State of Alaska
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

Information Circular 55

Geologic maps:

Solving problems by understanding our world

Assessing Resource Endowment

Photo provided by Teck Cominco Alaska Inc.

Overview of Alaska's Red Dog Mine, the world's largest zinc producer.

Infrastructure Design and Safety

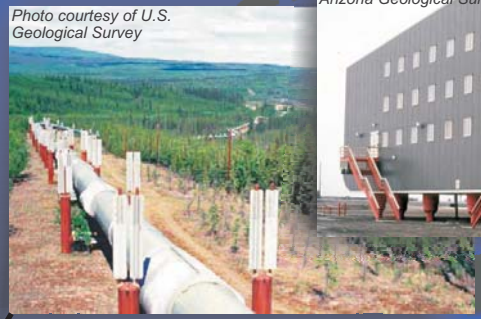

Photo courtesy of U.S. Geological Survey

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Structures constructed directly on permafrost will cause the underlying ice to melt and damage to the structure. Special construction techniques, as seen in the above photos, are required.

Mitigating Effects of Climate Change

Photos courtesy of Alaska Department of Commerce and Economic Development

The village of Shishmaref is facing evacuation due to rising temperatures, which are causing a reduction in sea ice, thawing of permafrost along the coast, and making the shoreline more vulnerable to erosion.

Benefiting Alaskans through Scientific Knowledge

The student pointing out erosion in permafrost is learning to see his environment in a new way.

Using Integrated Science to Protect the Environment

Seward Peninsula moose tooth breakage is attributed to naturally occurring heavy metals in the bedrock. Metals are absorbed by plants and affect moose nutrition.

The Alaska geologic map above is a modification of the complete version with legend available at http://www.dggs.dnr.state.ak.us.

Identifying Geologic Hazards

Photo courtesy U.S. Geological Survey

Government Hill Elementary School torn apart by subsidence at the head of a landslide that occurred during the 1964 earthquake.

Geologic maps

are our most important and complete compilation of information about the solid Earth we live on. Consequently, geologic maps are fundamental to understanding natural, earthbound processes and solving real-world environmental problems directly affecting people, plants, and other animals. The following Alaskan examples represent a sampling of the many uses of geologic maps.

Assessing Resource Endowment

Alaska, arguably the most resource-rich state, is also the most unmapped and under-explored state. Geologic mapping and related data suggest where to find a host of **necessary resources** for providing energy, building materials, and products ranging from cement to plastic to batteries.

Key Resources of Alaska

Metals…….	Gold, zinc, copper, lead, silver, tin, mercury, platinum, etc. necessary to make items such as bikes, batteries, computers, and mirrors
Energy…….	Oil, gas, coal, and geothermal for heat, electricity, and fuel, and products such as plastics, asphalt, clothing, etc.
Materials….	Riprap for erosion control, sand and gravel for roads and construction, decorative stone, limestone/marble for making cement
Minerals…..	Jade, diamonds, emeralds, soapstone, ceramics, barite, etc.
Water……..	Potable water; the most basic resource often taken for granted

Identifying Geologic Hazards

Due to its active and structurally complex geology, high relief, variable climate, and large coastal zones, Alaska is particularly prone to both large and small magnitude geologic hazards. Effective **mitigation of risk** from catastrophic geologic hazards requires knowledge and understanding of local geology and geologic processes.

Geologic mapping will help determine…

… areas at risk of river and ocean shoreline erosion – information that villages and municipalities can use to correctly manage and develop their lands.

… the eruptive history of volcanoes, leading to timely prediction of environmentally devastating events like toxic gas emissions, tsunamis, and large ash clouds

… where unstable ground could lead to landslides, road failure, building collapse, and infrastructure damage.

… the location and character of faults. Prediction of earthquake damage is possible by mapping soft sediments, which through liquefaction exacerbate the damage.

… who should install radon mitigation. Hazardous radon levels have been detected in Fairbanks area homes built on a specific Paleozoic rock unit.

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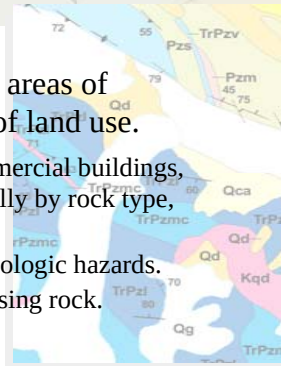
Infrastructure Planning



Development planning utilizes geologic maps to determine areas of suitable geologic and engineering character for many kinds of land use.

- Underlying rock units affect construction and stability of homes, commercial buildings, roads, dams, airports, and bridges. Erosion resistance varies dramatically by rock type, determined only through detailed geologic mapping.
- Design new transportation routes on sound bedrock with the fewest geologic hazards.
- Identify quality soils and farm land through geochemistry of decomposing rock.
- Predict well depths and water quality from local geologic knowledge.

Environmental Protection

The geology exposed at the earth's surface is a fundamental and critical component of all **ecosystems and watersheds**. Geologic knowledge is essential for resource conservation and protection, sustainable development issues, human health protection, and implementation of successful environmental regulatory programs. We use geologic mapping to:

✓ Identify areas of groundwater recharge and protect water from pollution and depletion.
✓ Determine whether hazardous chemicals are naturally occurring or human induced.
✓ Delineate ecosystems, critical wildlife habitats, and vegetation communities.

Predicting Effects of Climate Change

Alaska has been touted as the "barometer" for climate change, since the Arctic environment responds more quickly to warmer temperatures. Maps will help predict where to expect the **effects of warming**.

Shorelines – Determine future inundation due to accelerated erosion. In particular, Shishmaref is in imminent danger due to increased erosion from storms.

Permafrost areas – Interior Alaska's thawing permafrost is collapsing houses and destroying roads.

Glaciers – Retreating glaciers and weather changes will affect water quantity and quality, challenging aquatic life and subsistence fishermen.

Benefiting All Alaskans

Aside from the obvious scientific benefits for Alaska discussed above, geologic mapping brings **hidden benefits**, too.

- Alaskans are empowered by understanding Alaska's wonderful natural landscapes.
- Geologic mapping promotes public connection to natural surroundings and facilitates wise development choices.
- Local hire with on-the-job training, high school and University internships, support for student research, and money into local economies frequently accompany geologic mapping projects.