Mission

Mission: To provide education, training and support in Precambrian field studies for the next generation of geoscientists.

On the cover: Students Hugh Cowan, John Niedemiller, and Eric Stifter (L to R) measure the orientation of slaty cleavage during the 2008 Precambrian Field Camp.
The Precambrian Research Center was established in 2007 to satisfy an urgent, long-term need within the private and public sectors of the geological community for geoscientists skilled in geological mapping and the study of Precambrian geology. The Center’s goals are to train geoscientists in modern methods of geological mapping and map making in glaciated Precambrian terranes of the Canadian Shield. As shown in our logo, the Canadian Shield makes up almost half of the North American continent. Such terrains of low-lying ancient rocks form the cores of all of continents and are extremely important to global society because they host a large percentage of the world’s mineral resources.

The Precambrian Research Center is managed as a collaborative effort between two geosciences institutions at the University of Minnesota Duluth – the Natural Resources Research Institute and the Department of Geological Sciences. Training in field methods particularly suited to Precambrian terranes is provide through a variety of programs including the Precambrian summer field camp, professional workshops, graduate student advising, and various mapping and Precambrian geology courses offered at UMD. Instructors for these programs include a consortium of experienced Precambrian field geologists from the University, as well as from the Minnesota Geological Survey, other academic and governmental institutions, and private industry.
Letter from the Directors,

The most obvious thing that will be remembered about this, the sophomore year of the Precambrian Research Center, is how much easier everything was compared to our inaugural year. This year we were able to further develop our five basic programs. Field camp preparation was a relative breeze, and our field camp continues to gain an excellent reputation. Fundraising was easier to justify because we had a track record, and we were able to fully support another graduate student at UMD who is conducting a field-oriented Precambrian Master’s research project. The Geologic Maps course at UMD (GEOL 3000), now in its second year, has been very popular and well received by the students. As the Center’s directors, we continued outreach activities of providing geologic education and mentoring to the public and K-12 educators. Most gratifying, we got not just one, but two workshops off the ground this year!

Another thing that will be remembered about 2008 is the dramatic change in the minerals exploration industry, which is from where most of our benefactors come and to where many of our students hope to be headed. The dramatic shift from a frenzied state of activity in the summer to virtual stagnation in the fall is still hard to comprehend. Although we’ve had to modify our pitch for field camp (we can no longer claim that they would have jobs for the picking after camp), we still cannot overemphasize the importance of gaining field skills that will help them in their future academic and/or employment pursuits. We also point out that when the global economy recovers (hopefully sooner than later), there is every reason to believe that the previous conditions of a high demand for resources and a low supply of well-trained field geologists will return. Therefore, we continue to carry on in preparation of that eventuality.

One of our proudest accomplishments this year was the successful production of two workshops. The first came in April of 2008 with the hosting of a workshop for investors interested in the Cu-Ni-PGE prospects and the iron ore production occurring in northeastern Minnesota. This three-day workshop, organized by Dean Peterson, was attended by over 60 people. The workshop included presentations about the geologic setting, resource estimates, and state support for mining in Minnesota by academics, state agency staff, exploration company officials, and taconite mining managers. In October, we held our first professional workshop on the Physical Volcanology, Structure, and Hydrothermal Alteration associated with VMS (Volcanic Massive Sulfide) and
Lode Gold Deposits in Archean Greenstone Belts. With Harold Gibson (Laurentian), George Hudak, Ron Morton, and Dean Peterson as instructors, 15 participants were treated to three days of short course lectures and lab exercises and three days of a field excursion to Sturgeon Lake and Rainy River, Ontario and the Lake Vermilion area of Minnesota. (To get more information about the workshops, read the summary descriptions to follow).

Fundraising through corporate and individual memberships amounted to over $55,000 in 2008. This amount fell considerably short of our goal to double last year’s goal of $90,000, but we were still able to subsidize last summer’s field camp of 10 students, provide a graduate research assistantship, and provide funds for student research grants. We are very thankful to all who have contributed this past year, especially individuals like Paul Albers and Richard Patelke, and the collective membership of the Geological Society of Minnesota. We are also grateful for the renewed corporate memberships of Anglo American and Newmont and the new memberships of Teck American and Wallbridge.

This year’s Precambrian field camp, the centerpiece of the PRC’s programs, was another success. Although we only had 10 students enrolled (20 is the capacity), they were a remarkable group that worked exceptionally hard and seemed to thoroughly enjoy the experience. Check out the field camp summary on the next page to get more information and enjoy the many photos throughout this report from last year’s camp. One anecdote from last year’s camp is that on the last “graduation” day of camp, the one student who was finished with school and ready to look for work was given four job offers that day (minutes after concluding his presentation!).

We have been contacted by a number of students about next summer’s camp and have high hopes to reach enrollment capacity of 20 participants. We are also looking forward to the successful production of another professional workshop scheduled for October, 2009. With the assistance of 10 expert instructors, the short course and field trips associated with this workshop will focus on field, petrographic, and mineralization characteristics of mafic layered intrusions. We will let you know in next year’s annual report how these and other Precambrian Research Center activities turned out.

Here’s to a quick economic recovery!

Jim Miller  George Hudak  Dean Peterson
The second Precambrian Field Camp took place between July 13 and August 23, 2008. Based on student and faculty reviews, it was once again a great success. The camp was attended by ten students from ten different Midwestern colleges and universities (see following page) and involved the assistance of eight instructors over six weeks of the camp. Tom Johnson, a graduate of the first PRC field camp and current master’s degree candidate at UMD, served as a teaching assistant for the field course.

Preparation for the 2008 field camp started during fall 2007, when the field camp instructors met to review the exercises and results of the 2007 field school. Several small but important modifications were made to the curriculum based on what worked and what could be improved upon during the inaugural summer 2007 field camp. These changes primarily involved modifications to the timeframes for completing several of the geological mapping projects, but also involved selecting a different location for the greenstone mapping project. Additionally, several new capstone field mapping areas were selected during this meeting. All those involved would agree that having one year of teaching field camp behind us made preparations for the 2008 field camp significantly easier.

The 2008 Precambrian Field Camp once again focused on geological mapping at a variety of scales (1:250 – 1:24,000) within the diverse Precambrian terranes of northeastern Minnesota. While the core of this course involved training students in fundamental field mapping skills, such as those taught at most field camps, students also gained unique and valuable skills particularly suited to mapping glaciated Precambrian shield terranes. These skills include core logging, surficial (glacial) mapping and sampling, and mineral prospecting techniques, underground mapping, geophysical surveying, recognizing metamorphic grade, identifying and interpreting polyphase deformational fabrics, recognizing ore mineralization and associated alteration mineral assemblages, and bush and lake (canoeing) navigation and logistics.

The general structure of the field camp remained the same as in 2007. Student were involved in eight mapping exercises over the first four weeks of camp, with the first two weeks based in Duluth and the second two weeks based in Ely. During the fifth week, students and instructors dispersed to several field areas in the Boundary Waters Wilderness Area of northeastern Minnesota to conduct their Capstone Mapping projects. Back in Duluth for the final week of camp, student worked at compiling and constructing geologic maps from their capstone projects.

Two geological maps were produced from the capstone mapping projects this year. The students also summarized the findings of their capstone research by creating PowerPoint presentations which they presented to the field camp faculty and invited guests on the last “graduation” day of camp. These maps, which are shown on the back page of this report, and the student PowerPoint presentations may be downloaded from the PRC website: www.d.umn.edu/prc/fieldcamp (click on the Capstone Mapping Project link).

We continue to measure the success of our field camp by how our students have taken advantage of this experience to further their academic and career goals. Of the summer 2007 field camp students, several remain employed in the mineral exploration field, several are applying for positions in graduate geology programs, several continue to work on their master’s degrees in geology, and one has recently completed his master’s degree and will soon be starting a doctorate degree project at Eotvos Lorand University in Budapest, Hungary, to study the Duluth Complex. Of the summer 2008 students, only one was ready to seek employment in an exploration/mining field. That student received four job offers at the field camp graduation day and ultimately took a job with Rio Tinto working on its Lakeview prospect in Minnesota. One student is currently working on his master’s degree in geology at Colorado School of Mines. Seven of the students returned to their respective colleges or universities to complete their bachelor’s degrees, and several are currently applying to graduate school programs in the geological sciences (including several at UMD). One student continued his semi-retired status as a medical doctor and geo-phile in the Fargo, North Dakota area.
**Students**

- **Anders Carlson**
  University of Minnesota-Morris
  Independence, MN
  BS Geol rcvd 12/08

- **Hugh Cowan**
  University of Toronto
  Fargo, ND
  Retired

- **Jack Gibbons**
  Carleton College (MN)
  Hurley, WI
  MS Candidate Colorado School of Mines

- **Kevin Kane**
  Grand Valley State (MI)
  Livonia, MI
  BS Geol expected 4/09

- **Jackie Kowalik**
  Winona State University (MN)
  Libertyville, IL
  BS Geol rcvd 12/08; applying to graduate schools

- **Tracey Mason**
  Northwest Missouri State
  Patonsburg, MO
  BS Geol expected 5/09

- **Laura Murphy**
  Univ of WI River Falls (WI)
  Afton, MN
  BS Geol expected 5/09

- **John Niedermiller**
  Wayne State Univ (MI)
  St. Clair Shores, MI
  BS Geol expected 12/09

- **Eric Stifter**
  Univ of Minnesota Duluth (MN)
  Duluth, MN
  BS Geol expected 5/09

- **Jakob Wartman**
  Macalester College (MN)
  Richfield, MN
  Kennecott/Rio Tinto

**Staff**

- **Principal Instructors:**
  - **George Hudak**
    Dept. of Geology
    Univ of Wisconsin Oshkosh

- **Jim Miller**
  Dept. of Geological Sciences
  Univ of Minnesota Duluth

- **Dean Peterson**
  Natural Resources Research Institute
  Univ of Minnesota Duluth

- **Associate Instructors:**
  - **John Goodge**
    Dept. of Geological Sciences
    Univ of Minnesota Duluth

- **Mark Jirsa**
  Minnesota Geological Survey
  Univ of Minnesota Twin Cities

- **Phil Larson**
  Cliffs Natural Resources

- **Howard Mooers**
  Dept. of Geological Sciences
  Univ of Minnesota Duluth

- **Mark Severson**
  Natural Resources Research Institute
  Univ of Minnesota Duluth

- **Nigel Wattrus**
  Dept. of Geological Sciences
  Univ of Minnesota Duluth

- **Teaching Assistant:**
  - **Tom Johnson**
    Dept. of Geological Sciences
    Univ of Minnesota Duluth
Thank you guys so much for your time, patience, and dedication. This has been an amazing experience. I can’t wait to get back in the field.

At the end of the field camp, students were asked to anonymously evaluate their experience by answering a series of questions. Here are some answers to three of the questions asked.

**HOW DID THIS CAMP MEET YOUR INITIAL EXPECTATIONS?**

- It far exceeded my expectations. To be entirely honest, I didn’t know what to expect coming into this; however, I’m absolutely blown away by the amount of knowledge I’ve gained in six weeks.
- My expectations were exceeded so much, it wasn’t even close! This was the hardest, most fun, BEST thing I’ve done since beginning school ~18 years ago.
- This camp blew away my initial expectation. I did not know what to expect coming in, but I had a great time and learned a lot.
- Unbelievably great – completely changed my outlook on my career/academic goals.
- It exceeded them. I came in hoping to learn something about the school and the professors because UMD is a school I was thinking about for graduate school. I was really happy with the whole experience.

**HOW DO YOU THINK THIS CAMP WILL HELP YOU WITH YOUR CAREER GOALS?**

- The camp helped me decide that I want to be a field geologist. I really liked the professors and how they passed their excitement about geology on to all of us.
- I believe this is a top-notch camp/course that will give me the skills/head start on the fields of geology I would love to try working in.
- I feel much more prepared and confident in general. I know that I have the base that I’ll need to be a successful, productive field geologist. Thank you all.
- It will help me get a good entry job in geology and have more skills than the people I am competing against.
- I feel that I have a superb set of skills that I can take and be successful with in Precambrian glaciated terranes.
- I got 3-4 job offers at the end. I think it will be invaluable.

**WOULD YOU RECOMMEND THIS CAMP TO YOUR FELLOW STUDENTS?**

- Yes!!! Definitely.
- Absolutely!
- YES, and I plan on it!
- Yes!
- Yes, without any reservation.
- Definitely plan to spread the word.
- Oh yeah.

**Student Research Assistantships and Grants**

A primary objective of the Precambrian Research Center is to provide financial and advisory support to graduate and undergraduate students conducting field-based research on the Precambrian geology, primarily in the Lake Superior region. This support comes in the form of graduate research assistantships, which are limited to UMD graduate students, and research grants, which are available to undergraduate or graduate students from any school. The extent to which the Center can provide such support will vary based on the annual level of corporate and individual membership contributions.
For the 2008-09 academic year, the Precambrian Research Center supported UMD graduate student Tom Johnson with a Graduate Research Assistantship. Tom came to UMD by rather unconventional means. Tom, who grew up in Duluth, attended North Dakota State University where he majored in Civil Engineering. After working as a civil engineer for a couple of years, he came to conclusion that his real passion was geology. He applied to UMD to pursue a master’s degree in geology for the 2007-08 academic year. Although he had great academic credentials, Tom lacked several fundamental geology courses. It was recommended that he read a couple of geology textbooks and attend the 2007 Precambrian field camp, which would provide him with a general background in various aspects of geology. He agreed and did remarkably well in the field camp. In fact, he was recruited to be a teaching assistant for the 2008 field camp.

Tom’s is in his second year at UMD working with Vicki Hansen George Hudak, and Dean Peterson on a dissertation entitled “Structural, Kinematic, and Hydrothermal Fluid Investigation of the Murray Shear Zone, northeastern Minnesota with Implications for Gold Mineralization.” Tom has provided a brief summary of his research below.

Research Description: Last summer, I conducted research in the Murray Shear Zone of northeastern Minnesota to investigate its architecture and kinematic history with respect to fluid migration as a catalyst for gold mineralization. My research involved transect mapping through the Murray Shear Zone, which originates near Tower, MN and continues eastward through Eagle’s Nest Lake. In the middle to late 1980s, Newmont Mining Corporation discovered sub-economic gold mineralization (12.5 ppm) along the northern margin of the Murray Shear Zone. Exploratory drill holes intersected anomalous gold in the area but it was believed that economic mining was not feasible (Peterson and Patelke, 2003). Models of Archean gold deposits have since enabled a deeper understanding with which to base exploration in Archean shear zones. Sibson (1992) noted that in mesothermal environments (~ 10 km deep), within the brittle/ductile transition at the base of the lithospheric seismogenic regime, a process of intermittent high-pressure hydrothermal fluid release known as fault-pressure-activated valves is responsible for fluid movement up-dip of high-angle structures, mineralization, and hydrothermal self-sealing. These sub-vertical structures may be present within the Murray Shear Zone as preliminary field data indicate dominant dip-slip features. The objective of my study is to determine if indeed the Murray Shear Zone is an eroded and exposed mesothermal gold system. Methods for a thorough investigation include field mapping, drill core logging, thin section study, and whole rock geochemistry. This research will help to better understand the architecture of the Murray Shear Zone with implications for an economic gold deposit.

2008 STUDENT RESEARCH GRANTS

The Precambrian Research Center awarded over $5,000 in research to seven students in 2008 to support their undergraduate or graduate research on a variety of field-based Precambrian geology topics. The students, their college, the award amount, the use of the grant, and the topic of their research is listed below.

- **Chris White**, University of Minnesota Duluth ($1,400) - Microprobe analyses for master’s thesis Research Topic: Magmatic evolution and Cu-Ni-PGE mineralization of the northern South Kawishiwi Intrusion, Duluth Complex, northeastern Minnesota
- **Terra Anderson**, University of Wisconsin-Milwaukee ($1,000) - Thin sections for master’s thesis Research Topic: Linking the development of quartz fabrics and quantified strains during transpressional deformation
- **Emerald Erickson**, University of Minnesota Duluth ($495) - Thin sections for master’s thesis Research Topic: Structural and kinematic analysis of the Shagawa Lake shear zone, Superior Province, northeastern Minnesota: Implications for Archean (~2.75 Ga) crustal evolution
- **Susan Karberg**, University of Minnesota Duluth ($506) - Thin sections for master’s thesis Research Topic: Structural and kinematic analysis of the Mud Creek shear zone, northeastern Minnesota: Implications for Archean (~2.7 Ga) tectonic evolution
- **Tom Johnson**, University of Minnesota Duluth ($1,000) - Field expenses for master’s thesis Research Topic: Structural, kinematic, and hydrothermal fluid investigation of the Murray Shear Zone, northeastern Minnesota with implications for gold mineralization
- **Laura Murphy**, University of Wisconsin-River Falls ($250) – Thin sections for senior thesis Research Topic: Petrographic and geochemical study of Archean volcanics and volcanioclastics in the Disappointment Lake area, Lake County, Minnesota
- **Kevin Kane**, Grand Valley State University (MI) $250) – Thin sections for senior thesis Research Topic: Petrographic study of gabbric rocks from the base of the Duluth Complex in the Ima Lake area, Lake County, Minnesota
Investors' Workshop on Minnesota’s Cu-Ni-PGE and Iron Ore Resources

April 2008

A special workshop designed to educate the investment community on Minnesota’s Cu-Ni-PGE resources, as well as on new developments in Minnesota’s iron mining industry was held this past April in Duluth. The workshop was attended by 68 participants from the investment community, minerals industry, academia, and government agencies. The first afternoon of the three-day workshop included presentations on the geology, mineralization, and processing of Cu-Ni-PGE and taconite ores. At the evening banquet, Ron Graber, general manager of operations for Cliffs Natural Resources, gave a talk on the future of the US taconite industry. Presentations during the morning of the second day focused on the business climate for mining in Minnesota. This was followed by presentations on two of the Cu-Ni-PGE prospects of the Duluth Complex – Duluth Metal’s Nokomis deposit and Franconia’s Birch Lake deposit.

Workshop Presenters:
Don Fosnacht – Director, Center for Applied Research & Technology Development, Natural Resources Research Institute at UMD
Jon Scoates – Consultant, formerly with Manitoba Geological Survey and the Geological Survey of Canada, retired
Jim Miller – Associate Professor, UMD Dept. of Geological Sciences
Mark Severson – Senior Research Fellow, Natural Resources Research Institute at UMD
Dean Peterson – Senior Research Associate, Natural Resources Research Institute at UMD
Peter Clevenstine – Manager, Engineering and Mineral Development; Minnesota Depart. of Natural Resources
Cesar J. (Joe) Ferron – President, HydroProc Consultants (Key member, Platsol Process development)
Daniel Colton – Attorney at Law; Leonard, Street and Deinard
Frank Ongaro – Executive Director, Mining Minnesota
Marty Vadis – Director, Lands and Minerals Division; Minnesota Department of Natural Resources
Sandy Layman – Commissioner, Iron Range Resources; Minnesota State Government
Brian Gavin – President & CEO, Franconia Minerals
Henry (Rick) Sandri – President & CEO, Duluth Metals Limited

Most attendees also participated in an optional field trip that followed the technical program. The day and one-half excursion provided a tour of the Minnesota Department of Natural Resources drill core facility at Hibbing, a driving tour of the taconite mines along the Mesaba Iron Range, and visits to the field offices of some of the active Cu-Ni exploration programs.
A three-day field trip enabled participants to observe a wide variety of stratigraphic, structural, and alteration features associated with base and precious metal ore bodies and occurrences. On Thursday, George Hudak and Ron Morton, with the help of Ron Kennedy (Xstrata Copper), led participants on an investigation of the physical volcanology, hydrothermal alteration, and volcanogenic massive sulfide mineralization of the Sturgeon Lake Caldera Complex located north of Ignace, Ontario. An exceptional outcrop and diamond drill hole evaluation of Rainy River Resources’ geologically complex Richardson Township gold-nickel-copper-PGE occurrence was conducted by Wally Rayner on Friday. The last day of the field trip was led by Dean Peterson, George Hudak, Ron Morton, and Tom Johnson, and included numerous outcrop stops to investigate the physical volcanology, hydrothermal alteration, structural geology, as well as base metal and precious metal mineralization in the Vermilion District.

For a summary of the workshop and a photo tour, compliments of Dorothy Campbell of the Ontario Geological Survey, go to: www.d.umn.edu/prc/workshops
OUTREACH
Another important function of the PRC is to conduct outreach activities intended to explain Lake Superior area geology and mineral resources to the general public and to K-12 educators. This year, PRC staff were involved in two K-12 teacher workshops and several lecture presentations to the general public.

In June, the TIMES (Teaching Inquiry Methods in Earth Sciences) project was held at UMD under the direction of Jim Miller and Penny Morton. The TIMES project is a two-week field course annually organized by the MnSTEP program at Hamline University since 2000. Its objective is to train middle school earth science teachers on inquiry-based learning through field experiences. Twenty teachers from throughout the state participated in this field-intensive workshop. The workshop was assisted by several other PRC staff (Mark Severson, Dean Peterson, Mark Jirsa, and Al Knaeble).

In early August, the 12th annual Minnesota Minerals Education Workshop (MMEW) was held at Vermilion Community College in Ely. This two-and-a-half day workshop gave K-12 teachers educational resources, lesson plans ideas, and background information in order to introduce students to their local geology and mineral resources. It consisted of one day of classroom instruction and one and a half days of field trips. The field trip included a visit to a planned processing plant, a drill core facility, and an active drill site of some of the companies exploring for Cu-Ni sulfide deposits along the base of the Duluth Complex. The MMEW meeting was held at the same time that the PRC field camp was at Vermilion CC. This allowed several PRC staff (Miller, Peterson, Severson, Goode, Mooers) to participate as instructors and field trip leaders for the teacher’s workshop.

Several general public lectures on the geology and mineral resources of the Lake Superior region were given by Jim Miller and George Hudak over the course of the year. These included a presentation to an Elderhostel group on mineral resources of the Lake Superior regions and a lecture at a public forum at Vermilion Community College in Ely on the origin of the Cu-Ni deposits of the Duluth Complex. Jim also led a geologic field trip of the Duluth area that was attended by over 40 people from the Minnesota Geological Society (a geology club). George Hudak also gave several presentations related to the Precambrian geology of the Lake Superior district, including one to the Oshkosh Earth Science Club, and one to a high school geology class in Green Bay, WI. Hudak also gave a presentation regarding a new interpretation of the tectonic environment associated with the development of the Lower Member of the Ely Greenstone Formation to the Mesabi Range Geological Society.

PRC PROMOTION
PRC director Jim Miller traveled to several colleges in the upper Midwest (and New Orleans) during the winter and fall to promote the PRC field camp to students and often to give a more topical talk on northeastern Minnesota geology. These trips included:
1/17 - Carleton College (Northfield, MN)
2/21 – Tulane University (New Orleans, LA)
2/27 – University of Wisconsin-River Falls
11/5 – Minnesota State University (Mankato, MN)
11/6 – University of Wisconsin- Milwaukee
11/7 – University of Wisconsin- Whitewater
11/13 – North Dakota State University (Fargo, ND)

Promotion of the PRC to industry for the purpose of soliciting corporate memberships and advertise upcoming professional workshops was conducted at a number of venues this year.
• PDAC (March 2-5) - All three PRC directors attended the Prospectors and Developers Association of Canada meeting in Toronto, Canada. We distributed 2007 PRC annual reports and flyers advertising the October 08 workshop to exploration companies at the Exhibitors Forum and we assisted at the State of Minnesota booth throughout the convention.
• NWOPA (April 8-9) – Jim Miller attended the Northwest Ontario Prospectors Association meeting in Thunder Bay to distribute 2007 annual reports and workshop flyers.
• SME (April 15-16) – Jim Miller gave presentation at the annual Minnesota Chapter meeting of the Society of Mining Engineers in Duluth that summarized the first year’s accomplishments of the PRC.
• ILSG (May 8-9) – Jim Miller gave a talk at the Institute on Lake Superior Geology meeting in Marquette, MI, which summarized of the successes of the inaugural PRC field camp. At the meeting, student from the 2007 field camp presented their capstone maps at the meeting’s poster session.
• UMD (August 1) – Jim Miller gave a talk at a 60’s reunion celebration for UMD College of Science and Engineering graduates on the booming minerals industry in the state and UMD’s role in training students for jobs of the future in minerals exploration and mining.
CORPORATE AND INDIVIDUAL MEMBERSHIPS

One of the major sources of funding for the educational programs of the Precambrian Research Center is corporate and individual membership donations. With the minerals industry standing to be the prime beneficiary of the Center’s mission to provide training and support to students in modern field methods and map-making, we look to the minerals industry to serve as its principal benefactor. Each year, we actively solicit mineral resource companies and professional individuals to donate tax-deductible contributions to a gift fund held by the College of Science and Engineering at the University of Minnesota Duluth. Monies from this fund are used exclusively to benefit students through subsidies to the Precambrian field camp, supporting graduate research assistantships, and funding student research grants. Membership levels are listed in the table below. The main benefit of a membership to donors is the reservation of slots in annual professional workshops, which typically limit attendance to 20-30 participants.

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STUDENT MENTORING AND ADVISING

George Hudak became a mentor for the Society of Economic Geologists during the fall of 2008. This program provides volunteer mentoring for students and professionals interested in careers within the broad field of economic geology. Hudak’s participation in this program stems from his belief that it’s important to pay back all the mentoring he received from SEG members during his career in economic geology and academia.

All three directors are involved as thesis advisors for seven different graduate students at the University of Minnesota Duluth. In addition, George Hudak supervises field-based research project for several undergraduates at the University of Wisconsin-Oshkosh. Jim Miller is supervising one undergraduate research opportunity project (UROP) for a UMD student who participated in the 2008 field camp.

PRECAMBRIAN RESEARCH CENTER MEMBERS

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<td>Tom Gardner</td>
<td>Palladium</td>
<td>September 08</td>
<td>Member since 5/07</td>
</tr>
<tr>
<td>Al MacTavish</td>
<td>Nickel</td>
<td>February 09</td>
<td>Member since 4/07</td>
</tr>
<tr>
<td>Richard Patelke</td>
<td>Nickel</td>
<td>January 09</td>
<td>Member since 8/07</td>
</tr>
<tr>
<td>Paul Albers</td>
<td>Nickel</td>
<td>August 08</td>
<td>New in 08</td>
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**Financial Statement (January - December 2008)**

### Income

- **Natural Resources Research Institute Allocation**
  - Carry-over from 2007: 54,452 (17.7%)
  - FY 2008-09 Allocation: 100,000 (32.5%)

- **Precambrian Field Camp Tuition (10 students)**: 25,276 (8.2%)

- **Workshop Registration**: 46,950 (15.3%)

- **PRC Foundation Gift Contributions**
  - Carry-over from 2007: 24,700 (8.0%)
  - 2008 Corporate Contributions: 46,000 (14.9%)
  - 2008 Individual Contributions and Anonymous Match: 10,500 (3.4%)

**TOTAL INCOME**: 307,878

### Expenses

- **Directors Salaries (excluding Field Camp)**: 60,344 (28.3%)

- **Precambrian Field Camp**: 67,980 (31.9%)

- **Professional Workshops**: 24,820 (11.7%)

- **Student Assistantships and Grants**: 28,919 (13.6%)

- **General Expenses (Promotion, Travel, Supplies)**: 30,972 (14.5%)

**TOTAL EXPENSES**: 213,035

**YEAR END BALANCE**: 94,843
Looking Ahead to 2009

As we enter our third year, our goal for the coming calendar year is mainly to do a better job of what we are already doing. Our current small staff of three directors and a handful of associated University of Minnesota Duluth faculty and Minnesota Geological Survey staff limits our ability to pursue some other programs as we’d like (e.g., sponsor an exploration geology career fair for upper Midwest students, offer upper-level GIS mapping courses, or, thinking really big, starting up a Journal of Field Geology). These and other program ideas will have to wait until our organization matures and our staffing and funding increases. For now, we are content to keep doing what we originally set out to do – produce well-trained mappers – and doing it well.

Unfortunately, this task will be made a bit more difficult in 2009 with the partial departure of Dean Peterson, a co-founder and co-director of the Precambrian Research Center. In January of 2009, Dean left the Natural Resources Research Institute to take a Vice President position with a local exploration company for three-quarters of the year. Dean will continue to assist with the Precambrian field camp each summer and occasionally with other programs (e.g. a course on 3D mapping software). We wish him good luck in his new endeavor and look forward to reserving some of his time to share his expertise in mapping and map-making with students.

One of the programs we have high hopes for this year is our professional workshops. With the successful completion of our first professional workshop last October, we are well into planning another for next October. The upcoming workshop will address “Field, Petrographic, and Mineralization Characteristics of Mafic Layered Intrusions”. It will be held October 4-10 at the University of Minnesota Duluth campus. It should be an excellent opportunity for newly minted exploration geologists and seasoned veterans who are new to magmatic ore deposits to learn from over 10 experts about the descriptive aspects of mafic layered intrusions. A highlight of the workshop will be lab sessions that involve virtual field trips of the world’s classic mafic intrusions, with hands-on investigations of sample and thin section suites from the various intrusions. For more information on the workshop, go to: www.d.umn.edu/prc/workshops

We are also looking forward to another successful field camp. Based on preliminary indications of interest, we expect to attract more students to the Precambrian field camp this summer. It would be great if we could reach the limit of 20. In anticipation of a full camp, we are planning for five capstone projects. While our blanketing of all geology departments in the U.S. and Canada with our field camp poster is obviously getting the word out (we’ve had inquiries from Pennsylvania, to Texas, to Washington this year), we hope that the enthusiasm of our past students for the camp will become our primary means of promotion. For info on the 2009 field camp, visit: www.d.umn.edu/prc/fieldcamp

One rather unconventional program that the Center is involved in this year is organizing and hosting the 55th annual Institute on Lake Superior Geology. The Institute is an ad hoc organization that relies upon various organizations to host the meeting each spring in various locations around the Lake Superior region. This year’s meeting will be held in Ely, Minnesota, from May 5-10. In addition to two days of technical talks and posters, the meeting will include seven field trips on topics ranging from glacial deposits to greenstones and taconite to base metal sulfide deposits. It is a great venue for students and professionals from industry, academia and government to present their research and go on some great field trips. We think this year’s meeting will be very well attended with upwards of 200 participants. For information about the ILSG meeting, go to: www.d.umn.edu/prc and click on the “quick link” in the top right corner.

Finally, given the current economic crisis that is hitting the minerals industry particularly hard, we are not setting such lofty goals for fundraising in the coming year. Ideally we would like to match this year’s contribution total of about $55,000. This will allow us to cover the subsidy costs of the field camp (approximately $20,000), provide a graduate research assistantship for the 2009-10 academic year (approximately $17,000), and offer a number of student research grants ($1,000/student). We again want to thank our supporting members and especially those who have contributed in consecutive years – Anglo American, Newmont, Cliffs Natural Resources (formerly Cleveland Cliffs), Tom Gardner, Rich Patelke and Al MacTavish.

Again, here’s to a quick recovery in 2009.
Bedrock Geologic Map of the Paulsen Lake Area, Northeastern Minnesota

Jacqueline Kanold, John Haidasz, Hugh Clauer, and Mark Jost
University of Minnesota Duluth, Pecos Research Center
August 2006

Correlation of Map Units
- environmental and geomorphologic units

Description of Map Units
- bedrock geologic units

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