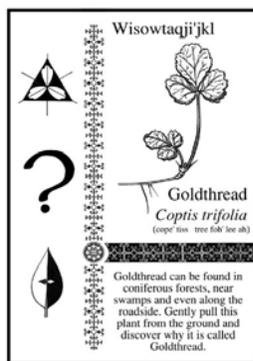


## NATURE'S MATHEMATICS - exploring mathematical patterns in plants and rocks

- 2001 and 2002
  - youth outreach plus language revitalization; science promotion and pattern research
- 

When we started developing new curricula for the Integrative Science academic program at Cape Breton University, we wanted to use innovative means to encourage young people to understand that mathematics in a language of patterns. Towards this goal, we decided to focus on creating awareness of commonly encountered patterns in the natural world and some of the simple mathematical understandings that were represented in those patterns.



Thus, in summer 2001, artist Basma Kavanagh, in conjunction with summer student research assistants Chantelle Cormier, Shauna Gould, Nadine Lefort, Clifford Paul, and Loren Pemberton (and also other members of the Integrative Science Research team), developed a set of bilingual (Mi'kmaq and English) cards that illustrated patterns found in local plants and rocks. The set contained seven plant cards and four rock cards plus two legend cards. Each card was a 12.5 cm x 17.5 cm, laminated, and printed on both sides. The series of cards that we developed is displayed on the pages that follow.

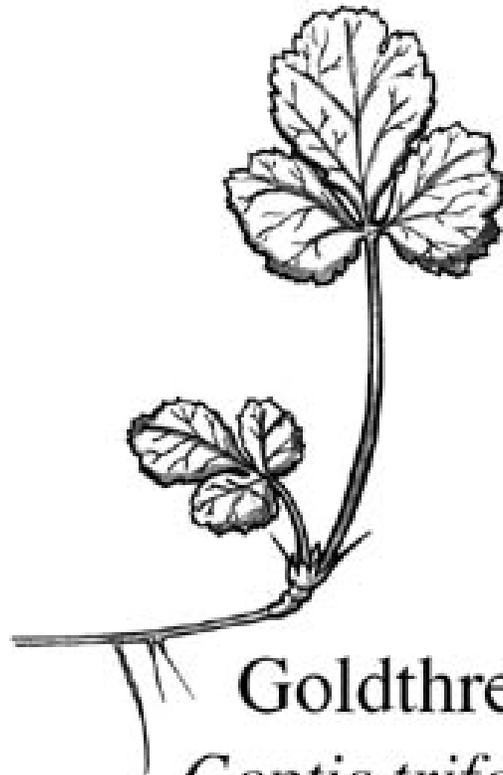
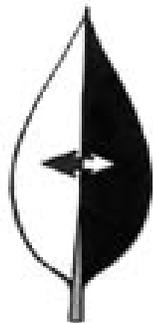
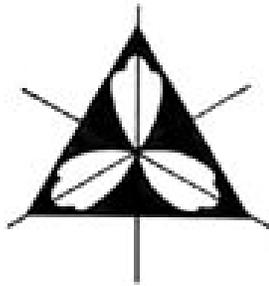
The initial audience for our cards was the group of young campers at the Mi'kmaw Junior High Science Cultural Camp in Potlotek (Chapel Island) First Nation in Summer 2001. Our Integrative Science summer research assistants accompanied the campers on hikes along nearby shorelines and guided the young people towards observing the plants and rocks along the way. In the discussions that ensued, the **Nature's Mathematics** cards were used to help participants recognize diverse patterned features in the various plants and rocks encountered. And, at the end of the week-long camp, a complete set of cards went home with each of the 70 campers. And, we encouraged the new owners to share the cards with their teachers when they went back to school in the fall. We also note that, although this was the camp's fourth year of operation, it was its first with a mathematics component.

In Fall 2001, we filled many requests for sets of cards from individuals in administrative and educational positions in Aboriginal communities throughout Atlantic Canada.

In Summer 2002, the Mi'kmaq Science Culture Camp went mobile and travelled to the various Mi'kmaw communities in Cape Breton, NS. **Nature's Mathematics** was an integral part of the program in each community and approximately 80 campers partook in activities.

This project was financed, in part, by an NSERC PromoScience program grant to Eleanor Bernard, (then) Director of the Mi'kmaq College Institute at Cape Breton University; the PromoScience grant was applied for and implemented by Cheryl Bartlett. The project was also partially financed by a research award by Sable Offshore Energy, Inc. to Cheryl Bartlett.

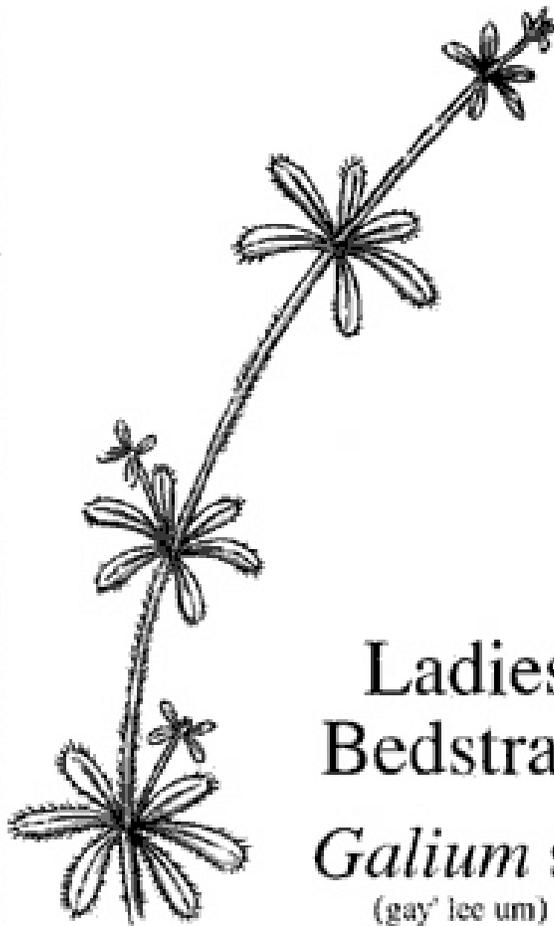
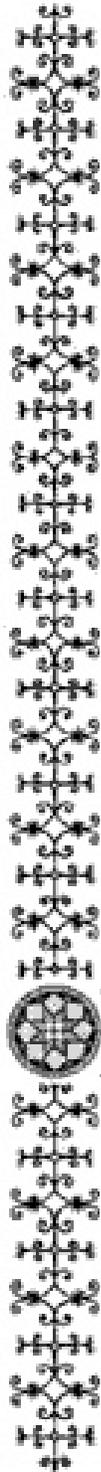
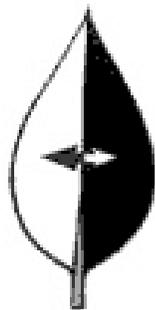
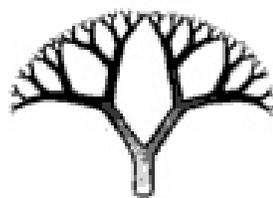
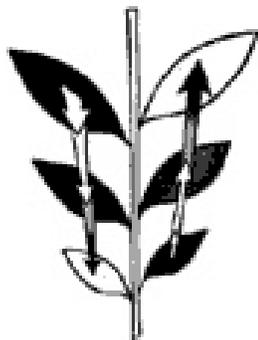
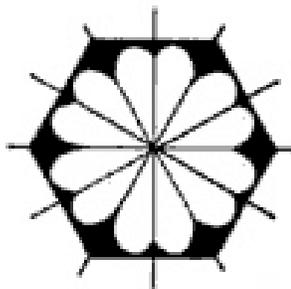
Wisowtaqji'jkl



Goldthread  
*Coptis trifolia*  
(cope' tiss tree foh' lee ah)



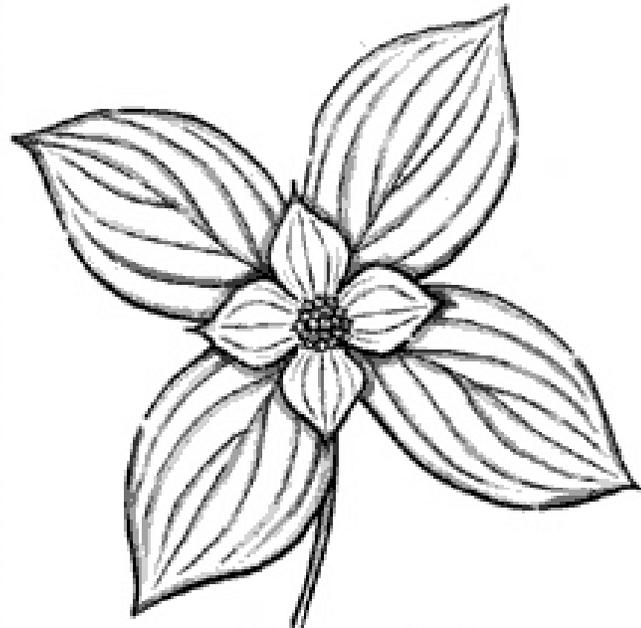
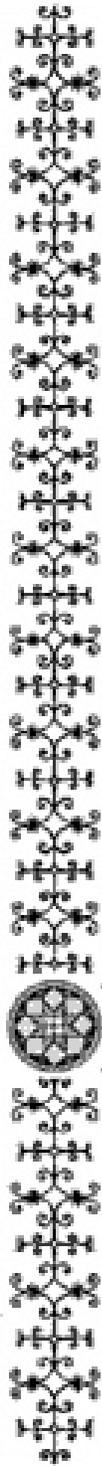
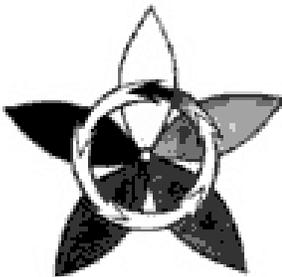
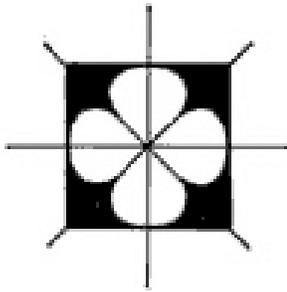
Goldthread can be found in coniferous forests, near swamps and even along the roadside. Gently pull this plant from the ground and discover why it is called Goldthread.



Ladies  
Bedstraw  
*Galium* sp.  
(gay' lee um)

Bedstraws are found in moist places under many different forest canopies. The genus *Galium* has over three hundred types of species!

Aso'kaminal



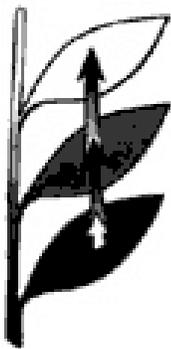
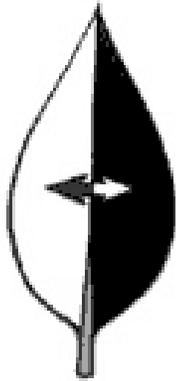
Bunchberry

*Cornus canadensis*

(core' nus    cah nah den' siss)



Bunchberry can be found at the edge of thickets and near wet areas. This plant often covers the ground beneath evergreens. Bunchberry leaves are arranged in a whorl pattern.



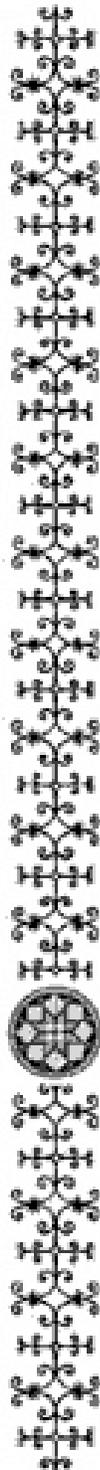
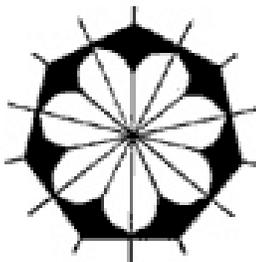
Muino'man



Creeping  
Snowberry  
*Gaultheria hispidula*  
(gall thay' ree ah hiss pee doo' lah)



Creeping Snowberry is found in shaded areas on the forest floor. It is found in mossy and somewhat wet areas. In autumn look for tasty white berries between the leaves and the moss.



## Starflower

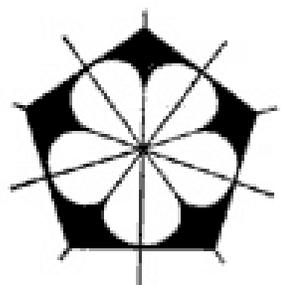
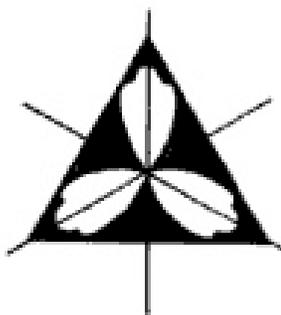
*Trientalis borealis*

(tree en tay' lis boh ree ay' liss)



Starflowers are often one of the first species of plants to grow in a new forest. They can be found on peaty slopes. The latin word "borealis" means northern.

# Atuomkmin

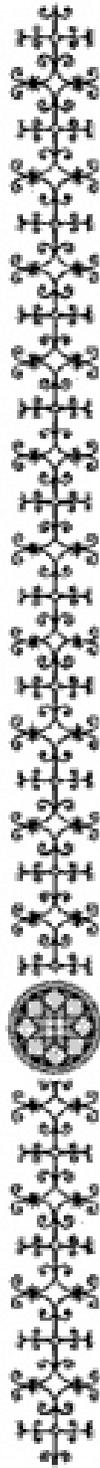
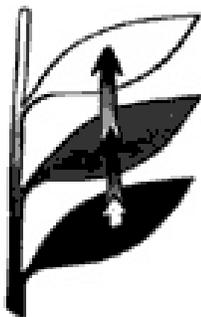
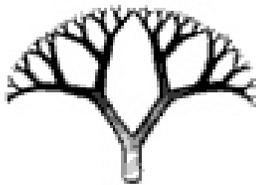
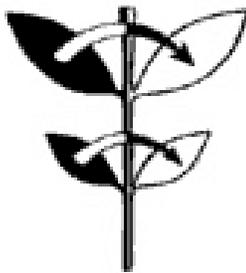
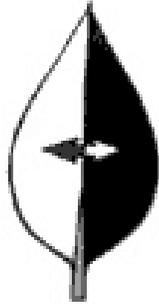
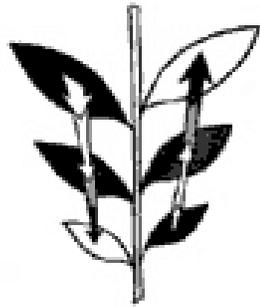


## Strawberry

*Fragaria virginiana*

(frah gay' ree ah vir gee nee ay' nah)

Strawberry plants can be found in both fields and wooded areas. Strawberry plants are linked together by runners creating strawberry patches. Did you know that tea can be made from the leaves?



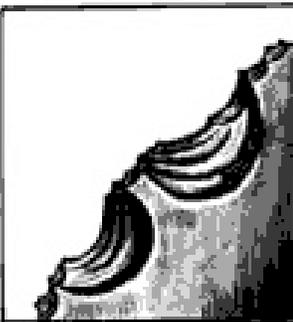
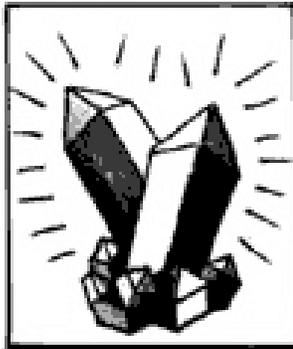
# Masusi



# Ferns



Ferns are found near and within all forested areas. Ferns were growing when dinosaurs roamed the earth. Some ferns grow to be taller than you!



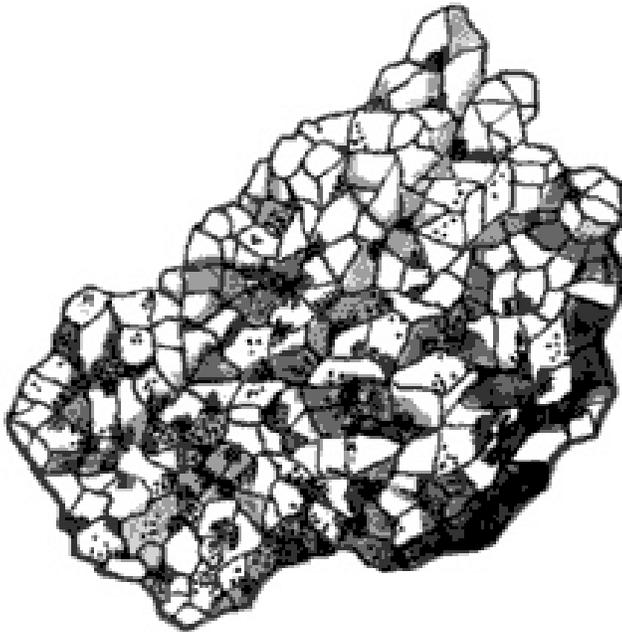
## Wapumu'kewey



Quartz (vein)

Quartz is found all over the world. Quartz is very hard and takes a long time to erode. The sand on our Bras d'Or Lake and ocean beaches is made up mostly of quartz. Sand is used to make glass.

# Amalpaqmu'kewey

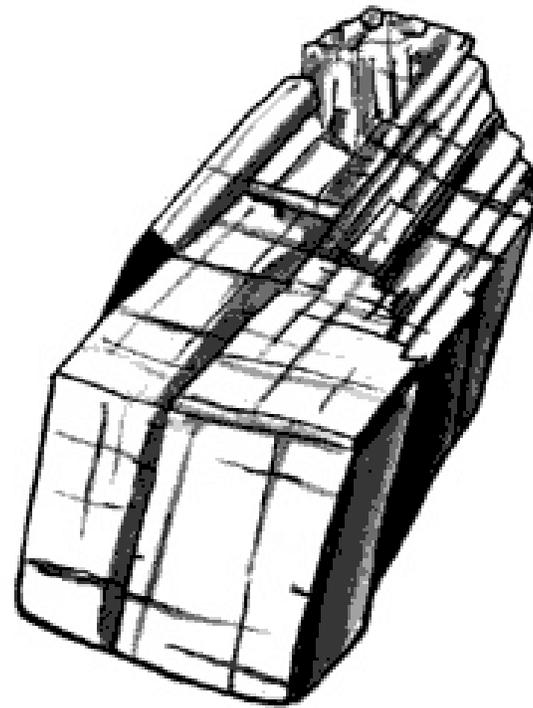
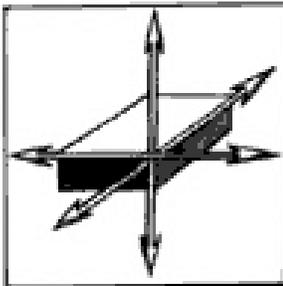
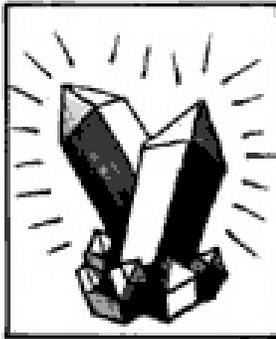


Granite



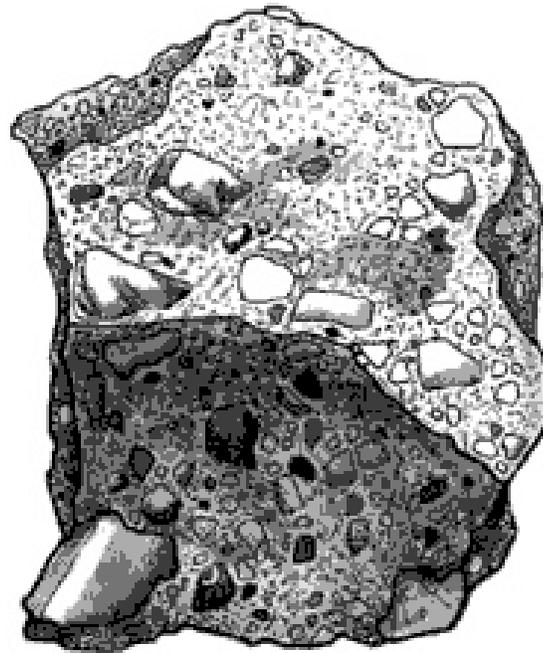
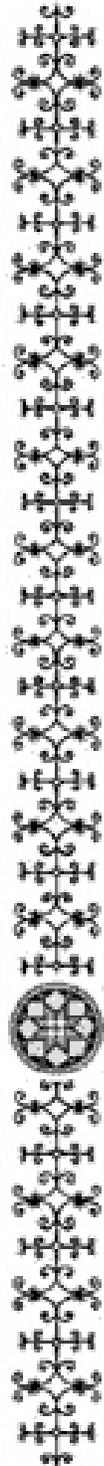
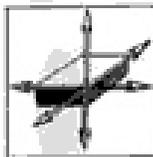
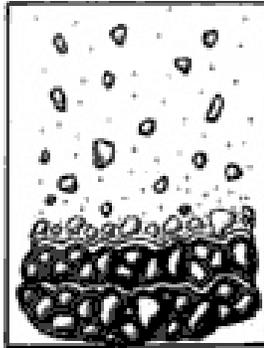
Granite is formed below the earth's surface when molten rock cools. Different minerals cool at different rates. When granite is formed, large grains of white, black and orange/pink minerals are solidified.

# Kesasamu'kewey



Calcite

Calcite is one of the most common minerals on earth. It is found in an unlimited variety of shapes and colours. Calcite makes up a large portion of the earth's rocks.



## Breccia



Breccia is a sedimentary rock made up of angular (sharp) pebbles which are surrounded by mother nature's very own cement. Look closely and discover the types of rocks and minerals that breccia is made up of.



*Igneous  
Rock*  
(heat and pressure)  
*puktewitasik kuntew*



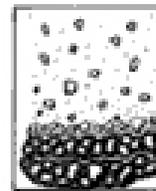
*Translation*  
(a pattern repeats)  
*majukwaltiki*



*Conchoidal  
Fracture*  
(shell shaped  
pattern of breaking)



*Phenocrysts*  
(made of many  
smaller crystals)



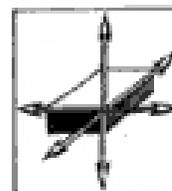
*Sedimentary  
Rock*  
(made of small rock  
and particles)



*Dilation*  
(repeating pattern  
that gets smaller  
or larger)  
*pemi-atki'ka'sik*  
*pemi-apsa'sik*



*Mineral*



*Cleavage*  
(in three  
directions)

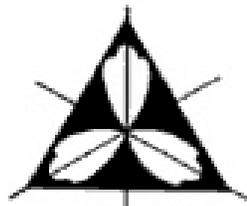


*Simple fractal*  
(patterns of  
self-similarity)

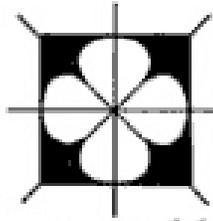


*Koqoey nemitu'n app?*

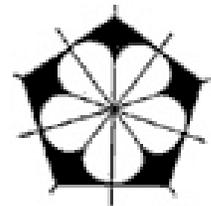
**legend card #1**



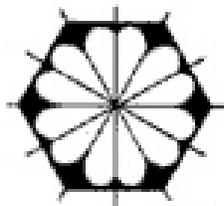
3 - Fold  
Symmetry  
nesanqikk



4 - Fold  
Symmetry  
newanqikk



5 - Fold  
Symmetry  
nanaqikk

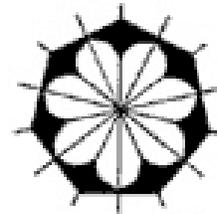


6 - Fold  
Symmetry  
asukom te'sanqikk

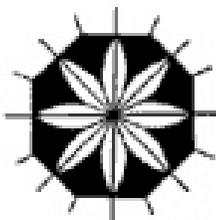


Reflection  
(a mirror image)

wijey etu'k



7 - Fold  
Symmetry  
l'uiknek te'sanqikk



8 - Fold  
Symmetry  
ukmuljin te'sanqikk



Rotational  
Symmetry  
(pattern repeats  
around a point)



Bilateral  
Symmetry  
(both sides same)  
wijey etu'k

legend card #2

Community Studies - Toqwa lu k! Kjjitaqnn / Integrative Science - Bringing Knowledges Together - Bachelor of Science



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University College of Cape Breton

<http://www.uccb.ns.ca>

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back of each card

