Vol. 6, No. 2

The Engineering Explorations Newsletter

Harmonics

What is geological engineering?

Mother Earth is alive. She flows and swells and changes her skin over time. Mountains rise from the ocean, lakes get left behind by retreating glaciers, sandy beaches build up against shorelines, oil bubbles from deep underground. Sometimes these changes happen very slowly , sometimes they happen in an instant. Right now for instance, people in the North know that the land is changing quickly because of climate change.

Reproduced with the permission of the Minister of Public Works and Government Services Canada, 2002 and Courtesy of Natural Resources Canada, Geological Survey of Canada, photo # B94S0019.

Hot summers in the westernArctic have melted permafrost, land which has been frozen for as long as anyone can remember. When the land melts, coastlines slump and fall into the sea and lakes; they are also more easily eroded by waves. The change impacts everyone and everything. In the town of Sachs Harbour, NT, building foundations have shifted and sunk causing homes to lean to one side. In some places the land can no longer support heavy roads, pipelines and utilities. Collapsing land has destroyed the lairs of ground-dwelling animals like lemmings. It has even opened one fresh water lake to the ocean, killing fresh water fish and destroying sources of drinking water.

Geological engineers have a very special relationship with Mother EarthThey watch her movements, listen to her sounds and explore her parts to understand the knowledge she has to share with us regarding her natural cycles. Geological engineers study rocks, minerals, fluids, fossils, mountains, sediments, glaciers, volcanoes and earthquakes. They look at how natural materials act and interact with the weather, animals, plants, people, and chemicals. To do so they use their eyes and ears, as well as special instruments designed to let them see what is happening deep below the surface. Geological engineers use these observations to understand more about the Earth and our relationship with it.

Geological engineers take on may dif ferent jobs. They help communities and companies manage water , mineral and energy resources. They work in construction, providing advice on where and how to build structures. They protect the environment by examining ways in which we can duplicate the earth's natural recycling processes. Geological engineers also work with groundwater, the water near the Earth's surface, making sure it doesn't get polluted by industrial processes. As Aboriginal communities reassume stewardship of the land in their traditional territories, we will need more Aboriginal geological engineers and scientists who can guide local land use for activities such as mining development and forestry management.

While geological engineers can't stop climate change, they can work with people and communities to help minimize its impact. Every place is dif ferent, and knowledge of the land is important for understanding how people live and work in a place. About 40% of communities in the western CanadianArctic are at risk of suffering permafrost melt like Sachs Harbour . As an Aboriginal geological engineer, your knowledge of the land combined with an understanding of how the Earth is reacting to climate change, could help people in these places maintain their way of life.

Some of the information in this article came from Inuit Observations on Climate Change, http://www.wsd.org/climate/arctic/, and the Meteorological Service of Canada Climate Report, Fall 2002, http://www .msc-smc.ec.gc.ca/saib/climate/docs/co2_fall02/section_2/content_e.html.

Native Engineers & Scientists

A place to meet people from your community.

Name: Nalaine Morin
Nation: Tahltan
Schools Attended: British Columbia Institute of Technology,
University of British Columbia
Degrees: Mechanical engineering Diploma
Bachelor of Applied Science, Metallurgical Engineering
Job Title: Metallurgical Engineer
Favourite thing about job: *"Developing working solutions to problems at hand."*

Like lots of curious kids, Nalaine grew up asking a lot of questions. "When I was young, I found that I was always asking myself why," she recalls. As a kid, she was also fascinated by how stuf worked, "Especially the industrial machinery at the sawmill where my dad worked." When Nalaine's dad had to go to work on a Sunday, she would tag along with him just to examine all the different machinery at the sawmill.

Nalaine always knew that when she left high school she'd be working towards a degree in engineering, "It just seemed like a normal path for me and I wanted to be able to go back and work for my people." The difficult part was trying to figure out what field of engineering she should study , "I wanted to go into environmental engineering, but found that [at the time] not many universities of fered it." With a little contemplating, the influence of her high school math teacher and an interest in metal and materials, she decided to pursue a degree in Metallur gical Engineering. She recalls, "My math teacher made me enjoy math and learning so much that I was eager to continue on with my schooling so that I could just learn more."

In 2002, Nalaine graduated from the University of British Columbia with a bachelor's degree in Metallurgical Engineering. She explains that even though "university was dif ficult at times; sometimes the course load was a bit heavy, it was an excellent learning experience." Her advice to students, "It is extremely important to practice good time management skills, do a lot of reading on your own, and always try to make a connection between science and math and everyday life."

For Nalaine, the best thing about school was meeting new people. "I still keep in contact with a lot of the people I met in school. Most of them have gone on to excellent and exciting careers with big companies."

Nalaine has also gone onto a very exciting career working as a Metallurgical Engineer at the Hudson Bay Mining and Smelting Co. in Flin Flon, Manitoba. Nalaine's job is to monitor , optimize and implement changes that will help improve the plant's performanceA lot of her work consists of testing, trouble shooting, data reporting, and writing reports and procedure manuals.

Outside of work Nalaine enjoys kayaking, skiing, playing tennis and traveling. She would also like to go back to school to pursue a master's degree in Environmental Engineering. For Nalaine, her "goal as an engineer is to always protect our Mother Earth." She would like to encourage young Native students to go to university and pursue a degree in engineering or the sciences so that they "can help protect our environment" and work to create self-sufficient communities.

An afternoon at Grandpa's

"Kids, no running in Grandpa's house!" Minnie and Joe's mother yelled as they ran towards Grandpa and gave him a big hug. Every Sunday they spent the afternoon with their Grandfather.

"What do you want to do today?" Grandpa asked.

"Play explorer!!" They shouted. Mom rolled her eyes and laughed, 'Playing explorer' meant going threw the things in Grandpa's storage space hoping to find treasures. They loved exploring the big closet. Whenever they found something interesting Grandpa would tell them a story about it.

"Well," Grandpa said "let's go see what we can find today!"

Minnie and Joe bolted down the hall while Grandpa and Mom followed. By the time they reached the storage space, the two kids had already waded into the stacks of boxes, old clothes and newspapers.

"Now this is cool," Bill said holding up a smooth oily-looking stone he found wrapped in newspaper. Everyone gathered around Bill to see it.

"This," Grandpa explained "is a soapstone."

"A soapstone?" Minnie said, sounding confused "You mean a stone people use in the bath tub?"

"No," Grandpa began to explain, "Soapstone is a type of rock that is very soft when it is first removed from the ground. It is used for carving. This piece is very old, too hard to carve easily," he said. "Long ago our people used soapstone to make cooking utensils, lamps and ovens."

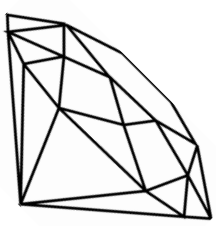
"I remember my grandfather telling me about soapstone," Mom told them. "He said there are two types of soapstone, one made of talc and the other from clay."

"That's right," Grandpa said, "The talc kind is usually the type used for making all those impressive carvings of polar bears and hunters."

"Do you know how to carve soapstone, Grandpa?" asked Minnie.

"Well," he said, "I seem to remember *my* grandfather giving me some carving tools when I was about your age. I think they're in the big closet somewhere. Why don't you see if you can find them? Then maybe next week, I can show you how to use them."

Minnie and Joe jumped back into the storage space eager to find the tools. While they searched, Grandpa and Mom went back to the kitchen to have a cup of tea.



Rock hard art

Rock art is an ancient form of expression practiced by people all over the world. Etchings and drawings of animals, people, and events appear on rock surfaces on every continent, except the Antarctic. In many cases, these lasting images are the only evidence we have that people lived in certain areas thousands of years ago.

The Aboriginal peoples of Turtle Island also created images in rock and stone. These images are called petroglyphs, from the Greek terms *petro* meaning rock, and *glyph* meaning writing. Some of the most famous petroglyphs in the world are found in the desert areas of the American southwest, but rock drawings and carvings were also made by peoples further north.

Petroglyphs in Hawaii.

Source: National Oceanic and Atmosphereic Adminstration
http://www.noaa.gov

Over time, rock that is exposed to the air develops a darker outer surface called a patina. Some scientists think the patina forms due to chemical weathering which pulls iron and manganese oxides deposits within the rock to the surface of the stone. Other scientists think that tiny airborne microorganisms oxidize these minerals and concentrate them on the rock's surface. By using tools made from sticks, bone and stone ancient people carved and pecked their pictures into the rock by removing the patina layer and exposing lighter rock underneath. Today, people still create petroglyphs, but the work is much faster because they use metal chisels and mechanical tools which cut through the patina faster.

Community Profile

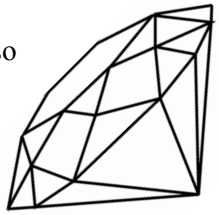
Mayo, Yukon

Mayo lies at the junction of the Stewart and Mayo Rivers, right in the centre of the Yukon Territory. It falls within boundaries of the Na-Cho Ny'ak Dun First Nation to which more than 60% of town inhabitants belong. Traditional activities in Mayo include trapping, hunting, and fishing. The town was once a fur trading centre, but in the early 1900s precious metals were found in the region and it became one point on the Yukon's Silver Trail.

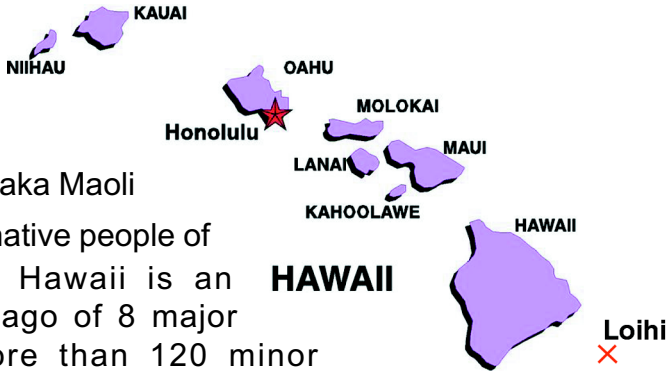
One of the largest mines near Mayo is the United Keno Hill Property, once the second largest silver producer in Canada. Between 1921 and 1941, the mine produced 1.5 billion grams of silver . It operated until 1989 when the price of silver dropped too low for the mine to remain profitable. In 2001, Keno Hill was sold to Advanced Mineral Technology, a company which hopes to reopen the mine when mineral and metal prices rise again.

The price of silver will likely rise because it is used extensively in the electronics industry. In fact, silver is a highly desirable metal for many applications. You probably know it's used for jewellery, coins and decoration. Did you also know it is used in photography, the electronics industry and dentistry? Silver can even make it rain; silver iodide is used to seed clouds and hasten the transformation of water vapor in the cloud into droplets which fall to the ground.

While the region around Mayo is know for its silver , as part of the Canadian cordillera it also holds many other metals including gold, lead, and zinc. Geologists are now examining the area for "placer" deposits of these metals. These are ore deposits left behind by retreating glaciers. While not as concentrated as ore found underground, placer deposits are often much easier - and cheaper to access.



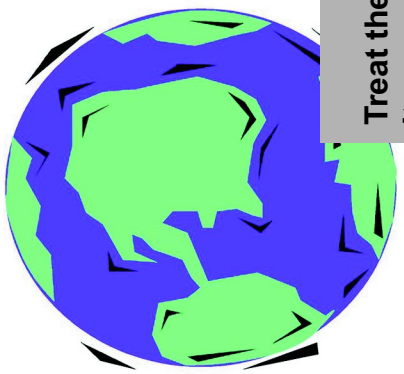
Fun facts and things to think about

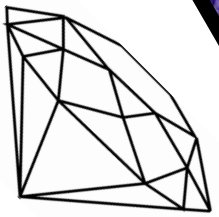


The Kanaka Maoli are the native people of Hawaii. Hawaii is an archipelago of 8 major and more than 120 minor islands located in the Pacific Ocean. Loihi (which means long one) is an under water volcano about 30 km south east of The Big Island, it will eventually be the newest Hawaiian island. Loihi is about 3700 metres above the sea floor at its highest point, but is still 1000 metres below the ocean's surface. It is going through birth pains, clusters of eruptions sometimes years apart, which are helping geologists and geological engineers understand how volcanos and islands are built. While no one is sure when, or even if, Loihi will rise above the waves, scientists are watching the growing island carefully.

Hawaii Centre for Volcanology, http://www.soest.hawaii.edu/GG/hcv.html

Treat the earth well,
It was not given to you by your parents,
It was loaned to you by your children.





Have you ever heard of a pingo?

http://sts.gsc.nrcan.gc.ca/permafrost/general.htm

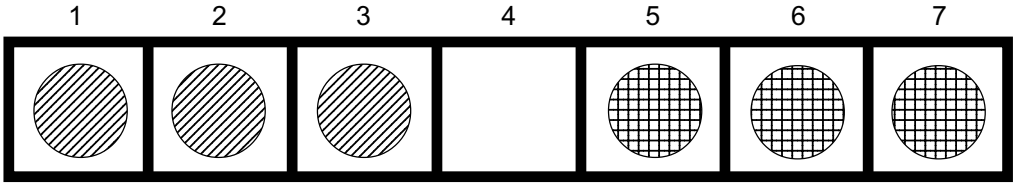
A pingo is a low hill or mound of earth forced up by pressure from frozen underground water lying on top of permafrost. Large pingos can be 45 - 75 meters high and measure up to 500 meters in diameter. The word pingo comes from the Inuktitut word *Pinguq*, which means a red spot on the skin like those caused by the measles or chicken pox.

http://www.frozentoes.com/teachers/activities/activity4.htm
Thanks to Bob Mesher and Sammy Putulik at Makivik Corporation help with translation.

Moving rocks

Edouard Lucas was an 18th century mathematician who developed all sorts of neat puzzles in his spare time. This is one of his puzzles.

You have three red rocks (stipes) and three black rocks (checker boards) placed as shown in the picture.



You want to move the red rocks to where the black rocks are, and the black rocks to where the red rocks are. Sound easy? Well, here are a few rules to make it trickier.

1. You can only move the red rocks to the right, and the black rocks to the left.
2. In each move, you can only move a rock one square over, or jump over a rock to an empty square directly behind it.

This puzzle has many solutions. How many moves will it take you to switch all the rocks?

Solution: The minimum number of moves for solving this puzzle is 15. One of the possible solutions is shown below. The numbers correspond to the numbers on the squares. Every move is shown as two numbers, the starting square - the finishing square.

5-4, 3-5, 2-3, 4-2, 6-4, 7-6, 5-7, 3-5, 1-3, 2-1, 4-2, 6-4, 5-6, 3-5, 4-3.

All about us

Native Access provides culturally relevant learning opportunities in science, math, engineering and technology to Aboriginal students and their teachers across Ca nada.

Established in 1993, the projectÕs ultimate goal was to increase the representation ofAboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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