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Newsletter of the Volcanology and Igneous Petrology Division
Geological Association of Canada

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From the President

As a member of the selection committee for the Gelinas Gold Medal, I read several Ph.D. theses over a period of several weeks. They were all excellent, cutting edge theses covering a wide variety of topics ranging from physical volcanology through experimental petrology to petrology of mineralized granites. While reading the theses, I thought back to about twenty years ago when I first was on the executive committee and the chair. At that time the division discussed creating an award for the best thesis in volcanology. A prominent member of the division, Leopold Gelinas from Montreal, had recently died so we decided to name the award after him. Initially, the division had only a single award so we had to compare Ph.D. and M.Sc. theses but the total number of theses submitted was significantly lower than at present. We were very proud of the high quality of the theses. Now that I am again involved in judging the theses, there are two things which strike me. The first is what's happened to the previous winners. Twenty years ago, the first winner of the Gelinas Medal was John Stix from (at that time) the University of Toronto (our website only lists the winners from 1991). This year, one of the Ph.D. theses considered belongs to Ben Kennedy of McGill, a student of John Stix who is a former chair of the division. Glyn Williams-Jones who won the Gelinas Medal in 1998 is currently the vice-chair of the division. The thesis of his student Patricia Nadeau was nominated for the Gelinas Silver Medal this year. And one can continue. Actually it is interesting to look at the division's website, which lists the winners from recent years and note that most of the past winners are still working in the field. The second noticeable thing is that many more theses are nominated and they are on more varied topics. This is probably in part due the enlargement of the division from Volcanology to Volcanology and Igneous Petrology. In short, what I want to say is that research in volcanology and igneous petrology in Canada has been doing well, the universities are producing high-quality graduates in our field and the theses topics are more diverse than they were twenty years ago but still outstanding.

From the Editor

In this issue we have activity reports from Dante Canil at the University of Victoria, Ryan Toole at the University of New Brunswick and Ben Edwards from Dickinson College. There have been a few significant eruptions in the last few months. Nevado Del Huila in Colombia erupted on 17-18 April causing damage to houses and destroying 19 bridges along the Páez and Símbola rivers. According to the New Zealand Institute of Geological & Nuclear Sciences, on Sunday, 19 March, rain triggered a lahar or volcanic mudflow down the slopes of Mt Ruapehu. A dam of volcanic rock debris on the rim of Crater Lake gave way and an estimated 1.3 million cubic metres of water poured down the Whangaehu River valley and eventually flowed out to sea near Wanganui. The crater lake level has dropped 6.5 metres following the lahar.

The Annual Meeting of the Volcanology and Igneous Petrology Division will take place on Friday May 25 at 12 noon in the Copper Room of the Yellowknife Inn, during the GAC-MAC meeting in Yellowknife

Lunch will be provided

If you plan to attend please let us know so we can have an idea of numbers

Update of Petrology Research at the University of Victoria

J. MacKenzie, Zhihuan Wan, Jeff Larocque, Laurence Coogan, Dante Canil

Jeff Larocque is currently studying an island arc of Jurassic age turned on its side and exposed along western Vancouver Island. Tilting of the arc has exposed different levels of the crust, with ultramafic cumulate-bearing gabbros and diorites at depth, grading into plutons of granodiorite to alkali feldspar granite composition. Overlying these intrusive rocks are basaltic volcanics, with lesser amounts of andesite also present.

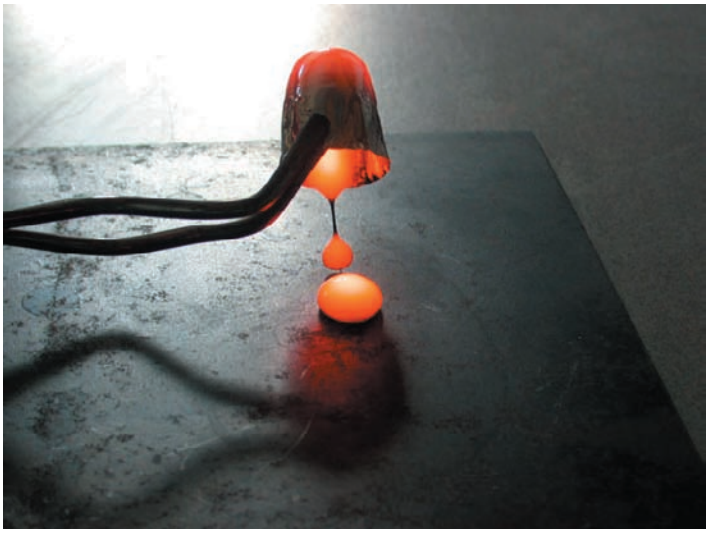
He is primarily interested in the petrological evolution of the arc magma, and how/if the different lithologies are genetically related. Ultimately the research sheds light on the origin of continental crust and the water balance in arc plutonic environment. The research involves field mapping, whole-rock geochemistry and mineral chemistry. The field work provides an appreciation for large trees and thick forests.

Arrested development in the formation of the mid-crust, southern Vancouver Island.

Zhihuan Wan is calibrating trace element geothermometer between olivine and spinel. Her work involves measuring the partition of Al between olivine and spinel, bioth in experiments and natural mantle samples. The goal is to provide the community with a geothermeomter between these two common coexisting minerals that does not reset easily at lower temperature (like Fe-Mg), so that we all really know how "hot" our rocks really are (or were).

Vancouver Island geology (...ahhh the trees) does not really exist without logging.

Jason MacKenzie is interested in the fluxes of environmentally (i.e. Hg, As, Cd) and economically (i.e. Cu, Zn, W) important heavy metals from volcanoes. Some fluxes have been estimated but significant gaps in our current understanding of the mechanisms and controls of metal degassing and transfer remain. Degassing involves complex interactions between melt and fluid phases partly governed by thermodynamic, kinetic and oxidation/reduction processes. As a start, Jason has measured Re mobility in melts and applied the results to models of Re depletion in arc basalts. He has also started measuring melt/fluid partitioning of heavy metals in basalts and looking at vapor transport of metals. A long term goal is to examine the flux of some of these metals through arc volcanoes.



The start of every good experiment – a good starting material.

Laurence Coogan has been continuing his work on mid-ocean ridge processes. In particular using samples from the Oman ophiolite, as well as drill core and samples collected by submersible from the modern oceanic crust, he has been determining the cooling rate of samples from the lower

oceanic crust using geospeedometric techniques (based on modelling the closure temperature of cation exchange thermometers). This has allowed, for the first time, differences in cooling rates within the lower oceanic crust to be quantified. These data provide insight into both the dynamics of magma chambers at mid-ocean ridges and the efficiency of the hydrothermal systems that surround these magma chambers in extracting heat. A recent digression from this led him into investigating just how unambiguous the, much publicised, evidence for early Hadean continental crust on earth is (or isn't).

The beginning of all bad experiments... a good party.

Dante Canil has been involved in the discovery of the first UHP (ultrahigh pressure) rocks in the Cordillera, requiring a re-thinking of the construction of this mountain belt (i.e. thick-skinned). Two of his recent graduate students combined high PT experiments with natural kimberlites to study the intensive variables of kimberlite magmas during emplacement. **Anthony Bellis** (MSc, now at Ashton Mining) showed that kimberlites worldwide are some of the most oxidized and reduced magmas known. The high oxidation state of some kimberlites can be attributed to their deep source region rich in ferric iron. The lower oxidation states also correlate with better diamond quality, the latter assessed by examining of thousands of stones from pipes in the Slave Province (**Yana Fedortchouk**, PhD, now at Yukon Geology Survey). Fedortchouk went further to experimentally calibrate the surface features of diamonds with the fluid in which they dissolve. Her work shows that only fluid- saturated kimberlite can dissolve diamonds, and that the fluid must be H2O-rich.

Update on activities at the University of New Brunswick

Ryan Toole

On Febuary 2nd, the University of New Brunswick SEG-CIM Student Chapter Workshop kicked of the first day of the Atlantic Geoscience Society's annual colloquium at the Delta Beauséjour Hotel, in Moncton New Brunswick. There was no problem attracting a large crowd to the workshop with 27 students and 27 professionals in attendance. This allowed for a great opportunity for networking and formal lectures.

This years student chapter workshop was titled: A Review of Physical Volcanology: A Metallogenic Perspective. Conveners of the workshop were Ryan Toole, a University of New Brunswick masters student and David R. Lentz, a professor at the University of New Brunswick. A total of eight lectures were presented covering a wide range of topics from volcanic rock textures to Archean subaqueous calderas.

The morning session of the workshop included three presentations, the first of which was called Volcanic Nomenclature: A Review, and was given by David R. Lentz. Dr. Lentz covered the basics of volcanology including general terms, types of deposits and naming schemes which allowed for a better understanding of the lectures presented later in the day.

Immediately following the lecture by David R. Lentz, Reg A. Wilson of the New Brunswick Department of Natural Resources Geological Surveys Branch in Bathurst, NB, presented Volcanic Rock Textures and the Interpretation of Volcanic Environments and Facies which incorporated many of the volcanic rock sequences found in the province of New Brunswick associated with the Bathurst Mining Camp.

The final lecture to end off the morning session of the workshop was given by David R. Lentz and was titled Examination of Feeder Dikes in Ore-Forming Systems: Analysis of Geological, Petrochemical, and Geotectonic Constraints. Dr. Lentz did a superb job in explaining the importance of feeder dikes in enhancing magmatic systems with ore-elements and S.

Beginning the afternoon session was the CIM Distinguished Lecturer Dr. Wulf Mueller of the Université du Québec à Chicoutimi where he presented Archean Subaqueous Calderas: First Order Hosts of Volcanic-Hosted Massive Sulfide Deposits in the Abitibi Belt. Dr. Mueller shared groundbreaking information from his own research on the advancement of volcanic-hosted massive sulfide exploration associated with Archean subaqueous caldera complexes.

Following Dr. Mueller was Cliff Shaw from the University of New Brunswick with his presentation called A Combined Experimental and Field Approach to Volcanology: Examples from the Quaternary West Eifel Volcanic Field, Germany. The audience was given new insights on dating techniques to distinguish between proximal volcanic events from recent studies done by the presenter.

Warna S. Downey, a University of New Brunswick Ph.D. candidate presented her research in a lecture titled Experimental Constraints on Peperite Formation and Relationship to Explosive Volcanism: A New Approach. Ms. Downey showed the audience new techniques in which she developed for her research to help explain magma-water/sediment interactions in subaqueous volcanic environments.

Steve R. McCutcheon of the New Brunswick Department of Natural Resources Geological Surveys Branch in Bathurst, NB, shared his work on the granite related Mount Pleasant Sn-W-Mo-In deposit in southwestern New Brunswick. Titled, A Late Devonian Epicontinental Caldera Complex In Southwestern New Brunswick – Precursor To The Granite-Related Mount Pleasant Sn-W-Mo-In Deposit, Dr. McCutcheon described the significance of caldera complexes in hosting Sn-W-Mo-In deposits with specific examples of the Mount Pleasant caldera complex.

The final presentation of the day, Benefits of Chemostratigraphy to facies Interpretation in the Flat Landing Brook Formation, Brunswick Belt, Bathurst Mining Camp, was given by University of New Brunswick Ph.D. candidate Alex Wills and revealed the significance of using geochemical data to interpret submarine volcanic, volcaniclastic, and volcanisedimentary facies with primary petrographic textures overprinted by chemical alteration and deformation fabrics.

The University of New Brunswick SEG-CIM Student Chapter Workshop was a great success due to the high quality of presenters and the outstanding support of outside parties. Many thanks go out to our sponsors Freewest Resources Canada Inc., First Narrows, Society of Economic Geologists, and New Brunswick CIM as well as all of the speakers, in particular the CIM Distinguished Lecturer Dr. Wulf Mueller. We sincerely thank and congratulate the Atlantic Geoscience Society for the success of the entire conference and for allowing us to conduct the student chapter workshop at their annual colloquium.

Fieldwork at Mount Edziza

Ben Edwards, Dickinson Colege

Last summer we completed the first of two field seasons for a three year project studying processes of glaciovolcanism at the Mount Edziza volcanic complex in northwestern British Columbia (Figs. 1A & 1B). The complex was mapped in detail by Dr. Jack Souther (GSC, VIP Division Lifetime Acheivement Recipient) over a number of years, and we are building on his encyclopedia of work with more detailed studies. Our project, funded by the National

Figure 1A. View looking west at the eastern side of the Edziza caldera.

Figure 1b. Alex Lloyd, Chira Endress and Ian Skilling with Eve Cone and the Desolation Lava field in the background

Science Foundation and Dickinson College, and is a collaborative project between Dickinson College (Dr. Ben Edwards), the University of Pittsburgh (Dr. Ian Skilling), the University of Wisconsin-Milwaukee (Dr. Barry Cameron), Acadia University (Dr. Ian Spooner), the University of Calgary (Dr. J. Osborn), the Geological Survey of Canada (Dr. Kirstie Simpson) and the New Mexico Institute of Mining and Technology (Dr. Bill McIntosh). The goal of the project is to devise a systematic approach for integrating information from mafic lavas, felsic lavas and coeval glaciogenic sediments to reconstruct paleo-ice conditions . The project is focused in part on an interval of deposits (Ice Peak Formation) thought to constrain a 1 Ma regional glaciation (e.g., Spooner et al., 1995); it also focuses more generally on refining our abilities to use glaciovolcanic deposits to constrain paleo-environmental conditions. The study involves five different student projects (1 Ph.D., 1 M.Sc., and 3 B.Sc.), briefly described below, plus a number of subsidiary studies

Jeff Hungerford (Ph.D., U Pitt): Jeff focused his 2006 fieldwork on the region surrounding Tennena Cone (Fig. 2), which is located immediately west of Ice Peak and is thought to be a late Pleistocene/early Holocene centre. His studies in 2006 focused on sampling pillows to be used for degassing studies aimed at determining ice thicknesses during the eruption, and describing coeval glaciogenic sediments immediately underlying pillow lavas at the distal end of the flows. Jeff also worked on describing glaciogenic sediments immediately underlying Ice Peak Formation flows (Fig. 2) adjacent to the Tennena area, that may preserve a record of a 1 Ma ice-sheet. During summer 2007 Jeff will visit several other localities to sample more pillows for volatile analyses and to focus on mechanisms of pillow formation in sub-ice environments.

Figure 2. View looking east at the western flank of Tennena Cone.

Kristen LaMoreaux (M.Sc., U Pitt): Kristen's M.Sc. thesis focuses on the emplacement of trachytic lava flows and domes. In 2006 she spent most of her time analyzing jointing patterns at Ornostay Bluff, a thick sequence of trachyte lava flows on the western plateau of Edziza (Fig. 3). Kristen also examined trachytic lava flows from Koosick Bluff and a trachytic dome (Triangle Dome). She is working at determining criteria for understanding how flow thickness may or may not be an indication that the progress of a lava flow was impeded by an ice barrier, resulting in an unusually thick flow.

Alex Lloyd (B.Sc., Dickinson College): Alex's B.Sc. thesis is focused on the cooling rates of pillow lavas as constrained by Crystal Size Distributions (CSD). He is examining in detail the variation in crystal sizes from the edge

Figure 3. View looking north at the southwestern end of Ornostay Bluff, an anomalously thick trachyte flow sequence.

to the centre of a pillow from Pillow Ridge (Fig. 4). By combining CSD analysis with a cylindrical cooling model, he has been able to estimate growth rates of plagioclase in the pillow. The rates fall close to the trend for plagioclase growth rates as a function of cooling rates from data compiled by Cashman (1993), which is a great validation of his CSD work.

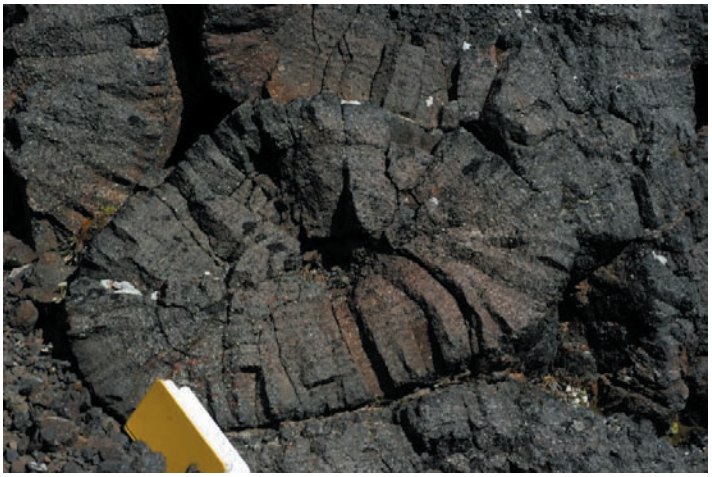


Figure 4. Pillow from Pillow Ridge

Chira Endress (B.Sc., Dickinson College): Chira's B.Sc. thesis is focused on a section of glaciogenic sediments immediately beneath a trachytic Ice Peak lava flow that we sampled and described during 2006 (the section she is describing is thicker than that shown in Figure 5 but with similar stratigraphic relationships). She is trying to determine if the sediments were deposited immediately before the lava flow was emplaced, or if they are likely to be much older. Most of her data has been gathered using the Energy Dispersive Spectrum on Dickinson's JEOL 5900 SEM. Chira has quantified the mineralogy of clasts and sand-sized particles from several samples in the sediment, and has determined that the mineralogy of several of the trachytic clasts is very similar to that in the overlying lava flow, including clinopyroxene, magnetite, alkali feldspar, and aenigmatite. She has also found several small lenses of pristine basaltic glass, which could have derived from the nearby Pillow Ridge.

Courtney Haynes (B.Sc., Dickinson College): Courtney is a 2nd year B.Sc. student at Dickinson College who will go into the field in 2007 to begun work on a project looking at the geometry of pillow lavas. Stay tuned for further updates on her thesis work.

Other projects

Stratigraphy of Hyaloclastite Ridges: A continuation of the 2006 fieldwork will focus on detailed mapping of lithofaces at several ridges thought to have glaciovolcanic origins, including Pillow Ridge, Tsekone Ridge, and Tennena Cone. We have already collected reconnaisance samples from each, and this year will focus on more detailed mapping and sampling.

Sheep Track Pumice: Collaborators at UBC have begun work on samples collected from deposits of Sheep Track pumice, which are found across the southwestern part of the Edziza plateau. The Sheep Track pumice is enigmatic in that its source vent(s) has not yet been identified, even though it is thought to be Holocene in age (Souther, 1992). Along with collaborators at Acadia and U. Calgary, work on this pumice may help constrain the ages of early Holocene ice formation at Edziza as well.

References

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Souther, J.G., 1992, The Late Cenozoic Mount Edziza Volcanic Complex, British Columbia. Geologic Society of Canada, Memoir 420, 320 pp.

Spooner, I., Osborn, G., Barendregt, R. and Irving, E., 1995. A record of Early Pleistocene glaciation on the Mt. Edziza plateau, northwestern British Columbia, Canadian Journal of Earth Science, v. 32, 2046-2056.

Figure 4. Coarse-grained, glaciogenic(?) sediments overlain by thin Ice Peak lava flow.

Meeting Announcements

GAC-MAC 2007

Yellowknife will host the first spring GAC-MAC conference north of 60°. "Yellowknife 2007, For A Change Of Climate" will feature a full technical program that highlights Canada's North: its climate, its culture, its mining heritage, and its future.

Symposia will include:

- Mitigation of Environmental Impact of Mining in the North
- Permafrost
- Mineral Deposit Models and Regional Exploration Symposium and Workshop

Special sessions are:

- Submarine Volcanism and Associated Mineralization: Modern vs. Ancient
- Geospatial Information and Tools in Support of Geosciences in the Canadian Arctic
- Recent advances in the geology of Laurentia
- Short-lived magmatic events of the Slave Province and environs: critical time markers and indicators of tectonic processes
- Northern Energy and Sedimentary Basins
- Northern Mineral Deposits
- Geoscience Skills Development for Canadian Comunities
- Diamonds: Exploration to Production - a northern Canada perspective
- Sustainable Mineral Resources Development: Critical Issues for Canada's North
- Northeast Canada and Greenland: Geology, correlations, and resource potential
- Comparative planetary geology: Terrestrial analogues to Mars in the Arctic
- International Polar Year Research

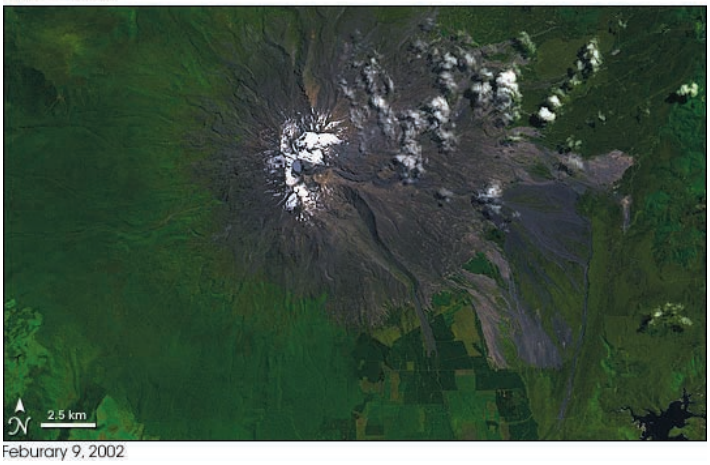
Pre- and post-conference short courses and workshops include:

- The Geology of Gem deposits
- Remote Predictive Geological Mapping,
- Oceanic Volcanism and Mineralization
- Application of Till and Stream Sediment Heavy Mineral and Geochemical Methods to Mineral Exploration in western and northern Canada will be presented.
- Towards an Integrated Future in Geoscience Education and Outreach
- Mineral Deposit Models and Regional Exploration Symposium and Workshop

Six field trips are also planned in conjunction with the meeting:

- Transect through the Southwestern Slave Craton
- Pine Point and Hay River Area: Middle and Upper Devonian Carbonates
- Yellowknife Geoheritage, Emphasizing Submarine Volcanic Eruptions, Unique Sedimentary Deposits, and Continental Glaciation
- A Geological Transect of Trans-Hudsonian Orogen from the Superior Craton to the Rae Craton: Geology of Northern Quebec, Baffin Island, and Western Greenland.

March 25, 2007



Feburary 9, 2002

Recent lahar on Mount Ruapehu, New Zealand. The top image was taken on March 25, 2007 whereas the lower image was teken on February 9, 2003. The lahar is visible in the bottom right of the upper image, which was taken using the the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on NASA's Terra satellite. The mudflow formed a river 30 to 40 meters (100 to 130 feet) wide and rose 6 to 8 meters (20 to 26 feet) over an access bridge. In 1953 a lahar from the same volcano killed 151 people when it destroyed a railway bridge in the path of an oncoming train. Image from http://earthobservatory.nasa.gov

Archean Terranes

The Volcanology and Igneous Petrology Division has agreed to be one of the main sponsors of the Archean symposium, "A Global Comparison of Archean Terranes". The symposium will take place from August 19th-25th, and involves a two-day conference at the University of Western Ontario and a 3-day fieldtrip in the Abitibi greenstone belt. The Abitibi belt of the Superior Province, Canada, is the largest and best-studied greenstone belt in the world. Komatiites, and mafic and felsic volcanic rocks ranging in age from 2724-2703 Ma, late-Archean (2690-2670 Ma) strike-slip basin deposits, and 2710-2686 Ma turbidite deposits are well-exposed throughout the volcanic belt. The 3-day field trip will provide an opportunity to visit critical outcrops and discuss significant issues with respect to Archean processes, including volcanic sequences, sedimentary successions, geochemistry, structural geology, geochronology, early life, ancient crustal evolution, mineral deposits, impact events, and the state of the early atmosphere. Igneous rocks will be one of the main focuses of the fieldtrip, with special emphasis on the physical volcanology of basalts, komatiites and rhyolites. These volcanic deposits represent a variety of depositional settings, such as ocean floors and plateaus, and caldera complexes. The past Chair of the Volcanology and Igneous Petrology Division, Wulf Mueller (UQAC), Real Daigneault (UQAC), and Vital Pearson (CONSOREM and UQAC) will be leading the fieldtrip. The Archean symposium is being organized by Patricia Corcoran (University of Western Ontario), a member of the Volcanology and Igneous Petrology Division, and a past winner of the Leopold Gelinas Gold Medal.

Contact Patricia Corcoran at pcorcor@uwo.ca for more details

Porphyritic basalt from Bullers Bay, Simpson Island, Lake Superior. Photo courtesy of Pete Hollings

Institute on Lake Superior Geology

The 53rd Annual meeting of the ILSG will be held in Lutsen, Minnesota on May 10 & 11, 2007 with field trips both before and after. Proposed field trips include the North Shore Volcanic Group, the Duluth Complex and the Proterozoic dykes and intrusions associated with Midcontinrnt Rift. Visit the ILSG website for more details.

Please send contributions to the next Ashfall to

peter.hollings@lakeheadu.ca.

Archean pillow basalts in the Ladder Flow at the Winston Lake Mine. Photo courtesy of Pete Hollings.