Mining Data Gold with Subsurface GPR

Overview

- CSGeo was tasked with scanning old mining areas in Austria to avoid any potential threats to the environment or future building.
- The Proceq GS8000 GPR was used as an efficient and accurate method of locating and mapping what lies beneath the ground.
- The scan resulted in clear subsurface data with real-time visualization, revealing vital information about the old mineral mine.

CSGeo is a geophysical surveying and underground detection service run by Geophysicist, Christian Stotter. This was one of Christian's first projects as a solo entrepreneur after many years working in seismic geomatics.

Challenge

Several old mine sites are being forgotten and neglected because they are not used anymore, and nobody cared mapping these. However, these forgotten mines are a potential threat to the environment and any building activity one wishes to carry around these areas. For this application, SFCW subsurface GPR was used to discover forgotten mining areas in Schwarzleo, Austria.

Between 1400 and 1833 ores containing silver, copper, mercury, nickel, cobalt, and lead were mined. Several tunnels were dug into the rock, creating an underground network of about 20 kilometers. Today, the Barbara tunnel and the Daniel tunnel are accessible as demonstration mine. The size of other tunnels like the Erasmusstollen or the Johannisstolllen, can only be estimated from historical maps, as parts of the tunnels and galleries have collapsed.

Same happens with other mining buildings in the Schwarzleo valley which are not preserved, and our knowledge comes mainly from historical maps. Vegetation and agricultural activities make the detection of these historical buildings and mines, even harder.

Knappschaft Leogang is a foundation interested in the preservation and investigation of the cultural heritage of the Schwarzleo area. CSGeo used Screening Eagle Technologies' GPR to localize foundations of historical buildings, tunnel entrances and cavities.

Solution

Ground Penetrating Radar (GPR) is an excellent tool for mining applications, and it can be used under different circumstances and needs. GPR can help a mining company reduce extraction costs, since it collects good quality data from the subsurface in a fraction of the time other methods require. One could determine the location, dimensions, and other characteristics of a mineral deposit.

GPR can also help with the safety strategy around a mine; scanning the inner walls of mines for voids or other discontinuities can contribute to a safer environment for the people who work inside the mine.

Screening Eagle Technologies’ GS8000 is a portable, digital subsurface mapping system that consists of a Stepped Frequency Continuous Wave (SFCW) Ground Penetrating Radar (GPR). The GPR antenna offers an ultra-wide bandwidth, enabling layers at various depths to be mapped with high resolution. The antenna communicates wirelessly to an iPad and an intuitive app is used for data collection, processing, and visualization.

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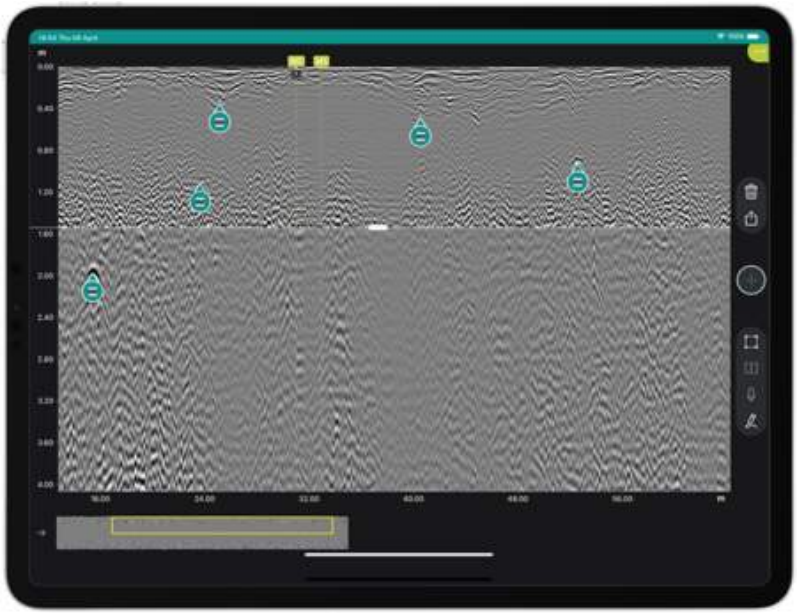
Results

Data was collected in straight lines of varying lengths, with the GPR antenna coupled to the ground (no air gap). For rough surfaces, the GS8000 antenna can be lifted, although in this case it was not necessary.



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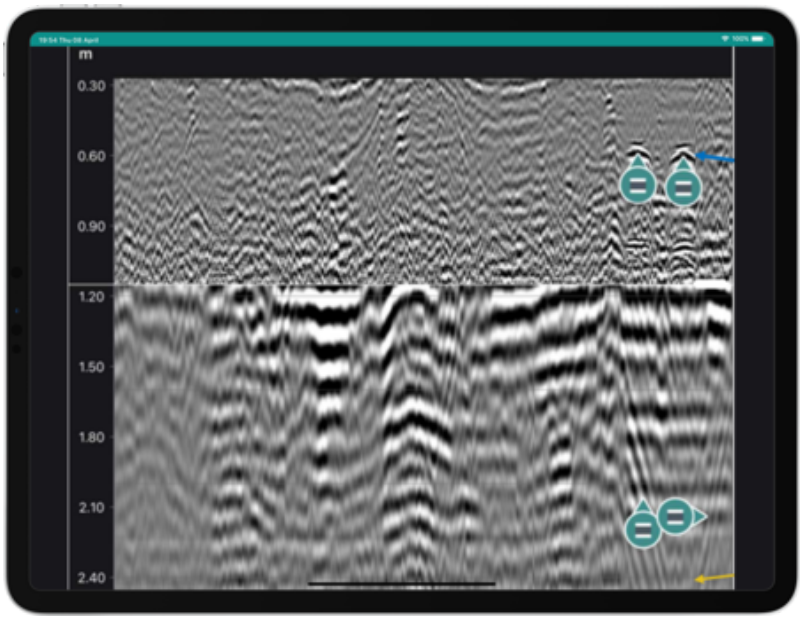

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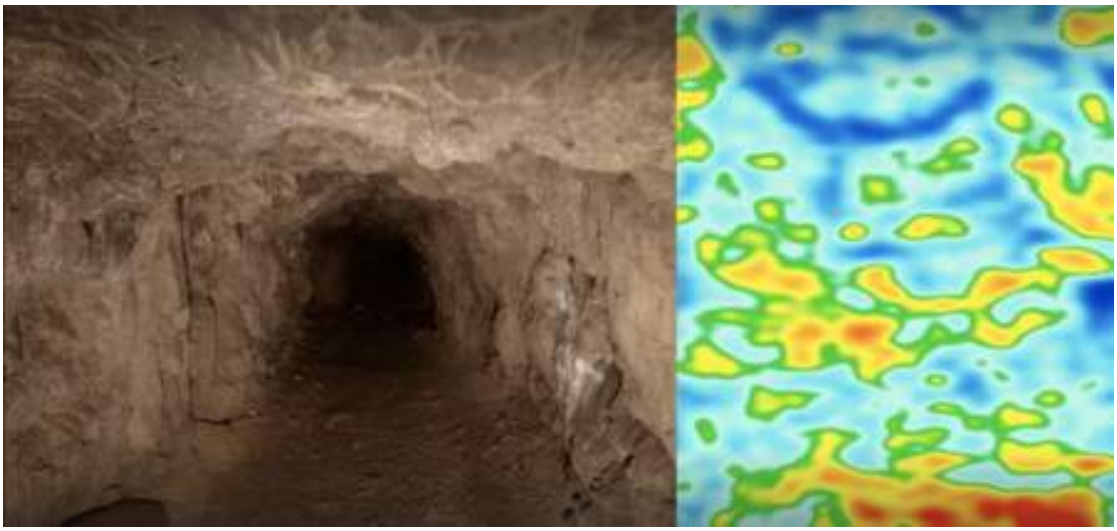
Three features of the GS app were used to efficiently process the data:

1. The multi-layer feature was used to set the correct dielectric constant for the different layers. The dielectric constant, and hence the speed of the radio waves, varies with material type, so it is important to adjust the dielectric constant for each layer. This is done with a few clicks on the app.
2. Tagging was used to identify layer interfaces at regular intervals along the scan length. This is very easy to do on the iPad touchscreen. The A-scan view can be used to identify the exact depth of the interface.
3. An HTML report was exported from the app. This report contains all the parameters of the survey and the horizontal (scan) position and depth of all the tags. Any spreadsheet software e.g., Microsoft Excel can be used to plot these positions and visualize the layers.

The deep data collected can be described as 'data gold' in terms of quality, depth and resolution.



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Alternatively, advanced users can opt to use GPR Slice or GPR Insights post-processing software. The GS app is used to collect the data, and this is exported in SEG-Y format. The data is imported into GPR SLICE and the different dielectric constants can be set.

See more customer case studies and application notes for subsurface GPR on our Tech Hub.

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