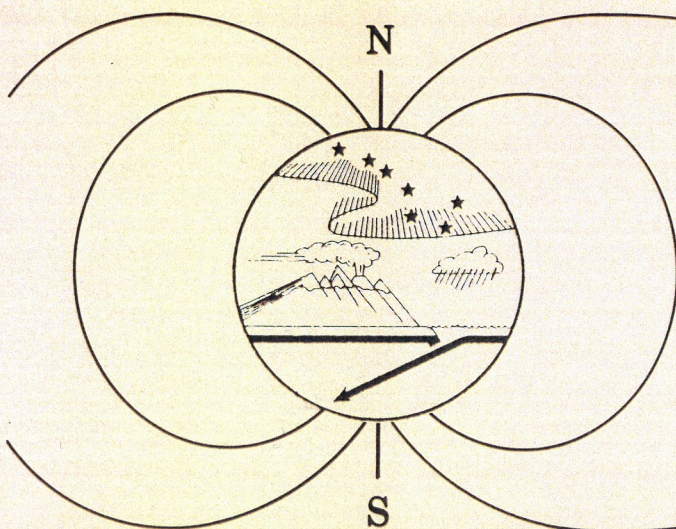




The GEOPHYSICAL INSTITUTE QUARTERLY

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The Director Introduces: a Report to Alaskans

*What do we do?
Why do we do what we do?
And what is in it for you?*

Explaining scientific research to the public is difficult. We scientists spend dozens of years learning to do what we do. We never finish: our profession is to learn! How, then, can we transmit to you in a few minutes what it took us years to learn and understand?

To explain, to elucidate, to educate, to teach is not science: it is an art. University researchers indeed must lead a double life: that of a scientist who learns the secrets of nature, and that of an artist who reveals these secrets to the world. Their world usually consists of students and fellow scientists — only occasionally is John Q. Public invited to the show.

The *Quarterly* is a modest effort on the part of the Geophysical Institute to remedy this situation, at least in what concerns our own activities. The creation of this publication reflects our sincere desire to communicate more effectively with the Alaskan public, our community leaders, and our elected and appointed officials. Detailed technical information on our research activities has been available for many years through our Annual Report, tailored to the scientific community and the funding agencies. The *Quarterly* is intended to provide non-technical information and — why not? — entertain the Alaskan public. I hope that we will succeed.

Of the questions introducing this

article, the last one is the most tricky to answer. What is in it for *you*? Maybe as little as nothing, maybe as much as your entire life's safety. The benefits of science are long-term, and scientific research is accountable only from a historical perspective. Look around you: everything you see, everything that happens in your human environment is ultimately based on some scientific discovery or some scientific study in the past. This is all the more apparent in Alaska: success in achieving Alaska's goals for the 1980s — more vigorous economic growth, better health and quality of life, enhanced protection of Native peoples' lifestyles, a stronger position in the management of our natural resources — will depend to a large extent on site-specific knowledge and on the development of local technologies *which can come only from scientific research*. In terms of the role of the University of Alaska and its research institutes, it all boils down to another, more simple question:

In whose hands do we want to see the future of Alaska placed?

Do we want it to be people educated and trained in Alaska by experts familiar with the specific economic, social, scientific, technological and cultural issues of Alaska — or, rather, should we continue to rely mainly on expensive expertise temporarily contracted from other states, honed in different environments, trained to solve different kinds of problems?

This first issue of the *Quarterly* is an experiment, conducted by its Editor

Gunter Weller, who is also our Associate Director for Planning. Gunter is assisted by Carla Helfferich, the editor of two other Geophysical Institute publications, *The Northern Engineer* and the outrageous *Geofizz*. My appreciation to both for their enthusiasm and effort invested in the conception, gestation and birth of this first issue!

Without feedback, an experiment is useless. If you are a non-scientist, did you find the information interesting? Did you find it useful? If you are a scientist or engineer, did you find it revealing? So, please take a few minutes of your time to drop us a note with your opinion. This will help us make future issues truly to the liking of our readers. By the way, the second issue will be dedicated to something which you will not find in this first one: science and money.

—Juan G. Roederer



The C.T. Elvey Building, headquarters for the Geophysical Institute.

Surprising Import: SIBERIAN SMOKE

Arctic haze, a wispy smear high in the sky, may be caused by industrial activity in Eurasia.

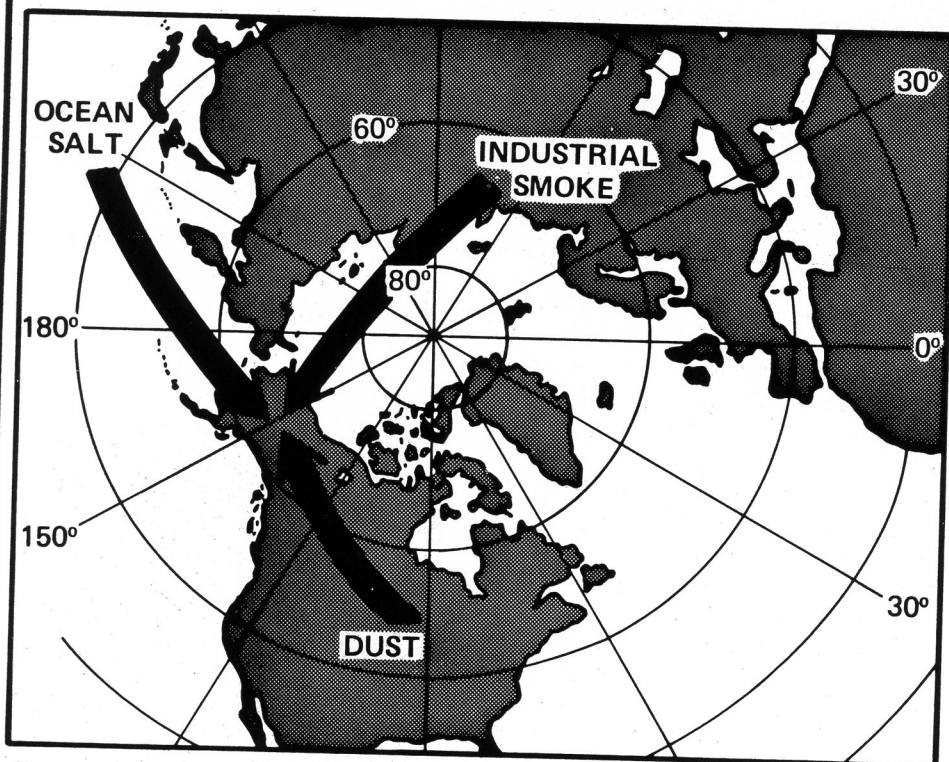
That is the preliminary conclusion from some scientific detective work by geophysicist Glenn Shaw. Assisted by graduate student Wolfgang Raatz, Shaw measured the size and composition of aerosols, tiny particles suspended in the atmosphere. Whenever the general airflow over central Alaska came from the east, their X-ray analysis of the aerosols showed that the motes were mostly aluminum or silica — dust from the earth's surface. Air from the south brought chlorine and sodium aerosols — sea spray escaped from the Pacific ocean. But when the Arctic haze flowed down from the north, the aerosols brought along included iron, titanium, nickel, chromium, manganese — metallic particles more to be expected over Pittsburg than over Fairbanks. Moreover, there was ten times more particle mass in the air during Arctic haze episodes coming from the north.

Why such dirty air blowing in from the supposedly clean Arctic? The airstreams above the earth coming from the north

must have passed over some industrialized area, picking up the aerosol load before they reached the Arctic. Working with global meteorological data, Shaw could backtrack the air that accompanied three Arctic haze episodes between February and April of this year. The trail led to Noril'sk, site of a huge mining and smelting complex in the Soviet Union. Shaw obtained satellite photos of the area — and found on the photos great plumes stretching 40 kilometers downwind from the smelters. The evidence is circumstantial, but convincing.

Shaw estimates that when the air that passed Noril'sk reaches Alaska four days to a week later, it is carrying up to four micrograms of aerosols per cubic meter. That is about what burning one cigarette would put into the air of a small high school gymnasium; it is ten times higher than the aerosol concentration usually present, but only one-tenth the concentration found in the air of a polluted city, so it need not greatly concern Alaskans yet.

Funds for this study were provided by the National Science Foundation.



How everything gets here: Like many of the state's citizens, the aerosols in the atmosphere moved to Alaska from someplace else. The diagram above simplifies the actual paths taken by the transported material.

Rocket Experiment Over Alaska Tests Planetary Formation Theory

Several years ago, Nobel Prize winner Hannes Alfvén advanced a theory of how the planets have been formed. The basis for his theory was the hypothesis that energy and mass from an electrically neutral gas cloud collapsing under its own gravity — a situation astronomers can detect elsewhere in the universe now — can be transferred to an electrified gas, or plasma, trapped in the rotating magnetic field of a star like the sun.

Laboratory experiments have revealed the possibility of such a process on a small scale, but without an interstellar space ship testing Alfvén's theory on an astrophysical scale seemed impossible. Then, from a rocket-borne experiment, German scientists believed they found corroborating evidence.

Recently, a rocket lifted off from the Geophysical Institute's Poker Flat Rocket Range bearing a highly explosive shaped charge encased in a shell of barium and strontium metal. The rocket's experimental mission, directed by Professor Gene Wescott, was multifaceted and complex, but one portion concerned a definitive test of Alfvén's theory. When the explosive charge detonated 496 km (308 miles) above the earth, it sent a rapidly expanding luminous disk of neutral barium and strontium atoms through the ionosphere. The expanding disk of atoms simulated the collapsing cloud the theory required, and the earth's ionosphere provided the plasma trapped in the rotating magnetic field.

On the ground below, Professors Chuck Deehr and Jerry Romick supervised sophisticated optical equipment measuring the encounter of cloud and plasma. The instruments found the evidence: Energy and mass did transfer from the neutral cloud to the magnetically controlled plasma.

Confirmation of Alfvén's theory is not quite final, but until the interstellar space ship comes along, the giant laboratory over Alaska will do quite well.

This study was funded by the National Aeronautics and Space Administration (NASA).

Geofacts: By mid-1982, the University of Alaska had conferred 59 Ph.D. and 81 M.S. degrees in which the required research was done at the Geophysical Institute.

PERMAFROST: A Problem Coming....and Going?

Geophysical Institute researchers and graduate students led by Professor Tom Osterkamp are monitoring how the recent string of milder winters is affecting permafrost in Alaska. First results show that the permafrost is indeed beginning to warm

in response to the higher winter temperatures. Further, the soil above the permafrost, called the 'active' layer because it thaws in summer and freezes again in winter, seems to be increasing in thickness because of the reduced outflow of heat

from the earth into the atmosphere in warmer winters. This increase takes place at the expense of the permafrost proper, the layer of permanently frozen ground, which is becoming thinner.

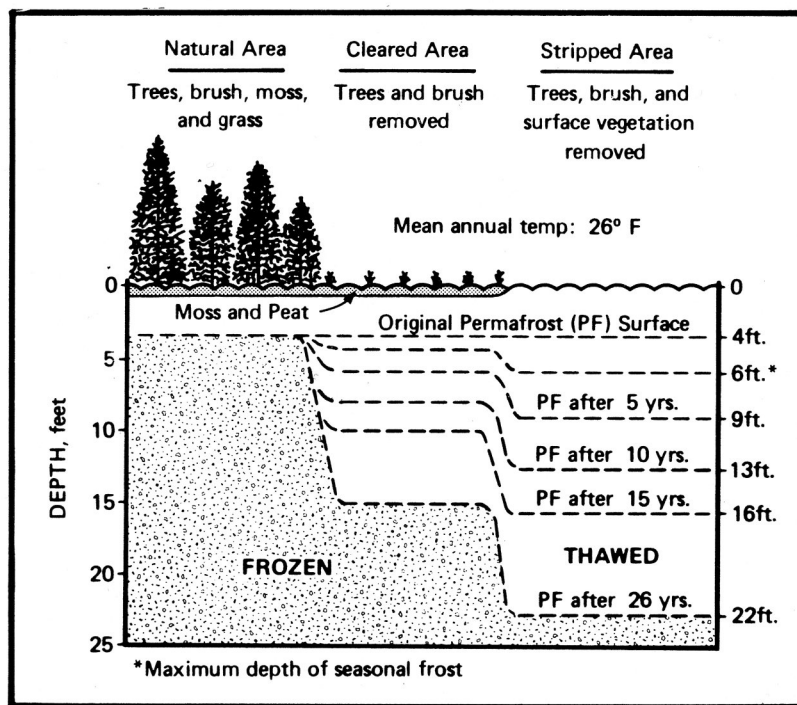
If the permafrost thaws, it could lead to substantial problems — even hazards — for human activity in Alaska. Thaw settlement may damage houses, roads, airports and other structures, hinder farming, alter stream channels, increase sediment transport in rivers, and lead to increased instability of slopes. Recent problems with Alaskan highways may be partially caused by increased permafrost thawing.

Detailed knowledge of possible permafrost soil warming will not prevent these things from happening, but will provide engineers with the information necessary so they can design means to mitigate their effects.

This study is funded by the Alaska Council on Science and Technology.

Left:

How permafrost recedes more deeply into the ground after the surface has been cleared and stripped of the insulating vegetation (after Linell). Climatic warming will produce the same effect, but more slowly.



NEWS AND NOTES

INTERNATIONAL RADIO MEETING

On August 9-13, a symposium sponsored by the International Union of Radio Science was held at the Geophysical Institute. This was the first conference ever held in Alaska by an affiliate of the International Council of Scientific Unions. The meeting, 'Radio probing of the high latitude ionosphere and atmosphere: New techniques and new results', was organized by Professor Robert Hunsucker and his administrative assistant, Pat Brooks, of the Geophysical Institute. Ninety-six participants from 13 countries attended the intensive week of scientific and technical discussions. As part of the symposium, visitors toured the Institute's Poker Flat rocket research facility and the Chena Valley high-power radio transmitter site. This trip was highlighted by the rare occurrence of a display of noctilucent clouds: high, sunlit clouds at about 50 miles altitude, which are sometimes visible at dusk or dawn. The group saw this display from Cleary

Summit and, as they rode back to town, were further treated to an auroral display and a meteor shower. All participants were grateful to Bob Hunsucker for arranging such a magnificent and rare entertainment.

NEW VISITING PROFESSOR

Dr. Keiiti Aki has joined the Geophysical Institute as Distinguished Visiting Professor of Geophysics. He spends approximately two months per year here, working with the seismology group on Alaska's seismo-tectonic problems (which, as problems for non-scientists, appear in the form of earthquakes).

Aki is a Professor of Geophysics at the Massachusetts Institute of Technology, where he holds the chair vacated by Frank Press when he became president of the National Academy of Sciences.

Describing him as "the most distinguished seismologist in the U.S. and probably the world," as a colleague here has done, is a sure way to elicit the reac-

tion shown in the accompanying photograph.

A member of the National Academy of Sciences, Aki is also a Fellow of the American Academy of Arts and Sciences, a Fellow of the American Geophysical Union and president of the AGU Seismological Section.



*Dr. Keiiti Aki
Distinguished Visiting Professor*

SOME RECENT CONTRACTS

The Geophysical Institute received more than 100 grants and contracts during fiscal year 1982 alone. This space will be used in each issue of the Quarterly to present a sampling of the grants received.

Overflow Ice on Alaska Rivers

Overflow ice occurs throughout Alaska in subfreezing temperatures when water overflows creeks and rivers and subsequently freezes. In this project, the sites where these frozen floods occur regularly are being mapped with the help of satellite photos. Overflow ice presents difficult engineering problems to highways and other structures; the maps should help planners identify high-risk locations where such structures should not be placed.

This study by Ken Dean is funded by the Alaska Division of Geological and Geophysical Surveys.

An Alaskan Mount St. Helens?

The thermal activity of Mt. Wrangell has been increasing spectacularly since the 1964 Alaska earthquake. Up to 30 million tons of ice have melted in the active North Crater. The volcano is of the andesitic-explosive type like Mount St. Helens, and does pose possible threats to the nearby Copper River Valley, especially in the form of outburst flooding and mudflows.

This study of glacier-volcano interaction on Mt. Wrangell is headed by Professor Carl Benson; it is funded by the National Science Foundation and the Alaska Council on Science and Technology.

More Ice Fog at Fairbanks' Airport?

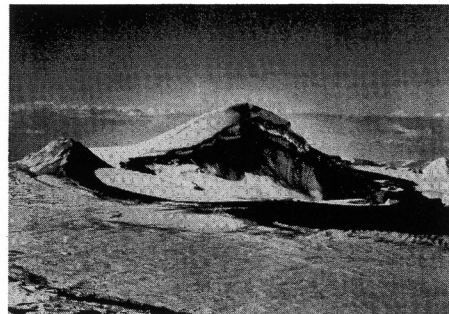
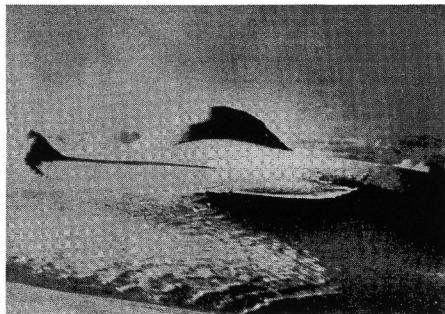
The purpose of this study is to estimate the likely increase in ice fog at the airport because of a planned change in heating systems for some State buildings. Particularly interesting is how much airport closure will increase because of the fog. This involves evaluating present and past conditions at the airport, over the last 20 years, and calculating how much water the new heating systems will add in the form of ice fog.

This study by Professors Carl Benson and Sue Ann Bowling is funded by the private firm of Ellerbe Alaska (subcontract from the Alaska Department of Transportation and Public Facilities).

Seismic Risks to Offshore Oil Platforms

The Bristol Bay, Kodiak, Shelikof Strait and Cook Inlet areas are regions of high seismic activity, as well as high petroleum potential. This project is intended to provide as much detail as possible about the nature and magnitude of strong ground motion and volcanic hazards in the region. Engineers need this information to design safe offshore platforms and onshore facilities.

The study by Professors Hans Pulpan and Juergen Kienle is funded by the Bureau of Land Management through the National Oceanic and Atmospheric Administration (NOAA).



There goes the glacier: George Wharton took the photo above left of the summit of Mt. Wrangell in 1965. Eleven years later, Carl Benson stood on the same spot and photographed the changed scene shown above right. More of the North Crater's stony face has been emerging every year as the volcano heats up.

GEOPHYSICAL INSTITUTE

of the
UNIVERSITY OF ALASKA
C.T. Elvey Building
Fairbanks, Alaska 99701



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