Alicia D. Schiller - 7/16/15

Final Project – Geological Resources of Iowa

Project Components

A. Site identification

1.) Donnellson Quadrangle – Iowa-Lee Co. – 7.5-Minte Series

Created in 2013

Photo was revised in June of 2011 from the North American Datum of 1988

2.) Donnellson Township 2 South; Range 5 East, Section 21 North 0” 56’ (17 Miles)

3.) 40.626293, -91.567137


USGS
U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY
US Topo
DONNELLSON QUADRANGLE
IOWA-LEE CO.
Produced by the United States Geological Survey
SCALE 1:24 000
DONNELLSON, IA
2013

B. Historical record

From the map data that I was able to access from ISU, the land area that I am utilizing for my student based geology fieldtrip project in Lee County Iowa was noted and listed as timber in the early 1800's. The areas surrounding my project site were mostly fields with a few thicket areas. Where the Donnellson Cemetery is currently located it was a cemetery in the 1800's too, or would soon. I cannot find any source specifically stating when it became a formal cemetery.

Using the Andreas Atlas map from 1875 the area that I am using for my project is still noted as field, thicket and timber areas.

Based in the provided aerial photos that were provided for the 1960's, this is when the potential for quarry usage was discovered for this property, and it's clearing and usage started. However, somewhere between the 1970 and the 1980 aerial photographs show this quarry became active during this ten year time period. From interviews with local people from Donnellson it is best estimated that the first mining in the quarry took place 35 years ago, in 1979, and prep work beam prior to that.

The city of Donnellson which is just located to the north of the area that I have selected, became an incorporated town in 1892 and was named after Esten A. Donnell, ironically enough, a surveyor in the area. How appropriate for this course and assignment!! In 1871 the railroad came through and passed through Donnellson and was in operation until 1969. Due to the railroad being established here the town grew very quickly and numerous people came and populated the city and area.

Donnellson was first inhabited due to the fertile farmland within the area and it was near Fort Madison and Keokuk, which are located along the river. Lee County was founded and populated similarly due to the access to the river and water, and Fort Madison was a stronghold

for the war of 1812, where the war ended. There has been evidence of arrowheads found near my home, which is about 13 miles from Fort Madison and 2 miles from my project site. When my current house was being constructed in 1981 many arrowheads were found as the soil was being moved and as it continued to settle for the next ten years. This helps show that this area was of interest enough for the Native Americans to take an interest in even though it was a ways away from the river (13 miles).

There are major rivers located about 15 miles from my project site and numerous other alluvial aquifers located around and running through my project site. This has helped sculpt and develop this quarry over time, and lead it to the mining source and site that it is today. Lee county as well as my selected project site is primarily Mississippian bedrock system, with a few sections of the Devonian period, and a few smatterings of Pennsylvanian system the here and there.

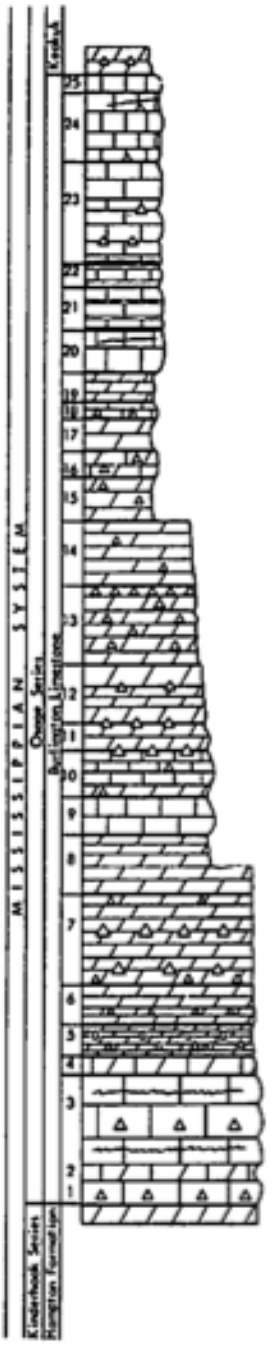
The Donnellson quarry that I selected for my project is of the Mississippian bedrock geologic system. The Mississippian region got its name due to the bedrock exposed in the Mississippi River valley between Burlington, Iowa and St. Louis, Missouri. The rocks in these areas are best referenced due to the environmental changes that altered the sea levels. During the time period 360-320 million years ago (Mississippian) seas were found several times in Iowa's heartland. Crinoids covered in hundreds of calcium carbonate structured plates covered these shallow sea floors. As it is known, limestone was the predominant deposit during this time. However, dolomites, chert, gypsum, shale, quartz and sandstone can be found too (Anderson, 1998). Due to the large amount of limestone and dolomite in this bedrock system it is easy to see why and how this quarry got established and has been mined for the past 35 years.

C. Define and describe the bedrock geology of your county, city, school, local outcrops and quarries.

The quarry that I am using for my class project mines for “aggregates”. As I have learned from this course an aggregate is a material or structure formed from a loosely compacted mass of fragments or particles. This can be in relation to any or all rock and mineral particles. Initially I thought that this was a specific term but have since been informed otherwise. The area that I have decided to conduct my project at is about 2 miles north of the high school that I teach at: Central Lee High School, and is a half a mile south of Donnellson Iowa. All of this area is used primarily as farmland and there are not any notable geologic anomalies as the area is very flat here and there aren’t any major hills or valleys or rock faces until you get near Fort Madison and the Mississippi river, which is 15 miles from my project site and the city of Donnellson. About five miles from Fort Madison or 10 miles from Donnellson there are some hills that now I know where the farthest out reaches of the Mississippi River basin when the river was even wider then it is currently. As you get to the out city limits it becomes apparent that this outmost area is a flood plane for the river boundary of the past. It is also not as mastery as to why Fort Madison floods when there is heavy rainfall, like many other areas around our county, state and nation. The bedrock geology of Lee County is primarily Mississippian bedrock system, with a few sections of the Devonian period, and a few smatterings of Pennsylvanian system the here and there.

1.) Include a description of each geologic formation present including the formations age, lithology, fossils, depth of bedrock and etc.

The limestone section pictured below from the Harris & Parker, 1964 publication is from the Keokuk, Iowa area of the Burlington limestone that can be found in this region. The Keokuk limestone is characterized by “dolomite, dusky yellow, finely crystalline calcareous, massive beds of white, mottled chert” (Harris & Parker, 1964). There are six layers of the characteristic limestone, iconic to this area, found in this section before getting to the layer of dolomite, and then these two types of rock alternate back and forth between the two throughout the rest of the Osage section. This represented section is about 70 feet deep, and in the top layer or two (layer 25) contained some fish teeth, but as the section gets down to layer 7-3 there are some fossils and fossil fragments identified of the crinoid variety.



Keokuk Limestone

Dolomite, dusky-yellow (5 Y 6/2), finely crystalline calcareous, massive beds of white, mottled chert

Cedar Fork Member

25. Limestone, very coarsely crystalline, glauconitic, fish-tooth horizon 1.0'

24. Limestone, light-gray, coarsely crystalline, crinoid fragments, recrystallized calcite in spary matrix, stylolitic 4.0'

23. Limestone, light-gray, coarsely crystalline, Spirifer grimesi abundant, lenses and nodules of white, tripolitic to porcellaneous chert, mottled light-gray (N 9 to N 7); light bluish-green (5 B 7/1), slightly dolomitic, blocky shale at base 7.0'

22. Limestone, greenish-gray (5 G 6/1), coarsely crystalline; salt flecks of glauconite (5 G 5/2) 1.0'

21. Limestone as below, numerous shale partings 2.0'

20. Limestone, light-gray (N 7), coarsely crystalline, calcite recrystallized from crinoids; disseminated glauconite (5 G 5/2) Dyscrinus 3.0'

Haigler Creek Member

19. Dolomite, grayish-orange (10 YR 7/4), finely crystalline, calcite 2.0'

18. Limestone, yellowish-gray (5 Y 8/1), medium-crystalline, dolomitic 1.0'

17. Dolomite, grayish-orange, finely crystalline, massive, friable 2.0'

16. Limestone and dolomite, irregularly mottled 1.5'

15. Dolomite, moderate yellowish-brown (10 YR 5/4), finely crystalline, calcareous, with siliceous fossil fragments 3.0'

14. Dolomite, brown, finely crystalline, thick-bedded 4.0'

13. Dolomite, grayish orange-pink (5 YR 7/2), finely crystalline; mottled gray (5 YR 5/1 and 5B 7/1) chert, banded parallel to margins, prominent cross-bedding on north face 5.0'

12. Dolomite, brown, finely crystalline, dense, light- to dark-gray mottled chert, chalcedonic to porcellaneous, irregularly bedded to nodular 3.5'

11. Dolomite, light olive-gray (5 Y 6/1), finely crystalline 1.5'

10. Limestone as below, coarsely crystalline, crinoidal 3.0'

9. Limestone, yellowish-gray (5 Y 8/1) interbedded with brown dolomite layers 3.0'

8. Dolomite grading into dolomitic limestone, light-gray; finely crystalline, dense, massive 4.0'

7. Dolomite as above with light- to medium-gray, porcellaneous chert, some fossiliferous; chalcedony-lined vugs; dolomite speckled with white siliceous fossil fragments 5.5'

6. Dolomite, brown, finely crystalline, thin-bedded, white siliceous fossil fragments, porous; with thin stringers of mottled, fossiliferous chert 2.5'

5. Dolomite, brownish-gray, finely crystalline, dense; laminae of greenish-black, rounded polished glauconite, nodules of chert 2.0'

4. Dolomitic limestone, brownish-gray, finely to coarsely crystalline, glauconitic 1.0'

Dolbee Creek Member

3. Limestone, very light-gray (N 8), coarsely crystalline, crinoidal, massive, stylolitic; lenses of white tripolitic chert 5.5'

2. Limestone, dolomitic, finely crystalline 1.0'

1. Limestone, pale-orange (10 YR 8/2), coarsely crystalline 1.5'

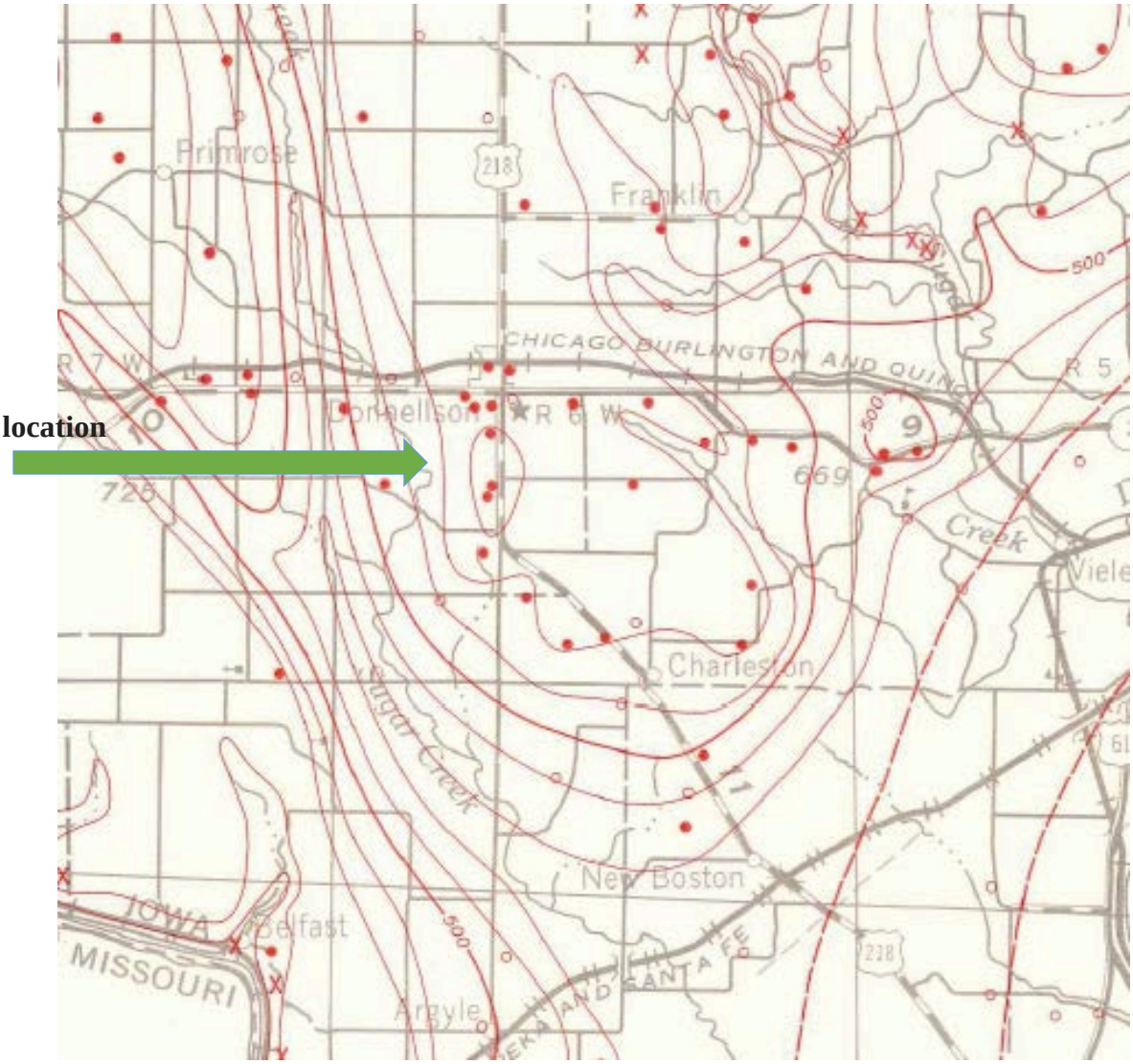
Wassonville Member

Dolomite, light-gray (N 7), finely crystalline

Figure 7. Burlington Limestone section exposed in Leonhard Quarry SE cor. sec. 1, T. 71N., R. 4W., Des Moines County, Iowa. Key to symbols given in figure 2.

2.) A localized bedrock map of your area.

Project site location



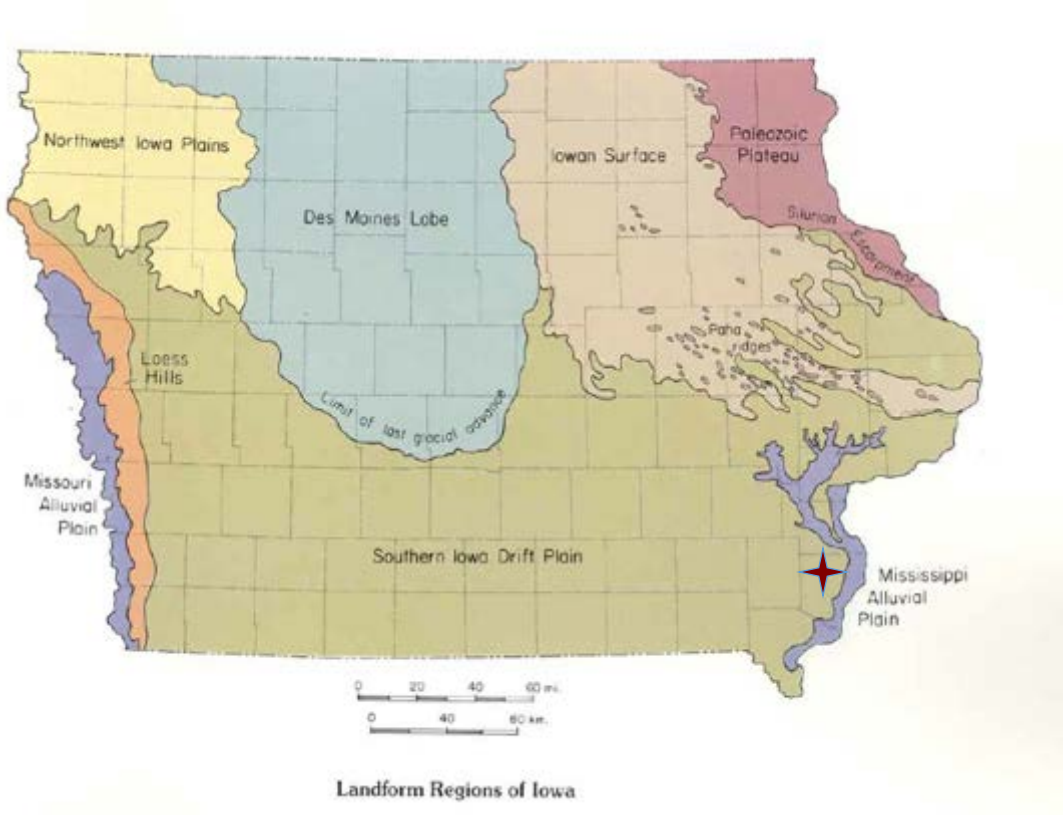
Bedrock Topography of Southeast Iowa (Hansen, 1973)

3.) Provide hand sample descriptions of representative samples.

This picture shows a representative sample of the “aggregate” that is produced at the quarry that I have deemed my “project site”. These rock samples from my project location represent four samples of limestone, one sample of chert, and one sample of marcasite (similar to pyrite).

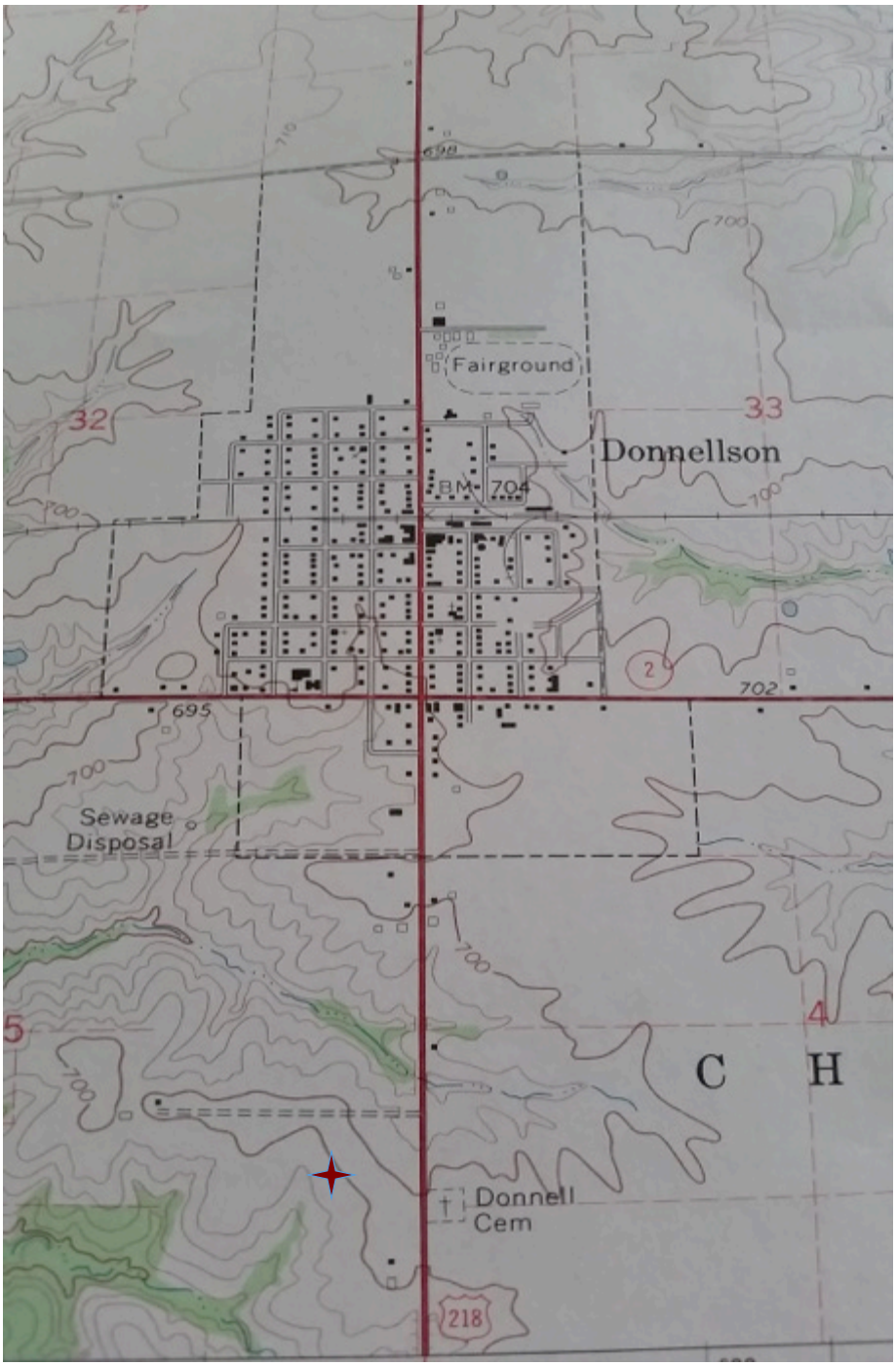
D. Quaternary Geology and Topography

My project site is located in the Southern Iowa Drift Plane landform region.



Landform Regions of Iowa

This start icon denotes where my project site can be found on the map above.



This start icon denotes where my project site can be found on the map above.

Finding documented soils data for Lee County was kind of a challenge but I was able to find collected data from our neighboring county Van Buren County and am using this to do general soil analysis of my project and school site. I also looked for soil data on Henry and Des Moines counties but these were also incomplete like Lee County. Van Buren county was documented as having eight different loam type of soils: two were loam, five were silt loam and one was a silt clay loam. The types of soil documented were: Adair silt loam, Carlow silty clay loam, Coppock silt loam, Edina silt loam, Lindley loam, Seymour silt loam, Shelby loam. These soils are very good for farming as they have a lot of broken down organic matter that makes them fertile Miller, Highland & Hallber, 1978). They are not the most fertile in the state of Iowa, but they are very good for farming and getting a good product. The large amount of limestone in the area also acts as a natural liming neutralizer agent too. This is a huge benefit to farmers.

E. Geological evolution/Local Earth History

There is quite a lot of limestone in Lee County. As you are well aware there was once an ocean covering Iowa. ☺ Which deposited a lot of dead animal, coral, and calcium carbonate (aka lime). In the area where my site is, there is a lot of "gravel" used by Cesford Construction Company. This is basically limestone, crushed up into gravel like particulate (aggregates). As I have discovered aggregates as made from ground up rock, gravel and sand and are used in the construction business such as concrete, lime and cement. Ready-mixed concrete is made of 80% aggregates and asphalt is made of 95% aggregates.

The Donnellson quarry that I selected for my project is of the Mississippian bedrock geologic system. That means that these rocks are 325-353 million years old. The quarry that I selected for my classroom project site demonstrates an example of Keokuk limestone and is characterized by "dolomite, dusky yellow, finely crystalline calcareous, massive beds of white,

mottled chert" (Harris & Parker, 1964). There are six layers of the characteristic limestone, iconic to this area, found in this section before getting to the layer of dolomite, and then these two types of rock alternate back and forth between the two throughout the rest of the Osage section. This represented section is about 70 feet deep, and in the top layer or two (layer 25) contained some fish teeth, but as the section gets down to layer 7-3 there are some fossils and fossil fragments identified of the crinoid variety. These fossils indicate and show that a shallow sea covered this portion of Iowa during a couple of the former geologic time periods. In fact, parts of Iowa might have even had "ocean-front property".

The Southern Iowa drift plane represents this portion of the landscape. Glaciers covered it at times, but during the second ice age, it was not covered as other parts of northern Iowa and other states. Due to this occurrence there are portions that are quite hilly due to where glacier activity had ceased. Rivers have also sculpted many portions of this drift plane. The river carving out areas and silt and sand filling it back in. Due to this there are areas that are filled with clay, and lots of sand. There are also layers of loam, alternating with silt and clay. The loam that can be found in our part of Iowa is quite fertile and as a result, there is a lot of farmland and decent crops produced too.

F. Project/s for your students

The whole crux of my student-based project is to spend time during my Ecology unit talking about introductory geology as we go through the natural nutrient cycles. The students will be given their student worksheet (seen below on the next two pages) before leaving the classroom to our site. They will be required to answer a majority of the questions while they are at the quarry site, and then complete a couple of final identification and overview questions upon returning back to the classroom the next class period. The point values for each question are given so that the students know my expectation regarding the amount of written response that is needed for each question.

I am planning on taking the students out to our local quarry and have them collect rock samples. Their collected samples could be ones that they think are neat, unique, pretty or they are just curious about identifying. I know from personal experience, that some of my favorites rocks in my collection were collected in Iowa quarries. Because the substrate has been broken up, I have found it much easier to find fossils, and quartz which is eye catching to me. I am hoping that the students will find as I have, how interesting the material is once "you" take a moment to look closer. My experience has made me take a closer look and notice many unique structures and components to the "rock" that I have in my driveways, or along paths that I run and walk.

Once the students have gathered and collected their tock samples, we will take them back to the classroom and try to identify as many of them as we can, that weren't identified in the field. I know that this may seem like a simple exercise, but as a Biology teacher this will lead to a fantastic segway into talking about how Biology incorporates into Geology, the geological history of Biology and how many types of rocks were formed from dead organisms and organic

material. I know that this will spur interest and excitement and I will be willing to take this in any direction of interest that my students show. I love leaving my lesson plans open for this kind of interest, as it always seems to happen with every unit. ☺

Student Worksheet

Donnellson Quarry Visit (30pts)

Name:

Class Period:

Date:

#1: Write a brief description (at least 4 sentences) of what the quarry looks like that we're visiting. Be sure to be specific. (Where do you see the rock and what does it look like, etc.) (4pts)

#2: Did you previously know about this quarry/location and that it existed? If not, are your surprised? If yes, when did you learn it was here? (2pts)

#3: What different rock structures do you see upon your first observations? Describe them in detail. (At least 3 sentences.) (3pts.)

#4: Make a brief sketch of the area (quarry) labeling major points of interest. (4pts.)

#5: Collect interesting/eye-catching rocks to take back to the classroom for later identification. (At least 3 rock samples.) Make a sketch and write characteristics for each sample. (5pts)

Sample #	Characteristics	Sketch	Name (ID)

#6: Identify samples once you are back to the classroom (or the next class period). Use labeled rock box, Internet, and Ms. Schiller's limited knowledge. Add your rock ID's to your table in question #5. (5pts)

#7: How has your view of our quarry site location changed as a result of this lesson? Describe at least three things in detail you have learned or have had your eyes opened up to as a result of this project. (6 pts.)

References

Alluvial Aquifers of Iowa 2004. (2003). Retrieved July 10, 2015.

Anderson, P. (2008, September 17). GIS Research to Digitize Maps of Iowa 1832-1859 Vegetation. Retrieved July 2, 2015, from http://www.public.iastate.edu/~fridolph/dnrglo.html

Anderson, W. I. (1998). *Iowa's Geological Past: Three Billion Years of Change*. University of Iowa Press.

Donnellson, Iowa. (2014, July 29). Retrieved July 1, 2015, from https://en.wikipedia.org/wiki/Donnellson,_Iowa

Free Topographic Map Reading. (n.d.). Retrieved July 2, 2015, from http://www.compassdude.com/topographic-maps.shtml

Harris Jr, S. E., & Parker, M. C. (1964). Stratigraphy of the Osage Series in southeastern Iowa.

Iowa Geographic Map Server. (1999). Retrieved July 2, 2015.

Miller, G.A., Highland, J.D., and Hallberg, G. R. (1978). Highway Soil Engineering Data for Major Soils in Iowa. Iowa Geological Survey.

Prior, J. C. (1991). *Landforms of Iowa*. University of Iowa Press.

Visitors Guide to Donnellson, Iowa. (2001). Retrieved July 1, 2015, from http://www.greatriverroad.com/quincy/donnellsonhome.htm

What are Aggregates? (2011). Retrieved July 13, 2015, from http://www.uepg.eu/what-are-aggregates