Bringing Earth Science to Life

Earth History
Geomorphology
Surface Processes
Soils
Rocks
Minerals
Tectonics
Using Natural Resources
Careers

www.edgeo.org

In partnership with:
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About Us
What is EdGEO?

EdGEO is a national program, established in the early 1970s, which supports local workshops designed to give Canadian teachers the knowledge and resources to confidently present Earth science material in the classroom. Local scientists and teachers work together to deliver the workshops. The national EdGEO Program can provide grants of up to $3000 per workshop.

EdGEO is a core activity of the Canadian Geoscience Education Network (CGEN) http://www.geoscience.ca/cgen/, which is part of the Canadian Federation of Earth Sciences.

Acknowledgements

EdGEO facilitators across Canada have provided all the materials in this resource manual. Their generosity and support is greatly appreciated.

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Credit for parts of the following activities in the tectonics section is due to people and groups outside of EdGEO:

**Continental Jigsaw Puzzle:** United States Geological Survey

**Plate Tectonic Flipbook:** Developed by Larry and Sheryl Braile, “Explorations in Earth Science”
http://web.ics.purdue.edu/~braile/indexlinks/educ.htm

**Time Travel to Past Continents:** Lithoprobe, “Dancing Elephants and Floating Continents” http://lithoprobe.ca

**An Edible Earth:** Susan Batson, St. Margaret’s School, Saanich BC

**First Nations Knowledge of Earthquakes:** Ruth Ludwin, University of Washington, ruth@geophys.washington.edu.

**Fault Types:** text: IRIS Consortium; images: Richard Harwood

**Earthquakes in Canada:** Historic earthquake data: Earthquakes Canada, Natural Resources Canada
How to use this Resource Manual

Who should use it?

Anyone interested in delivering an EdGEO workshop for teachers. Most EdGEO facilitators are Earth scientists working in universities, industry or government, and they often team together with education professionals.

What are its goals?

The classroom-ready activities in this manual have been used successfully and finetuned in EdGEO workshops all over Canada. We hope, by providing them in one online resource manual, to make it easier for new facilitators to put on workshops without having to “reinvent the wheel.” The manual also includes templates and samples of all the supporting materials (from advertising to funding applications) needed to put on a workshop. Facilitators of previous workshops will find this a useful archive of materials for new ideas and to supplement what they have already used. All the materials in this manual support current teaching methodology that values hands-on experiences where students take an active role in learning. The materials can be used as presented or tailored to meet local needs.

What does it include?

Classroom-ready activities for a wide range of Earth science topics
Information sheets to provide background
Ideas for adapting material to your local region
Templates and supporting materials from successful EdGEO workshops, including outlines, advertisements, manuals, funding applications, etc.
Organizing a Workshop

Fundraising

Funding and in-kind support are available for teacher workshops. The EdGEO national program can provide up to $3000 per workshop to cover expenses, such as teaching resources, field trip transportation and workshop promotion. Funds are intended to help ensure the workshop breaks even. Salaries and food are not eligible for EdGEO funding.

You can apply using the proposal form available online at http://www.edgeo.org/funding.html

Local partnerships can be beneficial in providing support for a workshop. See the partnership section for suggestions.

There are also many grant-giving bodies that support education activities. Some suggestions are:

- **Canadian Geological Foundation:**
  http://www.canadiangeologicalfoundation.org/

- **Regional divisions of the Geological Association of Canada**, for listing see http://www.gac.ca/chapters/

- **National professional associations for the Earth sciences**: see list on the home page of the Canadian Federation of Earth Sciences
  http://www.geoscience.ca/

- **Government agencies in your province/territory with an education or outreach mandate**

- **Philanthropic foundations at the municipal and provincial/territorial levels**, for example, the Ontario Trillium Foundation, the Winnipeg Foundation

- **Local, provincial/territorial, national corporations with an office in your community and an Earth science connection**, for example, mining or oil and gas or environmental companies

- **National corporations with offices in your community**, for example, the TD Bank’s Friends of the Environment Foundation has a youth and public awareness focus
Earth Science Teacher Workshop: FUNDING PROPOSAL

Proposed Activity: Teachers’ Earth Science Workshop

Details of event:
This is a daylong workshop to be held at (location) ________________ on (date) ____________ which is a local professional development day. The workshop is designed to provide teachers (Grades 7 to 12) with the confidence and skills to teach several Earth science topics. The workshop will cover plate tectonics, volcanoes and earthquakes, and will use hands-on activities that teachers can easily adapt to different grade levels and export to their classrooms. The workshop will be presented by students and staff of the Department of Earth Sciences at the University of ________________.

This year, the workshop will use the Geoscape* ________________ poster to provide local examples in the tectonic and earthquake components of the workshop. The workshop is limited to 20 teachers and will have 3 instructors and up to 5 graduate student assistants.

A $____ fee will be collected from each participant to cover the cost of lunch. Each participant will receive a 50-page manual, which describes both the science and the activities covered in the workshop, as well as several maps and overheads for classroom use. They will also receive a copy of the Geoscape poster.

Expected Results:
Teachers who are confident and excited about teaching Earth science to their students
Teachers who know about the educational resources available to them
Teachers will be introduced to Geoscape ________________ and be able to incorporate it in their classroom activities

In-kind support:
20 copies of local geology maps
20 copies of Geoscape ________________.
Approximately 20 hours of staff time in preparation and delivery of the workshop.

Funds requested: Total - $950.00
$300 foamies, cardboard, velcro for props to demonstrate plate tectonics
$500 mail-outs/advertising

* Geoscape provides Earth science information about many communities across Canada: http://www.geoscape.nrcan.gc.ca/
Partnerships

Many EdGEO workshops are facilitated by teams of people from organizations sharing similar goals. For example, one group may have facilities, another provides presenters, and a third offers materials. Initiating and building on partnerships is a very successful model for delivering excellent programming. Consider making contacts with:

- University and college Earth science departments (many have an education outreach mandate)
- Outreach groups, e.g. Let’s Talk Science, Women in Science and Engineering, Canadian Geoscience Education Network
- Schools
- School boards or districts
- Natural Resources Canada
- Geological surveys (federal, provincial and territorial)
- Science centres
- Museums
- Conservation areas and parks
- Local industry

Workshop advertising

When asked, the majority of teachers respond that workshops are successfully advertised through email. Most school districts have an internal email system for that purpose. One route is to make direct contact with a local teacher who can then distribute advertising internally. Alternatively, approach the school district and request the information be circulated. Search for a superintendent for curriculum, a subject consultant or team leader who should be able to assist.

EdGEO facilitators find that advertising is one aspect enhanced by partnerships with organizations that share similar goals (see the partnership suggestions).
EdGEO Earth Science Workshop for Teachers

Professional Development Day

Date Location

Summary: A one-day workshop with hands-on activities and demonstrations that may be used to teach about Earth’s constantly changing surface (plate tectonics), earthquakes and volcanoes (topics from B.C. Ministry of Education Integrated Resource Package for Science).

Hosts: Department of Earth Sciences, University, EdGEO

Outline:

AM  Plate tectonics - the cause of earthquakes and volcanoes
   Earth Structure
   Plate boundaries, earthquakes and volcanoes
   Our local plate tectonic setting – features on land and sea floor

Volcanoes
   Magma and viscosity
   Types of eruptions
   Products of volcanoes – on land and in the ocean

PM  Earthquakes
   Seismic waves – earthquake energy
   Recording earthquakes – seismograms
   Be a seismologist – locate an earthquake

Geoscope ______
   Geoscience in the media

Resources Provided include
   Geoscope ________ poster
   Regional Geology Map
   Selected igneous rock samples
   Workshop manual and set of colour overheads

Cost: $10

Place: _____________ University (map provided on registration)

Note: There are only 20 spaces so please register early. Teachers must be registered to attend!
Workshop outlines

EdGEO workshops have a great variety of formats, from a few hours to multiple days, for teachers of one specific school course or anyone interested. The workshop can focus on one topic in depth, or serve as an overview to a wide range of Earth science content.

EdGEO encourages workshop facilitators to focus their delivery style on active learning for participants. The emphasis is on having teachers carry out the activities as if they were the students. This hands-on approach maximizes learning and increases the likelihood that teachers will use the material in their own classrooms.

The whole group can do one activity at the same time, or a number of tasks can run simultaneously. Participants can either rotate through each activity station so that everyone completes each task (often called a round-robin or centres approach), or each group can present their activity to the others when completed (referred to as a jigsaw).

Five samples follow of workshop outlines.
Half-Day Workshops (~2 hours)

1. Rocks, Fossils and Earth History

Introductions
Activity 1: Raving Rocks – what stories do rocks tell?
Activity 2: Earth’s Timeline
Activity 3: Earth History Clock and Canada Rocks
Activity 4: Fabulous Fossils – how do they form and what do they tell us?
Activity 5: Reconstructing ancient geography
Activity 6: Putting it all together – figuring out relative age with fossils, superposition and cross-cutting relations

2. Plate Tectonics Earthquakes and Volcanoes

Demo 1: Earth as an egg
Demo 2: Coincidence of volcanoes, earthquakes and plate boundaries
Activity 1: Foamies and plates in the Pacific Northwest
Activity 2: Cross-section using Juan de Fuca Plate relief map
Activity 3: Volcanoes and viscosity
Activity 4: Earthquakes and seismic waves
Activity 5: Victoria Earthquake Hazard map

3. The Earth’s Crust, Rocks, Minerals and More

Getting You Enthused About Earth Science
- Let’s Get to Know One Another
- Icebreaker/self-reflective activity

Introduction
- What is Earth Science? Why teach Earth Science?
- Think-Pair-Share Role Model Activity

Sharing Enthusiasm About Earth Science With Your Students (Hands-on Activities)
- Introduction and Background Materials
- Structure of the Earth
• Demonstration I: What does the Earth look like?
  o Sedimentary vs Igneous vs Metamorphic Rocks
    ▪ Demonstration I: Sedimentary Setting (Sedimentary)
    ▪ Demonstration II: Lava Erupting (Igneous)
    ▪ Demonstration III: Squeezing Taffy (Metamorphic)
  o The Rock Cycle
  o Identifying Rocks and Minerals
    ▪ Activity I: Rock Identification
    ▪ Activity II: The Difference Between Rocks and Minerals; Mineral Identification
    ▪ Activity III: Earth Resources: Scavenger Hunt
  o The Earth’s Crust
    ▪ Activity I: Pangea Puzzle
  o Story Telling and Earth Science
    ▪ Using Stories and Case Histories to Teach Earth Science

Conclusions, Questions and Take-Away Activity
Full Day Workshop (~5 hours)

Plate Tectonics and Vancouver Island Geology

9:30 – 9:45 a.m. Welcome and Introduction, thanks to sponsors, give agenda

9:45 – 10:15 a.m. Speaker 1: Local Plate Tectonics and Earthquakes

10:15 – 10:30 a.m. Coffee Break

10:30 – 11:30 a.m. Demo 1: Earth as an egg (5 min.)
Activity 1: A look at plate boundaries (5 min)
Demo 2: Phone books and plate interactions (5 min)

Objective: To understand and describe types of plate margins

Activity 2: Plate motion in our backyard (Tectonics and foamies)
Activity 3: Tsunami basin model
Activity 4: Paper transform challenge

Objective: To understand the local plate tectonic setting

11:30 - noon Speaker 2: Episodic tremor and slip

Noon – 1:00 p.m. Lunch

1:00 – 2:30 Activity 4: GPS exercises

Objective: To understand how GPS measurements are used to study plate motions

2:30 p.m. - 2:45 p.m. Activity 5: Seismic relay and P and S wave propagation

2:45 p.m. - 4:15 p.m. Activity 6: First Nations’ Seismology - How earthquakes are described in First Nations’ oral tradition on the west coast

Objective: To explore the seismic history of the Pacific margin within First Nations oral tradition.

4:15 – 4:30 p.m. Workshop Evaluation and distribution of EdGEO newsletter and resources; wrap-up
Three Day Workshop (Residential program with field trips)

Day 1
11.30 – 12.00 registration  
12.00 – 12.30 welcome and opening  
12.30 – 13.00 brainstorming about geology  
13.00 – 14.30 rocks, minerals and the rock cycle  
14.30 – 14.45 break  
14.45 – 17.00 assessment activities and valuable resources  
18.30 – 19.15 pizza supper and prizes  
19.15 – 20.15 lab tours and geology games

Day 2
8.30 – 9.40 Fossils and time  
9.40 – 9.55 bathroom break and bus loading  
9.55 – 10.55 drive to field trip location  
10.55 – 11.30 tour and activities at field location  
11.30 – 12.15 lunch  
12.15 – 12.30 bathroom break and bus loading  
12.30 – 12.45 drive to beach  
12.45 – 16.30 become paleontologists on the beach  
16.30 – 16.40 bus loading  
16.40 – 17.40 drive back to base

Day 3
8.30 – 10.00 soil  
10.00 – 10.15 break  
10.15 – 12.00 sedimentary geology and how it relates to society  
12.00 – 13.00 lunch  
13.00 – 14.30 plate tectonics  
14.30 – 14.45 break  
14.45 – 15.30 Earth history and major geological events  
15.30 – 16.00 feedback, evaluation forms, distribution of resources, thank you
Tea**
### Specimen Kits

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<td>Pumice</td>
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<td>Conglomerate</td>
<td>Amethyst</td>
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<td>Sandstone</td>
<td>Chalcopyrite</td>
<td>Shark teeth</td>
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<td>Shale</td>
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<td>Limestone</td>
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<td>Phyllite</td>
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<td>Schist</td>
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<td>Coral</td>
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<td>Gneiss</td>
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<td>Brachiopod</td>
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<td>Trilobite</td>
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</tbody>
</table>

### Equipment:
- Slinkies
- Playdough
- Magnets
- Mineral testing kits

### Books:
- Dancing Elephants and Floating Continents
- South Vancouver Island Earth Science Fun Guide
- The Last Billion Years: A geological history of the Maritime Provinces of Canada

### Newsletters
- EdGEO News (available from www.edgeo.org)
- Minerals Update
- What on Earth (Canadian newsletter for Earth Sciences, available at http://www.whatonearth.org/)
- Where on Earth does your stuff come from?
- Provincial Mining Associations
- PDAC Mining Matters

### Maps
- Geological highway map
- Geological map
- Natural Resources Canada “Principal Mineral Areas of Canada”
- US Geological Survey “Plate Tectonic Boundaries”

### Posters
- PDAC Mining Matters “Mining makes it Happen” posters
- Geoscape
- Natural Resources Canada:
  - Climate Change
  - Fossils
ORGANIZING A WORKSHOP

Gemstones
Meteorites
Minerals
Types of Mining
Minerals of Canada
Natural Hazards of North America
Soil: a vital natural resource

**DVD**

NickelQuest: An Underground Mine Tour
Ground Rules

**Information Sheets**

A Guide to Rock and Mineral Collecting
Field Guide to Identification of Pebbles
Popular Geoscience Fact Sheets
(http://www.gac.ca/PopularGeoscience/index.html)
Local museums, science centres, conservation areas, parks

**Miscellaneous**

Postcards
Bookmarks
Stickers
Magnets
EdGEO participant feedback form

For workshops receiving EdGEO financial support, it is required that you collect feedback from participants at the end of the session. A sample form is included below. For any workshop, such feedback is valuable in evaluating the program, designing new workshops, and providing testimonials for future advertising and fundraising.

SAMPLE

EVALUATION FORM

NAME: (optional) ____________________________
Grade(s) taught: __________

1. What was right about this workshop?

2. What was wrong about this workshop?

3. Overall rating of the workshop

Outstanding Exellent Very Good Good Moderately Good Fair Poor

4. General Comments
When providing workshops for teachers, it is important to design content relevant to the teachers’ needs, i.e. what they have to teach in their classes as set out in the curriculum that they must follow. All publicly funded schools and most private schools deliver classroom programs that are based on their region’s education curricula. Across Canada, school curricula are prescribed at the provincial or territorial government level, and curriculum documents are available online for public access. An internet search using the region name and the terms “education” and “curriculum” usually provides a direct result. Earth science concepts may be included in science and social studies (geography) curricula. When designing a workshop, always choose activities that link to the local curriculum.

Prince Edward Island http://www.edu.pe.ca/curriculum/default.asp
New Brunswick http://www.gnb.ca/0000/anglophone-e.asp
Manitoba http://www.edu.gov.mb.ca/k12/cur/index.html
Alberta http://www.education.alberta.ca/teachers/program.aspx
British Columbia http://www.bced.gov.bc.ca/irp/
Yukon http://www.education.gov.yk.ca/psb/curriculum.html
The classroom activities provided in this resource are largely generic, but may be customized with data, information and examples from your local area. This is strongly recommended as it will greatly increase the impact for participants and will open up the possibilities for local field trips. The following table lists the activities where local content can be used.

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--- | --- | ---
Tectonics: Tectonic Boundary Processes  | Topography of Plate Boundaries  | Topographic map of plate boundary
Using Natural Resources: Uses of Rocks and Minerals  | Rocks Around Us  | Field trip to local structures built from stone
Using Natural Resources: Extracting Natural Resources  | Natural Resources in Our Community  | Regional map of mineral resources
Careers  | People who work in Earth Science  | People working in Earth science related careers

**Field trips**

Workshops can be wholly or partly based around a local field trip experience. Field trips may present local features of geological interest, or be used to practice Earth science in the field. The goal may be either further education for participants, or concrete examples of experiences they may duplicate for students. Options for destinations include conservation areas, parks, industry sites, research institutions, museums, science centres, tourist areas, etc.

**Planning Considerations**
- Bus transportation
- Food and drink provisions
- Washroom facilities
- Accessibility
- Production of field guide or teaching activities
- Safety
Safety Procedures

For personal and group safety, all participants are to read and heed the safety related procedures. It is always a good idea to have a trained first aider with you and to carry an adequate first aid kit on any field trip since accidents do happen even with proper precautionary measures.

Picks and hammers:

Do not indiscriminately hammer and use downward blows. Wear protective glasses or goggles when hammering. Be aware of persons standing around you when hammering. Only rock hammers are suitable for breaking samples. A carpenter’s hammer may splinter and send metal chips flying.

Suitable clothing:

Participants should have adequate footwear and protection against heat, wet and cold, including a hat, gloves and boots.

Hard hats:

These are compulsory in mines and quarries, and are recommended anywhere you intend to look at rocks where there are cliffs or overhangs.

Highways:

Road cuts often expose good rock sections and make good field trip stops, but can be very dangerous. You will be paying attention to the rocks and not the traffic. Park as far off the pavement as possible, on the same side of the road as the section you wish to view. Stay off the pavement unless you are crossing the road.

Cliffs and falling rocks:

Falling rocks are a major hazard. Avoid unstable or overhanging cliffs. Do not climb a cliff when others are below you.

Abandoned mine shafts and pits:

Many areas contain historic mine sites where deep shafts, open pits or trenches still exist. Some may be flagged with warning signs, but they may also be slumped in or covered with undergrowth. Do not venture close to potential shafts or trenches.

Hand washing:

Be careful not to place food directly onto rock surfaces, and wash your hands after handling rocks and before eating.
First Aid:

Participants with medical expertise or valid first aid certificates are encouraged to identify themselves at the beginning of the trip. Participants with medical conditions (allergies, diabetes, etc) are asked to advise the leader before departure. Medical information will be treated with the strictest confidence.

Field Trip Guide Contents

- Itinerary
- Safety procedures
- Collecting regulations
- Location map
- Regional geology map and description, including tectonic history
- Classification of local stratigraphic units
- Map of field trip with stops marked
- Distance log and identification of each stop
- Descriptions of each stop, with photographs, diagrams, cross section, stratigraphic column as appropriate.
- References and resources for further information
## Activity Index

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Education Resource List

Interactive Online Activities

Bridge to Classroom
http://www.eduweb.com/portfolio/bridgetoclassroom/
Design a bridge to withstand a magnitude 8.2 earthquake with the New Bay Bridge Organization activity “Engineering for Earthquakes.”

Cretaceous Crime Scene
http://www.learnalberta.ca/content/seccs/index.html
Investigate the mass death of a herd of dinosaurs 70 million years ago with this activity from Learn Alberta. It includes clues, suspects and lots of information about dinosaurs.

Groundwork: Exploring for Minerals in Canada
http://sciencenorth.ca/cool-science/cool-science.html#
Play a mineral exploration game developed by Science North and the Canadian Institute of Mining, Metallurgy and Petroleum. Available in French and English.

IRIS Earthquake Simulator
http://www.iris.edu/edu/10.5/EQSimulator.html
Change fault dimensions (length, depth and slip) and discover the magnitude of earthquake that would be produced with this simulator developed by the university consortium IRIS (Incorporated Research Institutions for Seismology).

QuakeChasers
http://www.quakechasers.ca
Create an earthquake and calculate its magnitude and location from the seismograms. Includes tutorials and background information on earthquakes in Canada. Adaptation for Canada produced by the POLARIS Consortium of “Virtual Earthquake.”

Virtual Courseware Project
http://www.sciencecourseware.org/
Work on a variety of interactive simulations for the Earth sciences, including:

Virtual Earthquake: Locate an earthquake’s epicentre and determine its magnitude.
Global Warming: Learn about global warming and climate change caused by both natural and human factors.

Virtual Dating: Learn how geologists and archeologists determine the age of rocks and artifacts in two activities: Isochron Dating and Radiocarbon Dating.

Virtual River: Learn about river processes in the River Discharge and River Flooding activities.

**Downloadable Lesson Plans, Resources and Activities**

**Burgess Shale Fossils**
http://www.pc.gc.ca/apprendre-learn/prof/sub/burgess/lessonplan3_e.asp

Parks Canada teachers page for the Burgess Shale fossils in Yoho National Park.

**Climate Change**
http://adaptation.nrcan.gc.ca/posters/

A series of seven posters in English and French, produced by Natural Resources Canada, depicting the regional impact of climate change in Canada.

**Dancing Elephants and Floating Continents**
http://www.lithoprobe.ca/media/dancing_elephants_companion_material_PDF.pdf

Free teachers guide, produced by the deep Earth research project Lithoprobe. It contains lesson plans for earthquakes, volcanoes, subduction zones, meteorites, etc.

**Digital Library for Earth System Education**
www.dlese.org

Extensive archive of Earth science resources. All the “Teaching Boxes” are excellent for classroom use.

http://www.teachingboxes.org

**Earth Learning Ideas**
http://www.earthlearningidea.com/

Library of Earth science activities contributed and reviewed by the international Earth science community.

**EQLocate**
http://bingweb.binghamton.edu/~ajones/eqlocate.html

Program that uses P wave arrivals on real seismograms to locate selected global earthquakes.
### Explorations in Earth Science
http://web.ics.purdue.edu/~braile/indexlinks/educ.htm

Extensive collection of student activities with a geophysics focus.

### Fossil Facts
http://www.fossils-facts-and-finds.com

Source of class handouts for fossils activities (word searches, crossword puzzles, etc.).

### FOSS Earth Material Module (Gr. 3-4)

Activities and games based on the observable characteristics of rocks and minerals; includes resources for parents and teachers.

### Geological Society of America
http://www.geosociety.org/educate/resources

A wide range of Earth science lesson plans, activities and resources for teachers.

### GeoRock Garden
http://www.geoscapesask.ca/pdfs/geogarden.pdf

Teachers guide, developed for Regina’s GeoRock Garden at Campbell Collegiate, includes lesson material on the rock cycle, mineral and rock identification, and erosion and glaciers.

### Geoscape Canada
http://geoscape.nrcan.gc.ca/

Bilingual resources that explain the landscapes, Earth and water resources, and natural resources of Canadian communities and regions. Includes: Calgary, Fort Francis, Montreal, Nanaimo, northern and southern Saskatchewan, Northwest Territories, Vancouver, Victoria and Whitehorse. An English only site is available for the Grand River Basin Geoscope
http://www.geoscapegrandriver.ca/geoscope_flash.html

### Getting into the Fossil Record
http://www.ucmp.berkeley.edu/education/explorations/tours/fossil/index.html

This University of California site provides a basic understanding of fossils and how they are preserved. Includes a teachers guide.
International Polar Year (IPY)
Classroom activities related to ice and water.

Let’s Do Science
http://letsdoscience.com/
A teachers guide to the Alberta elementary science curriculum.

Ocean Drilling Program
http://www.joilearning.org/classroom/default.html
Classroom activities for many Earth science topics, as well as chemistry, geography and math.

Qu’Appelle Valley
http://www.cmste.uregina.ca/valley/index2.html
Biology, geography and geology lessons, virtual tours and activities for Saskatchewan’s Fort Qu'Appelle region tailored for middle-year classrooms.

Science Education Gateway
http://cse.ssl.berkeley.edu/segway/educators_resources.html
Indexed portal for education activities that complement various NASA programs.

Science Net Links
http://www.scien netlinks.com/matrix.cfm
Comprehensive archive of standards-based activities and information sources developed by the American Association for Advancement of Science. Indexed by topic, grade and benchmark.

The Science Spot: Earth Science Lessons
http://sciencespot.net/Pages/classearth.html
Online and downloadable lesson plans developed by 8th grade science teacher, Tracy Trimp.

Seismic Eruption
http://bingweb.binghamton.edu/~ajones/eqlocate.html
Executable program that displays earthquake epicentres and volcanic eruptions.
Seismic Waves
http://bingweb.binghamton.edu/~ajones/#Seismic%20Waves
Executable program that models the propagation of waves through the Earth for selected earthquakes.

Teach Engineering
http://www.TeachEngineering.org
Teacher-tested, standards-based engineering activities for K to 12 teachers to use in science and math classrooms.

Teach the Earth: Resources for Geoscience Educators
http://serc.carleton.edu/
Activities and research for teaching Earth science from the Science Education Resource Center at Carleton College.

Teachnology
Online library of classroom activities, including many for the Earth sciences.

United States Geological Survey Educational Sites
http://education.usgs.gov/
Extensive resource site for information and activities covering all Earth science topics.

University of California Museum of Paleontology
http://www.ucmp.berkeley.edu/fosrec/
Extensive site with many classroom activities and information, of particular note: Learning from the Fossil Record
Evolution http://evolution.berkeley.edu/

Volcano World
http://volcano.oregonstate.edu/
Extensive site for student activities and information about volcanoes.

Waterscapes
http://geoscape.nrcan.gc.ca/h2o/
Poster series, some with lesson plans, illustrating water issues in communities across Canada. Available posters include Bow River Basin, Bowen Island, Gulf Islands and Okanagan Basin. The Bow River waterscape has elementary and junior high school teacher’s guides:
Online Information Sources

Canadian Centre for Energy Information
http://www.centreforenergy.com/Education/

   Education resources and information on energy resources and their usage; this group also publishes the book “Our Petroleum Challenge: Sustainability into the 21st Century.”

Earth Science World Image Bank
http://www.earthscienceworld.org/imagebank/

   Source of images that can be used at no charge for educational purposes.

Earth Sciences Canada
www.earthsciencescanada.com

   Earth science careers information. It also provides updates on the book in development “Four Billion Years and Counting: Canada’s Geological Heritage” and links to the WHERE Challenge, a contest for Canadians aged 10-14 (includes great video).

Earthquakes Canada
http://earthquakescanada.nrcan.gc.ca/

   Real-time, recent and historical information about Canadian earthquakes.

École des Mines
http://cri.ensmp.fr/gm/photos.html

   A-Z archive of mineral photographs.

Geological Association of Canada
www.gac.ca/populargeoscience

   Mineral and energy fact sheets.

   Minerals series: Gold, Placer Gold, Klondike Gold, Iron, Metals from Beneath the Crust, Metals from the Sea Floor, Pine Point, Polaris, Diamonds, Emerald and Aquamarine, Sapphire and Ruby, Aggregate, Carving Stone, Dimension Stone, Tyndall Stone, Jade, Labradorite
Energy Series: Petroleum, Oil Sand, Gas Hydrates, Coal, Arctic Oil and Gas, Gas Pipelines, Canol Pipeline, Geothermal Energy, Uranium

Internet Rock Shop
http://mineral.galleries.com/
Compendium of information about minerals.

IRIS Seismic Monitor
http://www.iris.edu/seismon/
Automatic map of the last 2 weeks of earthquakes, scaled for depth and magnitude on a background of epicentres for the last 5 years.

Natural Resources Canada
Downloadable maps for all subjects, usually with one linked to current events, and many education resources.

Canada Centre for Remote Sensing http://www.ccrs.nrcan.gc.ca/
“Tour Canada from Space” provides information and images.

Canadian Landscapes http://gsc.nrcan.gc.ca/landscapes/index_e.php
Searchable database of images of Canada’s landscape with substantive captions.

Links to downloadable educational materials and videos. Some educational posters and brochures are available and free to teachers. Contact the GSC Bookstore (http://gsc.nrcan.gc.ca/bookstore/ or 1-888-252-4301) for a list of what’s available.

Use of Minerals http://www.nrcan.gc.ca/mms/stude-etudi/sat_e.htm

Royal Tyrrell Museum of Palaeontology
http://www.tyrrellmuseum.com/
Information on fossils, with an interactive timeline on the home page.

This Dynamic Earth
http://pubs.usgs.gov/gip/dynamic/dynamic.html
Full text and graphics of the book of the same name, published by the United States Geological Survey.
United States Geological Survey Educational Sites
http://education.usgs.gov/
Extensive resource site for information and activities covering all Earth science topics.

United States Geological Survey Earthquake Center
http://earthquake.usgs.gov/eqcenter/
Latest earthquakes (last 7 days automatic map)
Recent earthquakes (last 30 days automatic map)
Earthquake search (create custom maps and lists)

Water monitoring
http://www.epa.gov/owow/monitoring/nationswaters/waters2.pdf

What on Earth
http://www.whatonearth.org/
Online archive of the Canadian newsletter for Earth sciences

Earth Science Education Organizations

Canadian Geoscience Education Network (CGEN)
http://www.geoscience.ca/cgen/
Promotes K-12 Earth science education nationally and encourages outreach to increase public awareness. Website provides links to core education programs and list of members indexed by region. Membership free, by sending email to cgen@sympatico.ca, with “Join CGEN” in subject line.

EdGEO
http://www.edgeo.org/
National teacher workshop program coordinated by the Canadian Geoscience Education Network.

Geological Association of Canada
http://www.gac.ca/
Bookstore provides educational resources along with descriptions of current Earth science research publications.
Let’s Talk Science
http://letstalkscience.ca/
National organization providing science outreach to schools, activities and workshops in all areas of science.

Calgary Science Network
http://www.calgarysciencenetwork.ca/
Calgary-area resources and scientists of all disciplines who will visit your classroom.

Scientists in Schools
http://www.scientistsinschool.ca/SiS/For_Teachers.html
Programs, workshops and resources linked to science curriculum.

Prospectors and Developers Association of Canada Mining Matters
http://www.pdac.ca/miningmatters
Workshops for teachers and Earth science educational resources.

Mineral Resources Education Program of British Columbia
http://www.bcminerals.ca/
Newsletter and range of educational resources and opportunities for BC teachers and students.

Yoho Burgess Shale Foundation
www.burgess-shale.bc.ca
Information about the discovery and significance of the Burgess Shale fossils in Yoho National Park. Also provides details of annual teachers field trip to visit the site.

Johnson GeoCentre
http://www.geocentre.ca/
Science centre specializing in Earth science, located in St.John’s, NL

Dynamic Earth
http://dynamicearth.ca/
Science centre specializing in Earth science and mining, located in Sudbury, ON

International Geoscience Education Organisation
http://www.geoscied.org/
Promotes Earth science education internationally at all levels.
Books for Teacher Use


Books for Teacher and Student Use


The Pebble in my Pocket: A History of our Earth (Hooper, M Coady, C) Viking Press, 1996.
The Quicksand Book (de Paola, T.), Holiday House, 1977.

**Books: General Interest**

These books are not aimed at young audiences, but are wonderful resources to engage readers in Earth science.


A Short History of Nearly Everything (Bryson B.) Doubleday Canada, 2003. Includes the basics of a little bit of everything, including chemistry, physics, paleontology, astronomy and geology.


Wonderful Life (Gould, S.) W.W. Norton, 1989. The fossils of the Burgess Shale in the Canadian Rockies are used to examine the evolution of life on Earth.

Videos/DVD


Geological Survey of Canada http://gsc.nrcan.gc.ca/edumat_e.php includes a link to free downloadable videos on various Earth science topics, many of which are available in French and English.

The Day the Earth Shook: Produced by Nova, this video shows footage from two earthquakes: California (1994) and Kobe, Japan (1995).

Way Cool Science: Rockfinders: This 2003 DVD explores rocks and how they form. Available through online vendors such as Amazon.ca.

Rock and Mineral Kits

School boards often have rock and mineral kits available for teachers. Local rockhound or gem and mineral clubs will often supply kits to teachers at no or low cost. Many Earth science or geology departments at universities and colleges across Canada have people active in education outreach who are able to supply materials, either for loan or permanent use. Sample kits are also available for purchase from scientific supply companies including Wards Natural Science, Northwest Scientific and Boreal Scientific.