Third Field Trip

ES546A Field Geomorphology

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Overview

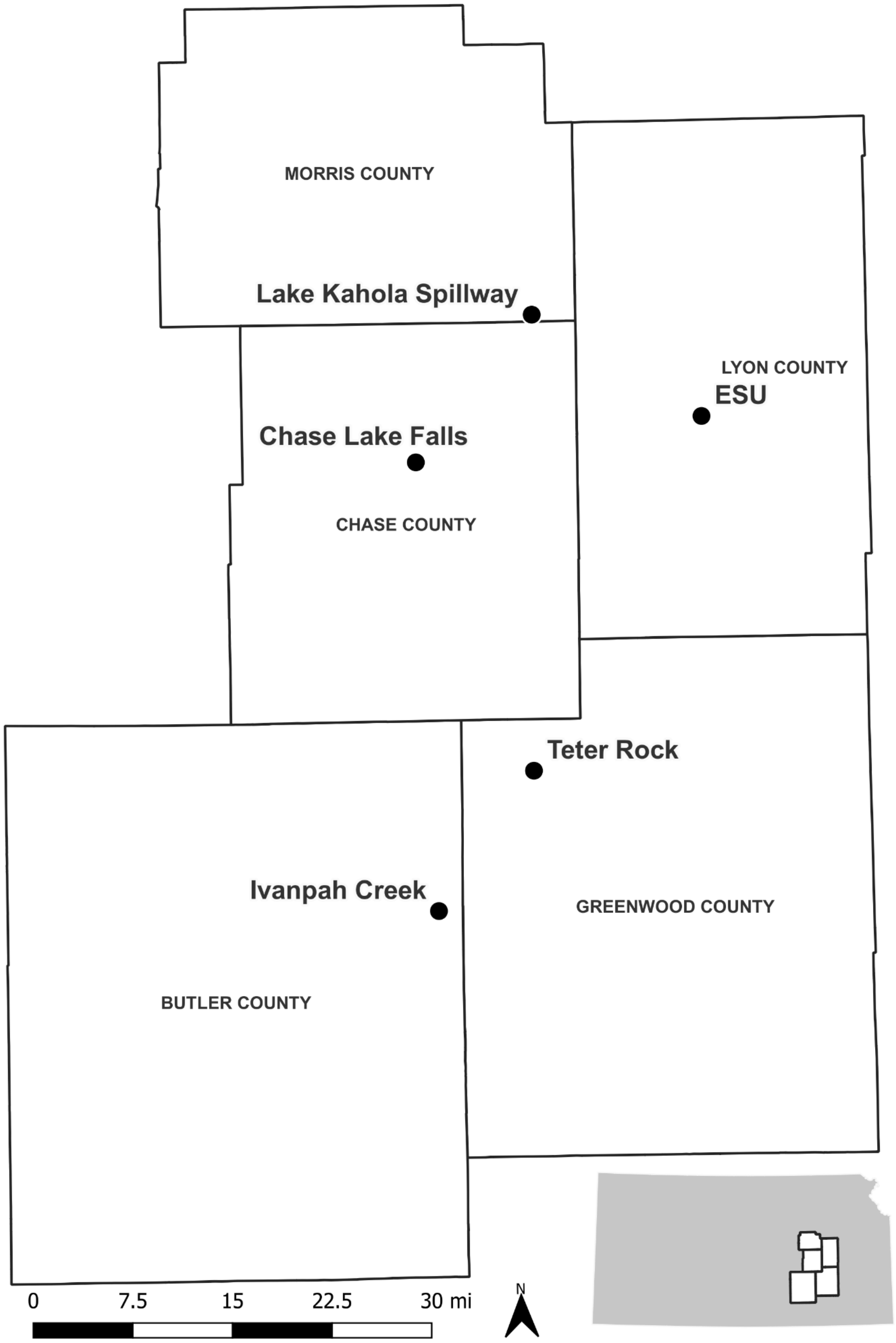

Figure 1. Field trip locations in relation to ESU and the state of Kansas. County and state shapefiles from naturalearthdata.com. Created by R. Olsen.

<u>Stop 1 - Lake Kahola Spillway</u>

Lake Kahola is a man-made reservoir located 15 miles northwest of the ESU campus. The lake was built in 1936 as a source of water for the City of Emporia (Kahola Homeowner's [sic] Association).

The spillway of Kahola Lake contains outcrops of Permian age strata belonging to the Beattie Limestone, Eskridge Shale, and Neva Limestone formations of the Council Grove Group (Aber, 2017). The thickest layer is the Cottonwood Limestone Member of the Beattie Limestone. Zeller describes the Cottonwood Limestone as "...massive, light buff, weathering nearly white, cherty, and contains abundant fusulinids in the upper part." There are many large fallblocks in the spillway of Cottonwood Ls. due to the underlying shale being undercut, amounting to about 25 meters of fallblocks.

The Cottonwood Ls. Mbr. overlies the Eskridge Shale Formation. The Eskridge Shale is the thickest layer at the spillway. Zeller describes the Eskridge Shale as "...composed of varicolored shales with gray and tannish-gray being the predominant color. Two persistent molluscan limestones are found in the middle or lower part of the Eskridge…". The upper layer of molluscan limestone is thicker and more resistant but it is not resistant enough to form a large overhang as the underlying shale and limestone is eroded. Fallblocks of either molluscan limestone are present in the plunge pool but are not as prominent as those of the Cottonwood Ls..

Underlying the Eskridge Shale is the Neva Limestone Formation. According to Dr. Aber the Neva is present at the spillway but it was not observed by the author, it is likely that the Neva forms the bedrock that Kahola creek flows over.

Approximately 300 meters south-southeast of the Kahola Lake dam is an old quarry where limestone of the Crouse Limestone Formation was quarried.

Figure 2. Cottonwood Ls. at the Lake Kahola spillway. Photo by R. Olsen.

Figure 3. Cottonwood Ls. fallblocks at the Lake Kahola spillway. Photo by R. Olsen.

Figure 4. Closer photo of Cottonwood Ls. at the Lake Kahola spillway showing pits. Photo by R. Olsen.

Figure 5. Cottonwood Ls. fallblocks, looking west and standing on the top unnamed limestone layer of the Eskridge Shale. Photo by R. Olsen.

Figure 6. Eskridge Shale looking north, the thicker upper layer of molluscan limestone is visible with a fallblocks of Cottonwood Ls. to the left side of the image. The variation of color in the shale is evident in this image as well as the lower molluscan limestone present in the formation. Photo by R. Olsen.

Figure 7. Eskridge Shale looking south. Photo by R. Olsen.

Stop 2 - Chase Lake Falls

Chase Lake is located 2 miles west of Cottonwood Falls and was constructed in 1964 (Stokes). The falls are composed of three separate waterfalls cause by alternating layers of limestone and shale and located east of the lake at the end of an overflow spillway that begins at the south end of the dam. From top to bottom the outcropping formations are the Crouse Limestone, and Bader Limestone. All outcrops in this area are Permian age (Zeller, 1968). None of the individual falls have a significant plunge pool, this may be due to the resistance of the limestone or ephemeral nature of the spillway.

At the top of the falls is the lower member of the Crouse Ls. Fm., Zeller describes the Crouse Ls. Fm. as "...an upper and a lower limestone separated by a few feet of fossiliferous shale. The upper part displays platy structure and weathers tan to brown. The limestone beds locally are cherty. The thickness ranges from about 6 to 18 feet." In the falls there are many fallblocks of fossiliferous limestone likely belonging to the Crouse Ls. Fm." This formation is responsible for the topmost waterfall of the Chase Lake Falls.

Immediately below the Crouse Ls. Fm. is the Easly Creek Shale Formation which Zeller describes as consisting of "... red, green, and gray shale, locally containing thin limestone beds. The lower part of the formation is largely red shale; the upper part is light-colored, calcareous shale." The shale of the Easly Creek Sh. Fm. is a light buff color and slightly calcareous, there are areas where dissolution in joints of the overlying Crouse Ls. Fm. has left deposits of calcium carbonate in the shale (Fig. 9).

Below the Easly Creek Sh. Fm. is the Bader Limestone Formation which consists of three members: Middleberg Limestone, Hooser Shale, and Eiss Limestone. This formation is responsible for the middle and lower waterfalls of the Chase Lake Falls. The middle waterfall is formed by the Middleburg Ls. Mbr. which Zeller describes as "...a slabby to massive limestone, a middle olive- to dark-gray shale, the lower part of which is fossiliferous, and an upper platy limestone." This member does not appear to form an overhang as the underlying shale is eroded, this may be due to the composite nature of this member being unable to support a sixable overhang.

Below the Middleberg Ls. Mbr. is the Hooser Sh. Mbr. which is described by Zeller as “...a gray to grayish-green and red shale. Its thickness ranges from 3 to 11 feet.”. This appears to be the thickest layer at the site and though not measured is closer to 11 feet thick. The upper half of this member is a light grey-green while the lower half is reddish.

At the base of the falls is the Eiss Ls. Mbr. which is described as “...two limestone beds separated by shale and is remarkably persistent across Kansas. The lower limestone, 1.5 to 6 feet in thickness, is shaly, thin-bedded, and fossiliferous. It contains abundant, small, high-spired gastropods. The middle part, 2 to 11 feet locally, consists of gray fossiliferous shale. The upper limestone bed, 2 to 3 feet thick, is siliceous and locally contains some chert. The thickness of the member ranges from about 7 to 18 feet.’’ by Zeller. The top unnamed limestone layer forms the lowest waterfall at the site and is not capable of supporting a significant amount of overhang.

It is very likely that the Crouse Ls. Fm., Middleburg Ls. Mbr., and Eiss Ls. Mbr. represent cyclothems, defined by R.C. Moore in 1964 as repeating environments of deposition consisting of patterns of limestone-shale-limestone that represent transgression and regression as sea levels rise and fall (Aber, 2009).

On the eastern side of the dam is a large slump, approximately 290-305 ft wide with a 1.5-2 foot scarp. This is problematic because it is relatively recent and means that the dam could be failing. The slump is not visible on 2021 NG11 imagery or on current Landsat 9 imagery, but this is due to the lower resolution of Landsat imagery being unable to detect the feature. It is unknown if the Kansas Department of Wildlife and Parks is aware of or monitoring this development.

Figure 8. Lower member of the Crouse Limestone Formation and top of the Easly Creek Shale Formation at the Chase Lake falls. Many fossiliferous limestone fall blocks are visible in the left half of the image. Photo by R. Olsen.

Figure 9. Fossiliferous limestone fallblock, likely belonging to the lower member of the Crouse Ls.. Photo by R. Olsen.

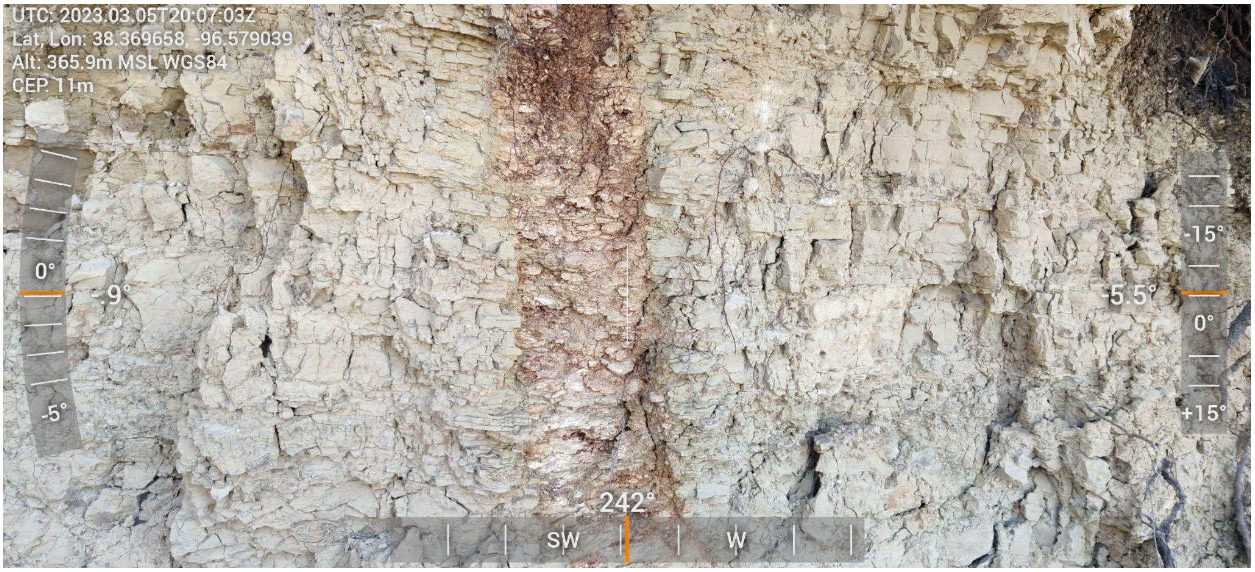

Figure 10. Calcareous shale belonging to the Easly Creek Sh. Fm, specifically in the center of the image is a streak of calcified shale caused by dissolution in a joint of the overlying Crouse Ls. Fm. Photo by R. Olsen.

Figure 11. At the bottom of the falls looking SSE. From top to bottom visible strata is Middleburg Ls. Mbr., Hooser Sh. Mbr., and Eiss Ls. Mbr.. All belong to the Bader Ls. FM., the Eiss Ls. Mbr. is a cyclothem and subdivided into an unnamed upper limestone, unnamed shale, and a lower unnamed limestone. The image was taken standing on top of the lower limestone layer of Eiss Ls. Fm.. Photo by R. Olsen.

Figure 12. Slump on the eastern side of the Chase Lake dam. Assuming a height of 5’5” to 5’8” of the people at the top of the dam and not accounting for perspective or parallax, the width of the affected area is approximately 290-305 feet. Photo by R. Olsen

Stop 3 - Ivanpah Creek

The third stop was at Ivanpah Creek located in the NW1/4 S. 17, T. 25 S., R. 8 E. in Butler County. The area is an ephemeral stream full of chert gravel and limestone cobbles to small boulders. The creek feeds into a manmade lake built some time in the 1960s by the US Army Corps of Engineers, the lake is locally known as Buckley's Lake because of the family that owns the property surrounding the lake. The lake outlets into the Ivanpah Creek proper via an adjustable gate in the dam.

Chert and limestone gravel composes the majority of the stream bed with some subsurface sand, clay, and silt. Measurements were not taken but the majority of fragment appear to be non-flat fragments ranging in size from gravel (2-76 mm dia.) to cobbles (76-250 mm dia.) and flat fragments ranging from channers (2-150 mm long) to flagstones (150-280 mm long) with some being stones (380-600 mm long) using the NRCS terminology in Table 3-5 of USDA Handbook No. 18. The deposits can accurately be described as poorly sorted. The area of the creek we visited was Quaternary Alluvium overlying either the Beattie Limestone or Eskridge Shale formation.

Figure 13. Typical section of the Ivanpah Creek looking northeast. Water is still present in the thalweg where the water has cut through the limestone and into the shale leaving limestone overhangs in some portions of the stream. Also visible are chert and limestone gravel channel deposits in the cutbank Photo by R. Olsen.

Figure 14. Typical section of the Ivanpah Creek looking north from a point near where Figure 12 was taken. The bands of gravel deposited by the stream channel meandering are readily apparent in this image. Graduations on the measuring pole in the center of the image are 10cm. Photo by A. Edmonds.

Figure 15. Typical gravel streambed deposits of the Ivanpah Creek. Other Ryan for scale. Photo by A. Edmonds.

Figure 16. Low resolution image showing darker colluvium or silt washed into the stream channel from the surrounding floodplain. Photo by A. Edmonds.

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Stop 4 - Teter Rock

Teter Rock is a slab of local limestone originally erected some time in the 1920s at a high point on land owned by James Teter to act as a guidepost for homesteaders. The original rocks were removed for use as building materials for building and foundations in the local area. In 1954 the current 16 foot tall slab of limestone that is Teter Rock was erected in honor of Mr. Teter (Stokes, 2017).

Teterville was a small oilfield community that formed around the Teter oil field but ceased to exist as it did in its heyday as the oil field became less productive (Stokes, 2017). The town was located 16 miles north-northeast of Eureka in Greenwood county and Teter Rock itself is located in north central S. 28, T. 23 S., R. 9 E. near the border with section 21.

Teter Rock itself is composed of three large slabs of limestone of unknown origin. If the slabs were procured in the local area of the site they are likely Permian age from the Wreford Limestone Formation or one of the formations of the Council Grove Group that outcrop in the area.

Teterville is situated on a major drainage divide that drains into the south flowing East Branch Fall River to the east and the northerly flowing Thurman Creek to the northwest. There are and draws and spurs in the terrain typical for the Flint Hills region and cliff and bench topography is prominent in the area. The many draws are due to ephemeral streams cutting headward through the soft shale and nickpoints in the limestone. Also prominent in the area is the flint gravel that remains after the shale and limestone has eroded, giving the Flint Hills their name.

On the main road near where Teter Rock is located is a large roadcut that has been cut through the top of the hill likely in order to reduce the grade for trucks. towing trailers or oil field equipment.

Figure 17. Teter Rock looking east showing the three slabs that form the monument. Photo by A. Edmonds.

Figure 18. Teter Rock looking northeast showing the width of the largest slab. Photo by A. Edmonds.

Figure 19. Looking southwest from Teter Rock, the stream barely visible on the left half of the image is Oleson Creek, a tributary of the East Branch Fall River. Photo by R. Clary.

Figure 20. Looking southeast from Teter Rock, the East Branch Fall River is visible by the trees that line it. Photo by R. Clary.

Figure 21. North facing side of road cut near Teterville, likely composed of Wreford Limestone Group. Photo by R. Olsen.

Figure 22. South facing side of road cut near Teterville, likely composed of the Wreford Limestone or upper Speiser Shale Groups. Photo by R. Olsen

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