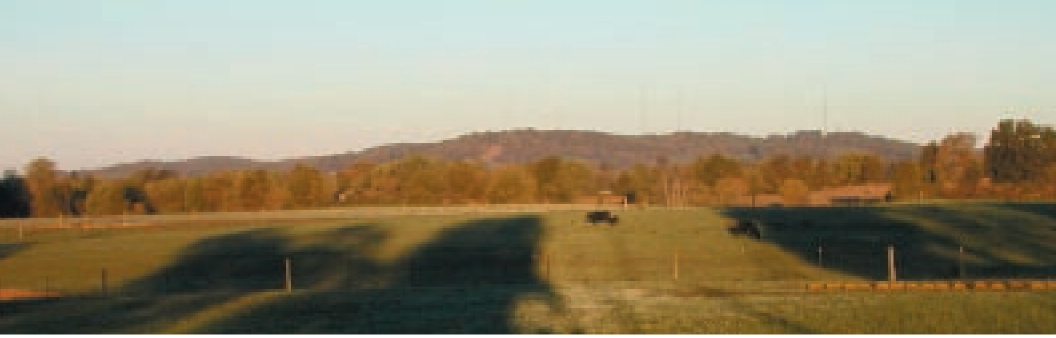
42nd Annual Meeting of the American Institute of Professional Geologists
"Geologic Information: Racing into the Digital Age"

The Jeptha Knob Cryptoexplosive Structure, Shelby County, Kentucky, and Buffalo Trace Distillery, Franklin County, Kentucky

Mark F. Thompson



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Abstract

This half-day trip is divided into two parts. First we will examine a Bluegrass bourbon distillery, followed by a westward excursion to examine the geology and geomorphology of a suspected impact structure. Our first stop will be a guided tour of the Buffalo Trace Distillery in Frankfort, Ky. This will occupy our entire morning. In the afternoon we will make six stops in the vicinity of the Jeptha Knob structure in eastern Shelby County, Ky. Our Jeptha Knob stops will provide opportunities to discuss regional versus local geology, the effects of impacts on carbonate target rocks, and the geomorphic evolution of this structure.

Introduction

Many scientists today suspect that the Jeptha Knob structure (Fig. 1) is an impact structure. It is not listed with the more than 170 such places on Earth because many of the accepted criteria required to define impact structures have not been observed at Jeptha Knob. Ever since W.M. Linney mentioned Jeptha Knob in his 1887 geologic report (its first appearance in scientific literature), the interpretation of its origin has been a dynamic one, even to this day.

Jeptha Knob contains an eroded and buried remnant of a structure that is undergoing a second cycle of erosion. After deposition and lithification of the Middle and Late Ordovician shallow marine carbonates, the Jeptha Knob event occurred, forming a structure that was subjected to subaerial weathering processes during Late Ordovician to Early Silurian time. A Silurian transgression resulted in carbonate deposition (Brassfield Formation), which buried the

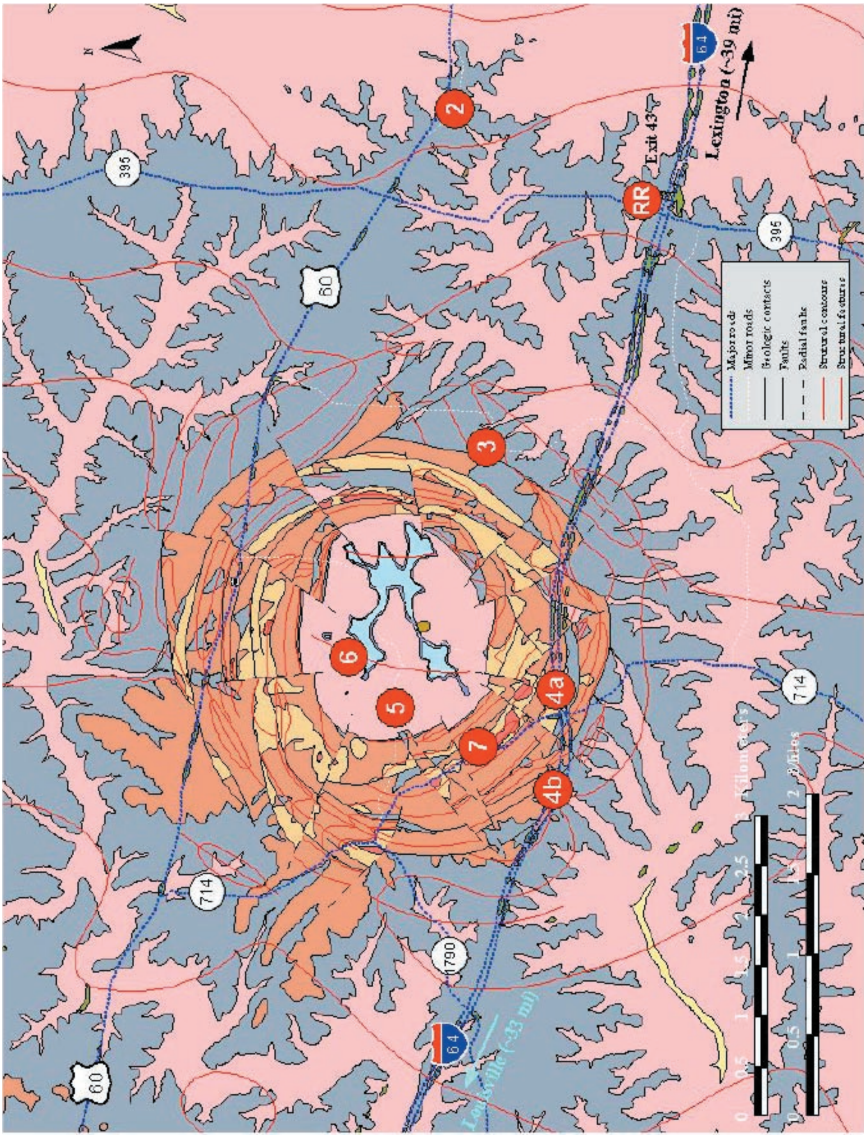

Figure 1. Geologic map of Jeptha Knob showing local roads and locations of field trip stops (adapted from trip leader's field map).

structure. Today, within the second cycle of erosion, much of the Jeptha Knob structure has been eroded down an additional 220 to 320 feet below the level of the Ordovician-Silurian contact (Fig. 2). As a result of erosion and a thick soil cover, only sparse rock crops out at Jeptha Knob.

Figure 2. Westward view of Jeptha Knob from 3 miles away. Horizontal line represents the approximate Ordovician-Silurian contact.

The Jeptha Knob structure is a nearly circular (approximately 3 miles in diameter) area of uplifted, intensely faulted and folded, Middle to Late Ordovician, shallow marine carbonate rocks (Fig. 3). Jeptha Knob is situated about 50 miles west of the axis of the Cincinnati Arch and nearly 50 miles north of the 38th Parallel Lineament of Heyl (1972) (Fig. 4).

Previous Scientific Investigations

The Jeptha Knob structure was first reported by William M. Linney (1887) of the Kentucky Geological Survey. Linney discovered localized faulting in the Jeptha Knob area and suggested that the structure was produced by localized subsidence and subsequent infilling of sediment. Walter H. Bucher (1925) produced the first geologic map of Jeptha Knob, based primarily on biostratigraphy, and suggested it had a cryptovolcanic origin. During the construction of Interstate 64 in eastern Shelby County, Willard Rouse Jillson (1962) discovered three previously unmapped faulted disturbances south of Jeptha Knob.

C. Ronald Seeger (1968) studied Jeptha Knob and performed geophysical work (gravity and magnetic surveys). His magnetic survey showed that a basement counterpart to the Jeptha Knob structure is unlikely because deformation essentially disappears 700 feet below the present surface of Jeptha Knob, leaving the crystalline basement rocks 5,500 feet below the present surface unaffected. From this and many other findings, Seeger concluded an exogenetic origin for Jeptha Knob, hypervelocity impact from a bolide being the most likely mechanism. Seeger failed to provide confirming evidence of unquestionable criteria for his impact hypothesis, however.

SYSTEM	SERIES	GROUP, FORMATION, MEMBER Heavy line to left of column marks units that crop out in structure	THICKNESS, IN FEET	DESCRIPTION
SILURIAN	Middle	Louisville Limestone Waldron Shale Laurel Dolomite Osgood Formation	75	Concealed by soil and chert residuum. Presence inferred from fossils identified in residuum (Foerste, 1931, p. 182) and from thickness of interval
	Lower	Brassfield Formation	18	Finely crystalline calcareous dolomite; contains abundant small vugs; angular fragments of very finely crystalline dolomite present in some beds; basal 3 to 6 ft. in several localities is calcarenite and calcirudite consisting largely of fragments reworked from Upper Ordovician formations
		UNCONFORMITY		
ORDOVICIAN	Upper	Drakes Formation: Bardstown Member	25–50	Nodular-bedded fossiliferous limestone and shale
		Drakes Formation: Rowland Member	50	Argillaceous, dolomitic limestone
		Grant Lake Limestone	140	Nodular-bedded fossiliferous limestone and shale
		Calloway Creek Limestone	60	Fossiliferous limestone and minor interbedded shale; 6–8 ft. thick calcarenite at top
	?	Clays Ferry Formation	300	Interbedded limestone and shale
	Middle	Lexington Limestone: Sulphur Well Member	200	Fossiliferous limestone
		Perryville Limestone Member		Calcilutite
		Tanglewood Limestone Member		Calcarenite
		Grier Limestone Member		Fossiliferous limestone
		Logana Member		Brachiopod coquina, calcisiltite, and shale; 24–56 ft. above base of formation.
		Curdsville Limestone Member		Calcarenite

Figure 3. Stratigraphic section at Jeptha Knob. Thickness and presence of members based on regional thickness and facies trends (from Cressman, 1981).

Earle R. Cressman mapped the Jeptha Knob structure on the basis of lithostratigraphy and produced the most detailed geologic maps of the structure in existence today (Cressman, 1975a, b). His

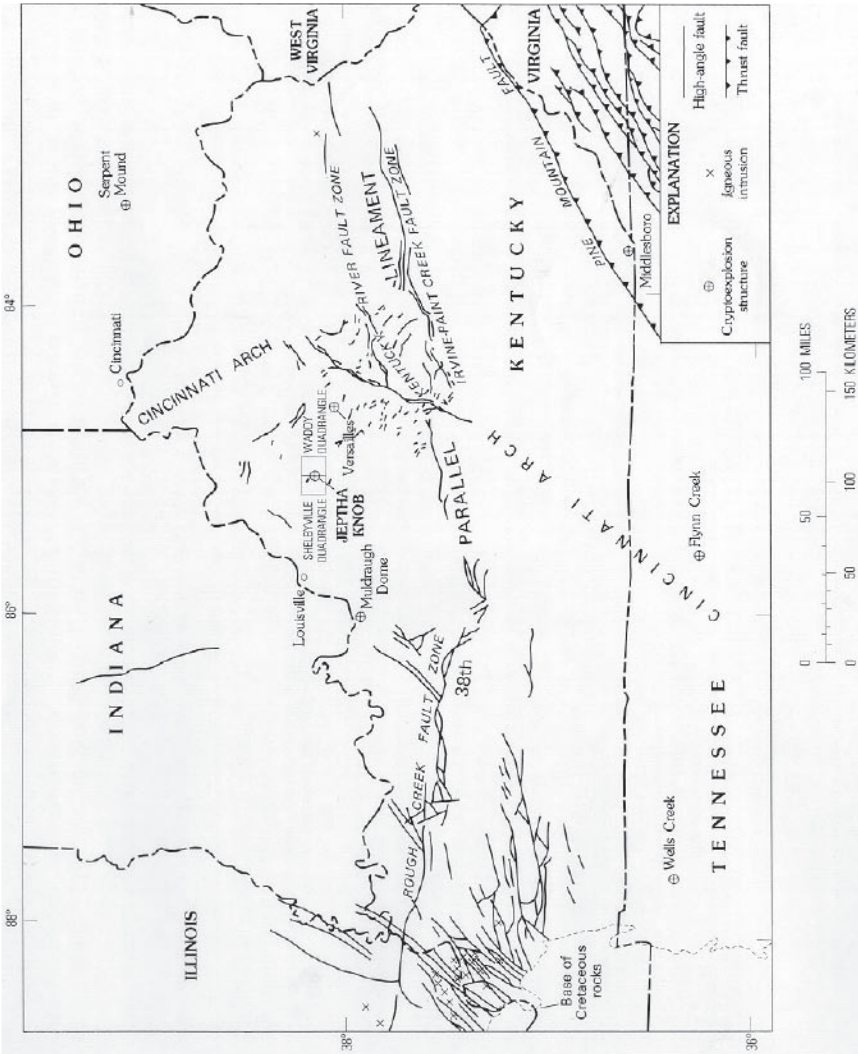

Figure 4. Map showing the structural features of Kentucky and parts of adjacent States (from Cressman, 1981).

maps show a cap rock, a central core of uplifted material, and a belt of faults and a belt of folds. The fault belt consists of radially propagating faults, several listric normal faults ringing the structure, and three reverse faults in contact with the central core of uplifted material (Cressman, 1981).

Seeger and others (1985) conducted an iridium survey in the vicinity of Jeptha Knob. They analyzed and compared samples collected from the highest breccia occurrences at Jeptha Knob, within the basal Brassfield Formation, with other breccias found there. The basal Brassfield Formation breccias yielded anomalously high levels of iridium (0.094 to 0.122 ppb). Such small amounts of iridium may merely represent iridium that fell upon Earth during Ordovician-Silurian lacunae, only to be reworked and concentrated in lag deposits during Silurian transgression. Nevertheless, Seeger and others' (1985) survey may be worthy of further investigation by incorporating the Silurian rocks, which crop out approximately 19 miles west, into this survey. Detecting such low levels of iridium requires advanced techniques, instrumentation, and analytical experience, which only a handful of laboratories worldwide can provide (Montanari and Koberl, 2000; Koberl, personal communication, University of Vienna, 2005). Before his untimely death in 1980, Dr. Seeger was investigating the possibility that this structure is the central peak of a much larger complex crater (Seeger, 1986).

Carbonate Impact Targets

The shock metamorphic effects on sedimentary targets, especially carbonates, are a relatively new frontier in impact geology. There are no definitive microscopic impact criteria for carbonate rocks at this time (Bevan M. French, personal communication, Smithsonian Institution, 2005). Much of today's impact criteria are derived from studies performed on targets composed mostly of crystalline rocks (e.g., Sudbury, Ries, and Vredefort).

Gordon R. Osinski, J.G. Spray, Pascal Lee, and others are examining sedimentary targets with a fresh emphasis on carbonates. It has been widely held that sedimentary targets decompose during high temperatures as they release enormous quantities of H_2O and CO_2 during impact, and therefore deduced that they contain approximately two orders of magnitude less melt rock than crystalline targets do. The work of these gentlemen is proving otherwise. In short, during abnormally high pressures that occur during impact, carbonate rocks do not behave as has been widely held. Carbonates may instead melt, break up as diverse breccias, and, in some cases, flow as a fluidized mass. These scientists have determined the clast-to-melt ratio of carbonates to be nearly equivalent to coherent impact melt sheets found in crystalline targets (Osinski and others, 2002a, b).

Conditions are not normal during impact events (Fig. 5). The rapid release of large amounts of energy in such events puts too

Characteristic	Regional and Contact Metamorphism; Igneous Petrogenesis	Shock Metamorphism
Geological setting	Widespread horizontal and vertical regions of Earth's crust, typically to depths of 10–50 km	Surface or near-surface regions of Earth's crust
Pressures	Typically <1–3 GPa	100–400 GPa near impact point; 10–60 GPa in large volumes of surrounding rock
Temperatures	Generally ≤1000°C	Up to 10,000°C near impact point (vaporization); typically from 500° to 3000°C in much of surrounding rock
Strain rates	10^{-3}/s to 10^{-6}/s	10^{4}/s to 10^{6}/s
Time for completion of process	From 10^{5}–10^{7} yr	"Instantaneous": Shock-wave passage through 10-cm distance, <10^{-5} s; formation of large (100-km-diameter) structure <1 hr
Reaction times	Slow; minerals closely approach equilibrium	Rapid; abundant quenching and preservation of metastable minerals and glasses

Figure 5. Shock metamorphism from Impacts: Distinction from other geological processes (from French, 1998).

much sudden stress on the target rocks for them to respond in the normal way. Typical impact velocities of tens of kilometers per second far exceed the velocities of sound in the target rocks (typically 3 to 5 miles/second). The resulting impact-produced shock waves travel through the target rocks at supersonic velocities, and they impose intense stresses on the rocks without giving them time to give way by normal deformation. In the shock-wave environment, transient pressures may exceed 500 gigapascals (GPa) at the impact point, and may be as high as 10 to 50 GPa throughout large volumes of the surrounding target rock. Transient strain rates may reach seven to 12 orders of magnitude higher than those in ordinary geological processes. At the higher shock pressures (≥ 60 GPa), shock-produced temperatures can exceed 2000°C, and rapid, large-scale melting occurs immediately after the shock wave has passed (French, 1998).

Part 1: A Bluegrass Bourbon Distillery

Begin at the Radisson hotel and proceed northwest on West Main Street for 0.4 mile. Turn right onto Newtown Pike. Continue traveling Newtown Pike for 3.3 miles and then merge onto I-64 West toward Louisville. Continue west on I-64 for 19.1 miles, then take exit 58. Make a right and travel 2.5 miles north on U.S. 60 until it becomes U.S. 127/U.S. 421. Go straight for another 2.5 miles while following the signs to the Civic Center and downtown. Do not make any turns until you see the Buffalo Trace Distillery on the right.

Stop 1: Buffalo Trace Distillery, Frankfort, Ky.

Our first stop is the Buffalo Trace Distillery, which stands as America's oldest distilling site, located on an ancient buffalo crossing where the state's first settlement north of the Kentucky River was surveyed in 1773. Buffalo Trace Kentucky Straight Bourbon Whiskey has been developed to be the distillery's flagship bourbon and to reflect the history and heritage that are unique to Buffalo Trace Distillery.

At this stop we will receive a complimentary guided tour of the distillery. Afterwards we may visit their gift shop, collect our boxed lunches, and travel onward to stop 2.

Part 2: The Jeptha Knob Structure

From the Buffalo Trace Distillery, turn right onto U.S. 127S/U.S. 421N and continue for 0.9 mile. Turn right onto U.S. 60 and travel west for 8.8 miles. Make a left onto Peytona Beach Road and continue for 0.5 mile. Stop 2 is on the left side of the road.

*Stop 2: Panoramic view of the Jeptha Knob Structure (world geodetic survey [WGS] 84 datum, N 38.17258716, W 85.05705901, elevation 910 feet)**

Stop 2 is a westward view of the Jeptha Knob Structure. We are standing 3.25 miles east from the center of this structure. In the distant foreground, 2.5 miles away, is an outer arcuate belt of knobs (Figs. 2, 6). This eastern arcuate belt is approximately 1.7 miles long and trends north–south. Weathering processes on this complexly folded and faulted structure have characterized this outer arcuate belt of knobs with a pseudo-flatiron appearance. The occurrence of resistant rocks of the Drakes Formation situated in deeper, down-dropped fault blocks relative to the other surrounding fault blocks is the cause for the development of this arcuate knob belt. There may once have been another arcuate belt of knobs approximately 0.25 mile east of these and possibly many others throughout Jeptha Knob's geomorphic history. An imaginary line drawn in a horizon-

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*Latitude/longitude measured in decimal degrees.

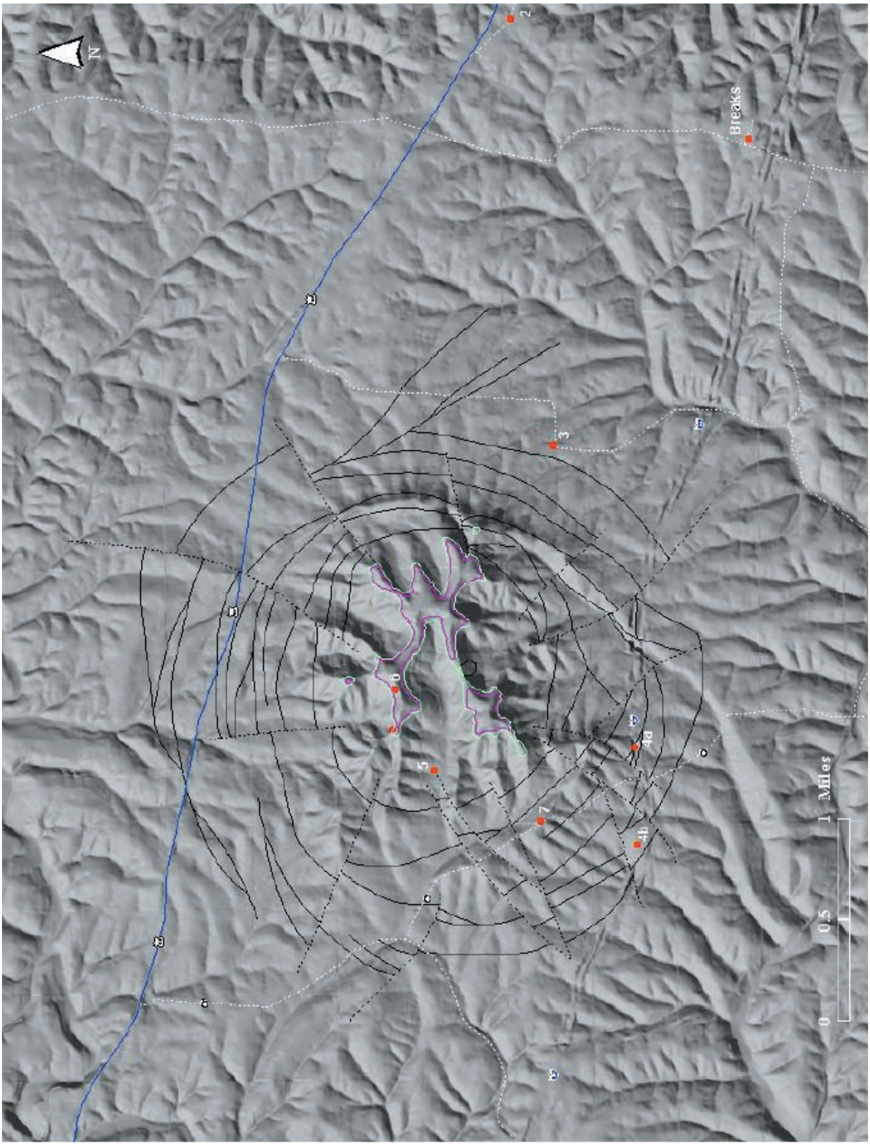

Figure 6. Hillshaded digital elevation map displaying faults, Silurian cap rock contacts, local roads, and field trip stops.

tal plane and placed just above this outer belt of knobs will represent the approximate Ordovician-Silurian contact when viewed from this location (Fig. 2).

From stop 2 continue on Peytona Beach Road for 0.3 mile until it intersects with U.S. 60. Make a left onto U.S. 60 and continue west for 1.7 miles. Make a left onto Buzzard Roost Road and continue for 1.6 miles. Stop 3 is on the right at the 90° bend in the road.

Stop 3: Margin of the Fault and Fold Belts (WGS 84 datum, N 38.17009807, W 85.09581157, elevation 875 feet)

Stop 3 occurs within the margin between this structure's proximal belt of faults and its distal belt of folds. The center of the Jeptha Knob structure is 1.25 miles northwest of this location. This stop also affords a scenic view of the knobs as they appear to rise up out of the surrounding plain (Fig. 7). The lone knob in the distant foreground is 0.6 mile away and it is the tallest knob in the eastern outer belt of arcuate knobs, rising to 1,142 feet.

From stop 3 continue south on Buzzard Roost Road for another 1.2 miles. At the stop sign make a left onto Bardstown Trail and continue east for 1.3 miles. At the stop sign make a make a left onto Ky. 395 and travel north for 0.3 mile. Turn right into a truck stop entrance. We will take a restroom break at exit 43 on I-64.

Figure 7. Scenic view to the northwest from the fault and fold margin. The knobs in the distant foreground appear to rise up from the surrounding plain. Chloe Utterback stands in the near foreground.

From exit 43, travel west on I-64 for 3.1 miles. Stop 4a is on the right. *Caution:* Stops 4a and 4b are very dangerous because of heavy traffic on the Interstate. Stay near the outcrop and *do not* attempt to cross the Interstate for any reason.

Stop 4a: Faults, Folds, and Injection Breccias? (WGS 84 datum, N 38.16473901, W 85.12339004, elevation 890 feet)

Note: This stop is sure to produce much hand-waving, heated discussions, and flying sparks.

Late in the summer of 1961, when the "grade and drain" construction of I-64 in eastern Shelby County was nearly completed, Willard Rouse Jillson was driving the westbound lane during a reconnaissance tour and noted faulted disturbances at three points south of Jeptha Knob. None of Jillson's observations were previously mapped by Bucher (1925).

Stop 4a is a visit to Jillson's, "Western Disturbance" (Fig. 8). Here we will observe mixed breccias injected into faults and bedding planes. Cressman (1981) noted that particular mixed breccias observed along Jeptha Knob faults were not unlike the mixed breccias reported to occur at Sierra Madera in Texas (Wilshire and others, 1972); at both locations the breccias consist of fragments that have moved both upward and downward. The difference is that most of the mixed-breccia occurrences at Sierra Madera are not along faults, but are in the vicinity of the central uplift and form tabular sheets that cut the country rock at steep angles (Cressman, 1981). The Lockne impact structure in Sweden contains clastic injection (breccia) feeder dikes that cut through country rock and propagate sideways (Sturkell and Ormo, 1997).

In the summer of 2004, I observed breccias between at least three bedding planes at the location of stop 4a (Fig. 9). Further investigation (Fig. 10) revealed bedding in a frozen state breaking into clasts (cataclasis) and broken clasts in the process of being plucked from bedding planes and subsequently incorporated into the breccia matrix (cataclasite). I also noted that the rocks at this outcrop contain a wide range of amplitudes over a small cross section of area. These strata appear to have very rapidly been forced into a smaller compartment.

From stop 4a travel 0.8 mile west to stop 4b, which also is on the right.

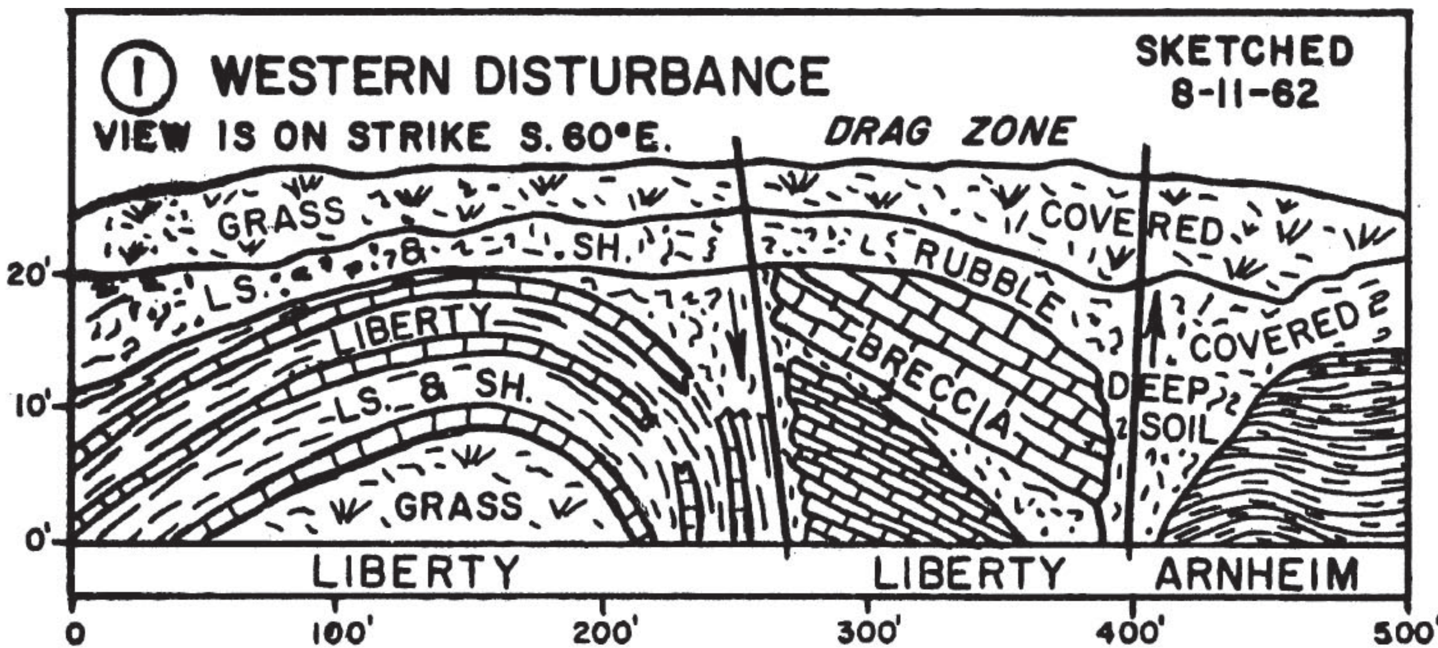

Figure 8. Sketch of deformed rocks of stop 4a. Tick marks are 10 feet vertical, 100 feet horizontal. This view covers from about 550 to 1,050 feet east of the Ky. 714 overpass on the north side of the north lane of I-64, in direction N60W. “Liberty” implies Drakes Formation; “Arnheim” implies Grant Lake Limestone. Rocks are more covered by soil and vegetation than implied in the sketch. A stratigraphic separation of over 50 feet is implied in the faulting shown here, but, as an indication of complexity, Cressman (1975b, 1981) mapped Calloway Creek Limestone south of these faults, and Clays Ferry is also involved. From Jillson (1962) and Seeger (1986).

Figure 9. Deformed rocks at stop 4a. The position of the rocks shown in Figure 10 is outlined. Notice the many ranges of amplitudes occurring here.

Stop 4b: Breccia Dikes, Breccia Sills, and Breccia Sheets (WGS 84 datum, N 38.16466928, W 85.13217696, elevation 870 feet)

At this location in the summer of 2005 I observed what appears to be a feeder dike cutting through the limestone succession and propagating sideways between bedding planes. Approximately 1,000 feet to our west is a very large sheet or irregular mass of breccia that you may walk upon.

Interpretation. I cautiously interpret the breccias and mixed breccias of the Jeptha Knob structure to have originated from impact-related clastic injections. The best model for this cursory field trip is that of the Ordovician Lockne impact structure in central Sweden (Fig. 11).

From stop 4b continue westbound on I-64 for 4.6 miles and take exit 35. Make a right onto Ky. 53 and travel north for 1.9 miles to the intersection with U.S. 60. Turn right onto U.S. 60 and travel east for 3.3 miles. Turn right onto Ky. 741 and travel south 1.5 miles and

Figure 10. Cataclasite frozen during formation. Bedding is breaking into clasts (cataclasis), and broken clasts are in the process of being plucked from bedding planes and subsequently incorporated into the breccia matrix (cataclasite). A small-amplitude fold caps the cataclasite.

slow down almost to a stop. Make a left into The Knobs Farm via Knob Valley Lane. *Note:* This is private land, and permission must be obtained from the landowner to enter. No exceptions!

Stop 5: The Knobs Farm—Resort Home and Cal Schmidt Lecture (WGS 84 datum, N 38.17905664, W 85.12504228, elevation 930 feet)

Stop 5, at The Knobs Farm (Fig. 12), is located 0.45 mile due west from the center of the structure and is approximately 0.2 mile inside the central uplift. Here Calvin T. Schmidt (Fig. 13) will deliver a historical account of Jeptha's Knobs. Cal is a major landowner of the Jeptha Knob structure and above all a true gentleman; someone I call friend. Cal's topics will range from the early Indians, to the Boone brothers, the origin of the name Jeptha, his father Paul F. Schmidt's original acquisition of this land, a few wildlife stories, and more (Schmidt, 2004).

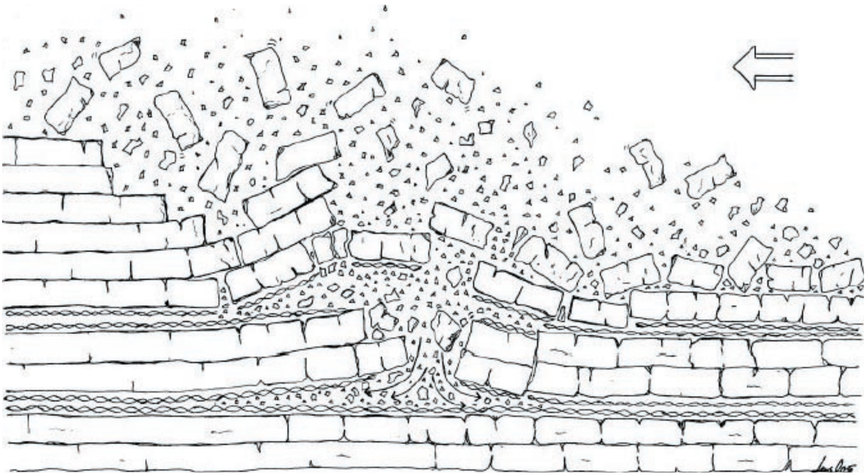

Figure 11. Drawing showing the rarefaction wave that follows the compression wave propagating through the sedimentary succession. The strata are separated along the bedding surfaces, especially along the weaker layers. Clastic material is sucked in between the separated beds (from Sturkell and Ormo, 1997).

Figure 12. Entrance to The Knobs Farm as it appeared on January 7, 2003. View is northeast. Britton Run is the valley in the foreground.

Figure 13. Cal Schmidt visiting his retreat deep within the confines of the Jeptha Knob structure. Photo taken on January 7, 2003.

From stop 5 travel east on Knob Valley Lane for 0.75 mile and make a hairpin left turn at its intersection with Knob Crest Lane on top of the knob. Continue west on Knob Crest Lane for another 0.3 mile to stop 6. This is the home of Cal's nephew, Paul Schmidt.

Stop 6: A View from the Top and Ordovician-Silurian Contact (WGS 84 datum, N 38.18178177, W 85.11766621, elevation 1,165 feet)

Stop 6 affords us many spectacular views from the top of Jeptha Knob upon the Silurian cap rock (Fig. 14). After we take in the views we will examine the Ordovician-Silurian contact (Fig. 15) and look at karren feature development upon the subparallel Brassfield Dolostones. Karren, from the German "wheel tracks," is furrows that occur from solution by rain wash on carbonate rocks.

This location is 0.2 mile northwest of the center of the structure. From here you can look west-northwest and view Kentucky's Knobs geophysical region. This is the escarpment approximately 19 miles away on the distant horizon. The confluence of the Kentucky

Figure 14. Scenic view looking northwest from the top of the Silurian cap rock.

River with the Ohio River is approximately 35 miles due north in Carroll County, Ky. On a clear day it is possible to see clouds of steam rising from power plants along the Ohio River. Try to imagine a Pleistocene moment in which a 1-mile-thick ice sheet may have once glistened blue-green along the horizon to our north, or a herd of megafauna roaming and grazing the peneplain in our foreground view. If you're into modern history, you may imagine buffalo migrations or Indians or pioneers traveling along the Midland Trail, which was succeeded by U.S. 60. More important, take a moment to experience the present moment and the deafening silence this location provides.

Why does this Jeptha Knob structure rise as a monadnock above the slightly rejuvenated peneplain of the Tertiary that we see before us? Why wasn't this structure eroded down to the approximately 900-foot elevation of the Lexington Peneplain? Is the caprock protecting this structure? How could this occur when the caprock once covered this entire region? Walter H. Bucher (1925) was the first

Figure 15. Silurian caprock outcrop (Brassfield Formation) at the Ordovician-Silurian contact. This site is comparable to one that contains Seeger's (1985) iridium anomaly.

to address this question, and subsequent observations have built upon his interpretation.

The reason Jeptha Knob survives as a residual hill on the Lexington Peneplain is most likely threefold. It is a combination of normal faulting, porous rock occurrences, and the presence of encompassing marginal synclines. The occurrences of the Drakes Formation in downdropped normal fault blocks have protected Jeptha Knob from earlier erosion. Present-day erosion is exposing these rocks in downdropped fault blocks. Their relatively porous and permeable nature with respect to other surficially exposed units, has reduced surface runoff, however, and therefore inhibited Drake Formation erosion. In other instances, the synclinal structures within the fault blocks that contain the Drakes Formation also inhibit surface runoff through capture and diversion away from stream channels. Therefore, all three of these conditions play a role in slowing erosion of the Jeptha Knob structure.

Retrace the two previous routes. Travel east on Knob Crest Lane then make a right down Knob Valley Lane to the crossing of the mighty Britton Run and on up the hill to the intersection with Ky. 714. Make a left onto Ky. 714 and travel 0.80 mile to stop 7.

Stop 7: The Southwest Fault Belt and Arcuate Knob Belt (WGS 84 datum, N 38.17150354, W 85.12987562, elevation 990 feet)

Stop 7 is located in the middle of the southwestern fault belt and situated 0.9 mile southwest of the center of the Jeptha Knob structure. We're standing upon the spine of yet another arcuate knob belt. This southwestern belt of arcuate knobs is approximately 1.1 miles long and trends in a northwest–southeast direction. Like the eastern belt of arcuate knobs, this southwestern belt is also a product of differential erosion. In contrast to the eastern knob belt, the resistant Drakes Formation rocks here are in faults blocks that appear to be situated at higher relative positions than many of the other surrounding fault blocks. Also noteworthy is that the rocks of the Drakes Formation at this location are tightly folded into an inwardly plunging syncline.

Erosive forces have been at work on the Jeptha Knob structure more excessively on its southwestern region than on its eastern region. This is because the structure is located in the headwaters of the westward-draining Salt River watershed. The southwestern section of Jeptha Knob is located in a more mature section of the Salt River drainage, whereas the eastern section is in the headwaters. Therefore, the eastern region is subject to slower erosive rates.

Looking 0.5 mile to the northeast, into the central uplift, you can see an approximately 90-foot-thick sequence of Silurian caprock rising to an elevation of approximately 1,185 feet at its crest (Fig. 16). The elevation of this location is 990 feet and it is near the contact between the Saluda and Bardstown Members of the Drakes Formation. Therefore, the strata within the fault block at this location have downdropped a minimum of 55 to 80 feet from their original stratigraphic position.

The view south is across the fault and fold belts (Fig. 17). I-64 is 0.5 mile due south, where it passes over some of the structure's southernmost faults. Beyond I-64 for approximately 0.5 more mile south is the fold belt that dampens into strata having structural dips consistent for this region, ranging from 16 to 22 feet per mile.

Continue south on Ky. 714 for 1.8 miles, then make a left onto Hemp Ridge Road. Continue traveling for 3.0 miles on Hemp Ridge Road and make rights at all yield signs. At the stop sign make a left onto Ky. 395 and travel north for 0.3 mile. Turn right into a truck stop entrance.

Figure 16. Scenic view from the southwestern fault belt looking northeast into the central uplift and upon the overlying Silurian caprock.

Figure 17. Scenic view toward the southwest from the southwest fault belt.

We'll take a restroom break at I-64 exit 43, then return to Lexington via I-64 east.

End of field trip.

Acknowledgments

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