

# INFORMATION CIRCULAR



*"The rocks are the final court of appeal" Francis Pettijohn*

PRECAMBRIAN RESEARCH CENTER PROFESSIONAL WORKSHOP SERIES



## **GEOLOGY, MINERALOGY, AND GENESIS OF PRECAMBRIAN IRON FORMATIONS**

**October 10-16, 2010**

***University of Minnesota Duluth  
Duluth, Minnesota***

***Sponsored by:***  
**Precambrian Research Center**  
**Department of Geological Science**  
**Natural Resources Research Institute**

**[www.d.umn.edu/prc/workshops](http://www.d.umn.edu/prc/workshops)**

## About the Workshop

The workshop is designed for professional geologists, academic researchers, and graduate students working with Precambrian iron formations. The goal of the workshop is to familiarize participants with the stratigraphy, mineralogy, textures, internal structures, geochemistry, and geometallurgy of both Lake Superior-type and Algoman-type iron formations, as well as with current genetic models proposed for their formation.

The workshop includes two days of short course lectures by internationally and regionally renowned experts on Precambrian iron formations. It will also include four days of field excursions on the classic iron formations of the Lake Superior area led by local experts. The short course lectures will be conducted on the campus of the University of Minnesota Duluth.

## Tentative Workshop Schedule

### Sunday, October 10

6-9 PM **Welcoming Reception** (Inn on Lake Superior, Canal Park); Introductions

### Monday, October 11

#### AM: CLASSIFICATION, GEOLOGIC SETTING, AND GENESIS OF IRON FORMATIONS

7:30 Participants transported by van to UMD; depart from Inn on Lake Superior lobby

8:00-9:00 **Lecture 1: Classification of Precambrian Iron Formations**  
*B. Simonson, Oberlin College, OH*

9:00-10:00 **Lecture 2: Depositional Environments and Geodynamic Settings of Iron Formations**  
*P. Fralick, Lakehead University, ON*

10:00-10:30 Coffee Break

10:30-11:30 **Lecture 3: Biogenetic Influences on Iron Formation Genesis**  
*R. Shapiro, California State-Chico*

11:30-12:30 **Lecture 4: Hydrothermal Influences on Iron Formation Genesis**  
*J. Peter, Geological Survey of Canada*

12:30-1:30 Lunch at UMD

#### PM: GEOLOGY AND STRATIGRAPHY OF IRON FORMATIONS IN THE LAKE SUPERIOR AREA

1:30-2:15 **Lecture 5: Stratigraphic Place and Economic Role of Algoman-type Iron Formation**  
*P. Thurston, Laurentian University, ON*

2:15-3:00 **Lecture 6: Overview of Lake Superior-type Iron Formations**  
*R. Ojakangas, University of Minnesota-Duluth*

3:00-3:15 Break

3:15-4:00 **Lecture 7: Geology and Stratigraphy of the Biwabik Iron Formation**  
*M. Severson, Natural Resources Research Institute, UM-Duluth*

4:00-4:45 **Lecture 8: Geology and Stratigraphy of the Negaunee Iron Formation**  
*T. Waggoner, Consultant, Negaunee, MI*

4:45-5:30 **Lecture 9: Geology and Stratigraphy of the Gogebic Iron Formation**  
*G. LaBerge, University of Wisconsin-Oshkosh & W. Cannon, US Geological Survey, Reston, VA*

5:30 Participants return to Inn on Lake Superior

### Tuesday, October 12

7:30-4:00 **Field Trip 1 – Geology of the Gogebic Iron Formation, Western Upper Michigan & Northwestern Wisconsin**

**Leaders:** *W. Cannon, US Geological Survey*  
*G. LaBerge, Univ. Wisconsin-Oshkosh*  
*P. Fralick, Lakehead University*  
*H. Djerlev, Global Minerals Engineering LLC*

6:30 Participants return to Inn on Lake Superior

### Wednesday, October 13

#### AM: MINERALOGY, METAMORPHISM, AND ALTERATION OF IRON FORMATIONS

- 8:00 Participants transported by van to UMD; depart from Inn on Lake Superior lobby
- 8:30-9:30 **Lecture 10: Mineralogy of Iron Formations: Primary, Diagenetic, and Metamorphic**  
*C. Klein, University of New Mexico*
- 9:30-10:00 Coffee Break
- 10:00-11:00 **Lecture 11: Thermal Metamorphism of Iron Formations**  
*P. McSwiggen, Consultant, Minneapolis, MN*
- 11:00-12:00 **Lecture 12: Origin of High-grade Iron and Manganese Ore Deposits by Supergene and Hydrothermal Processes**  
*N. Beukes, University of Johannesburg, SA*
- 12:00-1:00 Lunch at UMD

#### PM: GEOCHEMISTRY, METALLURGY AND ECONOMIC GEOLOGY OF IRON FORMATIONS

- 1:00-1:45 **Lecture 13: Geochemical Models for the Genesis of Algoman-type Iron Formation**  
*G. Baldwin, Laurentian University, ON*
- 1:45-2:30 **Lecture 14: Geochemistry of Iron Formations**  
*B. Beard, University of Wisconsin-Madison*
- 2:30-3:15 **Lecture 15: Geometallurgy of Iron Formations**  
*R. Johnson, Consultant, Negaunee, MI*
- 3:15-3:45 Break
- 3:45-4:30 **Lecture 16: Economic Geology of Iron Formations**  
*R. Fink, Cliffs Natural Resources, OH*
- 5: 15 Participants return to Inn on Lake Superior

### Thursday, October 14

- 8:00-5:00 **Field Trip 2 – Geology of the Central Mesabi Range, Minnesota**  
Leaders: *M. Severson, Univ. Minnesota-Duluth*  
*R. Ojakangas, Univ. Minnesota-Duluth*  
*P. Jongewaard, Cliffs Natural Resources*  
*M. Campbell, Cliffs Natural Resources*

Overnight in Biwabik, MN

- 6:30-9:00 Banquet and Talk –**History of Development of the Mesabi Iron Range**  
*M. Jirsa, Minnesota Geological Survey*

### Friday, October 15

- 8:00-3:30 **Field Trip 3 – Geology of the Eastern Mesabi Range and the Soudan Iron Formation, Northern Minnesota**  
Leaders: *M. Severson, U Minnesota-Duluth*  
*T. Campbell, Cliffs Natural Resources*  
*D. Halverson, Cliffs Natural Resources*  
*D. Peterson, Duluth Metals Ltd.*

Overnight in Grand Marais, MN

### Saturday, October 16

- 8:00-3:00 **Field Trip 4 – Geology of the Gunflint Iron Formation and the Sudbury Impact Layer, Northeastern Minnesota**  
Leaders: *M. Jirsa, Minnesota Geological Survey*  
*P. Fralick, Lakehead University, ON*

- 6:00 Return to Inn on Lake Superior

## Workshop Instructors and Principal Field Trip Leaders

The short course lectures will be given by a preeminent group of scientists and researchers who have devoted much of their careers to the study of Precambrian iron formations. The field trips will be led by local geologists who are renown experts on the geology and stratigraphy of Lake Superior-type iron formations.

- **Brian Beard** - Associate Research Professor, University of Wisconsin-Madison (PhD, Wisconsin)

*Research Interests:* Brian is an isotope geochemist with a major research effort to develop the Fe and Mg stable isotope systems. This effort includes experimental studies to characterize fluid mineral fractionations suitable for understanding authigenic mineral formation and development of new femto second laser ablation methods to make high precision isotope analysis on minerals within their petrographic framework. Other areas of research include geochronology, volcanology, sedimentary provenance studies, forensic sciences, and development of miniaturized instrumentation suitable for deployment on space-craft.

- **Nicholas Beukes** – Professor, University of Johannesburg (PhD, Rand Afrikaans)

*Research Interests:* Genetic stratigraphy and basin analyses of Precambrian sedimentary successions with the aim of understanding early depositional systems and environments on Earth. Focused mainly on the large basinal scale chemical sedimentary systems of BIF, manganese and carbonate deposition with special reference to the Transvaal Supergroup in South Africa. However, has also worked extensively on siliciclastic depositional systems of for example the Mesoproterozoic Pongola and Witwatersrand Supergroups on the Kaapvaal craton. For the past 12 years he has been leader of the Paleoproterozoic Mineralization Research Group at the University of Johannesburg (formerly RAU). Since 2002 a major part of his research was devoted to a study of high-grade iron ore deposits hosted by BIF in South Africa, Brazil and India.

- **Geoffrey Baldwin** – Ph.D. Candidate, Laurentian University, Sudbury, ON (MSc, Laurentian)

*Research Interests:* The stratigraphy and geochemistry of banded iron formations. Past work (MSc thesis) has been on Algoma-type iron formation in the Abitibi Greenstone belt. Current research is focused on the Neoproterozoic Rapitan Iron Formation, with particular focus on the redox-sensitive metal stratigraphy.

- **Thomas Campbell** – Manager - Resource Analysis, Cliffs Natural Resources, Hibbing, MN (PhD, South Dakota School of Mines)

*Research Interests:* Responsibilities include development of geologic models for various iron deposit types including, but not limited to, Superior- and Algoma-type iron formations, magmatic iron deposits, and iron oxide (Cu-Au) type deposits to assist in target generation and promote a better understanding of ore continuity/controls. Also involved in the development, implementation, and maintenance of innovative exploration targets and associated diamond drill programs to find and delineate additional resources at U.S. operations and perform target generation activities within the South American business development unit.

- **William F. Cannon** – Geologist, U.S. Geological Survey, Reston, VA (PhD, Syracuse)

*Research Interests:* Bill has studied the regional geology and tectonics of the southern Lake Superior region for the past 43 years, including the major iron ranges of Michigan and Wisconsin. A synthesis of the geology and iron resources of the Gogebic Iron Range was recently published as a USGS Professional Paper. His studies have provided a context for the age, depositional setting, and subsequent deformation and metamorphism of the iron formations. Recently, he has mapped and studied the Sudbury impact layer in the iron ranges of Michigan and Wisconsin and used that layer to clarify stratigraphic relationships between the geographically separated ranges.

- Henry Djerlev** – Consulting Geologist, Hibbing, MN (MS, Minnesota-Duluth)

*Research Interests:* Current interests involve the geology and taconite economics of the Western Gogebic Iron Range, as a consulting geologist working for Global Minerals Engineering LLC. Global manages considerable land holdings on the western Gogebic. Following a 30 year career with Pickands Mather/Cleveland Cliffs, Henry has spent the last 10 years as a consulting geologist. Early career experience involved base and precious metals exploration, in western U. S. and Canada. The bulk of his later experience was as Mine Geologist at Hibbing Taconite from its inception in 1973 to his 'retirement' in 2000. Recent consulting experience has involved iron formation and non-ferrous database development for land ownership in Minnesota, Wisconsin, Michigan and Canada.
- Richard Fink**– Vice President, Technical Business Development, Cliffs Natural Resources, Cleveland, OH (MBA, Baldwin-Wallace College; MA, Washington U)

*Research Interests:* Project leader for the development of massive chromitite deposits within the Ring of Fire polymetallic district located in the James Bay lowlands of Ontario. Over 40 years experience in the natural resources industry primarily focused on evaluating the economic potential of Precambrian iron formation deposits located in North American, South America and Australia. Supervised the development of standards and procedures for ore reserve estimation and mine planning at Cliffs.
- Philip Fralick** – Professor, Lakehead University, Thunder Bay, ON (PhD, Toronto)

*Research Interests:* Depositional and tectonic models for sedimentation during the Precambrian, with emphasis on chemical sediments and the information they provide on the geochemistry of the atmosphere-hydrosphere system. Phil has published on an assortment of different types of iron formations ranging from Archean sulfide mounds formed by hydrothermal venting, through Archean, shallow-water, delta-top iron formations precipitated by microbial processes in nutrient-rich areas, to broad Paleoproterozoic shelves where movement of water masses drove precipitation. Currently, he is working on the sedimentology of the Sudbury ejecta sheet that overlies chemical sediments of the Gunflint Formation.
- Mark Jirsa** – Senior Geologist, Minnesota Geological Survey, St. Paul, MN (MS, Minnesota-Duluth)

*Research Interests:* Geologic mapping, utilizing the combination of geophysical, drill core, and outcrop information to improve and convey the understanding of Minnesota's Precambrian terranes. Recent projects include creation of a bedrock geologic map and structural study of the Mesabi Iron Range, State-wide bedrock geologic map, maps of wilderness areas affected by forest fires, and research related to 1850 Ma Sudbury meteorite impact layer and Archean unconformities. He is also review coordinator and content editor for MGS map products.
- Rodney Johnson** – Chief Scientist, Rod Johnson & Associates, Negaunee, MI (PhD, Michigan Tech)

*Research Interests:* Geometallurgical characterization and genesis of ores of iron, nickel, copper and gold. Rod provides ore and waste characterization, petrographic, economic geology, and process improvement services to exploration and mining companies world wide. He teaches courses in the geometallurgy of iron ores, core logging methods, petrography and rock classification. He has a wide range of experience in the exploration for and the mining and analysis of iron, nickel, copper, gold, diamonds, uranium and PGE's. Rod was North American nickel specialist for Western Mining Corporation; chief geologist for Copper Range Corporation, White Pine Mine and process mineralogist for Cliffs Natural Resources Inc.
- Peter Jongewaard** – Minnesota District Geologist, Cliffs Mining Services, Eveleth, MN (MS, Minnesota-Duluth)

*Research Interests:* Stratigraphy of the Mesabi Range and southern Labrador Trough; ore characterization, deposit modeling, mine-to-mill reconciliation, process mineralogy; mine geologist at the Thunderbird Mine in Eveleth from 1995-2006. Since joining Cliffs in 2003, Peter has worked on due diligence investigations of iron ore prospects in Minas Gerais, Amapa, Bahia, and Mato Grosso do Sul states in Brazil. He has previous experience in base and precious metal exploration in the upper Midwest and New England with Noranda Exploration.

- **Cornelius (Kase) Klein** – Professor, University of New Mexico (PhD, Harvard)

*Research Interests:* Petrology, geochemistry, and the genesis of Precambrian iron-formations worldwide; the mineralogy of amphiboles and of amphibolite-type metamorphic assemblages. Joint studies (with N.J. Beukes) of Proterozoic iron-formations in South Africa have provided much new insight into their probable origin. This work has been extended (jointly with A.E. Ladeira) to the Archean and Proterozoic iron-formations (and ores) in the Quadrilátero Ferrífero of Brazil. Kase is the author of one of the most popular mineralogy textbooks in current use – Mineral Science.

- **Gene LaBerge** – Emeritus Professor, University of Wisconsin-Oshkosh (PhD, Wisconsin)

*Research Interests:* Gene began his work on iron formations in 1957 with the Oliver Iron Mining Co (U.S. Steel) doing detailed mapping of the Negaunee Iron-formation in the Ishpeming and Champion, MI areas. His Ph.D. thesis at UW-Madison was a petrographic study of magnetite in iron formations in the Lake Superior region. Gene had two post-doctoral experiences with iron formations of the Hamersley Range of Western Australia and in South Africa. In 1965, Gene took a faculty position at the University of Wisconsin – Oshkosh, where he taught for 33 years. With support from the Wisconsin Geological and Natural History Survey and the U.S. Geological Survey, he spent 34 consecutive summers conducting regional mapping of Precambrian rocks in central and northern Wisconsin, with special emphasis on the Gogebic Range.

- **Peter McSwiggen** – Consulting Geologist/Microscopist, McSwiggen & Associates, Minneapolis, MN (PhD, Minnesota)

*Research Interests:* Mineral investigations and characterization of iron formations, including the Biwabik and Cuyuna Iron Formations, and the progressive metamorphism of sedimentary basins. Peter spent 23 years at the Minnesota Geological Survey and the University of Minnesota, Department of Geology and Geophysics doing research mostly on the Paleoproterozoic rocks of east-central Minnesota, and later managing the department's electron microprobe laboratory. Currently, Peter operates his own electron microprobe business, and consults and runs training courses on microscopy and electron microprobes.

- **Richard Ojakangas** – Emeritus Professor, University of Minnesota-Duluth (PhD, Stanford)

*Research Interests:* Sedimentary petrology of Precambrian volcanoclastic and sedimentary rocks, Precambrian history of the Lake Superior region and the Baltic Shield, with emphasis on economic deposits in sedimentary rocks, iron-formations, and ancient glacial deposits. Dick received his BA in Geology from UMD in 1955 and returned in 1964 as a faculty member until his retirement in 2002. He has conducted geological research in Minnesota, Wisconsin, Michigan, Utah, Missouri, California, Puerto Rico, Canada, Finland, Australia, Antarctica, India, South Africa, and Russia and traveled extensively elsewhere on geological field trips.

- **Jan Peter** – Research Economic Geologist, Geological Survey of Canada, Ottawa, ON (PhD, Toronto)

*Research Interests:* Ongoing research has focused on the study of ancient and modern seafloor hydrothermal mineralization. He has tended to focus on mineralization in sedimentary settings (e.g., Besshi-type deposits, volcanic-sediment-hosted massive sulfides). Deposit locations include Windy Craggy, BC; Bathurst, NB, Finlayson Lake, YT, Hackett River, NU). Recently, he has also begun to investigate the application of novel and unconventional methods and techniques (portable x-ray fluorescence spectrometry, laser ablation ICP-MS, hyperspectral surveying) in mineral exploration. He co-led a recently completed six-year IGCP project on the global comparison of volcanic-hosted massive sulfide districts. Prior to joining the staff of the GSC in 1994, he held an NSERC postdoctoral fellowship at the GSC.

- **Dean Peterson** – Senior Vice President of Exploration, Duluth Metals Ltd, Duluth, MN (PhD, Minnesota)

*Research Interests:* Economic geology, geological mapping, Precambrian geology, mineral potential modeling, and three-dimensional modeling of ore systems. Dean has broad experience in geological mapping of rocks of all types, ages, and locations mainly through work with the mineral exploration industry in search of mesothermal-gold, epithermal-gold, volcanogenic massive sulfide, copper-nickel-PGE in the Duluth Complex, high-grade copper-PGE veins beneath the Sudbury Igneous Complex, and copper-gold-molybdenum porphyry deposits.
- **Mark Severson** – Senior Research Fellow, Economic Geology Group, UMD Natural Resources Research Institute, Duluth, MN (MS, Minnesota Duluth)

*Research Interests:* Economic geology, geological mapping, Precambrian geology, mineral potential Bedrock geologic mapping and mineral prospecting in: Archean greenstone terrains in Minnesota and western US; Paleoproterozoic iron formations and related rocks in Minnesota; Mesoproterozoic Duluth Complex of Minnesota; and Tertiary volcanic terrains in the western US. Mark has conducted geologic mapping, core logging, and mineral prospecting in various Precambrian terranes with particular experience with the Cu-Ni-PGE mineralized gabbros of the Duluth Complex and the Biwabik Iron-formation of the Mesabi Range.
- **Russell Shapiro** – Associate Professor, California State University- Chico (PhD, UC Santa Barbara)

*Research Interests:* Stratigraphy and petrography of microbial deposits, particularly with regards to astrobiology. After an initial start on the modern stromatolites of the Bahamas in the late 1980s, Russell has worked on a variety of deposits ranging back to the Paleoproterozoic. His publications encompass many scales, from field mapping to isotopic signatures of microbial deposits. For the past eight years, he has focused his efforts on the Biwabik Iron Formation stromatolites. In addition to teaching courses in sedimentology, paleontology, and field mapping, Russell has consulted for Anadarko Petroleum and has served on the NASA Astrobiology Panel.
- **Bruce Simonson** – Professor, Oberlin College, Oberlin, OH (PhD, Johns Hopkins)

*Research Interests:* While studying sedimentary geology with Francis Pettijohn at Johns Hopkins University, Bruce acquired a keen interest in what things were like on the early Earth in general and the origin of banded iron formations (BIFs) in particular. He has studied various iron formations in North America starting in 1975, then ventured over to Western Australia to see how they compared with the classic BIFs of the Hamersley Basin starting in 1985. While working in the Hamersley Basin, Bruce became intrigued by the distinctive sand-size spherules of former melt that represent impact ejecta and has continued to study evidence for extraterrestrial impacts in the geologic record.
- **Phil Thurston** - Adjunct Professor, Laurentian University, Sudbury, ON (PhD, Western Ontario)

*Research Interests:* The geology and origin of Archean greenstones involving a holistic approach using stratigraphy, sedimentology, volcanology, geochemistry and tectonic analysis. Work has established the unique REE character of VMS-related rhyolites, the tectonic role of quartzite-komatiite sequences, and the role of iron formations as stratigraphic markers, in greenstones of the North Caribou terrane, the Abitibi-Wawa subprovince and the Baltic shield. Prior to joining Laurentian he worked for many years for the Ontario Geological Survey doing helicopter-supported reconnaissance, detailed stratigraphy and geochemistry in the Confederation Lake area amongst other regional mapping projects and editing the Geology of Ontario maps and volumes.
- **Tom Waggoner** - Consultant, Negaunee, MI (MS, Michigan State)

*Research Interests:* Tom served as chief geologist and lands manager for Cleveland-Cliffs in charge of iron ore reserve definition, mine planning, development and operation ore quality control for the Tilden and Empire Mines. He was also in charge of exploration for nonferrous deposits in the US, Canada, Central and South America. After retiring from Cliffs in 1997, Tom has delved into the origins of BIFs (popular topic) by examining REE, sulfur isotopes and Re-Os age dating; also by examining iron oxides associated with VMS, iron skarns and IOCGs.

## Short Course Lectures

A total of 16 Powerpoint lectures will be presented on a variety of iron formation topics during the two days of short course instruction (see *workshop schedule for topics*). Participants will be presented with a short course notebook that will include extended abstracts, Powerpoint lecture handouts, and related articles and handouts. After the workshop, participants will be mailed a CD copy of the short course notes.

Extended abstracts for each lecture will be posted here by mid-September.

## Field Excursions

Four days of the workshop will be devoted to field excursions that highlight the geology, stratigraphy, mineralogy, deformation, and metamorphism of iron formations in the Lake Superior region. Most of the trips will visit active mine sites and classic outcrops of Lake Superior-type iron formations in the Gogebic, Mesabi, and Gunflint ranges (Fig. 1). The trip to the Gunflint range will include a visit to exposures of the Sudbury impact layer (a breccia capping the iron formation related to the 1.85 Ga Sudbury impact event). In addition, Neoproterozoic-aged (Algonian-type) iron formation of the Vermilion Range will be visited at Soudan Iron Mine State Park and will include an underground tour of the 2700' level.

A guidebook for all field trip stops will be presented to both partial and full workshop participants.



Figure 1: Iron ranges of the western Lake Superior region. Areas to be visited during the workshop are shown in bold type.

## Registration and Fees

Participants have the choice of registering for the full six days of the workshop or for only the short course lectures and one-day field trip to the Gogebic Range. Registration for the complete workshop is **limited to 40 participants** with preference given to PRC members\*. Up to seven students enrolled in MS or PhD programs may register at a discounted rate. Registrations will be begin to be accepted after MARCH 22. After that date, participants will be accepted to the workshop on a first come – first serve basis contingent upon receipt of the registration form and full payment of the workshop fee. After August 30, registration costs will increase by \$200 for the full workshop.

\*To learn about PRC membership, visit the website: [www.d.umn.edu/prc/membership](http://www.d.umn.edu/prc/membership)

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Professional Registration for Full Workshop (Sun-Sat)	<b>\$1450</b> before 8/30/10 <b>\$1650</b> after 8/30/10
Student Registration for Full Workshop	<b>\$ 900</b> (limited to maximum of 7)
Partial Workshop (Sun-Wed)	<b>\$ 800</b>

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The workshop registration includes:

- Short course notebook and CD of extended abstracts, lecture Powerpoints, handouts, and reprints
- Field trip guidebook
- Certificate of attendance indicating contact hours
- Van transport between Downtown Duluth/Canal Park hotels and UMD
- Welcoming reception Sunday evening (10/10)
- Lunches and morning coffee breaks throughout workshop and field trips
- Banquet dinner Thursday evening (10/14; full workshop registrants only)
- Field trip transportation (by coach bus)

Participants will be responsible for all other meals not indicated above, as well as their hotel accommodations in Duluth and transportation to and from Duluth.

## Notice of Acceptance and Cancellation Policy

Upon receipt of a completed registration form and full payment, a preliminary notice of acceptance will be sent. If the course fills before the early registration deadline (Aug. 30), registrants can request to be put on a waiting list and have their check held. Because a limited number of PRC members have priority for the course at any time before the early registration deadline, it is possible to be bumped from the workshop by a PRC member, especially for late registrants.

A full course refund will be given if notice of cancellation is received by Friday, **October 1**. Our program obligations make it necessary to assess a charge equal to one-half of the course fee for later cancellations. No course refund is possible after the course begins on October 10.

## Graduate Student Registration

Up to seven graduate students enrolled in accredited M.S. or Ph.D. programs in Canadian or US colleges during the 2010-2011 academic year may attend the workshop at a discounted registration rate of \$900. Student registrations must be accompanied by:

- a letter by the student briefly describing how the workshop pertains to their thesis research and career goals.
- a letter of recommendation from their thesis advisor commenting on the qualifications of the student and the usefulness of this workshop to the student's thesis research.

Student registrations do not initially require payment of fees. If more than 7 students register, the most qualified students will be chosen and notified on **August 30th**. Upon notification of acceptance into the workshop, students must pay the registration fee by **September 24<sup>th</sup>**.

## About Duluth

Duluth, the world's largest freshwater inland port, is located at the western tip of Lake Superior, midway between the Twin Cities of Minneapolis / St. Paul and the Canadian border. Nestled in the hills overlooking the largest of the Great Lakes, the city offers breathtaking scenery and serves as the gateway to abundant recreational opportunities.

Participants seeking additional information about Duluth can call the Duluth Convention and Visitors Bureau at 1-800-4-DULUTH (438-5884) or visit their website (<http://www.visitduluth.com/>). For additional information about Minnesota, call the Minnesota Office of Tourism at 888-TOURISM (868-7476) or visit their website at <http://www.exploreminnesota.com/>.

## Air and Ground Transportation to Duluth

Daily flights into Duluth International Airport ([www.duluthairport.com/](http://www.duluthairport.com/)) are provided by Delta, United, and Allegiant Airlines with arriving from Minneapolis-St. Paul, Detroit, and Chicago. Transportation from the airport to area hotels and motels is available by taxi at reasonable rates and some hotels provide shuttle service (check with your hotel). Rental cars may also be obtained at the airport from Alamo, Avis, Budget, Hertz, and National.

## Hotel Accommodations

Participants are expected to reserve and pay for their own hotel accommodations for the first 4 days of the workshop (Sun-Wed). For ease of collecting and transporting people to and from UMD by van, participants should book accommodations in one of the Downtown/Canal Park area hotels listed below and shown on the attached map. Participants are encouraged to book rooms at the Inn on Lake Superior, where the welcoming reception will be held on Sunday (10/10). A total of 30 rooms have been reserved at a special rate of \$99 (+tx; good until 9/10). Request the "**PRC Workshop Rate**" when making a reservation.

### Downtown/Canal Park Hotels (see map)

<b>Inn on Lake Superior</b>	218/726-1111	888/668-4352	<a href="http://www.innonthelake.com/">WWW</a>
Canal Park Lodge	218/279-6000	800/777-8560	<a href="http://www.canalparklodge.com/">WWW</a>
Hampton Inn	218/720-3000	800/426-7866	<a href="http://www.hamptoninn.com/">WWW</a>
The Suites	218/727-4663	877/766-2665	<a href="http://www.thesuites.com/">WWW</a>
Comfort Suites	218/727-1378	800/517-4000	<a href="http://www.comfortsuites.com/">WWW</a>
Radisson	218/727-8981	800/333-3333	<a href="http://www.radisson.com/">WWW</a>
Holiday Inn	218/722-1202	800/477-7089	<a href="http://www.holidayinn.com/">WWW</a>



## **For More Information**

Workshop Information - **Jim Miller** [mille066@umn.edu](mailto:mille066@umn.edu)

218-726-6582 (UMD office) or 218-720-4355 (NRRI office)

Field Trip Information - **George Hudak** [ghudak@d.umn.edu](mailto:ghudak@d.umn.edu)

218-720-4393

Registration, Lodging - **Julie Anne Heinz** [jheinz@nrri.umn.edu](mailto:jheinz@nrri.umn.edu)

218-720-4272



*"The rocks are the final court of appeal" Francis Pettijohn*