Classroom Rocks

A service-learning project to increase pedagogical tools for local earth science teachers and K-12 student interest in geology

By Kristen Schmeisser*, Ashley Altheide, and Carrie Wright

The problem

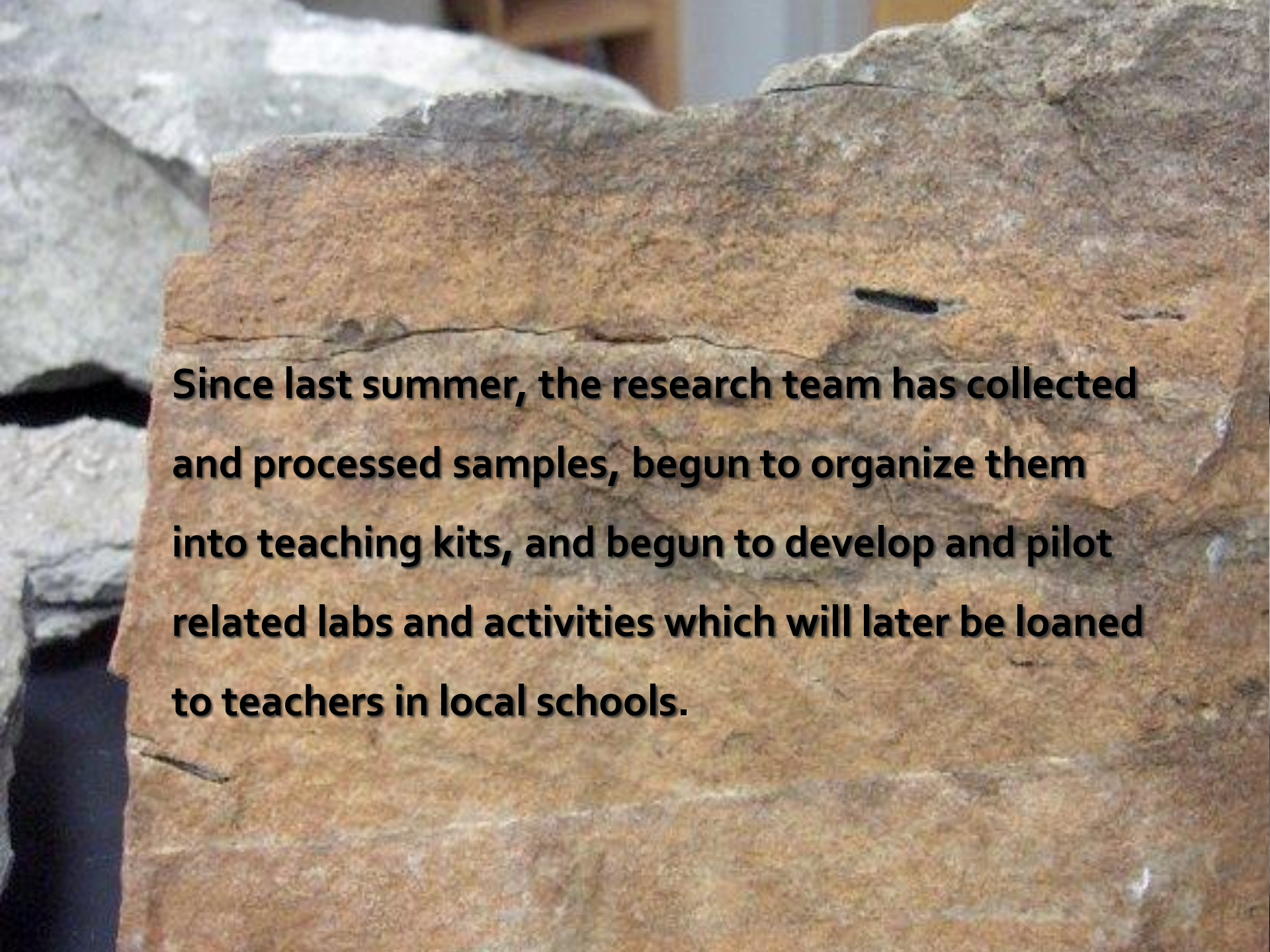
- Local Earth science teachers do not have access to the quality rock samples they need
  - Survey conducted by Chris Grathler and Allison Grabert, summer 2009
- Pre-course surveys show basic Earth Science concepts in the state standards do not "stick" in students' minds
  - Possibly due to a lack of access to high-quality rock samples
- Teachers want access to better samples, but lack funding to buy them and/or knowledge to collect samples themselves
- Samples from science supply sources often beyond budget or not adequate

The problem

- Few college freshmen at USI declare a geology major; most join the department after "discovering" geology in an intro course
- Probable causes
  - Lack of awareness (in high school) of geology as a viable and exciting major leading to a real career
  - Lack of stimulating geoscience education in middle and high school

Literature review

- The literature suggests that physical interaction with the samples will enhance student understanding.
  - Clear and comprehensive visuals aid in student understanding (Dickey and Hicks, 1991)
  - Lessons using manipulatives have a higher probability of producing greater achievement (Suydam and Higgins, 1997)
  - Concrete materials presented by a knowledgeable instructor improves student attitudes about the subject (Sowell, 1989)



Since last summer, the research team has collected and processed samples, begun to organize them into teaching kits, and begun to develop and pilot related labs and activities which will later be loaned to teachers in local schools.

Overarching goals

- Increase geoscience interest in area K-12 students
  - Increasing the likelihood that they might choose geology as a career path
- Increase geological content knowledge and pedagogical content knowledge for area K-12 teachers
- Continue to build upon the SwISTEM K-16 connection, making it an even better resource for educators, students, and schools

Rock samples

- Sedimentary rocks and fossils collected from local outcrops
  - Improve students' geological sense of place
  - Increase knowledge of geology "in their own backyard"

Rock samples

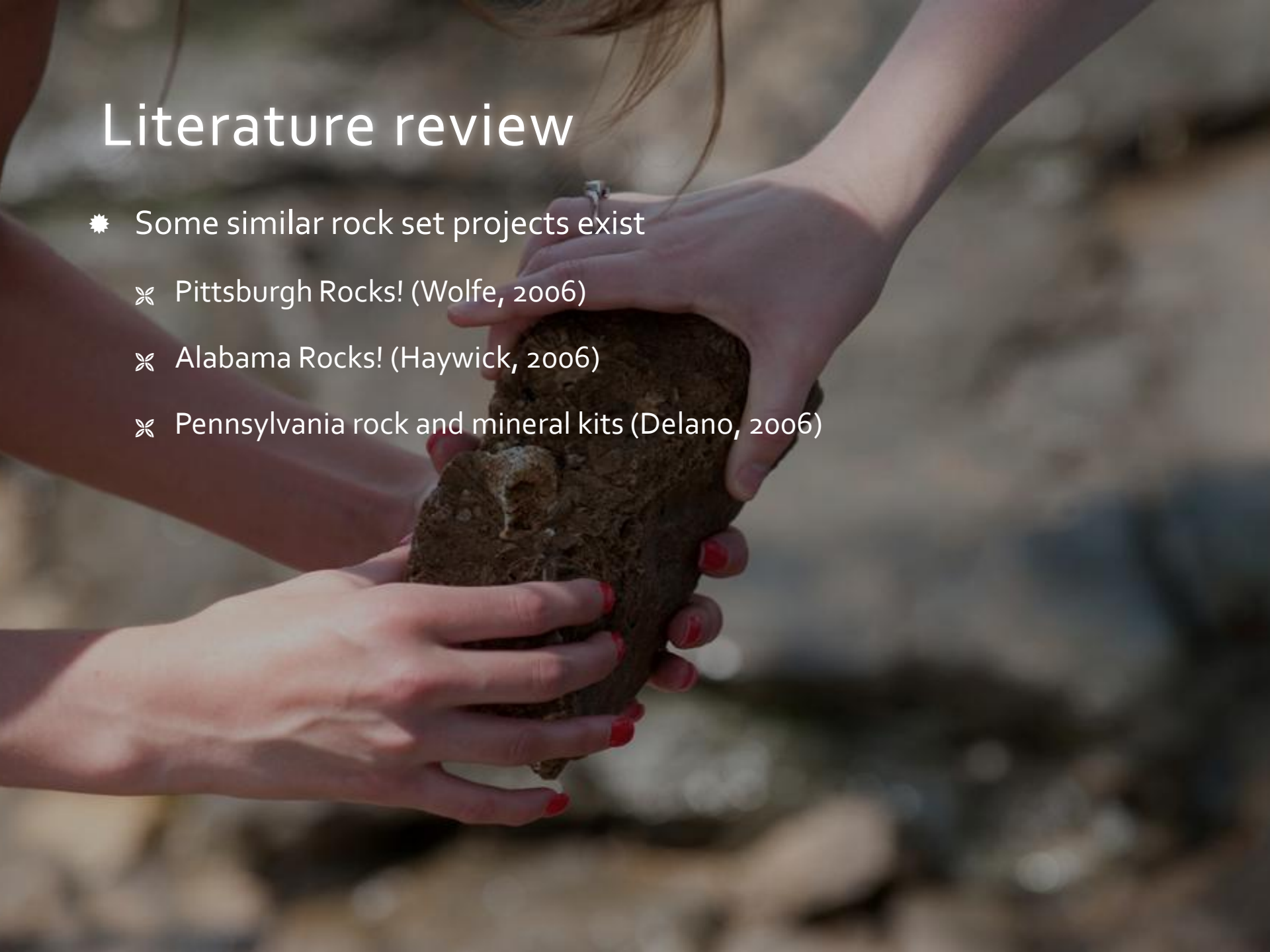
- Non-local samples were collected in the American West
  - Basalts- Eastern Snake River Plain
  - Evaporites- Bonneville Salt Flats
  - Metamorphics- West Wendover, NV; Albion Range

Teaching kits

- Plastic containers with samples in a variety of sizes
  - Loose fossils, minerals, and other loose, fragile samples- small, clear tackle boxes with dividers
  - Small samples- white-out spot labeled in permanent marker to correspond with guide in a shoe box sized kit
  - Large samples- like the smaller samples, but set in larger boxes and intended for whole class instructional use

STEM resource center and trucks

- Delivers professional development, lab equipment, and manpower for K-12 teachers.
- 2 mobile storage units, with $350,000 worth of STEM equipment
  - Primarily for high school teachers
  - A free service
  - 2 staff members drive the decorated U-Haul trucks
  - Trucks funded by $600,000 of a WIRED grant, as well as money from the ISTEM network
  - Currently have a Ward's rock set in each truck

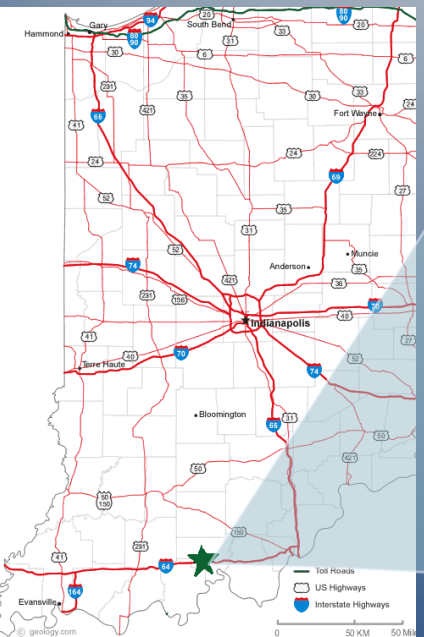


Literature review

- Some similar rock set projects exist
  - Pittsburgh Rocks! (Wolfe, 2006)
  - Alabama Rocks! (Haywick, 2006)
  - Pennsylvania rock and mineral kits (Delano, 2006)

Methods

- Sample collection
- Geological field notes
- Outcrop photography

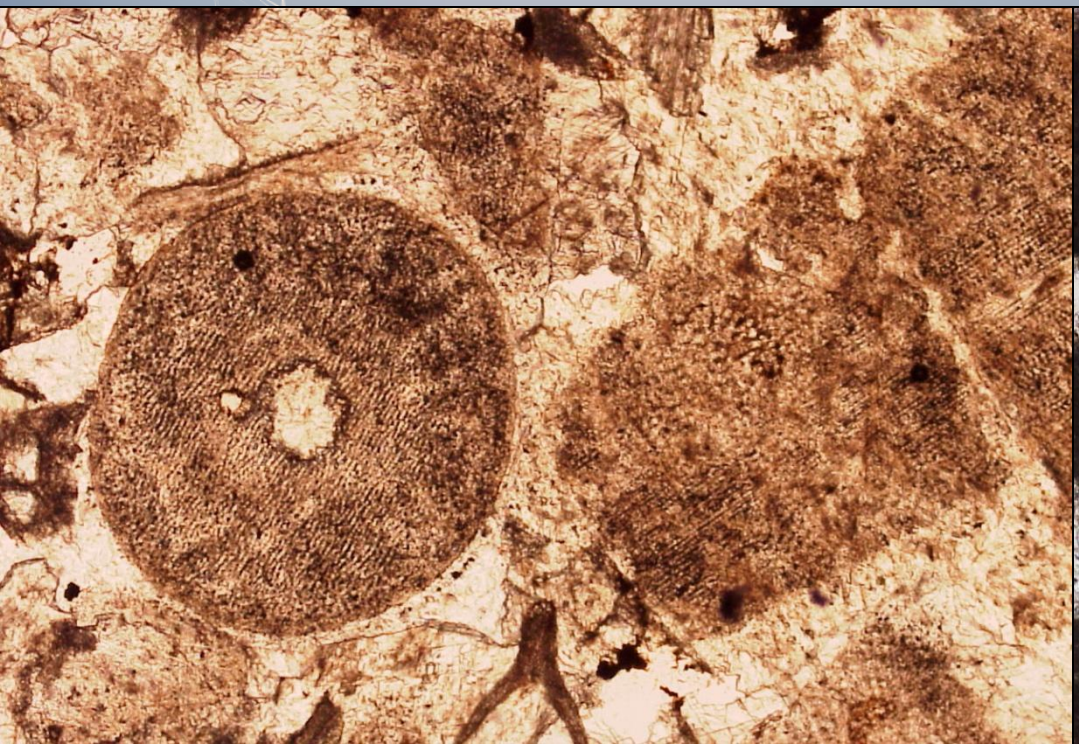


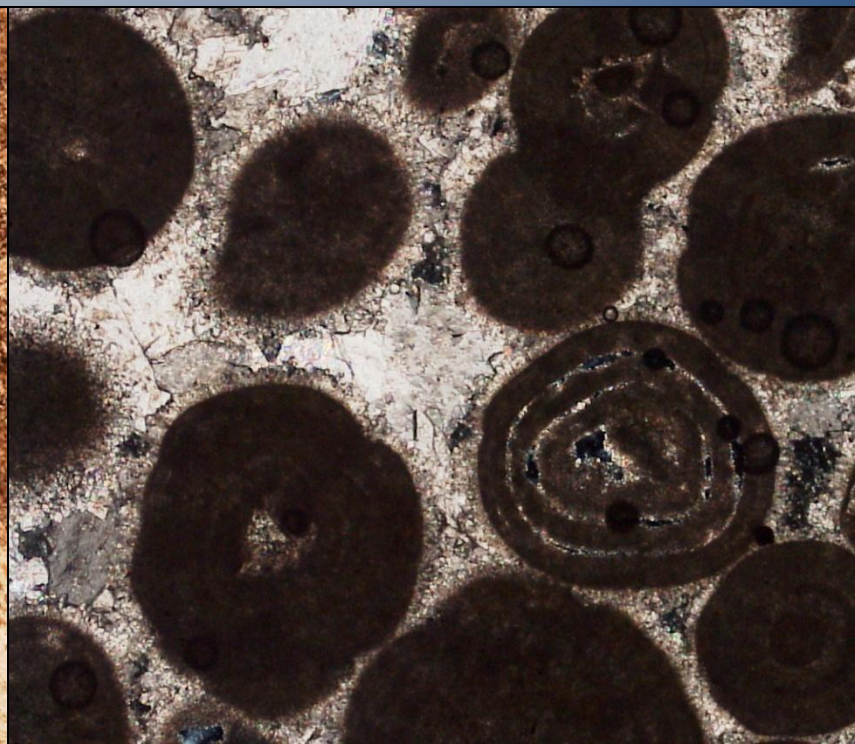
Methods

- Sample cleaning
- Sample identification
- Sample photography

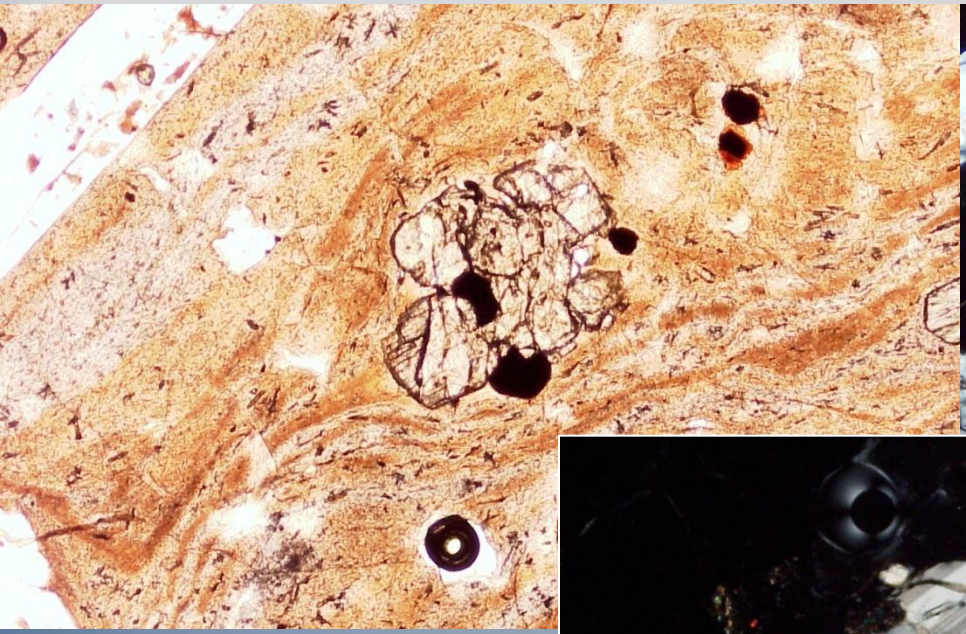
Methods

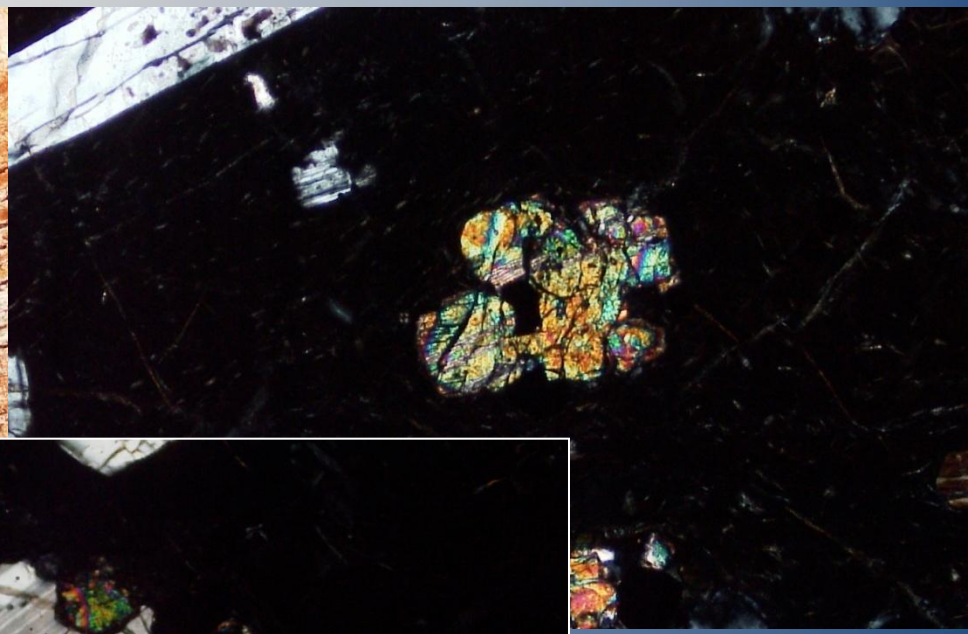
- Thin sections of samples
- Photography, printing, and lamination of thin section pictures

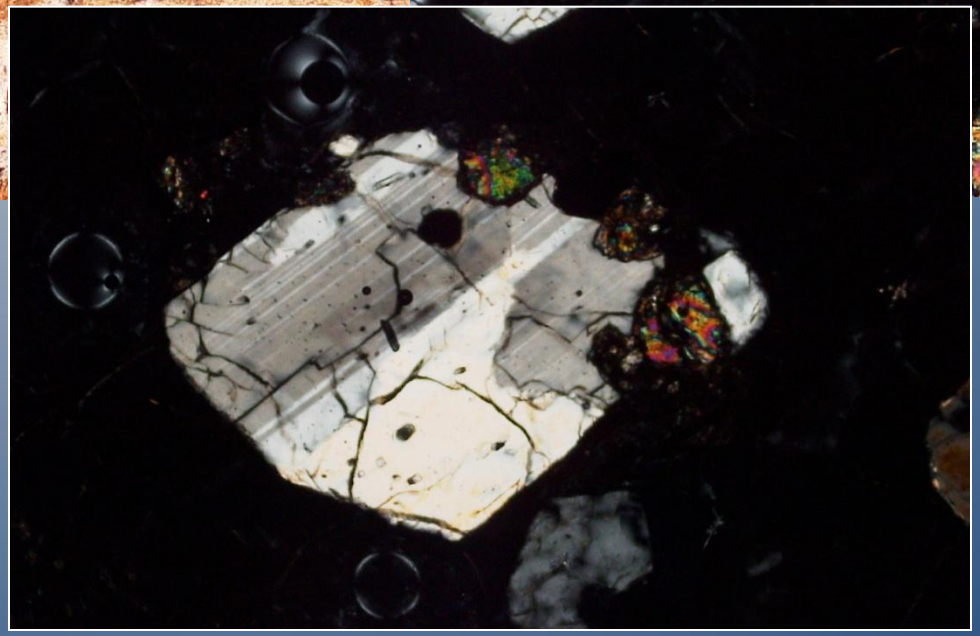




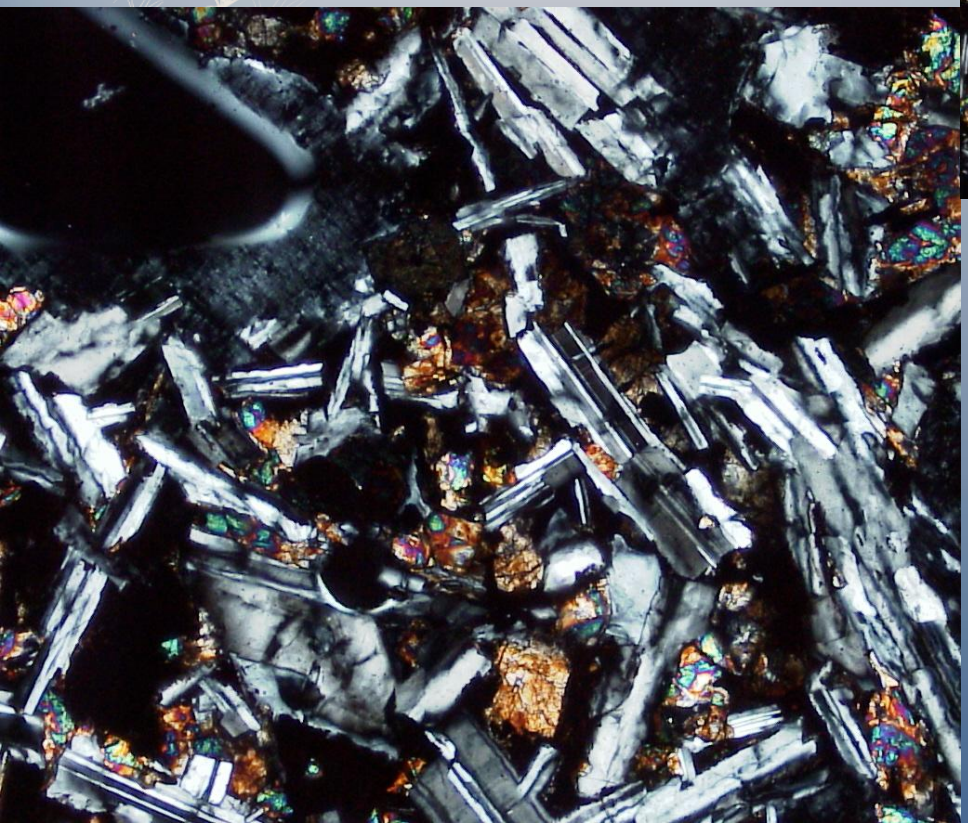
Albion Range Vitrophyre







Clear Lakes Grade basalt



Craters of the Moon basalt

Methods

- Catalog
  - Photographs
  - Detailed descriptions
- Stratigraphic facies analysis (EOD's)
- Write up descriptive work in the form of a classroom guide
- Develop labs and activities using the rock sets for various K-12 age groups

Example sample description

	(biomicrite)	and fossils	corals	
BCF- 91	**Fossiliferous limestone (biomicrite)**	Sedimentary rock containing carbonates and fossils	Blastoid head, crinoid stems, pelecypod, corals, archimedes fragment, possible brachiopod	Reacts with mild HCl
BCF- 92	Fossiliferous	Sedimentary rock	Crinoid stems	Reacts with mild HCl

	(Fe_2O_3); commonly known as rust
Limestone	A sedimentary rock composed primarily of calcium carbonate
Micrite	Microcrystalline calcite, with a grain size finer than 4 μm
Sandstone	A sedimentary rock composed of

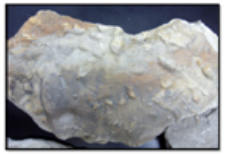
Lesson plan- Kindergarten WS

Kindergarten Scientific Observations

Student Lab Handout

Name: _____ Class: _____

Limestone



Sandstone

Basalt

Hornfels with veins

Circle the one that looks most like your rock. If none of the pictures look like your rock circle the "other" box.

OTHER

Draw your rock in the box below. Put the sample number in the box on the right.

Use words to describe your rock (like big, rough, sandy):

_____

_____

_____

How do you think your rock might have formed?

_____

_____

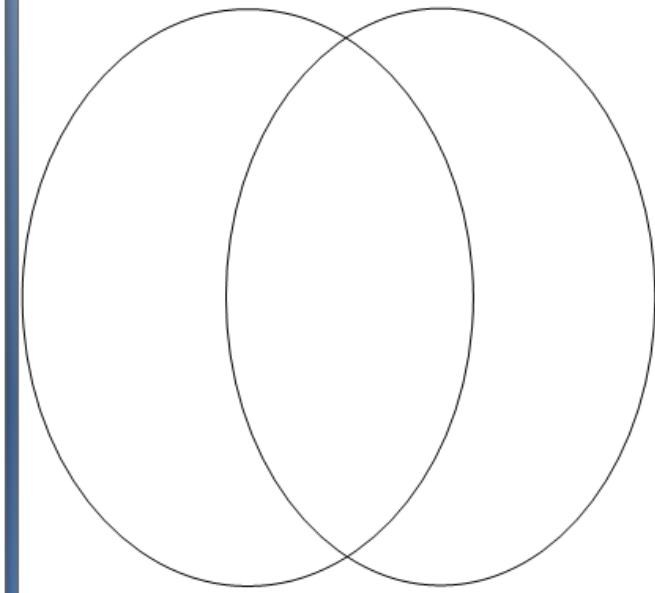
_____

Compare and contrast your rock with a classmate's rock.

Your rock | Both | Your classmate's rock

Your sample number

Your classmate's sample number



Lesson plan- Circle the hypothesis

HYPOTHESIS: In what environment were the rocks deposited? (Circle 1)

Coral reef or other underwater

Volcano

Forest

River

Mountain-building

Desert

Images courtesy of www.weirdwarp.com, www.global-warming-awareness2007.org, www.care2.com, and www.climatechange.thinkaboutit.eu

Lesson plan- Biology, math, and fossils

	Archimedes	Blastoid	Brachipod	Crinoid	Coral	Pelecypod
15				x		
14				x		
13				x		
12				x		
11				x		
10				x		
9				x		
8				x		
7	x			x		
6	x			x	x	
5	x			x	x	x
4	x			x	x	x
3	x			x	x	x
2	x	x	x	x	x	x
1	x	x	x	x	x	x

9.) Explain trends and conclusions you and other students notice in paragraph form in your notebook. Be sure to address the following questions:

a. What were the relative densities of organisms preserved in the fossil record?
   i. What fraction of observed preserved community did *Archimedes* make up?
   ii. Did blastoids make up?
   iii. Did brachiopods make up?
   iv. Did crinoids make up?
   v. Did corals make up?
   vi. Did pelecypods make up?

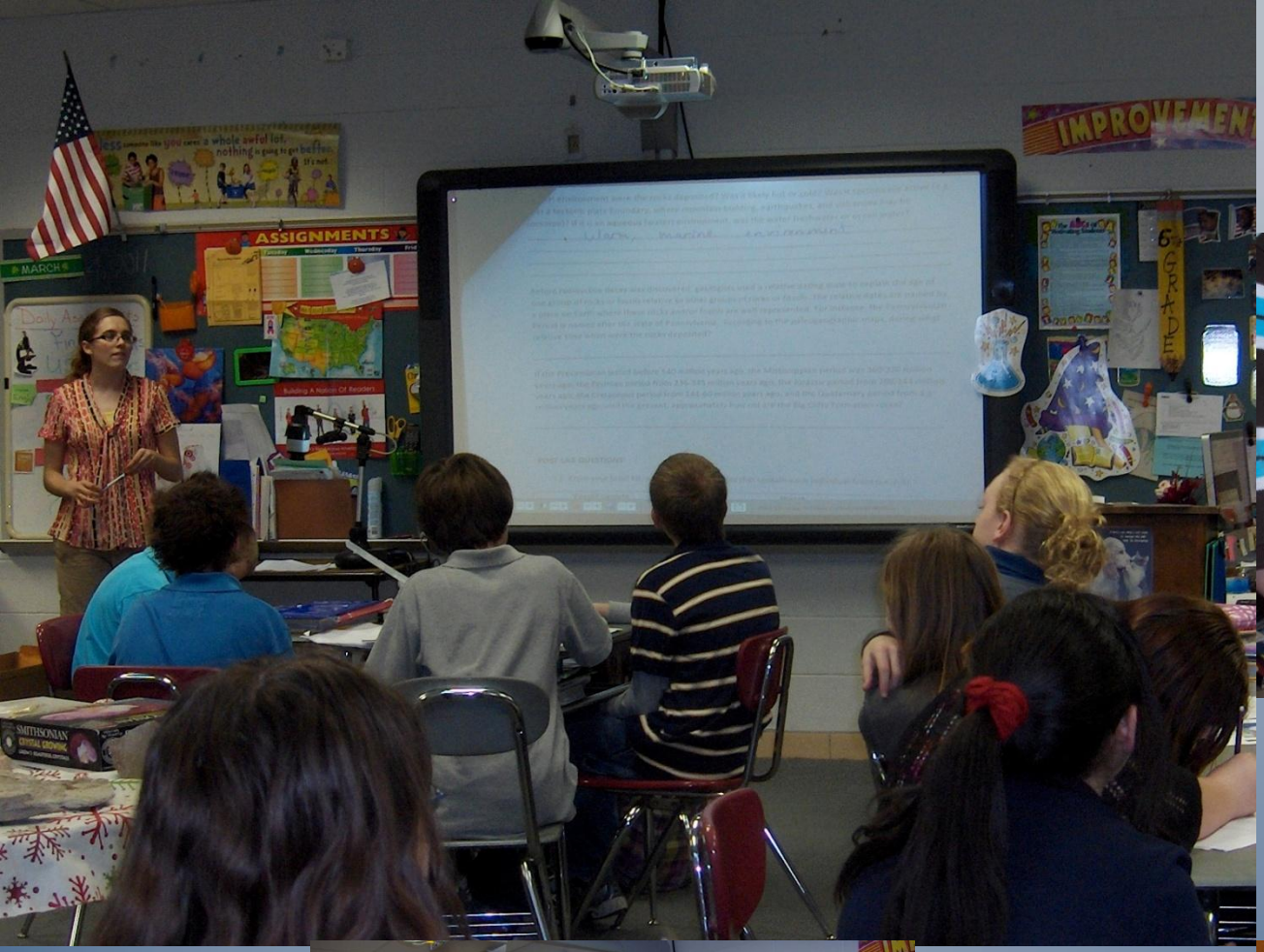
b. Do the densities of fossils in these samples accurately reflect the real densities of organisms in the Mississipian period in southern Indiana? Why or why not?

c. Were their limits in the size of the organisms? Did thinner organisms grow longer? Why might that be?

d. Are more familiar, modern organisms also limited by size?

e. How are these ancient organisms similar to or different than modern organisms in southern Indiana? In modern oceans, lakes, and rivers?


Phylum Bryozoa
• Colonies resemble crusts, branches, or fans
ASSIGNMENTS


ASSIGNMENTS
MARCH


Cnidarians—stinging cells

Future work

- Test kits on a group of teachers in summer STEM workshops
- Process any and all new samples
- Finish thin section work
- Continue activity/ lab development

Future work

- Trips to other collecting destinations
  - Cincinnati-area Ordovician brachiopods and rocks
  - Southern Oregon
- Publish our work in the Journal of Geoscience Education

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