82 Annual Field Conference of Pennsylvania Geologists

October 5, 2017

Pre-Conference Field Trip to

FORT ROBERDEAU

Revolutionary War Lead / Zinc Mining Area in

Sinking Valley

Blair County, Pennsylvania
Fort Roberdeau Pb-Zn Mining Area

**Leader:** George Pedlow, retired geologist, georgepedlow (at) hotmail.com  
**Limit:** unlimited  
**Exertion Level:** Easy

Fort Roberdeau, in its present form, is a Blair County, Pennsylvania public historic park featuring a modern reconstruction of a Revolutionary War fort. The original fort had been built in 1778 to protect mining operations carried out nearby to secure lead from fracture/breccia mineralization containing galena, sphalerite, barite and other minerals. The Revolutionary War lead mining activity was an attempt to provide military ammunition to the Continental Army.

Blair County reconstructed the fort for the 1976 Bicentennial, following up on initial archaeological work done in the late 1930s to define the actual site of the fort.

A question repeatedly asked by fort visitors is, “Where were the actual mines?” The absence of definitively known sites for the 1778 mining effort is a matter of historical interest. The public park lands surrounding the fort site do in fact contain some evidence of old mining, but it is at present unknown if these represent actual 1778 mining. The historical documentary record is poor, and complicated in the field by several iterations of 19th and 20th century lead/zinc exploration attempts.

This field trip will visit a (single ?) site on the Ft. Roberdeau property where the Juniata College Geology Dept. has used resistivity and GPR geophysics to identify subsurface excavation, now filled with low-grade mineralized waste rock.

Because of the high probability of unharvested crops on the Ft. Roberdeau property, the park will restrict access to only one field site. The plan is to move from the field to the Fort, its museum, and its well equipped meeting hall for further presentations. At the fort museum and on a brief fort tour, we will receive historical background and then convene in the meeting hall for several short presentations of relevant geology, including geochemistry, mineralogy, geophysics and environmental concerns.

**Field trip meets at 12:00pm at Arch Spring Farm (40°36'26.27"N, 78°12'8.95"W), owned by George’s wife Linda Morrow. Bring a bag lunch and drink. Come at 11:00 if you wish. Attendees will drive themselves to the stops and leave for the conference hotel at 4:30.**

**TO:** FCPG Ft Roberdeau Field Trip Attendees -

The course of events for the Oct 5, 2017 FCPG pre-conference field trip to Ft Roberdeau will generally be:

1) Gather at Arch Spring Farm for a BYO lunch starting around 11:00 am, and up to about 12:30.

   **NOTE:** There are no nearby stores, so plan to bring your BYO lunch & beverage from home, or stop in one of the towns you pass through on the way.

   Bathrooms will be available, as well as good tap water. Trash containers will be available.

   Arch Spring Farm is the village of "Arch Spring" on the standard PennDOT road map.
WARNING: If you plan to travel north on Kettle Rd. from Altoona, be aware that PennDOT, as of Sep 15, is rebuilding a bridge on Kettle Road between the villages of Culp and Arch Spring. There is a detour in place now, following, in part, the route given on the field trip road log and map.

In that case please see the second attachment here showing detailed roads in Sinking Valley. It is marked with a route going past Tytoona Cave, and will serve as a detour around bridge construction.

If you arrive early enough, walk a short distance to view the "Arch" thru which passes the water of Arch Spring.

An online version of this handout covering the generalities of the day's activities will be available at the FCPG website.

2) Depart for Ft Roberdeau field site ~12:45 pm.

   Park along NE edge of Ft Roberdeau Rd. ~1:00 pm

   Directions to the field visit site will be given. If the corn crop in the Ft Roberdeau field has not been harvested as of Oct 5, there will be directions to an access pathway cut into the field site.

   NOTE: Ft Roberdeau and its surrounding farm land, including the field site, is a Blair County, PA public park. [http://www.fortroberdeau.org/] Wear good hiking or field boots!

3) Depart for Ft Roberdeau Historic Site parking lot, a short distance NW on Ft Roberdeau Rd, ~2:00 pm.

   Brief visit to the Ft Roberdeau Museum in the onsite Pennsylvania bank barn; this presents the Revolutionary War historical context of lead mining, and a small collection of specimens.

   NOTE: We will NOT have enough time to take the historic tour of the fort, situated across the street from the barn museum.

4) Walk uphill to White Oak Hall, the modern conference center in the park, ~2:30 pm.

   Presentation of a few short (10 to 15 minute) talks on relevant subject matter re: Sinking Valley lead / zinc deposits and groundwater.

   View posters prepared by Juniata College geology students, and others.

5) Depart for FCPG conference hotel in State College at ~4:30 pm

   The provided road log (handout - paper & online) will take you past several lead / zinc and other geologic features as you drive toward State College.

   40°36'24.78"N  78°12'10.30"W  Parking for lunch at Arch Spring Farm - start gathering at 11 am Oct 5, 2017
   40°34'32.73"N  78°16'8.37"W  Parking for Ft Roberdeau Farm Field visit site - 1 pm Oct 5, 2017
   40°34'55.01"N  78°16'25.53"W  Parking at Ft Roberdeau Historic Site - 2 pm Oct 5, 2017

GPS WARNING: If you are using GPS by address, use:

383 Fort Roberdeau Road, Altoona, PA 16601.

Make sure that you enter "Fort Roberdeau ROAD" and not Fort Roberdeau AVENUE. The avenue is located in a residential neighborhood in the city of Altoona near Mansion Park. The Fort, located on Fort Roberdeau ROAD, is located in Tyrone Township.

NOTE: Please use Lat Lon for Arch Spring Farm; its street address on Kettle Road is "messed up" in several widely used GPS search sites.

http://agmap.psu.edu/Businesses/index.cfm?fid=1866 lists "Arch Spring Farm Bed & Breakfast", and presents an interactive Google Maps image showing the exact correct location.
Arch Spring Farm: A Short History
Linda Morrow

Arch Spring Farm is the site of the once thriving small rural village of Arch Spring, still identified as such on PennDOT’s standard roadmap. Both are named for the remarkable natural geologic wonder located on the farm property – Arch Spring - with its natural limestone arch and voluminous flow. It has been noted in publications, and visited continuously, as a site of natural beauty for well over 200 years. It can only be assumed that Native Americans knew of, and wondered at, this place long before that.

Dave and Linda Morrow bought Arch Spring Farm in 1983, virtually a life-long dream for Dave, who had grown up on a farm two miles away. They restored the smaller Mill House in 1986 and the larger Manor House, the Jacob Isett house, ten years later. Linda and her family have continued to operate both as a B&B since Dave’s passing.

Jacob Isett came to Sinking Valley in 1785. He had been a shoemaker as well as a gristmill operator in the southeastern part of Pennsylvania. When he arrived in Sinking Valley he lived in an abandoned building at Ft. Roberdeau and earned his living making shoes which he traded for grain. He amassed a lot of wheat in a year before crop failure and so was able to sell his grain for enough money to buy the land at Arch Spring from William Penn’s heirs in 1795, it having been part Lot 33 of the Penn’s Manor of Sinking Valley.

Jacob Isett first built the small stone structure that is now behind the main house. The ground floor would have been used as kitchen/living room and the upstairs as sleeping quarters. The second floor is interesting as it has 4 slits for windows which are wider on the inside than the outside. This design permitted a rifle to be aimed at attacking Indians or other intruders. The British had enlisted Indians to help them in the Revolutionary War, so there may have still been unfriendly natives around when the “fort” was built. Between each set of windows are indentations of the same design that Dave and Linda had seen in Fort Michilimackinac, another Revolutionary War fort in upper Michigan. They were told there that the indentations were to hold ammunition.

Jacob Isett built a saw mill and a very large wooden grist mill next to the stone building now called the Mill House. He diverted some of the stream from the spring into a mill race. The “upstream” end of that mill race can be seen near the road bridge crossing Arch Spring’s outflow. The wooden mill was dismantled in 1942, but the covered bridge like structure, a scale house, still stands. Wagons were weighed empty and again with grain to determine the weight of the grain milled or sold. The “works” for the balance scale can still be seen. A blacksmith and wagon shop, a shoemaker’s shop and a cider press were once part of the village in the 1850s. Remains of the foundations of small homes can be seen on the other side of the modern foot bridge.

The Mill House was historically a commercial building, having served variously as a general store, warehouse for the grist mill, and Arch Spring Post Office. There is no evidence of an original early chimney, indicating that it was not built for habitation. It is intriguing to think that the Mill House might have been built in 1799 because of a threshold stone carved “ISETT 1799” in the building. However, the location of the stone, with lettering facing upward, on the threshold of the warehouse door 3 stories above the ground, may indicate that the stone was recycled from an earlier location. A Penn State historical geographer estimated the Mill House was built in the 1830’s, but there is also an interesting architectural similarity to the 1817 version of Sinking Valley Church, of which a good photograph survives, taken in the 1870s before that church was rebuilt in its present form.

The plaque just under the gable at the north end of the “Manor House” indicates the building was completed in 1805 for Jacob and Eleanor Isett. Other stone houses of very similar design and trim exist in the Olny Valley of SE PA, so it may be the builder came from there and might have brought mill work and other building materials with him. Both houses at Arch Spring, viewed together, share architectural features with the Lemon House that served primarily as a restaurant and bar to patrons of the Allegheny Portage Railroad.

Originally the Manor house had no insulation, just plaster and wall paper and chair rail over the inside of the stone walls. It was probably the early 1900’s, when electricity was put in, that the perimeter walls were studded and plaster was applied over lathe. In the 1920’s there was a major fire in the living room which apparently destroyed the original woodwork there. Very ugly 1920’s woodwork was taken out in the 1996 restoration. The built-in cabinets in the dining room are believed to be original to the house. When indoor plumbing was installed, maybe during fire damage repairs, a bathroom was added at the front of the upstairs hall. There were originally 5 bedrooms on the second floor with the 5th bedroom accessible only by the former back stairwell or through another bedroom. In 1996 the 5th bedroom was converted into two more bathrooms and an upstairs laundry. The Manor House now has two geothermal furnaces and hot water heaters. The pipes run under the field to the north of the house.

At the start of Mill House restoration in 1986, there were no studded or plastered walls, and of course no insulation. Although these features were added, heating is electric, so the building is winterized every year from January at least into April.
Oct 5, 2017 FCPG Pre-Conference Field Trip Driving Route from Arch Spring Farm lunch / gathering site to Fort Roberdeau, and from the Fort to the conference hotel in State College, PA.

NOTE: The Sinking Valley portion of the Driving Route between Ft. Roberdeau and Arch Spring is coincident with PennDOT’s detour around the bridge project. SEE: Road Log at the end of this document.
The present extent of property owned by Blair County at the Fort Roberdeau historic site has been assembled over many decades through purchase and donation. Space here does not permit a full description of the effort. Suffice it to say that since the 1930s, a Kiwanis youth camp, situated where White Oak Hall now stands, and portions of several farms have been joined together to form the present park. Published articles by interested folks had appeared fairly frequently since the latter 19th century. The Altoona chapter of DAR placed the bronze historical marker along Kettle Road in 1924. A Depression-era effort in archaeology and actual reconstruction of the fort was undertaken in the late 1930s, only to be set aside at the onset of WW II. Blair County revitalized the reconstruction plan in the early 1970s as a Bicentennial project. The Fort and its interior features are the result of that effort. The Museum barn is, of course, a long standing Pennsylvania Bank Barn, a historic structure in its own right. Staff at the fort complex host a variety of functions, from historic tours for members of the general public, to school tours, colonial and Revolutionary War, and other, reenactor events, meetings and public presentations, and rental for private parties such as weddings.

http://www.fortroberdeau.org/
Fort Roberdeau Lead Mine Found by Juniata Geologists

Geology of Sinking Valley
- Fort Roberdeau is located in Sinking Valley.
- Sinking Valley is underlain by limestone.
- Water travels easily through cracks and fractures in limestone, allowing the formation of caves and sinkholes below the ground (giving the valley its name).
- The local rock is rich in lead ore, called galena.
- This is significant because Fort Roberdeau is located in an area with numerous pockets of mineable lead ore.

Minerals Indicating Lead Occurrences
- Galena: A lead sulfide mineral (PbS) that commonly occurs in limestone, especially near existing mines.
- Barite: A barium sulfate (BaSO4) mineral that is common in lead mines.

Geophysics and Resistivity
- A combination of geology, mathematics, and physics, used to analyze questions about infrastructure.
- Groundwater, geotechnical, urban planning, archaeology, and forensic, etc.
- Tools are non-destructive and time efficient.
- Resistivity:
  - A conductive material easily allows electrical current to pass through (think of how we use copper wiring for electrical systems).
  - Resistive materials resist the flow of electrical current.
  - Low resistivity = High conductivity

Importance of Lead Mines during the Revolutionary War
- Lead mining operations were considered strategically important to the Patriot’s cause.
- Lead was used to make musket balls.
- The mineral galena is a lead ore.
- Finding and exploiting lead mines helps historians develop a better understanding of the mining operations happening in the area at Fort Roberdeau.
- Historical maps showing mining locations and primary documents discussing them have been compiled to help find possible historical sites.
- Much of the possible mining locations have been magnetically surveyed and georeferenced to help find possible historical sites.
- Sections of tired farm land are “burnt spots” where crops do not grow. This is a possible indication of a buried mine underlying.

Results of the Study
- With data acquired, a cross section was developed (see below).
- The cross section shows a twelve meter dive in the subsurface which has been infilled by sediment.
- We can interpret this infilled region to be a Revolutionary-period mine.
- We can use this technique to find other mines in the area and expand our knowledge of Revolutionary-era mining around Fort Roberdeau.

Our Project
- Juniata College students and professional geologists placed electrodes at set intervals.
- Electricity is sent into the ground and then is measured.
- Produced data points of different resistivity measurements.
- These measurements account for depth.
- A cross-section view of the subsurface is acquired.

A cross-section view of part of the field where the mine was found. This gives us an image of layers based on resistivity. There is a clear outline of the sediment filled pit where a hole was dug. The top of the site is shown and easily seen in the field.
Ysis of Inactive Lead Mines at Fort Roberdeau in Central Pennsylvania

Potpara1, Jenna Faith1, Joseph Orso1, Mike Felckerson1, Steven Stroup1, Ben Gershalb1, Ryan Mathur1, Jenna Staley1, George Pedlow1

1 Juniata College, Department of Earth Science, 122 First Street, Huntingdon, PA 16652; Corresponding Author: George Pedlow.

METHODS:

INTRODUCTION:

The purpose of this study was to evaluate the potential for using electromagnetic techniques to detect the existence of inactive lead mines in the eastern United States. For this study, the authors used magnetic and electrical methods to search for the presence of lead mines in the Fort Roberdeau area.

To confirm the presence of lead mines in the area, the authors collected data using a magnetic gradiometer. The data was then analyzed to determine if there were any anomalies that could indicate the presence of lead mines. The results of the analysis showed that there were anomalies in the data that could be indicative of lead mines in the area.

To further confirm the presence of lead mines, the authors used electrical methods to investigate the area. The data was collected using an electromagnetic system and analyzed to determine if there were any anomalies that could indicate the presence of lead mines. The results of the analysis showed that there were anomalies in the data that could be indicative of lead mines in the area.

DISCUSSION:

The data collected during this study shows a strong correlation between the magnetic and electrical anomalies and the presence of lead mines in the area. The results of the study suggest that electromagnetic methods can be used to detect the presence of lead mines in the area.

ROAD LOG

Reiterating critical location information:

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<th>Step</th>
<th>Description</th>
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<td>Turn left onto Golf Course Rd/Sr1015</td>
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<td>Turn right and head southwest on Kettle Rd/Sr1013</td>
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<td>STOP 2 - Ft. Roberdeau - Blair County Historic Park; turn left toward parking lot (128 ft) and/or White Oak Hall Conference Center END</td>
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At this point drive northeast on PA Rt 45 to Pennsylvania Furnace; turn left on Whitehall Rd; drive to South Atherton St in State College; Ramada is to the left just a few hundred feet; Total Mi Fort to Ramada ~38