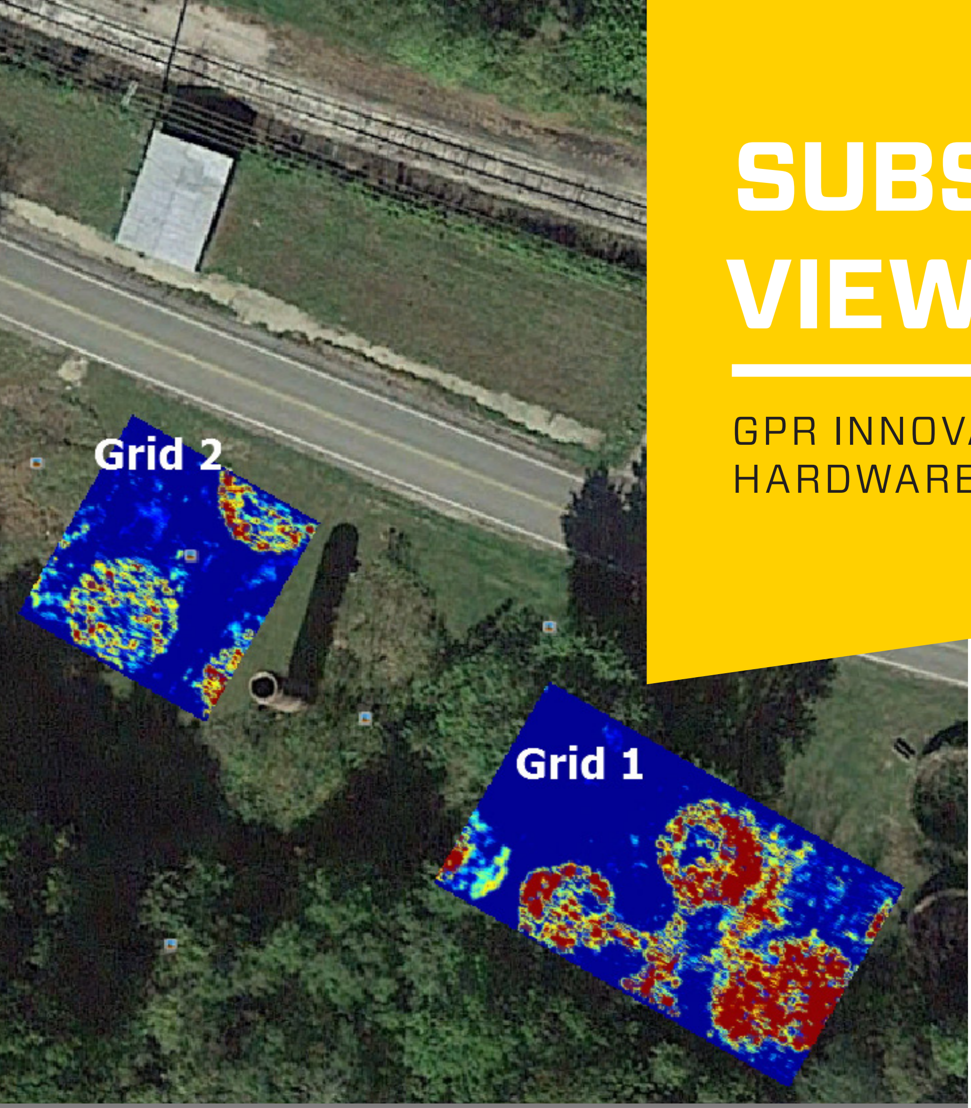

SUBSURFACE VIEWS

GPR INNOVATIONS
HARDWARE AND SOFTWARE

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In this issue

GPR Survey at a Late 19th Century Brick Factory in Ohio

When we think of archaeology, we usually think of searching for artifacts from ancient civilizations in distant lands but the reality is that many archaeological projects involve looking for nearby objects from the not-so-distant past. The following Noggin case study from Dr. Jarrod Burks from Ohio Valley Archaeology, Inc. is a great example of rediscovering local, recent history. According to Dr. Burks:

Nelsonville, Ohio is a small Appalachian community in southeastern Ohio on the Hocking River. The region is known for its beautiful wooded hills and hollows and its thick buried clay layers deposited at the end of the last ice age. In the late 1800s it was one of the region's most famous brick manufacturing centers, and the Nelsonville Brick Company cranked out millions of bricks per year using dozens of large, circular kilns. In 1937, the Nelsonville Brick Company folded and the site was eventually abandoned. Today, a few of the circular brick kilns and square chimneys are still standing in a road-side park (Figure 1), but most of the kilns have been knocked down and their exact locations are no longer evident on the surface.

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Figure 1: Hocking College students with the Noggin 500 GPR system at the Nelsonville Brick Company site. Some of the brick kilns and chimneys are still standing but most have been demolished. See Figure 3

Nelsonville is also home to Hocking College, a two-year college that formerly had an archaeology technician training program—it was one of the few in the U.S. On two occasions I have taught a short course on the use of geophysics in archaeology to students at Hocking. During one of these short courses, the class visited the roadside park at the Nelsonville Brick Company and the students conducted a GPR survey in three areas in proximity to the surviving kilns. Prior to the survey the location of additional kilns was not known. The students placed GPR survey grids in the most open and easily accessible areas.

On a brisk, late winter day with a dusting of snow on the ground, the students collected three GPR grids using a Sensors & Software Noggin 500. Grid 1 is the largest, 37 x 20 meters, while Grids 2 and 3 are approximately 20 x 20 meters each. All grids were collected with lines in the Y direction, spaced 0.5 meters apart. GPR samples, called traces, were collected every 2.5 centimeters along each survey line (41 per meter) so, with a total line distance of about 3000 meters for the 3 grids, more than 110,000 individual traces were collected in the area.

The survey didn't take long and the students had little trouble running the GPR unit (except for missing a couple of lines in Grid 3—students are students!). During the survey it was clear from the images we saw on the Digital Video Logger (DVL) that the penetration depth was more than 2 meters and there were some very reflective features and layers below the surface at the Nelsonville Brick Company site (Figure 2).

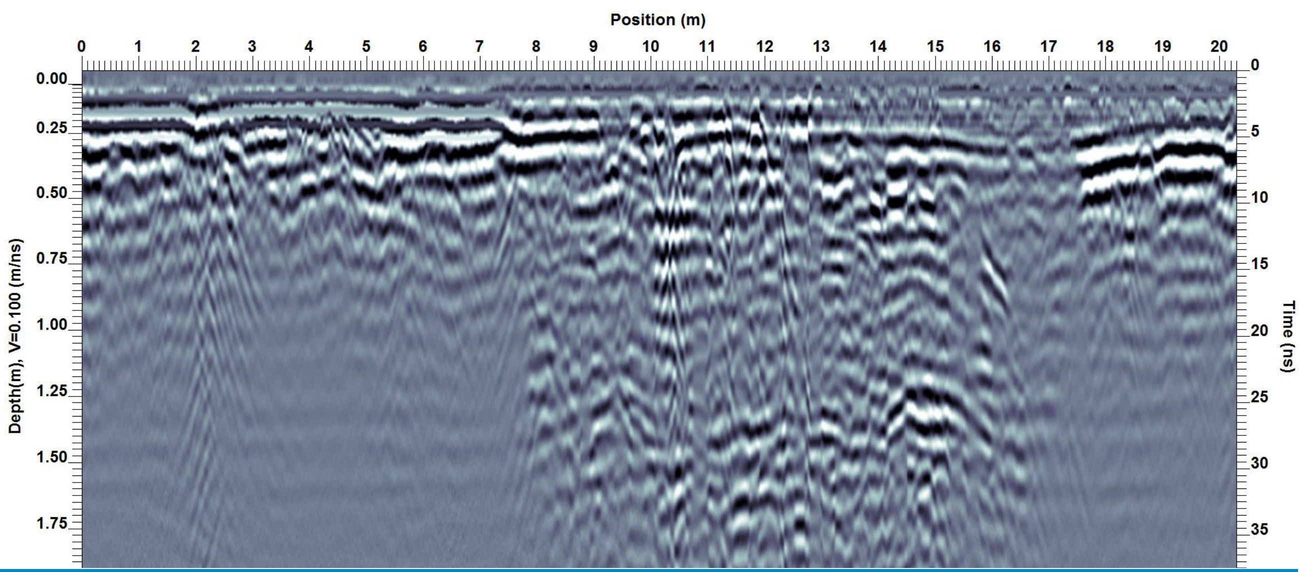

Figure 2: GPR LineY2a from Grid 1 shows deeper penetration and stronger reflections from positions 8 to 16 meters. This area turns out to be a demolished kiln that appears as a circular feature in the GPR depth slices.

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After the survey and back in the classroom, the class used the SliceView module of the EKKO_Project software to quickly process the data and create a series of amplitude slices at various depths. Much to everyone's surprise, the GPR data was loaded with the foundations of flattened kilns!

Looking at the depth slices from the three grids, it was clear that we had located a number of different circular kiln clusters. In Grid 1 (Figure 3), one chimney appears to be connected to multiple kilns by an underground tunnel. In Grid 2, the class located portions of three kilns and in Grid 3, which had recently been graded down to improve the roadside drainage but the group were still able to detect large circular features at depth (Figure 4).

By collecting the GPS position at one corner of each grid, the global positions of the grids were added in post-processing; this allowed the depth slices from all three grids to be displayed in their correct positions on Google Earth (Figure 4).

Since GPR surveys are three-dimensional datasets, it is hard to appreciate all of the features we encountered in the data by looking at just one depth slice, as in Figure 3. Looking at a sequence of slices makes it more apparent that there are different kinds of features present at different depths (Figure 5). For example, the kiln foundations do not become apparent until about 50-80 cmbs (cm below surface). Some of the shallower features include what are probably driveways and walkways made from brick (see the 31-32 cmbs slice in Grid 1 (Figure 5), for example).

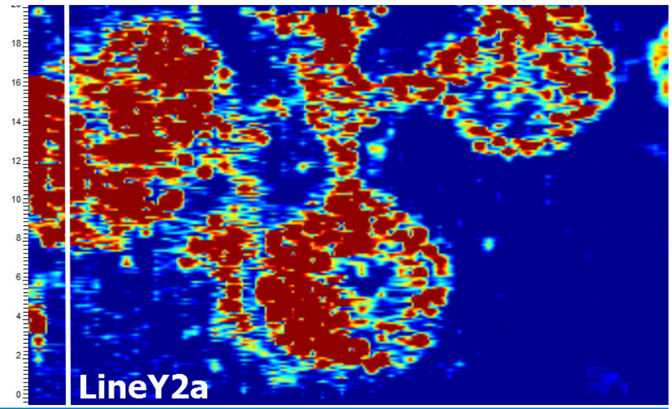

Figure 3: Grid 1 depth slice at 1.2 meters depth shows circular features interpreted as the foundations of kilns. The kilns appear to be connected, probably to one chimney.

Needless to say the Nelsonville Brick Company site is an ideal setting for demonstrating to students the utility of geophysical survey instruments in identifying subsurface structural remains. Without accurate maps tied to known points on the surface it is impossible to know what is present beneath the surface at this site without conducting destructive and expensive excavations. My experience is that former industrial sites are some of the best places to use GPR because there are so many hard targets to detect. Further, because GPR produces 3D datasets that can be examined at different depths, it allows the class, to some degree, to tease apart the often complex sequences of construction and demolition before even one spade of earth is turned over.

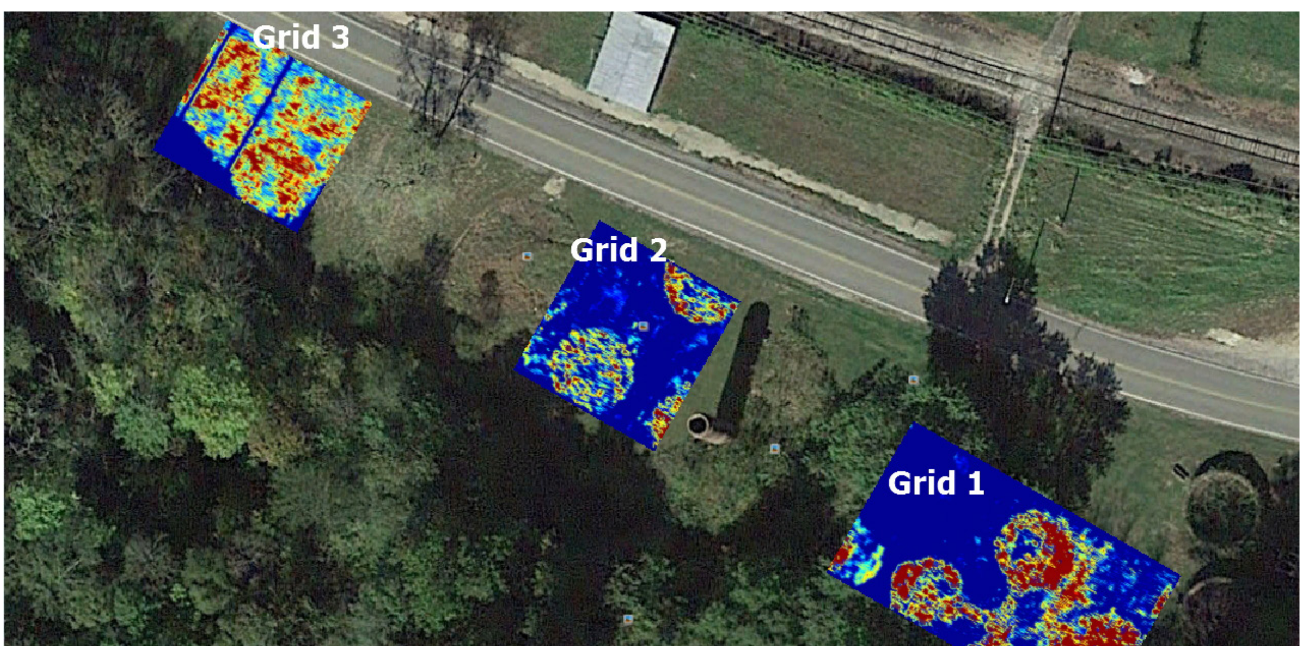

Figure 4: Depth slices from Grids 1, 2 and 3 displayed on Google Earth. The latitudes and longitudes of the corners of the grids were measured using GPS and added to the grids in post-processing using the EKKO_Project software.

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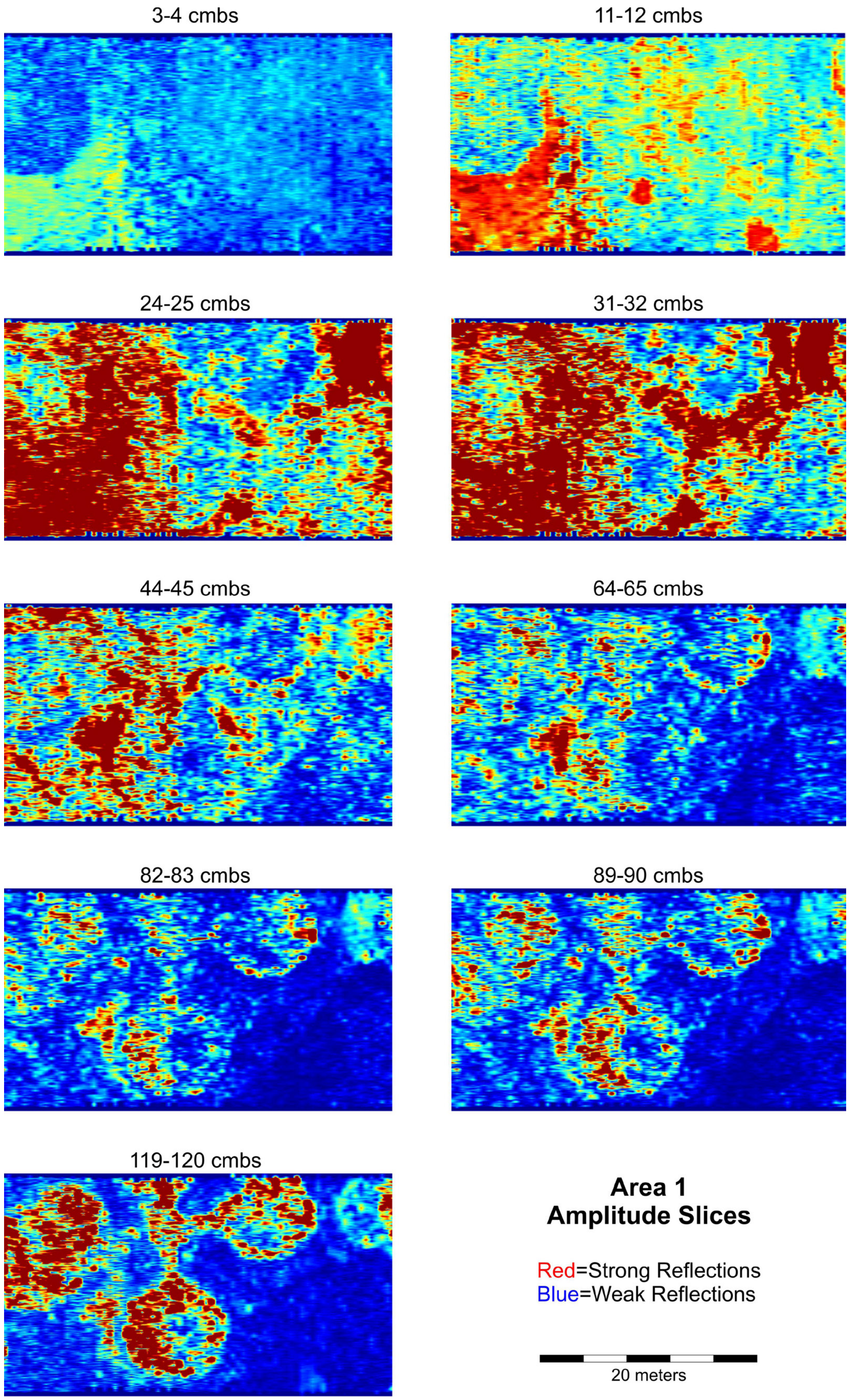

Figure 5: Nine depth slices from Grid 1 showing different features at different depths. (cmbs = cm below surface)

Announcing the new Noggin GPR system

The new Noggin is an adaptable, high performance GPR system. It provides professional users with the highest quality GPR data, flexible data collection and powerful in-field analysis with reporting.

Adapt to any application –Noggins are available in 4 different center frequencies, ranging from 100 MHz for deep penetration to 1000 MHz for high resolution surveys. These systems can be deployed in 4 standard configurations (SmartCart, SmartTow, SmartChariot, SmartHandle) as well as a custom user configuration, to perform in any terrain. From efficient surveys of highways to detailed archaeological exploration or extreme geotechnical investigations; the Noggin can do it all.

Flexible data acquisition – Easily adjust collection parameters, efficiently collect data and add field interpretations. Instantly view results in the field with the new high resolution, touchscreen digital video logger (DVL). Process grids directly on the DVL for immediate depth slice maps and prompt analysis. Mini-reports can be sent through a Wi-Fi link to share results instantly while on-site so projects can progress at maximum speed.

Easy Data Processing – Noggin data integrates seamlessly into EKKO_Project where survey results can be analyzed in seconds. Complete technical reports can be generated in the software while keeping data and site images organized. GPS is fully integrated with the GPR data allowing for export to all major GIS formats with the click of a button.

Expert Support – Our GPR specialists will be there to support and help you grow your business every step of the way. Whether assessing application feasibility or providing support for field collection and data reporting; you can count on us to help you take on new projects with confidence. Rental options are available to support your Noggin efforts.

The Noggin is a complete GPR solution that provides maximum flexibility and expandability, enabling you to successfully take on new GPR projects and expand your business.

TIPS

Collecting grid data around obstacles

There are times when you must deal with an obstacle in your grid survey area. You may encounter this in cemeteries, wooded areas or even at gas stations.

With the Noggin GPR systems, collecting data around obstructions is flexible, easy and accurate. When you approach the obstruction and can go no further, end that grid line. You have the option of adding a line, and collecting in the reverse direction of the incomplete line. Start this line from the far side of the grid and approach the obstruction from the opposite side, as shown in Figure 1.

In this example, Lines X27 to X45 were partially collected due to an obstruction. New lines were added and collected in the reverse direction. Whenever you have to work around an obstruction, there will be a blank space where the obstruction was (as no data was collected there); the depth slice image below (Figure 2) shows an example of a blank area.

All collected lines are automatically part of the project grid and no further editing is necessary. This is easy to do on the fly and maximizes the amount of data coverage in a gridded area.

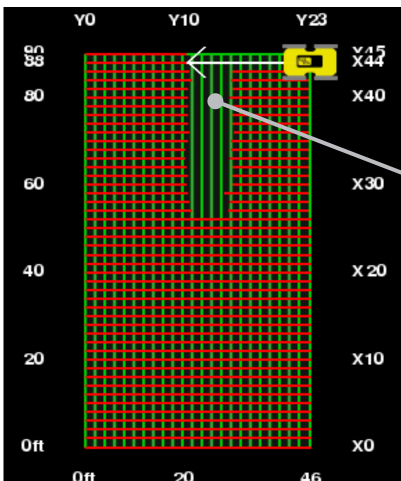

Figure 1

Obstacle

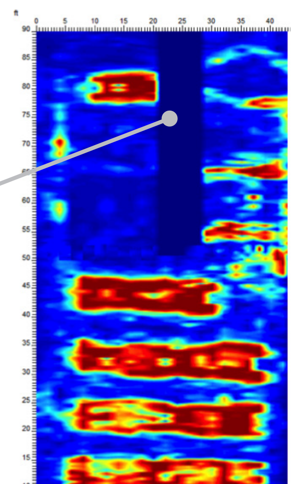

Figure 2

Upcoming Courses

Subsurface Imaging with GPR course - September 12, 2016. Mississauga, ON, Canada

Concrete Scanning with GPR course - September 13, 2016. Mississauga, ON, Canada

GPR Principles (Geological Society of America Convention) - September 24, 2016. Denver, CO, USA

Upcoming Tradeshows

Geological Society of America (GSA)
September 25-28, 2016, Colorado Convention Center. Denver, CO, USA

American Geophysical Union (AGU)
December 12-16, 2016, Moscone Center South. San Francisco, CA, USA