Earth, Fire, and Water: Geology and Flowering Plants

Killarney Provincial Park
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Where Are We Going?

- Geology and animals, you and plants
- Geology, habitat, and plant adaptation
  - Precambrian Shield bog
  - Deserts - rock and sand dune
  - Manitoulin Island alvar
Disclaimer

• Not
  • a biologist
  • a horticulturist

• Am a geologist
• Wildflowers and photography are hobbies

• No medicinal or culinary uses of plants – be careful what you eat.

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• There are many questions

• I don't have all the answers

• Let’s try together to provide an answer
Ideas to Explore

• Geology
  – shapes the Earth
  – affects our lives
  – affects animals and plant communities
Societal Views
Geology = Dark Side

“Civilization exists by geological consent, subject to change without notice.”
Will Durant (1926) “The Story of Philosophy”

Mount St. Helen’s, 8:30 AM, May 18, 1980
Societal Views
Geology = mysterious

• “I do believe that enduring geological features are important, though I don't think I can be clear about exactly why.”
  - Tracy Kidder (1981) - American Pulitzer Prize-winning author
Geological Processes Shapes the Earth

- Mountain
- Bog
- Pingo
- Eskers
Geology and You!

- Food - hygiene
- Drinking water
- Energy
- Minerals
Geology and You!
Mountains - Weather - Rain

Windward

Leeward

Rain shadow
Geology and You! Volcanoes Affect Weather

- April 1815: Tambora, Indonesia
  - powerful eruption
  - 3°C drop in global temperature

- 1816: “Poverty year”, “Year without a summer”
  - 4°C drop in global temperature
  - North America: June snow
  - Europe: “Year without summer”

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Geology and You!
Volcanoes Affect Aircraft

Kliuchevskoi Volcano, Kamchatka Peninsula, Russia, October 1994 (USGS)

Image: FAA Aircraft Safety Journal

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Geology and Animals!
Animals Eat Mineral Salts
Geology and Life!
Surface Mineral Spring – Algal Life
Geology and Life!
Ocean Mineral Spring - Black Smokers and Life
Geology and Plants

Different Habitats

Landscape

Plant Communities

Geological Processes

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Geology and Plants!
Plants Eat Rocks (and Sunlight)
Learning 1: Geology and You!

- Geological process:
  - shapes the Earth
  - Influences our life
  - Influences animal life
  - Influences other life forms
  - Influences plant communities

White Mountain Aven
Learning 2 – Geology and Plants
Geology, Habitat, and Plant Community
Acidic Bog

Sheep Laurel

Bog Laurel
Bog - Geology

- Glaciers
- Depressions
- Chemistry
- Plants
Bog Conditions

- Closed basin
- Solar UV
- Acidic Metal poisons
- Low nutrient
Bog – Plant Survival Tactics

• Carnivorous
• Non-carnivorous
• Conservation

Grass-pink Orchid
Bog – Carnivorous Bladderwort

• “Leaf traps” - nutrients from water insects


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Bog – Carnivorous Pitcher Plant

Colour and nectar attract insects
Bog – Carnivorous Pitcher Plant

- Leaves - “soup”
- Hairs trap insects
- Insect nutrients

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Bog - Carnivorous Sundew

- Sticky leaves
- Attract insect
- Trap insect
- Insect nutrients
Bog - Leatherleaf
Symbiotic Relationship

Mycorrhizal association

- Plant: keep leaf nutrients
- Plant: sugars to fungi
- Fungi: nutrients to plant
- Fungi: bar metal poisons

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Bog - Labrador Tea
Symbiotic Relationship

• Mycorrhizal association
• Plant: Keep leaf nutrients
• Plant: Retains water - curled, woolly leaves

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Bog – Cranberry
Symbiotic Relationship

Mycorrhizal association
Edible, commercial cranberry cultivated from this wild species
Bog Summary

- Geology, chemistry, botany
- Acidic
- Low nutrient
- Carnivorous
- Non-carnivorous
  - Mycorrhizal association
  - Leaf retention
Geology and You!
Leda Clay – Lemieux Slide 1993

Landslides in Leda clay of the Champlain Sea

[Map showing landslides and maximum extent of Champlain Sea]

Notre-Dame-de-la-Salette

Buckingham

Hawkesbury

Ottawa

Casselton

Anatomy of a landslide

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Rock and Sand “Desert”

- Poor soil
- Poor nutrient
- High solar UV
- No water
- Temperature extremes

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“Desert” - Boreal Forest?

Geology:
- Glaciation
- Erosion
- Rock or soil

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Desert - Rock Outcrop
Pearly Everlasting

- Drought tolerant
- Leaves

- Used dried flower arrangements
- Language of Flowers:
  - "I think of thee"
  - "always remembered"
  - "never-ceasing memory"
Desert - Rock Outcrop
Sedum

- Drought tolerant:
  - Day: Stomata close
  - Night: stomata open

- Rock garden plant

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Desert - Rock Outcrop
Bristly Sarsaparilla

- Deep roots
- Deciduous shrub
- Root beer plant
Desert - Rock Outcrop – Wintergreen

- Single root system
- Evergreen shrub
- Methyl Salicylate
  - Wintergreen flavour agent
Desert - Sand Dune
Manitoulin Island

Dunes: less than 8,000 years old (after glacial melt).

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Desert - Sand Dune
Geological Process

Wind

Vegetation

Water

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Desert - Beach Strand Line
Sea Rocket

- Sand anchor
- Dunes start at plant

- Waves remove plants and seeds
- New plants ashore
Desert - Sand Dune - Beach Pea

- Sand anchor
- Nitrogen-fixer
- Root bacteria fix air nitrogen in sand
Desert Survival Summary

- Leaf design
- Drought tolerant
- Deep tap roots
- Community root system
- Fix nitrogen
- Seed
Geology and You!
Earthquake zones or faults

Alaska - 1964

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Manitoulin Island Alvar
Geology - Special Plants

- Geology
- Soil: alkaline
- Hot, floods - dry
- Calciphile
Manitoulin Island Alvars – Geology
In The Beginning

Manitoulin limestone: tropical ocean 300-400 million years ago

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Alvars - Calciphiles - Lakeside Daisy

- Endemic and Rare
- Dolomite alvar
- Water storage
Alvar - Calciphiles - Fringed Gentian

- Damp, sunny, calcareous alvars
Alvar – Calciphiles - Shrubby Cinquefoil
Manitoulin Summary - Calciphiles? Geology and Modern Influence

• Geological history, alvar, conditions
  – Calcium- and magnesium-tolerant plants
Understanding

• Geology
  – Shaped the Earth
  – Influences human, animal, and plant communities

• Plants
  – different geological processes, different landforms, different habitats, different plants

Clintonia
“I do believe that enduring geological features are important, though I don't think I can be clear about exactly why.”

**BUT – with apologies to Tracy Kidder**

“I do believe that enduring geological features are important, AND I NOW UNDERSTAND exactly why, “from the perspectives of plant and humans”.

Lakeside Daisy

Fringed gentian
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