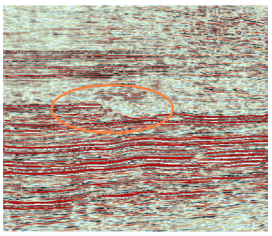
Geophysics in Alaska

Alaska Division of Geological & Geophysical Surveys

Geophysical data provides information about the physical properties of the earth and can be used to locate oil and gas reservoirs, metal and mineral deposits, characterize hazards, and map geology. Geophysical data maximizes the effectiveness of geologic mapping by providing insights in areas covered by vegetation or soil, or that are inaccessible. Geophysical surveys create a clearer picture of the geology below the surface.

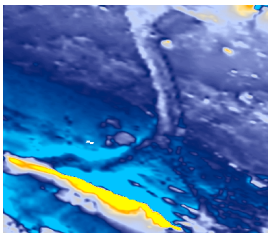
Alaska's Geophysical Data

The Division of Geological & Geophysical Surveys (DGGS) acquires, uses, and distributes several types of geophysical data.



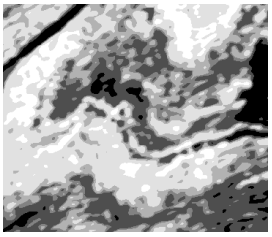
Reflection Seismic Data

Reflection seismic surveys collect data by shaking the ground and recording the returned energy ("reflections") much like sound echoing in a canyon. By measuring the returning energy waves, scientists can determine rock type, density, consolidation, and potential hydrocarbon reservoir geometry. Reflection seismic surveys are made available through the Geologic Materials Center (dggs.alaska.gov/gmc/seismic-well-data.php).



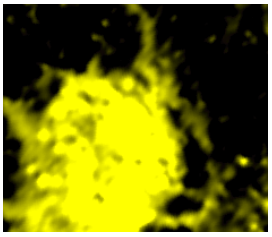
Magnetic Data

Magnetic survey data are used to make maps of the local magnetic field produced by rocks. Patterns on these maps reflect rock type, faults, and alteration. In addition to geologic mapping, magnetic data are used for mineral exploration.



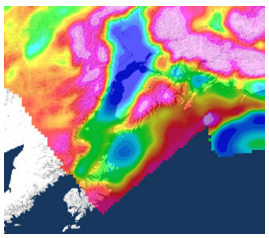
Electromagnetic Data

Electromagnetic surveys record electric fields and/or changing magnetic fields. These data measure how conductive or resistive rocks and soils are to electrical current. This data is used to determine properties including rock type, alteration, saturation, and whether soils and rocks are frozen or not.



Radiometric Data

A radiometric survey records the gamma ray energy emitted by trace amounts of naturally occurring, radioactive elements present in the first few centimeters of the earth's surface. Levels of gamma ray energy can be used to differentiate rock types and surficial material.



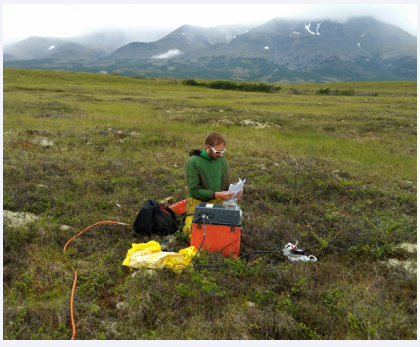
Gravity Data

The strength of the Earth's gravitational field changes depending on the density of rocks in the subsurface. These variations indicate different types of rocks, faults, and alteration. The blue area in this image outlines the hydrocarbon-producing Cook Inlet sedimentary basin. Gravity data are used in mineral and energy exploration.

Why Geophysics?

Geophysical data provides continuous spatial coverage over areas that would not be cost or time effective to investigate with other methods.

Airborne electromagnetic data collection over Goldstream valley in Fairbanks, Alaska.



DGGS geophysicist Abraham Emond collects magnetotelluric (MT) and controlled source audio magnetotelluric (CSAMT) (electromagnetic) data at Pilgrim Hot Springs.

Geophysics in Alaska
Alaska Division of Geological & Geophysical Surveys

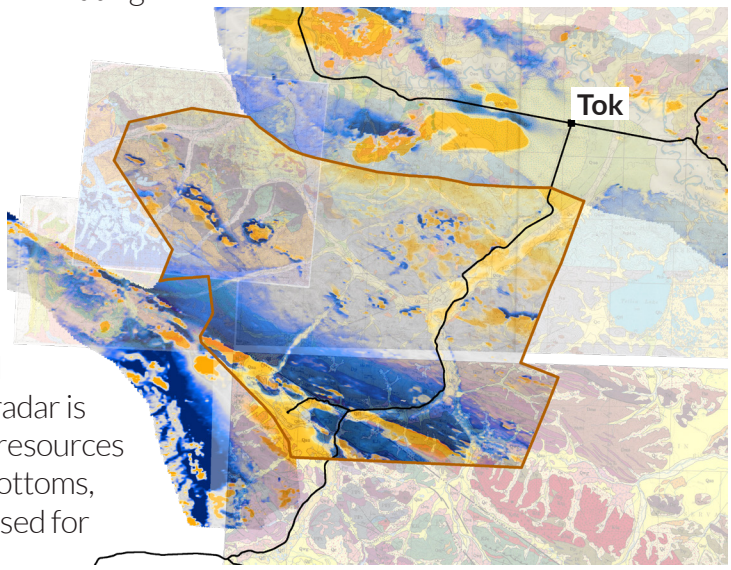
Using Geophysics in Alaska

Oil and Gas Exploration
Seismic data can be used to locate underground geologic structures acting as potential hydrocarbon traps and define subsurface stratigraphy. Magnetic and gravity data are also important in determining basin geometry, locating large-scale geologic structures that provide potential hydrocarbon traps and pathways, and generating other subsurface models.

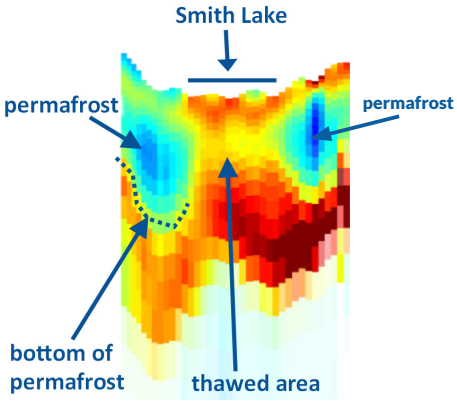
Geophysical data collection in Tonsina, Alaska.

Mineral Exploration
Mineral explorers, and other researchers use geophysical data, including electromagnetic, magnetic, and radiometric data, to assist in geologic mapping, determining the mineral potential of an area, and for locating mineral deposits.

Engineering Geology Applications
Geophysical data has many engineering geology applications including infrastructure support, helping to locate construction materials, and contributing to geohazard mitigation. Gravity surveys can estimate depth-of-fill, which is useful for infrastructure planning and understanding hydrology. Seismic surveys can be used to estimate fill depth and to learn more about the mechanical properties of the subsurface materials. Ground penetrating radar is used to map near surface stratigraphy, locate archaeological resources and utilities, test roadbed or concrete thickness, study lake bottoms, and estimate snow and/or ice thickness. Magnetic data are used for geologic mapping and locating buried objects.



Magnetic data grid over geologic map near Tok, Alaska.



Resistivity model from electromagnetic survey.

Permafrost and Groundwater
Geophysical (electromagnetic) data are used to identify and map permafrost, shallow groundwater, and sea ice thickness. Frozen sediments containing low amounts of free, fresh water are resistive. In contrast, thawed sediments with a high water content are conductive. This physical property contrast allows frozen and thawed areas to be identified.

Outreach, Education & Citizen Science
Several of our data products are usable without specialized software by a wide range of audiences, including teachers and the public. More information about how to use these products is available on our website: dggs.alaska.gov/geophysics. You can also use our interactive map to see where we cover data in the state: maps.dggs.alaska.gov/gp/.

Learn more online: dggs.alaska.gov
dnr.dggs.geophysics@alaska.gov | 907-451-5060
IC 78 | http://doi.org/10.14509/30157