TEACHER LESSON PLAN

Developing a Stratigraphic Column: Lake Cayuga Basin, New York

Adapted by Hilary Clement Olson
(original exercise by Nancy Spaulding, modified by Larry Wood and Steve Kluge)

Standards:

Middle School TEKS (6th-8th)	Biology TEKS	Earth Systems Science TEKS (ESS)	Environmental Systems TEKS	AP Enviro. Sci. Standards	NGSS	
7th grade	1.A-B	1.A-B	1.A-B	4.1	2-ESS1-1	HS-LS2-2
1.A-B	1.F-G	1.F-G	1.F-G	6.1	3-LS4-1	HS-ESS1-5
1.F-G	2.A-B	2.A-B	2.A-B	6.3	4-ESS1-1	HS-ESS2-1
2.A-B	3.A-C	3.A-C	3.A-C	6.4	4-ESS2-1	HS-ESS3-1
3.A-C	9.A-B	4.A-B	4.A-B	6.5	4-ESS2-2	
10.A-B		7.A-F	7.A-B		MS-ESS1-4	
		8.E			MS-ESS2-2	
		8.H			MS-ESS2-3	
		9.C			MS-ESS3-1	
		13.A				

Level: 8-12, undergraduate, graduate

Objective: During this activity students will learn how to construct a complete stratigraphic column from a number of different outcrops in the Lake Cayuga Basin, New York area. The earliest attempts at correlating disparate outcrops to create a regional stratigraphic column used basic principles of stratigraphy to better understand the geologic history of an area. Similarly, the various lithologies, fossil assemblages and index fossils in the Lake Cayuga region can be used to correlate a suite of rock layers from one outcrop location to another. Students will use various correlation techniques to organize a series of nine outcrops in the proper stratigraphic order to create a complete stratigraphic section. In addition, students will incorporate information on absolute age dating to anchor the completed stratigraphic section to the geologic time scale.

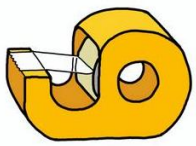
Background Information: A challenge for field geologists is that the stratigraphy of a particular region (a complete vertical section of all the rocks in a particular area) is rarely exhibited in a complete outcrop. A clear exception is the Grand Canyon, where the complete stratigraphy is remarkably displayed in outcrops. In the typical case, how does a geologist assemble a model of the complete stratigraphy of the area: a regional stratigraphic column or stratigraphic section? The geologist must assemble the complete stratigraphic record from multiple outcrops that represent only partial vertical successions of the entire rock record. Geologists who specialize in this work are called stratigraphers and their work is to use all the tools at their disposal to piece together a complete stratigraphic record. In essence a stratigrapher is a puzzle solver.

Time Requirements: 40-50 minutes

Teacher Preparation:

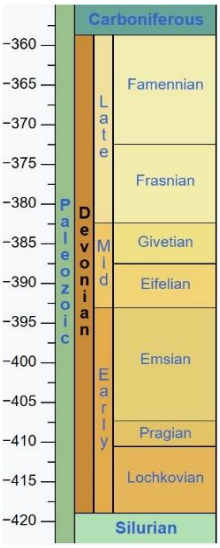
Materials:

1. Student packets (1 per student)
2. Optional: extra copies of the outcrop page from the student packet (1 per student so students don't have to rip pages out of the student packet)
3. Manilla folders (1 per student)
4. Scissors (1 per student)
5. Tape or glue (1 per student, or can share)
6. Optional: colored pencils
7. Optional: Powerpoint presentation on *Marcellus Shale: An Unconventional Hydrocarbon Resource*
8. Optional: fossils of brachiopods, nautiloids, or other Devonian fossils to show students



Procedure:

Stratigraphy, Fossils, Geologic Time



1. Teacher introduces or reviews relative vs. absolute time.
2. Teacher introduces or reviews the basic principles of stratigraphy (Original Horizontality, Lateral Continuity, Superposition, Cross-Cutting Relationships, Inclusions, Faunal Succession) as the foundation of relative dating.
3. Teacher introduces or reviews absolute dating using K-Ar dating with volcanic ash as an example.
4. Teacher introduces or reviews the concept of index fossils.
5. Teacher reviews basic lithologies: limestone, sandstone, shale.
6. Teacher introduces or reviews lithologic correlation.
7. Teacher introduces or reviews faunal correlation.
8. Teacher reviews the geologic time scale, highlighting the Devonian (perhaps showing some examples of Devonian fossils related to the activity).

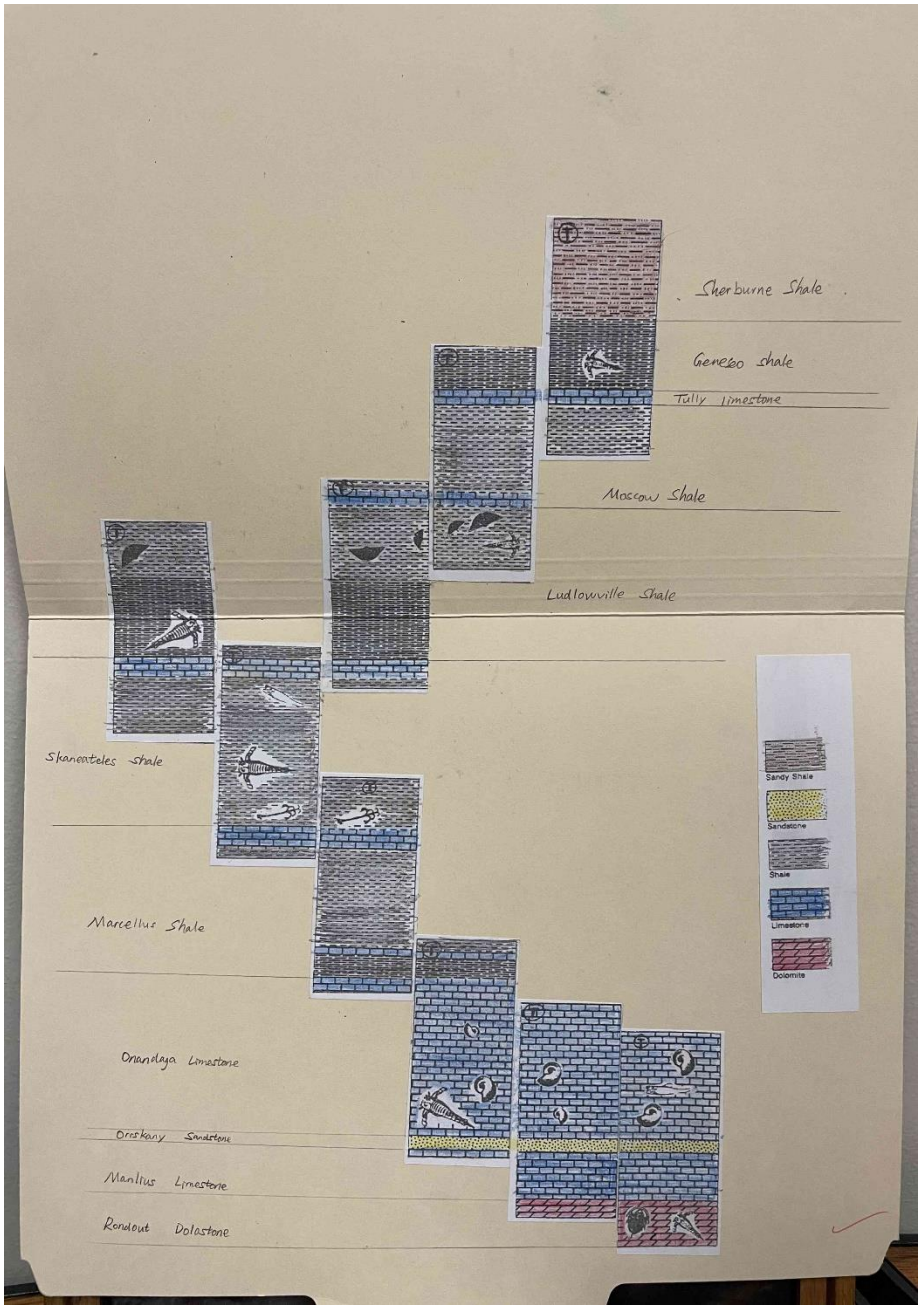
Finger Lakes Region

9. Teacher introduces the glacial history of the Finger Lakes Region of New York.
10. Teacher introduces the Devonian geologic history and plate tectonic setting of the region.

Activity

11. Teacher passes out materials (student packet, manilla folder, scissors, tape/glue, optional colored pencils).
12. Teacher gets students started with the Procedure (Instructions) in their student packet.
13. Teacher queries students on the construction of their stratigraphic section (students could work in groups if desired).
14. Teacher assesses student understanding using the Questions for Reflection in the student packet.
15. As a summative discussion, teacher can present the Powerpoint presentation on *Marcellus Shale: An Unconventional Hydrocarbon Resource*, or have students do online research to write a reflection under Additional Investigation on their student packet.

Solution: Solutions for the complete stratigraphic section will look similar to this anonymous student example.



Supporting Documents:

Student Worksheet
Teacher Resource Handout
Slide deck on *Marcellus Shale: An Unconventional Hydrocarbon Resource*
*Word Version of Teacher Lesson Plan

REFERENCES:

Regents Earth Science Bedrock Correlation
original exercise by Nancy Spaulding, modified by Larry Wood and Steve Kluge
https://newyorkscienceteacher.com/sci/files/download.php?id=725&file=esrbedrockcorrelation.pdf