

Arctic pollution's surprising history

Scientists know that air pollution particles from mid-latitude cities migrate to the Arctic and form an ugly haze, but a new University of Utah study finds surprising evidence that polar explorers saw the same phenomenon as early as 1870.

“The reaction from some colleagues – when we first mentioned that people had seen haze in the late 1800s – was that it was crazy,” says Tim Garrett, assistant professor of meteorology and senior author of the study. “Who would have thought the Arctic could be so polluted back then? Our instinctive reaction is to believe the world was a cleaner place 130 years ago.”

The study will be published soon in the March 2008 issue of the *Bulletin of the American Meteorological Society*.

By searching through historic records written by early Arctic explorers, Garrett and his collaborator Lisa Verzella, former undergraduate student at the University of Utah, were able to find evidence of an aerosol “dry haze” that settled onto the ice to form a layer of grayish dust containing metallic particles. The haze and dust were likely the byproducts of smelting and coal combustion generated during the Industrial Revolution.

“We searched through open literature, including a report in the second issue of the journal *Science* in 1883 by the famous Swedish geologist Adolf Erik Nordenskiöld, who was the first to describe the haze,” says Garrett. “We also looked through books describing Arctic expeditions that had to be translated from Norwegian and French.”

The historic accounts show that more than 130 years ago, the Industrial Revolution was “already darkening the snow and skies of the far North,” Garrett says.

History of Arctic Pollution

Garrett and Verzella say the first report of Arctic haze pollution usually is credited to a U.S. Air Force meteorologist J. Murray Mitchell, who in 1957 described “the high incidence of haze at flight altitudes” during weather reconnaissance missions from Alaska over the Arctic Ocean during the late 1940s and 1950s.

Mitchell was credited in the 1970s by Glenn Shaw from the University of Alaska, Fairbanks, and his collaborators Kenneth Rahn and Randolph Borys, from the University of Rhode Island, who were the first to discover the haze contained high levels of heavy metals, including vanadium, suggestive of heavy oil combustion.

In a later study, Rahn and Shaw said: “Arctic haze is the end product of massive transport of air pollution from various mid-latitude sources to the northern polar regions, on a scale that could never have been imagined, even by the most pessimistic observer.”

Since humans had been generating aerosol pollution long before 1950 – namely, since sometime after the advent of the Industrial Revolution in the late 1700s – it made sense to Garrett that pollution generated from earlier times also might have made it to northern latitudes from Europe, Asia and North America.

“I thought that pollution had to be observed in the Arctic prior to 1950, so I decided to find out if that was true,” says Garrett. So he hired Verzella to search historic records to determine if there was written evidence of early Arctic pollution.

Verzella found a number of published reports from the late 1800s to early 1900s that mention a whitish haze in the sky, or a gray or black dust on the ice. But Nordenskiöld “was the first to explicitly draw attention to the haze phenomenon” during his 1883 expedition to Greenland, the researchers concluded.

Even during an earlier expedition in 1870, Nordenskiöld observed “a fine dust, gray in color, and, when wet, black or dark brown, is distributed over the inland ice in a layer which I should estimate at from 0.1 to 1 millimeter.”

He found that the dust contained “metallic iron, which could be drawn out by the magnet, and which, under the blowpipe, gave a reaction of cobalt and nickel.” He believed it to be a “cosmic dust” possibly from meteors. However, the concentration of metallic iron, nickel and cobalt made it much more likely that the origin was industrial pollution generated at mid-latitudes.

Last year, other researchers found that the dust is present in ice core samples. “Recent Greenland ice cores show a rapid rise in anthropogenic soot and sulfate that began in the late 1800s, but with peak sulfate levels in the 1970s, and peak soot between 1906 and 1910,” Garrett and Verzella say in their study. A higher composition of sulfate suggests oil combustion, while higher soot suggests coal combustion, consistent with the main sources of pollution generated in the 20th versus 19th centuries.

Early Arctic Warming

In a 2006 study, Garrett concluded that particulate pollution from mid-latitudes aggravates global warming in the Arctic. Did it do the same back in the 1800s?

“It is reasonable that the effect of particulate pollution on Arctic climate may have been greater 130 years ago than it is now, because during the Industrial Revolution, technologies were dirtier than they are now,” says Garrett. “Of course, today carbon dioxide emissions are greater and have accumulated over the last century, so the warming effect due to carbon dioxide is much greater today than 100 years ago.”

In fact, after fossil-fuel combustion became more efficient in the mid-1900s, the levels of particulate pollution in the Arctic dropped dramatically from levels earlier in the century. However, Garrett believes that we might be seeing another increase due to higher emissions from developing industrial countries such as China.

Source: University of Utah

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