

# Expert Says Arctic Ocean Will Soon Be an Open Sea

## Catastrophic Shifts in Climate Feared if Change Occurs

BY WALTER SULLIVAN

Col. Bernt Balchen, polar explorer and flier, is circulating a paper among polar specialists proposing that the Arctic pack ice is thinning and that the ocean at the North Pole may become an open sea within a decade or two.

Although he bases his thesis on predictions in recent years by several experts in polar weather and ice behavior, interviews with a number of other specialists have shown a widespread belief that the progressive shrinkage of the Arctic pack ice over the last century has reversed itself, at least temporarily.

Disappearance of the Arctic pack would enable the largest tankers to reach the newly discovered oil fields of northern Alaska. However, of major concern is the possibility of catastrophic climate changes.

A number of specialists believe that an ice-free Arctic Ocean would not freeze again. If so, it has been predicted that storm paths would change and the food-producing areas of the Central United States and Eurasia might become deserts. Likewise, it is thought that great ice sheets would form farther north.

Soviet scientists reportedly agree with their American colleagues that the warming trend in the Arctic has shifted to a slow cooling. The Russians, because of their dependence on sea routes to ports along their long Arctic coastline keep the closest watch of anyone on weather trends and the drifting pack ice of the Arctic Ocean.

A number of Soviet and American specialists nevertheless believe with Colonel Balchen that the ice cover of that ocean is "vulnerable." A moderate increase in solar heat production or a change in transparency of the atmosphere (man-made or natural) could remove the ice.

Because removal of the pack would probably have cataclysmic effects, investigation of factors controlling this "thermal lever" on the world's climate is being pressed. However, according to sources within the National Science Foundation, the budget for some aspects of this research has been severely cut.

One focal point is the use of giant computers to simulate the world's weather patterns to see what would happen when the Arctic Ocean is free of ice. Would it, in fact, remain so? A preliminary attempt to explore this possibility has been carried out at the University of California, Los Angeles, with results that were reportedly ambiguous. Now, a more ambitious effort is in preparation.

### Thin Crust of Ice

The Arctic pack is a thin crust of ice over a deep ocean. Thus, it differs basically from the Antarctic ice sheet, which rests on a lofty continent. Whereas melting of the Antarctic ice—or slippage of part of it into the seas—would raise sea levels throughout the world by many feet, the melting of the floating ice of the Arctic would have no such effect.

This is because floating ice displaces just as much water as the water produced when the ice melts. When ice cubes in a glass melt, for example, the water level does not rise.

About one quarter of the Arctic pack melts each summer, although the percentage varies widely. Unlike other oceans, the Arctic Ocean is almost landlocked, but warm Gulf Stream water flows into it from the Atlantic and a lesser amount of heat is also carried in from the Pacific through the Bering Strait.

Hence the Arctic Ocean, at depths below 500 feet, is underlain by a layer of warm water 2,500 feet thick. Its surface would also be warmer, were it not for its covering of ice, which on the average is a few yards thick. The North Pole region receives more solar heat in summer months than do the tropics, since the sun shines on it day and night.

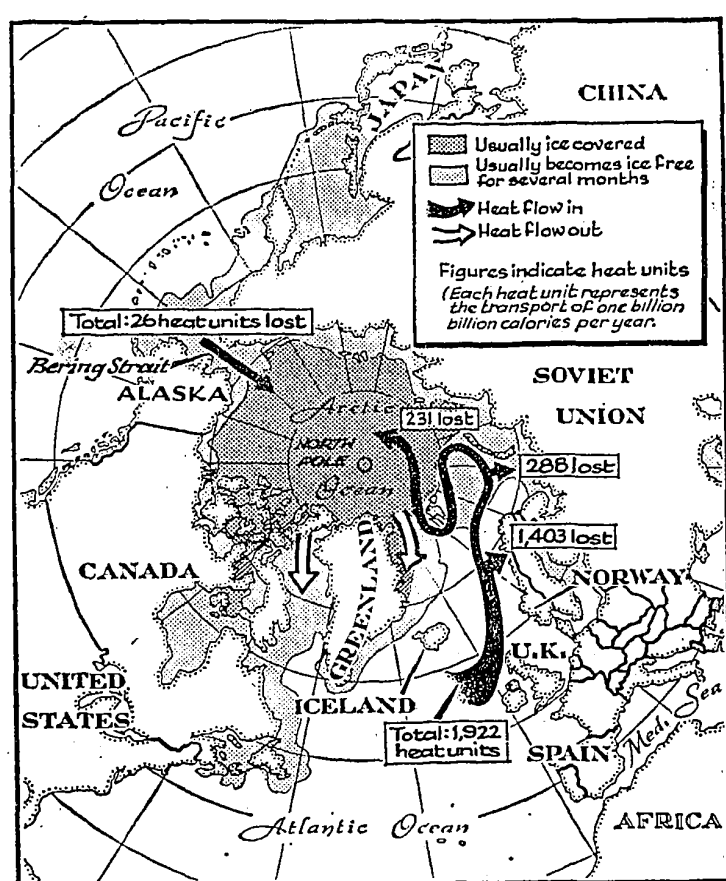
The brilliant white surface of the pack reflects almost all of this energy back into space, but if the pack were gone, the water would absorb much of it. Thus, such specialists as Dr. Mikhail I. Budyko, director of the Main Geophysical Observatory in Leningrad, and Dr. Henri Bader of the University of Miami, believe that the ocean would not freeze again, even in winter, once the pack had disappeared.

In fact Dr. Budyko argues that an ice-free Arctic Ocean is the "normal" situation. He thinks that, throughout the tertiary period—the 70 million years preceding the successive ice ages of the last million years—the ocean was ice-free. He notes that during the tertiary temperate zone vegetation grew on the Arctic islands and along the Arctic coasts, while tropical vegetation moved northward.

There is a strong suspicion on both sides of the Atlantic that the ice ages—which may continue to recur—represent some kind of cyclic behavior related to the presence or absence of ice on the Arctic Ocean.

At present, the ice cover inhibits evaporation from that ocean. It persists as a region of barometric high pressure and the movement of storm paths across the northern continents is therefore deflected to the south.

If the ocean were free of



The New York Times Feb. 20, 1969  
**Substantial heat is carried into the Arctic Ocean, as shown above, from the Atlantic Gulf Stream and to lesser extent from the Pacific. But the Arctic ice pack prevents warming of the ocean surface. Some scientists believe that if the pack disappeared, the Arctic Ocean would become too warm to freeze over again. The map was adapted from studies published by the Rand Corporation.**

ice, storm paths, it is thought, would move farther north, depriving the plains of North America and of central Eurasia of rainfall. Winds blowing off the Arctic Ocean would become moist, and snowfall on mountains in the path of those winds would be almost continuous.

This would strat the formation of ice sheets such as those that several times have flowed south across North America and Eurasia.

The warning sounded by Colonel Balchen has stirred up enough excitement in Washington for the Navy to ask Dr. Norbert Untersteiner of the University of Washington to

prepare an assessment of trends in the pack. His report will appear shortly in Naval Research Reviews.

Dr. Untersteiner, who has spent a good part of his professional career living on or studying the Arctic pack, summarized his report in a telephone interview. In essence, he believes not only that the climatic trend in the Arctic has turned toward cooling, but that the evidence for swift and dramatic thinning of the pack is unreliable.

Those who argue for such radical thinning cite a report by Fridtjof Nansen from 1893 that the pack was 43 feet thick. Col. Balchen cites a succession

of subsequent reports indicating a steady thinning of the pack that, the data suggest, could vanish by 1970 or sooner.

Col. Balchen, who has retired from the Air Force and is now with General Dynamics, flew Adm. Richard E. Byrd across the Atlantic and to the South Pole in the nineteen-twenties. He has been concerned with polar flight operations ever since.

The weakness in drawing conclusions from old ice-thickness reports, according to Dr. Untersteiner, is that the pack varies widely in thickness in terms of season and location. Newly frozen leads, or channels, between the floes may be only a few inches thick.

Yet in the central Arctic, particularly where the circular drift of the ice has subjected it to great compression, the floes become rugged conglomerations many yards in thickness.

Walter I. Wittmann of the Naval Oceanographic Office, who has made five of the seven under-ice journeys of American nuclear submarines, reports no evidence of impending disintegration of the pack.

The journeys, totalling 40,000 nautical miles, were made in winter and summer. The submarines carry devices that accurately record the vessel's depth, in terms of open water, as well as the distance to the bottom of the ice overhead. From these two figures it is possible to calculate ice thickness along the entire route.

Dr. Waldo Lyon of the Navy Electronics Laboratory in San Diego, another leading specialist on Arctic ice, agrees with Mr. Wittman's assessment. He said this week that the pack thickness seems to respond less to climate warming than does the areal extent of the pack.

During the century of climate warming before 1940 or 1950, he said, there was a decrease in areal extent of the pack. However, climate cooling during the last decade or two seems to have reversed this trend, he added. The Navy keeps track of pack ice distribution through monthly Project Birdseye flights over a large part of the Arctic Ocean.

Both Soviet and American

## Other Specialists See No Thinning of Polar Ice Cap

specialists predict continued cooling in step with an expected decline in sunspot activity through the nineteen-eighties. Col. Joseph O. Fletcher, a retired Air Force polar specialist now with the Rand Corporation in California, has cited the presence or absence of pack ice around Iceland as an index of such trends.

From the 9th century to the 13th century almost no ice was reported there. This was the period of Norse colonization of Iceland and Greenland. Then, conditions worsened and the Norse colonies declined. After the Little Ice Age of 1650 to 1840 the ice began to vanish near Iceland and had almost disappeared when the trend reversed, disastrously crippling Icelandic fisheries last year.

Colonel Fletcher shares with others a belief that these bad conditions will continue with the cooling trend.

Until recently there was a suspicion that the warming trend of the century preceding 1940 was a by-product of the industrial revolution. Carbon dioxide, produced by combustion, makes the atmosphere less transparent to infra-red radiation, thus trapping the earth's heat like the roof of a greenhouse.

There is evidence that the carbon dioxide content of the world's air has risen from 10 to 15 per cent during the last century. However, the cooling trend of recent years indicates that other factors are at work, including perhaps the volume of dust and smog in the air. This tends to reduce the solar heat reaching the surface.

According to Dr. Reid A. Bryson, professor of meteorology at the University of Wisconsin, transparency of the atmosphere above the highest summit of the Hawaiian Islands has been decreasing at a rate of 30 per cent each decade. In view of the summit's remoteness from industrial areas, this is taken as an index of global air pollution.