Marianne McGrane

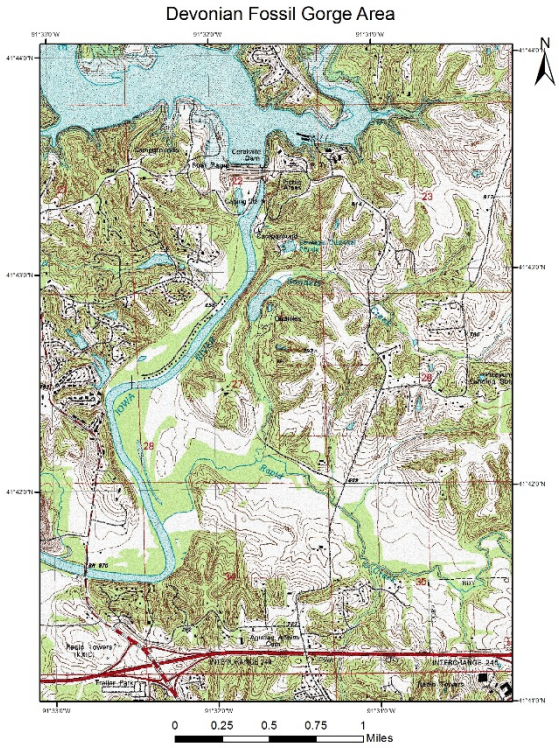
June 29, 2015

Geologic Resources of Iowa Project

A. Site Identification:

Conklin Quarry – 41°41′18″N 91°35′12″W. Quad ID: T80N, R6W, Sec. 32, E ½ + Sec. 33, N.E. ¼

Devonian Fossil Gorge – 41.7928°N Lat. / 91.5746°W Long. Quad ID: T80N, R6W, Sec. 22, N.E. ¼, S.W. ¼



B. Historical Record:

The Iowa River was the main reason for the initial settlement of the Coralville area. It was around this location that in 1841 David and Joshua Switzer set up the first grist mill on Clear Creek that allowed for flour and meal to be ground in Johnson County. This mill was quickly overcome by need and Walter Terrill built a new grist mill and dam closer to Iowa City, by the current City Park to capitalize on the need of the pioneers of Johnson County. This new Terrill Mill D0am and Grist Mill had the ability to grind up to 300 bushels of grain in 24 hours and attracted farmers from up to 100 miles away. This mill and dam were later destroyed in a flood that came through the area in 1881. (History of Johnson county: Iowa, 1973)

Around the same time, the Coral Mill and the Coral Dam were created in 1843 in what is now the Coralville area. This was located about 2.5 miles upstream from the Terrell Mill

and Dam that was closer to the Iowa City area. In 1848 the Dam was purchased by Ezekiel Clark. Through his financial prowess, the area soon became filled with different mills utilizing the hydrological power of the dam and the town was named Clarksville after the owner of the dam. Paper mills, woolen mills and several grist mills were created in this area during this time period. With this increase in manufacturing in the area, the population also increased. By the time the city of Coralville was incorporated in 1873 the population was at 300 people. (History of Johnson County: Iowa, 1973)("Coralville History | Coralville, IA - Official Website." n.d.)

The town's current name of Coralville was established in 1866. A visiting professor from Harvard University, was giving a lecture at the University of Iowa on the different fossilized corals in the area. A great many of these fossils were found in the rock formations around present day Coralville when exploratory holes were being dug for the purpose of finding a suitable location for the original Coral dam. The professor Louis Agassiz, a trained zoologist, was interested in these fossilized coral reefs that surrounded the Iowa City area. Mention of these lectures brought interest to the area and the town was renamed Coralville soon after. By the 1900's the Iowa City Electric Company had purchased all the waterpower rights on the river and the mills of the area closed. Without the manufacturing jobs that these mills brought to the area, the population of Coralville began to go down (History of Johnson County: Iowa, 1973).

In addition to the rich resource of the river, the underlying limestone was also an important part of the history and development of the area. Today, quarries are still found across the state. The Limestone is used as aggregate for gravel roads, as an ingredient in

cement and our farming communities benefit from ag-lime used to enrich the soils in our farm fields. ("Coralville History | Coralville, IA - Official Website." n.d.)

The earliest reference of limestone use as a building material from the quarries around the Coralville area is that of a high quality cream colored variety that was sought after for use in gravestones from around the 1840's and as a building material referred to as "Iowa Marble" (Marshall, Fields, et.al., 2010). Many of the larger buildings of the area were created from the local geology of the area. At the time this must have been a great economic benefit to the early pioneers of the area, as the savings in manpower and transport would have been greatly reduced. The former capital of Iowa, located in downtown Iowa City, IA., was built of limestone brought in from a local quarry from the Penn Township located about 8 miles northwest of Iowa city at the time. It was said that there was an "inexhaustible abundance" of building material within the many quarries of the area. Red Ball Quarry, a.k.a the Old Public Quarry, located on the lower bluff below the University of Iowa's President House was used in the mid 1800's and is also referenced as a source of rock for the Old Capital mall. The Red Ball, along with many other small currently abandoned quarries in the area, are overgrown but can still be seen to the trained eye as what it once was. The Conklin Quarry, located in Coralville is shown to have been in use since the late 1800's. The Conklin and many other, now abandoned quarries of the area are made of stone from the middle to upper Devonian period. This stone was laid down approximately 397-374 million years ago (Marshall, et.al, 2010).

C. In addition to being a historical source of building material for structures in the Iowa City area, many of the older and current quarries in the Johnson country area were used

for aggregate in county roads, and Ag lime for agricultural use. Conklin Quarry and its sister quarry Klein Quarry, both located in the city of Coralville, IA, are major sources of the aggregate used in creating the interstate system we have in Johnson County and across the state. The geology of the quarries and the surrounding area are from the Devonian age and are part of the Cedar Valley Group. (Bettis III, E. Arthur, et.al, 2015) The Cedar Valley Group is divided into several members; the Coralville member, the Rapid member, Solon member, and the lowermost ledge of the Davenport and Spring Grove member. The Coralville member is rated by the Iowa Department of Transportation to be a class 3I. This ledge can be used to make concrete which has a 35 year service life, making it very suitable for interstate pavement use. Class 3I is the highest quality rating and makes aggregate from this member very desirable. The Rapid member is listed as rated for use for road stone, backfill and subbases for structures. The road stone is used in unpaved shoulders and gravel rock roads. The Solon member ledge contains Solon and Davenport Breccia. Breccia are beds of broken rock which have been cemented together within a fine grained matrix. This bottom layer or ledge has been deemed by the Department of Transportation to be of a 3I rating, meaning rated for use in interstate concrete or commercial concrete.(Bettis III, E. Arthur, et.al., 2015)

Evidence of the Cedar Valley Group can also be seen around the Coralville Lake in the aftermath of the 1998 flood that exposed the Devonian fossil gorge. In the location surrounding the lake, the upper most part of the Wapsipinicon Group can be seen as well as the entire Cedar Valley Group (Biggs, 1987).

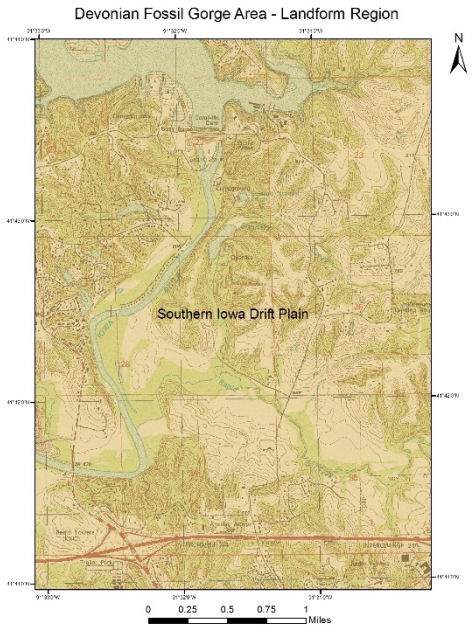
The Wapsipinicon Group was laid down during the middle Devonian, approximately 397-391 million years ago. This Group has a maximum thickness of about 180 feet. The

Cedar Valley Group was laid down during the middle to upper Devonian, approximately 391 to 385 million years ago and is directly located above the Wapsipinicon (Barr, 2004). Since this limestone was formed in a shallow marine environment, this rock may contain marine organisms that lived during that time locked up in the rock as fossils. At the Devonian Fossil Gorge, located at Coralville, IA., we are fortunate to see many of these fossils locked in time. After the major flooding in the summer of 1993, in which the emergency spillway was breached at the Coralville dam, layers of earth were removed and the bedrock was exposed below. Within this bedrock we can now see the Rapid Member of the Little Cedar Formation that is part of the Cedar Valley Group. Within this exposed rock we see Brachiopods, Crinoids, bryozoans and different types of corals. More rare, but also possible to locate within the rock are trilobites and some primitive fish. With the abundance of marine life located within these rock Groups, it can be seen why the Devonian is called the "Age of the Fish" (Anderson, 2006).

D. Coralville is located in the Southern Iowa Drift Plain. This area is fortunate to be located right on the edge of the Iowan Erosion Surface area. Being only a couple miles apart I believe that it would be difficult to see a hard line where one landform region starts and another starts. Because of this I feel that this location allows for observation

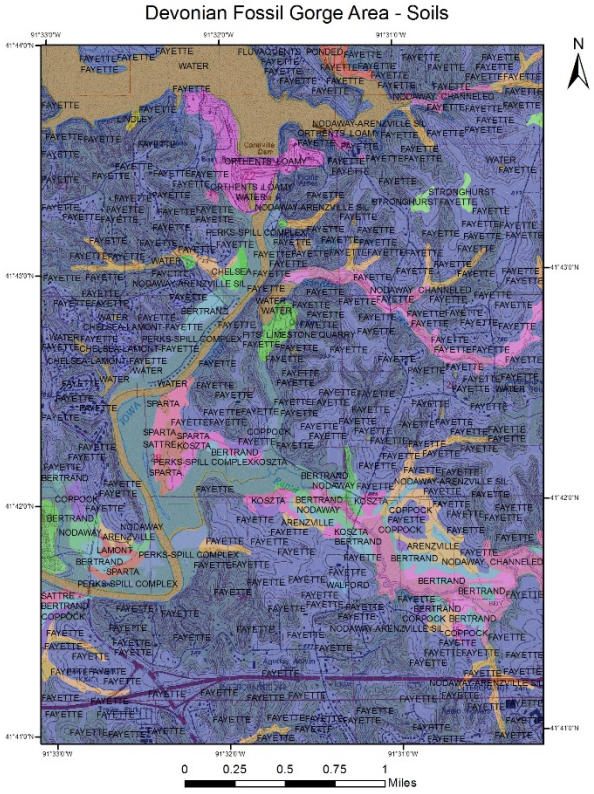
and educational opportunities to examine a transitional area where the two regional geologic settings come together (Anderson & Fields, 2006). Both the Southern Iowa Drift Plain and the Iowa Erosion Surface have been subjected to several glaciation periods within the last 2.6 million years. The Southern Iowa Drift Plain consists of Pre-Illinoian till deposits overlain by Wisconsin Episode loess.

The Southern Iowa Drift Plain can be further categorized into four upland surfaces, Yarmouth-Sangamon, Late-Sangamon, Iowan, and Holocene. The Yarmouth Sagamon paleosol is thought to have been deposited by a Pre-Illinoian drift plain. This predates the Illinoian ice age which lasted 191,000 - 130,000 years ago. It is thick gray in color and poorly drained. It is thought to have developed from pre-illinoian through to the beginning of the Wisconsin ice age, and can be found only in the flattest un-eroded areas of the Iowa City/ Coralville area. The Late-Sangamon paleosol is found underneath the Yarmouth Sagamon and is less developed through weathering. It has a thinner sola, and is better drained. It can be identified by its red to reddish-brown color. This layer is also associated with a gravel lag, which can be indicative of an erosion process through flow of water, where the lighter sediments are carried away, leaving behind a stone zone of heavier sediments. Below this layer are found the sediments that make up the Iowa Erosion Surface, however between the 2 “surfaces” there appears to be a disconformity in the record. Possibly an older glaciation outwash that could have aided in the creation of



the Iowa Erosion Surface? On top of these older sediments are two formations of loess. The Pisgah Formation is a loess directly above the Yarmouth Sagamon paleosol and the Peoria formation is a thicker loess that rests above the Yarmout Sagamon (Bettis et.al., 2015).

Our current soils in Iowa are relegated to Mollisols and Alfisols in designation. These soils are associated with certain climate-vegetarian zones. Mollisols are found within temperate grassland areas. They have a thicker A horizon, have a dark colored surface horizon and are base rich and are mollic in nature. The primary suborder soil structure is Udolls. The vegetation at the time of settlement of the Udolls was dominantly tall grass prairie. This soil was laid down where slopes are not too steep and today most all of these soils are used for agriculture purposes. Some are used as pasture or rangeland. Alfisols are found within temperate deciduous forest/savanna areas of the State and are Ochric in nature. They have a more pronounced leached area (horizon E).beneath the A horizon. The primary suborder soil structure for this order is the Udalfs. These soils are being developed in and are /or have supported forest vegetation at some time during their development. (Dominant Soil Orders, n.d.)

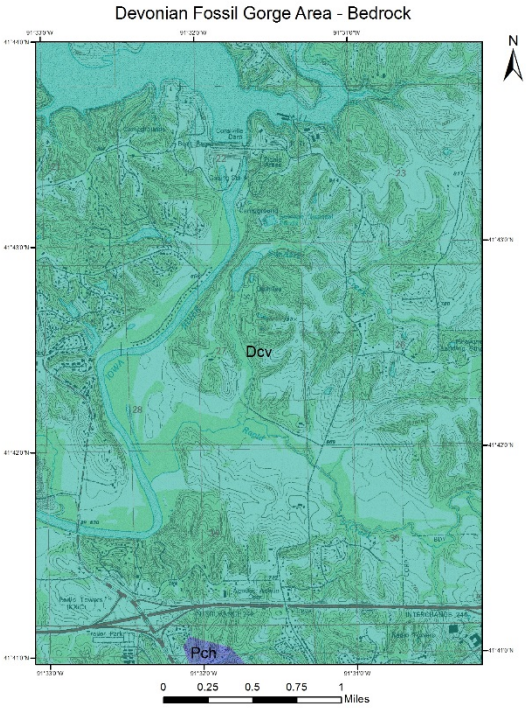


When looking at the Soils map of the Devonian/Coralville area, the Fayette series is the predominant series listed. This series

has well drained soil formed in loess, as loess is the parent material. Soils are not only a byproduct of parent material, but also climate which consists of temperature and precipitation of an area. These soils were formed in an environment where the mean yearly temperature is nine degrees Celsius and the average rainfall is about 850 ml. The taxonomic class is that of a fine-silty, mixed, superactive, mesic Typic Hapludalfs. The A horizon is 0-8 cm and can be very dark grey with many roots, very acidic and show a clear, smooth boundary. The E horizon is divided into E1 & E2 and can be 8-28 cm thick. This horizon moves from dark gray to dark grayish brown, is silty loam and has few roots, moderately acidic and a clear irregular boundary. The BE horizon is 28-36 cm thick, brown in color, silty clay loam and has a moderate fine subangular blocky structure. There are few roots in this level and it is strongly acidic. The soil continues to transition through Bt1, Bt2, BC and finally ending in C. Horizon C is 119-185 cm thick and is yellowish brown in color. This level is strongly acidic, has common few pores, very few clay accumulations in some root channels and few oxides. This series was first established in 1919 in Fayette County, IA (Fayette Series, 2006).

E. The underlying geology of the Iowa City/Coralville area is that of Limestone. Limestone, which consists of the majority of Iowa's bedrock, is a biochemical sedimentary rock composed of calcium carbonate. It requires the precipitate of $CACO_3$

out of water to then settle out and buildup on a sea floor. The factors needed to precipitate the calcium carbonate are temperature, pressure, salinity, photosynthesis and bacterial activity. If the temperature of the water is raised then we see a rise in $CACO_3$ and a loss in CO_2 in the water. If pressure goes down, you will have an increase in precipitation. If salinity is decreased, as with the influx of fresh water from melting ice flooding the oceans, then the will increase the precipitation of $CACO_3$. And if there is more photosynthesis, as in the case of shallow sea environment, you pull more CO_2 out of the environment which allows more $CACO_3$ to precipitate out of the sea water. Because of the factors needed to create this bedrock, most of the limestone comes from areas that were at one time in a tropical climate, where the water was warm and well lit for photosynthesis to occur. This shows that Iowa was at one time much closer in latitude to the equator and covered by a shallow sea. This shallow sea can be more evidence of a much warmer global climate where our earth was in a glacial minimum and very little water was locked up in ice, allowing the overall ocean levels to be raised enough to flood the interior of the continent. These rocks would have been forming 375 to 425 million years ago in Devonian and Silurian seas. During this time many colonial corals would have been living in the shallow tropical seas. Corals like, *Pachyphyllum* and *Lithostrotionella* as well as solitary corals such as the horn corals easily seen today in the Devonian Fossil



Gorge in Coralville. This was an exciting time on the earth, where life was taking hold of the planet during the Paleozoic time period (Prior, 1993).

F. Project for Students

Take the students on a virtual field trip of the Devonian time period. I will use the "Geo 2 Go" Discovery trunks resources found at the University of Iowa Natural History Museum (http://www.gwaea.org/attachments/principals/2012-2013/docs/Teaching%20Trunks%20-%20Brochure%20(small).pdf).

Through these resources and examinations of area rocks, physically and chemically, we can discuss how these organisms got in Iowa, and what this means for Iowa's geologic past in terms of landscapes and landforms.

Students will develop a travel poster from the perspective of an organism living during that time, complete with a slogan that describes what thrills, sites and scenes await potential travelers to the distant Devonian time period in Coralville, IA 350 million years ago.

We will then move into the economic history of Coralville and how our community is dependent on and benefits from our local limestone resources.

We will brain storm the positive and negatives quarrying for limestone by having a Tug of War debate. Each child will have a post-it note and be able to put up their ideas on either side of the debate. We can examine these ideas and have a discussion.

Students will then be able to grab an idea, go home and look up more information to come back for another discussion the next day. Hopefully, they will discover that the positives outweigh the negatives, but here might be another opportunity to examine past mining practices compared to present practices.

Follow up: I could have the students take core samples from a setup of layered playdoh (drilling samples using a see-thru straw) to determine the geologic underlying structure and sediment history of the area. Then they would create a column showing the different layers and have to come up with a story of how the geology of Iowa changed and what changed it (ex: seas came in and retreated based on layers in rock – based on shifting of tectonic plates, or rebound of land). They would need to defend their "story" and compare to other groups in the class. Good discussion could be had on conflicting ideas, disconformities, etc.

Big Idea 1: Earth Scientists use repeatable observations and testable ideas to understand and explain our planet.

1.6: Earth scientists construct models of Earth and its processes that best explain the available geological evidence.

Big Idea 2: Earth is 4.6 Billion years old.

2.1: Earth's rocks and other materials provide a record of its history.

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