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The Big Melt

As Polar Ice Turns to Water, Dreams of Treasure Abound

By CLIFFORD KRAUSS, STEVEN LEE MYERS, ANDREW C. REVKIN and SIMON ROMERO

CHURCHILL, Manitoba - It seems harsh to say that bad news for polar bears is good for Pat Broe. Mr. Broe, a Denver entrepreneur, is no more to blame than anyone else for a meltdown at the top of the world that threatens Arctic mammals and ancient traditions and lends credibility to dark visions of global warming.

Still, the newest study of the Arctic ice cap - finding that it faded this summer to its smallest size ever recorded - is beginning to make Mr. Broe look like a visionary for buying this derelict Hudson Bay port from the Canadian government in 1997. Especially at the price he paid: about \$7.

By Mr. Broe's calculations, Churchill could bring in as much as \$100 million a year as a port on Arctic shipping lanes shorter by thousands of miles than routes to the south, and traffic would only increase as the retreat of ice in the region clears the way for a longer shipping season.

With major companies and nations large and small adopting similar logic, the Arctic is undergoing nothing less than a great rush for virgin territory and natural resources worth hundreds of billions of dollars. Even before the polar ice began shrinking more each summer, countries were pushing into the frigid Barents Sea, lured by undersea oil and gas fields and emboldened by advances in technology. But now, as thinning ice stands to simplify construction of drilling rigs, exploration is likely to move even farther north.

Last year, scientists found tantalizing hints of oil in seabed samples just 200 miles from the North Pole. All told, one quarter of the world's undiscovered oil and gas resources lies in the Arctic, according to the United States Geological Survey.

The polar thaw is also starting to unlock other treasures: lucrative shipping routes, perhaps even the storied Northwest Passage; new cruise ship destinations; and important commercial fisheries.

"It's the positive side of global warming, if there is a positive side," said Ron Lemieux, the transportation minister of Manitoba, whose provincial government is investing millions in Churchill.

If the melting continues, as many Arctic experts expect, the mass of floating ice that has crowned the planet for millions of years may largely disappear for entire summers this century. Instead of the white wilderness that killed explorers and defeated navigators for centuries, the world would have a blue pole on top, a seasonally open sea nearly five times the size of the Mediterranean.

But if the Arctic is no longer a frozen backyard, the fences matter. For now it is not clear where those fences are. Under a treaty called the United Nations Convention on the Law of the Sea, territory is determined by how far a nation's continental shelf extends into the sea. Under the treaty, countries have limited time after ratifying it to map the sea floor and make claims.

In 2001, [Russia](#) made the first move, staking out virtually half the Arctic Ocean, including the North Pole. But after challenges by other nations, including the [United States](#), Russia sought to bolster its claim by sending a research ship north to gather more geographical data. On Aug. 29, it reached the pole without the help of an icebreaker - the first ship ever to do so.

The United States, an Arctic nation itself because of [Alaska](#), could also try to expand its territory. But several senators who oppose any possible infringement on American sovereignty have repeatedly blocked ratification of the treaty.

Indeed, not everyone agrees that warming of the Arctic merits concern. No one knows what share of the recent thawing can be attributed to natural cycles and how much to heat-trapping pollution linked to recent global warming, and some scientists and government officials, particularly in Russia, are dismissive of assertions that a permanent change is at hand.

"We are not going to have apple trees growing in Vorkuta," said the mayor of that coal-mining city, Igor L. Shpektor, who is also the president of Russia's union of Arctic cities and towns.

But the current thaw is already real enough for the four million people within the Arctic Circle, including about 150,000 Inuit. "As long as it's ice," said Sheila Watt-Cloutier, leader of a transnational Inuit group, "nobody cares except us, because we hunt and fish and travel on that ice. However, the minute it starts to thaw and becomes water, then the whole world is interested."

Increasingly, big corporations, the eight countries with Arctic footholds and other nations farther south are betting on the possibility of a great transformation. Energy-hungry [China](#) has set up a research station on the Norwegian island of Spitsbergen and twice deployed its icebreaker Snow Dragon, which normally works in [Antarctica](#), to northern waters to conduct climate research.

Interest in Arctic-hardy vessels has picked up so much that in January, Aker Finnyards, a giant shipbuilder based in Helsinki, created a subsidiary just to develop ice-hardened ships. Its new double-ended tanker slips smoothly through open water bow first but can spin around and use an icebreakerlike

stern to smash through heavy floes. A Finnish energy company bought two for about \$90 million apiece, and after buying one Russia licensed the design and is building two more.

In January, the State Department's Bureau of Intelligence and Research held a closed two-day meeting to hear from experts on the implications of a warming, opening Arctic.

"There are likely to be a number of foreign-policy issues that must be addressed by the United States and other nations" if the climate trends persist, said a summary of the meeting. "These issues include the availability and potential for exploitation of energy, fisheries and other resources; access to new sea routes; new claims under Law of the Sea; national security; and others."

A look at a map of the globe with the North Pole at its center explains why a new frontier matters. Some countries that one might think of as being half a world part appear as startlingly close neighbors, and relatively speaking, they are.

In the days of empire, Rudyard Kipling called jockeying among world powers in Central Asia the Great Game. Christopher Weafer, an energy analyst with Alfa Bank in Moscow, says this new Arctic rush is "the Great Game in a cold climate."

The Petroleum Rush

To understand the practical terms of this new competition for territory, opportunity and resources, a good place to begin is Hammerfest, [Norway](#), one of the northernmost towns in the world and one of 12 Arctic settlements visited over six months by correspondents of The New York Times preparing this series of articles.

Hammerfest, once an austere beautiful fishing village burned to the ground by the Nazis in World War II, is starting to swell with young people from other parts of Norway, [Finland](#), Russia and Asia, as well as with highly trained technical workers from Europe and North America. They are drawn by Snohvit (in English, Snow White), a mammoth complex being built to receive natural gas piped from the Barents Sea and liquefy the gas for shipping.

The Norwegian government, which controls Snohvit in part through its majority ownership of the energy company Statoil, is desperate for Snohvit to be a success and put the country in the forefront of Arctic energy exploration. Being first, however, has had its challenges in the severe operating environment of the High North, as Arctic areas are called in Norway. Overruns have put the price of Snohvit at \$8.8 billion, almost 50 percent above its original estimate.

The project has a firm backer in John Doyle Ong, the blunt United States ambassador in Oslo. Snohvit is scheduled to start sending liquefied natural gas to the Cove Point port in [Maryland](#) in 2007, just as American imports of liquefied gas from competing sources in the Middle East and Africa are set to rise rapidly. Importing natural gas from a stable country like Norway - already the world's third-largest oil

exporter, after [Saudi Arabia](#) and Russia - is a rare option these days.

"Norway's importance to the United States in terms of our national energy policy is increasing with every passing year," Mr. Ong said.

But the United States' interests go beyond that - too far beyond for many in Norway. In September, the opening of frontier areas in the Barents and Norwegian Seas emerged as a central issue in elections that brought a leftist coalition to power, with some coalition members favoring a ban on Arctic oil and gas exploration in environmentally sensitive areas.

And besides supporting Snohvit, Mr. Ong, a former energy executive, has stepped into disputes between Norway and Russia over a large gray zone in the Barents. His insistence that Arctic-related matters be "trilateral" rather than bilateral is viewed as belligerent by some Norwegians.

In private, Norwegian officials welcome the heft of the United States in its negotiations with Russia. Norway is eager to resolve the territorial dispute so that some order, and Norwegian drilling expertise and environmental standards, can be imposed on Arctic exploration. Because as large as Snohvit is, it is dwarfed by a far bigger gas field to the east in Russian waters. That field, called Shtokman, is being developed by Gazprom, Russia's gas behemoth.

In September, Gazprom selected five companies - Statoil and Norsk Hydro from Norway, Total from [France](#) and Chevron and ConocoPhillips - as finalists in a search for partners to develop Shtokman, in the Barents Sea, 350 miles north of Russia's Kola Peninsula. The development costs are estimated at \$15 billion to \$20 billion. The field is reported to hold more than double all of [Canada's](#) gas reserves.

"They're going to find more of them," Mr. Weafer, the Moscow-based energy analyst, said of Arctic gas deposits. "It's the next energy frontier."

And while natural gas is certainly valued, the prize that is generating the biggest interest is oil. Virtually every large international energy company is studying how eventually to win permission from Norway and Russia to explore in the Barents, and the Norwegian Polar Institute has been contacted repeatedly by oil companies to explore the feasibility of drilling in the icier waters north of Spitsbergen.

Jan-Gunnar Winther, director of the institute, said the seasonal melting of the polar cap might allow access to more petroleum deposits but also create more challenges.

"A warmer climate in the north would mean more icebergs, rather than less," he said. "There will be obstacles in getting to the petroleum, but if oil prices stay high there will be enticements as well."

A push into the Barents Sea could help redraw the politics of energy allegiances, and gas in particular puts Russia in a strong position. "It has a good chance of becoming a more effective counterbalance to

OPEC," Mr. Weafer said.

As for Norway, the warming world gives it the chance to seek influence far beyond its size. Energy-hungry countries that might have written off the Arctic not long ago are showing considerable interest in Norway's opening of the Barents; one visitor to Oslo in September was [India's](#) oil minister, seeking a role in exploration. And if a route farther north opens just four or five months of the year, Norway could even become a major supplier of oil and gas to China, said Sverre Lodgaard, director of the Norwegian Institute for International Affairs.

Norway is trying to position itself as "a dwarf among giants," Mayor Alf Jakobsen of Hammerfest said. "We're attracting young people to Hammerfest instead of sending them away, for the first time in years. The opportunity to become a springboard into the Arctic is upon us."

Fisheries Head North

Charlie Lean easily recalls when he realized that big changes were sweeping the fish stocks along the northern shores of Alaska.

Just over 10 years ago, when Mr. Lean was the state's fisheries manager for the northwest region, a call came in from the tiny Eskimo outpost of Kivalina, on the Chukchi Sea 150 miles northeast of the Bering Strait. A village elder was reporting "a massive fish kill" in the Wulik River, Mr. Lean said. Everyone assumed it was from some toxic spill upriver at the giant Red Dog zinc mine.

"I rounded up a plane and blasted off and flew up there," he said. "Flying overhead I could see right away it was the end of a pink salmon run. They were dying of natural causes as they always do once they spawn."

The elders had never seen a run of this salmon species. But they have shown up every year since.

The colonization of new rivers by pink salmon is just one of many changes in fish and crab stocks that appear linked to retreating sea ice and warming waters in the Chukchi Sea and, farther south, the Bering Sea. The changes are important because the Bering is rich with pollock, salmon, halibut and crab, already yielding nearly half of America's seafood catch and a third of Russia's.

Recent studies have projected that in a few decades there could be lucrative fishing grounds in waters that were largely untouched throughout human history.

In a 2002 report for the Navy on climate change and the Arctic Ocean, the Arctic Research Commission, a panel appointed by the president, concluded that species were moving north through the Bering Strait. "Climate warming is likely to bring extensive fishing activity to the Arctic, particularly in the Barents Sea and Beaufort-Chukchi region where commercial operations have been minimal in the past," the report said. "In addition, Bering Sea fishing opportunities will increase as sea ice cover begins later and

ends sooner in the year."

But problems could emerge, as well, as stocks shift from the waters of one country to those of another. Snow crabs, for example, appear to be moving away from Alaska, north and west toward Russia, as the sea ice retreats. They depend on nutrients that sink to the bottom from algae growing under the ice. The valuable fishery could eventually move entirely out of American waters, some federal fisheries scientists said.

The fishing industry, a business where surviving one year to the next is the main worry, has largely not taken notice of the changes, although American crab boats are finding they have to steam farther and farther to haul in a decent catch.

"If the crabs move over into the Russian zone," said Glenn Reed, the president of the Pacific Seafood Processors Association in Seattle, "there's not much to be done about that except hope they come back someday."

Who Governs What

"Stalin once just drew a line from Murmansk to the North Pole and then to Chukchi and said, 'U.S.S.R. Polar Region' - and nobody worried about it," said Artur N. Chilingarov, an Arctic explorer and deputy speaker of Russia's lower house of Parliament.

Now, instead of Stalin, the lines will be drawn by an international commission and the geography of the seabed itself.

That means that the Arctic land grab could be decided in part inside a lab at the University of New Hampshire in Durham. There, at the Center for Coastal and Ocean Mapping, scientists are studying sonar scans of the seabed from a 2002 expedition on a United States Coast Guard icebreaker in waters north of Barrow, Alaska.

In the lab, Larry Mayer, the center's director, gave a reporter a joystick-driven virtual tour of the seabed two miles beneath the ice. The ocean appeared on a wall-size screen as a basin with ridges and valleys dropping into the depths around the edges, representing oceanographers' best guess at the topography before the expedition. Then Dr. Mayer pushed a button, adding depth data from the survey, which used new multibeam sonar. Suddenly a giant underwater mountain sprouted up 10,000 feet where the old chart had shown only a vague bump.

One of the old depth-sounding voyages had passed within a few miles but missed it. "That's the state of our knowledge," said Dr. Mayer, who named the undersea mountain Healy, after the icebreaker.

Such physical features matter enormously to nations seeking to expand their undersea territory under a murky clause, Article 76, in the Law of the Sea. With only fragments of the Arctic ever surveyed, by

icebreaker or nuclear submarine, various countries are mounting new mapping expeditions to claim the most territory they can.

The exclusive economic zone controlled by a country generally extends 230 miles from its shores. But under Article 76, that zone can expand if a nation can convince other parties to the treaty that there is a "natural prolongation" of its continental shelf beyond that limit.

The shelf is the relatively shallow extension of a landmass to the point where the bottom drops into the oceanic abyss. But in many places, the drop-off is a gentle slope or is connected to long-submerged ridges that, if precisely mapped, might add thousands of square miles to a country's exploitable seabed.

Claims of expanded territory are being pursued the world over, but the Arctic Ocean is where experts foresee the most conflict. Only there do the boundaries of five nations - Russia, Canada, [Denmark](#), Norway and the United States - converge, the way sections of an orange meet at the stem. (The three other Arctic nations, [Iceland](#), Sweden and Finland, do not have coasts on the ocean.)

"The area does get to be a bit crowded," said Peter Croker, chairman of the Commission on the Limits of the Continental Shelf, which assesses claims. It is composed of experts appointed by countries that ratified the treaty.

Disputes over overlapping claims must be worked out by the countries involved, but the commission weighs control over areas that would otherwise remain international waters.

Countries that ratified the treaty before May 13, 1999, have until May 13, 2009, to make claims. Other countries have 10 years from their date of ratification.

Russia adopted the treaty in 1997, and four years later laid claim to nearly half the Arctic Ocean. The commission's technical panel rejected the claim, and now Russia hopes the recent voyage of its research ship Akademik Fyodorov to the North Pole will yield mapping data in its favor.

In June, Denmark and Canada announced that they would conduct a joint surveying project of uncharted parts of the Arctic Ocean near their coasts.

Denmark is particularly interested in proving that a 1,000-mile undersea mountain range, the Lomonosov Ridge, is linked geologically to [Greenland](#), which is semiautonomous Danish territory. If it finds such a link, Denmark could make a case that the North Pole belongs to the Danes, Danish officials have said.

Canada could also claim a huge area, and then face challenges from the other Arctic nations. The United States could petition for a swath of Arctic seabed larger than [California](#), according to rough estimates by Dr. Mayer and other scientists. But while the government financed Dr. Mayer's survey, it has not made a

definitive move toward staking a claim.

American ratification of the Law of the Sea treaty has repeatedly been blocked by a small group of Republican senators, now led by Senator James M. Inhofe of [Oklahoma](#). They say, among other things, that the treaty would infringe on American sovereignty.

In a Senate hearing last year, Mr. Inhofe said, "I'm very troubled about implications of this convention on our national security." The deadlock has persisted even though the Bush administration in 2002 described ratification of the Law of the Sea and four other treaties as an "urgent need."

Many proponents of the treaty, including the Pentagon, the American Petroleum Institute and Senator John McCain, Republican of [Arizona](#), say this paralysis leaves the United States on the sidelines while others carve up an ocean.

"We need to be in the game, at the table, talking about fisheries management, mineral extraction, freedom of navigation," said Adm. James D. Watkins, a retired chief of naval operations who is chairman of the United States Commission on Ocean Policy.

Mr. McCain said, "I think what it would require really is a hard push from the president."

Treaty or no, territorial disputes ultimately imply questions about a country's ability to defend its interests. Here, too, the United States has shown less urgency while Canada has acted more aggressively to ensure sovereignty over a fast-changing domain it had long neglected.

Already, oil tanker traffic is rising and fishing boats are going farther north. The Royal Canadian Mounted Police is concerned that melting seaways could make it easier for narcotics traffickers to reach indigenous communities, and for organized crime to exploit the growing diamond trade. And the United States, which disputes Canada's control over parts of the petroleum-rich Beaufort Sea, has in the past sent vessels unannounced through other Arctic waters that Canada claims.

Three years ago Canada began patrolling the most remote Arctic reaches with army rangers, a mostly Eskimo force of 1,500 irregulars. Next year the military plans to launch Radarsat 2, a satellite system that will allow surveillance of the Arctic and sea approaches as far as 1,000 miles offshore.

The military is also buying three reinforced tankers to supply ships patrolling the north. The fleet of Twin Otters, the primary surveillance and transport planes in the north since the 1960's, will be replaced with bigger, faster transports. And senior officials are touring places that offer little but symbolic value.

Canada's aim is not only to tighten control of its territory, but also to establish a strong posture in future talks over the Northwest Passage, the long-sought shortcut from Europe to Asia across the top of Canada.

Bill Graham, the defense minister, said, "I don't see the Northwest Passage as something for another 20 years, but at the rate of present global warming, we know that it will be within 20 years and we have to get ahead now." This summer he made a point of visiting Hans Island, a two-mile-long rock claimed by both Canada and Denmark.

The Pentagon has focused elsewhere. The Navy spent up to \$25 million a year on polar research in the 1990's, and in April 2001 produced a report warning that weapons and ships were not designed with arctic conditions in mind, and that charts, navigational systems and support networks were inadequate for the north.

"Safe navigation and precision weapons delivery capability," the report said, "may be significantly constrained unless these shortfalls are addressed."

But in the budget shake-up after the Sept. 11 attacks, the Navy severely reduced spending for polar research.

At the same time, America's three large icebreakers are deteriorating. One of them, the Polar Sea, is inoperable and docked in Seattle, where it is being readied for a year or two of repairs. No replacements are planned.

Three Shipping Passages

Churchill, Manitoba, and Murmansk, on the Russian Arctic coast, are unlikely sister cities.

Churchill is not a city at all, but a barren outpost of 1,100 people on the western shore of Hudson Bay. It survives on the 15,000 tourists who visit each year for the chance to see and photograph migrating polar bears.

Murmansk, by contrast, has a population of 325,000, making it the biggest city inside the Arctic Circle. Founded in 1916 as Romanov-on-Murman, just before the revolution wiped out the Romanovs, it is a place of stolidly attractive old buildings, newer high-rises, wide boulevards and green parks. Though it lies north of Churchill, which is ice-bound up to eight months a year, Murmansk's harbor is kept free of ice by the Gulf Stream, the ideal base for the Russian Arctic fleet and commercial shipping.

One thing the communities have in common, however, is hard times. Churchill, never much to begin with, lost most of its population when Canada finished phasing out the Fort Churchill military base in the 1980's. Murmansk, like much of the rest of Russia, lost economic ground with the collapse of the Soviet Union. But the more relevant connection is an accident of geography and a shared dream: that the thawing of the Arctic Ocean would help create the so-called Arctic Bridge, a shipping route with their ports as the logical terminals.

The advantage of maritime shortcuts across the top of the world can be startling. For example, shipments

from Murmansk to midcontinental North America by the well-worn route through the St. Lawrence Seaway and Great Lakes to Thunder Bay, in western Ontario, typically take 17 days. The voyage from Murmansk to Churchill is only 8 days under good conditions, and from Churchill, rail links snake down through Manitoba, the American Midwest and points south all the way to Monterrey, [Mexico](#).

For Murmansk, an extended shipping season in Arctic ports that are now frozen much of the year could mean a boon in traffic - to the west and, perhaps once again, to the Far East.

The city was once the anchor of the Soviet Union's [Northern Sea Route](#), which stretched to nearly 3,500 miles to the rich nickel mines at Norilsk and on to newly established Arctic colonies at Dikson, Khatanga, Tiksi and Pevek before reaching the Bering Sea.

At its height, in 1987, more than seven million tons of cargo traversed the icy route. But when the Soviet Union collapsed, so did the Northern Sea Route. Today it handles only 1.5 million tons.

The Murmansk Shipping Company, newly privatized, now uses its icebreakers for tourist cruises to the North Pole - \$15,000 to \$20,000 a ticket, depending on the cabin.

The same way an Arctic Bridge could drastically cut the distance to Canada, a revived Northern Sea Route could shorten the journey for goods and raw materials from Northeast Asia to Europe by 40 percent.

Vladimir M. Chlenov, the transportation minister from the Siberian republic of Sakha, a vast region that borders the Laptev Sea, envisions dozens of ships carrying gold, timber and other resources up the Lena River to the port of Tiksi, and from there through ice-free seas to Europe and Asia.

The waters near the Siberian shore - when free of ice - are too shallow for giant cargo ships, and the infrastructure needed for navigation has deteriorated. But a study conducted from 1993 to 1999 by researchers from Russia, Norway and [Japan](#) found that a route once sustained by Soviet diktat could also be viable for private enterprise.

There is, of course, a third Arctic shipping route besides the Arctic Bridge and the Northern Sea Route: the Northwest Passage. It would be the last of the three main routes to succumb to the thaw. But some Canadian officials, eyeing what will happen in 20 years, say it is all the more justification for investing in the rebirth of Churchill.

"We're gearing up for the future," said Mr. Lemieux, the Manitoba transportation minister. "We look to be the gateway, the logistical hub of the world for circumpolar navigation."

A lucky winner would be Pat Broe, the American who bought the Port of Churchill in 1997 almost as an afterthought, for a token \$10 Canadian. Looking to expand his railroad company, OmniTrax, he had

already paid \$11 million for 810 miles of denationalized tracks in Manitoba. He acquired the port at auction, figuring he would rather own it than have someone else use it as a "toll booth" for his railroad.

Mr. Broe, a private man, declined to be interviewed for this article.

Since his acquisitions, OmniTrax estimates it has spent \$50 million modernizing the port to accommodate big ships carrying exports like grain and farm machinery to Murmansk, and incoming Russian products, including fertilizer and steel. By some hopeful estimates, Churchill's shipping season could eventually grow to 8 or even 10 months a year, compared with the current 4.

Michael J. Ogborn, OmniTrax's managing director, said he could see a future for Churchill when "the activity at the port will be as busy as an anthill, with machines, people, freight and ships at dock."

For now, though, there is a problem. While the port has continued to ship grain to Europe and North Africa, it is still waiting for its ship to come in - any ship from Russia, to demonstrate the advantages of the Arctic Bridge.

"There is still a huge marketing effort needed to educate shippers why they should ship through Churchill," Mr. Ogborn conceded.

And in an arena where sharp elbows are often the norm, there is great cooperation between Canada and Russia, not least through Russia's ambassador to Canada, Georgy E. Mamedov. A spreader of good will, the ambassador has even suggested using decommissioned nuclear submarines to transport cargo under the ice. On a visit to Churchill last year, he appointed his local driver honorary Russian consul, and stopped at the "jail" for polar bears that wander into town, laying his hand on the big black nose of one anesthetized inmate and addressing it fondly in Russian.

In the months since, Mr. Mamedov has talked ebulliently of the Arctic Bridge in meetings with Canadian officials, business groups and reporters. "Go to Churchill," he said in one interview. "Go there."

Clifford Krauss reported from Canada for this article, Steven Lee Myers from Russia, Andrew C. Revkin from New Hampshire and Washington, and Simon Romero from Norway. Craig Duff contributed reporting from Canada, Norway, Russia and Alaska.

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