

Earth Science Education 4. Geoliteracy Canada, A National Geoscience Education Initiative

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SUMMARY

Earth scientists are collectively responsible for ensuring that geoscience knowledge is incorporated into decisions about land use in Canada. The future of our discipline depends to a considerable extent on an educated public that realizes the value of earth science information. The vitality of earth sciences also depends on our ability

to convince bright students to enter our profession. In this paper, we propose an initiative in geoscience education, *Geoliteracy Canada*, based on expanded delivery of, and better linkages among, four national programs and an upcoming international conference. The programs that underpin this initiative are *EdGEO*, *EarthNet*, *WAT ON EARTH*, and *Geoscape Canada*. These national programs are linked, in turn, to the many local and regional geoscience education enterprises across the country. The Canadian Geoscience Education Network, the education committee of the Canadian Geoscience Council (CGC), will provide national coordination of the initiative.

RÉSUMÉ

C'est la responsabilité de tous et chacun des géoscientifiques de faire en sorte que les connaissances géoscientifiques soient prises en compte lors de toute décision concernant l'utilisation des terres du Canada. L'avenir de notre discipline dépend en grande partie des perceptions d'une population consciente de la portée des informations géoscientifiques. La vitalité des sciences de la Terre dépend aussi de notre capacité à attirer les meilleurs étudiants dans notre profession. Dans le présent article, nous proposons un projet d'éducation en géoscience, « Géolittératie Canada », visant à accroître les activités et les interrelations entre quatre programmes nationaux et une prochaine conférence internationale. Les programmes formant l'assise de ce projet sont *Edgeo*, *GéoNet*, *WAT ON EARTH*, et *Géopanorama du Canada*. Ces programmes nationaux sont eux-mêmes rattachés à de nombreux projets géo-éducatifs locaux et régionaux à travers le pays. Le *Canadian Geoscience Education Network* (Réseau canadien d'éducation géoscientifique), le comité d'éducation du Conseil géoscientifique canadien (CGC), assurera la coordination nationale de cette initiative.

INTRODUCTION

Readers of this article will find little to argue with in the assertion that earth science is an important discipline. Many Canadians, however, may not see clearly the connection between mineral, energy, and water resources and natural hazards on one hand, and their quality of life on

the other (Nowlan, 2001). Earth scientists have a responsibility to tell Canadians how we contribute to the public good and how the Earth works. Of course, communication is a two-way exchange. Earth scientists must continue to ask society what its geoscience-related needs are.

Earth science is not only important, it's interesting. Young children as well as adults are naturally interested in things geologic: rocks, minerals, fossils, meteorites, earthquakes, and dinosaurs to name a few. A child's natural curiosity about the Earth must be nurtured by their parents and educators. How many secondary school students are aware that they can have a rewarding career in earth science? Does the public know what geoscientists are and what they do? How well are we doing at communicating the wonders of the Earth and our enthusiasm for our profession to educators, students, decision makers, and the general public? Professional geoscientists have, over the years, developed a superb infrastructure for communicating among themselves (*via* conferences, journals, professional organizations, granting agencies). However, there appears to be room for improvement in communicating with people who do not speak our language.

Fortunately for all of us, many dedicated individuals across the country tirelessly promote earth science within and outside our schools. Volunteer geologists teach in primary and secondary schools, and outstanding local and regional programs, such as the *Calgary Science Network*, *Mining Matters*, and the Atlantic Geoscience Society, have substantially elevated public awareness of our science. Books such as *The Last Billion Years*, which describes the geologic history of the Maritime provinces, and *Geological History of Saskatchewan*, have been written to be read by the public. The Canadian Geoscience Council (CGC) and some of its member societies, as well as provincial and other museums, associations, and societies, and the Geological Survey of Canada, have all made important contributions to earth science education.

In this paper, we suggest a way to enhance geoscience education in Canada. We propose a national earth science education initiative, *Geoliteracy Canada*, built on four, successful, linked programs (Fig. 1). The framework programs are

national in delivery and complement the many effective local and regional programs of provincial government agencies, museums, associations, and others.

Geoliteracy Canada is about enhancing synergies among existing national programs, not about creating a new one. Existing programs are excellent; we just need to make them work together better. An upcoming international geoscience education conference in Calgary in 2003 (GeoSciEd IV) affords a wonderful opportunity to bring together Canadian earth science educators and to showcase Canadian efforts in earth science education.

This paper has three main objectives. The first objective is to describe GeoSciEd IV and the four programs that constitute our proposed national geoscience initiative. The second objective is to invite you to participate in these programs. The third objective is to encourage discussion about how the national programs can best serve the needs of communities and better support local and regional geoscience education initiatives.

Geoliteracy Canada is an initiative of the Canadian Geoscience Education Network (CGEN), of which we are members. CGEN is a loose-knit group of educators and scientists. It has no fees or dues; membership is open to anyone with an enthusiasm for geoscience education. CGEN's purpose is to raise public awareness of earth science in Canada and to alert local and regional geoscience education groups to related projects underway throughout the country. CGEN is part of the Canadian Geoscience Council (CGC); its president sits as a director of CGC.

EDGEO

EdGEO (<http://www.edgeo.org>), initiated in the early 1970s when CGC was created, supports local earth science workshops for Canadian teachers. The program is now co-ordinated by CGEN and funded by donors including CGC, the Canadian Society of Petroleum Geologists, the Geological Association of Canada, and other geoscience organizations and private companies.

The primary objective of EdGEO is to provide educational opportunities for teachers and, through them, their students. EdGEO workshops increase teachers' knowledge and confidence, and

equip them with new classroom resources. A strength of EdGEO is that its workshops put geoscientists face-to-face with teachers in an informal setting (Fig. 2). Teachers love EdGEO's hands-on activities and field trips. The contacts made between teachers and geoscientists at EdGEO workshops may continue long after the events. Workshops in Nova Scotia, for example, have helped create an active network of people who are interested in geoscience education. EdGEO also provides an opportunity to expand the workshop concept to include a broader range of topics: for example, soil, water, climate change, and oil and gas.

Local geoscientists and teachers organize EdGEO workshops with grants of up to \$3000 from the National EdGEO Program. In the last 5 years, EdGEO has supported 51 workshops and field trips attended by 1234 teachers. If you would like to organize a workshop, contact Fran Haidl by email at: FranHaidl@sem.gov.sk.ca.

EARTHNET

EarthNet is a unique Web site tailored to the needs of Canadian earth science educators (Fig. 3; <http://agc.bio.ns.ca/EarthNet>). These needs, expressed by educators who have attended science

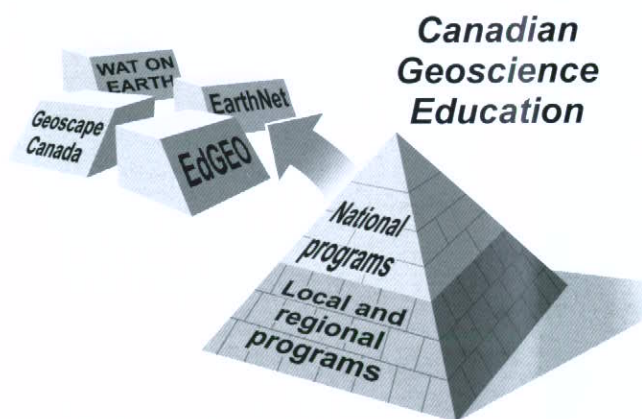


Figure 1 Structure of a national geoscience education program proposed in this paper: a foundation of grass-roots, local and regional initiatives nurtures four, interconnected national programs (EdGEO, EarthNet, WAT ON EARTH, and Geoscape Canada). The Canadian Geoscience Education Network provides co-ordination and promotion.



Figure 2 Papineau-Labelle Wildlife Reserve, Quebec: EdGEO fieldtrips provide teachers with a close-up look at local geology and instill in them an excitement and interest to share with their students.

teacher conferences and workshops, centre on easy access to basic earth science information. Teachers ask for information that is reliable, low cost, interesting, based on the Pan Canadian curriculum (Council of Ministers of Education, Canada, 1997), and centrally located for "one-stop shopping." Interestingly, these conditions also ensure that the site is useful to students, outreach geoscientists, and the general public.

The educational materials and teaching resources on EarthNet are accessible through 10 main sections:

- *Teaching Resources*, a database of over 2000 resources and a list of pre-packaged teacher resource kits
- *Activities* (specifically tailored for the classroom)
- *Geology in the Classroom*, a question and answer facility
- *Earth Science Site of the Week*
- *Especially for Teachers*, a section to facilitate communication among educators and to inform them of learning opportunities such as the EdGEO workshops
- An illustrated *Glossary*, which can be searched alphabetically or by subject
- *Calendar of Events*
- *Exploring Our Dynamic Earth* offers a selection of mini-tutorials in which graphics, text, and animation are used to explain geologic principles and processes
- *Virtual Field Trip* takes you on a field trip without going outside

- *Geology in Your Community* shows the importance of geoscience in our day-to-day lives; it includes Geoscape posters, which are described below.

Two sections that are being developed are *Hall of Fame*, which will showcase noteworthy Canadian geoscientists and their work, and *Geology in a Can*, which will provide presentation guidelines and suggested resources for budding outreach geoscientists. Periodic reviews of the EarthNet site by educators and geoscientists throughout Canada help to ensure a truly useful and accurate resource.

Input from geoscientists and educators is essential if EarthNet is to flourish. Are you interested in designing a virtual field trip for your local area? Do you want to be on call to answer earth science questions from your community? Would you like to post geoscience events in your area on EarthNet's *Calendar of Events*? If your answer to any of these questions is yes, contact Jennifer Bates (bates@agc.bio.ns.ca) to contribute to EarthNet. An enthusiastic interest in geoscience education is the only requirement.

WAT ON EARTH

WAT ON EARTH is an earth sciences newsletter established in 1987 at the University of Waterloo. Its main objective is to assist earth science and geography teachers by providing easy-to-understand commentaries and articles for use in

junior secondary schools, secondary schools, and universities. It also contains information of use to the general public.

WAT ON EARTH promotes national geoscience initiatives, such as the celebration of the 150th anniversary of the Geological Survey of Canada in 1992, National Earth Science Awareness Day (Morgan, 1997), EdGEO, the Prospectors and Developers Association of Canada educational programs, and Mining Matters. It is published twice a year and reaches all Canadian provinces and territories, including Nunavut. The newsletter is also sent to the United States, Australia, New Zealand, Hong Kong, Taiwan, Bermuda, Portugal, West Germany, the United Kingdom, and occasionally elsewhere in Europe and the Far East. The normal print run is about 1250, but more than 3000 copies of some issues have been printed.

Since 1994, WAT ON EARTH has been available online (<http://www.science.uwaterloo.ca/earth/waton/waton.html>). It is linked to more than 100 home pages, including those of individuals, rock, mineral, and fossil companies, university departments, and national geoscience organizations. SchoolsNet.com in the United Kingdom has most recently adopted it. Many articles are reprinted in other newsletters.

WAT ON EARTH will likely be re-named *GeoEducation Canada* in 2002, and the Web site address will change to something with a far shorter URL. We hope to make it the national geoscience education newsletter for Canada, adding to and complementing the outreach activities of EdGEO, EarthNet, and Geoscape. Your contributions are welcome; please send them to Alan Morgan (avmorgan@uwaterloo.ca).

GEOSCAPE CANADA

The Geoscape Canada program, led by the Geological Survey of Canada in partnership with provincial and municipal agencies and educators, communicates practical earth science information to communities across Canada. The program operates on the premise that if we want to show Canadians the usefulness of earth science information, we must explain local geoscience issues that are relevant to them. Canadians want good water supplies, continued access to earth

EarthNet...
your gateway
to earth
science
education
tools

- activities • virtual resource kits • searchable database • geo-lessons • calendar of events • illustrated glossary • site of the week • Q&A facility • virtual field trip

Géonet...
votre accès à
des outils
éducatifs sur
les sciences
de la Terre

- activités • trousseaux documentaires virtuelles • base de données consultable • géo-leçons • calendrier des activités • glossaire illustré • site de la semaine • questions et réponses • visite de terrain virtuelle





EarthNet/Géonet
agc.bio.ns.ca/EarthNet

Figure 3 EarthNet, gateway to geoscience education resources.

resources, mitigation of natural hazards, and protection of the environment during development.

The Geoscape Canada program builds on the success of *Geoscape Vancouver*, a graphic-rich, full-colour poster that focusses on important geoscience issues in the Vancouver area: for example, earthquakes, landslides, surface water, and groundwater (Turner *et al.*, 1996; Clague *et al.*, 1996). *Geoscape Vancouver* and its ancillary products, which now include three other posters and maps (see <http://geoscape.org>), a slide set, an overhead transparency set, and a Web site, have been enthusiastically received by educators and the public and have generated a large demand for more local geoscience information. To meet this demand, Bob Turner and John Clague are expanding

the local Geoscape Vancouver Web site and are writing a popular book on geologic issues in southwestern British Columbia.

Fourteen other Geoscape posters are now in production (see sidebar), with the support of the Geological Survey of Canada and various partners: Victoria, Nanaimo, the Fraser River basin in British Columbia, Whitehorse, Calgary, southern Saskatchewan, Winnipeg, Toronto, Ottawa, the Grand River basin in southern Ontario, Quebec City, Montreal, Halifax, and Nunavut (Figs. 4, 5). Most of the 15 posters and related Web sites, should be completed by the time the current phase of the Geoscape Canada program ends in 2003. The Geoscape Canada Web site (<http://geoscape.org>) is growing as new material becomes available. Information on Vancouver, Victoria, Fort Fraser (British Columbia), and Quebec is presently available on the Web site. Geoscape posters are also featured on EarthNet.

Each Geoscape poster and Web site is a grassroots effort, driven by local geoscientists and educators. Bob Turner (bturmer@nrca.gc.ca) and John Clague (jclague@sfu.ca), the Geoscape Canada program leaders, provide advice and guidance to local project teams, and participate in planning workshops organized by the project leaders. The

Geological Survey of Canada provides funds for poster and Web site development, and prints the posters as part of their Miscellaneous Report series.

GEOSCIED IV

CGEN is hosting the Fourth International IGEO (International Geoscience Education Organisation) Conference in August 2003 (Fig. 6). IGEO meetings, informally known as GeoSciEds, began at Southampton, England in 1993 (Morgan and Ferguson, 1993). Their main purpose is to provide a forum for geoscience educators to share teaching ideas and experiences that will advance earth science education at the local, national, and international levels. At GeoSciEd III (Morgan, 2001) in Sydney last year, Canada was selected to host the fourth conference at the University of Calgary.

Calgary was chosen for GeoSciEd IV for a variety of logistical, geologic, and geographic reasons. It is situated at the junction of the Cordillera, Foothills, and Prairies, and thus offers conference participants a wide variety of landscapes and features of geologic interest. The Royal Tyrrell Museum of Palaeontology and badlands with dinosaur remains are within easy reach. To the west are the Rocky Mountain Foothills and Front Ranges, a classic fold-and-thrust belt with rich oil, gas, and coal resources and

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Figure 4 Locations of current Geoscape Canada projects.



Figure 5 Geoscape Victoria (reduction of 90 x 156 cm poster; Yorath et al., 2001).

magnificent geomorphology. The Frank slide, Columbia Icefield, open-pit coal mines in the Crownsnest Pass area, and the Burgess Shale and Head-Smashed-in-Buffalo Jump UNESCO World Heritage Sites are also readily accessible from Calgary.

The university has excellent accommodation and conference facilities, but more importantly, Calgary is home to a group of distinguished geoscience educators who will ensure that the conference is a success. More information on the conference is available on the Web at <http://www.science.uwaterloo.ca/earth/geoscied/>.

It is our hope that GeoSciEd IV will strengthen linkages among geoscience educational groups in Canada. The conference will also showcase Canada as an emerging leader in geoscience education. Feature activities will include, but not be limited to, EdGEO, EarthNet, WAT ON EARTH, Geoscape Canada, the educational programs of museums and Canadian and provincial mining associations, books, posters, and videos produced by the Atlantic Geoscience Society, and provincial geologic road maps. Of course, the rest of the world will bring their ideas to Calgary, and Canadians will learn from their international colleagues.

A PLAN FOR THE FUTURE

CGEN envisions a positive synergy among the four programs and the conference described in this paper. EarthNet and WAT ON EARTH are platforms for making geoscience information and educational resources available to all Canadians. Geoscape Canada is an engine for producing relevant, local geoscience information that can be placed on EarthNet. EdGEO is the instrument for hands-on education of teachers, drawing upon information taken from EarthNet, Geoscape, and other sources. Lastly, GeoSciEd IV is an upcoming forum at which Canadian earth scientists can showcase geoeucational products and successes, including EdGEO, EarthNet, WAT ON EARTH, and Geoscape.

These programs, however, should not be seen as ends unto themselves. Geoscape Canada, for example, has 15 posters on the books, but we view the program as a catalyst for the production

of scores of additional posters, easy-to-understand geologic maps, and Web-based libraries of geoscience information at the community level. Other excellent local and regional educational initiatives, separate and different from those outlined in this paper, strengthen the national initiative outlined here. Please send us your comments and ideas. How about producing a Geoscape poster for your home place? Or maybe you'd like to contribute a virtual geologic field guide to EarthNet or an article to WAT ON EARTH? Would you be interested in helping a teacher organize an EdGEO workshop?

CGEN's plan is to draw more Canadian geoscientists into these programs. Educators must also be involved in these programs to ensure that the products are relevant to students and the public. CGEN has already undertaken fund-raising efforts for Geoscape projects in Ontario and is proposing, to the Natural Sciences and Engineering Research Council of Canada (NSERC),

expanded funding of EarthNet. It hopes to raise money to produce a new, up-to-date brochure on careers in earth science. CGEN's vision is a greatly expanded delivery of EdGEO, EarthNet, WAT ON EARTH, and Geoscape Canada, with contributions from geoscience outreach groups nationwide. What can we achieve in the long term, say 10 years from now? What if there were 50 community Geoscape Web sites, accessible to all Canadians? What if there were 50 virtual field trips across Canada that could easily be accessed from EarthNet? What if 50 EdGeo workshops were happening across Canada each year? What if ... ?

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Figure 6 GeoSciEd IV, the Fourth International IGEO Conference, to be held in Calgary in 2003.

Teachers' Comments about Recent EdGEO Workshops

Victoria, British Columbia

- "This was one of the best, most valuable and practical workshops I have attended."
- "Activities that I can take to school on Monday and use right away."
- "Excellent resources to go home with..."

Edmonton, Alberta

- "This program is wonderful to both educate and inspire us to pass these same qualities and knowledge along to our own students. A gift that keeps on giving."
- "A must for all! Especially first-year teachers scared about teaching the rocks and minerals unit in science!"
- "The best workshop I have ever attended."

Calgary, Alberta

- "One of the very most useful and well presented workshops that I have ever attended."
- "Presenters were relaxed, friendly and witty - for scientists."
- "Rocks and minerals was a unit I dreaded. Now I look forward to it."

Drumheller, Alberta

- "One of the best professional development activities I have ever been on - and a very enjoyable week."
- "The resources are amazing and I can't wait to use them this coming year."
- "This week will help me to 'bring the dinosaurs to life' for my students."

Rocky Mountains, British Columbia and Alberta (Yoho Burgess Shale Foundation)

- "Excellent! Many science teachers/educators would benefit/enjoy your course!"
- "I've always viewed Earth Science as the 'forgotten science' in high school. What we did this weekend reinforced the idea that more Earth Science needs to be incorporated into the traditional science courses."

Regina, Saskatchewan

- "I'm so excited about geology... So much of what I've learned will be immediately applicable with my students."
- "The best workshop I've been to..."
- "Superb presenters... Resource package is outstanding."

Quebec

- "Vous avez grandement aidé à faire grandir en nous l'intérêt pour les roches. Nous espérons demeurer ou devenir de francs multiplicateurs. Merci beaucoup. Des gens comme vous, on en a besoin."

Nova Scotia

- "I can't applaud this course enough. Spectacular!"
- "Great activities. I can't wait to use them and share them with fellow teachers."
- "The resources are exceptional."

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