

SESSION 1

New this year, an in-depth earth science track. All descriptions for track courses are listed together at the end of the short course descriptions.

1A) CRYSTALLOGRAPHY BASICS

Cheryl Sill, Science Teacher

Do you want your students to LOVE studying about minerals? Come to this class for a brief synopsis of mineral systems, focusing on the crystallography of the mineral families. I have a fun “paper” 3-D construction activity to get started and then a super fun “Crystallography” lab that can be completed over the weekend from evaporites. Beautiful crystals for the students to see crystal shapes through a hand lens. You can also use this to reinforce good lab skills.

GRADE LEVEL – ES, MS

1B) STORY MAPS AND APPS- TEACHER RESOURCES FOR MN GEOLOGY

Jacqueline Hamilton, Geologic Information Scientist, Minnesota Geological Survey

In June of 2013, President Obama announced the ConnectED initiative, designed to enrich K-12 education for every student in America. Minnesota is one of many states that have negotiated a statewide license for ESRI Geographic Information systems (GIS) software. This software is available to all K-12 public, private, charter and home schools including K- 12 aged formal and non-formal youth groups (including afterschool and summer programs).

With the availability of on-line GIS programs students have access to large amounts of information and resources with the ability to link that information to geographic location. In this course we will take a look at Minnesota’s geological on-line datasets as well as other data that is free to download to your GIS. We will explore Minnesota’s topography, both past and present, as we examine the Mesabi Iron Range which has seen significant change over time. We will also look at the resources Minnesota offers for setting up your class room with a GIS, where to find data, and what lesson plans are available for you and your students.

GRADE LEVEL - ES, MS, HS

1C) GEOPHYSICS—Self-Potential Survey

Andrea Reed, Mineral Resource Geologist, MN Department of Natural Resources

In this largely hands-on-based course, you will be introduced to a type of geophysical survey called a self-potential survey. The course will cover the real-world applications for the survey, how to operate the survey using readily-available materials, and some basic interpretation guidelines at a level appropriate for middle and high school students. You will also receive a set of written instructions and a rough budget for materials required for replicating this survey at

your school. Please come prepared for the weather: short of a thunderstorm, the majority of this course will occur outside.

GRADE LEVEL - MS, HS

1D) MINELAND RECLAMATION

Paul Eger, Environmental Engineer, Global Minerals Engineering

Coming soon!

GRADE LEVEL - ES, MS

SESSION 2

2A) MINERAL AND ROCK IDENTIFICATION

Andrea Reed, Mineral Resource Geologist, MN Dept. of Natural Resources

In this largely discussion- and hands-on-based course, attendees will be introduced to mineral and rock identification at a level appropriate for elementary and middle school students. The course will cover mineral characteristics and properties, basic mineral and rock classification categories, and the rock cycle. It will also provide worksheets and flow charts that can be used as a classroom aid for mineral and rock identification as well as links to educational rock and mineral resources.

GRADE LEVEL - ES, MS

2B) Groundwater Lab (Not just for science class anymore.)

Bruce Olsen, Hydrogeologist, MN Geological Survey/MN Department of Health (retired)

Minnesotans have relied upon a stable supply of high quality groundwater for their livelihood even before Minnesota became a state in 1858. Today, population increase and the ever expanding need for groundwater to support communities, agriculture, industry, and ecosystems has resulted in the development of local, state and federal partnerships to better manage and protect Minnesota's groundwater resources. However, a gap in public knowledge about groundwater hinders the capabilities for citizens and elected officials to understand and resolve local problems with groundwater quality and quantity. This session will use inexpensive materials to demonstrate basic concepts about groundwater occurrence and movement, how a well works, mapping movement/quality, and management. Also, opportunities to use session materials for cross discipline teaching in science and engineering, mathematics, and social studies are presented. This course is intended to be 75% hands on classroom demonstration with a minimal amount of time spent with lecture. Participants may take home a set of the classroom activities that have been prepared.

Grade level – (ES) MS (HS) Focus is on middle school students although all grade levels and adult education classes can benefit.

Bruce Olsen is a retired geologist with 42 years' experience working in ground water geology and ground water protection. He worked as a staff geologist with the Minnesota Geological Survey for 19 years and spent 23 years with the Minnesota Department of Health establishing and supervising the Source Water Protection Program for public water supply wells.

GRADE LEVEL – (ES), MS, (HS)

2C) Precambrian Geology of Northern Minnesota

Jim Miller, Geologist (ret) University of MN-Duluth

With the 20th MMEW taking place in Ely, the associated field trips will provide the opportunity to read rocks from three geological chapters of the greatest book ever written - Earth. Chapter 1 will tell the story of the formation of the 2.7 billion year old greenstone-granite terrane, which forms the core of North America. Chapter 2 will focus on the formation of the great Lake Superior iron formations in shallow seas about 1.85 billion years ago. Chapter 3 will investigate the igneous rocks created about 1.1 billion years ago during an aborted attempt by North America to break into two continents. This class will focus on detailing these incredible and dramatic geologic stories that are told by the rocks you will see (and collect) during the field trips.

GRADE LEVEL – MS, HS

SESSION 3

Session 3A) Mining and Geology 101

Karl D. Everett, PE, PG; Environmental Manager, Biosar America, LLC

What non-living creature has a face, back and ribs and exists deep underground? Answer: An underground mine. This course will cover basic geology, mining terms, and environmental aspects of mining in Minnesota. The geology of Minnesota will be discussed related to the formation of mineral resources and the mining of iron ore, silica sand, fossil resources, copper-nickel, gold, platinum, palladium, manganese, and rare earth minerals. Instructor will explain some basic mining terms, e.g. ore reserves, resources, footwall, hanging wall, heads, middlings, and tails. Course will cover the formation of ore deposits and the evaluation of resources, including some Minnesota mining history and practices; mining processes of drilling, blasting, haulage and mining processing equipment. Environmental compliance aspects will be reviewed including practices associated with controlling air emissions, land

disturbance, stormwater, groundwater, water discharge, tailings ponds, and the final reclamation of mine sites. Participants will be given some ore samples and teaching aids.

GRADE LEVEL - ES, MS, HS

3B) A “RECIPE” FOR ASPHALT: AN INTRODUCTION TO THE ENGINEERING AND GEOLOGY OF PAVING AND MATERIALS

Christina Morrison, Tiller Corp.

Ever wondered what asphalt tastes like? If you make it right, it tastes like chocolate and peanut butter! This course introduces the engineering and geology of paving and materials to fourth through seventh grade students. Through a hands-on activity, students will gain an understanding of the “recipe” for how asphalt is made and road construction techniques used in paving. Discussion will include the geology of the materials used in the production of asphalt and where those materials are mined in Minnesota.

Each participant will receive their own asphalt core to keep on display in the classroom which provides a cross-sectional view of the asphalt portion of a road.

GRADE LEVEL – ES, MS

3C) Iron Mining in the Classroom

Marinucci, SEH; Doran, NTS; and Loftquist, IMA

How does a rock in the ground in northeastern Minnesota turn into the vehicles, appliances, and infrastructure you use every day?

How has iron mining changed in Minnesota over the last 130 years?

How do Minnesota iron miners work to protect and preserve the land they’re mining for future use?

This course will help you answer these questions and more by first providing a brief overview of the history and evolving process of iron mining in Minnesota, as well as the future of the industry. The course will then review the different resources available to help you teach this information in your classroom.

Presented in conjunction between the Society for Mining, Metallurgy & Exploration (SME) and the Iron Mining Association of Minnesota (IMA), this course will review the multiple educational materials provided by both groups, including: Taconite Rocks! curriculum and its related classroom materials, Iron in our Electrical World, SME’s Mineral Education Coalition (MEC) resources, and more.

This course can be attended by educators for all grade ranges but is geared specifically toward middle- and high-school classrooms.

GRADE LEVELS – ES, MS, HS

SESSION 4

4A) MINERAL RESOURCE: OCCURRENCES AND USES

Ken Reid, Emeritus Professor, Mineral Resources Research Center, University of Minnesota
The fact that every material thing we take for granted in life is either made from minerals or depends on minerals for its production and/or transportation is not commonly recognized or understood. Examples of common everyday items will be traced back to their mineral source to show how modern civilization is totally dependent on mining. Materials available from The SME Minerals Education Coalition (www.mineralseducationcoalition.org) and Caterpillar Inc (www.cat.com) will be discussed and portions of DVDs and CDs covering documentaries and class demonstration projects will be discussed and shown, time permitting.
GRADE LEVEL - ES, MS, HS

4B) Physical Properties of Aggregate Resources in Minnesota

Sara Welna, Consulting Geologist
Steph Theriault, Barr Engineering Co.

Sand and gravel aggregate resources play an integral role in numerous Minnesota industries including construction, transportation, and landscaping. However, not all aggregate deposits are ideal for every industrial utility. Certain physical properties, such as grain size, durability, and mineralogy, make an aggregate deposit more or less desirable for a particular use. These physical properties are dictated by the geologic environment in which the sand and gravel were deposited and are observable in the field when conducting a geologic assessment of the deposit. This course will explore the geologic history of various sand and gravel deposits in Minnesota, how the aggregate is processed, and will include a hands-on session to evaluate physical properties of aggregate deposits similar to tests conducted in a laboratory.

GRADE LEVEL – MS, HS

4C) Ely's Golden Roots: Gold in the Archean Vermilion Greenstone Belt

Phil Larson, Geologist, Vesterheim Geosciences

Coming soon!

4D) SOUDAN MINE STATE PARK, GEOLOGY AND SO MUCH MORE!

Scott Alexander, Assistant Professor, Dept. of Earth Sciences, University of Minnesota
While the Soudan Underground Mine offers a peek into the mining history of Minnesota it also provides a unique access to the deep subsurface for geologists, physicists, hydrologists, and microbiologists. The deep subsurface is alive with microbiology that thrives in waters three times saltier than seawater. This talk will explore the research, beyond the fundamental physics experiments, that is on-going at this deep research site. Topics include early evolution of the Earth and its atmosphere, development of life on our planet and the potential for life on other planets.

GRADE LEVEL - MS, HS

TRACK COURSES: Interpreting the Environment of the Past: From Rocks to Sediments

By Dean Moosavi

This theme will be explored through a series of short courses offered in sequence. To gain a full understanding of the topic participants are strongly recommended to select the entire sequence as later components build on the former. All sessions will cover geoscience content while exposing participants to resources of direct relevance to classroom use by K-12 teachers.

IEP 1: The Sea Floor – Tectonic Structures & the Rocks They Leave Behind

We will begin the workshop by exploring the tectonic structure of the sea floor and the rocks left behind. Submarine volcanism & dike emplacement at mid ocean ridges and sediment burial in deep sea marine trenches leave behind distinct rock types allowing us to decipher past plate tectonic processes. This short course will tie in to the field component of the workshop with its focus on the Ely Greenstones, Platinum Group Elements hosted in rocks along the margins of the Duluth Complex and the iron formations visited at the Soudan Mine.

IEP 2: Marine Sediments – Record of Marine Life and Environment

This component of the workshop will look at the sediments found in the modern ocean. We will examine what the nature and geographic distribution of these sediments and how their distribution correlates with the climate of the ocean today. This short course will tie in to the field component of the workshop via rocks visited at Soudan Mine.

IEP 3: Paleoclimate from Marine Cores – Using Marine Sediment Cores to Understand Past Climate

This component of the workshop will examine how the contents of sediment cores can be used to interpret climatic conditions at the sites of deposition. We will look at smear slide and core data available to the general public and how these can be used with scaffolding in your classroom. This component of the workshop ties in to the field trip visits to Soudan Mine and offers links to the life size curriculum.

IEP 4: Climate Change & Humans - What Marine Cores Tell Us

This final component of the workshop will look what marine cores tell us about the effect of climate change on humans by looking at 2 case studies, the Maya Collapse of the Middle Ages and the Paleocene/Eocene Thermal Maximum, which is seen as a potential analog of human caused global

warming. This component of the workshop ties in to the social studies curriculum and the field trip stop at the Soudan Mine.