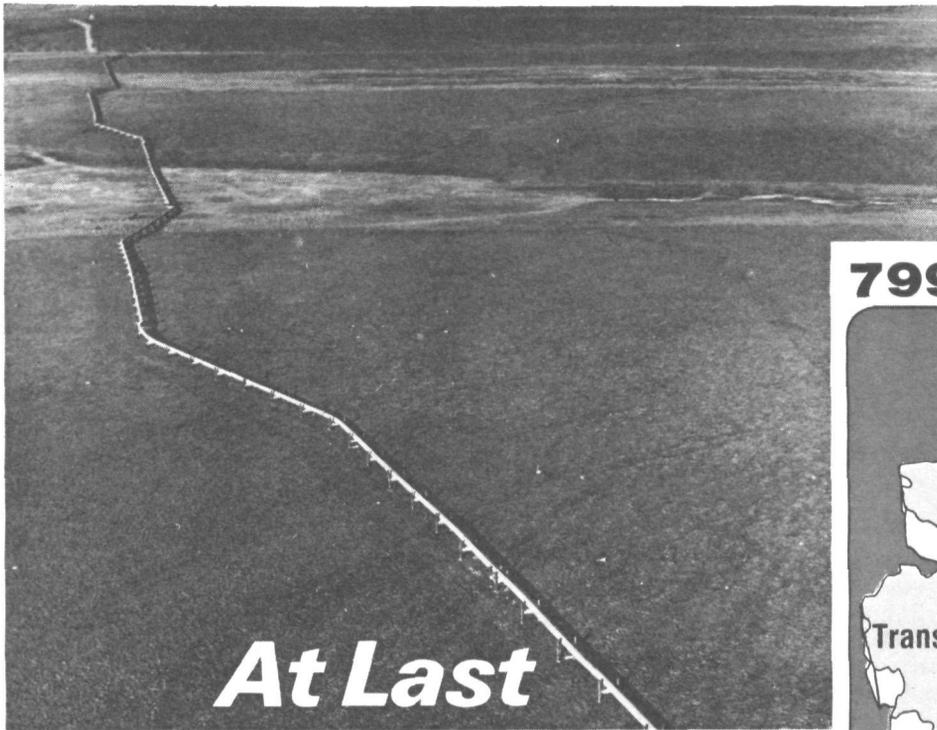
Originally the trading post and the Indian village were located about a mile or two upstream but it moved to

its present location in 1864.

After the purchase of Alaska, it was determined by Capt. C. W. Raymond, U.S. Engineers, that the British trading post was on U.S. territory and the site was soon taken over by Moses Mercier, a trader of the new Alaska Commercial Company.

The village population was 107 in 1880; 189 in 1890; 321 in 1910; 319 in 1920; 304 in 1930; 274 in 1939, and 446 in 1950.

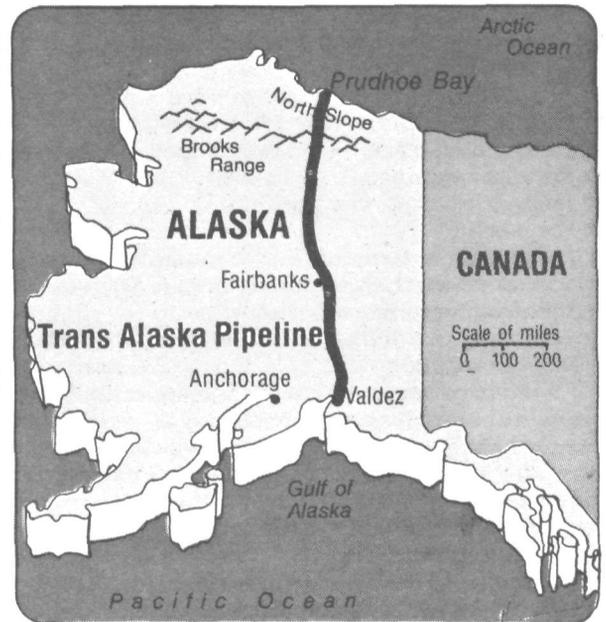
U.S. NEWS &amp; WORLD REPORT, June 20, 1977



*At Last*

# ALASKA'S OIL FLOWS SOUTH

## 799-MILE PIPELINE



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With the long-awaited Alaskan pipeline finally a reality, K. M. Chrysler of the magazine's staff visited the site for this on-the-spot report.

### PRUDHOE BAY, Alaska

America's richest oil treasure, until now lying inaccessible under frozen Arctic tundra, is ready to flow to the fuel-hungry "Lower 48" States—and perhaps to foreign countries as well.

This long-awaited bonanza of oil is at last available with the completion of the controversial, 799-mile trans-Alaskan pipeline. The first oil is to enter the pipe on June 20.

Alaskan oil will not solve this country's energy problems, and it will not be cheap. But it will make a significant contribution by:

- Reversing a decline in domestic oil production that began in 1970 and has worsened steadily.
- Saving the U.S. more than 17 million dollars a day that otherwise would have been spent on foreign-oil purchases. At the current world price of \$14.50 per barrel, that adds up to more than 6.3 billion a year.
- Reducing U.S. vulnerability to another oil embargo. By next September, when capacity is reached, 1.2 million

barrels of oil daily will be flowing down the pipeline. Although that represents only 10 per cent of domestic consumption, it is equal to almost half the shortage that created lines at gasoline pumps during the 1973 Arab oil embargo.

For almost a decade while the country's energy problems worsened, petroleum from the largest field ever discovered in North America has remained unavailable, awaiting completion of the pipeline.

Now, production from the Prudhoe field will begin flowing through the 7.7-billion-dollar pipeline from here to Valdez, an ice-free port 799 miles to the south on the Gulf of Alaska.

From Valdez, giant tankers will transport the oil. Most will go to ports in Washington State and California. Some will be carried through the Panama Canal to refineries on the Gulf Coast. Also under serious study is a plan to ship some of the oil to Japan. Details are described on page 38.

Prudhoe Bay oil will produce a gusher of tax and royalty money for the State of Alaska. Oil is expected to flow through the pipeline for at least 25 years. By 1985, it will be yielding 1 billion dollars annually to the State.

**Oil strike.** The saga of the pipeline began in 1968 when "wildcatters" struck oil on the North Slope of the Brooks Mountain Range. Geologists estimate that the field contains at least 9.6

billion barrels of oil and 26 trillion cubic feet of natural gas.

Development of the field and construction of the pipeline have challenged to the utmost the ingenuity and the pocketbooks of the petroleum industry. Its builders claim that the pipeline is the largest privately financed construction project in history and the single largest construction job since the digging of the Panama Canal.

**Nature's hostility.** Few parts of the world are less hospitable to man and machine than the North Slope, which lies 270 miles north of the Arctic Circle. Stretching to the horizon in all directions is the tundra—flat, treeless and frozen to a depth of 2,000 feet. Temperatures range from a high of 90 degrees on a few summer days to a metal-snapping 80 degrees below zero during the long winter darkness.

More than 110 wells have been punched in this forbidding terrain since 1968. But wells without a pipeline are little more than statistics. The oil must stay in the ground until there is some way to transport it.

Because of a series of delays caused by the land claims of Alaskan natives and suits filed by environmental groups, construction on the pipeline did not begin until 1974.

"That delay, on balance, was good," says a leading Alaskan environmentalist. "We have a far safer pipeline now, in

## ALASKA'S OIL

[continued from preceding page]

one of the most fragile environments you can find."

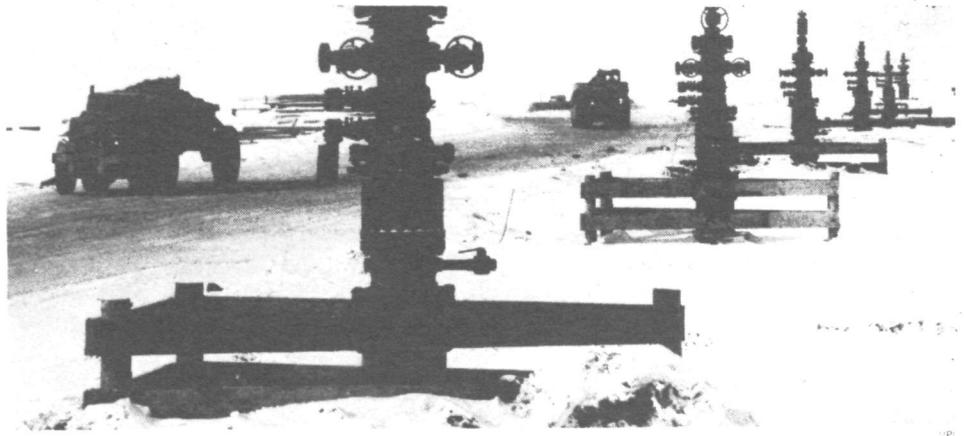
To get from Prudhoe Bay to Valdez, the 48-inch-diameter pipeline crosses three mountain ranges and 20 major rivers, cutting through the habitats of caribou, moose, bear and countless species of birds.

"We didn't fully appreciate what we were getting into," says Peter DeMay, construction chief of Alyeska Pipeline Service Company, the consortium formed by eight oil companies to build the pipeline.

To cushion earthquakes, for example, special joints at three locations permit the pipeline to move horizontally up to 20 feet and vertically up to 20 feet without snapping.

**Avoiding disaster.** Only 345 miles could be buried conventionally in a trench. More than half the line is elevated so that hot oil—above 90 degrees for most of the trip south—does not thaw the permafrost and create an environmental catastrophe.

Other problems aside from temperature and terrain included parts shortages, equipment breakdowns and substandard construction work.



Drilled, capped and ready, more than 110 wells on Alaska's North Shore have been waiting, some for as long as nine years, for a pipeline to carry their oil to civilization.

A year ago, nearly 4,000 welding irregularities were discovered. It took between 30 and 40 million dollars to put things right again.

Alyeska engineers say that the pipeline is the strongest and safest ever built. Environmentalists, on the other hand, are not yet convinced. Says Jack Hession of the Sierra Club in Anchorage: "How can they be so sure of untested technology? Empty line has popped out of stream beds and off supports. This is one grand experiment."

A report from the Senate Judiciary Committee on June 8 warned that the pipeline is highly vulnerable to sabotage or terrorist attacks.

Controversy clouds the cost of the project, too.

The original estimate of 900 million dollars soared to 7.7 billion. Interest on money borrowed to build the line is expected to add another 2.2 billion. The total cost is 1,400 times more than the United States paid Russia for the purchase of Alaska in 1867.

Much of the startling difference between original estimates and final figures resulted from major design changes, including doubling the capacity. One expert calculates that added environmental safeguards alone tripled

## ALL ABOUT THE PIPELINE Its Design . . . Cost . . . Risks

INTERVIEW WITH EDWARD L. PATTON,  
CHAIRMAN, ALYESKA PIPELINE SERVICE COMPANY



**What happens if the line breaks when the temperature is 50 degrees below zero? Will caribou coexist peacefully with it? The man who guided the system to completion answers these and other basic questions.**

**Q** Mr. Patton, what is the timetable for getting Alaskan oil to U.S. consumers?

**A** Oil will start down the pipeline around June 20 at a rate of 300,000 barrels a day. The line holds 9 million barrels, so it will take 30 days to reach Valdez. When the oil reaches Valdez around the first of August, we will increase the rate to 600,000 barrels per day.

When the remaining storage at Valdez is completed, we will increase the rate to 1.2 million barrels per day, which is our designed capacity, in September.

**Q** Is there any chance of a last-minute hitch that might delay your schedule?

**A** We anticipate the usual mechanical problems, but we are trying to get those "glitches" out by testing the equipment extensively before we actually start up. But inevitably, there are going to be some problems.

**Q** Have all the so-called bad welds been repaired?

**A** All have been repaired. Most of the "defects" were cosmetic in the first place.

**Q** What happens if the pipeline breaks?

**A** We'll shut it down, of course. A controller simply pushes a button, and our supervisory-control system shuts the line down at both ends. It would take about 10 minutes. The average draining which could occur, say, from a theoretical weld rupture would be 15,000 barrels. The maximum spill which would occur after shutting down would be 50,000 barrels—and that can occur in less than 1/2 of 1 per cent of the line's length.

**Q** What happens if you shut down when it's 50 degrees below zero? Would the oil in the line freeze solid?

**A** No. It's not going to freeze hard like a candle, but it can get to a jellylike consistency. The probability of such a thing happening is very small.

the price. For example, the only secondary sewage-disposal plants in all of Alaska were located at the major Alyeska construction camps.

Many Alaskans are convinced that the oil companies were not really concerned about the cost of the pipeline, confident that they could pass on extra costs to consumers.

Says a Fairbanks businessman: "They didn't negotiate wage rates very hard but just accepted outrageous demands in return for no-strike promises from the unions."

**Record wages.** Oil-industry spokesmen deny such charges but concede that wages along the pipeline were among the highest in the world. By 1977, a ditch digger was getting \$13.10 an hour, plus time and a half for more than 40 hours a week. Skilled workers earned much more. For a workweek that often ran 84 hours or more, wages ranged from \$1,400 to nearly \$2,000, plus free room, board and recreational facilities.

One of the biggest winners from this pipeline extravaganza was the Internal Revenue Service, a fact that caused workers, such as a father and three sons with combined earnings of more than \$6,000 a week, to search for tax shelters as eagerly as any millionaire.

A less-publicized aspect of the pipe-

line project was the presence of women, who made up about 10 per cent of the work force. Ponytails and hair curlers in remote construction camps unnerved some veteran construction workers but most adjusted to the fact of equal work and pay for women.

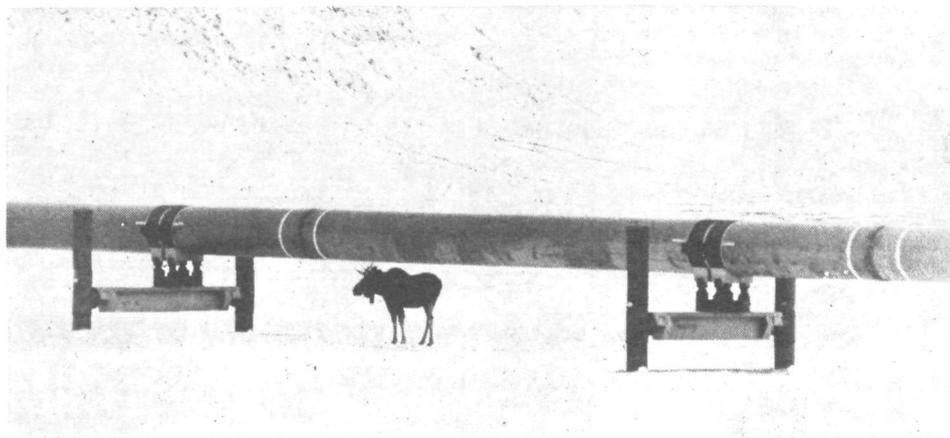
Now that the pipeline is completed, native Alaskans are hoping that life in the 49th State will regain some normalcy. In Fairbanks, a popular bumper sticker reflects the prevailing attitude with this hope:

"Happiness is 10,000 Okies going south with a Texan under each arm."

**Good and bad.** Pipeline construction produced many benefits for Alaska, but it also disrupted the economy and the frontierlike life styles that have attracted many residents to settle in the State.

Most citizens in Fairbanks and Valdez, the two cities that bore the brunt of the pipeline boom, feel that the good far outweighs the bad.

Oil money has built new schools, shopping centers and housing. Fairbanks, for



ALYESKA PIPELINE SERVICE COMPANY

For more than half the line's distance, the 48-inch pipe is above ground to prevent thawing the permafrost. Pipeline officials say that the region's wildlife has adapted.

**Q** A recent report claimed the pipeline is vulnerable to sabotage, particularly during the long period of Arctic darkness. Is safety a real problem?

**A** Vandalism is always a problem. But the key, or critical, installations are protected.

**Q** What is the principal environmental complaint that persists?

**A** The biggest hassle is whether or not the animal crossings are adequate. We provided about 400 animal crossings, either by elevating aboveground pipe to provide 10 feet of clearance or by dipping the pipe into the ground.

**Q** Has anyone noticed any difference in migratory patterns along the pipeline?

**A** There's been no change in the migration patterns. Studies indicate that moose and caribou will cross the pipeline any place they get 4 or 5 feet of clearance.

**Q** What's going to be the final cost of the project?

**A** Around 7.7 billion dollars. The original guesstimate was 900 million dollars. A lot of things have happened since then. We had a four-year delay that added 3.2 billion to the cost. The capacity of the line was increased from 500,000 to 1.2 million barrels a day, and that added another 700 million. About 220 million in State ad valorem property taxes have been added since the original estimate. About 350 million on the haul road was not in the original estimate. Additional environmental safeguards also boosted the cost—175 million for a vapor-recovery system and about 140 million for water treating at Valdez.

**Q** Questions have been raised about whether costs were held down sufficiently—

**A** A member of a General Accounting Office team sent to Alaska to study the project told us that the difference between our 1974 estimate and the final cost amounts to a 29

per cent increase in costs. This GAO fellow told us that, in the same time frame, the average federal project increased by 43 per cent. He didn't see what the uproar was about.

**Q** There were reports of staggering losses from theft during construction, as high as a billion dollars—

**A** Actual losses amounted to \$850,000. If someone had stolen a billion dollars, it would have been more than all of our camps and construction equipment—with the mainline pipe thrown in. That's a silly number.

And after you steal something in Alaska, what are you going to do with it? It's hard to get out without detection. The only other thing is to use it yourself. And the most popular item for thievery has been heated portable toilets. People with fishing and hunting cabins made off with quite a few of them.

**Q** The pipeline was delayed for four years—a period in which Alaskan oil was very much needed. Who is to blame for this long delay?

**A** First, the native-claims problem had to be settled by Congress, and that accounted for a year of delay. Right behind that you had the National Environmental Policy Act, which environmental groups used to win an injunction against the start of construction.

**Q** Did industry make any mistakes?

**A** In the sense that we should have done a lot more geotechnical studies before we even talked about the project—yes, that should have been done. But a lot of things that are required today didn't seem necessary in those days.

The Alaskan pipeline represents the greatest single leap forward in the art of environmental preservation and protection—but at considerable cost, and the country is going to have to pay more attention to the ratio of benefits versus cost in the future.

## ALASKA'S OIL

[Continued from preceding page]

instance, now has grocery, hardware and drugstore chains that are producing greater price competition. Valdez is preparing to build new schools and an elaborate indoor recreation center. There are reports that many native Alaskans are moving out of their old homes into the newer, more-modern housing that was left behind by construction workers.

Even though most of the 22,000 workers employed at peak construction have departed the State, economists assert that the end of the boom will not produce any disastrous business downturn. They are talking about a "postpipeline plateau."

One reason for the lack of concern: A solid bureaucratic base of federal, State and local government employees will still

provide 4 out of 10 jobs in Alaska. Also, much of the money spent on the pipeline flowed straight through Alaska back to the "Lower 48" States.

**Beyond the pipeline.** Economists point out that the production of Alaskan oil made possible by the pipeline will give the State a steadier flow of income than that derived from the project's construction. The 1 billion dollars a year that the State will get from royalties, taxes and other oil-related revenues is seen as only the beginning.

Exploration so far has been limited to only two of the State's 14 sedimentary basins that might contain oil. The huge natural-gas reserves discovered at Prudhoe Bay are yet untapped.

Three separate combines of companies are competing for the right to build a pipeline to carry Alaskan gas to the "Lower 48" States, a project that will take at least three years to complete.

Says an Anchorage banker: "Virtually all businessmen here are looking beyond the oil pipeline to gas. There will soon be another pipeline, new royalties and more revenue."

In this atmosphere of new prosperity, old-timers who long for the quiet, unspoiled Alaska are becoming a vanishing breed. The State's population has jumped 50 per cent in the past 10 years, and newcomers, many of whom do not share traditional Alaskan viewpoints, now hold the balance of power.

Even so, most Alaskans realize that the pipeline has left an indelible imprint on Alaskan society that is just as visible as the steel and concrete structure snaking its way across the landscape. And they understand the poignancy behind another popular bumper sticker that reads:

"Alaska resident—last of endangered species."

## AFTER VALDEZ: THE PROBLEMS MAY BE JUST STARTING

Even as the first drop of oil enters the Alaskan pipeline, a controversy is brewing over how to move Alaskan crude to U.S. refineries once it is loaded onto tankers at Valdez.

Unless a solution is found quickly, the U.S. may be forced to export oil to Japan to prevent a glut on the West Coast. Politicians warn, however, that exporting may prove untenable to a nation now grappling with a serious energy problem and currently paying out around 41 billion dollars yearly to foreign oil producers.

Simply put, the problem is this: Most existing West Coast refineries are not equipped to process the type of oil that will be coming from Alaska—crude with a high sulphur content. As a result, 400,000 to 600,000 barrels of oil daily—up to half of the pipeline's daily flow—could end up as surplus.

Oil tanker in Valdez harbor.



The long-range solution is to refit existing refineries to process high-sulphur crude and build a pipeline linking Pacific ports to Midwest and Gulf Coast refineries, where shortages of crude are the worst. Several pipeline projects are planned, but all face economic or environmental problems that could delay construction for years.

Until then, the best solution, according to many industry and Government experts, is to trade the surplus to Japan in exchange for Mideastern crude that otherwise would have been shipped to Japan. Since Alaskan crude will be sold at the world price, there would be no difference in cost to United States users. But proponents claim that a swap would save about \$1 a barrel in shipping charges. The Mideast crude, paid for by Japan, would be shipped to the East and Gulf coasts. U.S. buyers, in turn, would reimburse the Alaskan producers.

**Politics of swapping.** The proposal faces formidable political obstacles. A trade with Japan would require congressional and White House approval. Senator Henry Jackson (Dem.), of Washington, cosponsor of the law that made the Alaska pipeline possible, says that such a complicated deal would be "difficult to explain to the American people at a time when the Government is asking them to sacrifice to reduce U.S. oil imports."

Another solution is to transport Alaskan oil down the Pacific Coast to the mouth of the Panama Canal. There, the oil would be transferred to smaller ships capable of navigating the Canal.

The oil would then go to refineries on the Gulf Coast.

Sending large tankers all the way around the tip of South America is not considered feasible because of the tremendous cost.

While building new refineries or refitting existing ones would alleviate the problem, most experts say that the best long-range solution is to build a pipeline from the West Coast to the middle of the country, where most refineries are located and where crude shortages are most severe.

**Sohio's solution.** The pipeline proposal that has attracted the most attention is a 1,000-mile California-to-Texas project that would employ an existing but unused natural-gas pipeline. Standard Oil Company of Ohio (Sohio), a major producer in Alaska, plans to build a pipeline from Long Beach, Calif., where tankers would unload, to the Arizona border. There, it would link up with an existing but idle natural-gas pipeline that runs to Midland, Tex., where the oil would be transferred to pipelines to refineries in the Midwest and on the Gulf Coast.

Sohio's proposal would cost around 500 million dollars. A major roadblock is the environmentalists' complaint that oil vapors from unloading tankers at Long Beach would increase air pollution there.

The problems involved in all of these proposals makes this certain: Completion of the trans-Alaskan pipeline has not ended the controversy surrounding efforts to exploit the State's vast oil wealth.

# Eskimos, 'United' by Alaska Meeting, to Press Claims

The New York Times

OTTAWA, June 25—Eskimos of Canada, Alaska and Greenland, fresh from their first international conference, are preparing to press a series of demands upon their respective government ranging from land claims to political recognition.

Canadian delegates, back at their Ottawa headquarters, feel that the meeting in Barrow, Alaska, and the identity of views established there, have strengthened the Eskimo cause.

"Being united now, definitely we will have more political clout," said Michael Amarook, of Baker Lake, Northwest Territories, the president of the Eskimo Brotherhood of Canada.

Mr. Amarook said he hardly expected the Eskimo community and its sympathizers, who include environmentalist groups, to become a force in government overnight. In such important matters as driving a pipeline through the Arctic, which the Canadian Government wants

but to which the Eskimos object, "the Government probably will do as it pleases," he said.

The Eskimo Brotherhood estimates that there are 46,000 Eskimos in Greenland, 22,000 in Canada, and 39,000 in Alaska, including such allied groups as the Aleuts. There were also 1,300 in Siberia, according to the 1970 census. They were unrepresented at the Barrow conference, although an invitation had been extended through the Soviet Embassy in Washington.

A permanent international committee of Eskimos called the Inuit Circumpolar Assembly, now in formation along lines discussed at Barrow, will seek affiliation at the United Nations as a nongovernmental organization, said Eric Tagoona, also of Baker Lake. "Inuit," meaning "the people," is the term by which Eskimos prefer to call themselves. The term "Eskimo" is a Cree Indian word meaning "eaters of raw meat."

Resolutions adopted at Barrow are concerned mainly with preserving the culture of the Eskimos, many of whom earn their livelihood in the traditional way by hunting, fishing and trapping. Western influence has often been corrosive, introducing alcoholism and other ills, though also producing leaders like Mr. Armarook and Eben Hopson, the Eskimo Mayor of North Slope Borough, a section of Alaska that includes the town of Barrow.

"The Inuit of Greenland, Alaska and Canada are one indivisible people with a common language, culture, environment and concerns," said a keynote statement setting forth the objectives of the conference.

Another resolution demanded that the three governments concerned permit "free and unrestricted movement" for Eskimos in the Arctic without obstruction by national frontiers of recent origin in the long span of Eskimo history.

## Key Issue Is Resolved On Greenland Home Rule

GODTHAAB, Greenland, June 20 (Reuters)—A commission trying to work out a home-rule constitution for the Danish territory of Greenland said today that it had reached a compromise agreement on the key issue of who should control the rights to its natural resources.

A spokesman for the commission, which is made up of Danes and Greenlanders, said the formula was reached after two days of stormy debate. Greenland is expected to gain home rule in two years.

The formula says that "the permanent population of Greenland has fundamental rights to the (nonliving) natural resources of Greenland and that, by law, investigation, prospecting and exploitation of these resources should be undertaken in accordance with agreements between the Danish Government and the provincial council."

Greenlanders are expected to vote in late 1978 or early 1979 on whether they want home rule. If they vote that they do, the provincial council will become the territory's government.

## Greenland Supports Bible Translation

Reuter

GODTHAAB, Greenland, May 12—The Greenland Provincial Council has approved a grant for the printing of a new Eskimo translation of the Old Testament, it was announced here today.

The Danish Bible Society earlier granted about \$70,000 to translate the Bible to Greenlandic, the eastern dialect of the Eskimo tongue. An older translation is thought to have become linguistically archaic.

## BEAUFORT SEA DRILLING IS CLEARED BY CANADA

OTTAWA, June 1—Overriding the objections of environmentalists, the Canadian Government authorized today offshore exploratory drilling for oil and natural gas in the Beaufort Sea for the next three years.

However, the sensitive operations will be carried out under more stringent monitoring than before and will be reviewed by the Government at the end of each season's drilling before permission is granted to continue the next year.

Dome Petroleum Ltd. of Calgary, the company that has been conducting the Beaufort Sea drilling through a subsidiary, Canadian Marine Drilling Ltd., has estimated that the offshore reservoirs in the area hold up to 40 billion barrels of oil and 320 trillion cubic feet of natural gas.

The drilling, started last year, is carried out from specially equipped ships on three sites North and East of the Mackenzie River delta, in the Northwest Territories, a Federally administered area covering most of the Canadian Arctic. "The Government belief that the risks of drilling are low enough to be acceptable and, balanced with the need to confirm Canada's energy resources, justify continuing the exploration," Warren Allmand, Cabinet minister, declared in announcing the decision.

## Heat Defeats Polar Expedition

LONDON, May 26 (Reuters)—A British North Pole expedition of four men and two women has withdrawn from the polar ice cap because of exceptionally hot weather after coming within 170 miles of the pole, its organizers said today. They said the expedition had to be abandoned because of the unusually early ice breakup, caused by record high temperatures for May.

## Alaska Team Will Go to Siberia To Study Management of Reindeer

ANCHORAGE, May 28 (AP)—A six-man team of Alaska natives, accompanied by American scientists, will spend a month in Siberia this summer studying reindeer and caribou management alongside natives of Siberia and Soviet scientists in the communities of Norilsk and Yakutsk.

The NANA Regional Corporation, which represents Alaska native interests, proposed the trip after Soviet reindeer specialists visited Alaska in 1975. It was authorized under a 1972 environmental agreement between the two countries.

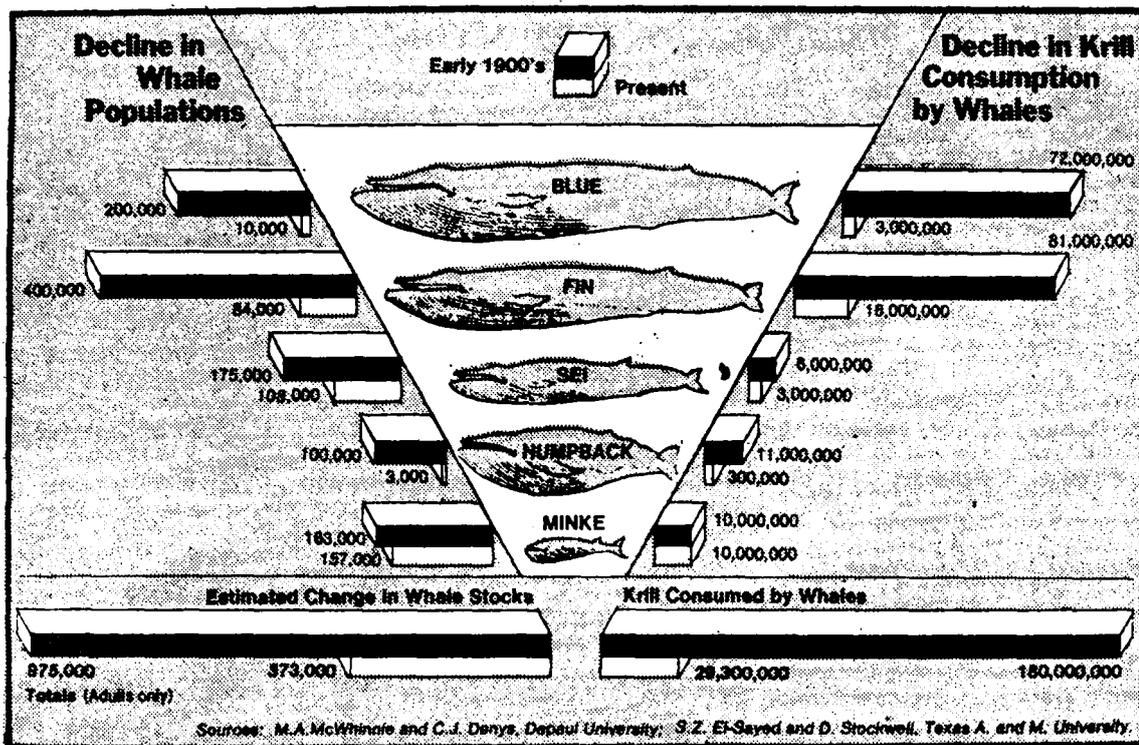
Senator Mike Gravel, Democrat of Alaska, who acted as liaison between the corporation and the Departments of State and Interior, announced approval of the trip. He said that the Soviet Union had been applying modern techniques to reindeer and caribou management.

"These are important subsistence staples for natives in Siberia, just as they are in Alaska," he added. "There is no question that Alaska natives can benefit from studying the approach."

## University Gets Extra Fish Fund

SEATTLE (AP) — The University of Washington has received a \$587,000 shot-in-the-arm to continue research on the impact of oil on sea ice and for studies of fish and ocean plant life in the Gulf of Alaska and Arctic waters.

The National Oceanic and Atmospheric Administration contract is part of a major environmental study by the U.S. Department of Commerce to determine the impact of oil exploration on Alaska's outer continental shelf.



# Scientist Compares Crystals

**Anchorage Times**  
**BARROW** - The Arctic and Antarctic are the only two regions on earth conducive to ice crystal precipitation. And although a world apart, the crystals have almost identical characteristics. This phenomenon currently is being studied in Barrow by Dr. Takeshi Ohtake of the Geophysical Institute at the University of Alaska.

Ohtake says there are only two kinds of ice crystals those formed in clouds and those from "invisible" clouds formed out of the air in a cloudless sky. While both types occur in the Antarctic, only the latter occurs in the Arctic. The crystals can only be observed from mid-March to mid-April, says Ohtake.

In Barrow ice crystals form approximately 1,550 yards from the ground and are an average of 30 microns in diameter, the same size as "cloudless" crystals in the Antarctic. The Arctic crystal's concentration has been measured at a maximum of 100 particles per .908 quarts.

# Lemmings Are Studied

**Anchorage Times**  
**BARROW** Lemmings are one of the amazing creatures of the arctic and two students are conducting investigations to find out just how amazing these active creatures are.

Sarah Campbell, a University of Alaska graduate student working on her master's, and Dr. Tim Casey, postdoctoral fellow, are studying lemmings at the Naval Arctic Research Laboratory in Barrow.

Ms. Campbell is observing the animals in the field and laboratory to determine the energy costs involved in raising and maintaining baby brown lemmings, one of the main factors in quantifying population size. She will correlate her observations with weather data from last winter and attempt to make inferences about the lemmings' subnivian environment in the winter.

# Fur Seal Faces New Threat To Food Supply—Man

By **WALTER SULLIVAN**  
 The New York Times

The catastrophic decline in great whales has freed Antarctic fur seals from their chief competitors for food and led to an estimated doubling of their population every four years.

Wildlife specialists consider the near extinction of the fur seals, followed by protection and explosive repopulation, one of the most remarkable episodes in man's influence on the marine environment. They also see looming on the horizon, however, a new competitor for the now abundant food of both fur seals and great whales.

This competition is in the form of specially designed harvesting ships. And the competition is for krill, a small, shrimplike crustacean whose schools in Antarctic waters become so dense and vast that it may become possible to locate them with earth satellites. They are the chief sustenance of both fur seals and the great whales.

Krill reach two inches in length. For human consumption they are prepared as a paste by the Russians and as a delicacy by the Japanese.

The near extinction of the fur seals took place as hunters tracked down one after another of their breeding grounds and annihilated populations of a million or more for their pelts. The latter were largely traded in Canton, China, for silks and teas.

When in the 1930's the British research ship Discovery visited one of the few surviving rookeries (on Bird Island off South Georgia) only 12 pups could be counted in an estimated population of 100, according to Dr. Richard M. Laws, a leading specialist on marine mammals. Dr. Laws was interviewed in Cambridge, England, last week at the offices of the British Antarctic Survey, which he heads.

By the 1950's, he said, there were "thousands" at Bird Island. The seals have now migrated to the big island of South Georgia, where they

number about 300,000 and they are recolonizing the South Orkneys and South Shetlands.

"They could well reach their former abundance of millions in 15 to 20 years," Dr. Laws said.

The recovery of the great whales—notably the blue whale, believed to be the largest creature ever to have lived on earth—is bound to be much slower, he added. He believes ultimate recovery is "likely" although he says not all specialists share his optimism.

Because so few of the great whales remain it is estimated that close to 150 million tons of additional krill are available for fur seals and penguins (such as the Adelle and chinstrap varieties) and for human consumption.

The consumption of krill by humans could increase the total tonnage of harvests from the sea as much as three-fold. Estimates of the total amount of krill in Antarctic waters range from 800 million to five billion tons.

Estimates of annual harvestable yields range from 50 to 200 million tons whereas the current world fish catch is from 65 to 70 million tons. Japan and the Soviet Union began exploring the potential of Antarctic krill some 15 years ago and more recently Britain, Poland, Taiwan and West Germany have joined in.

Harvesting to date has been small, with an estimated 30,000 tons taken in 1975, but it is increasing. In addition to its use as food krill products are used as lubricants, vitamins, animal feed and a form of dentifrice.

Competitors for this abundant source of protein, in addition to whales, seals and penguins, include other birds, fish and squid, the latter, in turn, providing food for a variety of penguin and seal species.

In the heyday of sealing, as much as 940 tons of oil was obtained annually from the elephant seals of South Georgia. June 4

# METEORITES FOUND BY ANTARCTIC TEAM

Discoveries by Three Geologists  
Confirm a Hunch That Some  
Had Called Farfetched

By WALTER SULLIVAN

Feb. 18

Ignoring the ridicule of scientists who said their mission was futile, two American geologists and a Japanese colleague, aided by sharp-eyed helicopter crewmen, have discovered a bonanza of meteorites sitting atop the The Antarctic ice sheet.

The finds, confirming a seemingly far-fetched hunch, have demonstrated that the flowing ice sheet of Antarctica is an efficient collector and assembler of stones and chunks of iron that have fallen from the sky over a large area during many centuries.

Further searches on the continent at the bottom of the world should greatly enlarge the collections of such objects, whose composition carries the record of many past events in evolution of the solar system.

In recent weeks the group found 11 meteorites, one of which, when it fell, was a stone weighing at least 900 pounds. It is one of the largest stony meteorites ever discovered.

The finds were made where ice flowing off the Antarctic continent has been stalled by intruding mountains west of McMurdo Sound. That such a situation might produce an accumulation of meteorites had been hinted by the recent Japanese discovery of roughly 1,000 meteoritic fragments resting on blue ice dammed up by the Yamato Mountains on the opposite side of Antarctica.

## Origin of Proposal

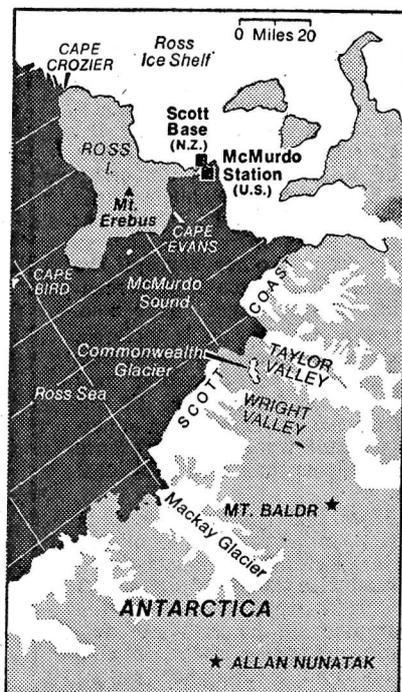
This led Dr. William Cassidy of the University of Pittsburgh and Dr. Edward J. Olsen of the Field Museum of Natural History in Chicago to propose a search where similar situations were presumed to exist west of McMurdo Sound.

Dr. Olsen hopes it will be possible to estimate how long ago each specimen fell.

The two American geologists were joined in their search by Dr. Keiso Yanai of the Japanese Institute of Polar Studies in Tokyo. Dr. Yanai had taken part in the meteorite hunt near the Yamato Mountains. In the last two months heli-

Little credence was given to the proposition that the Japanese meteorites had been picked up over centuries or millenniums during the slow flow of ice across Antarctica and had then accumulated near the mountains much as driftwood in a river piles up against a bridge pier. If so, it was asked, why had such an accumulation not been seen elsewhere?

Now the hypothesis seems to have been confirmed, opening up the possibility that other collections can be found where similar conditions exist in many parts of Antarctica. Dr. Brian Mason, meteorite specialist at the Smithsonian Institution in Washington, said yesterday that



wind was probably a critical factor in exposing the meteorites to view.

Cold air flows off the inland plateau in this region like water flowing over a great waterfall, blowing almost constantly and with devastating force. This copter missions from the McMurdo base repeatedly carried the meteorite hunters past the coastal mountains in search of blue ice like that near the Yamato Mountains.

On one of them, with Dr. Yanai and this writer aboard, several such areas were found where ice, flowing from the hinterland plateau, first meets the mountains, poking only their summits through the ice as "nunataks."

The savage winds of the area had swept away all snow and névé—the compacted intermediate state between snow and glacier ice—leaving only hard blue ice beneath. In the clear air several square miles of it could be scanned at a glance and no black specks were in evidence.

Some time later, as reported yesterday by Dr. Olsen, who has just returned, they had landed near Mount Baldr alongside Wright Upper Glacier to select a camp site and a black object was spotted on the ice. Soon another was found, but then five weeks of futile search followed, most of it on foot.

As Dr. Olsen put it in a telephone interview, they were about to "fold up and go home" when one of the pilots suggested looking in an area farther north, near Allen Nunatak, where, he said, there were "miles and miles and miles of blue ice."

With "four or five pairs of eyes" peering out different windows, as they skimmed over the ice, Dr. Olsen reported, someone spotted a black rock "right in the middle of nothing." Within minutes four had been found (one broken into three pieces). Later, in a span of 15 minutes, another four were spotted.

Finally, in flight, a crewman spotted what he proposed was a moraine—rocks bulldozed into a ridge by glacial action. The geologists, however, know that such a feature could not exist on top of the inland ice, which in this area may have been 1,000 feet thick.

NOW IN THE NORTH

# Mountain Named for Dr. Patty

A 4,625-foot mountain in interior Alaska has been named for the late Dr. Ernest N. Patty, third president of the University of Alaska.

The mountain is near 4,305-foot Mount Kathryn—named for Patty's first wife who died in 1961.

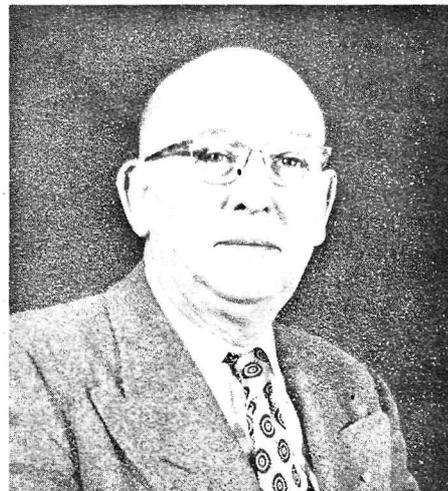
The University had proposed naming a mountain in Alaska for Patty following his death last year in Seattle, where he had lived since retiring from the University in 1960.

The executive secretary of the U.S. Board on Geographic Names informed the University this month that the board had approved the name Mount Ernest Patty for the interior peak, some 130 miles east northeast of Fairbanks near Woodchopper Creek and the Yukon River, an area where Patty had mined extensively.

Patty, 81 at the time of his death, was a mining engineer by profession. He had spent some 40 years in the North, directing mining operations and helping to pioneer and develop Alaska's public system of higher education.

He was one of the original six faculty members when the Alaska Agricultural College and School of Mines, forerunner of the University, opened its doors in 1922 to six students.

His many years in the North are described in his book, *North Country Challenge*, published in 1969.



Patty

# 19 Countries to Discuss Antarctic Resources

## Treaty Isolates Continent From Rivalries—7 Nations Claim Slices of Region

By WALTER SULLIVAN

Negotiations to be conducted in the coming months may well determine the fate of the world's last unexploited continent—Antarctica. At stake are its mineral deposits and, of more immediate concern, its offshore food and fuel resources.

The 19 governments that will participate—at least 12 of them with full voting rights—seem unified in their resolve to preserve the landmark treaty that they signed in 1959 and that for more than 17 years, has largely isolated Antarctica from national rivalries.

This was achieved despite the fact that seven of the signatories claim slices of the continent, three of which overlap. The treaty, achieved after prolonged negotiation, has enabled the continent to serve as a theater of cooperative research into world weather, ice age causes and many other fields.

Originally the claims issues could be shelved because there seemed no early prospect of exploitation, but now the world has changed. Fuel and some minerals are increasingly in short supply.

### Oil and Gas Reserves

Three holes drilled beneath the Ross Sea, off the Antarctic coast, have produced whiffs of natural gas. The United States Geological Survey has estimated oil and gas reserves on the continental shelves of Antarctic to be comparable to those of the United States.

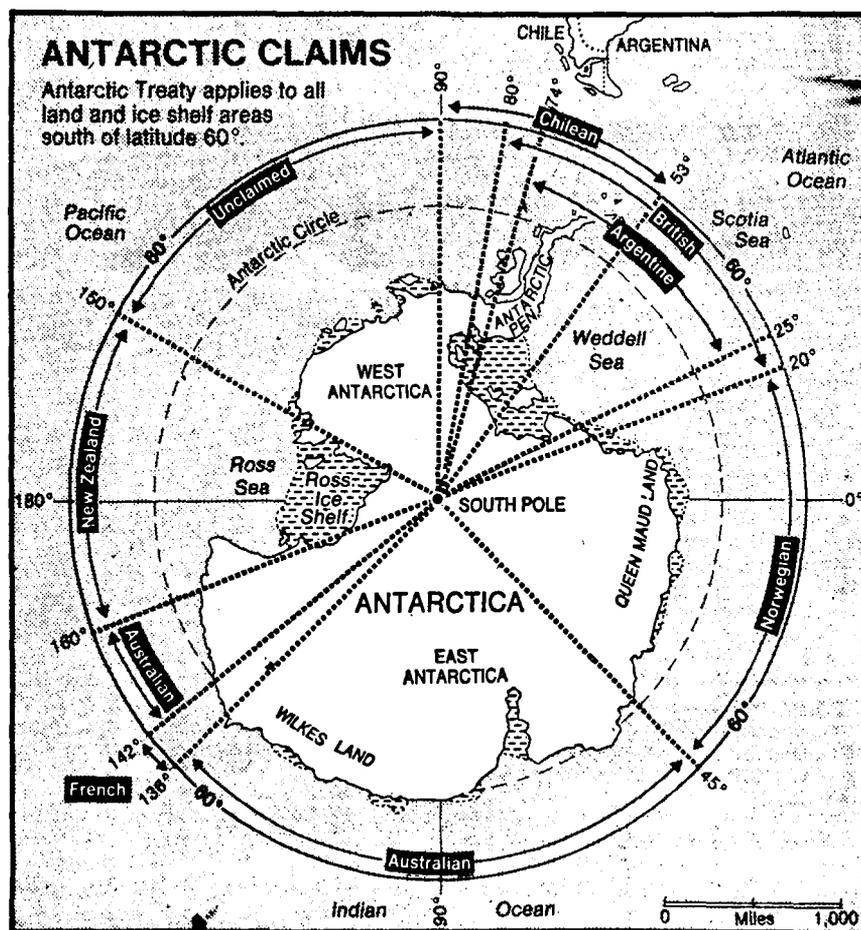
Drifting icebergs of mammoth dimensions and deep water would hamper oil extraction, but a number of oil companies in the United States and elsewhere have already inquired about the legal implications of exploration there.

Even more pressing, for international resolution, is the exploitation of krill—the tiny shrimp that abound in Antarctic waters. One swarm may amount to several tons, tinting the ocean pink in a manner that appears evident in satellite images.

Japan, Poland, the Soviet Union and Taiwan are among those who have begun harvesting the krill, used both for human and livestock consumption. While they were formerly consumed in great quantity by blue whales, those monsters of the deep have been so depleted that krill now abound. Their vulnerability to overexploitation is, however, unknown.

### Military Activity Barred

The Antarctic Treaty was a revolutionary step in that it outlawed military activity from an entire continent and provided for unrestricted inspection of all installations there. To establish this precedent as firmly as possible the United States repeatedly has sent "observers" to visit, unannounced, the stations of other



The New York Times/Jan. 17, 1977.

participants in Antarctic research including those of the Soviet Union.

In approaching the thorny problems of claims and resource exploitation the United States and the Soviet Union find themselves in much the same position—as they did during the long treaty talks.

Each has carried out far more Antarctic research and exploration than any of the claimants. Each says it recognizes none of the claims and reserves the right to make a claim at some future time.

The treaty provides that every two years there be a "consultative meeting" to review problems relating to its provisions. The last was held in Oslo in 1975 and the next will be in London next September. A preparatory meeting was held in Paris last July and another is planned for London in March.

### Original Signatories

The original signatories consisted of the seven claimants (Argentina, Australia, Britain, Chile, France, New Zealand and Norway) plus the others then active in research there (Belgium, Japan, South Africa, the Soviet Union and the United States).

Seven more have adhered to the treaty: Poland, in 1961, followed by Czechoslovakia, Denmark, the Netherlands, Rumania, East Germany and Brazil. They can acquire voting rights at the meetings if they qualify as active in Antarctic research.

This southern summer (coinciding with the northern winter) and last summer Poland has operated a highly sophisticated research ship in the area to study krill and therefore may apply for voting rights in September.

The treaty provides that substantive decisions must be unanimous. It is this requirement that, in the past, has made for compromise but such unanimity could be imperiled if resource exploitation forces a reopening of the claims question.

The most adamant claimants are Argentina and Chile. Early this month Chile's President Augusto Pinochet left via navy transport ship to visit Chile's three outposts on the Antarctic Peninsula, also claimed by Argentina and Britain.

Before she was deposed last March President Isabel Martinez de Peron of Argentina reportedly flew to the area for a similar reaffirmation of sovereignty only to be turned back by weather. Australia says its claim is "not negotiable." It maintains that statutes applicable to its capital territory, where Canberra lies, also apply in the vast region of Antarctica to the south.

### An Emotional Issue

It is noteworthy that the only delegates at the 1975 meeting who mentioned their claims during introductory speeches were those of Argentina and Chile. Over the past two or three decades a certain amount of drumbeating by politicians and the press in those countries has helped keep the subject an emotional issue.

# Scientists at Pole Run For Fun at 100° Below

By WALTER SULLIVAN

The New York Times

In recent interviews New Zealand officials indicated more flexibility regarding claims than did officials in Australia. New Zealand, however, hopes the claimants will receive some form of preferential treatment.

The border between the New Zealand and Australian claims almost the region, west of McMurdo Sound, where American and West German geologists in recent weeks have been looking for uranium. The rival Argentine, British and Chilean claims all include the Antarctic Peninsula, a geologic continuation of the mineral-rich Andes.

However, to the relief of policy makers in Washington and elsewhere, no highly tempting mineral resource has yet been found.

The report of the Oslo meeting says that all participants "urge states and persons to refrain from actions of commercial exploration and exploitation" while they seek "timely agreed solutions to the problems raised by the possible presence of valuable mineral resources in the Antarctic Treaty Area."

The latter embraces all lands and ice shelves south of 60 degrees south latitude. While it does not include the "high seas" where whalers have long been active, a supplement to the treaty provides for protection of the region's living resources.

Known as "Agreed Measures for the Conservation of Antarctic Fauna and Flora," this supplement will become fully operative when all 12 original treaty signers ratify it. Four have not yet done so: Australia, Belgium, Japan and the United States, although the United States, for example, is assiduously carrying out its provisions.

## Enforcement a Problem

The reasons for delay arise largely from legal problems of enforcement in regions of uncertain sovereignty and jurisdiction. Who, for example, is to police the penguin rookeries? The Oslo meeting designated a number of them as "specially protected areas" under the Agreed Measures.

Among them is Cape Crozier, the eastern tip of Ross Island, where the British, in 1902 and 1911, were the first to observe an emperor penguin rookery, as made famous in Apsley Cherry-Garrard's book, "The Worst Journey in the World." American helicopter pilots are forbidden to fly over the designated rookeries.

Nor is any vehicle or aircraft permitted in Barwick Valley, an ice-free region with several lakes of special interest. To avoid any contamination of the fragile environment all human waste at research camps in two nearby valleys is preserved and flown out.

Another provision of the Oslo resolutions is that each signatory try to limit tourist visits to "Areas of Special Tourist Interest" and stations for which permission has been granted. According to the State Department in Washington, American tour leaders have been conforming to this policy.

Another pending agreement is the convention for Conservation of Antarctic

SOUTH POLE STATION, Antarctica—Most of those who go south for the winter bask in the sun, play golf and tennis, or swim. But there is a small coterie who go all the way (south), and for them the chief sports are tobogganing down a geodesic dome and sprinting nude to the South Pole.

They are the group of about 20 scientists and supporting personnel who winter at the station maintained by the United States within about 100 yards of the pole.

For them it is 200 miles to the nearest real hill, and so for tobogganing they make use of the giant dome that covers the clustered two-story buildings of their lonely camp. The dome is partly drifted over with snow.

To add zest to their seclusion they have formed a very exclusive club limited to those who, when the temperature first drops to minus 100 degrees Fahrenheit, sprint nude 100 yards to "The Pole," which is spirally striped like the emblem of a barbershop.

Having run 100 yards there and 100 yards back at minus 100 degrees, the sprinters become members of the 300 Club, entitled to all its rights and privileges.

Since it is now summer in the Southern Hemisphere it is "warm"—about 16 below—but summer visitors are allowed to qualify for a lesser honor—membership in the 200 Club (they run the 200-yards round trip but not at

minus 100). They did so recently in brilliant sunshine—the sun does not set until autumn—having emerged damp from the camp sauna.

It was a very different race to the pole from that of the heroic era of polar exploration 65 years ago, when Roald Amundsen and his Norwegian companions reached here a month before Robert F. Scott's team did so, doomed to perish on their return march.

Today Antarctica is the theater of a multination, cooperative effort at research into climate change and other phenomena of mutual concern. Flags of the participants encircle the symbolic "South Pole" that serves as the goal of the frigid dash.

By the time the sprinters return to scurry under the entrance sign that reads "United States Welcomes You To The South Pole" they usually are clutching towels around their waists and the hair on their backs is hoary with frost. But a warm welcome awaits them in the sauna, followed by stimulating refreshment in the station clubroom.

The clubroom harbors the only penguin to have reached this far inland. Named Jonathan Livingston Penguin, it adorns a giant poster, smokes a hookah and declaims, bleary-eyed, "Who says penguins can't fly." The bartender was apologetic. "I'm afraid," he said, "we are a bit short on ice."

Seals, which would authorize the harvesting of certain species in designated areas under a quota system. This was ratified by the United States last month, bringing to five the number of nations that have done so. Seven are needed to bring it into force.

The manner in which the convention would operate was demonstrated at the American and New Zealand McMurdo Sound bases last month. Physicians from Boston's Massachusetts General Hospital were studying the nostril-closing effect of deep-diving Weddell seals for possible clues to "crib deaths" that mysteriously kill many infants.

At the same time the New Zealanders needed seals to feed their dogteams. A limit of 50 had been set on the number of seals that could be taken in the area so the Boston doctors caught the seals and then, after their experiments, turned them over to the New Zealanders.

If the treaty countries are unable to reach agreement on the resources issue it could be brought before the full membership of the United Nations. In view of the prolonged difficulties within that forum in seeking agreement on seabed exploitation there is pressure on the treaty countries to move ahead on their own.

There also appears to be wide conviction among them that whatever machinery is established for exploitation it must make provision for nontreaty na-

tions, notably the emerging countries of the third world that regard resources of Antarctica as the heritage of all mankind.

Some, and perhaps many, of the prospective negotiators doubt that a full settlement can be achieved this year. More likely, they say, is progress toward regulation of the region's living resources, where territorial claims are less directly involved. This could then serve as a step toward more comprehensive agreement.

## Cold at South Pole Sets 19-Year Record

Reuter

WELLINGTON, New Zealand, April 9—It is always cold at the South Pole, but last year's average daily temperature was the lowest in 19 years—a bone-chilling minus 58 degrees.

The coldest day was minus 105, according to the U.S. National Science Foundation's polar programs division.

Even on the hottest day, the mercury only crept up to minus three, and this, the foundation said, was exceptional.

The coldest temperature ever recorded in Antarctica was -126.9 degrees F at Vostok, Antarctica, on Aug. 24, 1960.



The New York Times/Walter Sullivan

Dr. Samuel Treves of the University of Nebraska examines a wind-eroded boulder in Don Juan Pond, located between the Olympus and Askard ranges in Victoria Land, Antarctica. While quite extensive, the pond is only inches deep.

## *Life on the Bottom of Lakes Flies to New Antarctic Home*

By WALTER SULLIVAN

The New York Times

LAKE BONNEY, Victoria Land, Antarctica—Like miniature spaceships seeking to populate a new world, communities of life on lake bottoms are taking flight from here, each carrying several million "individuals" representing some 60 species of organism.

Only a very small percentage—lichens, fungi and bacteria—are destined to land in a newly formed pond to awaken and populate it. But in this way, life is keeping its fingertip hold on the hostile environment of this region of dry valleys, walled in by glacier-draped walls.

The life cycle of these airborne communities is being studied by a group from the Virginia Polytechnic Institute in Blacksburg, led by Dr. Bruce C. Parker. The cycle is adapted to the special circumstances of this region, where there is, essentially, only one "day" a year.

This region has almost six months of darkness and then a comparable period of continuous daylight. The lake, in a valley whose upper end is filled by Taylor Glacier, is covered with 14 feet of permanent ice, although in late summer a moat of open water 20 feet wide forms

around its rim.

### Ice and Sun Warm Lake

It is now early summer in the Southern Hemisphere.

When the sun returns in spring, the ice acts somewhat like the glass of a greenhouse, enabling the lake underneath it to become warm. A coating of algae, fungi and bacteria on the bottom awakens and, according to Dr. Parker, begins manufacturing oxygen.

This gas makes the matting of the lake bottom buoyant. It rises and becomes embedded in the bottom of the ice cover. Then, when warmed by the sun, it melts its way upward. It migrates up with each seasonal cycle of winter ice-growth on the bottom and ice-wasting on the surface. After four or five years, the mat emerges on top as a crinkly, paper-like brownish mass with a velvety texture.

This dries and is carried off by the fierce winds of the area. Those who have wintered in a hut at Lake Vanda in a neighboring valley say that the winds blow so hard and persistently that they feel as if they are living on an express train. The hut is pelted by rocks lifted

by the blast.

If one of the airborne mats is placed in tepid water, within a few days it turns bluish-green. Laboratory study, according to Dr. Parker, has shown each mat to be "a pretty complex community" consisting of 10 species of algae, 50 of bacteria and some fungi.

He and his colleagues are trying to construct a mathematical model of the lake, including interactions between its inhabitants and the environment, and the input of energy and nutrients.

Attempts to do this with lakes in other regions, including the Arctic tundra, Dr. Parker says, have failed because of the great complexity of such interactions there. Lake Bonney seemed to offer a simple combination of circumstances.

Its water and its life have proved highly stratified, forming a succession of layers that differ in their temperature, chemistry and inhabitants. The lake's maximum depth is 100 feet, and its bottom temperature in summer reaches 45 degrees Fahrenheit.

### Water Found Corrosive

There are only a few lakes in the region, and each has its distinctive characteristics. The most remarkable is Don Juan Pond, which, while quite extensive, is only two or three inches deep and is saturated with calcium chloride. This occurs in a rare form in which one calcium chloride molecule combines with

six water molecules forming a substance that Japanese scientists here have dubbed antarctite.

The pond water is corrosive, yet it is inhabited by rugged varieties of bacteria. It also causes leather to shrink in dramatic fashion. Dr. Samuel Treves of the University of Nebraska, an authority on the geology of the area, warned visitors about to splash across the pond not to do so if they were wearing leather boots, because they would suffer a special form of torture.

The boots, he said, "would shrink from size ten to size six quite rapidly, and you might tell all!"

While the pond is corrosive, drilling has disclosed that water in the ground underneath becomes fresher at greater depths and is finally potable. It may be, Dr. Treves said, that water is seeping there from a lake buried beneath an ice sheet 10 miles away.

Probing of the ice sheet by airborne radar has shown that, even where it is a mile or more thick, lakes of considerable extent are beneath it.

## Carter restates U.S. support to halt whaling

CANBERRA, June 20 (AP)—President Carter reaffirmed U.S. support for a 10-year halt to commercial whaling in a message read to the opening today of the International Whaling Commission's 29th annual meeting.

Carter congratulated the commission on its past efforts, but said: "Much more needs to be done to achieve protection of whales."

Despite lobbying by conservationists, no proposal for a 10-year moratorium appears on the meeting's agenda.

Rep. Paul McCloskey, R-Calif., a member of the House Committee on Merchant Marine and Fisheries, urged the commission to ban imports of whale products from nonmember nations.

McCloskey's targets were Peru, Chile and South Korea, which are not commission members but have major whaling industries and sell whale products to Japan.

The commission's main task at each annual meeting is to set catch quotas for the following year.

Japanese delegate Kunio Yonezawa argued against any significant cut in present quotas, under which about 27,000 whales may be caught annually.

He said the nine nonwhaling members of the 16-member commission should not "push through certain policies without giving due regard to the opinions of the minority group (the whaling nations)."

Yonezawa also said if nonwhaling countries act unilaterally to give whales greater protection within their territorial waters, other nations will be free to take unilateral action.

# Scientist, 80, is back from Antarctica trek

Back in Tucson a week and a half from a journey to the bottom of the world, the first American geologist to set foot on Antarctica already is talking about going back.

"I'm only 80. Why shouldn't I go back?" asked explorer-turned-University of Arizona professor Laurence M. Gould.

It was his sixth such trip to the frozen continent.

His first was in 1928 when he served as the second in command and senior scientist on the first expedition of Adm. Richard Byrd.

But his visits haven't dampened his enthusiasm about the land in which he traveled about 15,000 miles by dog sled in sub-zero temperatures on that first journey. "There is nothing in the world as beautiful," he said.

Gould's purpose for making the trip was different this year — so were the living accommodations.

Gould left Tucson New Year's Day to accompany four members of the National Science Foundation to Antarctica. He was there to



Laurence M. Gould

"Why shouldn't I go back?"

explain the importance of the 54 scientific projects there funded by the foundation. He returned to Tucson Jan. 17.

The American visitors stayed in heavily insulated, wooden barracks at a base on Ross Island which had "all the comforts of home,"

including running water for bathing, he said.

On the first journey, Gould and his companions had to melt snow to get fresh water, he said. Also, Gould sometimes stayed in tents.

Instead of traveling by dogsled, helicopters took Gould and the foundation members to various sites during their week on the ice.

Their trip from New Zealand to the base was more difficult, however. It took three days instead of one, because of engine trouble and a blizzard.

But Gould said with growing technology on the continent, "much of the romance is gone." Still, it remains the "one part of the world man has not spoiled."

The journey left him "feeling better than I have in years, both physically and emotionally," Gould said.

This year's visit differed little from one he made in 1969. "After all, Antarctica hasn't changed much in the last 10 million years," he said. Jan. 28

## Whaling Commission Cuts 1978 Catch Quotas by 35%

CANBERRA, Australia, June 24 (AP)—The International Whaling Commission today reduced whale-catch quotas by an average of 35 per cent for next year, and drastically reduced the number that can be taken in the North Pacific.

The ruling angered Japanese and Soviet delegates to the commission, who said the reduction in the North Pacific threatened to ruin their large whaling industries.

The commission ruled that the total sperm whale catch in the North Pacific should be cut from this year's 7,200 to 763. The quota of bryde's whales was dropped from 1,000 to 524 and of minke whales from 541 to 400 in the North Pacific.

However, the commission promised to reconsider the North Pacific quotas before next season.

The commission ordered a 35 per cent cut in the worldwide whale catch, from this year's level of 27,850 whales of all types to 18,192.

## Killer Whale Bears 6-Foot, 125-lb. Calf

LOS ANGELES, Feb. 28 (AP)—Corky the killer whale gave birth today to a 6-foot, 125-pound calf, believed to be the first time a killer whale has ever been born in captivity during the ten years the mammals have been held, officials said.

The father is 16-year-old Orky, the largest and oldest killer whale in captivity.

"We tend to think it's a female," Art La Vove, a spokesman for Marineland, said of the newborn.

He said that bystanders knew something was about to occur when "Corky started to act very strangely and Orky positioned himself between her and everyone else, and he was acting real weird."

"When 11 tons of killer whales act strange, you clear out of there," Mr. La Vove added.

The calf has not been named.

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## WORLD'S LAST FRONTIER

### McMURDO STATION, Antarctica

Down here at the bottom of the world, scientists from nearly a dozen nations are exploring the earth's last frontier and finding evidence that this frozen wasteland conceals a possible bonanza of untapped resources.

Hints of these riches—oil, natural gas, uranium, precious metals and vast food resources from the icy Antarctic waters—are so tantalizing that they threaten to touch off a global gold rush.

The Russians and Americans have stepped up efforts to assess what minerals definitely are here, and three nations already are filling ships' holds with the region's abundant fish life.

All this is developing on the earth's coldest, most hostile continent, where a transient population of hundreds lives in a few wind-blown huts and buildings scattered across a land mass bigger than the U.S. and Mexico combined.

To fully exploit the Antarctic's resources will mean overcoming monumental problems.

**icy summer.** So cold is most of the continent that even in the Antarctic summer a brief exposure numbs the flesh and in seconds freezes a man's breath into solid ice on his beard.

In most of the interior, there is no life—no animals, no plants, not even bacteria—just thousands of miles of silent mountain ranges and the largest plateau of ice in the world.

On top of nature's difficulties is a major point of law: It's not at all certain who owns the minerals and fish of the Antarctic.

A treaty that governs the continent was purposely vague on this point, and a few "old Antarctic hands" believe there eventually could be armed conflict on this desolate landscape before the ownership issue is settled.

Vigorous diplomatic efforts are under way to head off growing tension as each new discovery of a potentially exploitable resource sends a shudder through the small community of scientists who work out of McMurdo for months at a time.

They realize that what they are finding in the name of science may soon lure to their wilderness laboratory the drill rigs, bulldozers and fishing armadas of a world haunted by dwindling resources.

That invasion seems foreordained by promising findings such as these:

Research teams examining a small fraction of the 200,000 square miles of

the continent's surface not covered with ice and snow have found gold, platinum, iron, copper, nickel, cobalt, uranium and large quantities of coal. Some of the minerals are present in only trace quantities; others are found in relatively pure form.

The continental shelf of Antarctica appears to harbor oil and natural-gas fields of potentially vast proportions. Much work is needed, however, to fully assess early indications.

The icy waters surrounding the continent compose one of the richest feeding grounds for marine life in the world. Scientists believe the shrimplike krill, foundation of the food chain here, could rapidly become a major source of protein for the earth's people.

**Who owns Antarctica?** All countries that staked territorial claims to pieces of the continent during early exploration temporarily set aside those claims when they signed the Antarctic Treaty of 1961.

The continent was to be considered the entire world's property until 1991, a place to pursue the interests of science for the good of all.

The Treaty is still in force, the only framework of law for the Antarctic. Unfortunately, it does not spell out what happens to the continent's resources if a commercial venture or a country decides to exploit them.

Negotiators from the Treaty nations will be addressing the problem at their regular consultative meeting in September in London.

Meanwhile, the U.S. position is that before resources are tapped, exhaustive studies to determine impacts on the fragile polar ecology should be made. Exploitation might then be possible if the ecosystem can be preserved without significant damage.

At the moment, the Americans are officially ignoring the small amount of krill fishing down here despite grave concerns of some scientists that the activity eventually could upset the delicately balanced food chain. Penguins, fish, some seals and whales all depend on the krill as a primary food source.

The U.S. presence in the Antarctic is co-ordinated and financed through the National Science Foundation (NSF), an arm of the executive branch of the Government that funds a variety of scientific research.

The Navy provides logistics for the mission and is reimbursed by the NSF.

This year, Congress has appropriated about 45 million dollars for the NSF to continue financing research in the Antarctic, including support of four year-round stations.

During the long Antarctic winter, fewer than 100 Americans live on the continent, but in the summer—November through February—the number

swells to nearly 900.

Says Jerry Pilon, who was NSF representative in the Antarctic until mid-December: "This is one tenth of all the land on earth, and we've got to maintain a presence here. The U.S. would be foolish not to. We have chosen to do it with science."

The only other nation with a sizable program is the Soviet Union. It has six stations at which 240 people "winter over." Scientific outposts also are maintained by New Zealand, Australia, Argentina, Chile, Japan, South Africa, France and Britain.

In broad terms, what scientists are learning is this:

The backbone of the Antarctic ecosystem is the tiny krill. The tremendous numbers of this protein-rich crustacean are generating intense interest among the world's fishing community.

Estimates of how much krill can safely be harvested from Antarctic waters range from 100 to 150 million tons a year. To put this figure into perspective: The fishing fleets of the entire world now bring in only 65 to 70 million tons of fish a year. Thus a maximum harvest of krill could triple the world catch, providing protein for hundreds of millions of people.

**Big fishers busy.** The significance of these early krill estimates has not been lost on the world's great fishing nations.

In 1974, Russia "experimentally" harvested 20,000 tons and Japan 650 tons. West Germany sent two ships down during the last Antarctic summer as did Poland.

This year the largest krill expedition yet to ply Antarctic waters has arrived under the Polish banner. It includes at least three vessels, one a factory ship, and 400 crew members. They plan to fish right through the darkness of winter. The Russians are working two ships this season.

Exploitation of the krill may accelerate quickly as nations—among them Russia, Poland and Japan—are cut off or severely limited in catch from some of the world's best fishing grounds. On March 1, the U.S. will claim the right to control all fishing activity within 200 miles of its coastline. This includes rich fishing banks off the coasts of Alaska, New England and California.

Dozens of other countries already have gone this route, which leaves only the deep oceans and the Antarctic's unclaimed waters for unrestricted fishing.

One reason for the density of marine life around Antarctica is a phenomenon known as upwelling. The frigid water that circulates around the continent sinks as it is drawn to the north. Deep currents of warmer water from the South Pacific, Atlantic and Indian Oceans are then forced to the surface. They are rich with nutrients.



As the sunlight hits the nutrients, they bloom with microscopic plant growth which is the steady diet of krill. This upwelling creates one of the richest feeding grounds for marine life in the world.

The potential assault on krill is generating scientific and political concern. Sayed Z. El-Sayed, professor of biological oceanography at Texas A. & M. University and veteran of many Antarctic expeditions, stresses this:

The food chain in the Antarctic is so short and fragile that diminishing even one species could have serious side effects. Furthermore, relatively little is known about how many krill are really out there and how big a harvest would seriously hurt the species.

Says El-Sayed: "Unwise or reckless exploitation of Antarctic krill could lead to the collapse of their populations and trigger disastrous changes throughout the Antarctic marine ecosystem."

**On the land.** The continent's geological history underlies speculation that the Antarctic may someday be mined for minerals and drilled for oil and gas.

Several hundred million years ago, scientists believe, the Antarctic continent was part of a larger land mass known among geologists as Gondwanaland. Much of this land mass, including what is today Antarctica, was covered by rain forests.

Then a process called "sea-floor spreading" began, and pieces of Gondwanaland began breaking off and drifting to the north.

Those pieces, researchers say, are the present-day continents of South America, Africa and Australia; the islands of Madagascar and Tasmania, and the Indian subcontinent.

**The Dry Valleys region is left without major ice cover because of the slow disintegration of Antarctica's polar ice cap. Now the area is being surveyed for uranium deposits.**

Evidence supporting this history of continental drift is abundant in the Antarctic and important in assessing the region's potential mineral wealth.

For example, the continental shelf off the southern coast of Australia—the site of a big oil and natural-gas field—matches closely rock formations and sedimentary deposits along the Ross Sea shelf in the Antarctic. The matchup occurs at the point where scientists believe the continents were once joined.

Test holes that have been sunk along the Ross Sea shelf show strong evidence that oil is in the area. The holes were capped as soon as drillers hit natural gas, a common indicator of oil below.

Another illustration is the stratified-rock formations from various episodes of volcanic activity and flows of lava.

These kinds of rocks have been found in both South Africa and the Transantarctic Mountains. The formations match closely in age and thickness.

In South Africa, such formations are rich with deposits of platinum, nickel, copper, chromium, lead, zinc, iron and cobalt.

American scientists have been working in the Transantarctic Mountains, at a place called the Dufek Massif, for the last several months trying to find out if theoretical projections of rich mineral deposits can be firmed up with solid discoveries in the field.

Another project this season is a survey of potential uranium deposits.

Edward J. Zeller of the radiation-physics laboratory at the University of Kansas believes the chances are good that his team will eventually find urani-

um deposits of commercial grade, though whether there will be enough of it to attract commercial interest is another question.

He adds: "A lot of people down here say we're going to put the Treaty in jeopardy if we make a major find. Our position is, you can't make an intelligent decision about resource exploitation—one way or the other—without adequate base-line information."

DuWayne Anderson, chief scientist of polar programs at NSF, told *U.S. News & World Report* that if field teams discover a rich deposit of any commercially exploitable mineral in the Antarctic, "this is inevitably going to strain the Antarctic Treaty."

The first arrivals in the Antarctic in the early 1900s were explorers and adventurers who came to map a continent on which no human had ever set foot and to claim parts of it for their governments.

For years it seemed the region had little that the world really wanted. It was on just such an assumption that the Antarctic Treaty was successfully brought into being in 1961.

Now the second wave of explorers—the scientists—have been studying for the past 20 years the penguins, seals, geology and glaciers while monitoring the weather, the earth's magnetic fields and the showers of cosmic rays from the sun and outer space.

Their discoveries could be the undoing of a Treaty that worked well for the first half of its 30-year life and now may require diplomatic miracles to survive the second half.

## SOUTH POLE DIARY

## "It's Like Entering Another World"

Associate Editor Jack F. McWethy, who traveled thousands of miles across the Antarctic, kept a day-by-day log of his experiences. Excerpts from that diary:

**Wednesday:** Landed at McMurdo, the Antarctic's port of arrival for most Americans. It's like entering another world.

You travel 10,000 miles on a three-day journey from the U.S. in the dark hold of a military cargo plane. The aircraft bumps down on a runway of floating ice, 10 feet thick. And then—

You step out into a blinding world of 24-hour sunlight, ice and brilliant white snow.

At the South Pole, 750 miles away, the average temperature is 56 degrees below zero (Fahrenheit). Here at McMurdo, however, it's 20 degrees above zero, the Antarctic version of a summer heat wave. In another two weeks, the ice runway will be open water, and McMurdo will become a seaport for a month before the ice starts closing in again.

Off in the distance, a plume of steam rises from Mount Erebus, the still-active volcano whose eruptions aeons ago built Ross Island.

McMurdo itself is at the base of Mount Erebus. It's the main U.S. station and the Antarctic's largest city, with a summer population—from November through February—of nearly 800 people, and a "winter over" group of about 60.

It has a plywood-walled "guest house" run by the National Science Foundation, the agency that coordinates all U.S. activity down here. Quarters are furnished with bunk beds in double rooms and a communal bathroom. It's chronically overheated inside, as are most of the buildings in Antarctica.

Every civilian who comes here is issued about 60 pounds of cold-weather gear in New Zealand: three pairs of boots, parka, long underwear, wool shirts, mittens, hats.

Wherever you travel, by airplane, helicopter or tracked vehicle, you must take full survival gear. Even a balmy afternoon can turn unexpectedly into a deadly whiteout—when the sun hides behind a cloud, the wind kicks up surface snow and depth perception becomes a bad joke. The result could be



McMurdo Station, the main American base, is Antarctica's largest city. The population of 800 in the summer drops to 60 in the winter. South Pole is about 750 miles away.

an unscheduled camping trip that might last for days.

Most of the research here goes on less dramatically, however—and occasionally in ways that seem offbeat to a newcomer.

For instance, there's Art DeVries, a professor of physiology at the University of Illinois, who spends much of his time fishing. The object of his attention is the Antarctic cod. I watched him bring up an 85-pounder through a hole in the ice, only one of the nine that he caught today. Each was weighed, measured and tagged, then dumped back through the hole to swim away.

Altogether, the professor has caught more than 75,000 pounds of this species over the last five years. He has pioneered research on how a fish can thrive in water so cold it hovers between liquid and solid state.

Not all of the Antarctic cod are caught on behalf of science. Several of them each year end up in the DeVries smokehouse. Flavor? Oily, salty—but tasty. Once a year he sends one of his smoked delicacies over to Vostok, a Soviet station. The Russians send back vodka, an acceptable *quid pro quo*.

**Thursday:** Zero degrees south. Bottom of the world. End of the earth. Finally made it to the South Pole and the U.S. station that sits atop the largest continental ice sheet on this planet.

There are no mountains, just a seemingly endless plain of snow—it goes for thousands of miles. The ice is 2 miles thick below the pole marker.

We arrived in a ski-equipped LC-130 cargo plane after first flying along 500 miles of the Transantarctic Mountains—majestic peaks of 14,000 feet and some of the biggest glaciers in the world.

Pole Station today is experiencing the same heat wave that came to McMurdo, as the temperature soars to 17 degrees below zero. Our hosts apologize for not being able to provide really cold weather. In winter, they say, temperatures regularly hover at the minus-100-degree mark. The chill factor plus 24-hour darkness they experience for six months makes the thought



Downtown McMurdo at midnight features a frontier church and absolute silence.

## SOUTH POLE DIARY

[continued from preceding page]

of spending a winter in the Antarctic a depressing one.

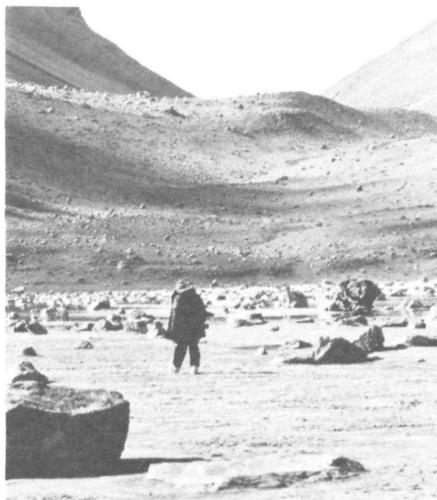
Strangely, people say that winter here isn't all that bad. In fact, says Dr. Fritz Koerner, this year's station physician, they don't always want to leave. They become accustomed to the security of the place, the isolated routine. They have real trouble facing a world of traffic jams, coats and ties, and headlines that warn of global crisis.

A big problem people experience here during the summer is adjusting to 24 hours of daylight. "Sunlight is a natural amphetamine," Dr. Koerner explains. In other words, people tend not to go to bed when they normally would.

South Pole Station is a series of one and two-story buildings protected from the worst of the elements by a central dome and two outlying tunnel shafts of corrugated steel. There is a pool table, a small library, a sauna bath and a different movie nightly.

There's an exclusive club at the South Pole—the "300 Club." To join, you sit in a sauna bath at 250 degrees, then run around the South Pole marker naked in minus-50-degree temperature. The 250 and the 50 add up to 300. A group of 10 made the run today, but it was only minus 17 degrees. That put them in the "267 Club."

**Friday:** Back at McMurdo and out on the ice today with Doug DeMaster and his wife Jeanette Thomas, young ecologists who are studying seals. It's a spectacular day: deep-blue sky, and Mount



Dry Valleys were studied before Mars mission because of similarities in terrain.

Erebus, the volcano, looms silently in the distance, its steamy plume flattened against the horizon.

Mild temperatures, however, make conditions hazardous as we drive a tracked vehicle some 80 miles across sea ice that is somewhat unreliable.

Last season, DeMaster says, he was riding in the same area when the vehicle started to break through the ice. He and two others jumped for their lives. A graduate student, driving the vehicle, didn't get out and went down with it in more than 300 feet of icy water. Neither vehicle nor man was found.

After relating this, DeMaster turns the driving over to me while he and his associate get out to "take attendance" along the many cracks in the ice that serve as seal holes.

More than 3,000 Weddell seals have been tagged since 1969 in this continuing experiment. Learning about seals today will give scientists in the future enough evidence to assess what impact human exploitation of minerals and fish is having on this delicate ecosystem. There are an estimated 10 million seals in the Antarctic.

As mild temperatures soften the surface ice, walking is tricky. Everyone puts at least a leg through the ice during the day but, because of high-20s temperatures, no harm is caused. On colder days, a wet trouser leg can freeze solid in two minutes.

The seals being counted for this research project are unafraid of humans. When approached, the 1-ton mammals just roll over on their backs and make a barking, yelping sound as though you are beating them. They aren't agile on the ice, but given the chance, they will rip an arm to shreds.

**Saturday:** Took a helicopter trip over some incredible landscape. With the side of the helicopter open from floor to roof for better photography, we went to 6,000 feet climbing over a mountain pass. The wind-chill factor was 30 below zero.

Underneath was one of the strangest, most breath-taking panoramas in all of Antarctica.

Early explorers were stunned by what is called the Dry Valleys—deep, U-shaped gorges devoid of snow. They are rimmed by rugged peaks, between which are often "hanging glaciers" that come part way down the valley wall, then just end, hanging above the canyon floor.

From the ground, it looks more like the landscape of Mars. Scientists did, in fact, study this region in their Mars research.

These valleys once were filled with a massive ice stream. It has retreated as the polar cap slowly disintegrates.

Terry Hughes, a glaciologist from the University of Maine, believes the movement of glaciers in the Dry Valleys and elsewhere may be signaling more rapid disintegration of the Western Ice Sheet in Antarctica.

If this continental ice sheet collapses, it could mean an 18-foot rise in the ocean levels and a radical change in world climate in a matter of several hundred years.

**Sunday:** There's a magnetic warmth of community among those who work here. Most of the people, especially the scientists, come because they love it with passion. Their personalities are transformed by the place.

During the long flight from California, you can watch them bloom. The closer they get to Antarctica and their field research, the more effervescent they become. Ten months a year they are dispassionate professors and researchers. Here in the field, they are in their element, studying the last true wilderness on earth.

It's so utterly quiet in Antarctica. Only the wind, your own footsteps and heartbeat break the silence. But you have to ask: How long will the Antarctic remain this way?



Husband-and-wife science team, Doug DeMaster and Jeanette Thomas, study seals from a remote hut on ice.

# Iceberg Aground After 10 Years at Sea

By WALTER SULLIVAN

A rogue iceberg almost the size of Rhode Island that has been banging around Antarctic waters for 10 years is safely aground after its collisions gave birth to at least one other giant berg.

Nevertheless, according to Navy weathermen, it will probably come afloat again and drift into the South Atlantic. The weathermen are keeping track of it through a variety of earth satellites that monitor weather and other phenomena.

The iceberg, measuring 25 by 45 miles, is one of the largest on record. In 1926 the Norwegian whalers aboard the ship Odd I reported seeing a berg 100 miles long, and in 1965 Soviet seamen said they saw one off Enderby Land that was 87 miles long and 2,700 square miles in area, or more than the area of Rhode Island.

Such giant, flat-topped bergs occur only in Antarctica, where there are large ice shelves—aprons of continental ice that have pushed far out over the sea. Once afloat, such shelves spread to a uniform thickness of about 1,000 feet and large sections sometimes break loose.

One or more of the United States camps at Little America were carried

to sea in this manner and were later sighted riding the berg.

The berg now under observation is believed to have originated as an ice tongue, a long, narrow seaward extension of a fast-flowing glacier. It

apparently broke from the Princess Martha Coast in 1967.

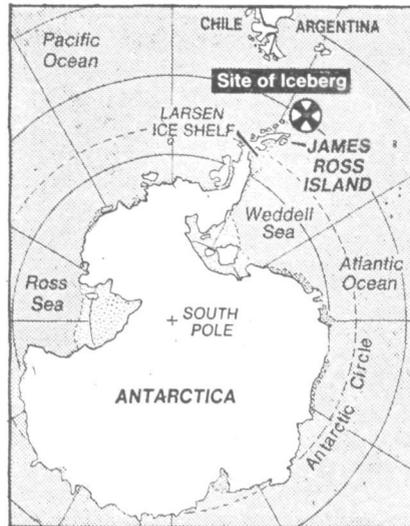
According to a status report issued yesterday by the Goddard Space Flight Center of the National Aeronautics and Space Administration, the berg, after drifting around the Weddell Sea, collided with the Larsen Ice Shelf on the eastern rim of the Antarctic Peninsula.

This dislodged a berg 13 by 36 miles, and both are now aground north of James Ross Island.

When the two bergs drift free, they will be monitored by satellite. They are expected to break up and melt before they enter shipping lanes. The Goddard Center in Greenbelt, Md., is relaying satellite data to the Navy's Fleet Weather Facility in nearby Suitland, Md.

A French group has been asked by Saudi Arabia to explore the practicality of towing Antarctic bergs of more modest size into the Red Sea to relieve water shortages there.

According to the NASA report, the larger berg contains enough fresh water to supply California's needs, at present levels, for 1,100 years (assuming none of the ice melted en route).



The New York Times/April 19, 1977

## Polar Team in Antarctica

A Norwegian expedition composed of 23 researchers and scientists is presently conducting studies in Antarctica. Organized by the Norwegian Polar Institute the team, in addition to scientific investigations at land and at sea, will also re-emphasize Norway's territorial rights on the Antarctic continent.

Participants were selected from the Norwegian Polar Institute, the Universities of Bergen and Oslo, the Institute for Norwegian Continental Shelf Research, and from the Fisheries Directorate/Research Council. Nine members will be stationed on land at the Larsen ice shelf and study this as well as Vestfella, both part of the Western region of Queen Maud's Land. The remaining 14 participants will, with the combined ice-breaker/sealer "Polar Circle", carry out research along the

coast of Queen Maud's Land and in the Weddell Sea. This type of research in Antarctica is a new venture for Norway.

The work consists of studies in climate changes, ocean currents, glacier movements and other geophysical, geological and biological relationships. Some research methods and instruments, which have not previously been employed in these areas will be used by the Norwegian team. Other countries are actively engaged in research in Antarctica, some of which are near or on land claimed by Norway since 1939. The research team will remain in Antarctica until March. Resources in Antarctica may be of vital importance in the future and thus Norway's participation in scientific investigation is paramount. A spokesman for the team said that any exploitation of minerals or ocean food, particularly the shrimp-like krill, will take into consideration the environment and fragile ecological balance of the region.



Dec. 22: Soviet Ice Breakers, Vladimir Ilyitch; 20kop, 4kop, Ermak; 6kop, Pilot; Krassin. Designer, A. Aksamit 10kop, F. Litke; 16kop;



Brazil publicizes the need to preserve the largest of all animals, the blue whale, with this 1.30cr stamp issued on June 3. The blue whale is threatened with extinction through exploitation by the whaling industry.



# GEORGE J. DUFEK, 74, AN ADMIRAL, IS DEAD

Acclaimed as Antarctica Expert,  
He Directed Building of 7 Bases  
for Scientific Polar Study

By BAYARD WEBSTER

The New York Times

WASHINGTON, Feb. 11 —

Rear Adm. George J. Dufek, retired, who commanded the United States Naval Support Forces in Operation Deepfreeze in the Antarctic from 1955 to 1959, died yesterday of cancer in the Bethesda Naval Hospital, Bethesda, Md. He was 74 years old.

Admiral Dufek was regarded as the Navy's leading cold weather expert at the time of his retirement in 1959. He won the praise of Federal, Naval and scientific authorities for his work in directing the construction of seven bases in Antarctica for use by American scientists in the International Geophysical Year.

One of the bases was at the geographical South Pole. The admiral was the third person and the first American ever to set foot on the pole. The first two persons were Roald Amundsen, the Norwegian, and Robert Scott, the Englishman.

Admiral Dufek's direction of the construction projects was described by Dr. Lawrence M. Gould, the director of the I.G.Y., as the "greatest logistic achievement in the history of Antarctic exploration." He was awarded the Distinguished Service Medal by President Eisenhower.

## A Veteran of Combat

Described as "a salty, brisk, blue-water sailor" when he was in charge of an operation, Admiral Dufek was a much-decorated combat veteran of World War II and the Korean War. He was also one of the few Naval officers to become qualified to command aircraft, submarine and surface craft.

His 38 years of Navy service began in 1921 when he entered the Naval Academy at Annapolis. After being commissioned as an ensign in 1925, he served aboard the battleship Maryland and was later assigned to submarine duty. At the end of four years of submarine training, he began flight training and was designated a naval aviator in 1933.

His first taste of ultracold weather came in 1939 when he volunteered for Rear Adm. Richard E. Byrd's third expedition to the Antarctic and was given the job of navigator on the old sailing vessel the Bear, the flagship of the Antarctic project.

In 1955, after several more expeditions to the Arctic and Antarctic, he was put in charge of the United States forces participating in the Antarctic phase of the



Rear Admiral George Dufek, U.S. Navy

I.G.Y.

In 1956, he landed in a plane at the South Pole to determine whether a plane with skis could successfully land on the polar terrain and also to find out if a scientific base could be established near the pole.

In addition to his tours of duty on seven North and South Polar expeditions, he held commands in World War II and the Korean War. He helped to organize United States amphibious assaults on Africa, Sicily and Southern France in World War II and commanded an anti-submarine task force in the Atlantic that was credited with sinking the last German submarine in that war.

In the Korean War, he commanded the aircraft carrier Antietam.

After the Korean War, he headed a special Antarctic Planning Group for the Navy in Washington and resumed his polar travels.

Most recently he was director of the Mariners Museum in Newport News, Va., where he made his home with his wife, Muriel.

In addition to his wife, he is survived by two sons, David and George Jr., and a daughter, Mrs. Bernard Bellit of Menlo Park, Calif.

A burial service will be held at 11 A.M. Monday at the Flag Officers Club at the Naval Academy.

## ANSON WALKER PERKINS

Kenosha, Wis. (UPI)—Anson Walker Perkins, 78, an insurance executive who accompanied Adm. Richard Byrd on his 1928 expedition to the South Pole, died at his home Tuesday after a long illness. Nov. 18



Richard E. Byrd, Roald Amundsen  
First flights over the North Pole, 50th  
anniversary.

## Polar history

A major new attraction has been added to New Zealand's list of tourist "musts"... the National Antarctic Center at the Canterbury Museum in Christchurch, the largest city in the South Island.

Explorers of the "Heroic Era" — America's Byrd and Siple as well as Norway's Amundsen and Britain's Scott and Shackleton — are honored at the Center.

Commander (later Admiral) Richard E. Byrd, the first man to fly over the South Pole (just 3,000 miles from Christchurch) in November, 1929, brought the Stars and Stripes with him on his flight. The flag is on display along with those which Englishman Dr. Edward Wilson took to the South Pole. Wilson, Scott and countrymen Bowers, Evans and Oates reached the Pole in January, 1912, only to find Amundsen's party had already planted the Norwegian flag there. The five Englishmen died on their long walk back from the Pole.

Another link with the "Heroic Era" is a snow hopper used by Sir Ernest Shackleton to supply fresh water on his 1907-09 Nimrod Expedition. The hopper, now rusty and full of holes, was filled with snow and attached to a motor car that was used to haul sledges.

The Center houses the world's best and biggest collection of Antarctic relics, some dating back to the 1890's. The U.S. Navy's "Operation Deep Freeze" — the big support force aiding America's scientific investigations on the ice — has contributed numerous exhibits, and the U.S. National Science Foundation has given \$59,000 in financial support.

Some other unusual items on display are a pony's snow shoe, a reindeer-hide sleeping bag, homemade dominoes, a pair of 75-year-old snow goggles cut from a single piece of wood, canvas trousers made by a marooned party and the Primus (small portable stove) used by Shackleton and his men during their 865-mile open-boat voyage seeking help for their comrades on the other side of the continent.

The museum also houses a fine library of books about the huge continent which is larger than the U.S. Among them is one of only 100 copies of the first book printed and bound in Antarctica, the "Aurora Australis", produced by the Nimrod expedition, who took a printing press south. The books owned by the museum are bound in smoothed plywood taken from provision cases.

Lang Manning, Senior Travel Commissioner for the New Zealand Tourist Office in North America, says that some of the exhibits are "very hallowed objects... we've even got the silver tea set used on the ice by Admiral Byrd."

**NINETY DEGREES SOUTH**

WILLIAM F. BAKER

*Earth's Last Frontier*

"IT'S A CROSS BETWEEN A MINING CAMP and a college campus," shouted Emmet Herbst, the assistant project director for Holmes and Narver, civilian contractors for the National Science Foundation's polar operation. Emmet greeted our party of a handful of journalists amidst the bustling metropolis of McMurdo Station which is urban Antarctica, summer population 1000 (winter, 60 people). As choppers, C-130's and immense track Nodwell vehicles roared by, we hardly felt we'd arrived on the continent billed as "the last frontier." To our initial dismay, we found that civilization had made its way even into the remotest place on the face of the earth, to a continent larger than the United States and Europe combined, a veritable repository for 90% of the world's ice and snow.

But only a mile past McMurdo Station, which stands in the heart of this magnificent plateau supported by a foundation of over 9000 feet of ice, we were totally awestruck by Antarctica's vastness and were soon reminded that here one never travels alone and parties never go off without first notifying the station's operations center. At this site we experienced not only frigid temperatures (the lowest temperature ever recorded on earth was on the continent of Antarctica in 1960 at 126.9°F. below zero), but also stark yet inspiring beauty.

Fuel, which by the time it arrives at the Pole costs \$3.40 a gallon at the Gulf sign, must be flown to the station by transport planes which keep their engines running lest they not restart. Water is obtained by the expensive process of melting snow using fuel oil. In the summer months (North America's winter), it is light 24 hours a day and temperatures range from 80° below zero to a record high of 6°F. above

Winds are the big problem. There is very little snowfall in this frigid desert, but just about any structure can be literally buried by drifting caused by the intense winds.

Another disconcerting factor for those who work in this desolate area is that it's 9,300 feet above sea level, and even walking 500 feet is not without effort at first. It takes approximately two weeks for the body to accommodate to the lack of oxygen in the air. A change in bone marrow function makes this possible.

While many travel to the Antarctic solely for adventure, the bulk of the support and work being done on the continent is for pure science. The National Science Foundation lends its support of \$25 million yearly for research which has been quite

meaningful. Scientists are studying the anti-freeze properties of fish blood at these sub-zero temperatures. A group from Virginia Polytechnic Institute are making observations of the atmosphere in this base-line region. It's sad to report that even here, minute traces of man's presence, his pollutants (including hair spray), have been discovered in the atmosphere.

A major event on January 9th, 1975 was the dedication of the new South Pole station which was built to replace the 17-year-old Scott-Amundsen station 20 feet below the ice. The new station consists of a Buckminster Fuller<sup>4</sup> geodesic dome 164 feet in diameter and 54 feet high. Outside air continually circulates within the dome to keep it from freezing up on the inside. The dome itself serves to keep huge drifts from piling up on the four small structures within and allows easy mobility for the 18 people who will be wintering over. The new station includes Antarctica's first bathtub (used by the station physician to treat hypothermia); an English-style dining hall; a library with a globe having the South Pole uppermost, of course; a "private space" (a study, meditation area); and 16 private rooms for the staff.

The station was built by Seabees and the Holmes and Narver construction company for the National Science Foundation at a materials cost of \$6 million. Some of the workers are lawyers, businessmen and other professionals who for one reason or another seek adventure or escape.

The station physician is Dr. Michael Hummer, who is 27, single and not a bit concerned about the lonely wintering over when the station is cut off from the rest of the world for 10 months. He plans to continue doing immunity studies on the men at the camp and has already been able to discern some interesting phenomena. Because of the extreme cold, very few organisms can remain viable, and consequently the men contract very few colds or other ailments. However, when visitors arrive, as with the first plane of the season, colds and flu spread quickly because of the men's lack of exposure to various bugs and subsequent lack of resistance. Also, 70% of the men become ill upon their return to civilization.

One tough problem the station physician must deal with is that of adjustment to the high altitude (an effective 12,000 feet). This condition causes tempers to be short as well as one's breath. In such confined places the men soon learn the touchy areas of their comrades' personalities and how to avoid sensitive

situations. They may pass the time by playing chess on the shortwave radio with stations in other parts of the continent; or, if all else fails, they go shovel snow to work off tension.

Surprisingly, the station physician has very few patients with frostbite in this most frigid of climates. The reason for this is that the men become quite fastidious about taking the proper precautions to avoid such hazards. As a matter of fact, physicians preparing to go to polar regions are likely to see their only cases of frostbite in big city hospitals since many more derelicts suffer from this problem in metropolitan areas than do people living in Antarctica.

The new station's first cook, Melvin Miller, is the camp clown. Melvin and his cronies once assembled a marching band complete with placards for the benefit of visiting dignitaries to protest against Antarctic whaling. Since he purchased a Sony videotape recorder, he also boasts his position as proprietor of the world's southernmost TV station.

One of the most fascinating aspects of finding oneself at 90° South is that the pole's location seems to shift! There's a ceremonial South Pole which features a striped barber pole complete with a reflective globe at its top and the usual assortment of flags from countries participating in the Antarctic Treaty; and then there's the true pole which is usually marked by a small red flag atop a bamboo stick. Because the ice surface moves approximately one foot per month, the physical location of the geographic south pole can be rather elusive. Scientists, however, have been able to calculate its position to the nearest inch, and are therefore repositioning the flag with great regularity. The new station was built to one side of the pole and is expected to move to the true pole in about five years.

Complicating life in the Antarctic is the fact that there is no government sovereignty recognized in this area. The Antarctic Treaty with its 16 signers agreed to hold all claims on the area in abeyance for 30 years. This presents some interesting legal problems. For instance, if a non-military person murdered someone in the Antarctic, he would not be charged. Or if somebody chose to open up this continent for tourism or just travel freely about, there is nobody to stop him.

The State Department operates an Antarctic Desk in Washington. Perhaps the underlying reason for governmental interest in this continent is because of what may lie below the surface of the ice. It is surmised that oil and other minerals may be present in this land which may have been a lush tropical reserve millions of years ago. If one were to glance at a current map of the Antarctic region, it can be seen that the U.S. is supporting operations on one side of the continent and that the Russians are doing much the same on the other side. However, for the present, and hopefully for the future, there is no

obvious political orientation in Antarctica where countries are sharing information and working side-by-side for purely scientific purposes.

A returnee from the continent is most frequently asked two questions: "Are there animals there?" and "Are there women there?" The answer to both questions is "yes." As for the women, there are considerably few — but they *do* exist. For example, there is a female naval officer assigned to the Antarctic, and the NSF research program includes a number of women scientists. Even in the remote wannigans of the distant research posts one is frequently apt to come across a woman scientist or student living as part of a team of husky male researchers. What is unanticipated by many is that the women seem to conform to the environment quite readily, and the men take little notice of pulchritude in such a surrounding. However, at the pole and during the winter there are no women residents.

To the surprise of many, there are no polar bears, but there are large quantities of seals and penguins. In fact, one of the men there counted 80,000 penguins over a six-month period. There are two species of seals — the rather common Weddell seal and the more vicious leopard (also Ross and crab-eater). The Weddell pups are the most fascinating of all. They can dive into the sea, their only source of food since there is no vegetation on the continent, which is of necessity always nearby, and are able to hold their breaths for up to 40 minutes as they dive to depths of 2000 feet! Because the Weddell pup fears nothing and has no enemies, it's quite easy for a man to intrude upon him and only receive but a nasty bark of irritation in return. Most simply roll over and seem to hope for peace once more.

There are two main species, as well, of penguins, among the most primitive of birds — the little Adelie and the Emperor whose height reaches approximately three feet. The penguins are very friendly and appear almost human when sporting their characteristic "Charlie Chaplin" gait. In their rookeries some disconcerting problems are in evidence: because very little decays on the continent, the scattered remains of deceased birds and guano are distressingly prominent.

The penguin has an apparently strange system of navigation in which he uses only the sun, and as yet no one has been able to discover how he manages to get from one place to another so efficiently. Another amazing feat the penguin achieves is that of being able to drink sea water and expel the salt through his nose — a truly incredible accomplishment! Indisputably every bit as incredible as our journey to "The Earth's Last Frontier!"

*WILLIAM F. BAKER, Ph.D., is program director of WEWS-TV, Scripps-Howard Broadcasting Co., Cleveland, Ohio. At 33, after traveling extensively the world over in covering radio and television assignments, Baker lives close to his native Cleveland and serves on the Board of Overseers of Case Western Reserve University where he did his studies in communications and organizational behavior.*



Wm. F. Baker

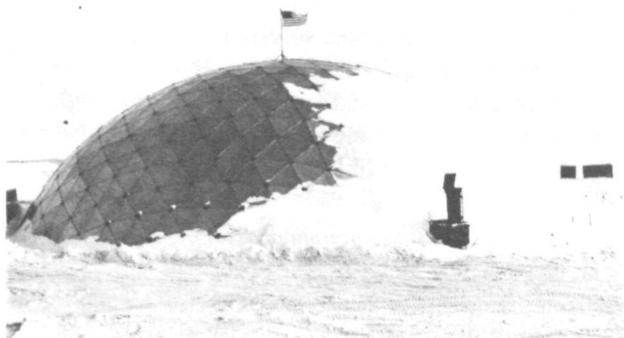
▲ Two helicopters at rest on floor of unusual dry valleys of Antarctica located near McMurdo Station. Free of ice for several hundred thousand years, the area consists of interbedded volcanic and glacial deposits existing at intensely cold temperatures.

► Wind-eroded sandstone rocks in Bull Pass, an area just off the central Wright Valley, Antarctica, show in close-up view what wind alone can accomplish in sub-zero temperatures over many millenniums. A team of 40 scientists and engineers of the Dry Valley Drilling Project drilled down 1,176 ft. to recover earth core samples.



PH2 Richard Beaudet, U.S. Navy

▼ Built by Navy Seabees, geodesic dome 164 feet wide by 54 feet high keeps snow drifts off four buildings inside.



PH2 Richard Beaudet, U.S. Navy



PH2 Richard Beaudet, U.S. Navy

▲ Charles Aiken of World Wide News, left, and Bob Baranowski and Julie Petruski of Virginia Polytechnic Institute's Lake Bonney Research facilities, Taylor Dry Valley.