



Using Geologic Maps

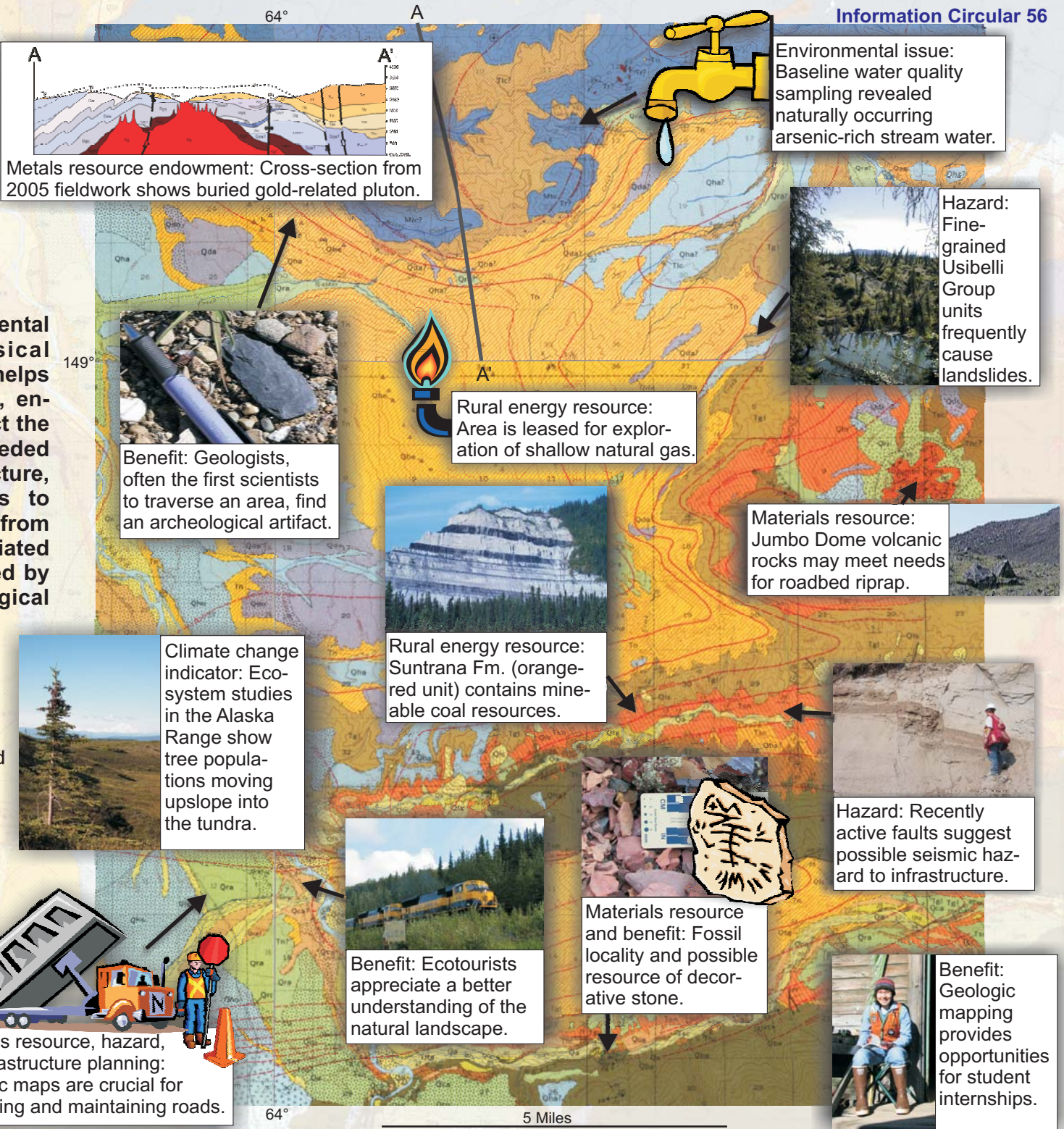
Geologic maps provide fundamental information about the physical environment. This knowledge helps protect us from natural hazards, ensure a viable environment, predict the effects of climate change, find needed resources, plan new infrastructure, and provide additional benefits to Alaskans. Here are real examples from the Alaska Range foothills associated with the area geologically mapped by Clyde Wahrhaftig (U.S. Geological Survey) in 1970.

Geologic Units

Quaternary sedimentary units

Paleozoic Totatlanika and Healy schists

Tertiary Nenana Gravel and Usibelli Group sedimentary rocks



Metals resource endowment: Cross-section from 2005 fieldwork shows buried gold-related pluton.



Environmental issue: Baseline water quality sampling revealed arsenic-rich stream water.



Benefit: Geologists, often the first scientists to traverse an area, find an archeological artifact.



Rural energy resource: Area is leased for exploration of shallow natural gas.



Hazard: Fine-grained Usibelli Group units frequently cause landslides.



Materials resource: Jumbo Dome volcanic rocks may meet needs for roadbed riprap.



Climate change indicator: Ecosystem studies in the Alaska Range show tree populations moving upslope into the tundra.

Rural energy resource: Suntrana Fm. (orange-red unit) contains mineable coal resources.



Hazard: Recently active faults suggest possible seismic hazard to infrastructure.



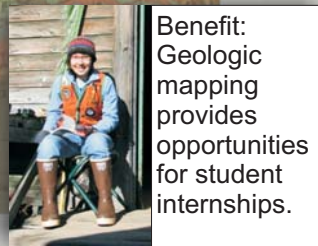
Materials resource and benefit: Fossil locality and possible resource of decorative stone.



Benefit: Ecotourists appreciate a better understanding of the natural landscape.



Materials resource, hazard, and infrastructure planning: Geologic maps are crucial for developing and maintaining roads.



Benefit: Geologic mapping provides opportunities for student internships.

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.

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.