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2012/2013 Educator Newsletter

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Ontario's Ring of Fire

What does the term “Ring of Fire” bring to mind? Most likely, you would think of the arc of volcanoes and sites of seismic activity that stretch along the coastlines of the countries and continents bordering the Pacific Plate beneath the Pacific Ocean. And you would be right. That Ring of Fire, comprising over 450 volcanoes strung along the 40,000 km distance, reminds us constantly of the power of the planet we live on.

But there's another Ring of Fire, this one a Canadian story that provides another example of Earth's creative forces. Comprising a 2,630 sq km area of muskeg swamps in the James Bay Lowlands in Northern Ontario, this Ring of Fire has the Canadian mining and minerals industry twitching with excitement. Centred on McFaulds Lake in the Kenora District, about 240 km west of James Bay and 500 km northeast of Thunder Bay, it holds what former Northern Development, Mines and Forestry Minister Michael Gravelle calls “one of the most promising mineral development opportunities in Ontario in more than a century.” The area has rich mineral deposits, including chromite, copper, zinc, nickel, platinum, vanadium, and gold.

It was a search for diamonds that revealed the region's potential. When looking for diamond indicators, geologists found strong indicators for minerals and metals such as copper and zinc. The search focus shifted and in 2007, “one of the most exciting drill holes in Canadian history” led to a major nickel, copper, platinum, and palladium discovery.

Then, in 2008, geologists discovered, for the first time in commercial quantities in North America, the rare mineral chromite. From chromite comes chromium, a metal used to harden, toughen, and improve corrosion resistance in steel, producing “stainless steel.” Alloyed with iron and nickel, it makes “nichrome,” a metal resistant to high temperatures and used to make heating units, ovens, and other appliances. Chromium alloys are used to “chrome plate” auto parts, appliances, and other products.

World chromite production comes mostly from four countries: South Africa, Kazakhstan, Turkey, and India. Developing Ontario's Ring of Fire chromite deposit could add Canada to that list; the deposit is so significant that experts say it could meet North America's needs for two centuries.

There are currently only two development proposals underway in the Ring of Fire area, but 30,000 claims are staked and 35 exploration companies are looking for the next big discovery.

Controversy often swirls around mining projects. Environmental concerns must be considered alongside economic benefits. Impact on communities might be considered positive or negative, depending on the viewpoint. In Ontario's North, Aboriginal peoples have a strong voice among those who weigh in on the pros and cons of developing a mine. Their traditional role in land and resource management has become widely recognized by resource industries in Canada.



Since 2003, *Mining Matters* has committed to respecting and furthering this traditional role by creating opportunities to engage Aboriginal communities, particularly their youth, in Earth sciences, providing them with the opportunity to develop skills, knowledge, and career information to equip them for the future.

The Ontario Government has also committed to increased participation of Aboriginal communities in the Far North's mineral sector, particularly in exploration and mineral development undertaken on their respective traditional areas. In 2012, *Mining Matters* partnered with the Ontario government to deliver a series of Mining 101 workshops for community members in remote Aboriginal communities.

To address environmental concerns, mining companies in Canada must meet rigorous standards when it comes to planning exploration, mineral development, and site rehabilitation of a depleted mine. Taking account of the potential impacts before initiating an exploration program helps to ensure that exploration professionals leave as light a footprint as possible during their work.

To help companies in their planning, the Prospectors and Developers Association of Canada (PDAC) publishes an Excellence in Environmental Stewardship (EES) toolkit: a comprehensive online resource for environmentally responsible exploration practices and issues. The toolkit is available for anyone to access at www.pdac.ca/e3plus/, a site dedicated to setting out a framework for responsible exploration,

along with two other toolkits concerning social responsibility and health and safety.

Patrick Whiteway, writing "Ontario's Ring of Fire: An Issue of Sustainability" (May 29, 2011) in the online *Canadian Mining Review*, states:

"With an appropriate level of long-term visionary leadership, the Ring of Fire development could transform Canada into the lowest-carbon-emitting source of stainless steel on the planet. How? Well, almost all of the things that go into making stainless steel – nickel, chromium, iron, scrap stainless steel, and low-carbon emitting hydro-electric energy – are readily available within a 500 km radius of the Ring of Fire. Putting them all to good use in a coordinated effort will be the challenge."

Not only is the Ring of Fire a discovery of historic proportions, it could also potentially be part of a shift in how Canadian minerals are processed: sustainably at home rather than shipped as raw materials abroad.

In the Canadian story, the name "Ring of Fire" comes from the famous Johnny Cash 1963 ballad, *Ring of Fire*. That song became a legend in the Cash repertoire; Ontario's Ring of Fire may just do the same in Canadian mining and mineral exploration history.

Join Mining Matters School Programs at the 2014 PDAC Convention

Since 2007, *Mining Matters* has presented a two-day, hands-on learning school program for elementary and secondary students at the Prospectors and Developers Association of Canada International Convention, Trade Show and Investors Exchange in downtown Toronto, Ontario. The four-day annual Convention, held at the Metro Toronto Convention Centre, has grown in size, stature, and influence since it began in 1932. In 2012, it hosted 30,369 attendees from 125 countries.



This learning opportunity is beneficial to all students, but may be of greatest interest to those interested in geology, engineering, and environmental practices related to land use. Students will visit the Trade Show and chat with some of over 1,000 exhibitors, exposing them to the immense scope of the mineral exploration and mining industry.

Teachers that use *Mining Matters* resources in their classroom and are interested in providing their students with this unique opportunity are encouraged to write a letter stating interest to *Mining Matters'* Manager of Teacher Training and School Programs. **Participants have already been selected for the 2013 Convention.** Letters, written on school letterhead, must be received by June 28, 2013, to be considered for the March 2014 education event.

Behind the Scenes: Mining Matters School Programs

Mining Matters could not deliver the wide range of programming at the PDAC Convention if not for the support and expertise of our network of Earth science advocates. We'd like to recognize and thank **Sylvia Gumpesberger**, **Stella Heenan**, **Lesley Hymers**, **Nicole Januszczak**, **Amanda McCallum**, **Beth McLarty-Halfkenny**, and **Peter Russell**, who have all contributed to the delivery of the PDAC Convention School Program since 2009. This eclectic group of individuals possesses a rich pool of knowledge that we draw upon to deliver three days of exceptional programming. We would like to tell you a little about these good people.



As a Professor of Jewellery Studies at George Brown College in Toronto, **Sylvia Gumpesberger** illuminates the wonders, characteristics, and origins of natural gems and gemstones and ways of distinguishing these from synthetics and imitations. She values the *Mining Matters* School Program as vital to mining awareness and has developed and delivered gem-related educational activities for *Mining Matters* at the PDAC International Convention since 2009.



Stella Heenan calls herself simply a home-schooling parent, employed here, there, and everywhere. But we know that she's much more. Her areas of specialization are geophysics, seismology, teacher professional development, and education resource development. Stella loves seeing people make discoveries about how the Earth works. That's one of the reasons she supports the *Mining Matters* School Program.



Lesley Hymers, Environment and Education Specialist with the Ontario Mining Association (OMA), has more than 13 years of Earth science education and outreach experience. In her current role with the OMA, Lesley provides educational opportunities focussed on high school students and teachers.



A Professional Geoscientist, **Nicole Januszczak** specializes in sedimentology and how glaciers have transported material over time. She has been working for De Beers Canada since 2005, currently as Targeting and Review Manager.

With De Beers, Nicole explores for diamonds within Canada. She has worked on every continent, both on land and at sea. As a part of her job, Nicole gets to work in remote locations with members of local communities, learning about their heritage and

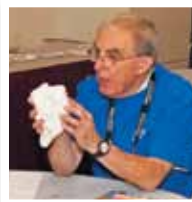
culture. She shares her enthusiasm for geology with the students in *Mining Matters* programs, talking about the challenges, rewards, and excitement of being a geoscientist in exploration.



Amanda McCallum is an Outreach Geologist with Geological Survey of Newfoundland and Labrador, (GSNL), Dept. of Natural Resources. She coordinates outreach and education programs to raise public awareness of the geological sciences, including mining and minerals related outreach. She has worked with *Mining Matters* staff over several years on a number of key outreach and educational initiatives throughout rural regions of Newfoundland and Labrador as well as various teacher workshops.



At Carlton University, Department of Earth Sciences, **Beth McLarty-Halfkenny** works as Curator of Collections and Outreach Coordinator. In this role, she organizes classroom visits, field trips, and presentations; creates Earth science teaching resources; and provides teacher training opportunities. She is committed to providing teachers and students with the resources they need to learn about Earth systems and processes and why wise management of its resources are so important to our future.



The University of Waterloo is fortunate to have **Peter Russell** as the Earth Sciences Curator of the Earth Sciences Museum. Peter specializes in Earth sciences outreach and says that his favourite part of the job is giving presentations to museum visitors, at gem shows, and other events.

Peter supports the *Mining Matters* School Program because he believes that we need to recognize that all the materials we use are either grown, mined, or recycled. He encourages anyone else involved in the Earth sciences and mining industry to volunteer at local schools to give students a first-person look at what the mining industry does for them.

This year we said good-bye to *Mining Matters* team members **Laura Clinton** and **Amanda Dillon** as they pursue new careers. Laura, a driving force behind *Mining Matters* for ten years, contributed immeasurably to the organization, creating countless opportunities for growth and establishing a reputation for excellence. Amanda worked tirelessly as our Coordinator of Special Events and Public Outreach for five years, presenting *Mining Matters* programs at public outreach events across Canada and supporting Aboriginal youth outreach initiatives.

To learn more about *Mining Matters*' programs or to contact one of our Earth science advocates, please call the *Mining Matters* office at **416-863-6463**.

Reflections on Mining Matters School Programs at the 2012 PDAC Convention

Thirty-four teachers took advantage of a full day of *Mining Matters* programming at the 2012 PDAC Convention. Students also had special junior and senior days dedicated to them: 99 junior students and 83 senior students experienced *Mining Matters* fun activities and the exciting buzz of the Trade Show.

A Teacher Discovers the World of Mining

This was my first time attending the Special Education Event for Teachers during the Prospectors and Developers Association of Canada (PDAC) International Trade Show and Convention, at the Metro Toronto Convention Centre (MTCC). Having a degree in physical geography as well as a passion for adventure, travel to geologically interesting places, and working with high school students, this event was perfect for me.

The day's schedule was packed with activities. I participated in the *Discovering Diamonds* workshop for high schools. Participants received the necessary materials and resources for activities that helped us understand how diamonds are formed, how they are discovered, and the ways to extract them. My partner and I analyzed real seismic data from the Indian Ocean Tsunami in 2004 and showed the difference on the graph between S and P seismic waves, sharing the results with others. This was a great experience, and I've learned many new things about Canadian diamond deposits and mining. This activity could definitely be used by teachers and students during science or geography classes. We all received a resource kit with ready-to-use lesson plans, visual digital resources, and rock samples. What a great and useful tool!! I really enjoyed the workshop.

Next on the agenda were lunch and a presentation by keynote speaker Shawn Ryan, also known as "the King of the New Gold Rush in Yukon." He shared his life story, his passion and knowledge of the land, and his exploration techniques. Ryan's pictures from the exploration areas in Yukon were amazing. He also told us how teachers' passion and interesting lessons can influence students for life.

In the afternoon, I visited the PDAC trade show. WOW! Over 100 countries had exhibits. It was impossible to see them all, so I planned my tour. I talked to the geologists and prospectors, watched the newest technology used in mineral exploration, and also collected several geological and mineral maps from different parts of the world. Some examples were Ontario, Afghanistan, Ghana, Norway, Greenland, New South Wales in Australia, Northern Canada, South Australia, Québec, Papua Guinea, and Alaska.

I had a great day at PDAC 2012. Not only did I learn new things, but I also received professional educational resources and samples ready to be used with students. I would highly recommend Teachers' Day at the PDAC Convention for all science and geography teachers, and for all who are interested in geoscience.



Day at the PDAC Convention for all science and geography teachers, and for all who are interested in geoscience.

Barb Ruszkowski, St. Marguerite d'Youville Secondary School, Brampton, ON

Junior Students Have Fun Learning

On Monday, March 5, 46 grade 4 students from Victoria Terrace Public School in Fergus, Ontario, and 53 from Humewood Community in Toronto, bounded through the doors of the Metro Toronto Convention Centre, eager to start their day at the *Mining Matters* School Program being delivered as part of the PDAC International Convention, Trade Show and Investor's Exchange. A delightful series of thank-you letters to *Mining Matters* staff shows what they took in and away with them. Here are a few samples:

March 4, 2012

Dear Janice and team,
Thank you for the fun activities that you let us do. The trade show was interesting and the escalators were awesome. There was a lot of stuff I learned that I did not know. It was funny to see all the guys in suits and the guy that was taking our pictures. Thanks for everything. I hope to come back.



Your friend,
Trent

March 8th 2012

Dear Jenni, Janice and team,

I was happy to be at the rocks and minerals convention on Monday. Thank you for inviting Victoria Terrace. I learned a lot about some of the mining companies and rocks and minerals. When I am older I want to be a geologist. I had lots of fun and I thought it was a cool experience to be at a trade show!

From your friend,
Madelyn

Dear Peter,

Thanks for teaching me about the rock cycle. I had a lot of fun. At the trade show I learned more about the rock cycle. I hope you teach more kids about the rock cycle. You are amazing!

Your friend,
Rhianna

Eye-Opener for Senior Students

On Tuesday, March 6, 83 excited grade 9 geography students from Sir William Mulock Secondary School in Newmarket travelled to the Metro Toronto Convention Centre to participate in the *Mining Matters* School Program. Their hosts for the day—*Mining Matters* Education Ambassadors—greeted and escorted them to a conference room where they received their stylish T-shirts and instructions for the day. In small groups, students attended a variety of interesting curriculum-related activities that focussed on careers and opportunities in mining and related fields. They also learned how to “read” the clues in the Earth to find minerals, how to assess a diamond, and how various technologies are implemented in mineral extraction.

One of the most educational moments of the day came on the trade floor where students witnessed geography in action. They were profoundly impressed by the variety of displays from around the world and the sheer number of attendees who illustrated, better than any textbook could, that careers in geography are both attractive and viable. The entire day was an eye-opening experience for the students, one that will surely encourage more than one to consider a future in geography.

Anne Henry, Head of Geography,
Sir William Mulock Secondary School, Newmarket, ON



Field Trip Subsidies Available

Mining Matters offers Field Trip Subsidies to enrich Earth-science learning. Teachers who have completed an in-service workshop and use a *Mining Matters* resource kit in the classroom may apply for the subsidy. The subsidies, up to \$500 each, help offset the cost of transportation and entrance fees to stone, sand and gravel, mining, and geoscience venues. Applications will be considered on a first-come, first-served basis. For further information, please call Janice Williams at **416-863-6463, ext. 322** or e-mail jwilliams@pdac.ca

To download the field trip subsidy application form, go to www.pdac.ca/miningmatters/pdf/field-trip-subsidy-application-form.pdf

Potential in Nunavut

Nunavut is the new kid in school among Canada's provinces and territories, having split from the Northwest Territories in 1999 to become the largest territory in Canada's Far North. With about 20 per cent of Canada's land mass, it is the largest yet least populated region of Canada, covering over two million sq km. Home to 33,330 residents (as of October 1, 2011), about 85 per cent of whom are Inuit, Nunavut has a wealth of resources such as gold, uranium, diamonds, nickel, and iron ore.



Nunavut, with its stable political environment and lands rich in minerals and metals, now hosts a rapidly growing mining sector. According to the Canadian Chamber of Commerce 2012-2013 Economic Outlook, “Mining activity will continue to drive growth in Canada's North. Recently released figures from Natural Resources Canada show that \$395.5 million was spent on mineral exploration in Nunavut in 2011.” It turns out that the new kid has a potentially bright economic future.

Mining Matters is looking forward to opportunities for collaboration with the Curriculum Services Division of the Nunavut Department of Education. A recent working group reviewed educational mining resources, including *Mining Matters* resources, for use in the development of a junior secondary Earth science module and senior secondary mining option. The meeting was attended by representative educators from across Nunavut.



Learning Opportunities outside the Classroom

For Teachers

Since 2007, *Mining Matters* has coordinated a special event for teachers at the **Annual PDAC International Convention, Trade Show and Investor's Exchange**, held in March, in Toronto, Ontario. The program for the day features guest speakers, workshops, and visits to the Trade Show Floor. For more information, contact *Mining Matters* Teacher Training and School Programs Manager Janice Williams at 416-863-6463, ext. 322.

The **Stonehammer Geopark** in New Brunswick will host an EdGEO teachers' workshop in August, 2013. Information and updates are available at www.stonehammergeopark.com/teachers.html. In 2014, it will host an International Geopark Conference, which will have a strong outreach component.

On June 1, 2013, teachers in the Greater Toronto Area can take advantage of the **Operations Pit Quarry Restoration Site Teacher Event**, otherwise known as O-P-Q-R-S-T Event. Brought to you by the Ontario Sand Stone and Gravel Association and *Mining Matters* in partnership with EdGEO, this event invites up to 40 teachers to learn about operations at the CBM Puslinch pit and the LaFarge Dundas quarry. They will also see firsthand the Nelson Quarry rehabilitation site now known as Kerncliff Park, used by local residents for informal recreation such as hiking and exploration. For more information, contact Janice Williams at 416-836-6463, ext 322.

For All

The **University of Waterloo Earth Science Museum** is open seven days a week from 8:30 a.m. to 4:30 p.m. and at other times by special request for school tours, Brownies, Cubs, Beavers, adults, and children. See the new replica mine tunnel that will transport you back in time to a 1950s silver mine in Cobalt, Ontario.

<https://uwaterloo.ca/earth-sciences-museum/>

The **Royal Ontario Museum (ROM)** has lots to offer. A ROM-conducted school visit is a one-of-a-kind experience that features hundreds of authentic artifacts presented in hands-on learning environments led by a ROM teacher. www.rom.on.ca/en/education/school-visits

ROM visitors with rocks, minerals, gems, fossils, or suspected meteorites can have them identified at special ID clinics, held six times a year on Wednesdays from 4:00 p.m. to 5:30 p.m. This clinic is free to the public; however, patrons wishing to visit the rest of the museum will be charged admission.

Encourage families and kids to enjoy special activities, events, and programs all year long at the ROM. For kids and youth 16 and under, programming includes the Saturday Morning Club, ROM MOMS, Tiny Tots, ROM Sleepovers, Summer Club, Explorers' Club, and the New to Canada Youth Club. www.rom.on.ca/en/activities-programs

Bring a piece of the museum to you with the ROM's Travelling Education Kits and Starlab. These hands-on, interactive tools are perfect for schools, community groups, or an individual inquiry.

Calling all geography, social studies, science, environmental science and careers teachers.

Save the date...

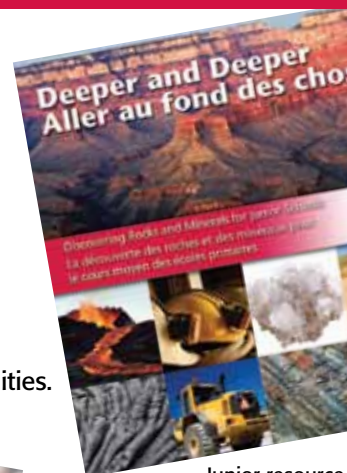


Sunday, March 3, 2013
Metro Toronto Convention Centre
Toronto, ON

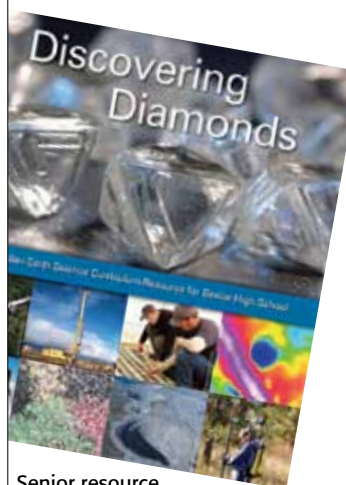
Event will take place during the world's largest annual mineral exploration convention

6th ANNUAL TEACHER'S DAY

Learn about Canada's mineral wealth and mineral exploration industries. Tour the outstanding exhibits on the trade show floor. See the technologies used in resource exploration, career opportunities, and the industry's social responsibilities to the environment and communities.



Junior resource



Senior resource

This year's theme, **The Mineral Resource Development Cycle**, will provide teachers with the opportunity to experience hands-on activities related to the mining industry in Ontario and Canada. Each teacher will receive free Earth science and career resources to take back to their classrooms!

www.MiningMatters.ca

Don't miss out on this unique professional learning opportunity. Register online today!

For more information, contact Janice Williams at jwilliams@pdac.ca or 416-863-6463 ext. 322

Registration deadline: February 8, 2013

Presented in partnership with

IBK Capital Corp.

The **Warsaw Caves Conservation Area and Campground**, approximately 28 km northeast of Peterborough, Ontario, takes its name from a series of seven caves formed at the end of the last ice age by the rushing melt waters of a glacier that covered Ontario. Take a flashlight or a headlamp to enjoy this natural underground jungle gym. Spend hours or the day exploring the caves. Learn more by downloading a Spelunkers Guide to the Caves. www.warsawcaves.com

Gros Morne National Park, on the west coast of the island of Newfoundland, was designated a UNESCO World Heritage Site in 1987. It provides a rare example of the process of continental drift, where deep ocean crust and the rocks of the Earth's mantle lie exposed. Glacial action has resulted in some spectacular scenery, with coastal lowland, alpine plateau, fjords, glacial valleys, sheer cliffs, waterfalls, and many pristine lakes.

Visit the Discovery Centre in Woody Point to look into the forces of nature that have shaped the land and the people of this place. Interactive exhibits help you explore the park's geology, plant and animal life, marine story, and human history. Daily interpretive activities occur throughout the summer. If you are bringing a group and would like the services of an interpreter for a guided event, a talk, or a step-on guide, contact grosmorne.info@pc.gc.ca or 709-458-2066 at least two weeks in advance. www.grosmorne.com/ or www.pc.gc.ca/eng/pn-np/nl/grosmorne/index.aspx

Thought to be one of Canada's ultimate road trips, the **Trail of the Dinosaurs** through the **Canada Badlands** in Alberta takes about two and a half hours by road from Drumheller to Dinosaur Provincial Park. Drumheller is home to the Royal Tyrrell Museum, one of the world's premiere palaeontological research facilities and Canada's only museum dedicated exclusively to palaeontology. The museum offers school visit programs and distance learning. Along the road, visit the historic Atlas Coal Mine, which also hosts school groups, and the fascinating Willow Creek Hoodoos. Dinosaur Provincial Park is a UNESCO World Heritage Site. Links to all of the above can be found at <http://canadabadlands.com/2012/04/trail-of-the-dinosaurs/>

Located in the former York County Jail in downtown Fredericton, New Brunswick, **Science East** has curriculum-related demonstrations and programs designed to meet specific science unit outcomes. Science East will host groups at the Centre or travel to your location.

The facility also offers a variety of PD workshops to New Brunswick teachers, all of which can be customized. Developed in conjunction with teachers, these workshops focus on building confidence when it comes to teaching science. They also offer a wealth of ideas for introducing more hands-on activities into the classroom. www.scienceeast.nb.ca/school.asp

Le Jardin des glaciers, situated in Baie-Comeau, Québec, by the St. Lawrence River and in the heart of a World Biosphere Reserve, is an integrated site for interpretation, exploration, and education. Discover how the melting of the Laurentian ice cap and the formation of the Ancient Seas shaped our landscape, while influencing the migration of the first inhabitants. Observe the various spectacular phenomena such as the giant glacial grooves, a valley of seashells unique to the world, fjords, deltas, moraines, canyons, beaches, and glacial lakes.

The dynamic team at Le Jardin des glaciers offers you the chance to extend your teaching framework. A territory of 40 sq km, including a Glacier Exploration Station and a Maritime Adventure Park, will allow you to discover, by means of organized treks and a program of outdoor activities, the spectacular traces left on the landscape by the last Ice Age. www.jardindesglaciers.ca/



GeoTours Northern Ontario, at **Dynamic North** in Sudbury, highlights the rugged Canadian Shield landscapes and rich mining heritage that define much of Northern Ontario. GeoTours dig into the geological stories that explain how Northern Ontario's well-known geological features came to be: lakes and waterfalls, cliffs and canyons, mines and museums. Initially, just stories from the Sudbury area are available. Soon, GeoTours will include geological sites from Thunder Bay to Parry Sound and Sault Ste. Marie to Timmins. www.sciencenorth.ca/dynamic-earth/geotours/

The ROM—Rocks and Minerals!

We would like to thank teacher Sally Warburton for her account of a field trip subsidized by the *Mining Matters* Field Trip Subsidy Fund.



In May, 2012, my grade 4/5 French immersion class had an excellent trip to the Royal Ontario Museum. We are very grateful to *Mining Matters* for subsidizing our trip through their Field Trip Subsidy program.

Since we'd been studying Rocks and Minerals as part of the Ontario Science Curriculum, our focus was the Rocks and Minerals exhibit. The students were very excited to learn more about rocks and minerals. They found the exhibit, with its fantastic displays of gold, silver, copper, and fluorescent rocks—to name a few—very interesting. Learning where and how the minerals are mined and seeing diamonds were fascinating.

Since teachers are given the opportunity to have a pre-visit to the ROM to plan class trips, I went and created a scavenger hunt questionnaire. This was the best idea ever, as the students were totally focussed, looking for specific information as they looked at all aspects of the Rocks and Minerals Exhibit. They really enjoyed completing the hunt in small groups with parent-helpers.

Although we focussed on Rocks and Minerals, we also saw the Animal, Egyptian, and Ancient China exhibits and, of course, the Bat Cave! We thank *Mining Matters* very much for the subsidy to pay for the students' entry to the ROM and for the school bus, up to a \$500 subsidy.

A great trip was made even better with our parent helpers allowing us to have small groups. *It's important to expose children to the mining industry at an early age so that they can realize the vast job opportunities available to them. C'était magnifique!* Merci beaucoup de la classe de Mme Sally Warburton, Sir Adam Beck Junior School, Toronto District School Board.

Resources 4 U

Web Sites

The McMaster University School of Geography and Earth Sciences offers Virtual Road Trips, including Albion Falls, Devil's Punchbowl, Jolly Cut, Red Hill Valley, Rock Chapel, Sherman Falls, Sulphur Creek, Sydenham Cut, Tew's Falls, Tiffany Falls, and Webster's Falls.

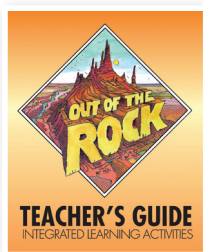
www.science.mcmaster.ca/geo/outreach/road_trips.html

In the Virtual Museum of Canada, the Nova Scotia Museum of Natural History teaches about trace fossils, which represent the activities of ancient animals.

<http://museum.gov.ns.ca/mnh/nature/tracefossils/english/>

The Canadian government science Web site has a page of links to resources for Earth and space sciences and other resources listed in the toolbar.

www.science.gc.ca/default.asp?lang=en&nav=8998F748-1



The U.S. National Energy Foundation (NEF) has developed Out of the Rock, a Web teaching tool that raises the level of awareness and understanding of the importance of the mining industry in the U.S., society, and people's personal lives. <http://outoftherock.org/>

The Natural History Museum, London, England, has a new evolution app for iPads. All details at

www.nhm.ac.uk/about-us/news/2012/july/new-nhm-evolution-ipad-app-launched112098.html with a short video description at www.nhm.ac.uk/business-centre/publishing/news/index.html

Innovative, Earth-related teaching ideas are easy to find.

www.earthlearningidea.com

For example, check out "What am I made of? A comparison between the chemistry of the human body and the rest of the Earth."

www.earthlearningidea.com/PDF/108_What_made_of.pdf

Read the latest in geology news around the world and in space.

www.sci-news.com/news/geology

Publications

Dynamic Earth has released full sets of Mineral Trading Cards. Discover what each mineral looks like, the elements it is composed of, and some common uses. Stay up-to-date on new card releases and special events. <http://sciencenorth.ca/dynamic-earth/mineralcards/>



GeoVistas for Jasper and Grasslands national parks are now available online. These downloadable brochures describe iconic views in Canadian parks in terms of their geological features and how they have influenced climate, ecology, and culture. Print versions are available at the parks' visitor centres. www.earthsciencecanada.com/geovista/

For junior grades, check out a lovely alphabet poster titled *Know Your Prehistory*. <http://birdandmoon.com/palaeobet.html>

For those visiting Newfoundland, there's an excellent new field guide to its geology. *Geology of Newfoundland*, by Martha Hickman Hild, is written for the non-specialist and is beautifully illustrated.

www.boulderpublications.ca/boulderpublications.ca/Nature.html

For those going to the U.S., the book *101 American Geo-Sites You've Gotta See*, by Albert B. Dickas, will guide you through some interesting geological terrain. <http://geology.com/store/101-american-geo-sites.shtml>

The National Academies Press has published *A Framework for K-12 Science Education: Practices, Crosscutting Concepts and Core Ideas*. Although written from a U.S. perspective, the book includes plenty of relevant material for Canadian educators. Download or read it online. www.nap.edu/catalog.php?record_id=13165

The Globe and Mail features pioneering geologist Joseph Tyrrell, who in the 1890s, was the first geologist to describe the oil sands (the Royal Tyrrell Museum of Paleontology is named in his honour). www.theglobeandmail.com/news/politics/what-the-gateway-commission-could-learn-from-an-oil-sands-pioneer/article554362/?page=all

The Library at Geological Survey Calgary houses one of the most comprehensive collections of geoscience publications in western Canada. It includes one of the most complete collections of information on the Western Canada Sedimentary Basin, as well as an outstanding selection of sedimentary and petroleum geoscience journals and periodicals. The Library holds 100,000 volumes and subscribes to 350 serial titles. Everyone, including industry and university geoscientists, students, and non-specialists, is welcome.

www.nrnc.gc.ca/earth-sciences/about/organization/organization-structure/geological-survey-of-canada/9776

The Mining Association of Canada recently promoted the strength of the Canadian mining industry with ads themed "Before it's yours, it's mined." The images linked everyday products, such as cell phones and hockey sticks, with the minerals and metals used to build them. These are identified by their respective periodic table elements.

www.mining.ca/www/media_lib/MAC_News/2012/Canadian%20Mining%20Ads%20_Web.pdf

Multimedia

Dynamic Earth reports the release of *Discover Sudbury*, a GPS-enabled smart phone tour of the geological, glacial, mining, and cultural history of the City of Greater Sudbury.

<http://sciencenorth.ca/apps/discoverudbury/>

Hear a one-hour radio documentary done in partnership with the CBC's *Ideas* program about the geology and landscape of Gros Morne

National Park. Download "Bones of the Earth."
www.pc.gc.ca/pn-np/nl/grosmorne/natcul/doc.aspx

Mining Your Future is a TV Mini-Series showcasing the diverse career opportunities in British Columbia's mineral exploration and mining industry. Hosts Danielle and Maggie follow three unique jobs each week for eight weeks, allowing you to discover, first-hand, over 20 of the 120 top-paying jobs in the province. www.miningyourfuture.com/videos

Vale, a global leader in iron ore and nickel production, recently launched a video that explains various aspects of base metals operations. The video is being included in *Mining Matters* resource kits and also distributed at teacher conferences and workshops. Key segments explaining base metal surface mining, underground mining, and processing are available on Vale's YouTube site under the "Operational Areas" tab. www.youtube.com/user/ValeGlobal

Careers

Natural Resources Canada (NRCan) recruits scientists and technicians in a variety of disciplines, as well as professionals and support staff in fields such as information technology, human resources, policy development, and communications. www.nrcan.gc.ca/careers

Mining Matters and Aboriginal Education

Paul Davidson, president of the Association of Universities and Colleges of Canada, and Roberta Jamieson, president and CEO of the National Aboriginal Achievement Foundation, Guest Columnists in *Windspeaker* (Volume 28, Issue 8, 2010), an Aboriginal Multi-Media Society (AMMSA) Publication, wrote:

If the future of a country is its youth, then Canada's future is increasingly Aboriginal. Canada's Aboriginal youth population is growing at three times the national average. It is and will be a force to be reckoned with. But whether these youth are a force for positive change and economic growth will be determined by the actions all of us take.

For the complete article, see www.ammsa.com/publications/windspeaker/canada%E2%80%99s-future-depends-aboriginal-youth-column

Mining Matters actively takes a three-pronged approach to introducing positive change to Aboriginal education. Under the direction of Barbara Green Parker, Manager, Aboriginal Education and Outreach Programs, we educate Aboriginal youth directly, we support teachers in Aboriginal communities, and we provide outreach to Aboriginal communities. We educate youth by giving them opportunities to attend *Mining Rocks* Earth science summer camps packed with hands-on learning activities. We support teachers with our Aboriginal Education and Outreach Programs (AEOP), delivering teacher workshops and combined teacher/student programming. We support communities by providing workshops and activities that develop Earth science knowledge in their members.



We applaud and appreciate educational leaders who think "outside the box" and recognize that our workshops provide unique ways of engaging students. In 2012, we delivered five school-run programs to teachers and students in Aboriginal communities: three in Ontario, one in Labrador, and one in Manitoba.

In January, *Mining Matters* facilitators travelled to Attawapiskat, Ontario, and delivered a three-day program, sponsored by De Beers Canada, that included two-hour sessions for 24 primary, junior, intermediate, and high school classes and teacher workshops for 62 elementary and high school teachers. *Mining Matters* left *Deeper and Deeper* resource kits for use by elementary teachers and *Discovering Diamonds* for secondary teachers. *Discovering Diamonds* was developed using actual Attawapiskat-area data.

In April, we partnered with the Geological Survey of Newfoundland and Labrador to deliver two-hour grade 4 and grade 7 programs to students in one Innu and five Inuit Coastal Community Schools. The workshops were tailored to provincial science learning outcomes for grades 4 and 7. They taught students about the diversity of the rocks and minerals found in Newfoundland and Labrador, the importance of mining and geology, and the benefit of using products made from minerals mined in the province.

Moving into June, our team of facilitators visited the Tadoule Lake First Nation in Manitoba to deliver three days of continuous programming, again sponsored by De Beers, for an entire school of students, from Kindergarten to grade 12. We were gratified when our final program review pulled in solid five-out-of-five scores for the many activities offered. Activities included NickelQuest, Rock Relay Race, Fossil Making, Crystal Structures, and Mineral Discovery, but the best answer to "What were your favourite activities?" was "The whole day!"

In September, *Mining Matters* headed up to the Sagamok First Nation in Ontario to deliver four days of continuous immersion to grades 6 to 8. We were able to include a community field trip to local sites that showed off nicely defined rock formations. According to the program evaluations, we inspired seven geologists, two engineers, one geomatic specialist, one diamond driller, and several miners! The program was so successful that the principal hopes to have us return to deliver it to other grades.

Finally, in October, Long Lac #58 First Nation in Ontario hosted our fifth workshop. *Mining Matters* facilitators presented a three-hour session to 29 students and six teachers from grades 7 to 12. Students found that the program opened their eyes to minerals and the products made from them. One student said, "Mica is in eye shadow. That's cool and I didn't know that. But now I know."

"Now I know." That's what *Mining Matters* is aiming for.



Gem and Mineral Shows across Canada

20th Annual Peterborough Gem, Mineral and Fossil Show:
March 2 – 3, 2013
Evinrude Centre, 911 Monaghan Road, Peterborough, ON
www.rockandfossil.com

Brantford 41st Annual Gem and Mineral Show: April 6 – 7, 2013
Paris Fairgrounds, 139 Silver Street, Paris, ON
www.brantfordlapidarymineral.ca

BC Gem Show: April 12 – 14, 2013
Ag-Rec. Building, Central Fraser Valley Fairgrounds,
32470 Haida Drive, Abbotsford, BC
www.lapidary.bc.ca/gemshow.html

Kitchener-Waterloo Gem and Mineral Club Annual Show: May 4, 2013
Waterloo Community Arts Centre, 25 Regina St. S., Waterloo, ON
www.calaverite.com/kwgm

Edmonton Gem, Mineral, Fossil and Jewellery Show:
May 10 – 12, 2013
Westwood Arena, 12040 97 St NW, Edmonton, AB
Contact Alex at calgarygemshow@gmail.com

Sudbury 31st Annual Gem and Mineral Show: July 19 – 21, 2013
Carmichael Arena, 1298 Bancroft Drive, Sudbury, ON
www.ccfms.ca/clubs/Sudbury/show.htm

Nova Scotia Gem and Mineral Show and Sale: August 16 – 18, 2013
Lion's Recreation Centre, Western Ave., Parrsboro, NS
<http://museum.gov.ns.ca/fgm/en/home/whattoseedo/gemmineralshow/default.aspx>

Ancaster Gem, Mineral, Bead and Jewellery Show:
September 27 – 29, 2013
Ancaster Fairgrounds, Ancaster, ON
www.ancastergemshow.com

Calgary Gem, Mineral, Fossil and Jewellery Show:
October 11 – 13, 2013
West Hillhurst Arena, 1940 – 6th Ave. NW, Calgary, AB
www.calgarygemshow.com/

Kingston Lapidary and Mineral Club 44th Annual Gem Storm:
October 19 – 20, 2013
Portsmouth Olympic Harbour, 53 Yonge Street, Kingston, ON
www.mineralclub.ca

University of Waterloo Gem and Mineral Show:
October 25 – 26, 2013
Centre for Environmental Information and Technology,
The Earth Sciences Museum, 200 University Ave. West, Waterloo, ON
<https://uwaterloo.ca/earth-sciences-museum/about-earth-sciences-museum/gem-and-mineral-show>

Montréal Gem and Mineral Club 54th Annual Show:
November 1 – 3, 2013
Place Bonaventure, 800 De La Gauchetière, Montréal, QC
www.montrealgemmineralclub.ca/pages/AnnualShow-Set.html

Teacher's Mining Tour

For a third year, *Mining Matters* took part in the Teacher's Mining Tour, August 6 – 10, presenting *Deeper and Deeper* and *Discovering Diamonds* curriculum activities to 35 participants in the North Bay Region. The fully-sponsored five-day tour gives educators foundation knowledge of the mining process and cycle, as well as specific information about modern mining processes, practices, and the career opportunities available to students. It highlights important regulatory procedures, environmental impact considerations, and land use practices that the industry must adhere to and discusses the economic health and prosperity the sector brings to Canada.

Courtney Murfin, Interpretive Planner at the Royal Ontario Museum (ROM) participated alongside teachers. She wrote to *Mining Matters* after the tour saying, "The *Mining Matters* workshops created tangible links between the new knowledge acquired on site visits and the needs of children at different grade levels. Though the resource kits were geared to elementary and secondary school students, I found the lessons immensely useful for my own understanding of the mining spectrum, from 'what is a mineral?' to the specific concerns of today's mining industry. And for my role at the ROM, it is very important that I comprehend the full context of modern mining."

Dates for the 2013 Teacher's Mining Tour are set, with two tours to choose from: July 29 to August 2 and August 19 to 23. These tours are FULLY SPONSORED. Register early as space is limited. For registration information go to www.canadianecology.ca/wp-content/uploads/2012/09/Registration-form-MINING-and-FORESTRY-TOUR-2013.pdf

As Courtney says, "It was definitely an action-packed week, but the experiences were incredible—worth the exhaustion at the end! The Teacher's Mining Tour is a wonderful program, and I'm so grateful I got to participate."



Teacher Training Workshops

Teachers across the country are taking advantage of *Mining Matters* exceptional teaching resources. Over the last year, over 25 workshops delivered *Mining Matters* material to 765 teachers and teacher candidates at such diverse locations as **Iqaluit** in Nunavut; **Whitehorse** in Yukon; **Cross Lake** and **Cranberry Portage** in Manitoba; **Kingston**, **Sudbury**, **Oshawa**, **Toronto**, and **Mattawa** in Ontario; **Laval** and **Montréal** in Québec, and **St. John's** in Newfoundland.

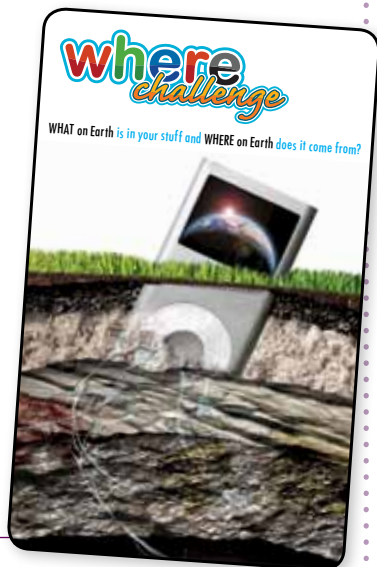
Mining Matters curriculum kits *Deeper and Deeper*, *Mining Matters II – The Earth's Crust*, and *Discovering Diamonds* are available to teachers, in French or English, through a prerequisite three-hour workshop, hosted by a school board or teacher organization. We can arrange workshops accommodating up to 30 teachers (minimum of 10) anywhere in Canada with at least four weeks' prior notice. Please contact us to make an inquiry.



The **WHERE** Challenge definitely gets young minds thinking. This national contest promotes awareness of non-renewable Earth resources, asking young Canadians aged 9 to 14 “What on Earth is in your stuff?” and “Where on Earth does it come from?”

Challenge 2013 launched on September 4, 2012, and runs until March 1, 2013. Entries are welcome in French and English. To learn more about the **WHERE** Challenge and to see all national and regional winning entries, go to www.earthsciencescanada.com/where

We congratulate our many 2012 participants for their efforts and creativity. National winners are listed below.



National Winners: 12 – 14 years

Best Overall: Postcards to Quadrisolas (\$500)
Alana Krug-MacLeod, Saskatoon, SK

Best Creative: To Freeze or Not to Freeze (\$250)
Brennan O’Yeung, Calgary, AB

Best Research: The Story Behind Photo (\$250)
Daniel Baik, Saskatoon, SK

Honourable Mention: What’s in a Pencil?
Hailey Zanth, Georgetown, ON

National Winners: 9 – 11 years

Best Overall: Fairy Dust (\$500)
Julie Krug-MacLeod, Saskatoon, SK

Best Creative: 4th Generation iPod touch (\$250)
Brian Liang and Matthew Pascal, Yellowknife, NT

Best Research: Mine Your Light (\$250)
Chloé Francoeur, Granby, QC

School Winners include École River Heights School (\$750), Winnipeg, MB; Parkview Elementary School (\$750), Granby, QC; and Georgetown District High School (\$750), Georgetown, ON.

University of Toronto Science Camp Rocks!



In August, 2012, 27 grades 10 and 11 students had the chance to find out what studying science at university is really like, at the Summer Science Camp hosted by the University of Toronto.

Students were treated to presentations by faculty and researchers from six departments of the Arts and Science Faculty—Math, Chemistry, Astronomy and Astrophysics, Earth Sciences, Computer Science, and Physics/Atmospheric Science (CANDAC)—and had access to experts and specialists in each field.

The Summer Science Camp was the brainchild of the University of Toronto Physics department, with support of the Math department, and put together by Dr. Kausik Das, Lecturer, and Pamela Brittain, Outreach and Special Projects Coordinator. The one-week day camp was attended primarily by students from the Greater Toronto Area, but all were welcome to attend. Participants paid \$325 to attend five full days, working with one or two different departments each day. Sessions included hands-on activities in such interesting topics as:

- Cryptography
- Disease Detection by Surface Chemistry
- Earth Sciences
- Magnetism and Its Applications in Modes of Transportation
- The Physics of Chaos

Students had lots of good things to say about their experience:

“Very hands on, excellent presenters and presentations, very helpful and informative.”

“Fun experiments with rocks, lots of info.”

“The diamond session is pretty cool.”

“Fantastic. Making a spectrometer is a really fun idea.”

The one-week program was such a success that this past fall it was officially named *Science Unlimited @utoronto*. Organizers are planning to offer the physical science focussed program to Toronto area students again next summer. Another learning opportunity for many a budding scientist. To learn more about this event, visit www.physics.utoronto.ca/students/outreach/science-summer-camp



Putting Earth into Science: Activities 4 U

What better way to reinforce the importance of Earth and its natural resources in science than to anchor scientific investigations for chemistry, physics, and biology, to rocks, minerals, and methods related to the extraction of the resource from the Earth? The activities that follow will highlight how Earth can be used as an anchoring theme in teaching middle school physics and secondary school chemistry.

If you have found creative and unique ways to put Earth into science, we would love to hear about it! Your submission could appear in future *Mining Matters* publications. Send your ideas to jwilliams@pdac.ca. Be sure to include information about your target audience, the name of your school, and if you use any of the *Mining Matters* teacher resources in your teaching practices.

Geophysics Activity: Discovering Optical Properties of Rocks and Minerals



Safety Matters

UV light can be harmful if not used properly. Never look directly at a UV lamp when it is on or shine it towards anyone's eyes.

Some of Earth's materials have an amazing ability to glow under ultraviolet (UV) light. During the activities below you will

- predict what will happen when a sample is exposed to UV light
- investigate what materials, such as water and sunscreen, can block UV rays.

Background

Electromagnetic Radiation

Visible light, X-rays, radio waves, and ultraviolet light are all forms of **electromagnetic radiation (EMR)**. EMR is a stream of tiny particles carrying energy; the particles travel in waves at the speed of light, 299,792,458 metres per second! **Visible light** is sometimes described as "all the colours in the rainbow," and its wavelength is comparable in size (scale) to microscopic organisms. **Ultraviolet (UV) radiation** has a shorter wavelength than violet visible light, so it cannot be detected by human eyes. See the *Electromagnetic Spectrum chart*.

Fluorescence, Luminescence, and Triboluminescence



Fluorescence



Luminescence



Triboluminescence

Fluorescence occurs when an object absorbs ultraviolet energy and then gives off (emits) energy at a larger wavelength of electromagnetic radiation (lower energy). Fluorescent rock and mineral samples (like the ones used in this activity) absorb ultraviolet radiation and emit visible light.

Luminescence is the conversion (change) of non-heat energy into visible light. It has a brightness similar to glow-in-the-dark rather than very bright light.

Triboluminescence converts (changes) mechanical energy to visible light. Wintergreen Lifesaver® candy is an excellent example of this phenomenon.

Photo: Fluorescence

Description: Collection of various fluorescent minerals under ultraviolet UV-A, UV-B and UV-C light. Chemicals in the rocks absorb the ultraviolet light and emit visible light of various colours, a process called fluorescence.

Date: 7 April 2005

Author:Hannes Grobe (Hgrobe 06:16, 26 April 2006 (UTC))

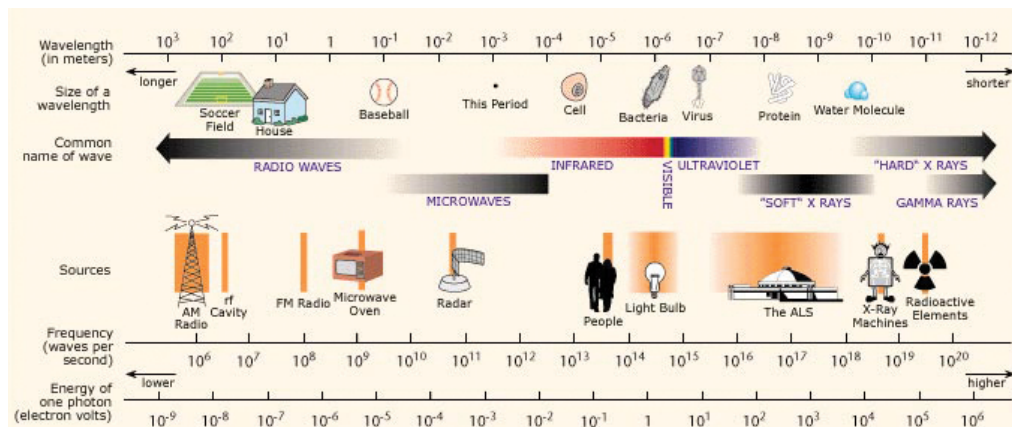
The Electromagnetic Spectrum

Ultraviolet radiation is divided according to wavelength, how fast the tiny packets of energy travel:

Long wave UV
closest to visible light

Mid-wave UV
causes suntans (or sunburns)

Shortwave UV
used for diagnostic testing in the field of medicine





Safety Matters

UV light can be harmful if not used properly. Never look directly at a UV lamp when it is on or shine it towards anyone's eyes.

Activity 1 – Glowing Minerals

Not all kinds of fluorescent minerals glow, or fluoresce, under a long wave lamp (also known as black light); some do so only under shortwave. Some minerals like calcite, corundum, fluorite, gypsum, quartz, and talc only fluoresce when certain impurities are present. The impurities work as **activators**, absorbing UV and emitting visible light.

In this activity, you will try to predict what will happen when you shine UV light on mineral samples in a dark box. What colour do you think each mineral will glow?

1. Turn off the room light.
2. Shine the UV light on the mineral specimens, inside the dark box, one at a time.
3. Answer the following questions:
 - What happens?
 - Are the colours what you expected?
 - Can you use the colours of a mineral in natural light to accurately predict what colour the mineral will be under ultraviolet light?

Activity 2 – Water Barrier

In this activity, you will test whether or not transparent items can block ultraviolet rays.

1. Place one of the specimens in a glass of water.
2. Shine the UV light on it in the water.
3. Answer the following questions:
 - Does the specimen still fluoresce?
 - Can you find any transparent item that does block UV rays?

Activity 3 – SPF as a Shield

In this activity, you will test whether or not various levels of sunscreen can block ultraviolet rays.

1. Coat a Plexiglas stand with a sample of sunscreen SPF 15.
2. Place the specimen being tested behind the sunscreen-coated Plexiglas.
3. Shine the UV light on the specimen through the sunscreen-coated Plexiglas.
4. Clean the Plexiglas and apply a second sample of sunscreen, one with a higher SPF.
5. Do as many trials needed to test the varying strengths of sunscreen available.
6. Answer the following questions:
 - Does the specimen fluoresce using sunscreen SPF 15 on the Plexiglas?
 - Are the results the same or different with varying strengths of sunscreen?

Activity 4 – Lightning Candy

In this activity, you will explore the optical phenomena of triboluminescence.

1. Open a pack of Wintergreen Lifesaver® candy. The candy must contain sugar, not a sugar substitute.
2. Place two or three candies in the mortar.
3. Turn off the lights in the classroom.
4. Carefully pulverize the candy using the pestle.
5. Observe what happens with the candy in the bottom of the mortar.
6. Describe what you observe.

Alternatively, this activity can be done without the mortar and pestle by lab partners observing each other as they chew the candy with their mouths open (molar teeth region) in a darkened classroom.

Materials

- Handheld UV lamp (long wave or shortwave)
- Darkened room (can be achieved with a draped area, student-created dark boxes, or by closing blinds and turning off lights)
- Mineral and rock samples that exhibit fluorescent properties: calcite, fluorite, corundum, talc, feldspar (orthoclase and plagioclase), gypsum, halite, galena, pyrite, and quartz
- Plexiglas stand
- A generous supply of Wintergreen Lifesaver® candy
- Sunscreen SPF 15, SPF 30, or higher
- Mortar and pestle
- Glass of water

Making a Dark Box

A dark box can be easily and economically made.

1. Choose a large, sturdy, cardboard box.
2. On the top of the box, cut an access port in which to place a UV lamp.
3. On the side of the box, cut an access port for viewing specimens placed under the lamp.
4. Paint the interior with black chalkboard paint or line it with dull black fabric or paper.

Boxes can be any size as long as they are large enough to contain and conceal the specimens and provide adequate space to view them, as well as sturdy enough to support a UV lamp. Interiors are made black to minimize the effects of any stray visible light that leaks in.

Geochemistry Activity: Testing Solubility

Modified from original source document: Water Solutions, Acid Mine Drainage, "Testing Solubility," Teacher Domain (2012)



Safety Matters

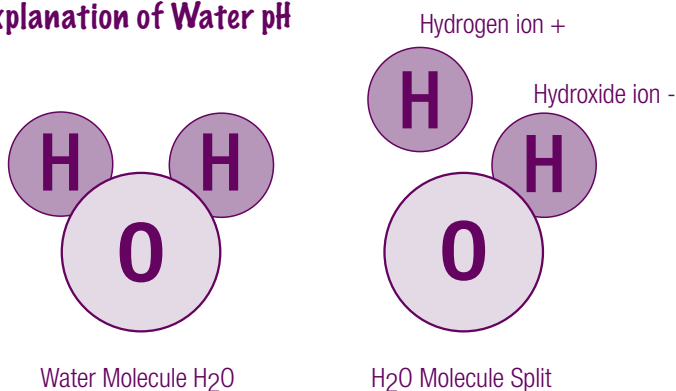
To avoid splashing acid, always pour acid (HCl) into the water, never water into the acid. Always wear goggles and gloves when mixing and handling the acid (HCl) solution. Ensure that students use tongs when working with heated objects and surfaces.

Background

In many areas, acid drainage occurs naturally when certain minerals come into contact with water and air. The weathering of the rocks and minerals in aquatic environments slowly releases the acids, metals, and sulfates into water. Human activities can also create acid drainage, adding to the amounts that naturally leach into water.

Water's structure and properties allow it to dissolve substances. However, water cannot dissolve certain ionic compounds. If the characteristics of water are changed, then its ability to dissolve compounds is also changed. For example, when acid mine drainage (AMD) releases hydrogen ions $[H^+]$ into water, the increased $[H^+]$ level lowers the water's pH, thereby changing the water's characteristics. As a result, the water's capacity to dissolve ionic compounds increases. When the water's pH is raised, the ions can no longer stay in solution.

Explanation of Water pH



A water molecule is balanced and neutral. When it splits, it becomes a negative hydroxide ion and a positive hydrogen ion. The more hydrogen ions there are in solution, the more acidic it is. The more negative hydroxide ions there are in solution, the more basic it is.

Activity

To understand how the acidity of AMD affects the ability of water to hold heavy metals in solution, students will investigate how the factors of temperature, surface area (pulverizing), pH, and stirring affect the rate at which a solute will dissolve in water (universal solvent), in other words, its solubility.

Objectives

1. Students will be able to distinguish among factors that increase the solubility rate of substances.
2. Students will be able to predict the effects of temperature, surface area, pH, and stirring on the rate of dissolution.

Materials

- Sugar cubes
- Pulverized calcite ($CaCO_3$); alternate solute, crushed calcium carbonate
- Baking soda ($NaHCO_3$)
- 0.10 M hydrochloric acid (HCl)*
- Distilled water

Equipment

(one set for each student group)

- Six large test tubes, with stoppers and rack
- Mortar and pestle
- 10 ml graduated cylinder
- 25 ml graduated cylinder
- Electronic balance or scale
- Two glass stirring rods
- Grease pencil
- Stopwatch
- Alcohol / Bunsen burner or hot plate
- Goggles
- Gloves
- Test tube tongs

*Teacher preparation in advance of laboratory session

1. Prepare 100 ml of 0.10 M solution of HCl by mixing 10 ml of 1 M HCl into 90 ml of distilled water.
For safety reasons, the teacher should measure out 10 ml of the 0.10 M solution into a 10 ml graduated cylinder for each group of students.
2. Obtain samples of calcite (from *Mining Matters*) and set aside a few that exemplify a rhombohedral crystal net.
3. With a mortar and pestle, pulverize the remaining samples so that there is enough crushed material for all lab groups to use in Steps 7 and 8 of the procedure.

Testing Solubility CONTINUED

Procedure

Divide the class into groups of two to four students. Give each group a set of the equipment listed above and an observations sheet, which they will use to record data and observations. Have students follow the instructions below.

- Before commencing, use the grease pencil to number the test tubes 1 through 6.
- Measure out 20 ml of distilled water into each of the first four test tubes in the six-test-tube rack.
- Add approximately 2 to 3 g of sugar to test tube #1. If the sugar cube is too large to fit into the test tube, it may be broken into pieces, but not pulverized.
- Using the stopwatch, measure the amount of time needed to dissolve the solute (the sugar) into the water (the solvent). If it does not dissolve in 5 minutes, students should record 5+ for the time.
- Pulverize the same amount of sugar with the mortar and pestle and then place it in test tube #2. Once again, measure the amount of time needed to dissolve the solute.
- Follow the same procedure as Step 5 for test tubes #3 and #4, with the following variations:
 - With the test tube stopper securely in place for test tube #3, shake the sugar and water until the sugar dissolves.
 - Using the test tube tongs, heat the sugar and water in test tube #4 over the burner until the sugar dissolves. As an alternative, apply a hot water bath by heating a 400 ml beaker on a hot plate.
- Measure 25 ml of water. Pour it into test tube #5 and add 2 to 3 g of crushed calcium carbonate (CaCO_3). Stir the solution with a stirring rod and measure the time it takes for the solute to dissolve.
- Measure 25 ml of water. Pour it into test tube #6 and add the same amount of crushed calcium carbonate to the water as in Step 7. Use the same stirring rod to stir the mixture. Add 5 ml of the 0.10 M solution of HCl to the water/calcium carbonate mixture.
- Stir the solution with the second stirring rod and measure the time it takes for the solute to dissolve.

Extension

- After 5 minutes, add 5 to 6 g of baking soda to the solution in test tube #6 and note any changes to the solution.

Safety Matters

To avoid splashing acid, always pour acid (HCl) into the water, never water into the acid. Always wear goggles and gloves when mixing and handling the acid (HCl) solution. Ensure that students use tongs when working with heated objects and surfaces.

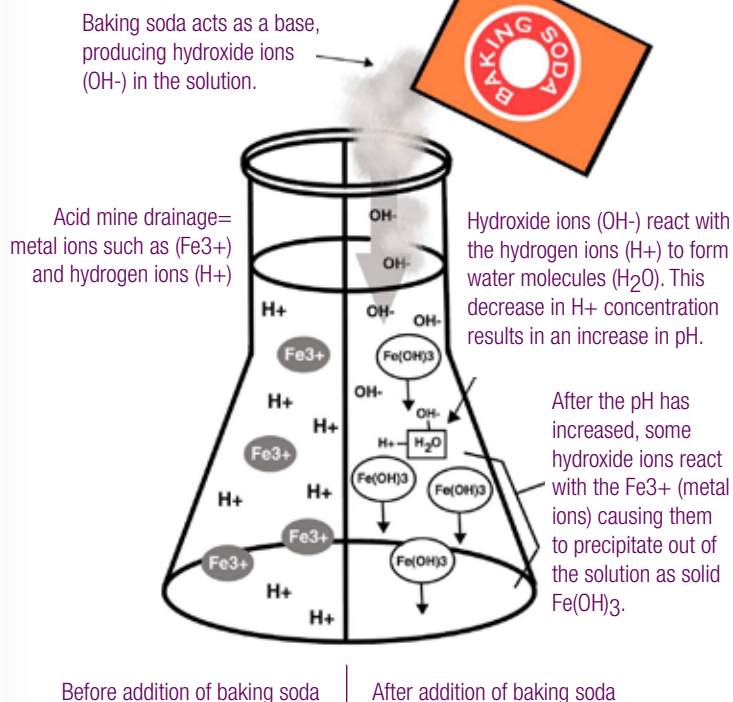
Observations / Results

Create a table for students to record their observations and data.

Suggested headings follow:

Test Tube #	Solution (solute/solvent)	Start Time (min : sec)	End Time (min : sec)	Time to Dissolve (min : sec)	Observations
#1					
#2					
#3					

Metal Precipitation



Conclusions

- Describe the effect of each factor on the solute's solubility.
- Explain which factor caused the greatest increase in the solubility.
- Discuss how the adjustment of pH in the calcium carbonate solution affected its solubility.



Contact Information



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Web site: www.MiningMatters.ca

Mining Matters creates exceptional educational resources to meet provincial Earth science curriculum expectations. Since 1994, this charitable organization has reached more than 490,000 teachers and students through resources that promote awareness of the importance of rocks, minerals, metals, mining, and Canada's geology. *Mining Matters* prides itself on building long-term partnerships with teachers by providing relevant, accurate, and authentic Earth science resources for the classroom, designed by teachers for teachers.

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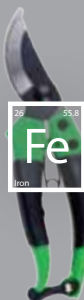
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DIAMONDS*



NEWSPAPER INK*



METAL TOOLS*

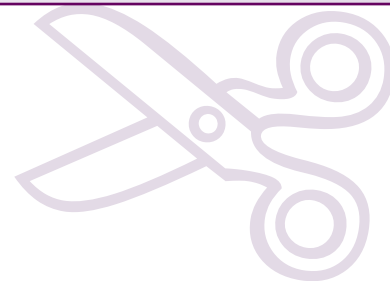
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Canada is blessed with an abundance of resources that are in demand all around the world.

Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

*Diamonds contain carbon, as does newspaper ink. Your garden shears are made of iron.

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