



## ***Final Report***

17<sup>th</sup> Annual

Minnesota Minerals Education Workshop

June 17-19, 2014

Southwest Minnesota State University

Marshall, MN

Prepared by

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## Executive Summary

A total of 69 participants registered for the 17<sup>th</sup> annual Minnesota Minerals Education Workshop (MMEW) held June 17-19, 2014 at Southwest Minnesota State University (SMSU) in Marshall, MN. This is in line with the average attendance to previous MMEWs of 68 participants. Attendees were largely K-12 earth science teachers from throughout Minnesota, but also included college educators, retired teachers, and non-teachers. The workshop involved 21 instructors and volunteers from various academic institutions, K-12 schools, state agencies, and mining, exploration, and geo-engineering companies.

The first day of the workshop was devoted to participants attending four out of 15 short course offerings on a variety of geologic and mineral resource topics. All participants attended a noon-hour talk by Minnesota Department of Natural Resources Director of Lands and Minerals Jess Richards on the importance of mining in Minnesota. He used the theme of science-based decision making to tie together topics including the state's role in mining and the significance of School Trust Lands. Teachers were presented with educational resources at the end of the day, which included gifts of geological dictionaries, Minnesota fossil kits (assembled by Dean Kjerland), various maps, posters, hardness kits, and a jump drive loaded with a variety of teacher resources. Most registrants attended a picnic at Camden State Park that evening and participated in a trail walk led by Carrie Jennings (MNDNR).

The second and third days of the workshop were devoted to field trips highlighting the geology and industrial mineral resources of southwestern Minnesota. On Wednesday, two busloads of participants visited Morton Outcrops Scientific and Natural Area, road cuts near Middag Knutea, Yellow Medicine River bluff, road cuts near Memorial Park in Granite Falls, the Martina-Marietta gneiss quarry, and an optional stop at Big Rock Wildlife Management Area. On Thursday participants visited the Lake Benton tunnel valley and Pipestone National Park.

Financially, the 2014 MMEW was a success. Total expenses for the workshop were \$19,564, which was about \$2500 under budget. Fewer instructors requested travel reimbursement than expected and limiting printing costs by posting most educational material on-line accounted for the bulk of the difference. Scholarships totaling \$1470 were provided by the Iron Mining Association of MN, Mining Minnesota, and Aggregate Ready Mix of MN to 49 participants for discounted lodging at SMSU dormitories. Feedback received in surveys (Appendix C) completed by nearly all participants was again largely favorable and contained many helpful comments and suggestions for improving future workshops.

## Introduction

A list of participants, instructors, volunteers and sponsors is given in Appendix A, as is the workshop and short course schedules. The budget for the workshop is summarized in Appendix B. The information reported in this summary comes largely from responses to surveys given to all participants after each day of the workshop, which is compiled in Appendix C. Most all of the participants, 60 of the attendees, replied to general workshop questions and short course questions.

## Participants

The total of 69 registrants was right at the average attendance of 68 over the 17-year history of MMEW. Participants came from throughout the Minnesota, with 75% of participants driving 3 hours or more to attend the meeting. One participant came from North Dakota.

This was the first MMEW meeting for 25% of the participants, with many first timers commenting that they will definitely attend future meetings. A total of 15 participants had attended at least three previous MMEW meetings. One teacher has attended 14 previous workshops!

Over 85% of attendees teach in a public or private K-12 classroom with 55% having more than 10 years of experience. Most teach middle school (grades 5-8) 68% and high school (grades 9-12) 30%. The most common discipline taught is earth science (34%), with a considerable number teaching multiple science fields (earth and life science (17%), earth, life, and physical science (16%), and 26% teaching science in addition to various non-science subjects.

## Instructors, Volunteers, and Field Trip Leaders

Twenty-one individuals, from academia (9), K-12 schools (3), state agencies (5), and minerals industries (4), volunteered as instructors, planners, field trip assistants, and/or meeting assistants during the workshop (Appendix A). Over nine individuals from Southwestern Minnesota State University and the local area contributed their time in helping to organize the first southwest Minnesota MMEW. The individuals who should be given particular recognition for their extraordinary efforts in making this workshop a success are:

- **Jim Miller** (UMD-PRC), who led the coordination of the workshop, organized short courses, procured teacher resources and arranged catering
- **Julie Ann Heinz** (NRRI) who again managed the registrations and budgets with efficiency and cheerfulness
- **Hannah Friedrich** (MNDNR) who assisted in coordination of the workshop and field trip.
- **David Southwick** (MGS emeritus) and **Carrie Jennings** (DNR) for coordinating the field trips and writing a field guide.
- **Cheryl Sill** (K-12) for helping procure the teacher resources.
- **Fred Corrigan and Jill Cohen of the Aggregate Ready Mix Association of MN** for helping with insurance

We thank all the volunteers listed in Appendix A for their time and efforts and their host organizations for allowing their involvement in this educational endeavor.

## Workshop Planning

This year, instead of holding planning meetings, the co-chairs decided to do the bulk of the

planning via email. This resulted in saving both time and transportation costs and was the safest option. On-site meetings included an initial meeting in St. Paul at MN DNR and a site meeting in Marshall at SMSU.

At the onset, ten subcommittees were established and specific tasks were delegated to core MMEW volunteers. These committees and the principal volunteers were:

- 1) Meeting Site Logistics – Jim Miller, Hannah Friedrich  
Duties: arrange classroom needs, meals for short course and field trips, busses for field trips Visit SMSU on Nov. 17<sup>th</sup> for initial planning
- 2) Registration – Julie Heinz, Jim Miller  
Duties: compile registration list, process payment, distribute receipts, create nametags
- 3) Field Trips – Dave Southwick, Carrie Jennings, Jim Miller, Hannah Friedrich  
Duties: develop trip content and route, prepare brief guidebook, lead trips, gain permission to site; Field preview in May to potential stops
- 4) Curriculum – Jim Miller  
Duties: plan short course schedule, recruit instructors
- 5) Promotion and Evaluation – Jim Miller, Hannah Friedrich  
Duties: develop promotional flyer, send out email notices to past participants, MESTA members, and other potential participants; convert survey to Survey Monkey and convince participants to complete the survey
- 6) Website – Jim Miller  
Duties: manage and update MMEW website, upload presentations to website,
- 7) Teacher Resources –Cheryl Sill, Marsha Patelke, Jim Miller  
Duties: collect fossil samples, resource books, educational material, posters, tote bags, jump drives
- 8) Continuing Education Certificate – Hannah Friedrich  
Duties: Email individual certificates to participants that completed the survey
- 9) Special Events–Hannah Friedrich, Carrie Jennings  
Duties: Recruit keynote speaker (Jess Richards), organize Tuesday evening activities at Camden State Park
- 10) Budgeting – Jim Miller, Julie Heinz, Hannah Friedrich  
Duties: work with planning committee and MCMRE treasurer to estimate workshop costs

### Workshop Venue and Logistics

Since MMEW was held in northern Minnesota last year, it was decided that it should be hosted somewhere in the southern portion of the state. A long-time participant pitched Marshall as a potential site. Factors such as unique geological features, SMSU as a probable venue, water quality issues specific to that area, significant industrial mineral mines, and MMEW has never been held in this quadrant of the state, were all reasons that reinforced the case to hold MMEW in Marshall, MN. After initial discussions with SMSU staff Loren Wiger and Thomas Dilley site visit was conducted by Jim Miller and Hannah Friedrich on November 22.

A total of four classrooms in the Science & Math Building were used for the workshop classes. In addition, the Auditorium in Bellows Academic Center was used for the welcoming talk, the noon-hour talk, dissemination of the teacher resources, and the field trip overview presentations. The foyer to the Science & Math Building adjacent to their Natural History Museum was used for the registration and morning and afternoon breaks.

Meals provided for the participants included 3 continental breakfasts, 1 lunch buffet, 2 bag lunches, and 1 picnic supper. In addition, snacks and refreshments were set out during morning

and afternoon breaks. All catering was provided by SMSU food service.

Based on the survey (appendix B), the participants were generally satisfied with the meals. Most complaints centered on the lack of healthy options for continental breakfasts and breaks and on the need to be more sensitive to special dietary needs.

Almost all of participants stayed at Sweetland Hall Dormitories, which is located on SMSU campus. 49 teachers and 12 instructors/volunteers stayed in the campus lodging. A generous \$10 per night discount was provided by scholarship donations from the Iron Mining Association, Mining Minnesota, and the Aggregate and Ready Mix Association of Minnesota.

Transportation for the workshop was provided by Southwest Coaches. Two 56 passenger coach buses were used for the field trips and a 48 passenger school bus was used for the Tuesday evening visit to Camden State Park. In addition, a pick-up truck rented from the UMD Natural Resources Research Institute was used to convey supplies to the SMSU and to serve as a chase vehicle during the field trips.

#### Pre-Workshop Set-up - Monday, June 16

Workshop supplies (hard hats, vests, safety glasses, classroom supplies, etc.), field guides, and teacher resources were packed up at the NRRI on Monday morning into a trailer and pick-up truck that was driven to SMSU by Jim Miller and Alex Steiner. Cheryl Sill, Kate Rosok, Alex Steiner, Amy Radakovich, Hannah Friedrich and Jim Miller assisted with the set-up in the mid-afternoon and early evening. They also set out teacher resource materials (tote bags, handouts, posters, maps, mineral hardness kits, fossil kits, jump drives, geology books...) in the auditorium. Some instructors arrived later in the afternoon to prepare their classrooms.

#### Workshop Day 1 (Short Courses) - Tuesday, June 17

The first day of the workshop had a full schedule of activities as shown in Appendix A. Participants began gathering at 7:30 AM in the Science & Math building, where they checked in, picked up name tags, folders filled with information, meal tickets, and took in a continental breakfast in the SMSU food court. We reconvened in the auditorium. After a welcoming and brief overview of the workshop by Jim Miller, participants dispersed among four different 75-minute short courses on a variety of geological topics (Appendix A). After a 15-minute coffee break, a second set of four short course classes on geologic topics were offered. A lunch buffet was served in the SMSU food court. After the lunch, MNDNR Lands and Minerals Director Jess Richards gave a PowerPoint presentation entitled "Minnesota Mineral Resources." Jess Richards used the core theme of science-based decision making to discuss MN mineral resources, MNDNR, and the importance of school trust lands to public education. The talk was very well received. The two afternoon sessions of short courses focused mostly on mineral resources.

For each short course, participants were asked in the survey (Appendix B) why they choose the short course topic. They were also asked to rank the degree to which they agree (strongly agree, agree, are neutral, disagree, strongly disagree) with the following statements:

- the course imparted relevant geoscience content
- the course provide content that could be applied to the classroom
- the instructor was prepared, knowledgeable, and engaging

Scoring the degree of agreement on a scale of 4 (strongly agree) to 0 (strongly disagree); a "GPA" score was calculated for each statement for each course (Tables 1-3). Viewed in this way, statements 1 and 2 on relevant content and applicability to the classroom (Tables 1 & 2) averaged B+ (3.25). Participant's views on the quality of the instructors (Table 3) averaged a score of B+

(3.45).

**Table 1. The short course imparted relevant geoscience content.**

	Course A	Course B	Course C	Course D
<b>Session 1</b>	Jigsaw on Heat -A Lab Activity <i>Kate Rosok</i> <b>3.17</b>	History of Hydrogeology <i>Greg Brick</i> <b>2.63</b>	Glacial Geology of SW Minnesota <i>Carrie Jennings</i> <b>3.68</b>	Crystallography Basics <i>Cheryl Sill</i> <b>3.29</b>
<b>Session 2</b>	Teaching Plate Tectonics <i>Stephen Allard</i> <b>3.41</b>	Ground Water Quality <i>Jim Lundy</i>	The Sioux Quartzite and the Rock Cycle <i>Richard Ojakangas</i> <b>3.41</b>	Rock and Mineral Identification <i>Amy Radakovich</i> <b>3.86</b>
<b>Session 3</b>	Place-based Teaching Approaches <i>Dean Moosavi</i> <b>3.40</b>	Sustainability of SW MN Groundwater <i>Jim deLambert</i> <b>3.46</b>	Aggregate Resources <i>Christina Morrison</i> <b>3.25</b>	Mineral Deposits- How, Where, When and Why Here? <i>Jim Miller</i> <b>3.65</b>
<b>Session 4</b>	Resource Lesson Plan Sharing <i>Marjorie Ostgaard</i> <b>2.82</b>	Protecting Groundwater Instead of Mitigating Mistakes <i>Bruce Olson</i> <b>3.64</b>	Applied Geology: Assessing and Mitigating Geological Risks <i>Leif Johnson</i> <b>3.30</b>	Mineral Uses <i>Ken Reid</i> <b>3.36</b>
				<b>Average GPA – 3.36</b>

**Table 2. The short course provided content that I could apply to my classroom.**

	Course A	Course B	Course C	Course D
<b>Session 1</b>	Jigsaw on Heat -A Lab Activity <i>Kate Rosok</i> <b>3.33</b>	History of Hydrogeology <i>Greg Brick</i> <b>2.25</b>	Glacial Geology of SW Minnesota <i>Carrie Jennings</i> <b>3.19</b>	Crystallography Basics <i>Cheryl Sill</i> <b>3.00</b>
<b>Session 2</b>	Teaching Plate Tectonics <i>Stephen Allard</i> <b>3.41</b>	Ground Water Quality <i>Jim Lundy</i>	The Sioux Quartzite and the Rock Cycle <i>Richard Ojakangas</i> <b>2.69</b>	Rock and Mineral Identification <i>Amy Radakovich</i> <b>3.71</b>
<b>Session 3</b>	Place-based Teaching Approaches <i>Dean Moosavi</i> <b>3.50</b>	Sustainability of SW MN Groundwater <i>Jim deLambert</i> <b>2.85</b>	Aggregate Resources <i>Christina Morrison</i> <b>3.00</b>	Mineral Deposits- How, Where, When and Why Here? <i>Jim Miller</i> <b>3.29</b>
<b>Session 4</b>	Resource Lesson Plan Sharing <i>Marjorie Ostgaard</i> <b>2.91</b>	Protecting Groundwater Instead of Mitigating Mistakes <i>Bruce Olson</i> <b>3.45</b>	Applied Geology: Assessing and Mitigating Geological Risks <i>Leif Johnson</i> <b>3.13</b>	Mineral Uses <i>Ken Reid</i> <b>3.29</b>

**Average GPA = 3.13**

**Table 3. The instructor was prepared, knowledgeable, and engaging.**

	Course A	Course B	Course C	Course D
<b>Session 1</b>	Jigsaw on Heat -A Lab Activity <i>Kate Rosok</i> <b>3.67</b>	History of Hydrogeology <i>Greg Brick</i> <b>2.63</b>	Glacial Geology of SW Minnesota <i>Carrie Jennings</i> <b>3.77</b>	Crystallography Basics <i>Cheryl Sill</i> <b>3.43</b>
<b>Session 2</b>	Teaching Plate Tectonics <i>Stephen Allard</i> <b>3.59</b>	Ground Water Quality <i>Jim Lundy</i>	The Sioux Quartzite and the Rock Cycle <i>Richard Ojakangas</i> <b>3.38</b>	Rock and Mineral Identification <i>Amy Radakovich</i> <b>4.00</b>
<b>Session 3</b>	Place-based Teaching Approaches <i>Dean Moosavi</i> <b>3.70</b>	Sustainability of SW MN Groundwater <i>Jim deLambert</i> <b>3.23</b>	Aggregate Resources <i>Christina Morrison</i> <b>3.75</b>	Mineral Deposits- How, Where, When and Why Here? <i>Jim Miller</i> <b>3.74</b>
<b>Session 4</b>	Resource Lesson Plan Sharing <i>Marjorie Ostgaard</i> <b>2.55</b>	Protecting Groundwater Instead of Mitigating Mistakes <i>Bruce Olson</i> <b>3.64</b>	Applied Geology: Assessing and Mitigating Geological Risks <i>Leif Johnson</i> <b>3.30</b>	Mineral Uses <i>Ken Reid</i> <b>3.43</b>

**Average GPA = 3.45**

Participants were also asked to make general comments on the short courses (Appendix C).

These rankings and additional comments have been delivered to the individual instructors, which they can use to improve their presentations should they chose to offer them again.

Following the afternoon short course sessions we reconvened in the auditorium where teachers filled MMEW-logoed tote bags with resources. In addition to a variety of posters, fliers and magazines, 2GB jump drives loaded with various teacher resources and lesson plan ideas which replaced the resource binders. Also distributed were Minnesota fossil kits and geological dictionaries.

A survey of participants' satisfaction with the resources, filled out the next day, indicated significant approval of the distributed resources (Appendix C). Participants also provided many other ideas for resources that might be offered in the future. One common suggestion made by several participants was to offer MMEW T-shirts for an additional cost. At this time participants were informed about the two workshop evaluation surveys asked to start filling out the first survey. The survey was divided into two parts; the first part evaluated the short courses and general demographic information. The second survey assessed the two days of field trips.

Next, Hannah Friedrich gave a safety talk before Carrie Jennings and Dave Southwick gave a preview of the field trip. The preview consisted of a logistical overview and a brief PowerPoint presentation introducing the bedrock geology and quaternary geology of southwestern MN. This presentation and copies of other PowerPoint presentations shown during the short courses have been posted on the MMEW website: [www.d.umn.edu/prc/MMEW/2014/MMEW/2014.archive.html](http://www.d.umn.edu/prc/MMEW/2014/MMEW/2014.archive.html))

A majority of the workshop participants attended the evening picnic and tour at Camden State Park. Survey replies indicate that the participants felt the evening activity added value to their MMEW experience. Attendees enjoyed the picnic lunch but they mentioned they would prefer less wasteful packaging and more of a BBQ type meal next time.

#### Workshop Day 2 (Field Trip 1) - Wednesday, June 18

The focus of this trip was to get an understanding of the origin and geologic history of the complex Archean metamorphic and igneous rocks that crop out along the MRV as well as the quaternary geologic history in the MRV and relate these rock types to mining purposes.

We started the day at the Morton Scientific and Natural Area. Dave Southwick laid the framework of regional bedrock chronology and structure. The next stop was road cuts of the Sacred Heart Granite which has a history of being quarried for dimension stone. At the Upper Sioux Agency State Park we had a picnic lunch and then took a short hike to view a steep river cut that exposed 600,000 years of glacial sediment.

After stopping at an excellent road cut exposure of metamorphosed basaltic and sedimentary rocks near Memorial Park in Granite Falls, we stopped at the Martin-Marietta Granite Falls Quarry. One of their staff graciously offered to lead us on a tour of the Granite Falls Quarry and answer our questions. From a safe distance we watched the operation. Another stop was to look at the exposures at Ramsey Falls Park in Redwood Falls, Yellow Medicine Shear Zone between the Morton and Montevideo Blocks. At the end of the day, half the group chose to visit an optional site at St. Leo, while the other bus returned to campus.

From the surveys (Appendix B), the attendees most enjoyed the visits to both the Morton SNA stop and the Granite Falls Quarry operation.

#### Workshop Day 3 (Field Trip 2) - Thursday, June 19

The main objectives of this day were to view significant glacial landforms and view the Sioux

Quartzite. At Lake Benton Carrie Jennings lead the discussion about the Des Moines lobe mechanics, the last advance resulting in the Bemis Moraine, Lake Benton tunnel valley, and wind turbines along the moraine. Next we drove to the Pipestone National Monument (PNM) where we broke into smaller groups and explored the outcrops. We had lunch at PNM. Participants left with a small sample of the Sioux Quartzite. The last stop at a gravel pit was canceled due to poor road conditions created by the recent flooding events. Participants expressed great enthusiasm for visiting PNM and seeing the Sioux Quartzite.

#### Continuing Education and College Credits

All workshop attendees who completed the surveys were emailed a certificate of participation, which stated the total contact hours for the workshop - 23. Only five people did not submit the surveys. The short course accounted for 7 hours, 1 hour for the evening tour at Camden State Park and 15 hours for the field trip experiences. These certificates can be used by teachers to receive continuing education credits for the teaching licenses. This year college credits through UMD were cost prohibitive and therefore were not offered. At least two of the teachers canceled their enrollment due to the lack of credits available this year. Additionally, 45% of participants said they would like to see the credits offered again and 15% said maybe. We will look into offering credits again next year.

#### Budget

Total expenses for the 2014 MMEW (excluding lodging scholarship expenses) were **\$19,564** which was \$2400 below anticipated costs (see Appendix B for financial summary). There were greater than expected food costs and unplanned costs for facilities but much lower expenses for travel reimbursement. With a commitment by the Iron Mining Association of MN, Mining Minnesota, and Aggregate and Ready-Mix Association of Minnesota to jointly pay for up to \$4000 for lodging scholarship, the total scholarship cost of \$1470 came in well below the estimated maximum. Splitting this cost three ways, each association contributed \$490 for the scholarship.

#### Future Workshops

The evaluation survey also asked participants about factors that would affect their attendance at future MMEW meetings. Here are some of the highlights of the survey:

- 1) When asked to identify two important factors in choosing a workshop location, 97% of respondents chose "interesting geology" and 47% chose "involvement of local expertise." Affordable accommodations (20%), scenic area (17%) and local mining activity (13%) were other contributing factors.
- 2) When asked what part of the state to hold a future MMEW, the top choice was "new place" (20%), followed by Duluth/North Shore (17%), a tie between western MN and northwestern MN (both 15%), greater Twin Cities (13%), northeast/northern MN (10%), southeastern MN (7%) and Mankato/southwestern MN (3%).
- 3) 95% of participants agreed or strongly agreed with statement that the 3-day format (a one-day short course and two-day field trip structure) is the right length for this type of workshop.
- 4) 69% of respondents strongly agreed that a \$40 registration fee is reasonable and 70% indicated that their schools did not contribute to the cost of their attendance.
- 5) The offer of discounted lodging influenced 68% of respondents' decisions to attend the workshop.

- 6) In asking how participants prefer to be notified about the workshop, an overwhelming majority of participants said email (93%). The others mentioned the MMEW website, the MN Earth Science Teachers Association flier and social media.

### Summary

With the assistance of dedicated and talented group of instructors, local field trip leaders and meeting volunteer, the 2014 MMEW was a success on many levels. Still, thanks again to teachers not being shy about voicing their opinions, we learned about many things that we can do better going forward. In no particular order of importance, these include:

- Lab activities and hands on elements in short courses is requested. Would have been nice to have a bit more info and activities which could be applicable and able to be implemented in a classroom
- Make sure we have audio equipment for the field portion of the workshop
- Meet in the evenings with instructors and review new information
- Strong feedback on the limited nutritious food choices also requests for more sensitivity to food allergies.
- T-shirts, “walking advertisements”
- More overview of the field trip within the guide book such as, “provide a blown-up overview map with roads, towns, and BASIC geological boundaries of the area we are traversing. Draw a line to each potential stop labeled with the page number for information about that stop.” “I would have liked written outlines of the (field) stops, beyond the field guide, as it is often difficult to hear with the wind etc. in the field.”
- “I just love this workshop. Some years I think I didn’t gain very much and then, surprise, it begins to fit together. I love learning and you have made it so wonderful! Thank you so much!”
- “Very organized and everyone is always prepared. There are topnotch geologists involved in this program.”
- “Some of the short courses gave information that was not useable in my middle school classroom. Good info for me, but too advanced for my students.”
- “Format is fantastic! Another great workshop- Thanks!”
- “I think you have given us an excellent selection of resources”

Respectfully submitted,



Hannah Friedrich  
2014 MMEW Co-Chair



Jim Miller  
2014 MMEW Co-Chair

### Appendices:

- A. Schedule, Participants, Instructors, Volunteers, Field Trip Leaders, Sponsors
- B. Financial Summary
- C. Participant Survey