

# 2011 GSA Annual Meeting in Minneapolis

Innovative Methods for Broadening Participation in the Geosciences through In-Service Teacher Professional Development

Minneapolis Convention Center: Room 208CD

2:00-2:15 pm, Tuesday, 11 October 2011



## TEACHING TEACHERS ABOUT THE EARTH-- MITEP'S SUMMER CLASS DESIGN

**ROSE, William I., KLAWITER, Mark F., ENGELMANN, Carol A., VYE, Erika,**  
and **GOCHIS, E.,** Geological Engineering & Sciences, Michigan Technological  
Univ, 1400 Townsend Dr, Houghton, MI 49931, [raman@mtu.edu](mailto:raman@mtu.edu)



# MiTEP summer classes

## Goals:

- Local focus of Earth Science
- Raise confidence of teachers.
- Achieve high levels of learning.
- Generate ideas for relevant, effective lesson plans.



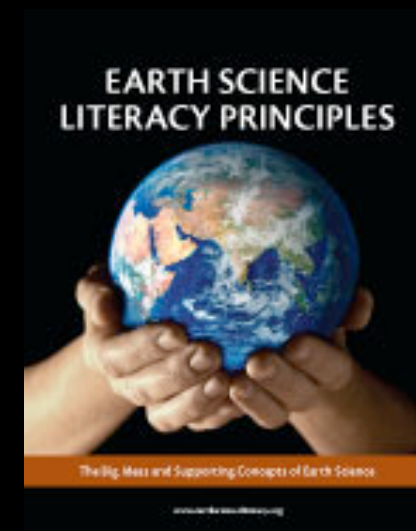
## Tools:

- Teach Outside.
- Use a Big Idea as the framework of the day.
- Use sites with sense of place.
- Misconceptions.
- Use GPS, Google Earth and Earth Cache.





# Earth Science Literacy Initiative



Each teaching day was introduced and driven throughout by one of the nine Big Ideas.



Field sites and field exercises derive from the Big Idea and serve to illustrate and reenforce it.



# One Day: Copper Harbor

Big Idea #1

“Earth Scientists use repeatable observations and testable ideas to understand and explain our planet”

Keweenaw Lookout  
Artesian Well--dipping rocks  
Centennial #6 Cu Mine  
Cliff Mine-- Keweenaw rift  
Brockway Mountain alluvial fan,  
Keweenaw Syncline  
Lighthouse Point--Green Rock  
Discovery  
Hunter's Point Mystery

## consistent themes:

reading rocks  
reading landscapes  
thinking broadly  
3D visualization  
testing hypotheses  
synthesizing





# By spending all day at it, and changing the context, we can explore and think about the idea to deepen understanding

## Stated Expectations:

The main insight you should get from today is to realize how earth scientists think and learn about the earth.

We will visit several places of wild beauty, where we will see a landscape being shaped by active processes.

We will propose hypotheses (claims), make observations and tests.

We will empower our own tests by believing and trusting them.

We will discover that knowledge must endure repeated testing.

We will find that disproving hypotheses is progress.

We will find that we must use principles from other fields to test earth science ideas---math, physics, chemistry, biology...

We will see that some hypotheses which seem quite important are difficult to thoroughly test.





# Final Stop: Hunter's Point (dinner, very dramatic site)



These rock rings have been known by geologists for over a century--you can read about them in the first visits to Copper Harbor by [Foster and Whitney](#) (see p. 61) in 1850.

**A new hypothesis:** The lavas in the Lake Shore Traps have “stripes” which originate after lichen colonies have lived on the rock surface.

We know that lichens are important agents for the weathering of rocks.

[Adamo & Violente \(2000\)](#)

[Chen et al \(2000\)](#)

## Backup examples

[Lichenometry](#)

[Thallus size isn't everything!](#)

[Lichen Growth and Global Warming](#)

[Lichen Growth and Rock Weathering](#)

[Face in the Mirror](#) by Trevor Goward





A list of pertinent misconceptions is developed for each day. These often derive from the big idea of the day and from the field sites.





# Misconceptions: Big Idea #1:

- Science is a collection of facts
- There is a single scientific method that all scientists follow.
- Science ideas are absolute and unchanging.
- Investigations that do not reach firm conclusions are useless.
- Science is pure and scientists work with no consideration of applications.
- Science is done by old white men.
- Science is too complex for a layperson to understand.
- Science is like a debate--it is a game of clever arguments.
- Scientists are all atheists and liberals.





# Outside experts drop in



Jim Diehl  
Paleomagician  
Earth's Magnetism



Susan Martin  
Anthropologist  
Mining Discovery

Bridging questions  
Use of master teachers  
Co-mingling of cohorts



Huge Backup commitment on Web  
provides support for lesson plan development  
covers the major points experienced every day  
links to major pedagogical efforts



[http://www.geo.mtu.edu/~raman/SilverI/MiTEP\\_ESI-1](http://www.geo.mtu.edu/~raman/SilverI/MiTEP_ESI-1)

[http://www.geo.mtu.edu/~raman/SilverI/MiTEP\\_ESI-2](http://www.geo.mtu.edu/~raman/SilverI/MiTEP_ESI-2)





Geospatial skills and awareness are central to earth science.

They especially reinforce contextural knowledge (reading the landscape).

Integration of Google Earth/GPS and Earth Cache into ESS-1 and 2 is done from day 1.

Each site is located with waypoints and translated to GE visualization.

Routine use of tracking applications and GoTo incorporated into the class.

EarthCache write-ups of visited sites done .

See presentation by Gochis et al (this meeting)





# Sense of Place

What are the elements of a sense of place?  
What makes these sites have power of inspiration and teaching? This is something to ponder a bit.

For Hunter's point, there is the triple peninsula--the UP, the Keweenaw and the Hunter's Point itself--each reaching more to the north. The word point captures this vulnerable compelling focus. There is the coast which is apocalyptic and often turbulent.

For the Green Rock there is also the human dream of riches and the pot at the end of the rainbow.

For Brockway there is the ridge and the perspective view of peninsula.

All of these places exhibit the fundamental geological pattern of dipping layers---these are the basis for the peninsulas, the ridges, the coasts.

See Vye et al. paper #66-3  
this meeting

