CORE Kids

Program Overview, Metrics and Evaluations

2014-2015

Report Prepared by Peter Voice

CoreKids Overview
And
2014-2015 Events List

CoreKids Program at the Michigan Geological Repository for Research and Education/Michigan Geological Survey

Prepared by Dr. Peter Voice, Director of K-12 Outreach, Michigan Geological Survey

Our Mission: To increase awareness and understanding of Earth, its processes and its natural resources among Michigan's students, teachers and citizenry. We utilize the unique geological resources of Western Michigan University Geoscience Department's Michigan Geological Repository for Research and Education (MGRRE). CoreKids educators carry earth science literacy, science literacy and citizenship messages from university faculty, our sponsors and our partners to the K-12 community and to the public. The program utilizes a mixture of presentations and hands-on activities to promote the understanding of earth science as well as to increase interest in the STEM (Science, Technology, Engineering and Math) fields especially the earth sciences among K-12 students. The majority of our contacts with southern Michigan students have been with higher grade level students who are making decisions about their future and we hope that we can influence some of these students into pursuing careers in the earth sciences. A basic tenet of the organization is to provide programming to schools and non-profit organizations without charge.

Our Current Funding: We thank the DTE Energy foundation for their generous support for the 2012-2014 period. We also thank the American Petroleum Institute for generous support for the development of a module focused on shale energy resources. The Western Michigan University Interdisciplinary Research Fund has also generously provided funds as initial support for the development of an online MGRRE Education Portal.

We are currently seeking additional funding to support the future activities of the CoreKids Program. We are working on a revision of the MGRRE Portal proposal and will be submitting it in the future to various grant-funding organizations and foundations.

Our Partnerships:

The Cranbrook Institute of Science

The Kalamazoo Geological and Mineral Society

The Michigan Department of Environmental Quality

The Michigan Aggregate Association

The Michigan Basin Geological Society

The Kalamazoo Air Zoo

The University of Michigan Museum of Natural History

The Michigan Mineralogical Society

The Branch County District Library

We also have the support and partnership of several Teachers associations: The Michigan Earth Science Teachers Association, the Michigan Science Teachers Association, the Michigan Alliance for Environmental and Outdoor Educators and the Metropolitan Detroit Science Teachers Association.

Future Proposals:

1. Develop a pilot MGS-MGRRE online education portal focused exclusively on Michigan energy issues. This portal would develop activities using authentic datasets to guide students through the process by which geologists go from exploration to oil and gas production. As part of portal development, we will engage professional Michigan geologists to work with teachers directly, both in the field and in the classroom. These could also lay the foundation for future mentoring relationships between sponsoring companies and participating schools.
2. Develop workshops and continuing education short courses for Michigan teachers. We would use the well cores and samples and production records at MGRRE and allow the teachers to lay their hands on the actual rocks that yield these natural resources such as oil, gas, minerals, metals, and groundwater. This would also allow us to build a stronger collaboration with local teachers associations (Michigan Earth Science Teachers Association, Michigan Science Teachers Association) and promote earth science clubs at their schools.
3. Develop additional classroom modules. Several teachers that we have worked with in the past are excited to learn that we now present new modules about natural hazards and shale energy. As a result they are inviting us into their classrooms for multiple events. A wider variety of modules will not only interest more teachers, they will invite us back for more events, and more teachers and students will gain a better understanding of our natural resources and the need to responsibly manage them.
4. Develop an Open House Event twice a year at the MGRRE Facility as a resource for local home school associations and youth groups. A series of hands-on activities are planned centered around Michigan Geology, Michigan Natural Resources, Energy and Fossils. We have already done a pilot version of this idea with the Kalamazoo Geological and Mineral Society and their youth group and it was very well received.
5. Create a traveling classroom to bring these modules to schools, educational meetings and conferences, parks, events, and neighborhood organizations where students and the public can participate in learning games and displays which show people of where natural resources come from, how they are used in their daily lives, and how important responsible management of these critical resources makes Michigan a better place to live in and an example for others to follow. The vehicle used for this endeavor would be labeled with the logo(s) of the financial backer.
6. Expand our impact by developing partnerships with other Michigan Universities and Colleges. We are currently building a partnership with Delta College to develop the first CoreKids Satellite. The primary CoreKids program would still be at Western Michigan University, but our satellites would be able to widen the geographic area that we could potentially reach. The current nature of the partnership would be to share physical resources such as module materials, rock and mineral samples, as well as contacts with area teachers in the region specified for the CoreKids Satellite.

CoreKids Frequently Asked Questions

1. Which regions of the state of Michigan does CoreKids go to?

We cover all of the southern Lower Peninsula of Michigan including the Kalamazoo, Grand Rapids, Lansing and Detroit Metro regions.

2. What is the MGRRE facility?

MGRRE is the Michigan Geological Repository for Research and Education. It is the premier collection of Lower Peninsula Geologic data and archives half a million feet of core rock data. We are part of the Michigan Geological Survey.

3. How many students can your Educators work with during a school trip or MGRRE tour?

Our modules are designed for groups of 30 students. We bring into the classroom all materials that we use including mineral samples and hands-on activities. We encourage schools with multiple sections of the same grade level at each period to schedule more than 1 day of CoreKids visits – i.e. one day for each 6^{th} grade teacher's sections.

At MGRRE we are limited to groups of 25-30 at a time. We have a classroom at the facility that we use for brief presentations and hands-on activities.

4. How can we book a CoreKids Event?

Contact Dr. Peter Voice (peter.voice@wmich.edu or 269-387-8696 or 269-387-5446) to schedule events. He will try to accommodate your group.

5. What modules do you take into the classroom?

We currently have six modules: Michigan Geologic History; Hydrogeology; Shale Energy and Hydraulic Fracking; Michigan Fossils, Natural Hazards and The Environment and Climate Change. The Natural Hazards module is designed as three submodules: Volcanoes; Earthquakes; and Impact Craters. Each module is designed for a 50 minute session and includes a brief presentation and hands-on activities. Michigan Department of Education Grade Level Content Standards have been described for each module and are available on request.

6. Can I schedule more than one CoreKids event for my school or group with different modules?

If we have room in our schedule, we will gladly visit your school or group multiple times during the year presenting different modules.

7. Is there a charge for CoreKids Events?

We are currently supported by generous grants from the DTE Energy Foundation. We are seeking funding for 2014-2015 from multiple sources. Our policy is to provide our content free of charge for school visits and MGRRE tours. For MGRRE tours, we cannot cover the cost of transportation to bring your group to the MGRRE facility. We do accept donations to support CoreKids activities.

8. What if my school has a snow day or other cancellation the day a CoreKids event is scheduled?

We will try our best to reschedule the CoreKids event.

CoreKids Events July 1, 2014 to June 30, 2015

(50 events – School visits, MGRRE tours and Larger Events with Allied Partners and 1 Conferences/Teachers Workshop)

July 3rd – University of Michigan Museum of Natural History Summer Camp

July 8th – Kalamazoo Air Zoo Eco Explorers Camp – on main campus [Michigan Geologic Resources and the Sandbox]

July 9th – Coldwater Branch, Branch Co. District Library [Natural Hazards: Volcanoes Module]

July 10th – Bronson Branch, Branch Co. District Library [Natural Hazards: Volcanoes Module]

July 10th Sherwood Branch, Branch Co. District Library [Natural Hazards: Volcanoes Module]

July 11th – Union branch, Branch Co. District Library [Natural Hazards: Earthquakes Module]

July 16th – Kalamazoo Air Zoo Eco Explorers Camp – at Air Zoo

July 17th – Coldwater Branch, Branch Co. District Library [Natural Hazards: Earthquakes Module]

August 6th – Hydrogeology Field Camp MGRRE Tour

Aug. 12th- University of Michigan Museum of Natural History Summer Camp

Aug. 14th –Aug. 16th – Michigan Earth Science Teachers Association Annual Meeting

Sept. 11th – M.B.G.S. Monthly meeting at MGRRE.

Sept. 12th – The Cranbrook Institute of Science Rouge River Water Festival

Oct. 10-12. Michigan Mineralogical Society Annual Show

Oct. 14: Classroom visit by K.G.M.S. President using CoreKids Core Pumps; Star Elementary School, Plainwell MI

Oct. 18: MSU/MESTA joint National Fossil Day Event

Oct. 23. Gobles Elementary School Science/Job Fair

Oct. 24th – school day visit, Central Michigan 49th annual Rock Show

Nov. 4. K.G.M.S. Club Meeting at MGRRE

Nov. 7th – Friendship Village, Bronson

Nov. 7-8. Gull Lake Community Schools Foundation – Sparks Series, Science and Engineering Fair.

Nov. 19: U-M, Museum of Natural History Geology Day

Nov. 21st – Grosse Pointe High School Fossil Day

Dec. 5th – Greater Heights Academy [MI Geologic History Module]

Dec. 5th – Southwood Elementary (Kentwood, MI) [MI Geologic History Module with emphasis on Fossils]

Dec. 10th – Western Middle School (Fossil Module)

Jan. 5th and 6th – Vicksburg Middle School (6th grade -- Fossil Module)

Jan. 12th and 16th – Gull Lake Middle School (6-7th grade – Module TBD)

Jan. 13th and 14th – Vicksburg Middle School (8th grade – Earthquakes Module)

Jan. 15th – Plainwell Middle School (6th grade – MGRRE tour + modified Michigan Geologic History Module)

Jan. 17 – WMU STEM-ulating career day

Jan. 21st -- EF Rittmueller Middle School (6th grade – MI Geologic History, 7th grade – Climate Change)

Jan. 28th – Western Middle School (Earthquake Module)

Feb. 3rd – Morley Stanwood Middle School (6th grade – MI Geologic History)

Feb. 9th – Walden Green Montessori School (Middle School – MI Geological History)

Feb. 12-13th – Berkshire Middle School

Feb. 12th – STEM Night, Southwood Elementary School

Feb. 19th – Discover Elementary School (Kentwood – MI Geological History Module)

Feb. 20th and 27th – Gull Lake Middle School (Earthquakes Module)

March 4th – Washington Writers Academy Family Literacy Night (modified MI Geologic History Module)

March 17th – U-M, Museum of Natural History Geology Day

March 18th - U-M, Museum of Natural History Geology Day

March 18th – North Hill Elementary, Rochester, MI (MI Fossils Module)

March 18th – Mattawan Middle School (modified Michigan Geologic History Module)

March 23rd and 24th – Western Middle School (Hydrogeology Module)

March 24th – Cub Scout Troop (MGRRE tour and Michigan Geologic History Module)

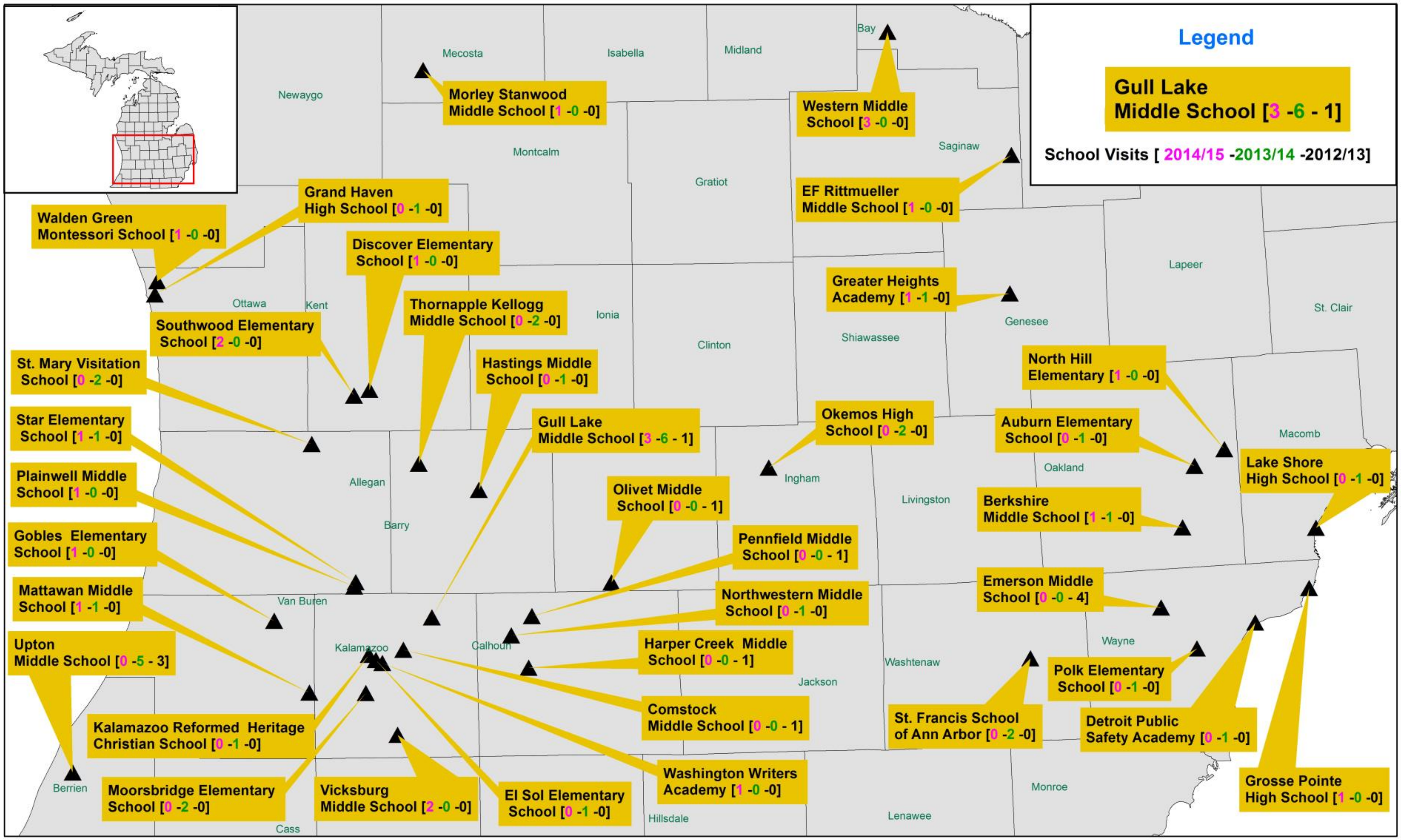
Apr. 22nd – DEQ Earth Day Event

May 1st -3rd – KGMS Annual Show.

May 6th – U of M Museum of Natural History (MI Geologic History Module) June 1st or 2nd – Moorsbridge Elementary School (modified Michigan Geologic History.

June 10th – North Hill Elementary School, Rochester, MI (MI Geological History Module)

Distribution of Scheduled School Visits and MGRRE Tours



Letters of Support

CRANBROOK INSTITUTE OF SCIENCE

39221 Woodward Ave.
Mail Correspondence to:
P.O. Box 801
Bloomfield Hills
Michigan 48303.0801
Ph 248.645.3139
Fx 248.645.3050

April 21, 2014

To whom it may concern:

I am writing this letter in support of the CoreKids K-12 Earth Science Outreach Program. Cranbrook Institute of Science partners with them to provide outstanding learning experiences that supplement and extend learning beyond the classroom.

Coordinated through the Michigan Geological Repository for Research and Education (MGRRE), Core Kids brings an important collection of rocks to public viewing and understanding. Their collection includes thousands of bedrock samples not found anywhere else, and most unique to Michigan. It is truly a one-of a kind storehouse of valuable geological information.

CoreKids does an outstanding job of relating Earth Science concepts to kids and families with fun, engaging activities and demonstrations that use MGRRE samples. These are impactful and memorable experiences for children to widen their knowledge and perspective on how geology relates to our lives and economy.

I have personally witnessed the excellence in interpretation and materials through numerous events: including water festivals and museum fairs. They inspire thousands of students each year about Earth Science and Natural Resources management. This education plays a significant role in shaping the knowledge and understanding of future citizens to build a sustainable society. I look forward to many years of partnership with the CoreKids K-12 Earth Science Outreach Program. Please feel free to contact me if you have any questions. I can be reached by phone at 248-645-3223 or by email at lappel@cranbrook.edu.

Sincerely,

L. Appel

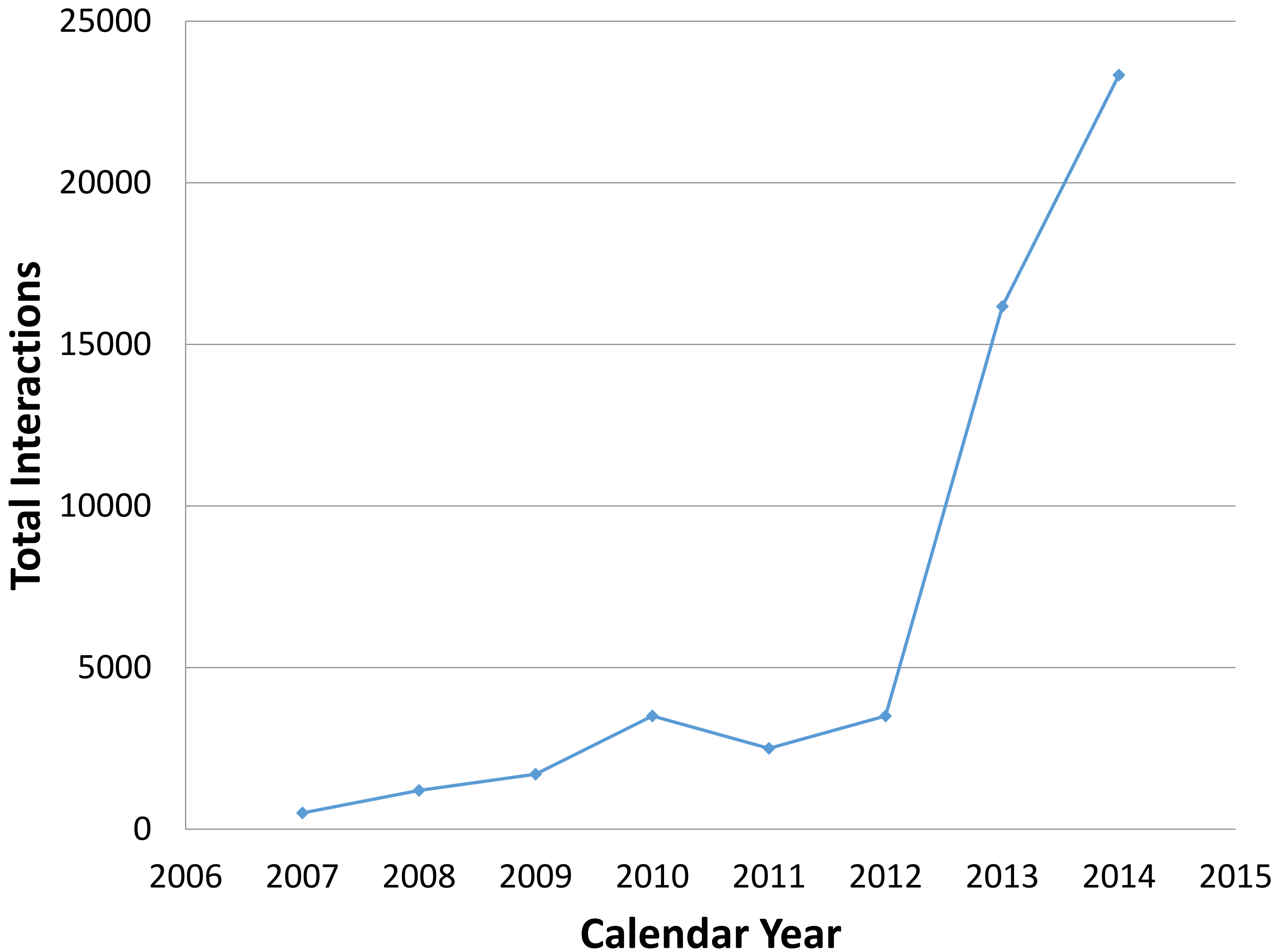
Lisa Appel
Watershed Education Coordinator
Cranbrook Institute of Science

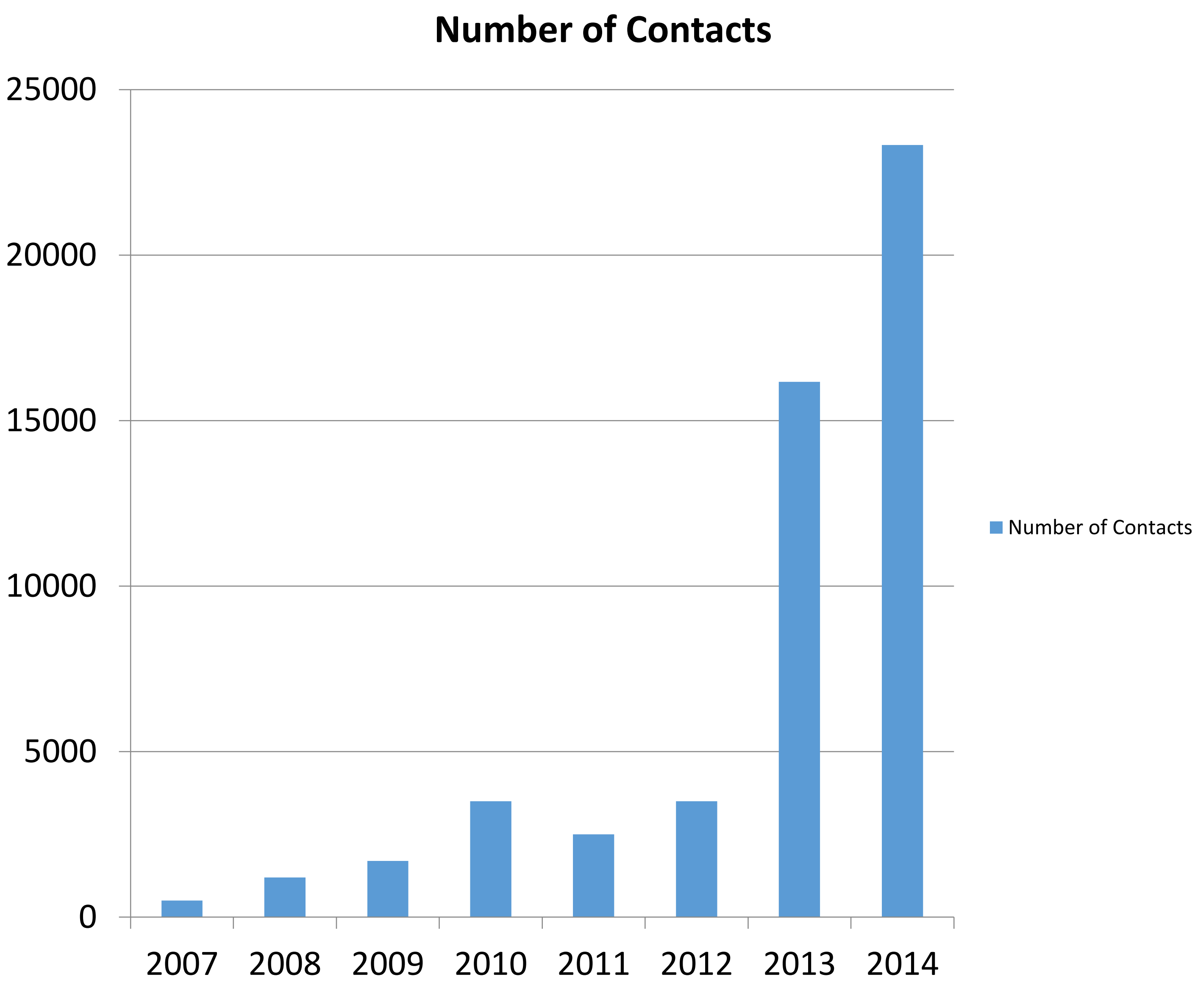
CORE Kids

Program Metrics

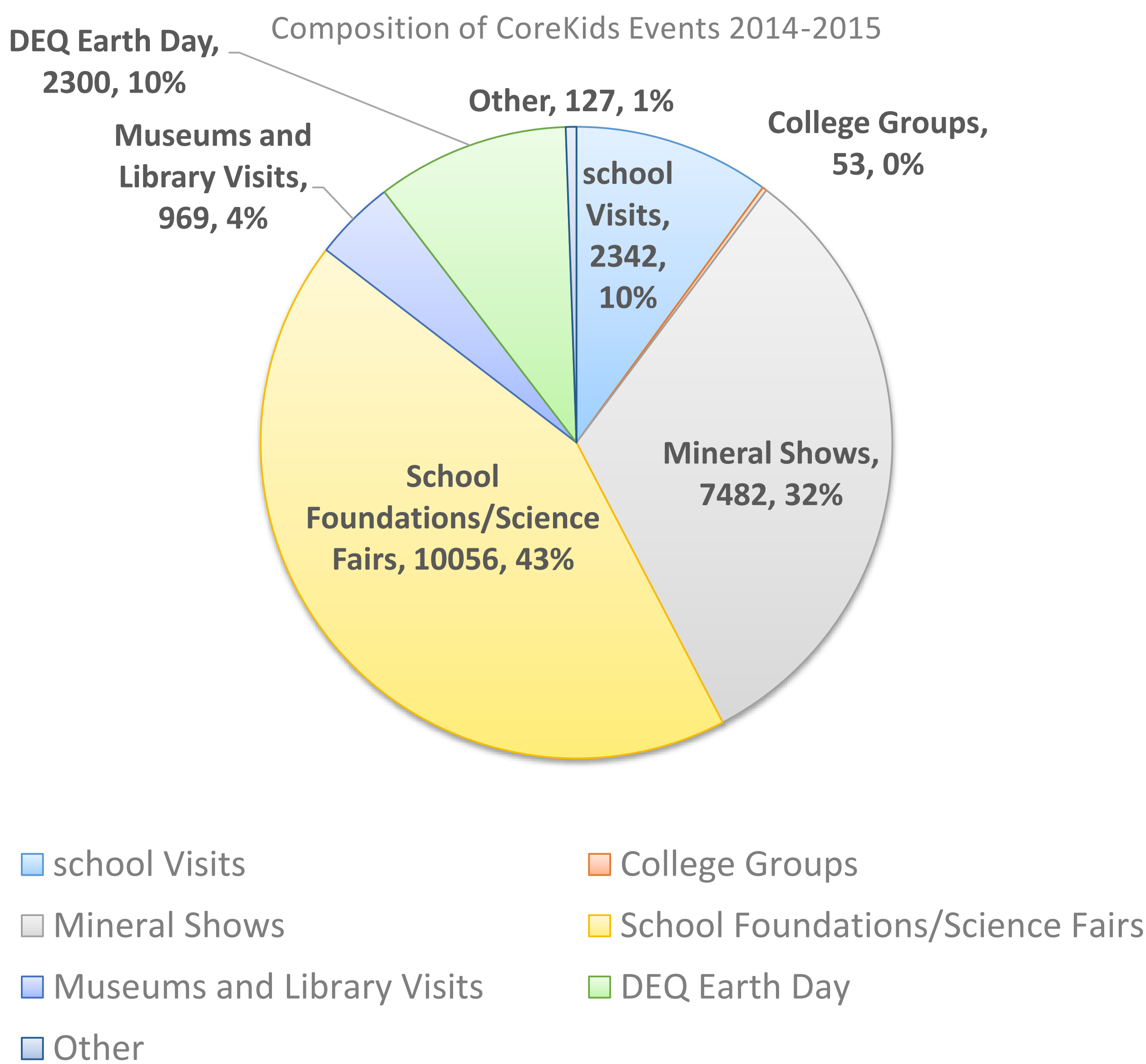
Current Totals (July 1, 2014 to July 1, 2015)

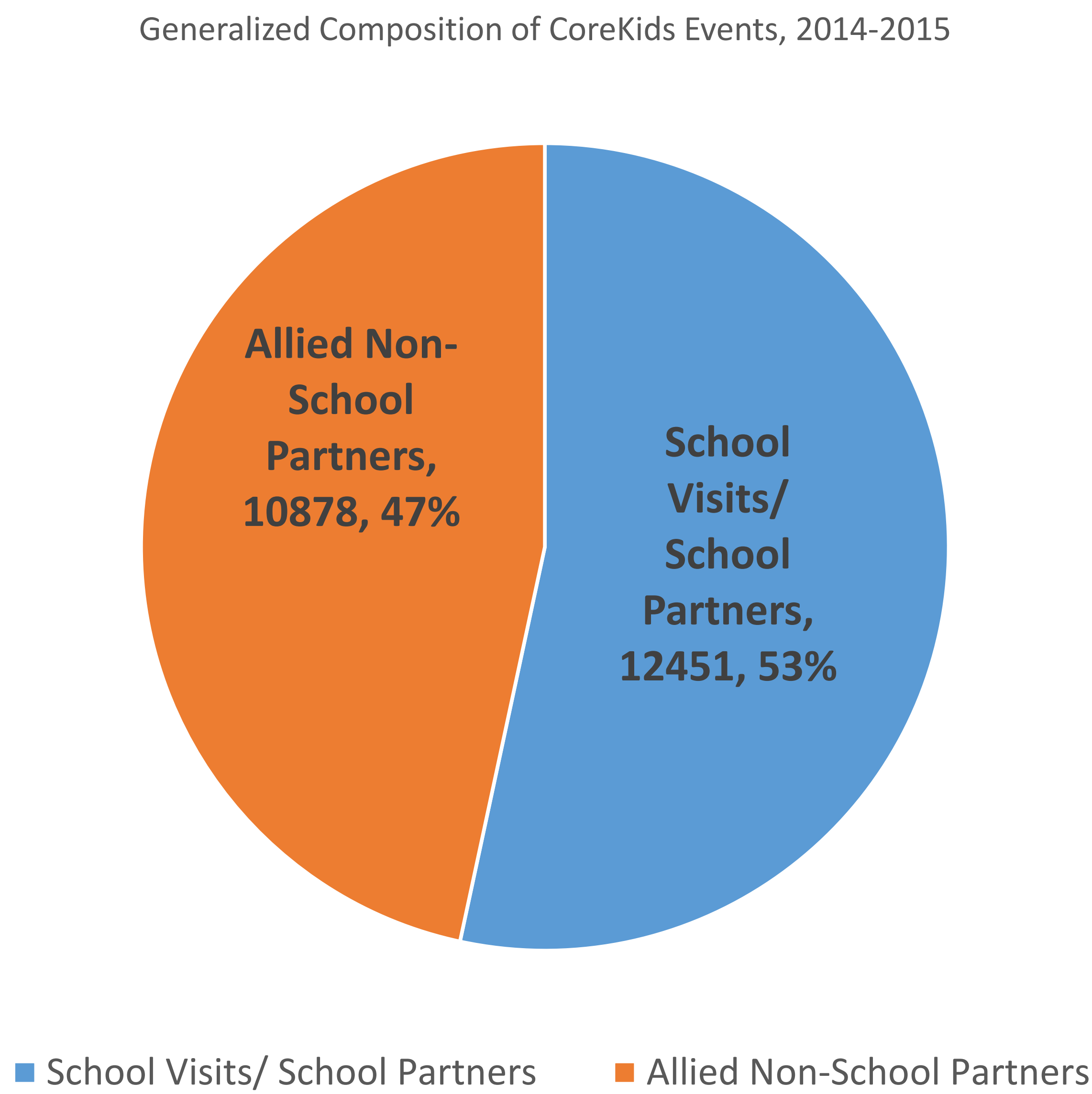
Scheduled School Visits	**2342**
Branch Co. Library System	**234**
U of M Museum of Natural History	**602**
Kalamazoo Air Zoo	**25**
College Groups	**53**
MESTA Conference	**37**
MBGS Sept. 11 meeting	**50**
Cranbrook Institute of Science Rouge River Water Festival	**108**
MMS Annual Show (School Day)	**2454**
MSU National Fossil Day [note waiting on metrics information – value approximate]	**400**
Central Michigan Annual Show	**979**
KGMS Meeting	**43**
WMU Foundation Event Bronson	**20**
Gull Lake Sparks Series Event [note waiting on metrics information – value approximate]	**9000**
Grosse Point North Fossil Day	**200**
WMU STEM-ulating Career Day	**56**
Southwood Elementary Science Fair	**400**
Other	**20**
DEQ Earth Day	**2300**
KGMS Annual Show	**4006**
Total	**23,329**


25000
20000
15000
10000
5000
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Total Interactions
Calendar Year



Number of Contacts
25000
20000
15000
10000
5000
0
2007
2008
2009
2010
2011
2012
2013
2014
Number of Contacts


Composition of CoreKids Events 2014-2015
DEQ Earth Day, 2300, 10%
Other, 127, 1%
College Groups, 53, 0%
Museums and Library Visits, 969, 4%
school Visits, 2342, 10%
Mineral Shows, 7482, 32%
School Foundations/Science Fairs, 10056, 43%
school Visits
College Groups
Mineral Shows
School Foundations/Science Fairs
Museums and Library Visits
DEQ Earth Day
Other


Generalized Composition of CoreKids Events, 2014-2015
Allied Non-School Partners, 10878, 47%
School Visits/ School Partners, 12451, 53%
School Visits/ School Partners
Allied Non-School Partners

CORE Kids

Evaluation Forms Metrics

Date: ___________ School:____Grade Level:_____________

District:____Total # of Students:______________

Teacher:__________**Sample Copy**_________________Office Phone:______________________________

Email:____

Presenter:___________________________Module:____

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	2	3	4	5
2. This activity:					
Was Enjoyable	1	2	3	4	5
Was Educational	1	2	3	4	5
Met Expectations	1	2	3	4	5
Was Too Difficult for Students	1	2	3	4	5
Had Clear Instructions	1	2	3	4	5
Had Clear Purpose	1	2	3	4	5
Improved Understanding	1	2	3	4	5
Presenter Was Knowledgeable	1	2	3	4	5
Presenter Was Organized	1	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

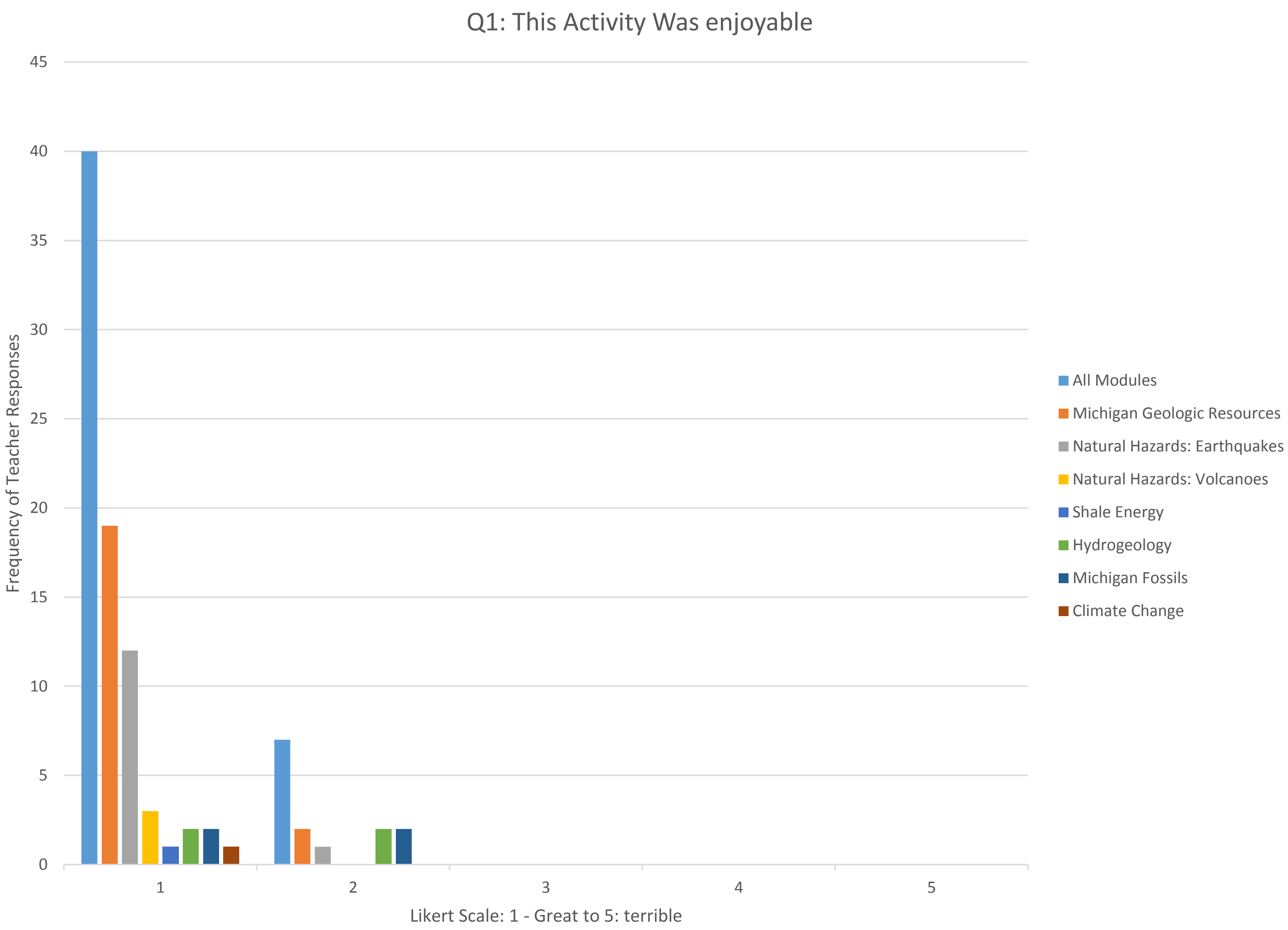
4. What was the least favorite part of this activity?

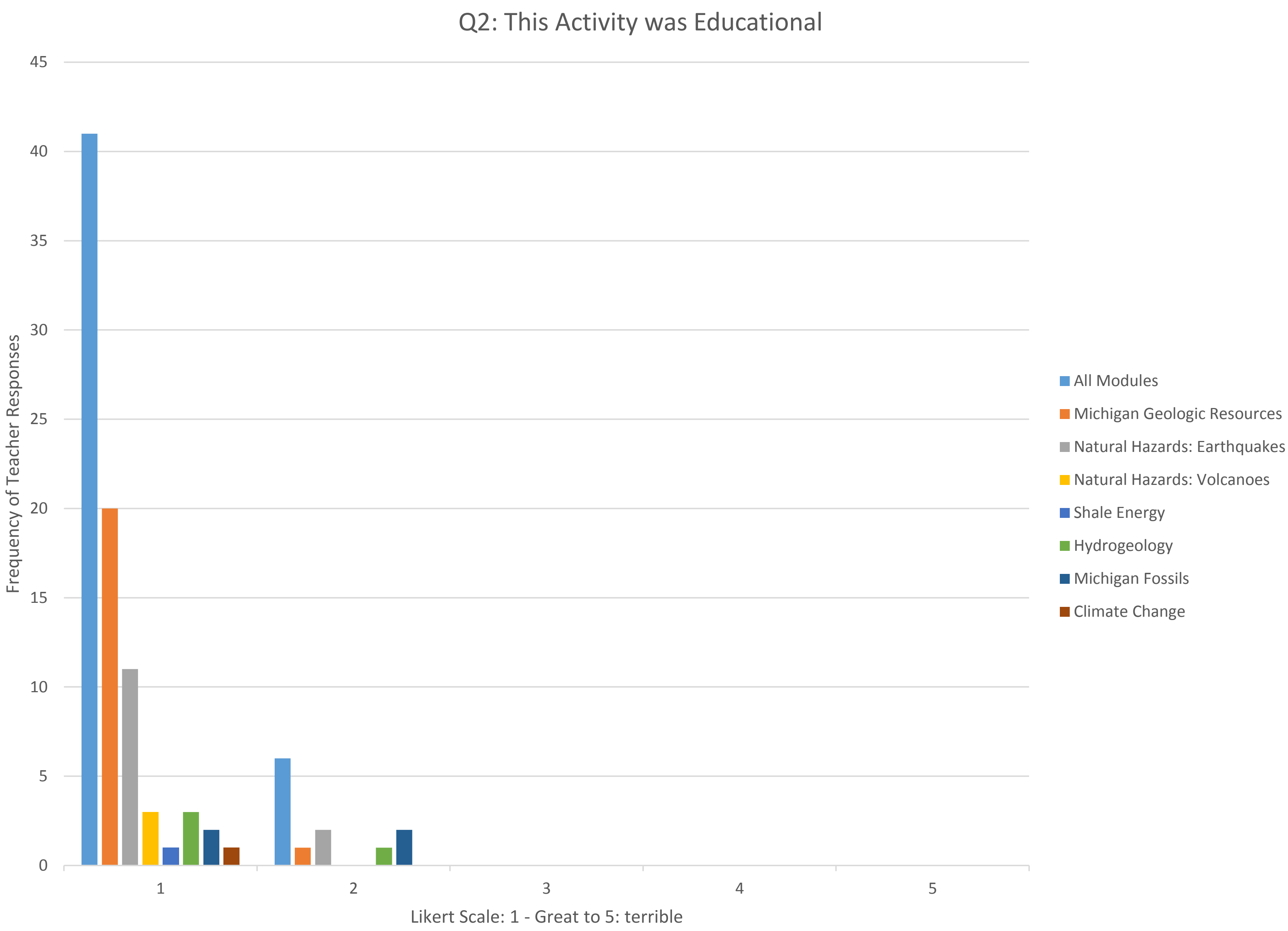
5. How could this activity be improved?

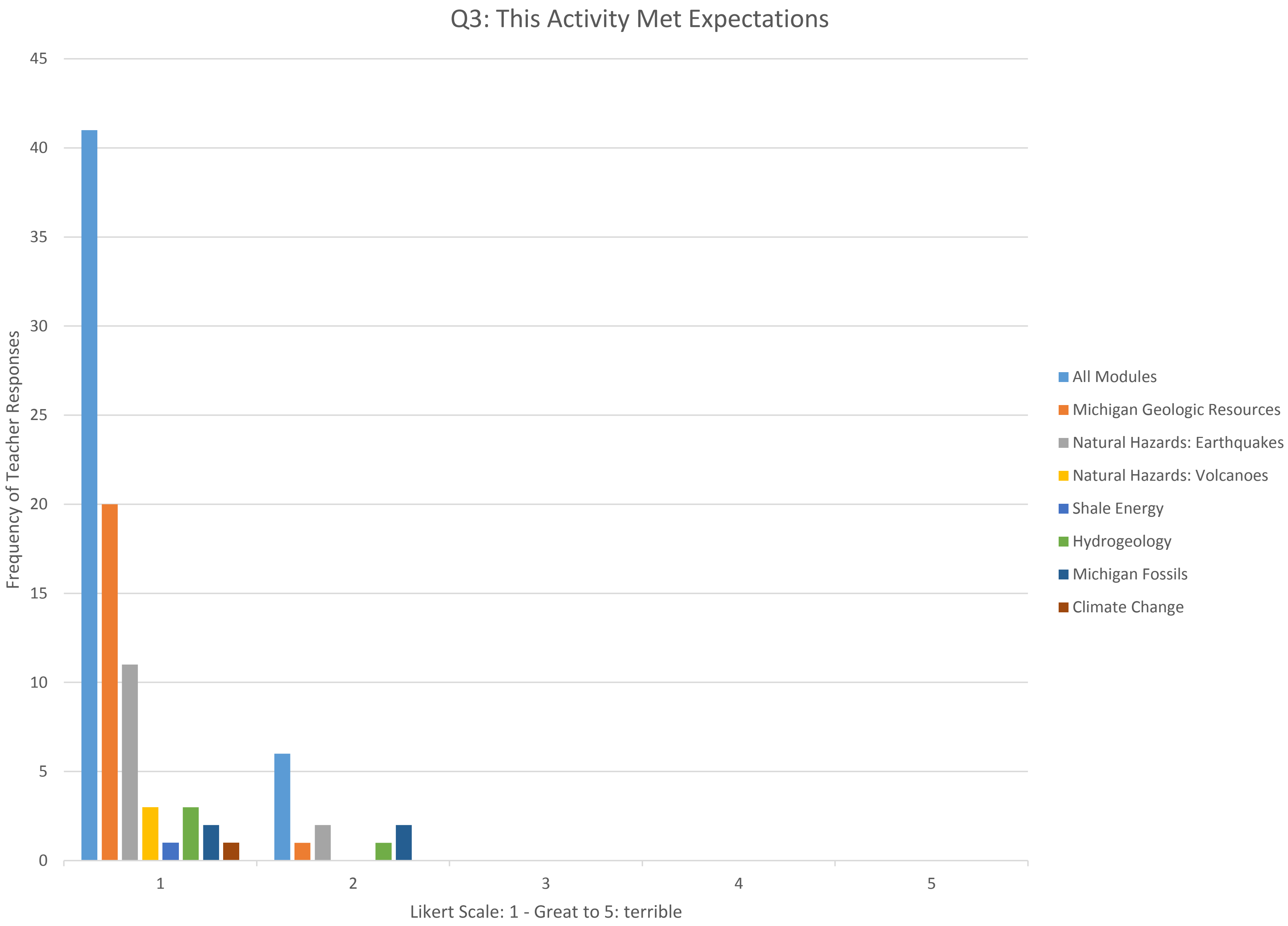
6. Do you feel this module meets Michigan State Science Standards?

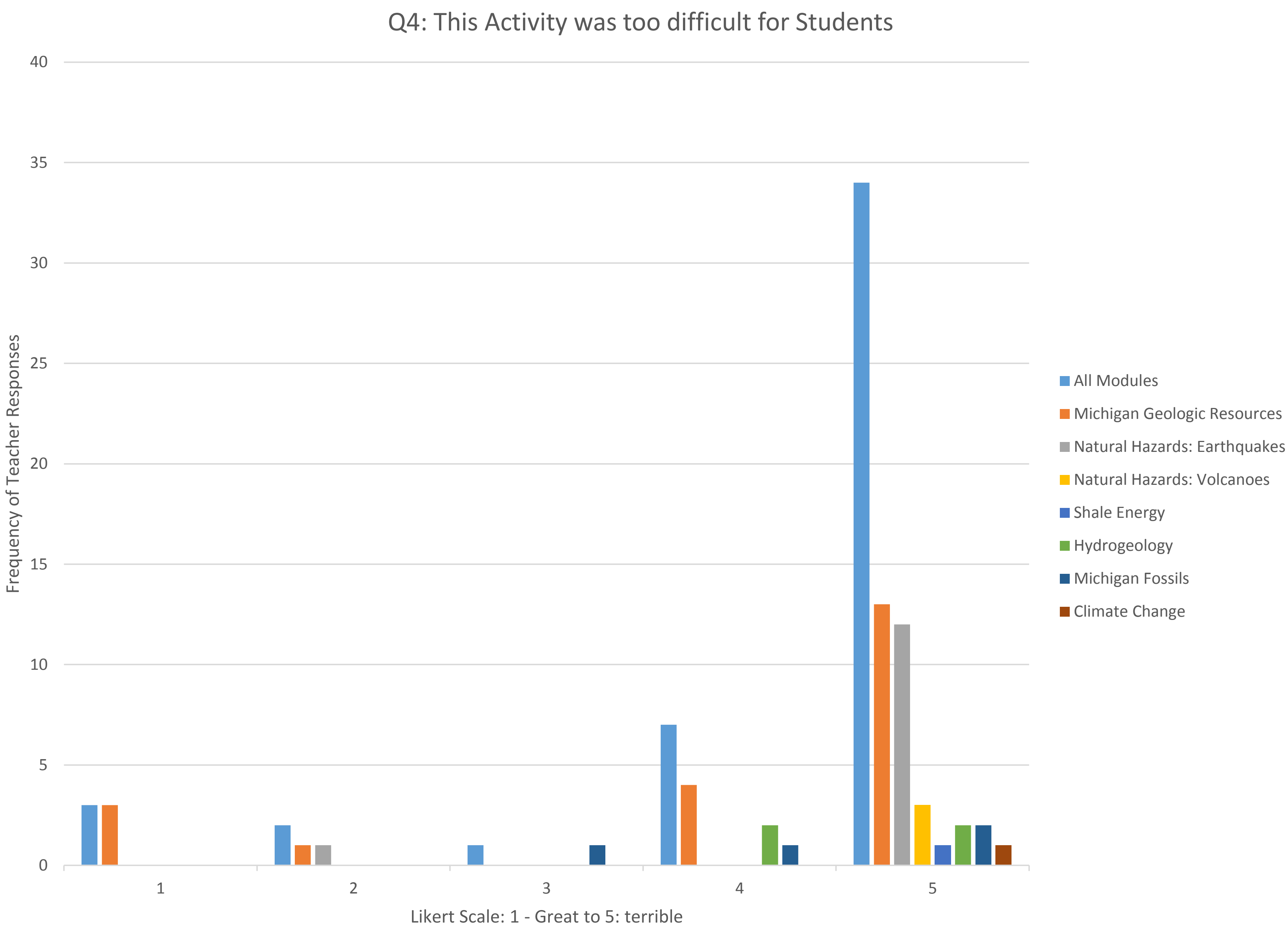
7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

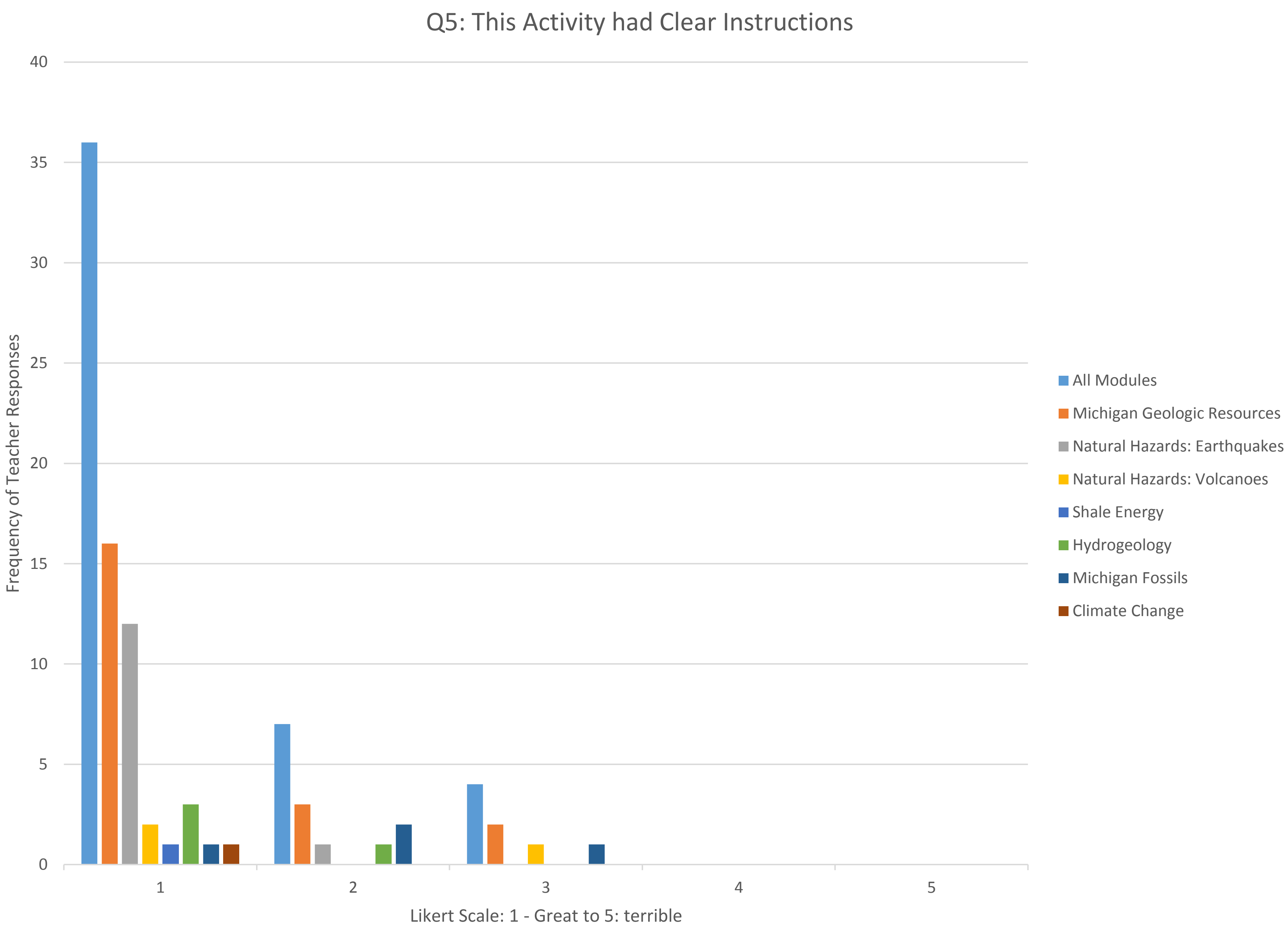
8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

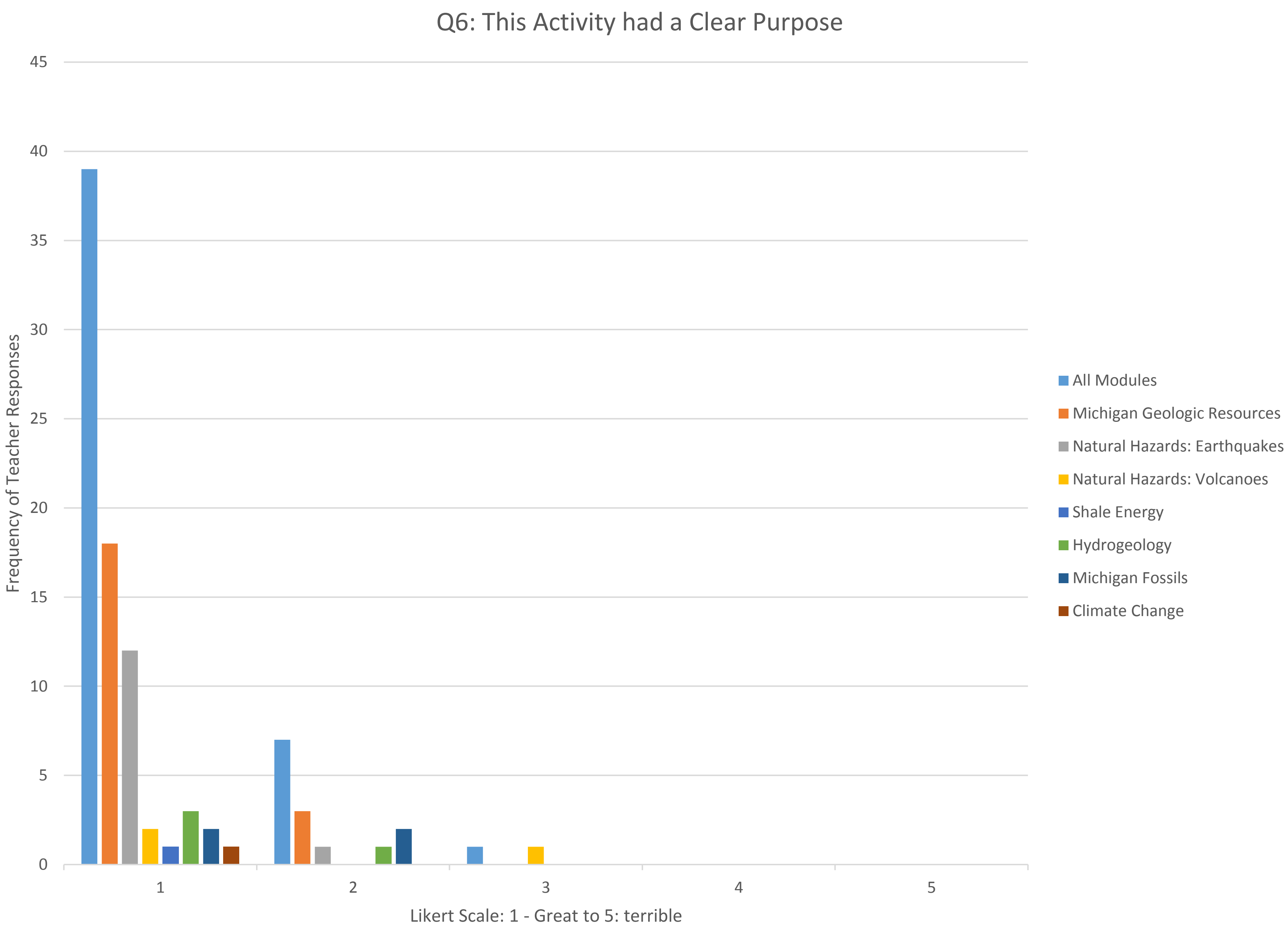

Q1: This Activity Was enjoyable
Frequency of Teacher Responses
0
5
10
15
20
25
30
35
40
45
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change

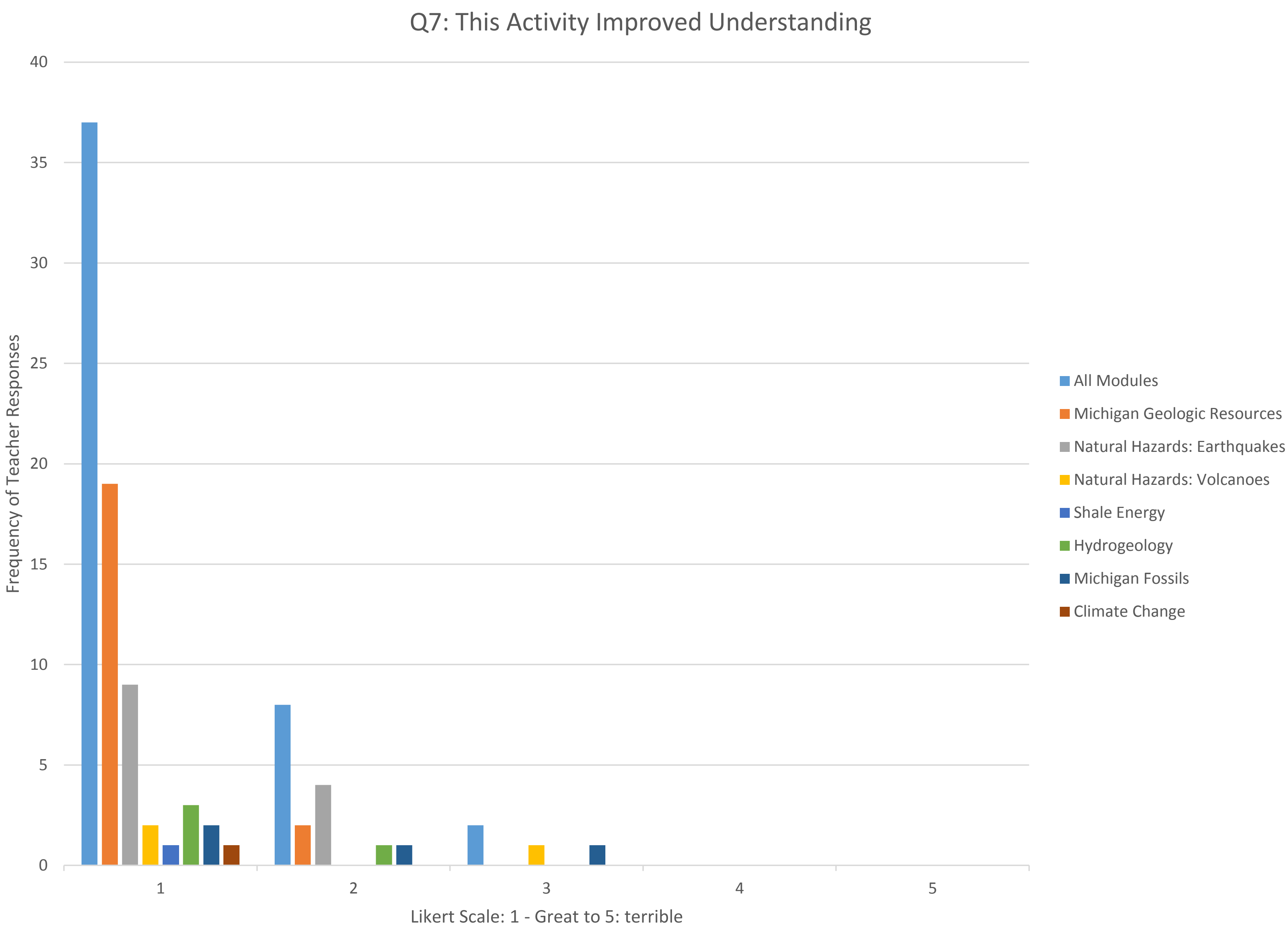

Q2: This Activity was Educational
Frequency of Teacher Responses
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q3: This Activity Met Expectations
45
40
35
30
25
20
15
10
5
0
Frequency of Teacher Responses
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q4: This Activity was too difficult for Students
Frequency of Teacher Responses
40
35
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q5: This Activity had Clear Instructions
40
35
30
25
20
15
10
5
0
Frequency of Teacher Responses
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q6: This Activity had a Clear Purpose
Frequency of Teacher Responses
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q7: This Activity Improved Understanding
Frequency of Teacher Responses
40
35
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
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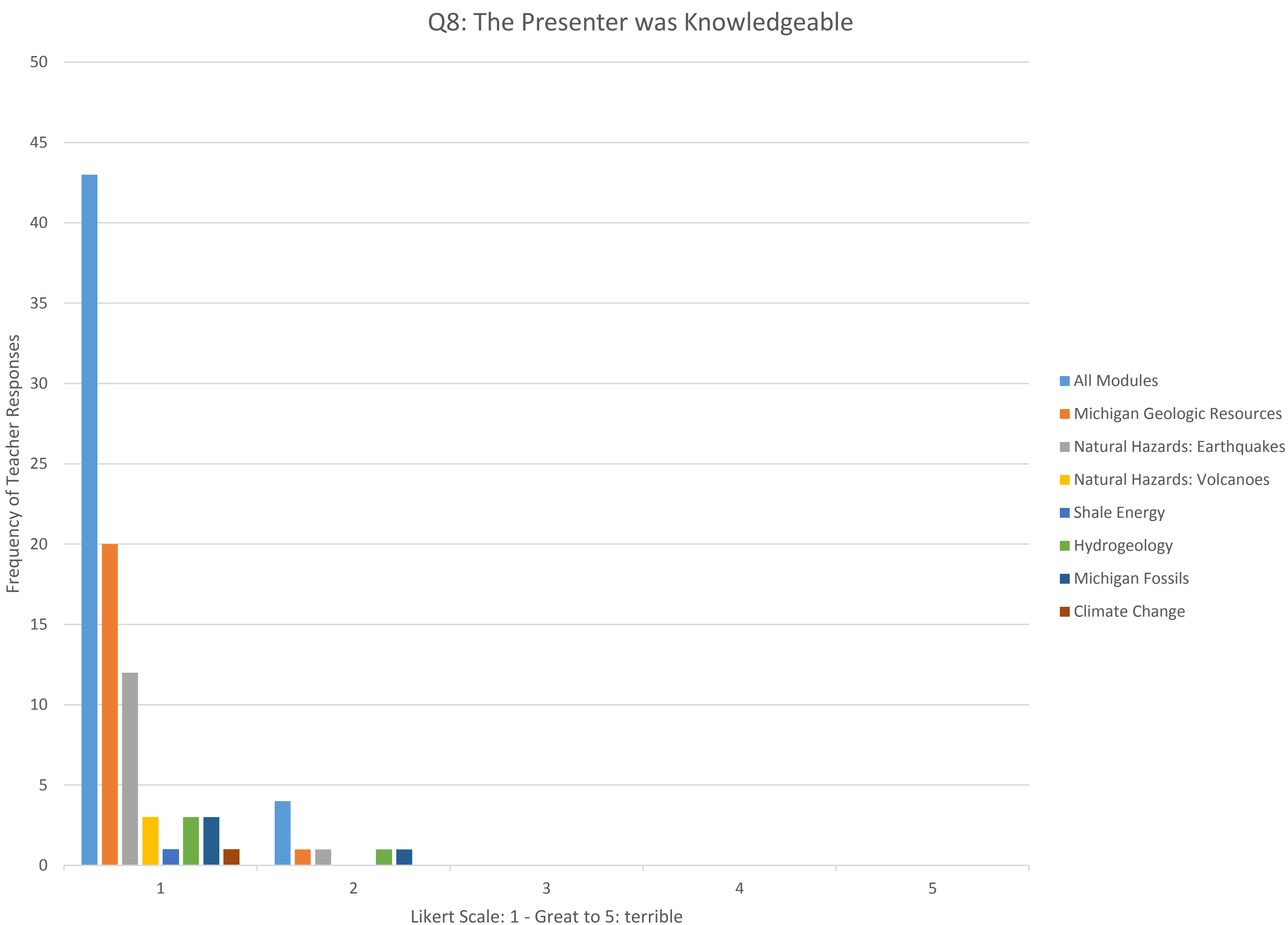
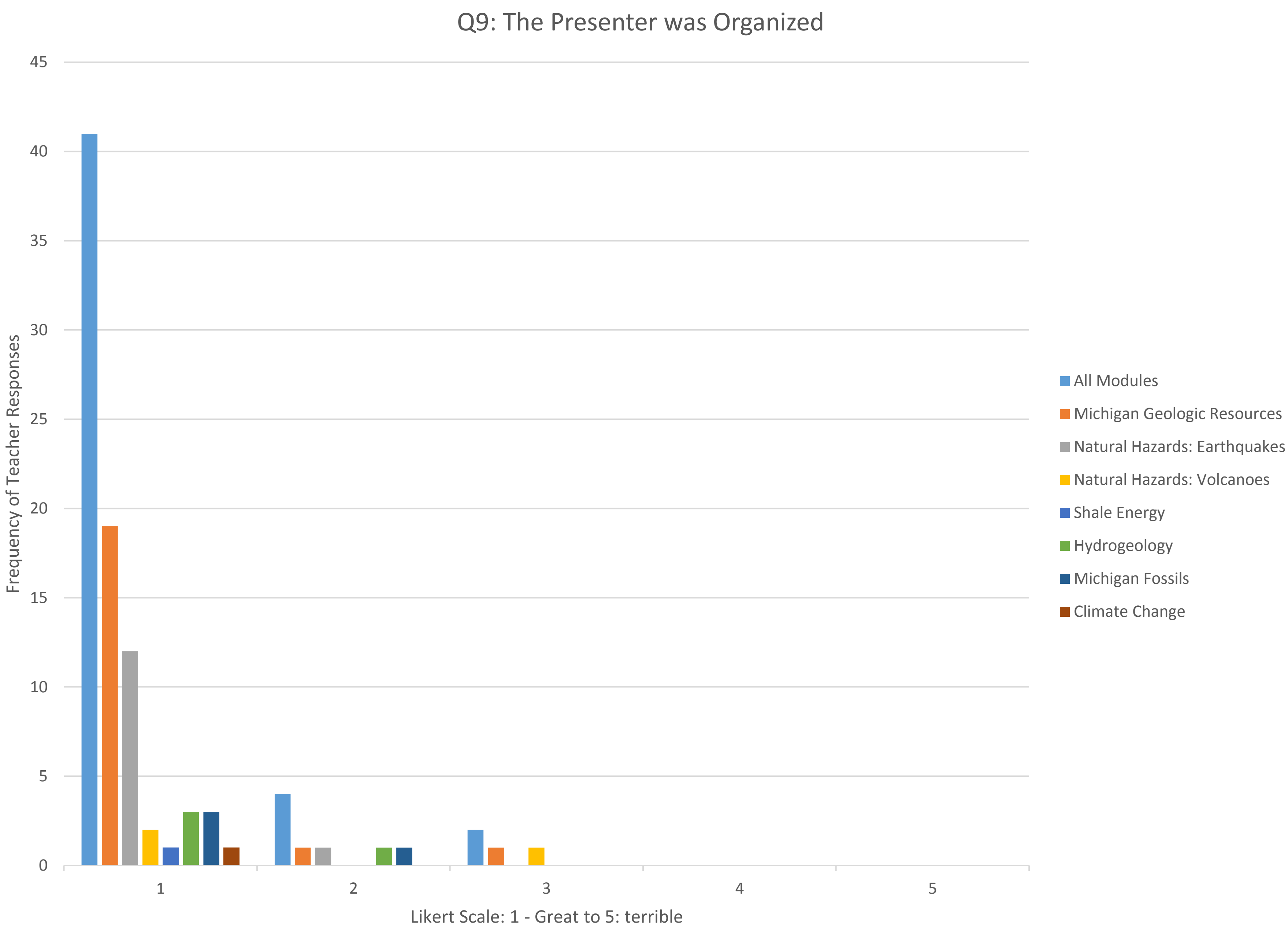
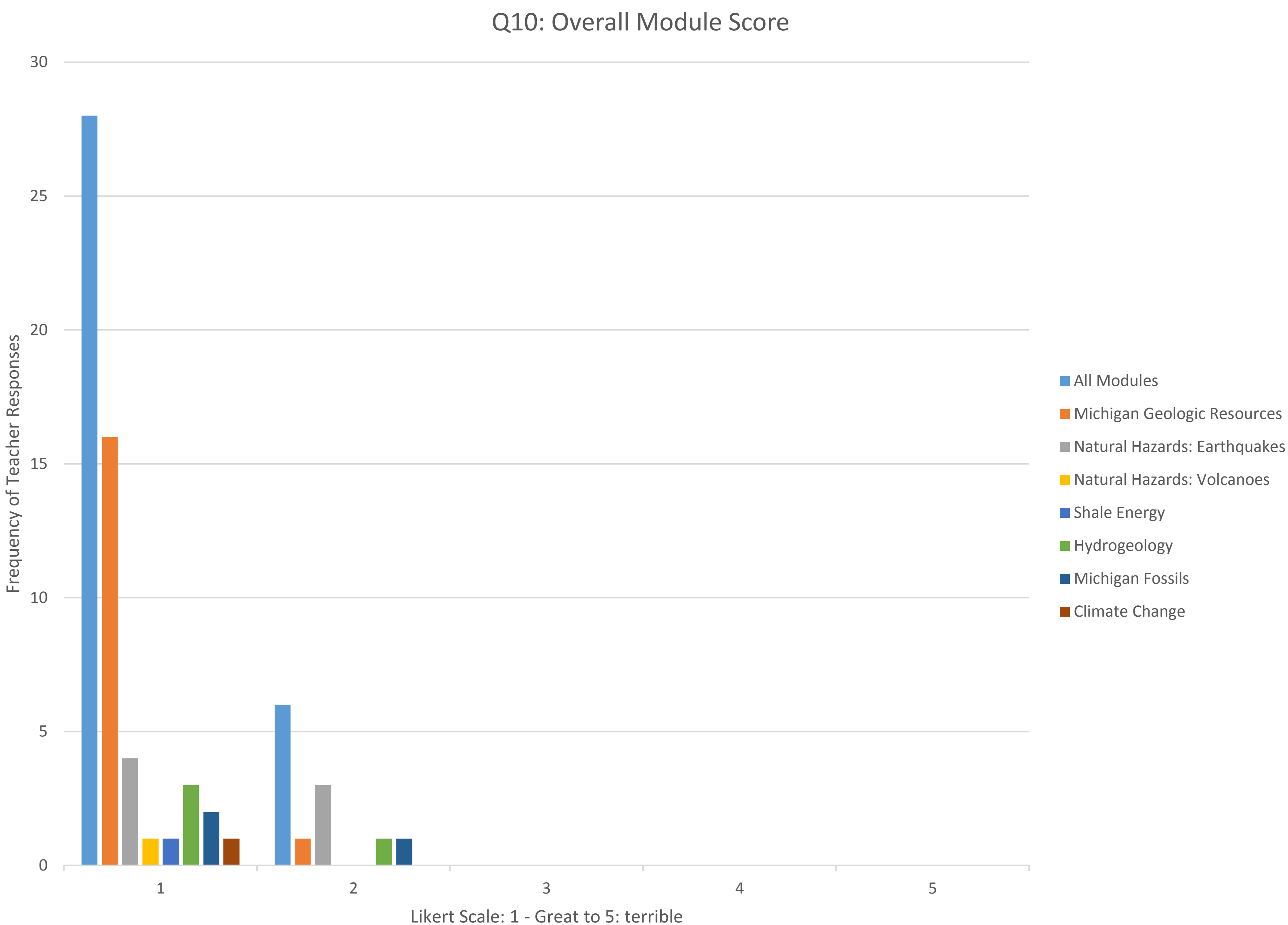
Climate Change



Q8: The Presenter was Knowledgeable
50
45
40
35
30
25
20
15
10
5
0
Frequency of Teacher Responses
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change



Q9: The Presenter was Organized
Frequency of Teacher Responses
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change


Q10: Overall Module Score
Frequency of Teacher Responses
30
25
20
15
10
5
0
1
2
3
4
5
Likert Scale: 1 - Great to 5: terrible
All Modules
Michigan Geologic Resources
Natural Hazards: Earthquakes
Natural Hazards: Volcanoes
Shale Energy
Hydrogeology
Michigan Fossils
Climate Change

All Modules: Metrics Summary Statistics

Question	Mode	Median	n
Q1	1	1	47
Q2	1	1	47
Q3	1	1	47
Q4	5	5	47*
Q5	1	1	47
Q6	1	1	47
Q7	1	1	47
Q8	1	1	47
Q9	1	1	47
Module Overall Score	1	1	34**

*This question was poorly worded and often was answered in a manner that contrasted sharply with all other feedback provided by the individual teacher.
**This question was separate from the other 9 questions and was not always filled in.

Feedback from teacher evaluations was collated from both 2013-2014 and 2014-2015 to increase the sample size to significant.

Teacher Feedback and CoreKids Module Evaluations

Date: 12-5-14 School: Greater Heights Academy Grade Level: 4th - 5th - 6th

District: Flint - Greater Heights Total # of Students: 75

Teacher: Ms. Crane Office Phone: 810-768-3860

Email: craned@greaterheightsacademy

Presenter: Dawn Tony Module: Michigan geology

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was: 1 2 3 4 5

2. This activity:

	1	2	3	4	5
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

Presentation was grade level. Students participated, discussing what they learned in class.

4. What was the least favorite part of this activity?

Everything was engaging and the students enjoyed the materials.

5. How could this activity be improved?

6. Do you feel this module meets Michigan State Science Standards?

I feel it enhances the classroom lessons.

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Yes

Date: 12/10/12 School: Western Middle School Grade Level: 6

District: Bay City Public Schools Total # of Students: 118

Teacher: Van Driessche Office Phone: 989 450 2467

Email: vandriesschea@bcschools.net

Presenter: ____________ Module: Michigan fossils

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was: (1) 2 3 4 5

2. This activity:

Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	1	(2)	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

I think that both the presentation & the hands on activities are a good balance to explore the topic

4. What was the least favorite part of this activity?

This module was great! No least favorites; sorry

5. How could this activity be improved?

In the plaques, perhaps directions for the students might help kids get started while the presenters make their way through the groups.

6. Do you feel this module meets Michigan State Science Standards?

Absolutely, this was an excellent way for kids to explore fossils.

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop. I most certainly would!

Date: 1/6/15 School: Vicksburg Middle School Grade Level: 6

District: Vicksburg Total # of Students: 113

Teacher: Donna Cubbage Office Phone: 321-1328

Email: dcubbage@vicksburgschools.org

Presenter: Nick & Nathan Module: Michigan Fossils

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

	1	2	3	4	5
1. Overall, this module was:	1	(2)	3	4	5
2. This activity:					
Was Enjoyable	1	(2)	3	4	5
Was Educational	1	(2)	3	4	5
Met Expectations	1	(2)	3	4	5
Was Too Difficult for Students	1	2	3	(4)	5
Had Clear Instructions	1	2	(3)	4	5
Had Clear Purpose	1	(2)	3	4	5
Improved Understanding	1	2	(3)	4	5
Presenter Was Knowledgeable	1	(2)	3	4	5
Presenter Was Organized	1	(2)	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The actual fossils of mammoth & porous rock demo was the best

4. What was the least favorite part of this activity?

With 6th graders the fossil area with little info to the end gave them more time to be less engaged. Once Nathan helped them they liked it more

5. How could this activity be improved?

Some of the explanations with the powerpoint were more "college" vocab. Try to relate more to 6th graders

6. Do you feel this module meets Michigan State Science Standards?

Yes - great follow-up to our unit!

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Great experience, lots of hands on activities we can't provide

(may use comments)

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Date: 1/13/2015 School: Vicksburg Middle School Grade Level: 8

District: Vicksburg Total # of Students: ~150

Teacher: Lisa Harbour 321-1330 Office Phone: 321-1300

Email: Lharbour@vicksburgschools.org

Presenter: Nathan + Cameron Module: Earthquakes

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	(2)	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	1	(2)	3	4	5
Met Expectations	1	(2)	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	1	(2)	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	1	(2)	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The hands on activities and the knowledge and passion of the presenters.

4. What was the least favorite part of this activity?

N/A

* More time to do more activities!

5. How could this activity be improved?

More time, more activities, more time for presenters to share about their educational experiences

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?)) Yes!

Having graduate students in ~~my~~ a classroom is an opportunity that all K-12 students should have! This was a great way for students to see what opportunities are available in the future as well as understand the commitment and drive necessary to be a →

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Absolutely!

successful professional. The passion of the presenters was obvious and that, along with their knowledge, was appreciated by myself and the students. I am hoping that there may be another opportunity during the 2014/15 school year to have COREKids in my classroom.

Thank you

[signature]

Lharbour@vicksburgschools.org

321-1330

Date: 1/14/15 School: Vicksburg Middle School Grade Level: 8

District: Vicksburg Total # of Students: 42

Teacher: Donna Cubbage Office Phone: 321-1328

Email: dcubbage@vicksburgschools.org

Presenter: Nathan/Cameron Module: Earthquakes

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	(2)	3	4	5
2. This activity:					
Was Enjoyable	1	(2)	3	4	5
Was Educational	1	(2)	3	4	5
Met Expectations	1	(2)	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	1	(2)	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

I think they totally enjoyed the 3 demo's about seismic waves. This totally integrated with our class discussions.

4. What was the least favorite part of this activity?

I didn't have one

5. How could this activity be improved?

- maybe more time for questions about earthquakes from the kids. Our demo's etc. went right to the bell.

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Educational, fun, great experience for the kids

(yes- can use comments)

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Date: 1/16/15 School: Gull Lake Middle School Grade Level: 6th

District: Gull Lake Community Schools Total # of Students: 116

Teacher: Mrs. K. Clancy Office Phone: 488-5040 ext. 2122

Email: kclancy@gulllakecs.org

Presenter: Cameron & Dawn Module: Michigan Fossils

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

Presenters were both extremely engaged with students in small groups filling them with facts/info about fossils

3. What part of this activity was most effective to help students explore this topic?

hands on activities, informational powerpoint, presenters intricate knowledge of topic. Students related closely to topic because of Michigan connection! Very well done!

4. What was the least favorite part of this activity?

—

5. How could this activity be improved?

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Absolutely, hoping to get CoreKids in for our next Unit Earthquakes, Volcanoes or minerals / Rocks!

Date: 1/5·1/6 School: Vicksburg Middle School Grade Level: 6

District: Vicksburg Community Schools Total # of Students: 196

Teacher: Kay Office Phone: 269.321-1352

Email: kKay@vicksburgschools.org

Presenter: Peter / Nick / ~~[illegible]~~ Nathan Module: YMP Fossils

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	2	3	4	5
2. This activity:					
Was Enjoyable	1	**(2)**	3	4	5
Was Educational	1	**(2)**	3	4	5
Met Expectations	1	**(2)**	3	4	5
* Was Too Difficult for Students	1	2	**(3)**	4	5
Had Clear Instructions	1	**(2)**	3	4	5
Had Clear Purpose	1	**(2)**	3	4	5
Improved Understanding	1	**(2)**	3	4	5
Presenter Was Knowledgeable	**(1)**	2	3	4	5
Presenter Was Organized	**(1)**	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

I think the porosity activity was most effective

4. What was the least favorite part of this activity?

Students said the play-doh center wasn't very informative. ~~[illegible]~~

5. How could this activity be improved?

Students would have rather had more identified fossils / info about Mammoths

6. Do you feel this module meets Michigan State Science Standards?

yes * watch vocab though - maybe get a list from teacher to/ work taught / not taught content

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

yes - forwarded to Frankenmuth School District (Sister HS principal)

Date: 1/15/15 School: Plainwell Middle Grade Level: 6

District: Plainwell Community Schools Total # of Students: 29

Teacher: Lisa Wininger Office Phone: (269)685-5813

Email: lwininger@plainwellschools.org

Presenter: Peter Voice Module:

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	(1)	2	3	4	5
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The students enjoyed the oral discussion on the main floor that discussed locations & techniques for drilling cores.

4. What was the least favorite part of this activity?

none

5. How could this activity be improved?

None that I can think of.

6. Do you feel this module meets Michigan State Science Standards?

Yes – 6th grade Earth Science

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Yes, I would

Date: 1-21-15 School: E. F. Rittmueller Middle School Grade Level: 6th + 7th grades

District: Frankenmuth Public Schools Total # of Students: 110

Teacher: Heather Brey Office Phone: 989-652-6119

Email: hbrey@frankenmuth.k12.mi.us

Presenter: Jake, Jay, Frank Module: Michigan Geological History & Climate Change

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The students gained a lot from all of the station activities. The students made connections to the bike pump - porosity activity.

4. What was the least favorite part of this activity?

In the Climate Change module the students were not as engaged in the tree ring activity, however I think it is important part of the lesson.

5. How could this activity be improved?

Possibly adding some discovery activity or questions to figure out using the tree-ring would be helpful.

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

WMU Core kids was highly engaging. I appreciate the presenters bringing Science into my Classroom using hands-on activities. It really helped my students understand and connect to our unit of study. The presenters were so friendly and worked so well with my students.

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Yes - I will share the information.

Thanks again!

Date: January 12, 2015 School: Gull Lake Middle School Grade Level: 6^{th} and 7^{th} Science

District: Gull Lake Total # of Students: 126

Teacher: Laurie Klok Office Phone: 269-488-5040

Email: lklok@gulllakecs.org

Presenter: Cameron and Frank Module: Rocks and Minerals

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	2	3	4	5
2. This activity: Was Enjoyable	1	2	3	4	5
Was Educational	1	2	3	4	5
Met Expectations	1	2	3	4	5
Was Too Difficult for Students	1	2	3	4	5
Had Clear Instructions	1	2	3	4	5
Had Clear Purpose	1	2	3	4	5
Improved Understanding	1	2	3	4	5
Presenter Was Knowledgeable	1	2	3	4	5
Presenter Was Organized	1	2	3	4	5

3. What part of this activity was most effective to help students explore this topic? Looking at the minerals was helpful as we approach our next unit. The permeable rocks helped us to wrap up our last unit.

4. What was the least favorite part of this activity? The students loved the permeable rocks.

5. How could this activity be improved? Maybe more mineral identification. Set up stations so they can do all the tests.

6. Do you feel this module meets Michigan State Science Standards? YES!

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?)) Students love the hands on approach. Both graduate students were knowledgeable, friendly, and interacted well with the students.

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

YES!!!

Date: 1/9 School: Walden Green Grade Level: M.S. (6-7-8)

District: Walden Green Montessori Total # of Students: 46

Teacher: Dusty DeHare Office Phone: 616 842-4523 x112

Email: dustindehare@WaldenGreen.org

Presenter: Dawn + [illegible] Module:

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The presenters did a great job of making the students work for the correct answers

4. What was the least favorite part of this activity?

N/A

5. How could this activity be improved?

A check for understanding at the end.

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Date: 2/9 School: Walden Green Montessori Grade Level: 6-8

District: Walden Green Total # of Students: 24/6

Teacher: Joy Slager-Hyde Office Phone: 616-842-4523

Email: joyslager@waldengreen.org

Presenter: Dawn & Jay Module: ______

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	(4)	5
Had Clear Instructions	1	2	(3)	4	5
Had Clear Purpose	1	(2)	3	4	5
Improved Understanding	1	(2)	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

Hands on activities & and the interactions w/ the instructor during the activities.

4. What was the least favorite part of this activity?

NA

5. How could this activity be improved?

The objectives could be more clear, verbal intructions for the students for the activity would be helpful.

6. Do you feel this module meets Michigan State Science Standards?

yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?)) yes

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

absolutely! It was great!

Date: 2/9/15 School: WaldonGreen Montessori Grade Level: 6-8

District: WG Total # of Students: 11

Teacher: Penni Powell Office Phone: 616 842 4523

Email: pennipowell@waldongreen.org

Presenter: ____________ Module: geology

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	**(2)**	3	4	5
2. This activity:					
Was Enjoyable	1	**(2)**	3	4	5
Was Educational	**(1)**	2	3	4	5
Met Expectations	**(1)**	2	3	4	5
Was Too Difficult for Students	1	2	3	**(4)**	5
Had Clear Instructions	**(1)**	2	3	4	5
Had Clear Purpose	**(1)**	2	3	4	5
Improved Understanding	**(1)**	2	3	4	5
Presenter Was Knowledgeable	**(1)**	2	3	4	5
Presenter Was Organized	**(1)**	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

the hands on! They love to learn with their hands ♥ Great job

4. What was the least favorite part of this activity?

Nothing

5. How could this activity be improved?

It was great ♥ It was very informative

6. Do you feel this module meets Michigan State Science Standards?

yes it does

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop. yes

Date: 2-12-15 2-13-15 School: Berkshire Middle School Grade Level: 6

District: Birmingham Public Schools Total # of Students: ~250

Teacher: Mark Phillips Office Phone: 248-203-4702

Email: mp06bps@birmingham.k12.mi.us

Presenter: Dawn + Nathan Module: Michigan Geology

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

	1	2	3	4	5
1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

Hands on! 5 minutes per station seemed about right.

Enthusiastic Presenters!

4. What was the least favorite part of this activity?

Students do not like to sit for long periods, but your frequent questioning kept them mentally alert.

5. How could this activity be improved?

Asking students to respond in different ways, e.g., raise left hand, right hand, thumbs up, clam yell (open + close hand)

6. Do you feel this module meets Michigan State Science Standards?

Yes!

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop. Yes!

Date: 2/23 School: Gull Lake Middle School Grade Level: 6th grade

District: Gull Lake Community Schools Total # of Students: 130

Teacher: Kim Clancy Office Phone: 269-488-5040 ext. 2122

Email: kclancy@gulllakecs.org

Presenter: Cameron & Dawn Module: Earthquakes

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was: 1 2 3 4 5

2. This activity:

Was Enjoyable	(1)	2	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	4	(5)
Had Clear Instructions	1	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

- modeling an earthquake with an electric toothbrush really enjoyable for students ~ realistic results.
- sugar cubes representing building ~ comparing soil to not soil ground

4. What was the least favorite part of this activity?

5. How could this activity be improved?

?

6. Do you feel this module meets Michigan State Science Standards?

Strongly supports learning standards

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

Yes!

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

Absolutely

Date: 3-23-15 School: Western Middle Grade Level: 8

District: Bay City Public Schools Total # of Students: 58

Teacher: Charlie Lalonde Office Phone: 989-662-4489

Email: lalondec@bcschools.net

Presenter: Dawn & Tony Module: Hydro geology

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	1	2	3	4	(5)
2. This activity:					
Was Enjoyable	1	2	3	4	(5)
Was Educational	1	2	3	4	(5)
Met Expectations	1	2	3	4	(5)
Was Too Difficult for Students	1	(2)	3	4	5
Had Clear Instructions	1	2	3	4	(5)
Had Clear Purpose	1	2	3	4	(5)
Improved Understanding	1	2	3	4	(5)
Presenter Was Knowledgeable	1	2	3	4	(5)
Presenter Was Organized	1	2	3	4	(5)

3. What part of this activity was most effective to help students explore this topic?

Permeability lab (sand & gravel)

4. What was the least favorite part of this activity?

—

5. How could this activity be improved?

—

6. Do you feel this module meets Michigan State Science Standards?

Yes

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?))

This presentation covered so much of what we learn about; the water cycle, groundwater, pollution, permeability

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

& take as a resource → Yes! Great job!

Darrell Carsten @ Handy Middle would love

Date: 3-23-15 School: Western Middle School Grade Level: 8th

District: Bay City Public Schools Total # of Students: 80

Teacher: Kelly Bonds (student teacher for Vicki Smith) Office Phone:

Email: smithv@bcschools.net; kkbonds@svsu.edu

Presenter: Dawn + Tony Module: Hydrology

Please circle one for each question (scale 1-5: 1 = awesome/absolutely agree, 2 = really good/strongly agree, 3 = pretty good/somewhat agree, 4 = fair/slightly disagree, 5 = terrible/firmly disagree)

1. Overall, this module was:	(1)	2	3	4	5
2. This activity:					
Was Enjoyable	1	(2)	3	4	5
Was Educational	(1)	2	3	4	5
Met Expectations	(1)	2	3	4	5
Was Too Difficult for Students	1	2	3	(4)	5
Had Clear Instructions	(1)	2	3	4	5
Had Clear Purpose	(1)	2	3	4	5
Improved Understanding	(1)	2	3	4	5
Presenter Was Knowledgeable	(1)	2	3	4	5
Presenter Was Organized	(1)	2	3	4	5

3. What part of this activity was most effective to help students explore this topic?

The sand vs. gravel activity was a great way for students to explore porosity.

4. What was the least favorite part of this activity?

All activities helped enrich the topic

5. How could this activity be improved?

Perhaps the powerpoint could be broken up more. Have students start with an initial activity.

6. Do you feel this module meets Michigan State Science Standards?

yes, this aligns with the standards.

7. Comments: (May we use any of your comments in our promotional materials (brochures, module handouts, website?)) The speaker (Dawn) was excellent in her presentation. She kept students engaged during the experiments.

8. Would you recommend CoreKids to your colleagues, friends and other districts? If so, please forward our contact information to them. The more students we reach the more funding we can obtain, and the more modules we are able to develop.

yes, I would. This a great program.

CORE Kids

Module Overviews

Module	Recommended Grade Level	Michigan Department of Education Standards	Description
Michigan Geologic History	2-12	E.ES.03.41, E.ES.03.32, E.ST.04.31, E.SE.06.12, E.ST.06.42, E4.p3A	Discussion of Michigan's Geologic resources in their historical geology context. Emphasis on resources such as Oil and Gas, and Groundwater
Hydrogeology	7-12	E.ES.07.81, E4.1A, E4.1C	Discussion of infiltration rates, porosity and permeability.
Natural Hazards: Earthquakes	6-12	E.SE.06.51, E.SE.06.52, E.SE.06.53, E3.4A, E3.4C, E3.4f	Emphasis is on vibrational energy of earthquakes and its impact on structures.
Natural Hazards: Volcanoes	4-12	E.SE.06.52, E3.1d, E3.4C, E3.4d, E3.4e, E5.4B	Flow rates and magma chemistry are used to classify different types of volcanic eruptions. Volcanoes as natural hazards are explored.
Natural Hazards: Impacts and Asteroids	2-12	E5.p1A, E5.3C, E5.4B, P3.6A, P3.6B	Describes the influence of asteroids on Earth's geologic history.
Shale Energy and Hydraulic Fracturing	7-12	E.ES.03.41, E.ES.03.32, E2.2B, E2.4A, E2.4B, E3.1c, E4.1C	Discussion of conventional vs. unconventional hydrocarbon reservoirs. Explains the process by which hydraulic fracturing occurs.
Michigan Fossils	2-12	E.ST.04.31, E.ST.06.31, E.ST.04.32, E.St.06.42, Ef.3D, E5.4f	Michigan fossils are used to explore Michigan's changing climate as a function of plate tectonics through geologic time. Fossils are used to explore basic ecological principles (food webs, competition, niches).
The Environment and Climate Change	2-12	E.ES.03.52, E.ES.07.41, E1.2B, E1.2f, E1.2g, E2.3A, E2.3d, E2.4B, E5.4A, E5.4e	Module presents an overview of the nature of carbon dioxide gas and the greenhouse effect. The albedo effect is used illustrate the impact of changes in land cover and land use.

1. Michigan Geological History Presentation (Michigan Natural Resources)

The Michigan Geological History Presentation provides an overview of the approximately 3 billion years of Earth Processes that the state of Michigan has experienced with an emphasis on two time periods, the Paleozoic and the Holocene. The presentation illustrates that the climate of Michigan has changed through geologic time with much warmer tropical climates during the Paleozoic and colder glacial conditions in the recent past. The concept of uniformitarianism is defined as one of the paradigms of modern Geology – that processes acting on modern environments are the same processes that acted in ancient environments. Examples are used to illustrate uniformitarianism through comparison of Silurian age reefs in the Michigan Basin and modern reefs in the Bahamas. One of the key aspects of this module is the exploration of the rich variety of natural resources present in the subsurface of the state of Michigan. The students are encouraged to discuss everyday objects that they use and the natural resources that had to go into the production of those objects. Natural resources such as groundwater, oil and natural gas, metallic resources, aggregate (sand and gravel), as well as salt are discussed and placed in the framework of the geology of Michigan. A final topic covered in the module is the idea that rocks have pore space which can be used to store materials like oil, natural gas, and water. A hands-on activity designed to supplement this module is the Core permeability test described below. This presentation is appropriate for grades 3-12 and meets the following content standards:

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.ES.03.41 Identify natural resources (metals, fuels, fresh water, fertile soil, and forests).

E.ES.03.32 Describe how materials taken from the Earth can be used as fuels for heating and transportation.

E.ST.04.31 Explain how fossils provide evidence of the history of the Earth.

E.SE.06.12 Explain how waves, wind, water, and glacier movement, shape and reshape the land surface by eroding rock in some areas and depositing sediments in other areas.

E.ST.06.42 Describe how fossils provide important evidence of how life and environmental conditions have changed.

8-12 Standards

E4.p3A Describe how glaciers have affected the Michigan landscape and how the resulting landforms impact our state economy.

2. Hydrogeology Presentation

The availability of potable water is a significant problem worldwide. This module was developed to increase awareness in students of issues pertaining to the extraction of groundwater as well as to environmental issues that impact groundwater supplies. The module specifically outlines the distribution of water on the Earth's surface and in its interior. Fresh water makes up approximately 2.5% of the total water on the Earth's surface and much of that water is frozen as glacial ice. The module presenter explores with the students the water cycle and how water molecules move from the atmosphere to the surface as precipitation, from the oceans to the atmosphere through evaporation and the connection between surface waters and groundwater stored in subsurface aquifers. The balance of rainwater (and meltwater) runoff and infiltration is discussed in the context of how groundwater aquifers are recharged. As in the Michigan Geological History module, the properties of porosity and permeability are important concepts explored in this module. The storage space in an aquifer is the pore space between sediment particles that make up the rock portion of the aquifer. The importance of permeability to extraction/production of groundwater is discussed with the students. One final concept that is explored is the contamination of aquifers and how hydrogeologists can study or model the movement of contaminants in an aquifer. A brief discussion of remediation techniques is also described. This presentation is appropriate for grades 7-12. The following content standards are met by this module:

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.ES.07.81 Explain the water cycle and describe how evaporation, transpiration, condensation, cloud formation, precipitation, infiltration, runoff, ground water, and absorption occur within the cycle.

8-12 Standards

E4.1A Compare and contrast surface water systems and groundwater in regard to their relative sizes as Earth's freshwater reservoirs and the dynamics of water movement (inputs, outputs, residence times, sustainability).

E4.1C Explain how water quality in both groundwater and surface systems is impacted by land use decisions.

3. Natural Hazards

The study of how natural hazards occur is an important component of applied geosciences. Students will gain a better appreciation of the types of natural hazards and the destructive nature of these events. Three different sub-modules have been prepared for this module: Earthquakes, Impacts and Asteroids, and Volcanoes. Each sub-module is designed around a series of hands-on activities and rock samples. The individual sub-modules are designed to fill a 50 minute class period and we bring in all of the materials necessary for the activities.

a. Natural Hazards: Earthquakes

The earthquake sub-module develops for the students an understanding of the behavior of earth materials during an earthquake. The students explore the harmful effects of an earthquake through construction of model cities on different substrates. Earthquakes are put into a plate tectonics context and the forces that generate earthquakes are discussed in the short presentation.

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.SE.06.51 Explain plate tectonic movement and how the lithospheric plates move centimeters per year.

E.SE.06.52 Demonstrate how major geological events (earthquakes, volcanic eruptions, mountain building) result from these plate motions.

E.SE.06.53 Describe layers of the Earth as a lithosphere (crust and upper mantle), convecting mantle, and dense metallic core.

8-12 Standards

E3.4A Use the distribution of earthquakes and volcanoes to locate and determine the types of plate boundaries.

E3.4C Describe the effects of earthquakes and volcanic eruptions on humans.

E3.4f Explain why fences are offset after an earthquake, using the elastic rebound theory.

b. Natural Hazards: Volcanoes

The volcanoes module is a fun, hands-on module that explores the principle of viscosity and its relationship to the fluid flow dynamics of lava. A classification of volcanoes based on shape and size, magma composition, and eruption style is presented to the students and analog versions of the volcanoes are used to exhibit the viscosity of different lava types. Students work in groups to explore crystallization and cooling rate. A discussion of intrusive versus extrusive igneous rocks, highlights the textural differences observed in these igneous rocks which is a function of cooling rate.

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.SE.06.41 Compare and contrast the formation of rock types (igneous, metamorphic, and sedimentary) and demonstrate the similarities and differences using the rock cycle model.

E.SE.06.52 Demonstrate how major geological events (earthquakes, volcanic eruptions, mountain building) result from these plate motions.

8-12 Standards

E3.1d Explain how the crystal sizes of igneous rocks indicate the rate of cooling and whether the rock is extrusive or intrusive.

E3.4C Describe the effects of earthquakes and volcanic eruptions on humans.

E3.4d Explain how the chemical composition of magmas relates to plate tectonics and affects the geometry, structure, and explosivity of volcanoes.

E3.4e Explain how volcanoes change the atmosphere, hydrosphere, and other earth systems.

E5.4B Describe natural mechanisms that could result in significant changes in climate (e.g. major volcanic eruptions, changes in sunlight received by the earth, meteorite impacts).

c. Natural Hazards: Impacts and Asteroids

This sub-module discusses the impact that a collision by meteorites or asteroids with the Earth would have on humanity. Basic types of meteorites are described and samples are provided for the students to examine. A brief discussion of orbital dynamics and gravitational attraction sets the stage for a hands-on activity where students simulate impacts on the Earth with different types of impactors (size, density, shape) and incident angles. The shapes of craters are described. Example impact craters in the Midwest region, including the Sudbury impact crater (Ontario) and the Calvin 12 structure (Southern Michigan) are used to illustrate how we can identify deposits related to these events in the geologic record.

Michigan Department of Education Grade Level Content Standards covered:

8-12 Standards

E5.p1A Describe the motions of various celestial bodies and some effects of those motions.

E5.3C Relate the major events in the history of the Earth to the geologic time scale, including the formation of the Earth, formation of an oxygen atmosphere, rise of life, Cretaceous-Tertiary (K-T) and Permian extinctions, and Pleistocene ice age.

E5.4B Describe natural mechanisms that could result in significant changes in climate (e.g. major volcanic eruptions, changes in sunlight received by the earth, meteorite impacts).

P3.6A Explain earth-moon interactions (orbital motion) in terms of forces.

P3.6B Predict how the gravitational force between objects changes when the distance between them changes.

4. Shale Energy and Hydraulic Fracturing

This module provides a balanced approach to discussion of hydraulic fracturing and utilizing hydrocarbon resources hosted in shales. Hydrocarbons underpin the world's economy and students need to understand where these natural resources come from that affect their daily lives in so many ways. Permeability and Porosity are used as a starting point for discussion of the differences between conventional hydrocarbon reservoirs and unconventional shale reservoirs. At the end of the session, students will be able to explain the process of hydraulic fracturing and how it is used to extract hydrocarbons from both conventional and unconventional hydrocarbon reservoirs. Students will also be able to list both the positives and negatives of hydraulic fracturing. The module consists of a short presentation and several hands-on activities.

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.ES.03.41 Identify natural resources (metals, fuels, fresh water, fertile soil, and forests).

E.ES.03.32 Describe how materials taken from the Earth can be used as fuels for heating and transportation.

8-12 Standards

E2.2B Identify differences in the origin and use of renewable (e.g. solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear [U-235]) sources of energy.

E2.4A Describe renewable and nonrenewable sources of energy for human consumption (electricity, fuels), compare their effects on the environment, and include overall costs and benefits.

E2.4B Explain how the impact of human activities on the environments (e.g., deforestation, air pollution, coral reef destruction) can be understood through the analysis of interactions between the four Earth systems.

E3.1c Explain how the size and shape of grains in a sedimentary rock indicate the environment of formation (including climate) and deposition.

E4.1C Explain how water quality in both groundwater and surface systems is impacted by land use decisions.

5. Michigan Fossils

The Michigan Fossils module illustrates the diversity of life found in the fossil record of Michigan's sedimentary record. Discussion of how an organism becomes a fossil is presented with hands-on activities that simulate the process of fossilization. At the end of the module, students will be able to define the term index fossil. Specific fossils from Michigan are presented as index fossils that constrain the age of the host sediment. Behavioral and ecological principles are also explored with specific fossils (mastodons and mammoths) as diet and habitat can be inferred from skeletal morphology.

Michigan Department of Education Grade Level Content Standards covered:

K-7 Standards

E.ST.04.31 Explain how fossils provide evidence of the history of the Earth.

E.ST.06.31 Explain how rocks and fossils are used to understand the age and geological history of the Earth (timelines and relative dating, rock layers).

E.ST.04.32 Compare and contrast life forms found in fossils and organisms that exist today.

E.ST.06.42 Describe how fossils provide important evidence of how life and environmental conditions have changed.

8-12 Standards

E5.3D Describe how index fossils can be used to determine time sequence.

E5.4f Describe geologic evidence that implies climates were significantly colder at times in the geologic record (e.g., geomorphology, striations and fossils).

Presentations on the CoreKids program at Meetings

2014: Michigan Earth Science Teachers Association Field Conference

2015: North Central Geological Society of America Section Meeting

MESTA ANNUAL CONFERENCE PRESENTER FORM

MESTA 2014 Field Conference
Alpena Community College, Alpena, Michigan.

Presenter #1:

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Presenter #2 **(if co-presenting)**

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Presenter #4 **(if co-presenting)**

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Position/Title: Graduate Assistant

Home Address: ______________________________

Home Phone: 484-883-3052

E-Mail Address: andrew.p.bentley@wmich.edu

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PRESENTATION TITLE: The MGRRE Education Portal: Investigating Rocks and Fossils under Michigan

Presentation Description (please word this as you wish it to appear in the conference program):

The Michigan Geological Repository for Research and Education (MGRRE), part of the Michigan Geological Survey within the Department of Geosciences at Western Michigan University (WMU), maintains an extensive collection of Michigan geological information in the form of rock and sediment core samples, chemical and physical datasets, fossil collections, and information about wells drilled for water, mineral and hydrocarbon resources. With funding from the WMU College of Arts and Sciences, we are in the process of making these authentic subsurface datasets available for NGSS-aligned classroom activities. The purpose of this presentation will be to introduce K-12 teachers to an example rock core and associated datasets by exploring both a physical core and digitized photos and data. The sample core is the St. Charlton 4-30 from Otsego County and exhibits Upper Silurian to Lower Devonian rocks of the Bass Islands Group, Bois Blanc, Garden Island and Amherstburg Formations. These different geologic units include limestones, dolomites and cherts. Participants will have an opportunity to try out two of our pilot Education Portal activities. One activity focuses on fossil identification and relating fossil assemblages to past environments. The second activity focuses on graphing and interpreting rock permeability and porosity data to find a potential host rock for CO_2 sequestration. Participants will receive copies of digital data used in the presentation for their classroom use, and will be asked to provide feedback to improve the activities.

Appropriate Level(s): (check) ☒ **Elementary** ☒ **Middle School** ☒ **High School**

Michigan Science Content Expectations Presented: (http://www.michigan.gov/mde/)

Fossils - S.IP and S.IA, E.ST.04.31, L.EV.05.13, E.ST.06.31, E.ST.06.42, E1.R1

Rock porosity and permeability - S.IP and S.IA,E.ES.07.41, E1.2A, E5.3B, E5.R3

Audio/Visual Requests: **Our resources are limited. If at all possible, please bring your own audio visual equipment (laptop, LCD projector, slide projector, extension cord, or overhead projector). If this is NOT possible, we will try to provide what you request. Check the items you will need.**

☐ **TV/VCR** ☐ **OVERHEAD PROJECTOR** ☒ **SCREEN** ☐ **SLIDE PROJECTOR**

The MGRRE Education Portal: Investigating Rocks and Fossils Under Michigan

Presented by Heather Petcovic, Peter Voice, Brian Horvitz, Andrew Bentley, Joe Lane

WESTERN MICHIGAN UNIVERSITY
The Mallinson Institute for Science Education

The MGRRE Education Portal: Investigating Rocks and Fossils under Michigan

- This is a preliminary Project for a multi-year program to develop an online portal using the Resources at the Michigan Geological Repository for Research and Education (MGRRE) at Western Michigan University.

The MGRRE Education Portal: Investigating Rocks and Fossils under Michigan

- Today's Goals
  - Introduce participants to core and MGRRE Education Portal
  - Pilot test two student activities
    - Porosity and Permeability
    - Fossils
  - MGRRE Resources - flashdrive
  - Feedback to improve activities

www.wmich.edu/corekids/core/home

CORE Kids

The Michigan Geological Repository for Research and Education (MGRRE) Presents:

Investigating Rocks and Fossils under Michigan

Home	Overview	The Core	Fossils Activity	Perm/Por Activity

The Michigan Geological Repository for Research and Education (MGRRE) Module on investigating rocks and fossils under Michigan. In this module you will discover the geologic past of Michigan and how our past relates to the resources we find here today.

Home

- Describes a quick overview of the module www.wmich.edu/corekids/core/home

CORE Kids

The Michigan Geological Repository for Research and Education (MGRRE) Presents:

Investigating Rocks and Fossils under Michigan

Home	Overview	The Core	Fossils Activity	Perm/Por Activity

The Core Energy St. Charleton #4-30. was used as a stratigraphic test well in support of CO_2 sequestration analysis.

Home

- Describes a quick overview of the module www.wmich.edu/corekids/core/overview

CORE Kids

MGRRE Presents:

Investigating Rocks and Fossils under Michigan

Home | Overview | The Core | Fossils Activity | Perm/Por Activity

What is a rock core?

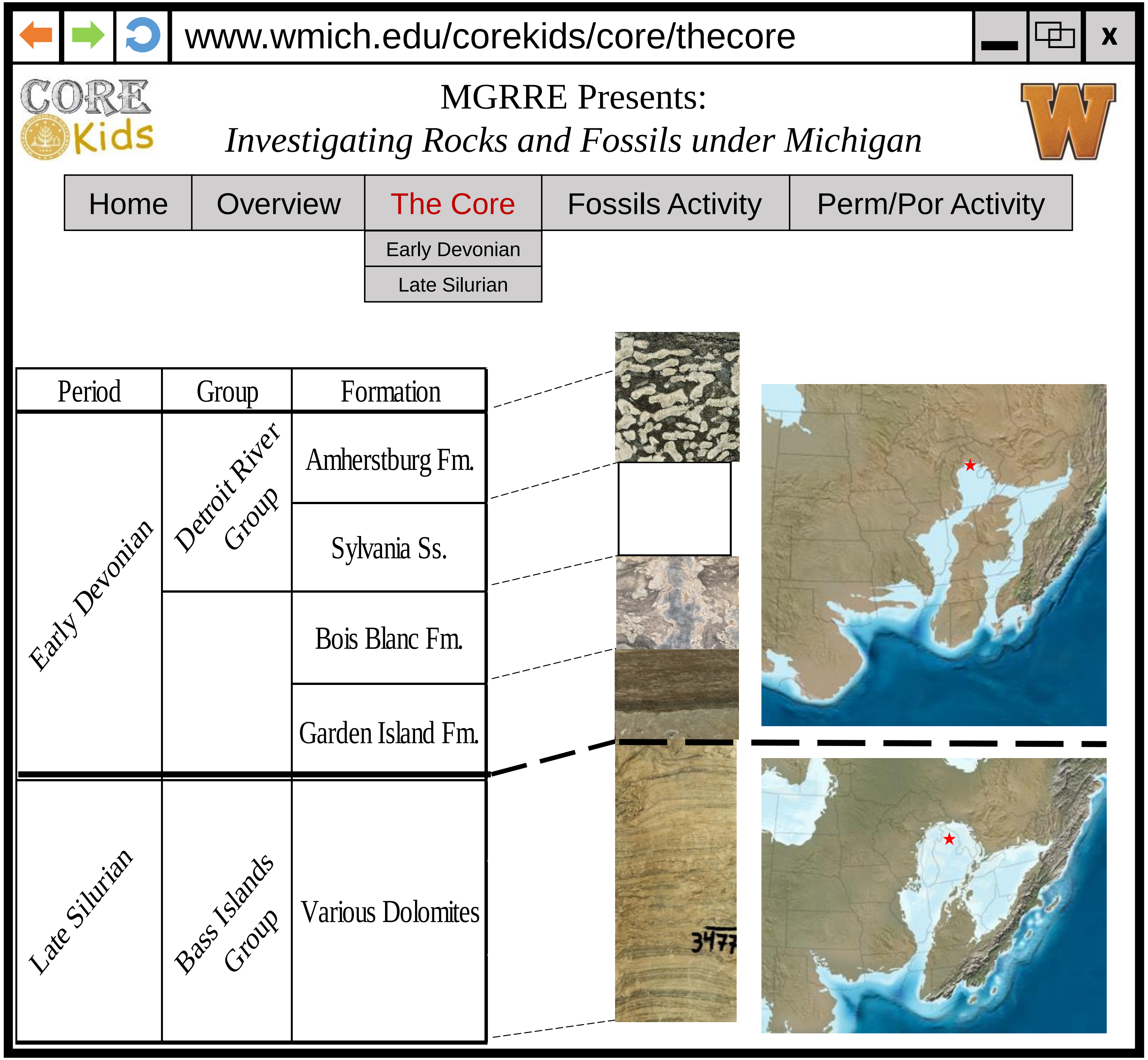
A rock core is a cylindrical sample of rock taken from the subsurface when drilling a well. It is the best type of data to look at subsurface geology. Unfortunately this type of sampling is expensive, so for most wells we have to rely on geophysical datasets or ground-up rock material called cuttings. Cores are collected by Petroleum Geologists, Environmental Geologists, Geological and Civil Engineers, and Hydrologists.

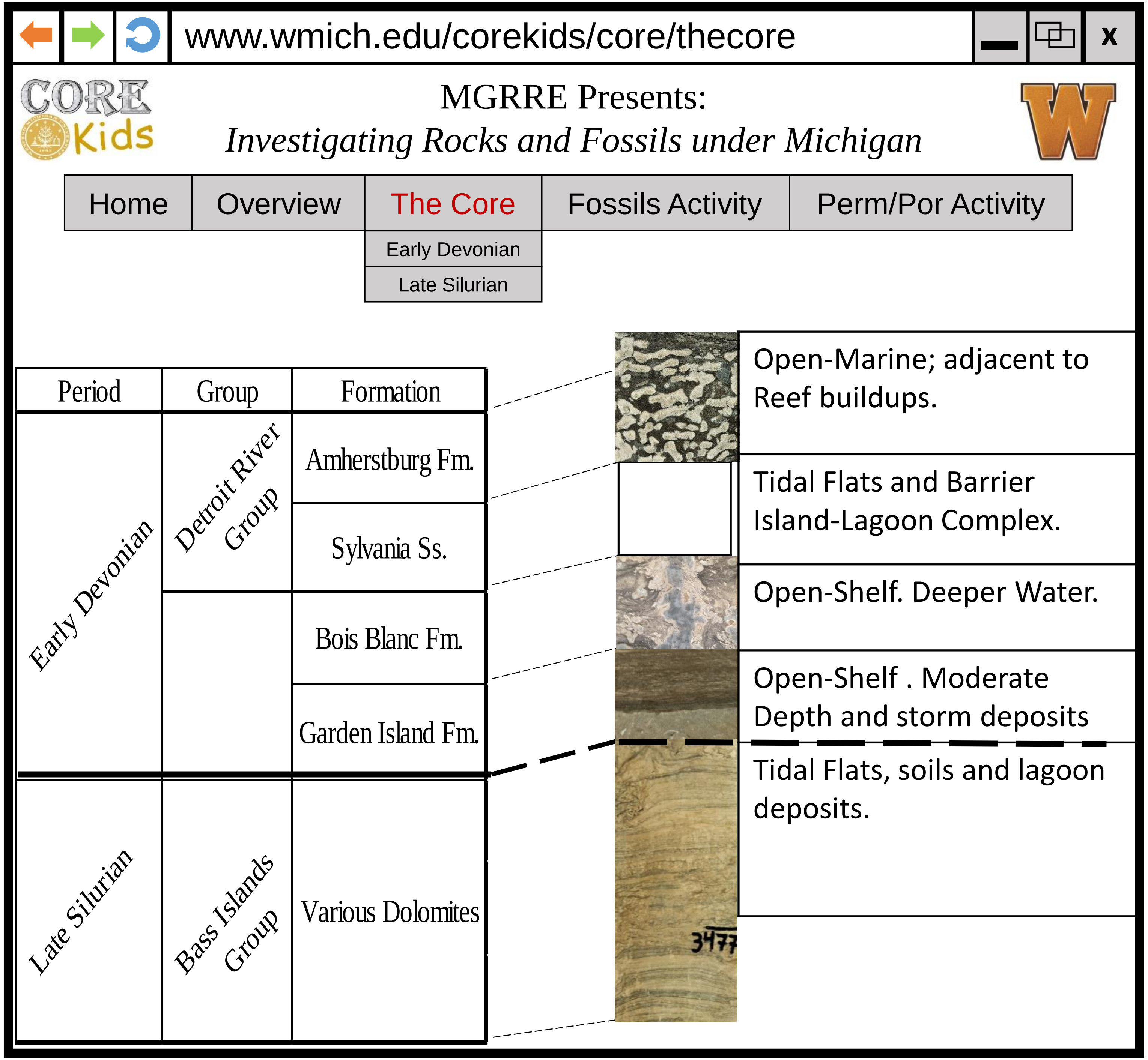
Overview

- Describes What a rock core is, and how we extract them
- Discusses the scientific (diagenesis and paleo-environments) and economic (show me the $$) significance of studying core samples
- Describes the present day location of the core sample

The Core

- Contains digitized core with clickable sections





The Core

- Contains digitized core with clickable sections www.wmich.edu/corekids/core/thecore

CORE Kids

MGRRE Presents:

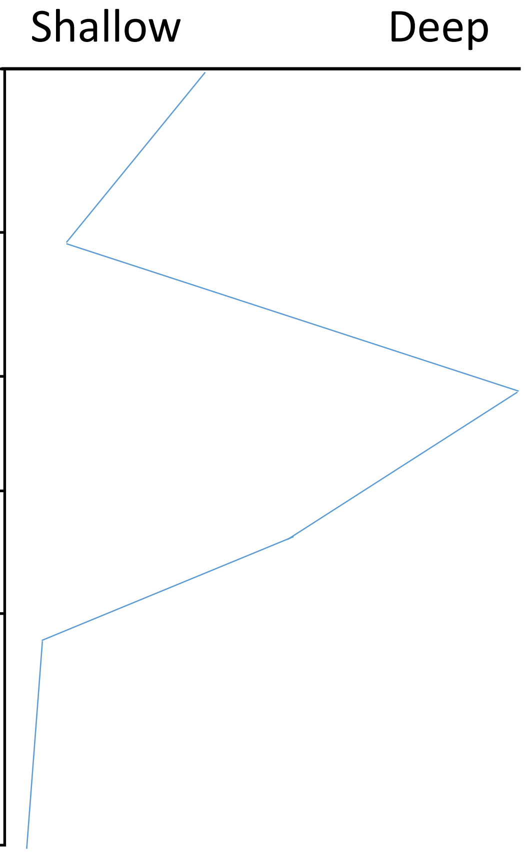
Investigating Rocks and Fossils under Michigan

Home | Overview | The Core | Fossils Activity | Perm/Por Activity

- Early Devonian
- Late Silurian

Period	Group	Formation
Early Devonian	Detroit River Group	Amherstburg Fm.
		Sylvania Ss.
		Bois Blanc Fm.
		Garden Island Fm.
Late Silurian	Bass Islands Group	Various Dolomites

- Open-Marine; adjacent to Reef buildups.
- Tidal Flats and Barrier Island-Lagoon Complex.
- Open-Shelf. Deeper Water.
- Open-Shelf . Moderate Depth and storm deposits
- Tidal Flats, soils and lagoon deposits.



www.wmich.edu/corekids/core/latesilurian

CORE Kids

MGRRE Presents:

Investigating Rocks and Fossils under Michigan

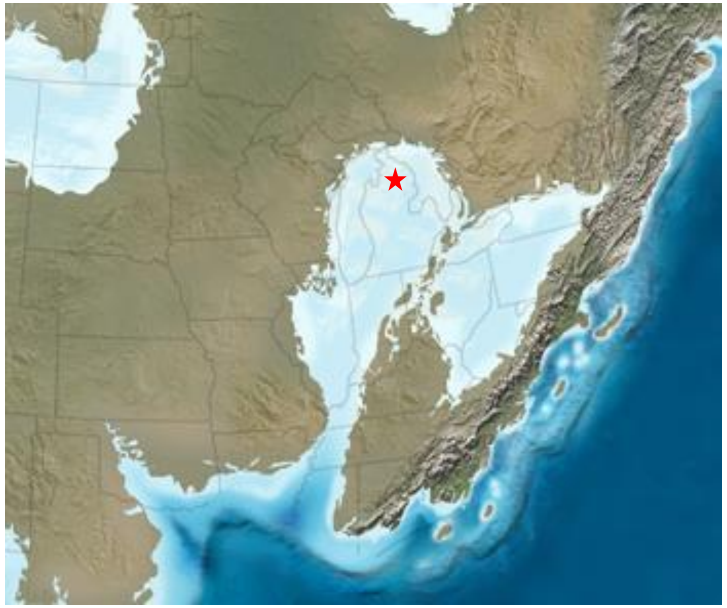
Home | Overview | The Core | Fossils Activity | Perm/Por Activity

Early Devonian

Late Silurian

Late Silurian

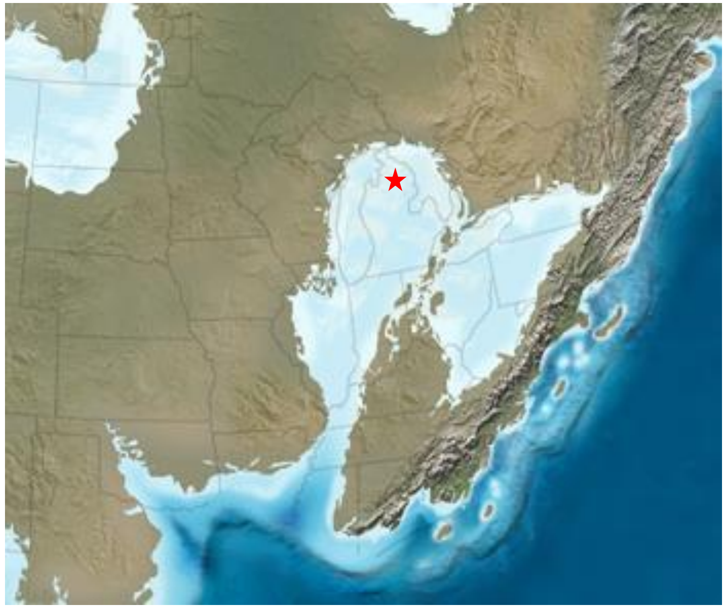
During the Late Silurian Michigan was located in the tropics and was likely tropical semi-arid. The dolomites found in this section of the core most likely formed on a tidal flat. A modern example today would be the Gulf Coast Sabkhas.



Late Silurian

- Describes the paleoenvironment the area
- Relates rock types to paleoenvironment

www.wmich.edu/corekids/core/latesilurian



Anhydrite in the Bass Islands Group. Deposits from an ancient sabkha.

Late Silurian

- Describes the paleoenvironment the area
- Relates rock types to paleoenvironment

www.wmich.edu/corekids/core/earlydevonian

CORE Kids

MGRRE Presents:

Investigating Rocks and Fossils under Michigan

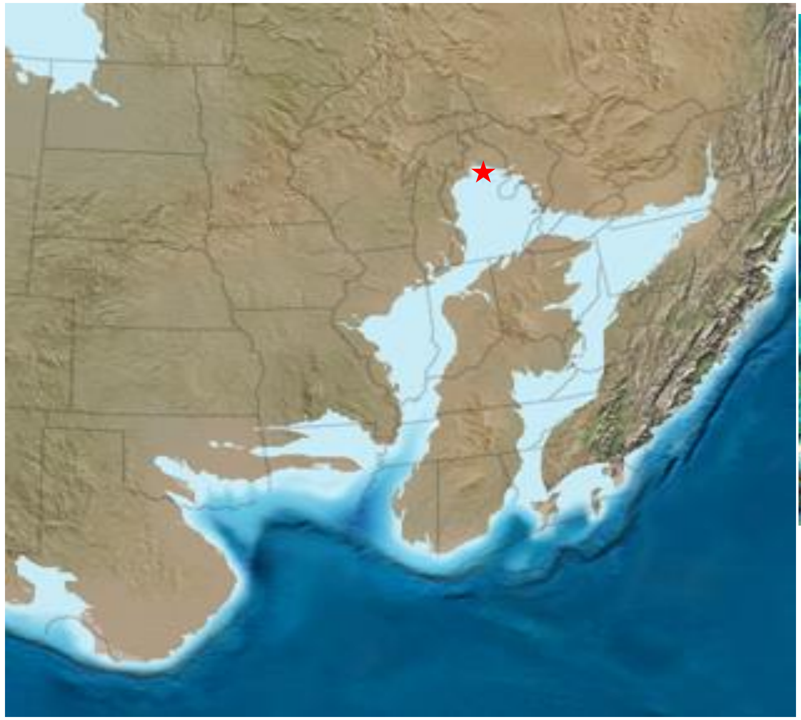
Home | Overview | The Core | Fossils Activity | Perm/Por Activity

Early Devonian

Late Silurian

Early Devonian

During the Early Devonian Michigan was located in the tropics and was likely tropical humid. The sediments for this strata were deposited near a reef environment like we see today in the Bahamas or in the modern Florida Keys Reef Tract.



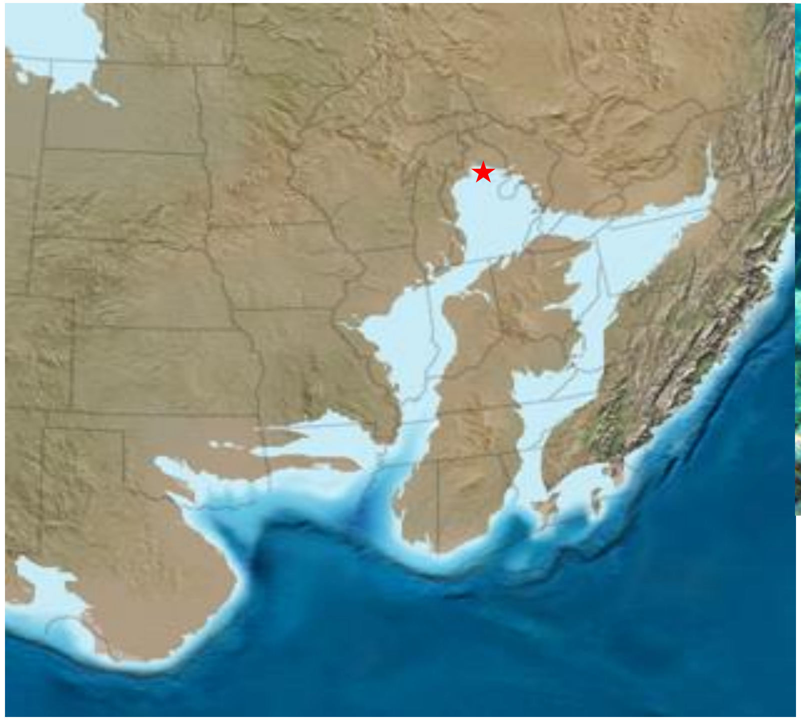
Early Devonian

- Describes the change in paleoenvironments
- Relates rock types to paleoenvironment

Early Devonian

- Describes the change in paleoenvironments
- Relates rock types to paleoenvironment

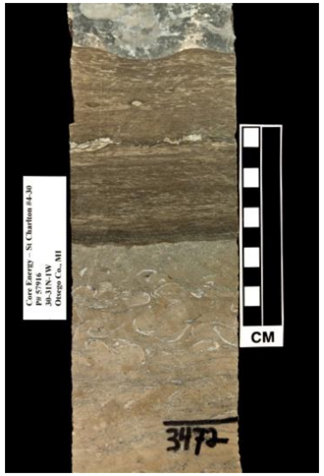
www.wmich.edu/corekids/core/earlydevonian



Amherstburg Fm.

Bois Blanc Fm.

Garden Island Fm.



Activity 1: Fossils

www.wmich.edu/corekids/core/fossils

CORE Kids

MGRRE Presents:

Investigating Rocks and Fossils under Michigan

Fossils

Fossils tell geologists a lot of information about past environments. Particular animals enjoy particular environments. If you find a rock with a certain set of animal remains you can glean what the environments must have been like in the past. The following are a few fossil specimens found here in Michigan.

Tabulate Coral: This is a tabulate coral known as *favosites sp*.

Body view

Slice view

Fossil Activity

- Describes some common fossils in Silurian and Devonian rocks. Look at their morphologies. Look at the environments that these animals live in.

Fossil Activity

- Describes some common fossils in Silurian and Devonian rocks. Look at their morphologies. Look at the environments that these animals live in.

www.wmich.edu/corekids/core/fossils

Tabulate Coral: This is a tabulate coral known as *favosites sp*.

Body view

Slice view

Rugose Coral: This is a rugose coral; they are also known as horn corals.

Body view

Slice view

www.wmich.edu/corekids/core/fossils

Rugose Coral: This is a rugose coral; they are also known as horn corals.

Body view

Slice view

Rugose Coral: This is a colonial Rugose coral called *Hexagonaria percinata* or the Petoskey Stone. [Click here to learn more](#).

Body view

Slice view

Fossil Activity

- Describes some common fossils in Silurian and Devonian rocks. Look at their morphologies. Look at the environments that these animals live in.

Fossil Activity

- Describes some common fossils in Silurian and Devonian rocks. Look at their morphologies. Look at the environments that these animals live in.

www.wmich.edu/corekids/core/fossils

Rugose Coral: This is a colonial Rugose coral called *Hexagonaria percinata* or the Petoskey Stone. Click here to learn more.

Body view

Slice view

Brachiopod: This is a Brachiopod known as *Atrypa sp*.

Body view

Slice view

Fossil Activity

- Describes some common fossils in Silurian and Devonian rocks. Look at their morphologies. Look at the environments that these animals live in.

www.wmich.edu/corekids/core/fossils

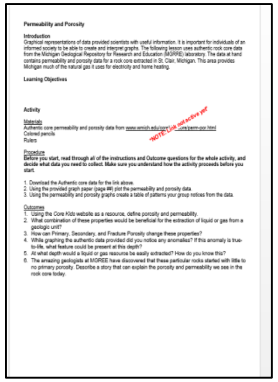
Brachiopod: This is a Brachiopod known as *Atrypa sp*.

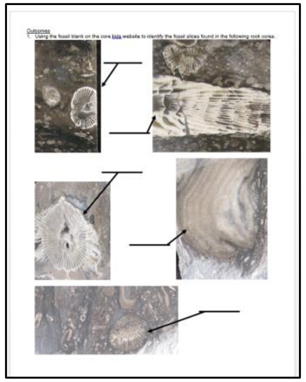
Body view

Slice view

Fossil Activity

Download the following file. Use the information presented on this website to help you answer the prompts at hand.





Activity 2: Porosity and Permeability

www.wmich.edu/corekids/core/fossils

CORE Kids

MGRRE Presents:

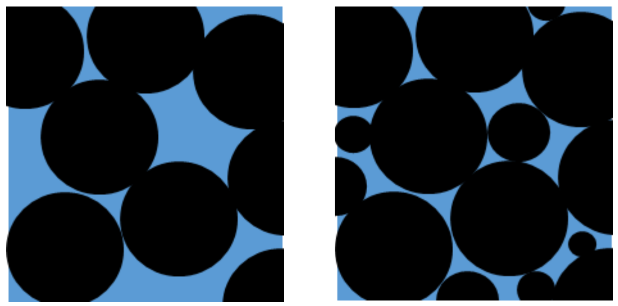
Investigating Rocks and Fossils under Michigan

Home	Overview	The Core	Fossils Activity	Perm/Por Activity

Porosity

$$\phi = \frac{(V_b - V_s)}{V_b} * 100$$

Porosity is the percentage of free space in a geologic unit.



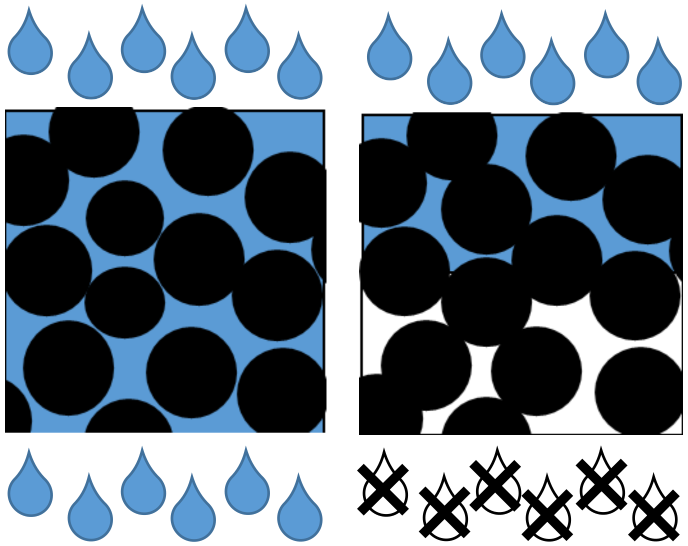
High Porosity

Low Porosity

Permeability

$$Q = \frac{\kappa / \mu}{dp / dl}$$

Permeability is a calculation of how interconnected pores are in a geologic unit



High Permeability

Low Permeability

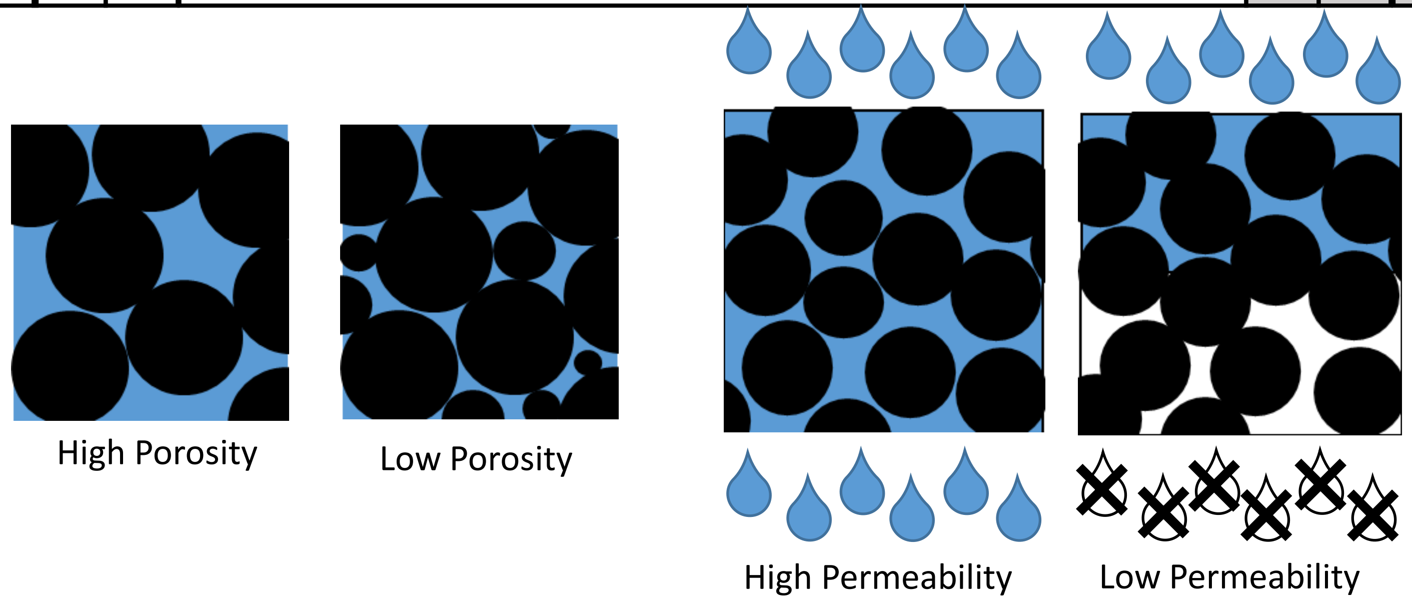
Perm/Por Act.

- Describes what permeability and porosity is, how to calculate it, how it forms, and what this means for liquid/gas extraction.

Perm/Por Act.

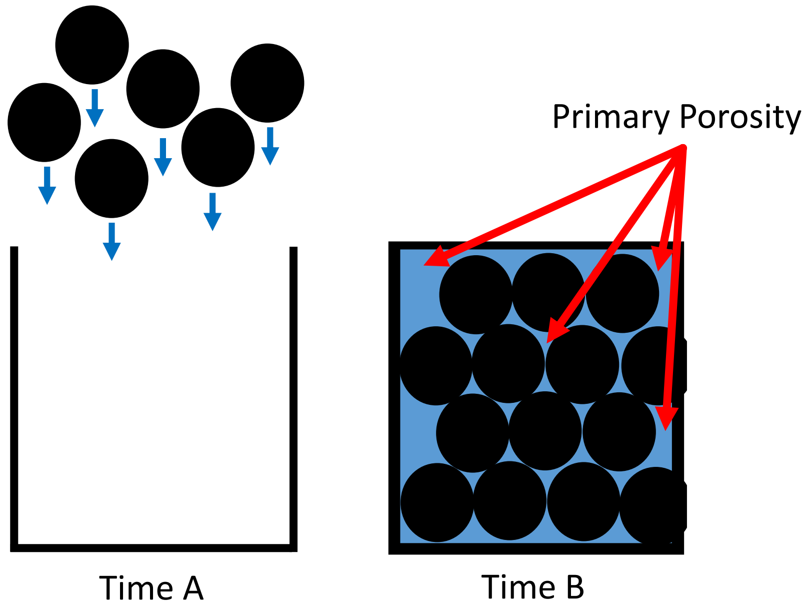
- Describes what permeability and porosity is, how to calculate it, how it forms, and what this means for liquid/gas extraction.

www.wmich.edu/corekids/core/perm_por



Porosity Types

Primary porosity is the original porosity that existed when the sediment became a rock. Imagine filling a glass jar with pebbles. If we could somehow freeze this into a rock in it's current state, the space between the pebbles would represent primary porosity.



www.wmich.edu/corekids/core/perm_por

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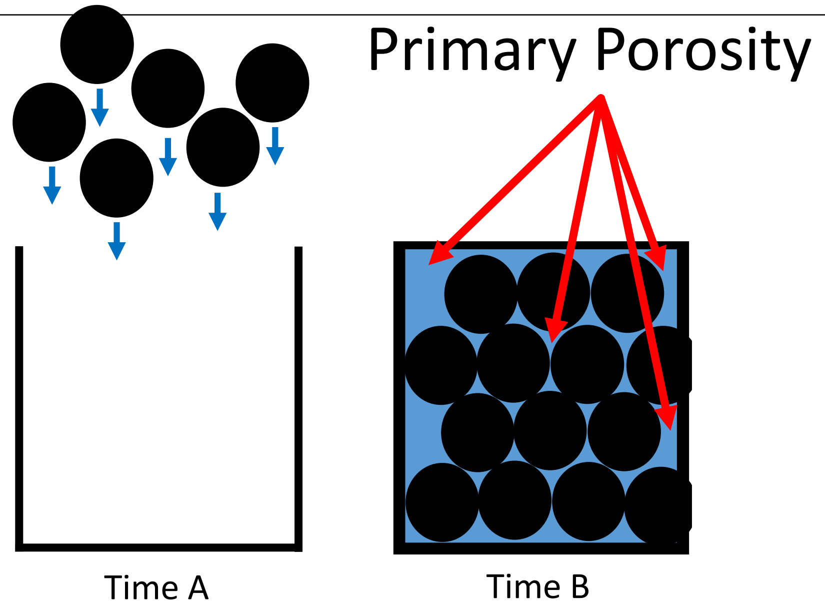
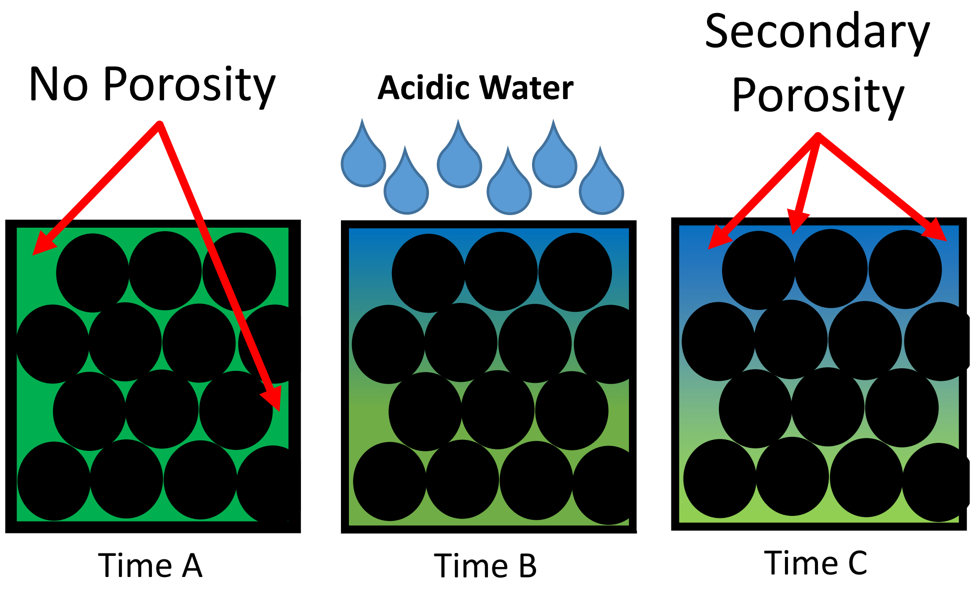


Secondary porosity is an increase of porosity due to the dissolution of particular mineral grains or cement in a rock. Imagine the green space represents calcite cement and the water that runs through the rock is acidic. The space left behind represents secondary porosity.



Perm/Por Act.

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www.wmich.edu/corekids/core/perm_por

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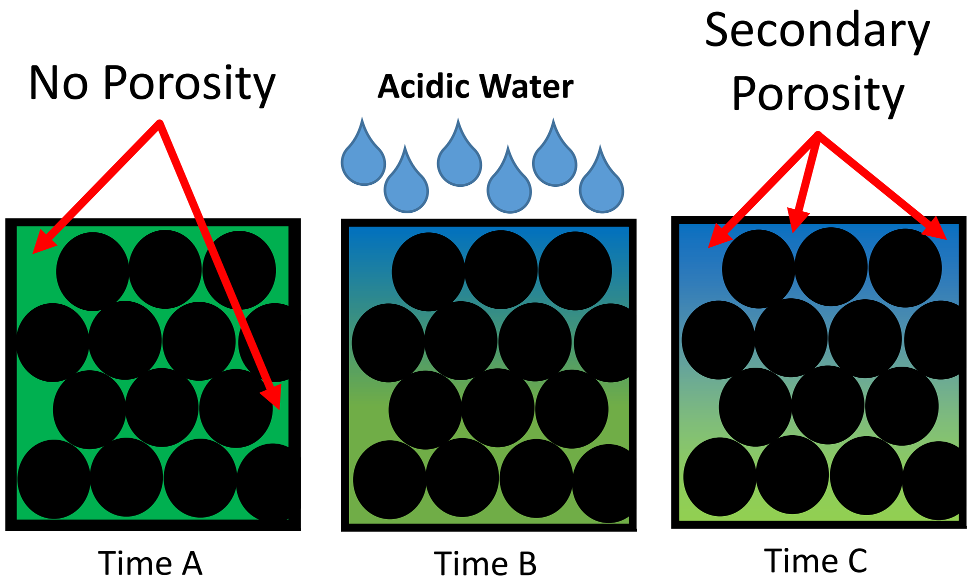
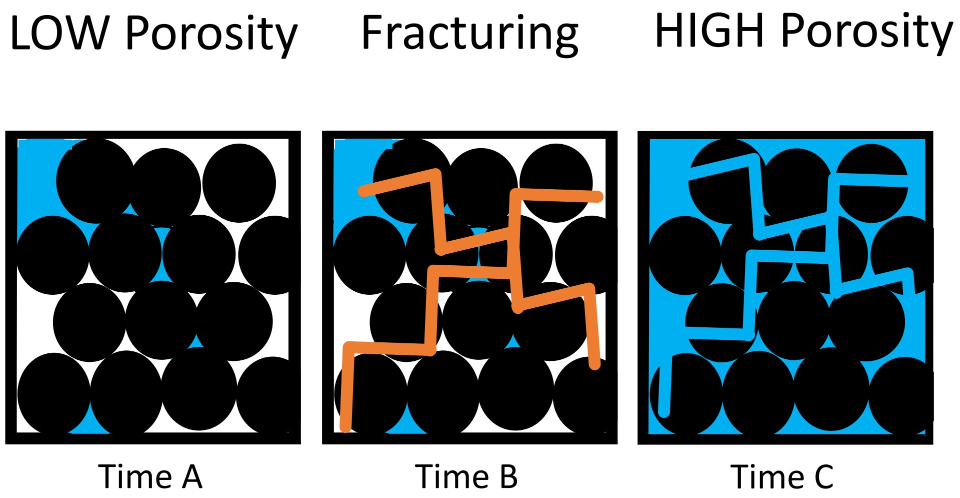


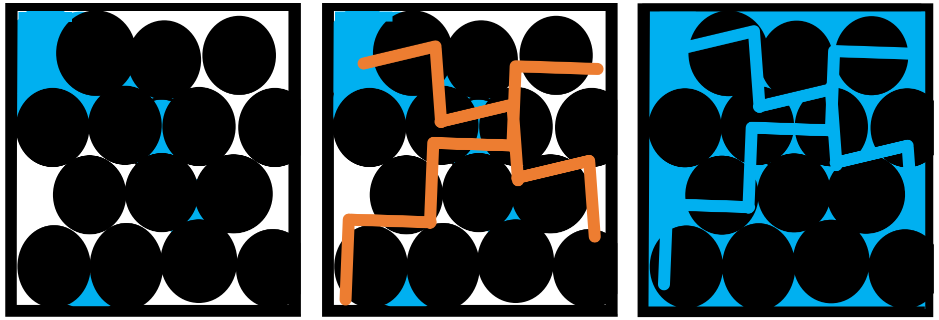
Fracture Porosity is an increase of porosity due to breakage of the rock. The breakage occurs due to natural stresses on the rock. Fractures act as conduits.



www.wmich.edu/corekids/core/perm_por

Fracture Porosity is an increase of porosity due breakage of the rock due to stress on the rocks. Fractures act as conduits.

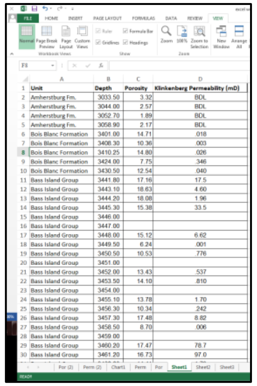
LOW Porosity | Fracturing | HIGH Porosity

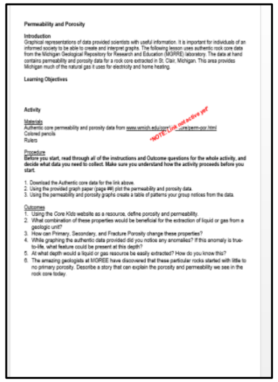


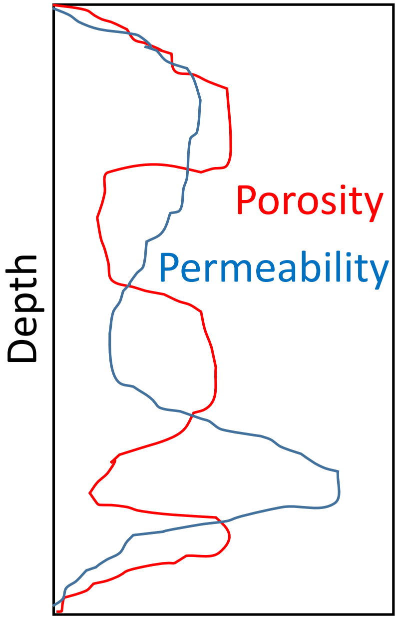
Time A | Time B | Time C

Perm/Por Activity

Click here to download porosity and permeability data and Activity.







An example of an overlaid permeability and porosity graph. Are porosity and permeability always related?

Perm/Por Act.

- At the end of the perm/por page students will be provided with an activity sheet and authentic dataset for download.

The MGRRE Education Portal: Investigating Rocks and Fossils under Michigan

- **Thank you!**

- **Please fill out the Evaluation Forms!!!!**

North-Central Section - 49th Annual Meeting (19-20 May 2015)

Paper No. 15-7
Presentation Time: 3:50 PM

INVOLVING STAKEHOLDERS IN DEVELOPING WEB-BASED OUTREACH RESOURCES: AN EXAMPLE FROM THE MGRRE EDUCATION PORTAL

Heather Petcovic, Department of Geosciences and The Mallinson Institute for Science Education, Western Michigan University, Kalamazoo, MI, Peter J. Voice, Geosciences, Western Michigan University, Kalamazoo, MI, William Cobern, Mallinson Institute for Science Education, Western Michigan University, Kalamazoo, MI, Brian Horvitz, Department of Educational Leadership, Research and Technology, Western Michigan University, Kalamazoo, MI, William B. Harrison III, Michigan Geological Survey, Western Michigan University, Kalamazoo, MI and Andrew Phillip Keller Bentley, The Mallinson Institute for Science Education, Western Michigan University, Kalamazoo, MI

As part of their education initiatives, surveys, museums, and other organizations commonly disseminate online resources for K-12 classrooms. These resources vary from individual activities, to authentic scientific datasets tailored for classroom use, to fully developed curricula. Models for resource development also vary widely, but early involvement of stakeholders is more likely to ensure that the final resources are aligned with users' needs and thus are widely adopted.

The Michigan Geological Repository for Research and Education (MGRRE), part of the Michigan Geological Survey, maintains an extensive collection of subsurface rock and sediment samples, fossil collections, and chemical and geophysical datasets. We are creating a web-based Education Portal that when fully developed will engage K-12 students in investigating real-world problems using authentic, local subsurface data. With funding from an internal grant, we brought stakeholders to three preliminary planning workshops. The first workshop explored the resources at MGRRE, developed a vision of the portal interface and design, and identified datasets that best match current lessons and align to state and national standards. At the second workshop, we developed an initial set of activities based on an exemplar core and associated datasets. At the third workshop, we pilot tested two portal activities.

Sixteen individuals, dominantly middle and high school teachers, were engaged in shaping the vision and content of the portal through our workshops. For example, teachers were excited by a place-oriented approach that focused on geological data "underneath" their schools. Teachers want to use authentic datasets, but they stressed preparing a collection of classroom-tested example lessons as a resource for less experienced users. Topics of interest included how scientists: study cores, identify fossils in cores (matching 2D fossil slices to 3D fossil models), use stratigraphic principles to determine the sequence of geologic events, and relate porosity and permeability to economic resources. Bringing potential stakeholders to the workshops provided valuable feedback in planning and developing new online resources. It also provided a cadre of teachers willing to classroom test the portal once it is constructed.

Session No. 15

T22. Thinking outside the Display Case: Innovative Geological Outreach at Museums, Parks, and Surveys
Tuesday, 19 May 2015: 1:30 PM-5:30 PM

Hall of Ideas I (Monona Terrace Convention Center)

Geological Society of America *Abstracts with Programs.* Vol. 47, No. 5, p.26

See more of: T22. Thinking outside the Display Case: Innovative Geological Outreach at Museums, Parks, and Surveys
See more of: Theme Sessions

<< Previous Abstract | Next Abstract >>

Involving Stakeholders in Developing Web-based Outreach Resources: An Example from the MGRRE Education Portal

Heather Petcovic,
Peter Voice,
Bill Cobern,
Brian Horvitz,
Bill Harrison,
& Andrew Bentley

This work is supported a Western Michigan University College of Arts & Sciences Interdisciplinary Research Initiative Award (PI Petcovic).

Stakeholder Involvement in Creating Web-based Outreach Resources

Stakeholders (Teachers)

Online resources

Widespread classroom use

What is the MGRRE Education Portal?

MICHIGAN GEOLOGICAL SURVEY
WESTERN MICHIGAN UNIVERSITY GEOSCIENCES
Established 1837

College of Arts and Sciences
Department of Geosciences
WESTERN MICHIGAN UNIVERSITY

http://wsh060.westhills.wmich.edu/MGRRE/index.shtml

Mission:
- Applied and basic research
- Student training
- Educational outreach

Core repository:
- ~500,000 linear feet of rock core
- Rotosonic core from glacial sediment
- Fossil collections
- Geophysical & geochemical datasets

What is the MGRRE Education Portal?

http://wmich.edu/corekids/

Mission:

- Enhance public understanding of Earth Science

What is the MGRRE Education Portal?

CORE Kids

http://wmich.edu/corekids/

Activities

- K-12 classroom visits
- Teacher professional development
- Public outreach

KGMS

MICHIGAN MINERALOGICAL SOCIETY

MICHIGAN BASIN GEOLOGICAL SOCIETY

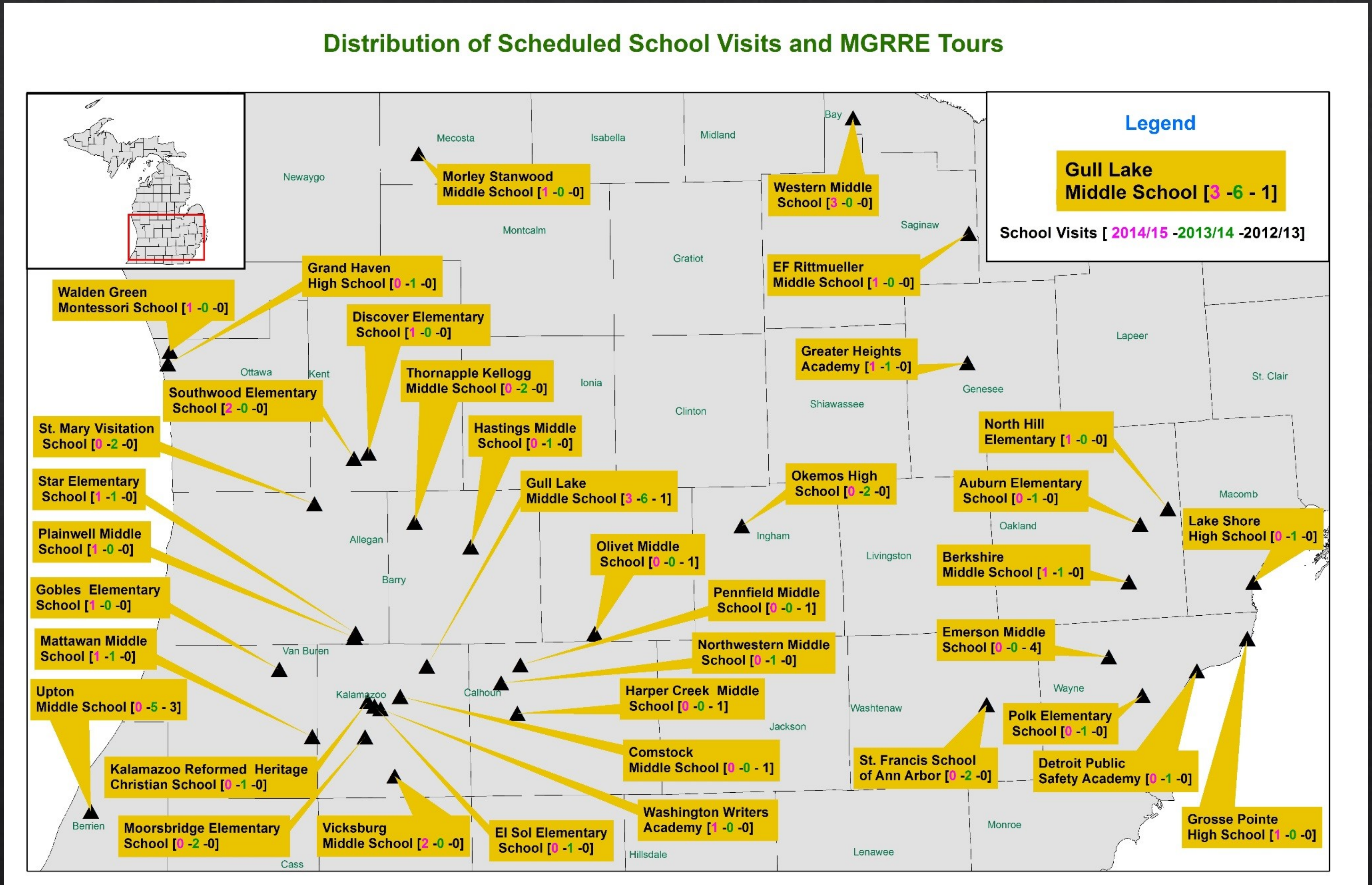
AIR ZOO

Like No Place Else on Earth!

What is the MGRRE Education Portal?

CORE Kids

http://wmich.edu/corekids/



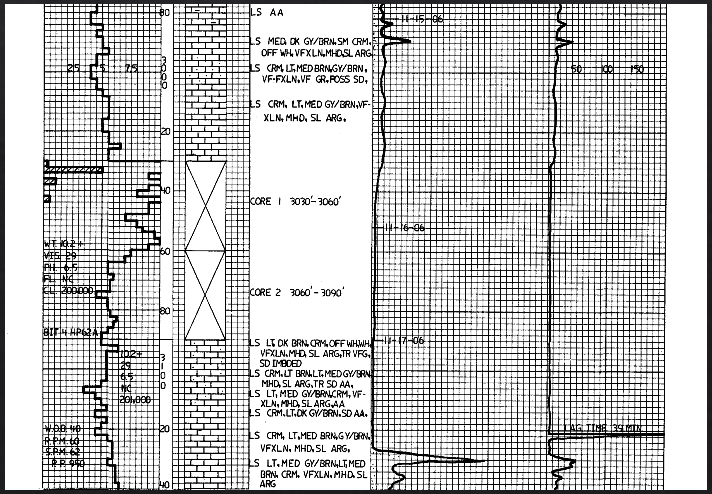
Limitations

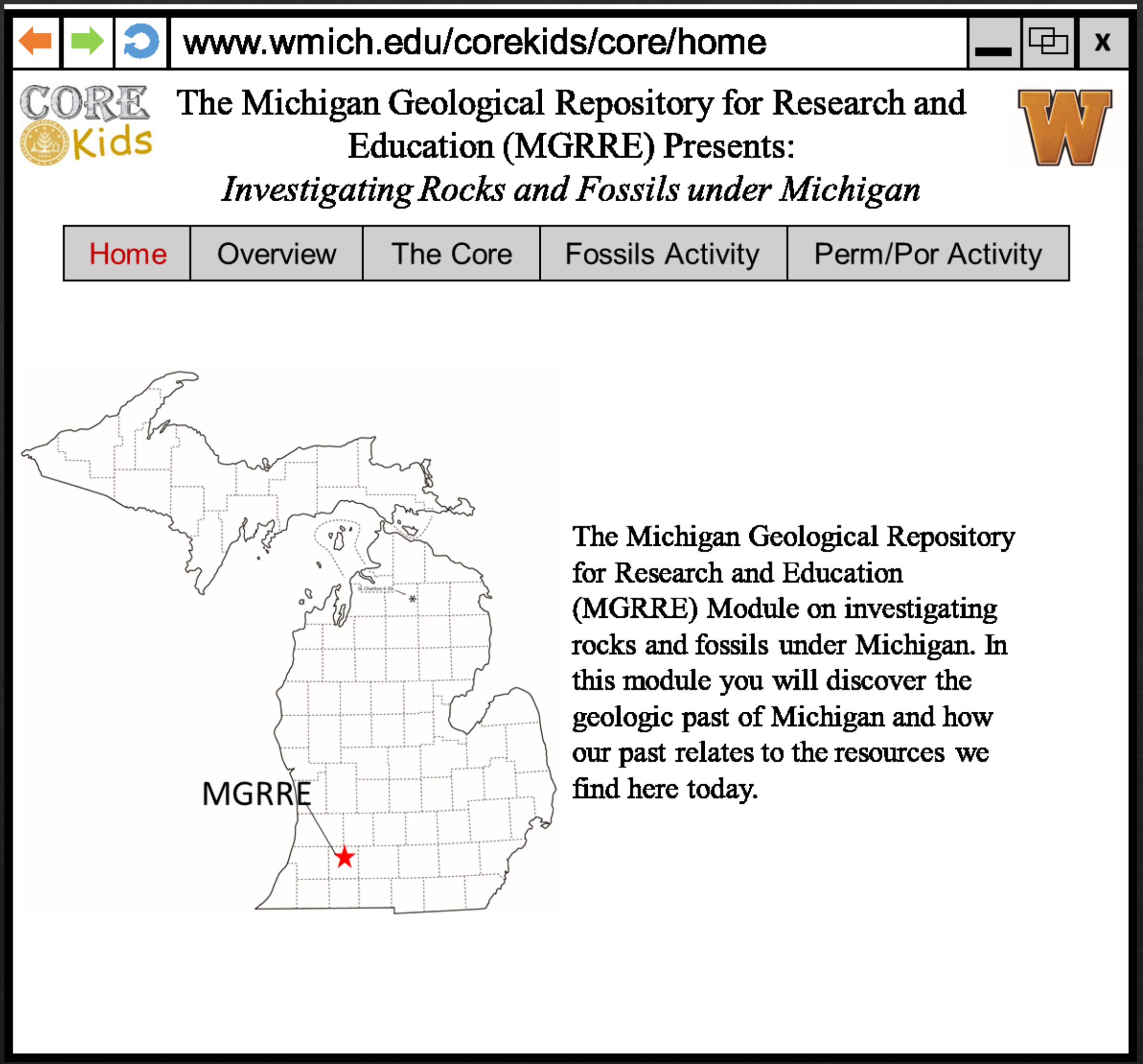
- Distance
- Time
- $$$$$

What is the MGRRE Education Portal?

Goal

- Make MGRRE resources and data available for K-20 classroom use in a web-based format
- Facilitate inquiry-based investigations using authentic data



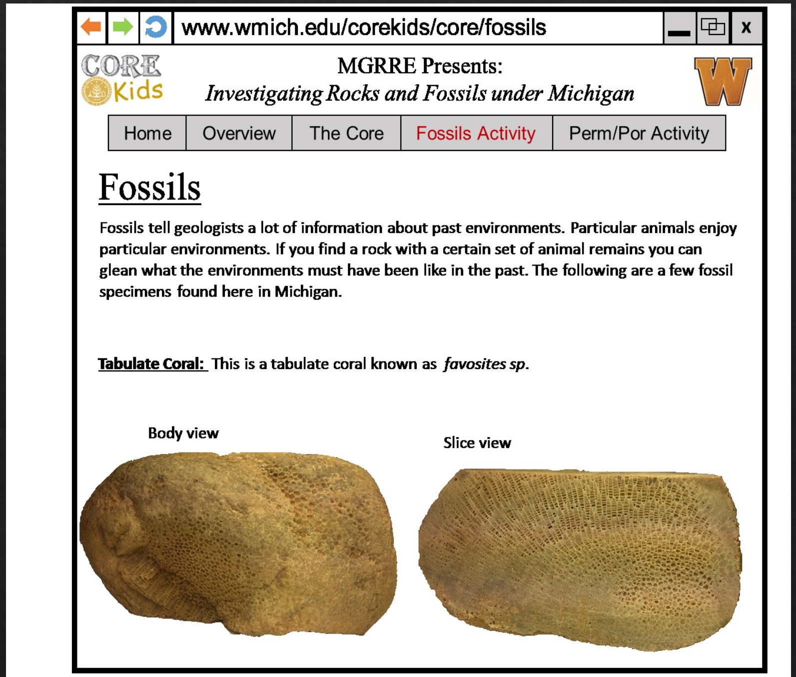


MGRRE Education Portal Planning Activities

Three planning workshops involving K-20 teachers

- Workshop I (11/13) – explore resources, design interface, select datasets
- Workshop II (5/14) – develop initial set of activities and datasets
- Workshop III (8/14) – pilot-test two initial activities

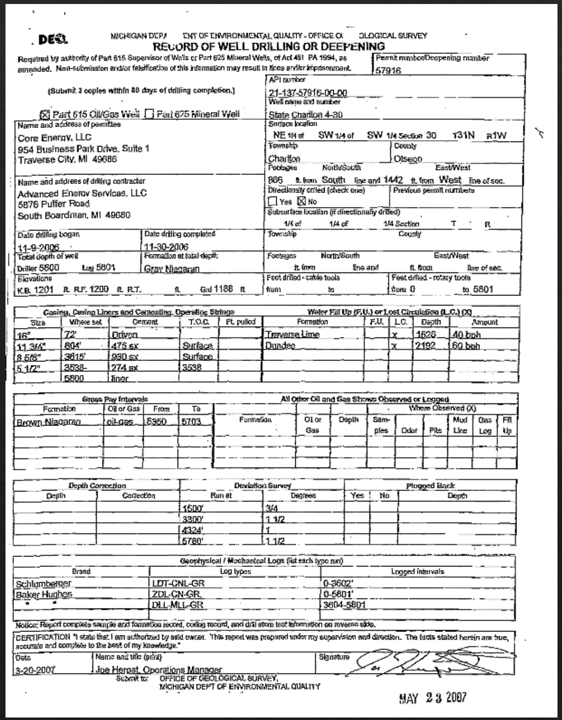
Funded by internal grant from WMU College of Arts & Sciences



Workshop I: Explore and Design

Workshop I (11/13)

- Nine teachers (seven teaching grades 8-12, 1 2YC, 1 district coordinator)
- Tour of MGRRE resources
- Brainstorming and discussion sessions



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - OFFICE OF GEOLOGICAL SURVEY
RECORD OF WELL DRILLING OR DEEPENING

Permit number/Deepening number: 57916
API number: 21-137-57916-00-00
Well name and number: State Charlton 4-30
Part 615 Oil/Gas Well
Name and address of permittee: Core Energy, LLC, 954 Business Park Drive, Suite 1, Traverse City, MI 49686
Township: Charlton
County: Otsego
Name and address of drilling contractor: Advanced Energy Services, LLC, 5876 Puffer Road, South Boardman, MI 49680
Date drilling began: 11-9-2006
Date drilling completed: 11-30-2006
Total depth of well: Driller 5800, Log 5801
Formation at total depth: Gray Niagaran
Elevations: K.B. 1201 ft, R.F. 1200 ft, Grd 1188 ft
Feet drilled - rotary tools: from 0 to 5801

Casing, Tubing, Liners and Cementing, Operating Strings

Size	Where set	Cement	T.O.C.
16"	72'	Driven	
11 3/4"	804'	475 sx	Surface
8 5/8"	3615'	930 sx	Surface
5 1/2"	3538-5800	274 sx liner	3538

Water Fill Up or Lost Circulation

Formation	Depth	Amount
Traverse Lime	1629	40 bph
Dundee	2192	60 bph

Gross Pay Intervals

Formation	Oil or Gas	From	To
Brown Niagaran	oil-gas	5350	5703

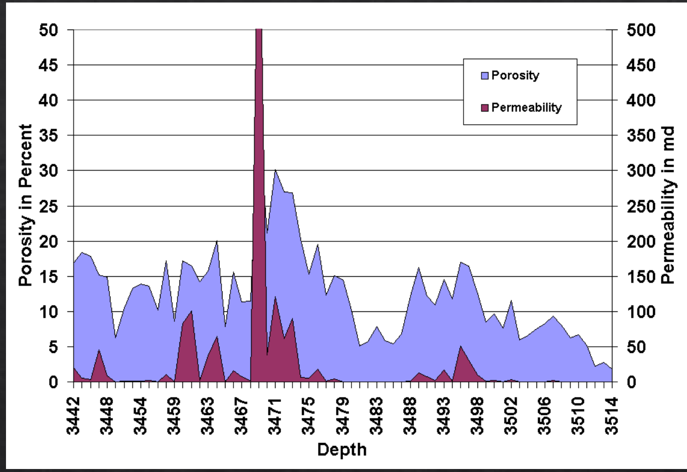
Deviation Survey

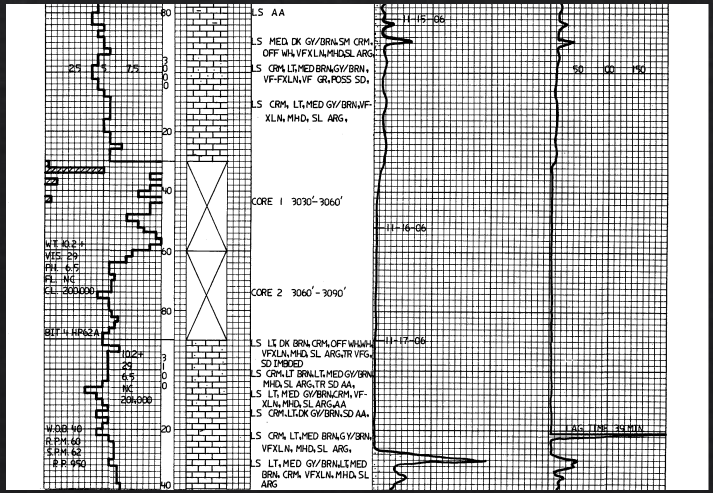
Ran at	Degrees
1500'	3/4
3300'	1 1/2
4324'	1
5780'	1 1/2

Geophysical / Mechanical Logs

Brand	Log types	Logged intervals
Schlumberger	LDT-CNL-GR	0-3602'
Baker Hughes	ZDL-CN-GR	0-5801'
	DLL-MLL-GR	3604-5801

Date: 3-20-2007
Name and title: Joe Herget, Operations Manager
MAY 23 2007





Workshop I: Explore and Design

Workshop I (11/13)

Lessons learned

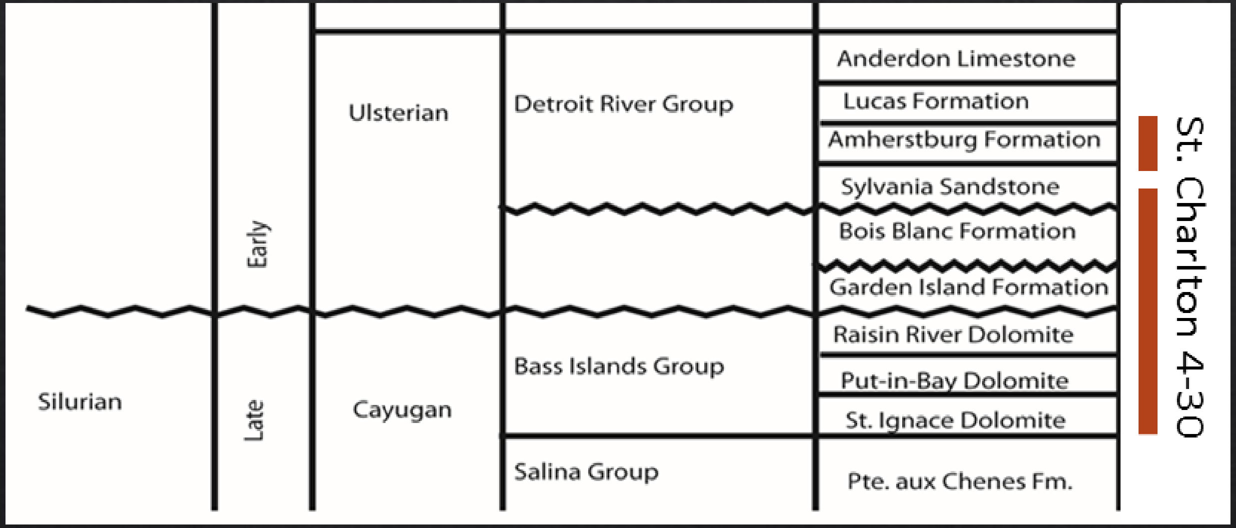
- Interface
  - "What's in my backyard?" [GIS]
  - Searchable by key terms
- Support
  - Video tutorials
  - Scaffolded for novice to expert users
- Content
  - Example activities and lessons
  - Datasets available to download

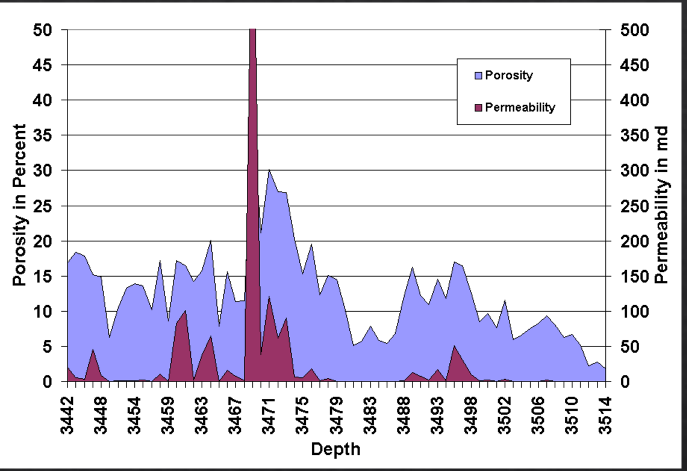
Rate the usefulness of to each dataset to your lesson plans: (1=most useful; 5=least useful)	
- Photographs of cores and rock specimens	1.0
- Geographic location data for individual wells	1.0
- Permeability and porosity data	1.5
- Drillers reports showing formations and depths	1.7
- Fossil content (to phylum or class)	1.8
- Major element rock chemistry	1.9
- Wireline logs showing natural rock radioactivity	2.2
- Trace element rock chemistry	2.3
- Wireline logs showing sonic velocity data	2.4
- Stable isotope rock chemistry	2.9
- Organic chemistry of oils	3.0

Workshop II: Build an Example

Workshop II (5/14)

- Nine teachers (eight teaching grades 8-12, 1 teaching grade 4, five new)
- Explore an example core and datasets
- Develop pilot classroom lessons





Workshop II: Build an Example

Workshop II (5/14)

Lessons learned

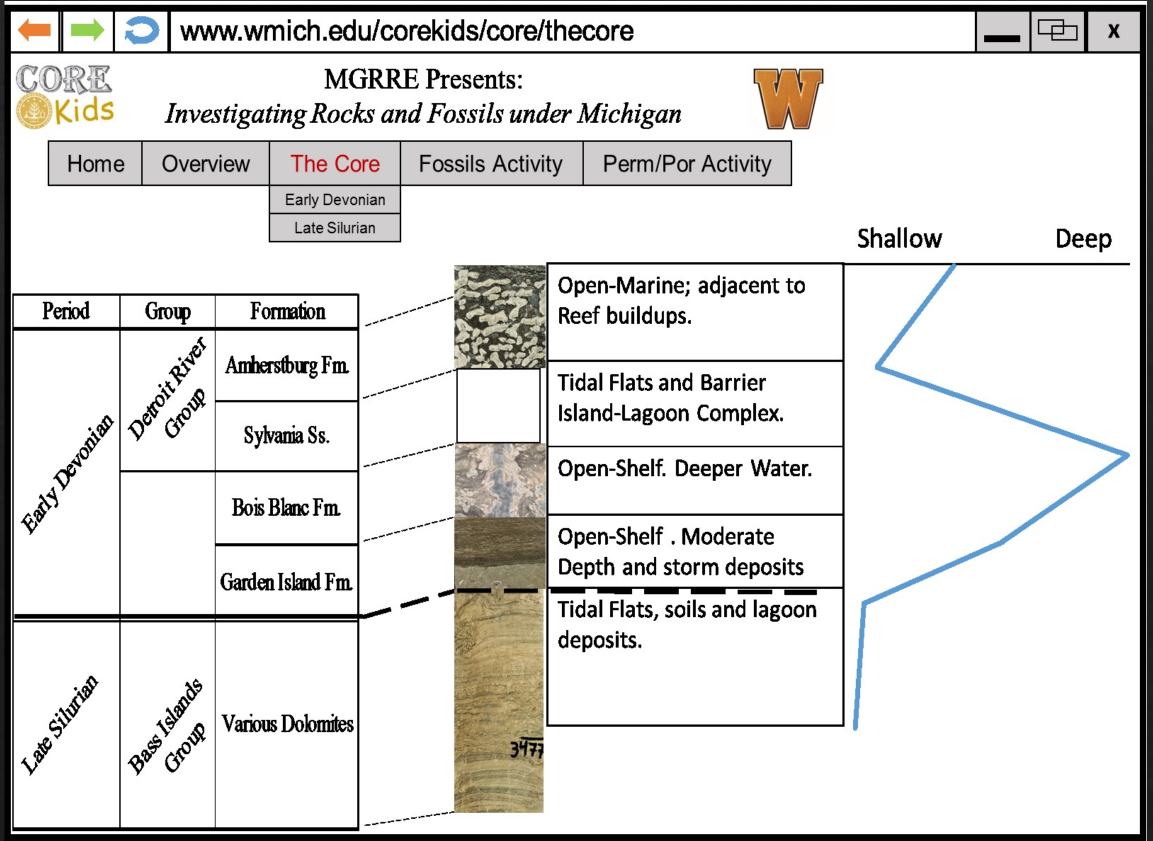
- Use of online datasets
    - Teachers want to use datasets
    - But are not comfortable designing their own lessons
- Content
    - Example activities and lessons
    - Scaffolded for novice to expert users through interface

Topic	Activity
How scientists study cores	• Describe lithologies and compare to scientific interpretation
Fossils and past environments	• Match 2D fossil "slices" in the core to 3D fossil models • Identify common fossils and use these to interpret past environments
Geologic time	• Use fossils and superposition to determine the time period for each formation
Mineral and rock types	• Identify key minerals and rock types • Determine the "story" of a rock
Maps	• Create a 3D underground map from numerous core samples
Porosity and permeability	• Graph porosity and permeability data • Compare rock types of high and low porosity/permeability
Economic resources	• Compare different cores and pick the one most likely to have hydrocarbons

Workshop III: Pilot-test Two Lessons

Workshop III (8/14)

- Three teachers (all teaching grades 8-12, two new)
- Present two example lessons
- Improve lessons with feedback



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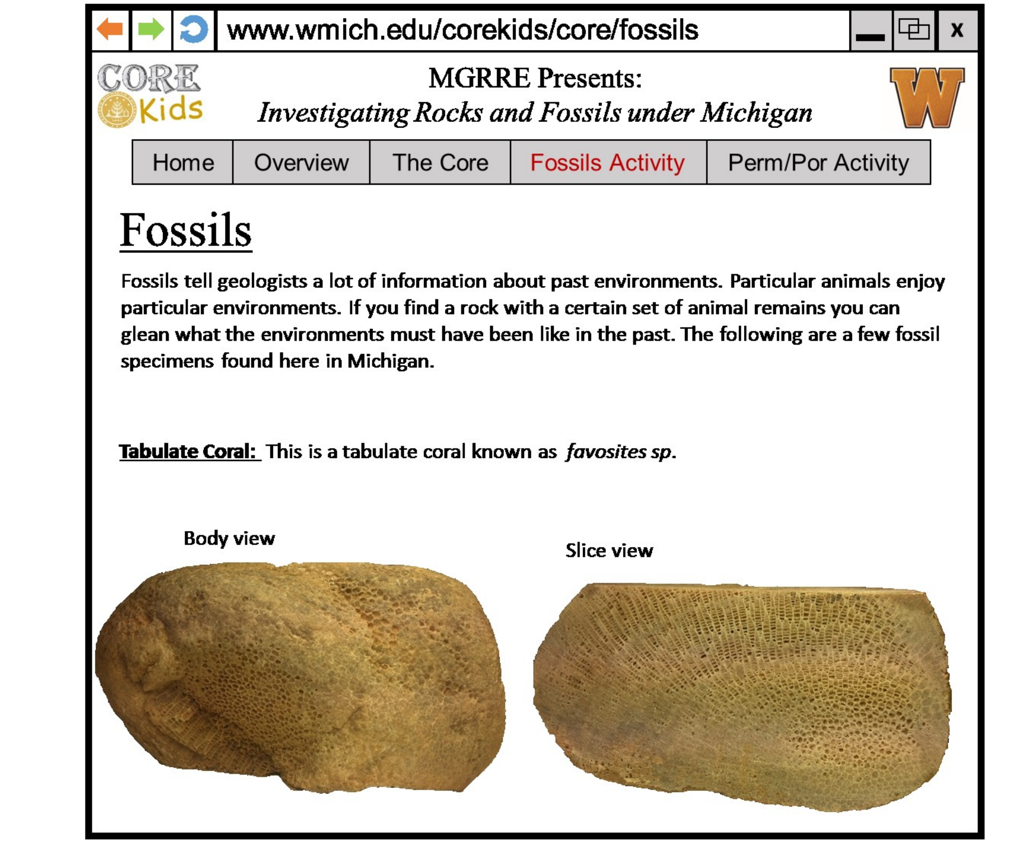
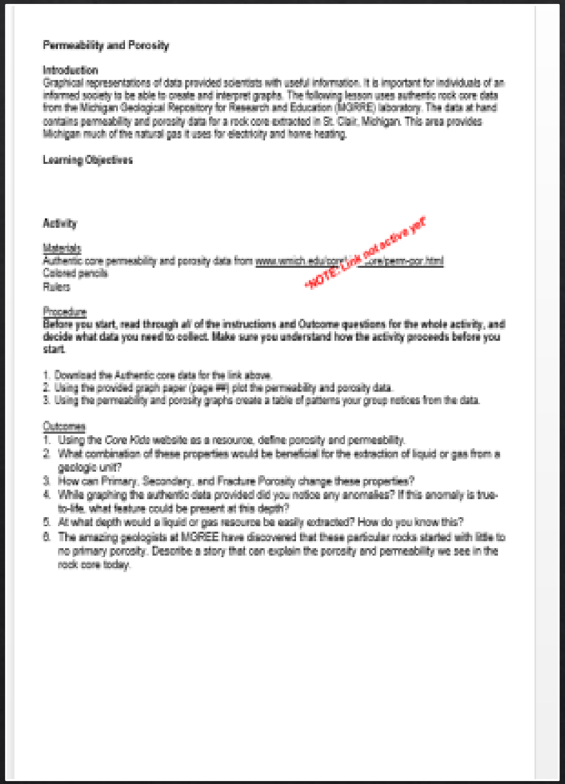




Permeability and Porosity

Introduction
Graphical representations of data provided scientists with useful information. It is important for individuals of an informed society to be able to create and interpret graphs. The following lesson uses authentic rock core data from the Michigan Geological Repository for Research and Education (MGRRE) laboratory. The data at hand contains permeability and porosity data for a rock core extracted in St. Clair, Michigan. This area provides Michigan much of the natural gas it uses for electricity and home heating.

Learning Objectives

Activity

Materials
Authentic core permeability and porosity data from www.wmich.edu/corekids/core/perm-por.html
NOTE: Link not active yet
Colored pencils
Rulers

Procedure
Before you start, read through all of the instructions and Outcome questions for the whole activity, and decide what data you need to collect. Make sure you understand how the activity proceeds before you start.

1. Download the Authentic core data for the link above.
2. Using the provided graph paper (page ##) plot the permeability and porosity data.
3. Using the permeability and porosity graphs create a table of patterns your group notices from the data.

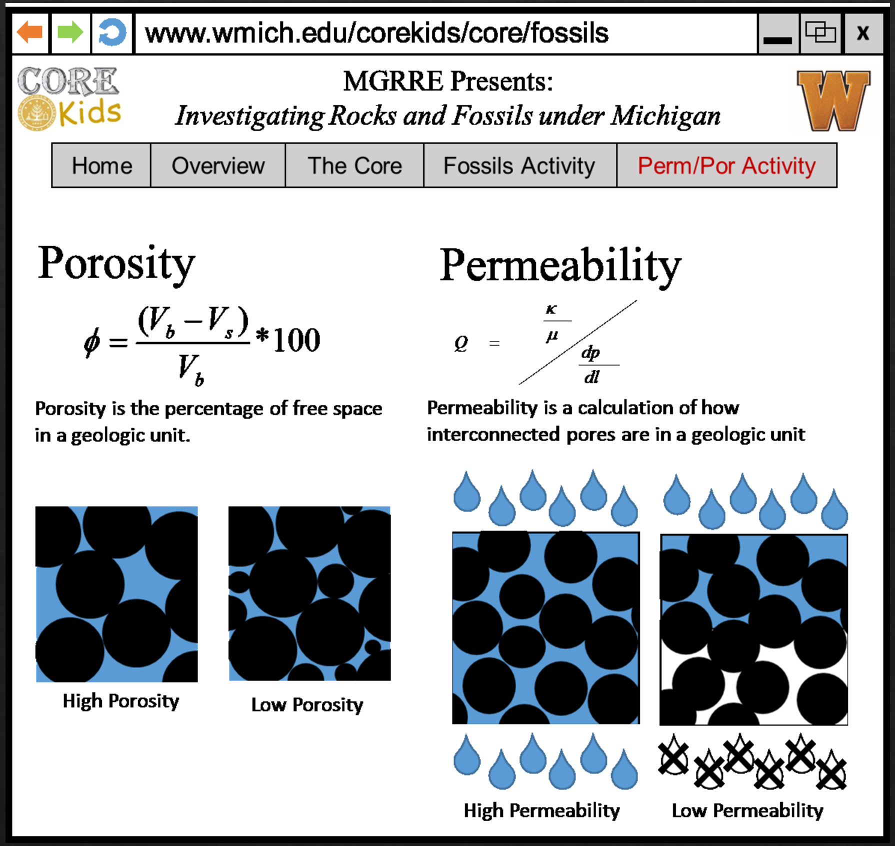
Outcomes
1. Using the Core Kids website as a resource, define porosity and permeability.
2. What combination of these properties would be beneficial for the extraction of liquid or gas from a geologic unit?
3. How can Primary, Secondary, and Fracture Porosity change these properties?
4. While graphing the authentic data provided did you notice any anomalies? If this anomaly is true-to-life, what feature could be present at this depth?
5. At what depth would a liquid or gas resource be easily extracted? How do you know this?
6. The amazing geologists at MGREE have discovered that these particular rocks started with little to no primary porosity. Describe a story that can explain the porosity and permeability we see in the rock core today.

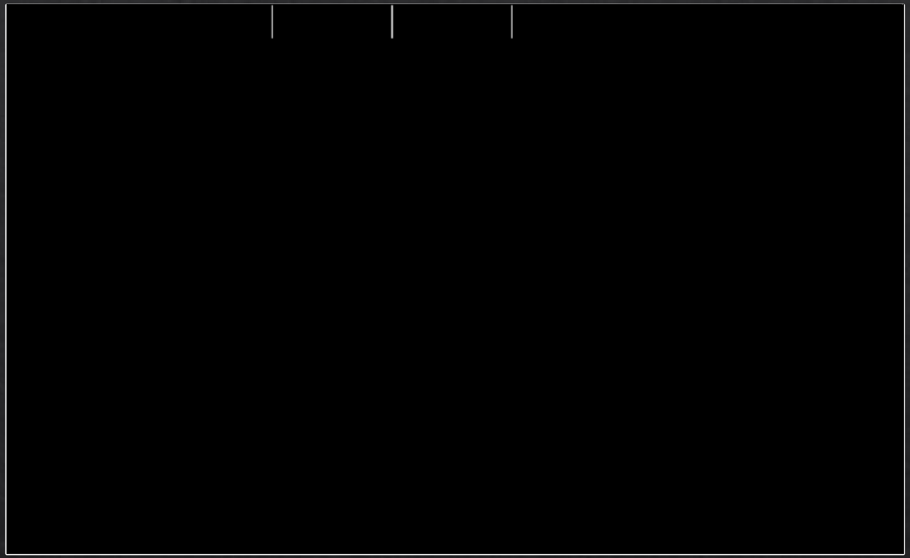
Outcomes
1. Using the fossil blank on the core kids website to identify the fossil slices found in the following rock cores.

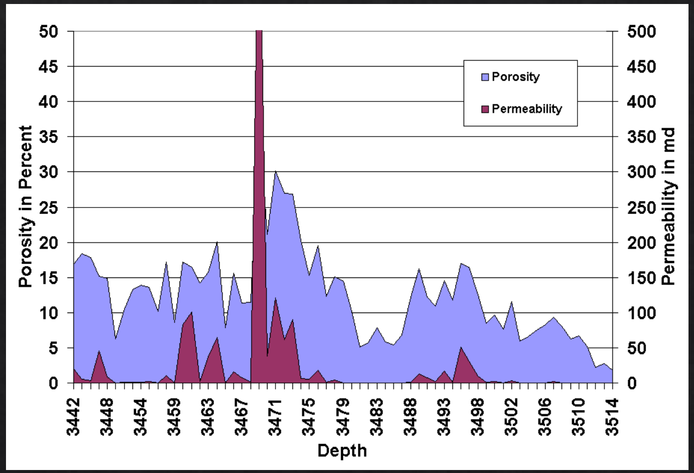
Workshop III: Pilot-test Two Lessons

Workshop III (8/14)

- Three teachers (all teaching grades 8-12, two new)
- Present two example lessons
- Improve lessons with feedback





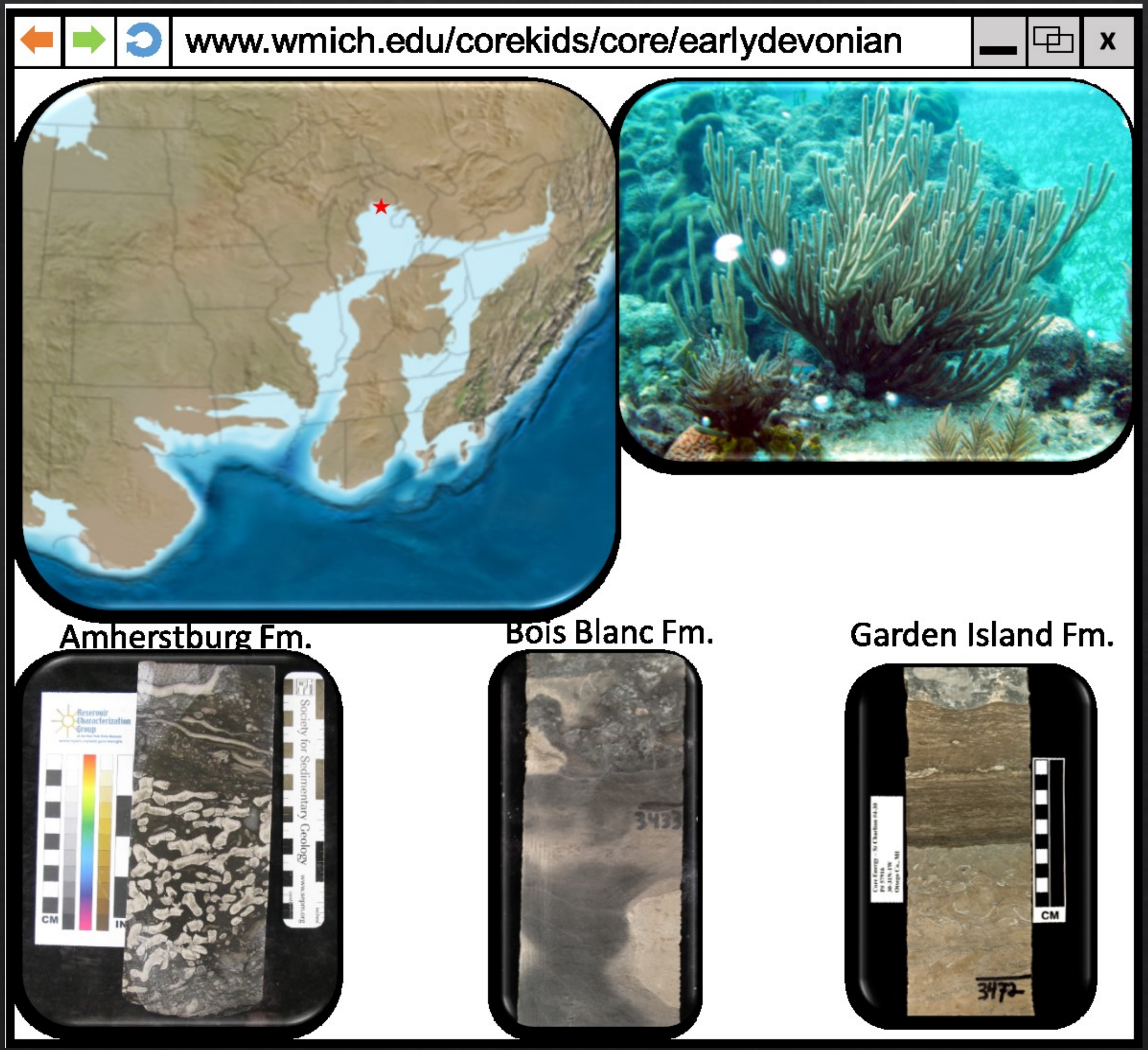


Workshop III: Pilot-test Two Lessons

Workshop III (8/14)

Lessons learned

- Online versus physical samples
  - Teachers would like samples to supplement online activities
- Content
  - Topics are appropriate for grades 8-12
  - Scaffolded for novice to expert users through interface



Lessons Learned and Next Steps

Involvement of teachers from the start:

- Discover stakeholder preferences

- Align development activities with actual classroom needs

- Identify teachers willing to pilot test materials and resources

Next steps:

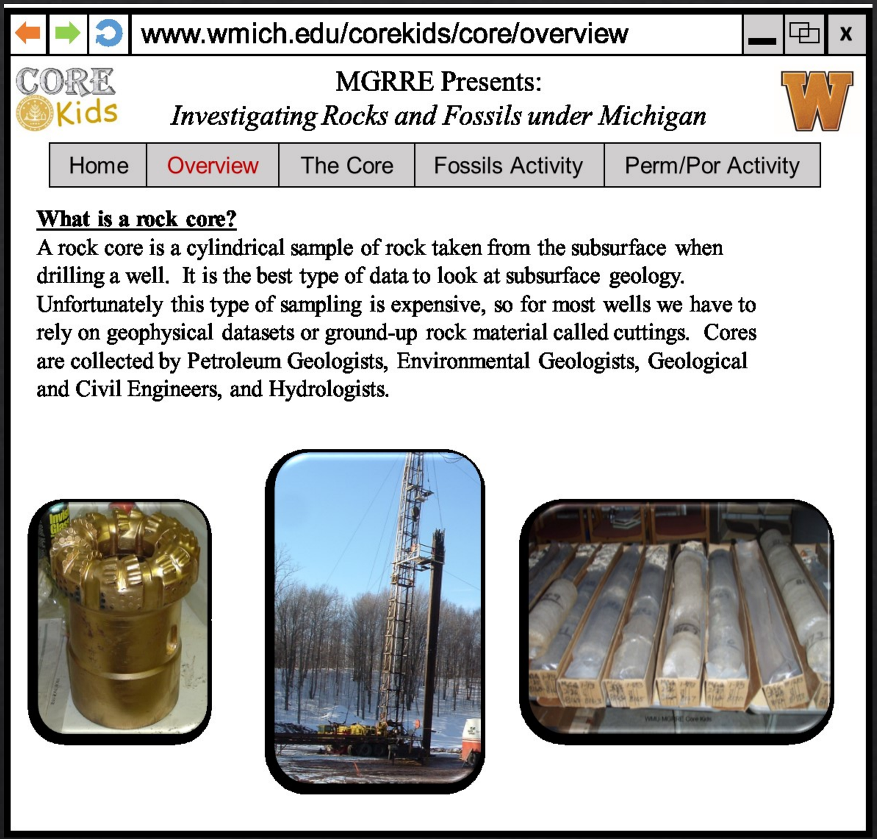
- Secure funding to develop a portal prototype
  - Teacher consultants
  - Web design & development
  - Geoscientists
  - Science and technology educators

CORE Kids

http://wmich.edu/corekids/

Stakeholder Involvement in Creating Web-based Outreach Resources

Stakeholders (Teachers)



Online resources

Widespread classroom use

North-Central Section - 49th Annual Meeting (19-20 May 2015)

Paper No. 15-10
Presentation Time: 4:50 PM

A DEMONSTRATION MODEL OF HYDRAULIC FRACTURING: HANDS-ON ANALOG TO FRACTURING SHALE

Peter J. Voice[1], Ann M. Gilchrist[2], Heather Petcovic[3] and William B. Harrison III[2], (1)Geosciences, Western Michigan University, Kalamazoo, MI, (2)Michigan Geological Survey, Western Michigan University, Kalamazoo, MI, (3)Department of Geosciences and The Mallinson Institute for Science Education, Western Michigan University, Kalamazoo, MI

The Michigan Geological Survey and the Department of Geosciences at Western Michigan University has developed a physical analog model for hydraulic fracturing in a vertical well. Hydraulic fracturing has become a controversial issue over the past decade, even though it has been in use as a standard well-completion technique for over 60 years. The development of high-volume hydraulic fracturing and the increase in utilization of hydrocarbons from unconventional reservoirs has made this technique much more common. Because direct experience of hydraulic fracturing is not possible in most teaching contexts, we developed a hands-on model that illustrates this process. The model serves as one component of a module from the WMU CoreKids program for K-12 demonstration. It is also used in a laboratory lesson on hydraulic fracturing in a college earth science content course for future elementary teachers.

We use an artificial stratigraphy to illustrate the layered nature of sedimentary rocks in a basin similar to the Michigan Basin. One of the layers is composed of agar gelatin, whereas the other layers consist of either impermeable, cemented sand, or of plastic and foam. Agar gelatin sets at room temperature and is sufficiently transparent to observe the fractures that develop. A mixture of glycerin and colored sand is an analog to the hydraulic fracturing fluid. The glycerin acts as the injectant and carries the proppant (sand) into the agar layer. The hydraulic fracturing fluid is injected under pressure into a pre-set well-bore. The hydraulic fracturing process develops wing-shaped fractures in the agar. These fractures form this morphology as the well-bore is designed to only allow the hydraulic fracturing fluid out into the agar through a vertically aligned perforation in the well casing.

One of the more interesting properties of the agar is that it can be removed from the model readily as a discrete block. After removal, the students can slice the agar along the fracture planes. The students can observe that the sand (proppant) lines the surface of the fracture. In using the model in the classroom, we have found that children and adult students alike enjoy the (somewhat messy) hands-on aspect and gain an appreciation of the mechanics of hydraulic fracturing.

Session No. 15

T22. Thinking outside the Display Case: Innovative Geological Outreach at Museums, Parks, and Surveys
Tuesday, 19 May 2015: 1:30 PM-5:30 PM

Hall of Ideas I (Monona Terrace Convention Center)

Geological Society of America *Abstracts with Programs.* Vol. 47, No. 5, p.26

See more of: T22. Thinking outside the Display Case: Innovative Geological Outreach at Museums, Parks, and Surveys
See more of: Theme Sessions

<< Previous Abstract | Next Abstract >>

A Demonstration Model of Hydraulic Fracturing: Hands-on Analog to Fracturing Shale

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CORE Kids

MICHIGAN GEOLOGICAL SURVEY
WESTERN MICHIGAN UNIVERSITY GEOSCIENCES
Established 1837

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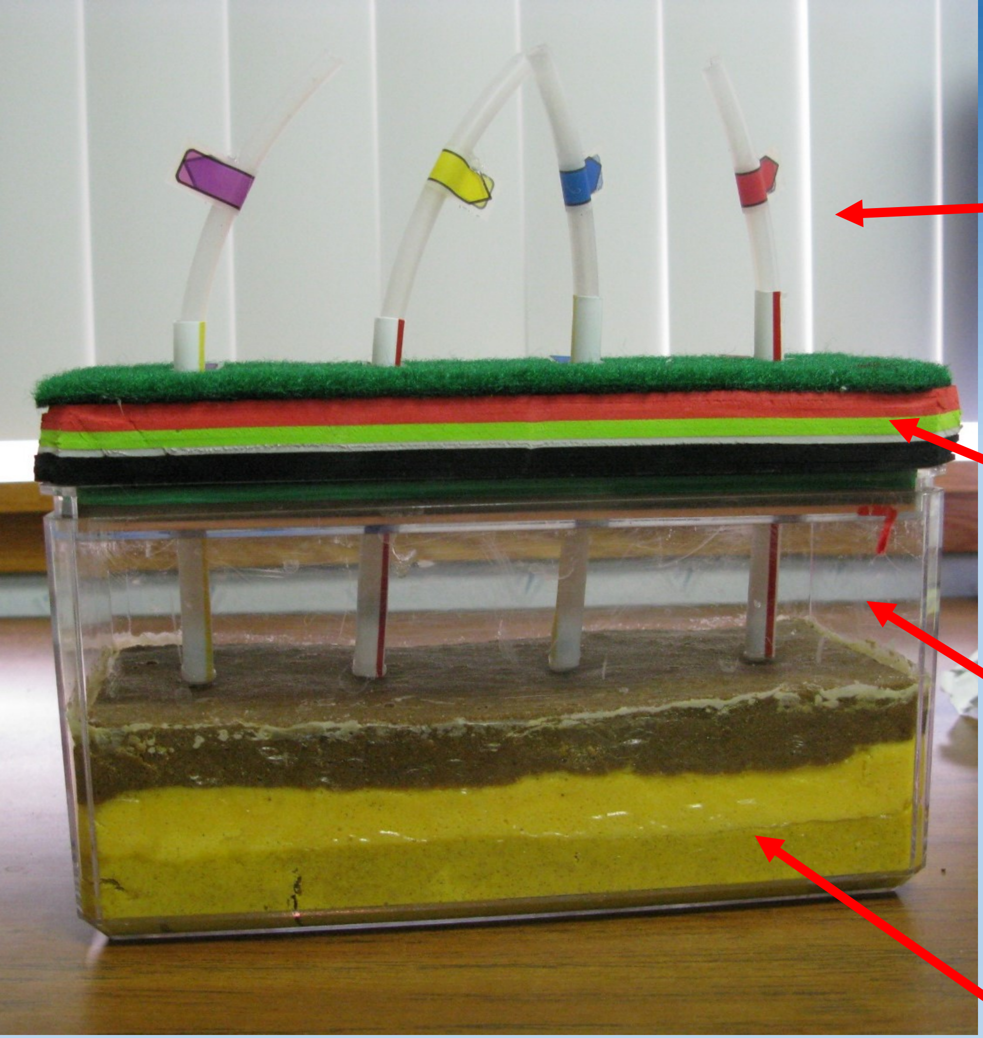
Hydraulic Fracturing Module

- Core Pumps – illustration of porosity and permeability in both reservoir and seal rocks
  - Conventional vs. Unconventional Reservoirs
- Coring drilling bit and Core samples – discussion of mechanics of drilling well
- Hydraulic Fracturing Model – illustration of unconventional reservoir
- Teachers resources -- http://www.fracky.org/uploads/3/2/9/9/3299341/fracky_speaks_out.pdf

Children using our core pump experiment.


Core Energy – St Charlton #4-30
P# 57916
30-31N-1W
Otsego Co., MI
3054
CM



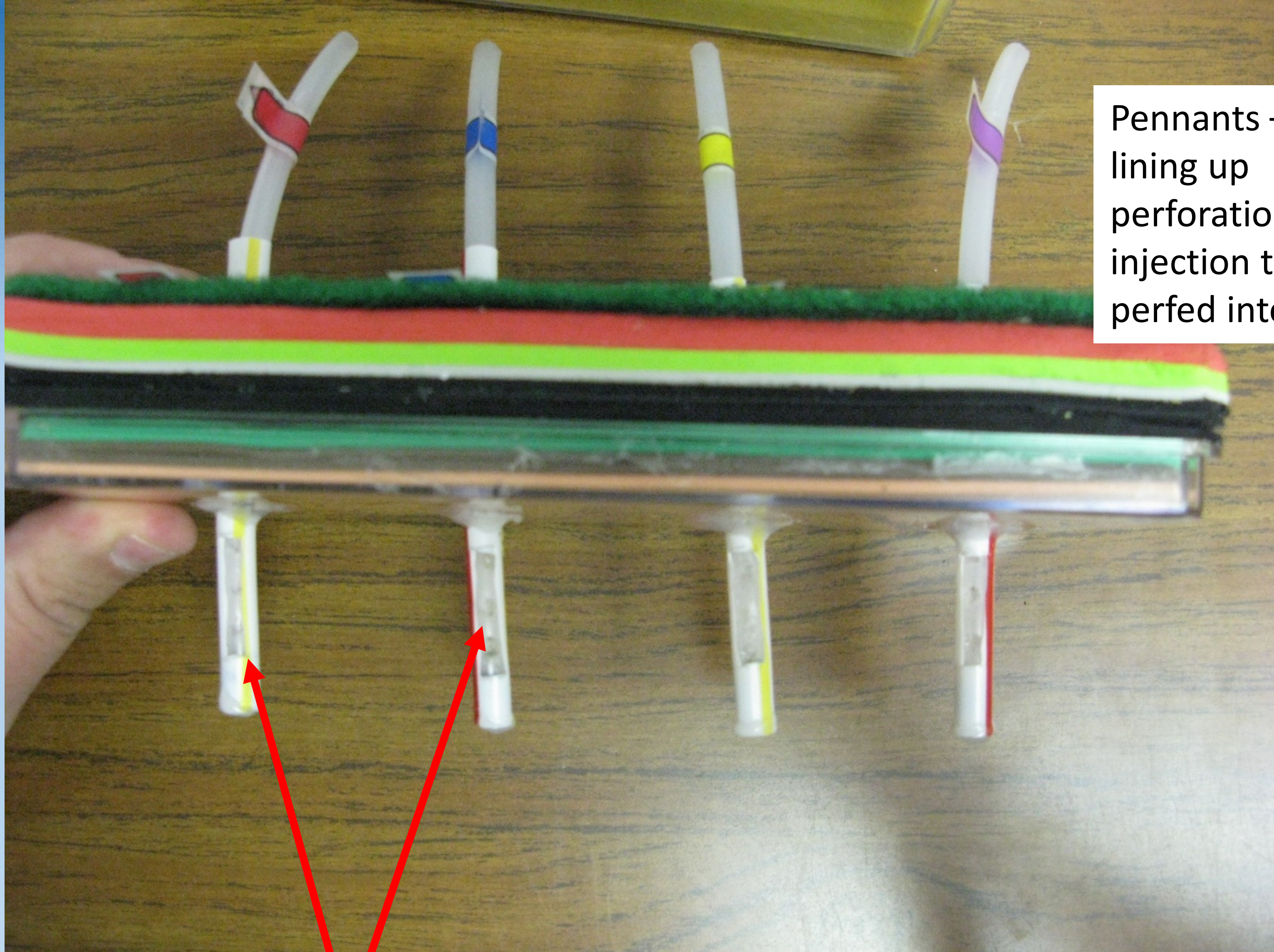
Well Casing– with injection tube for hydraulic fracturing fluid

Impermeable upper layers and ground surface analog

Chamber for agar – shale analog with pre-positioned well casings/well bores

Layers of sand – sand cemented with glue. Impermeable layers.

The Model



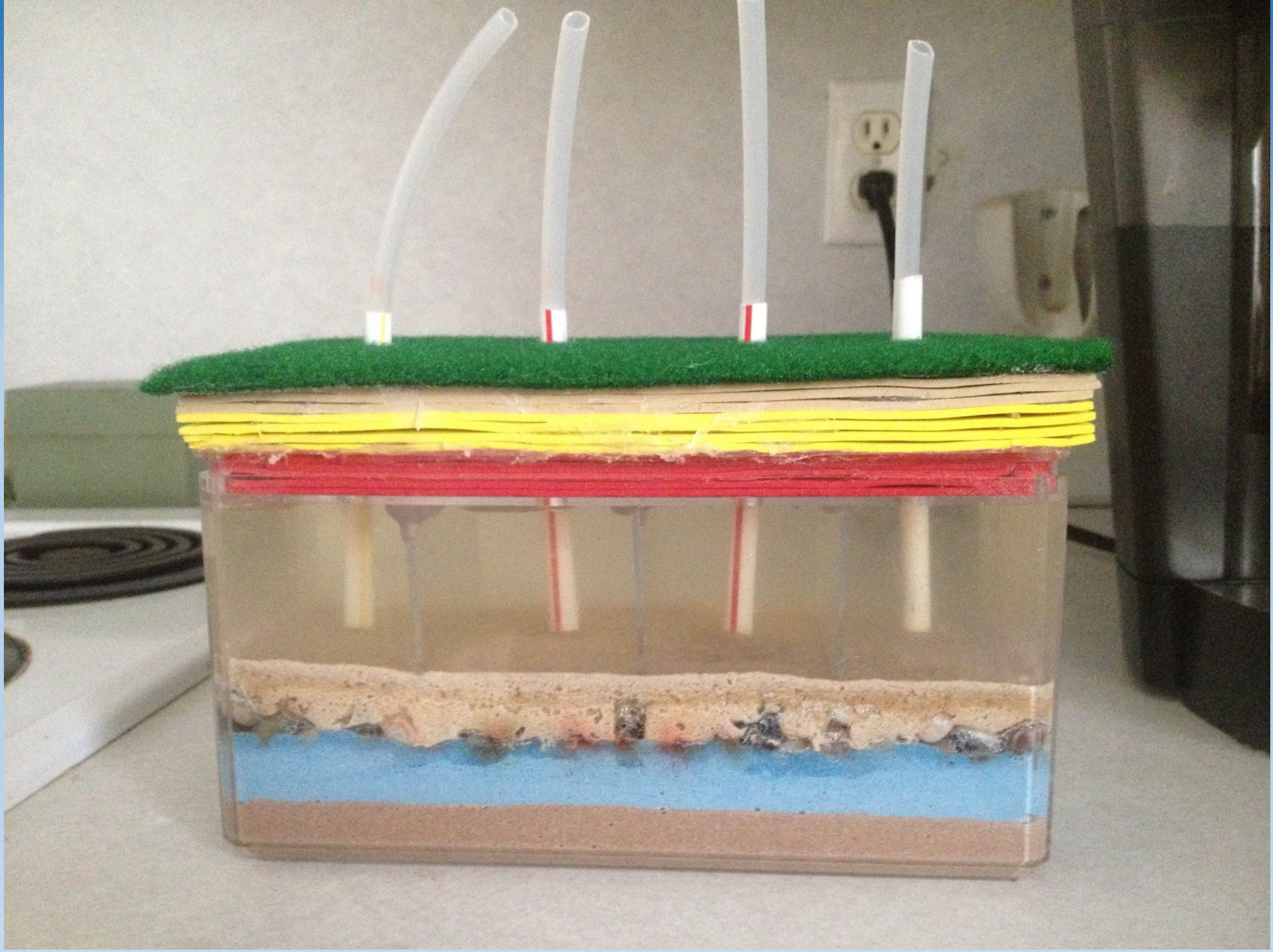
Pennants – allow for lining up perforations in injection tube with perfed interval

Perfed interval in the well casing with perforations in the injection tube.

Shale Analog = Agar

- Agar – translucent, gelatin
- Follow directions on box – but allow to cool at room temperature
- Stays gelatinous at room temperature
- Disadvantages – growth media (becomes fuzzy if left out for a couple of days!)

http://ecx.images-amazon.com/images/I/81jx6to1nxL._SY550_.jpg



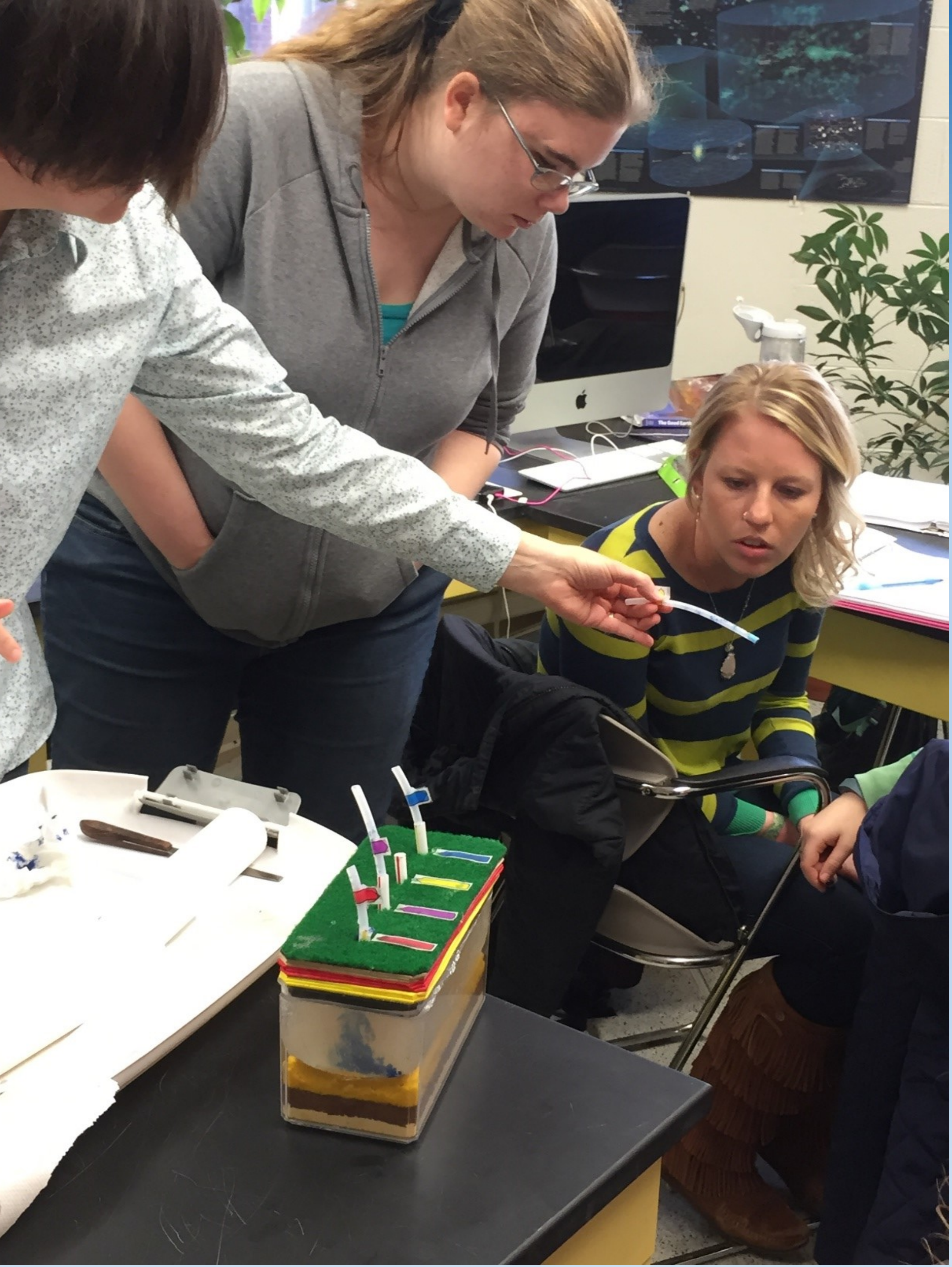
Earlier prototype with agar

Injection of Fluid into Agar

- We use a sand + glycerin mix as our hydraulic fracturing fluid analog
  - Sand = propant
  - Glycerine = fluid
- Higher viscosity fluids worked better at pressures required (glycerin, molasses)
  - Water and baby oil – did not keep sand in suspension – led to clogging of perfs and fluid running up well casing
- 1:1 mix of sand and glycerin – worked best
  - Too much sand – clogs syringe and perfs
  - Too little sand – fluid tends to run up along well casing and pools on top of agar

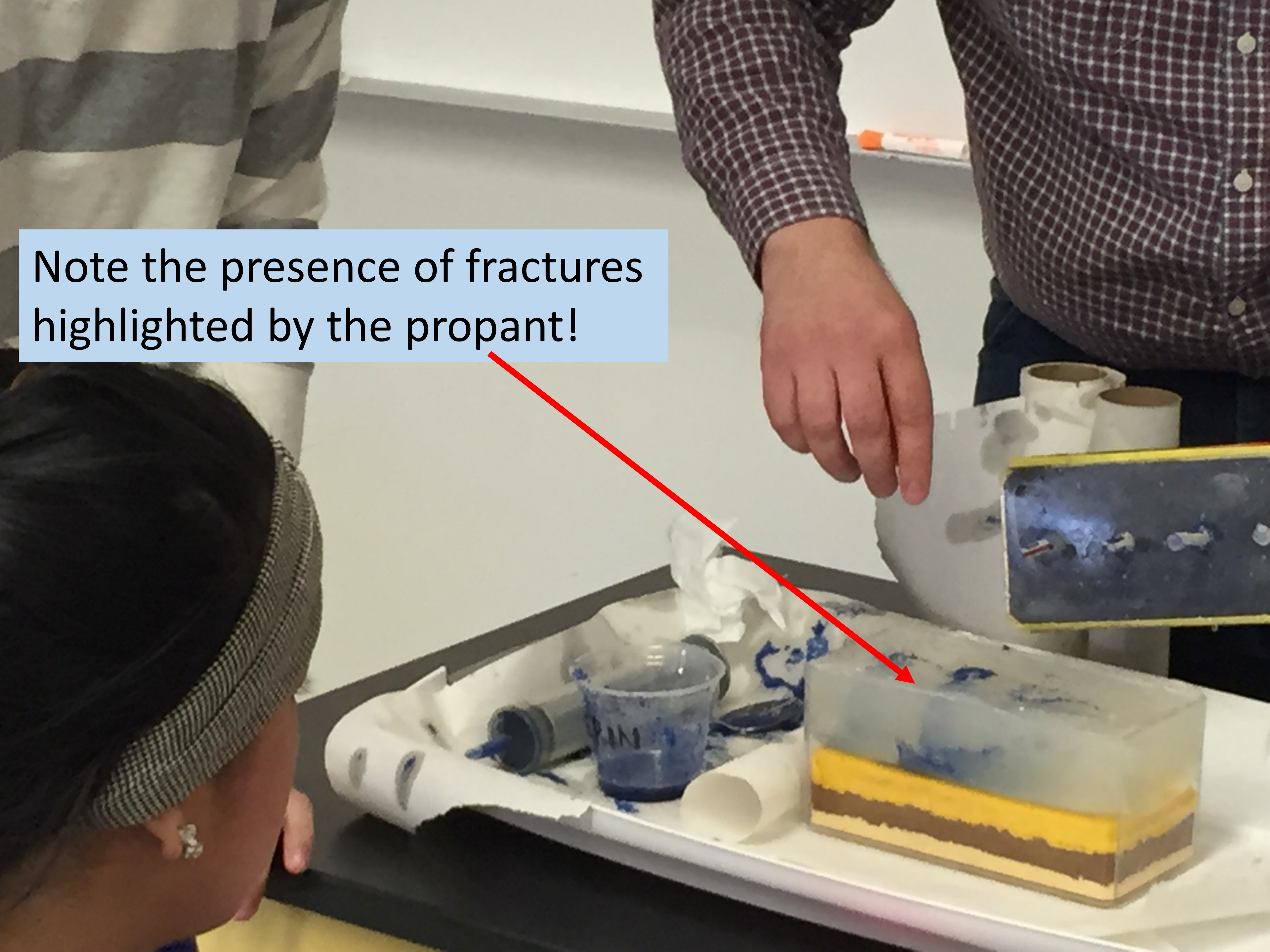
We use a brightly colored sand for the propant – so one can observe the process in the agar

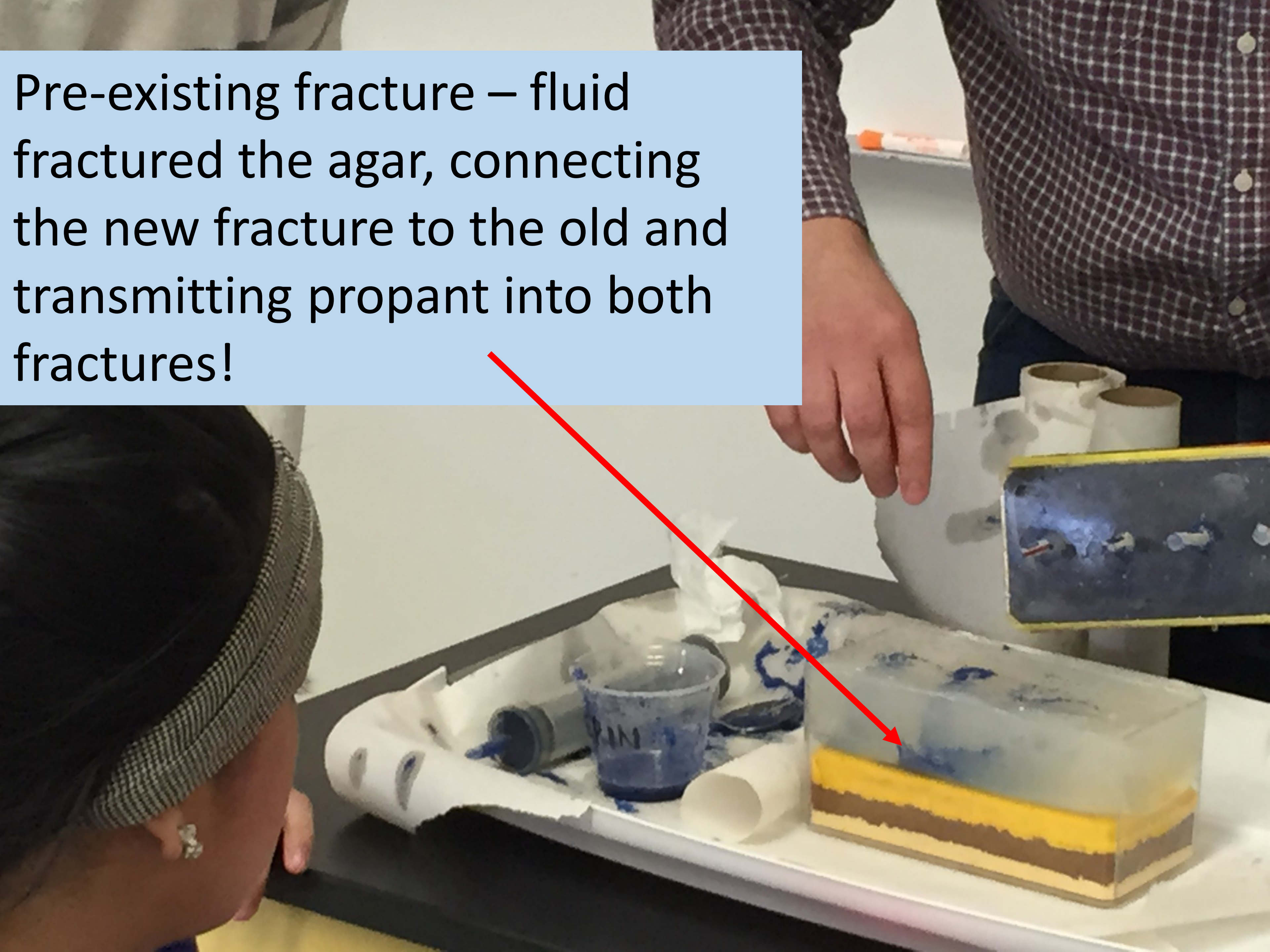
Injection of hydraulic fracturing fluid into well -- in this case, using molasses as the fluid.



Students observing the perforations in the injection tube – ask them to predict types/shapes/numbers of fractures generated

Injecting the Hydraulic fracturing fluid at the well

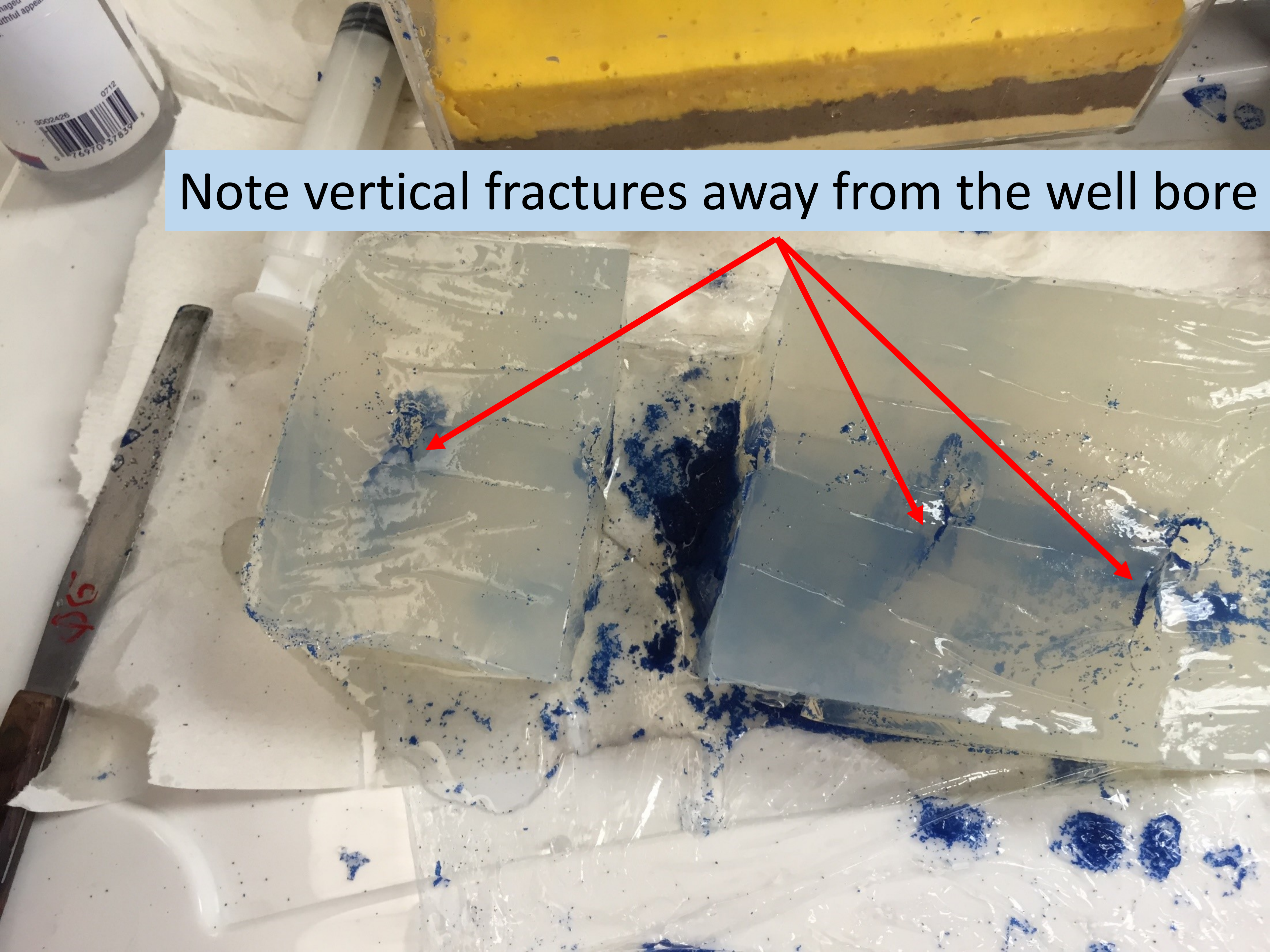

Note the presence of fractures highlighted by the propant!

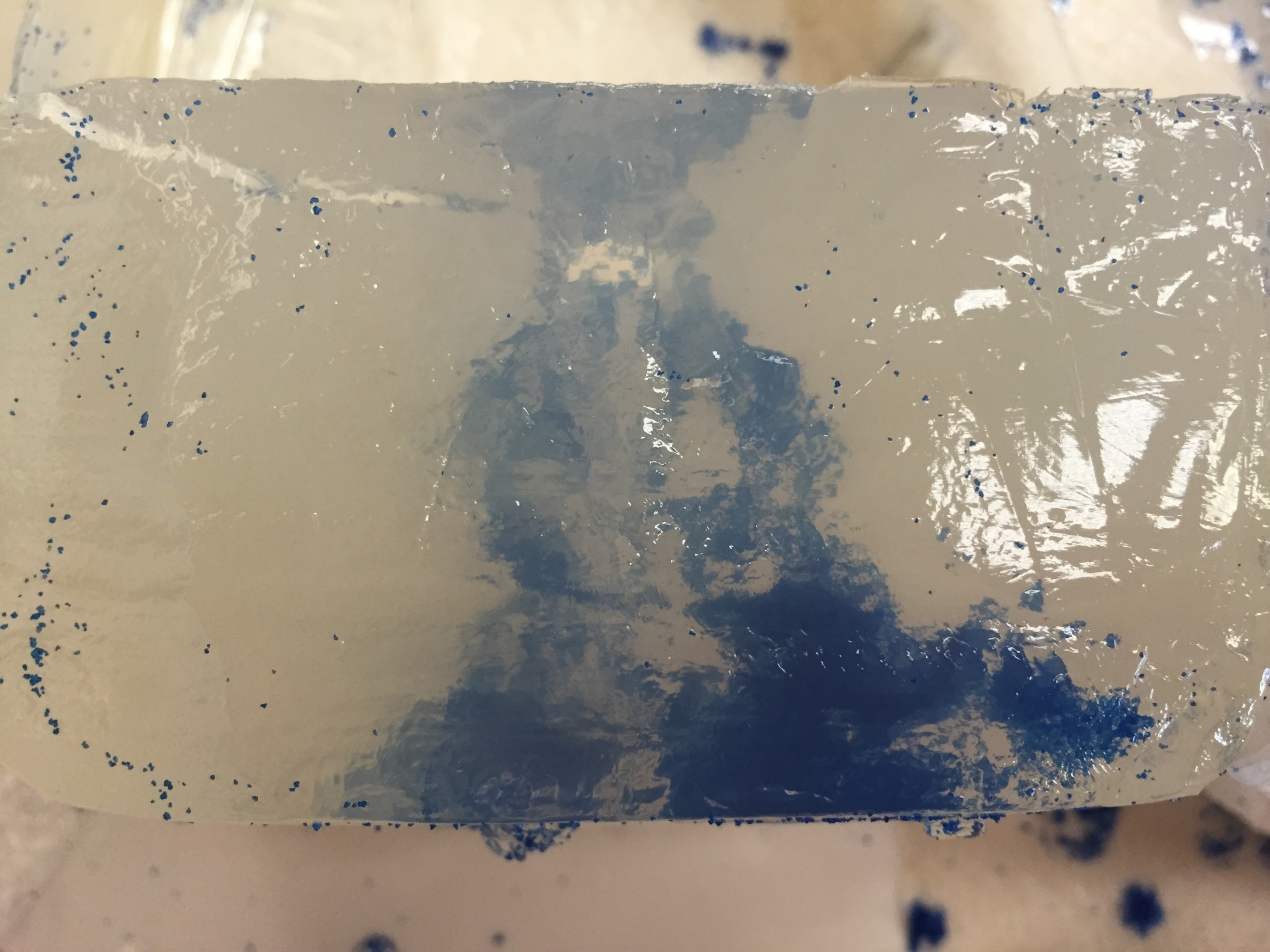


Pre-existing fracture – fluid fractured the agar, connecting the new fracture to the old and transmitting propant into both fractures!

Fractures and Agar

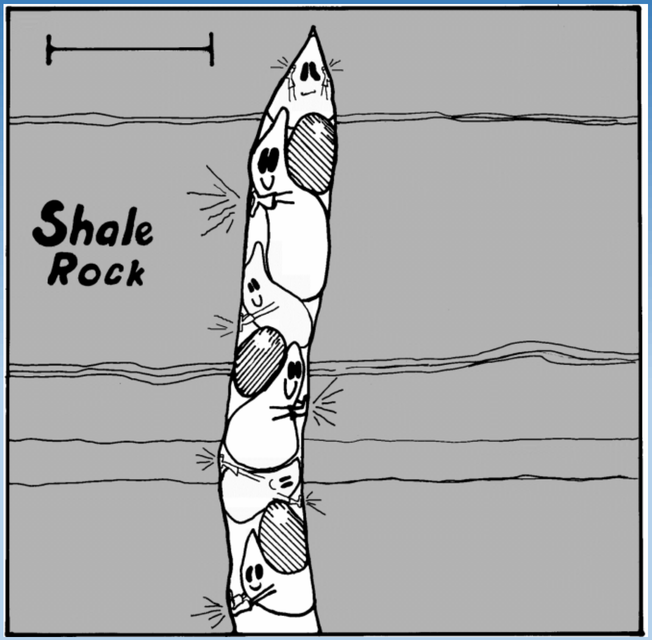
- Agar – easily removed from model
  - Either pour agar directly into model
  - Or line model with saran wrap and pour agar into that
- Agar slides right out – and then can be dissected with plastic knives – cut across or along fracture planes to illustrate propant properties of sand
- Afterwards – rinse model and spray with lysol

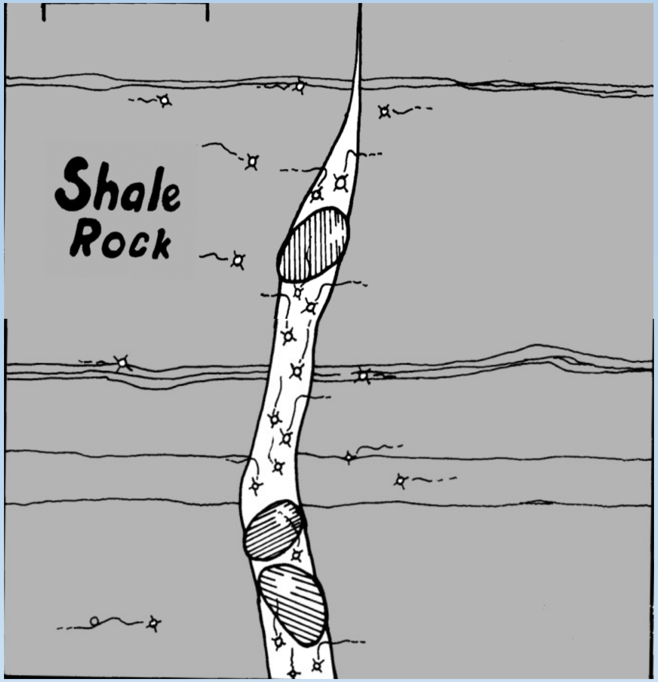

Note vertical fractures away from the well bore



Fracky Speaks Out

- Web booklet by Darcy Hubbert
- Provides Michigan-centric overview of hydraulic fracturing
    - Factual information
    - Well illustrated
- www.fracky.org





Feedback

- The model has been shown at several Oil and Gas Trade shows and meetings of the Michigan Basin Geological Society – the professional geologists were quite excited by the fractures generated
- Classroom tests –
  - College Level – H. Petcovic’s classes
  - Highschool level – Okemos Middle School (grades 9-12) – Advanced Earth Science Class and Earth Club

Feedback

- “This module turns a social controversy into a scientific inquiry”

Dave Chapman, Okemos Middle School Teacher, Member of the MESTA Governing Board

Conclusions

- Fun (messy) way to illustrate an analog model of hydraulic fracturing
- Relatively cheap to build the model – which is reusable
- Agar, sand and glycerin – only continuing costs

Acknowledgements

- Betty Adams and Andrew Bentley
- Laura Tinigin
- John Fowler

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