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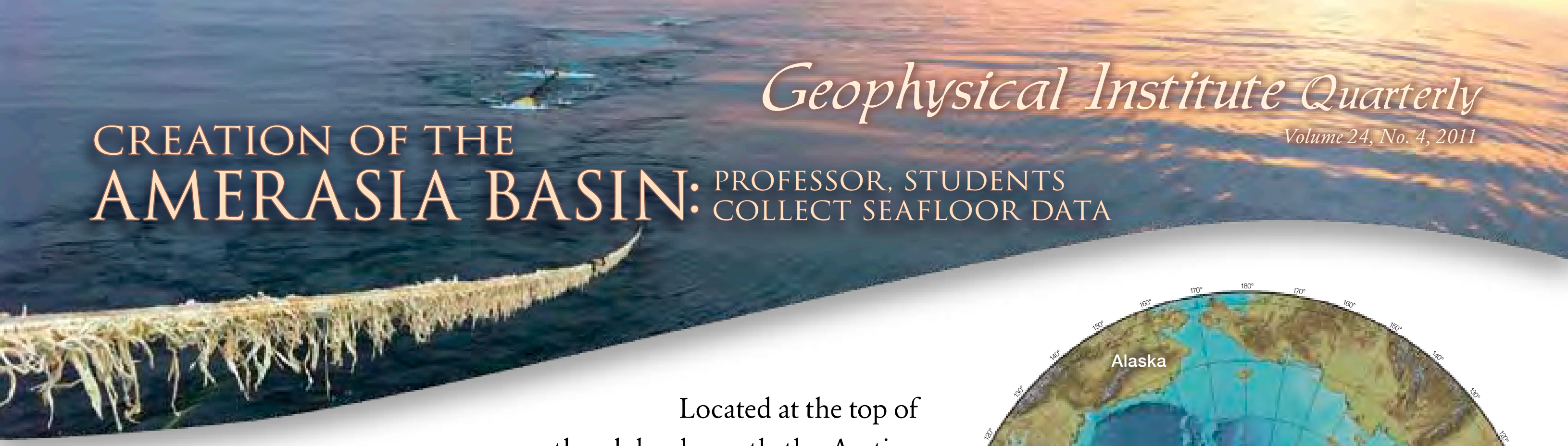
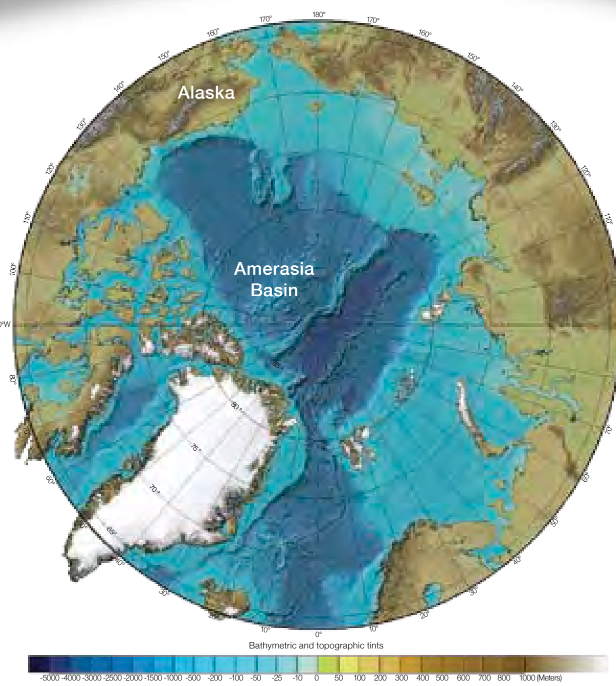


CREATION OF THE AMERASIA BASIN: PROFESSOR, STUDENTS COLLECT SEAFLOOR DATA



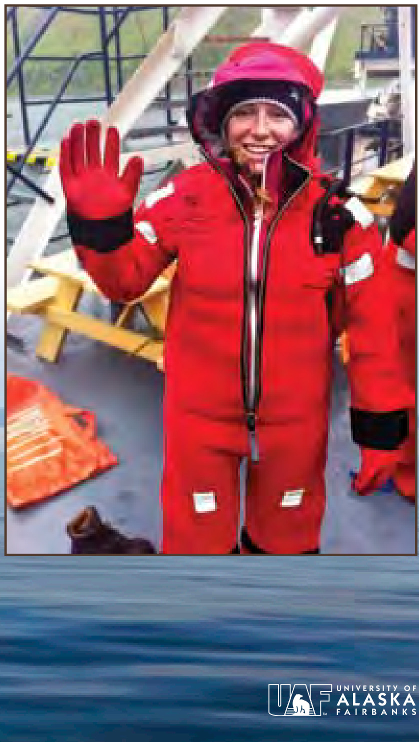
SEAFLOOR EXPLORATION - At top, the Arctic Ocean as seen from the Marcus Langseth. The airgun array, used as a low frequency sound source, is visible above the water; the hydrophone array used to record the echoes of the airgun shots trails underwater. Above, the International Bathymetry Chart of the Arctic Ocean features the subdivided basin. The Chukchi Borderland extends from the continental shelf north of the Bering Strait. Below, Karina Monsen, student from Tromso, Norway, tries on a survival suit during an abandon ship drill.

Located at the top of the globe, beneath the Arctic Ocean, the Amerasia Basin is poorly understood. This large depression in the ocean floor was created during the Mesozoic Era, the age of the dinosaurs, but how the tectonic plates shifted to open up and create the basin remains a puzzle. From Sept. 4 to Oct. 9, 2011, Professor Bernard Coakley and a crew of students gathered seismic reflection data to help solve the mystery.

"We got about 20 percent more data than I expected," Coakley said upon his return from the research cruise.

Coakley, a marine geologist with the University of Alaska Fairbanks Geophysical Institute and the College of Natural Science and Mathematics, was the chief scientist on the project funded by the National Science Foundation. After spending more than a month on the research vessel Marcus G. Langseth in the fall of 2011, he felt students gained a unique perspective out at sea.

The crew collected seismic reflection data, which uses low frequency sound to image the stratigraphy and structure beneath the seafloor, across the transition from the Chukchi Shelf to the Chukchi Borderland. Imaging the structure between these two blocks of continental crust constrains the overall deformation that created the Amerasia Basin.



Undergraduates Emily Decker and Grant Cain and doctoral candidates Ibrahim Ilhan and Melissa Johnson, all from UAF, assisted Coakley at sea. Dayton Dove, a UAF alumnus, now at the British Geological Survey, performed ably as co-chief scientist. The student crew worked 12-hour shifts, partnering with other students from Stanford, Ohio State and universities in Korea, Norway and Germany.

At sea, data were crudely, but correctly, processed. At home, more advanced processing techniques are being used to eliminate some noise and improve resolution. Once completed, these data will be the basis for in-depth interpretation. Data not specific to the cruise objectives was shared for analysis among other researchers.

"The goal is to make use of everything we collected, interpret the data and extract the stories of the past that we can find. Then we will write it down and share it with the world," Coakley said.

Bernard Coakley photos

Infrasound: Another tool to understand the planet

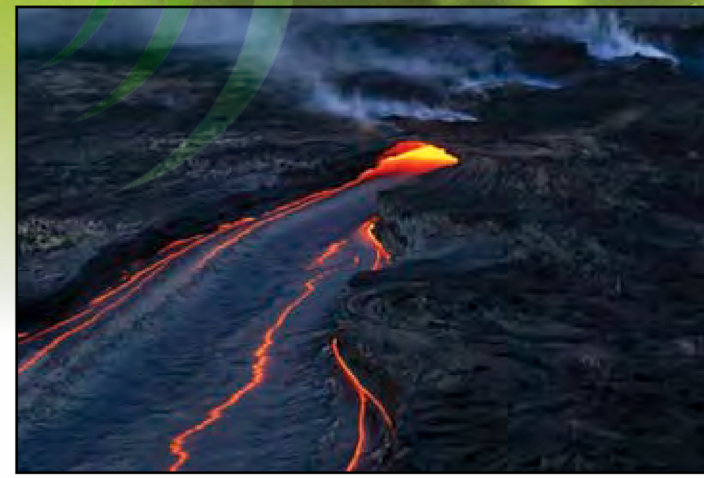
Just because we cannot hear the sound, doesn't mean it isn't there. Many geophysical and man-made sources produce long wavelength, low frequency acoustic signals known as infrasound. Like a language, infrasound can be analyzed and translated. For the Wilson Infrasound Observatories based at the Geophysical Institute, infrasound is just another tool to better understand our world.

With infrasonic arrays in Fairbanks and Dillingham, Alaska and Windless Bight, Antarctica and access to data from a global network of infrasound microphones, the GI is able to tap into the low-frequency waves that travel around the earth. Receiving real-time infrasound data, scientists are some of the first to know of storms in faraway seas, an avalanche, or man-made blasts detonated thousands of miles away.

For Assistant Research Professor David Fee, infrasound research meshes well with his seismology background. Analysis of both seismic and infrasound signals gave the scientist an edge when studying Hawaii's Kilauea Volcano.

A low-level signal hummed for nearly 30 minutes on June 19, 2007. After locating the origin of the signal and examining its characteristics, Fee and colleagues were able to determine that a crack split open somewhere between Kilauea's summit and Pu'u'O'o crater. The infrasound signal was the only observed geophysical signal associated with the fissure opening. The fissure continued to widen over a period of nearly 13 hours and it was from there that gas and lava spewed.

LISTENING TO EARTH–Infrasound sensors are used to research a broad spectrum of geophysical phenomena that emit low-frequency sound, such as volcanoes and the aurora (both pictured in the background).



USGS Hawaiian Volcano Observatory photo

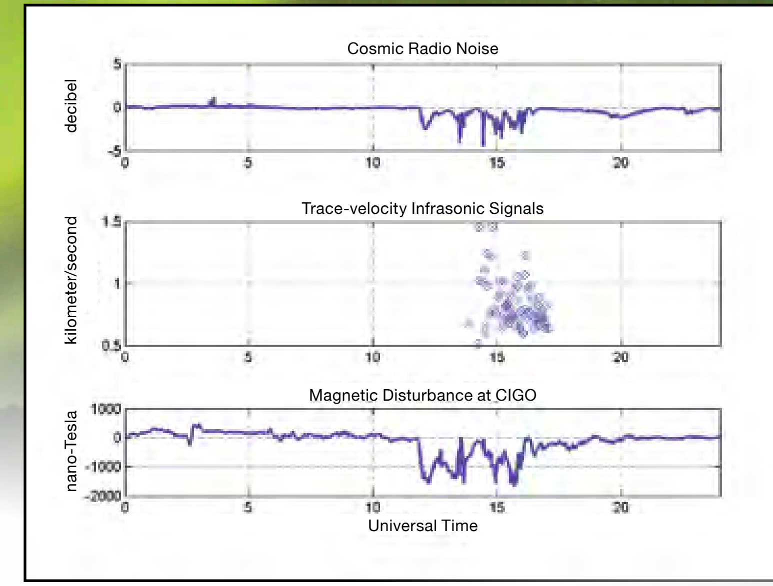
LAVA FLOW–Lava erupts from a fissure at Kilauea Volcano in July 2007. The lava channel eventually crusts over to form a lava tube.

"We were able to characterize how fast the fissure opened up. That's fairly unique," Fee said. "There were two fissure eruptions, but the first was seismically quiet, so no one saw it."

In this case, infrasound data provided a more comprehensive picture of a volcanic eruption and was covered in a paper Fee published in the Geophysical Research Letters several years later.

Infrasound research got its start at the GI back in the '60s. At that time, Charles "Buck" Wilson was a graduate student, examining the connection between infrasonic waves and auroral activity. He found that hundreds of auroral infrasonic waves were observed during magnetically disturbed periods on Earth. Using an infrasonic array located near the University of Alaska Fairbanks, Wilson, now a professor emeritus of geophysics, could detect the direction and speed of the infrasound coming from the aurora and confirm his data with visual observations. He later published his study in the journal Nature, where he also verified that auroral infrasonic waves were distinct from those produced by volcanic eruptions, storms or jet stream turbulence.

"When I was working on my Ph.D., I was writing letters to Europe for data, sometimes it would take months for the data to get here," Wilson said. "Now, I have instant access and that's why I can keep doing this."



SIGNALS–This diagram from May 8, 2005 demonstrates the relative time relationship of the Cosmic Radio Noise absorption, due to auroral electron precipitation into the lower ionosphere, the reception of auroral infrasonic signals at Fairbanks and the magnetic disturbance logged at the College International Geophysical Observatory.

Wilson explained that he has four ways to examine the aurora to better understand it. He can monitor magnetic effects on Earth's surface, he can rely on visual observations and data from imaging riometers and he can tap into the auroral infrasound signals.

"Infrasound is a gold mine," Wilson said. "There's a rich data field ready to pan and I want to find those nuggets of information."

Whether it's examining the dynamics of a volcanic eruption or auroral behavior, infrasound complements the range of techniques scientists can deploy to better understand Earth and its processes. Scientists associated with the Wilson Infrasound Observatories continue to refine techniques for signal processing and classification, supplying new, powerful tools for today's geophysicist.

Paul Jensen photo

Among many other signals, the Geophysical Institute's infrasound arrays have received: large explosive eruptions from Alaska volcanoes, including Augustine and Fourpeaked in 2006, Okmok and Kasatochi in 2008, and Redoubt in 2009; "microbaroms," the distant roar from marine storms in the Gulf of Alaska and elsewhere; and rocket launches from Poker Flat Research Range, 30 miles north of Fairbanks.

Pu'u'O'o Crater photo courtesy of the USGS Hawaiian Volcano Observatory

Redoubt eruption photo by Game McGimsey, Courtesy of AVO/USGS; coastal storm image source: Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC; rocket photo courtesy of the Geophysical Institute

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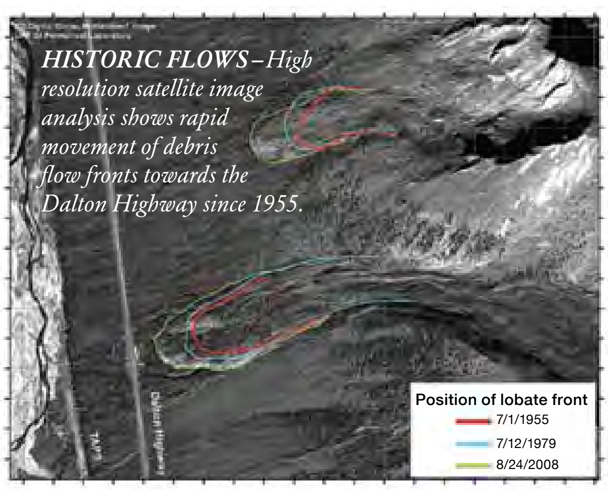
Debris lobes on the move in northern Alaska

Ronald Daanen photo

Research Assistant Professor Guido Grosse of the Geophysical Institute and Ronald Daanen of the Institute of Northern Engineering are studying frozen debris lobes consisting of blocky and fine grained rubble on the slopes of the Brooks Range in northern Alaska. The scientists, using remote sensing images and field surveys, have found several of the features north of Coldfoot along the Dalton Highway that are now rapidly moving downslope despite being classified as stable just 30 years ago.

One of the features, moving at three meters per year, is now within 70 meters (about 230 feet) of the Dalton Highway. Though it's moving slower than the fastest observed debris lobe, it might speed up and affect the only road to Prudhoe Bay.

"If it accelerates to 10 meters per year, it will hit the road in less than a decade," Grosse said. "The road culverts are already getting clogged up from loads of fine sediment being washed out from the advancing flow."



HISTORIC FLOWS – High resolution satellite image analysis shows rapid movement of debris flow fronts towards the Dalton Highway since 1955.