**What lies beneath: examples from ground-penetrating-radar mapping of bedrock surfaces**

*Esther Babcock, Logic Geophysics & Analytics LLC, Anchorage, AK, USA*

Mapping depth to bedrock is a key challenge for many infrastructure development projects. Unfortunately, the bedrock surface can be inconsistent and variable; and corresponding drilling campaigns to map the overburden thickness are expensive, time-consuming, and provide only point information. On the other hand, ground-penetrating radar is often used for mapping depth to bedrock for geotechnical site characterization because the interface between overburden and bedrock is generally sufficiently high contrast electrically to cause an coherent, interpretable reflection event. Furthermore, ground-penetrating radar can provide spatially extensive profiles of the bedrock surface, to complement and complete the borehole data. By collecting the data in multiple transects across a site, the processed GPR data can then provide pseudo 3-dimensional maps of the bedrock surface. When georeferenced properly, clients can intake such maps into the geographic-information-systems (GIS) software for seamless integration into their engineering plans. Here I provide examples of bedrock mapping in both 2-dimensional profiles and pseuso-3D maps. I will review key concepts for GPR-derived bedrock mapping, situations where the GPR method is limited, as well as processing steps often overlooked but crucial to reliable results. These case studies are taken from multiple sites and conditions across the state of Alaska. The first case study is at a site in northern Alaska where low-frequency GPR was used to image the top of bedrock to a depth of almost 90-feet below surface. In this situation, we collected the GPR data using a sled on top of packed, deep snow cover. Compensating for the snow cover also was required for accurate depth results. Ten transects across the site were then combined into a pseuso-3D map. In the second example, on Alaska’s Kenai Peninsula, 100-MHz antennas were used to image bedrock lying between 2 and 20 feet below surface. The overlying soil was saturated, requiring borehole data ground-truthing in order to estimate an accurate velocity and produce reliable depth results. With a single calibrated velocity applied across the site, the resulting GPR profiles and maps showed excellent agreement with borehole-measured depth to bedrock. Finally, I will present a case study demonstrating the effects of dipole orientation on successful imaging particularly where significant bedrock topography exists. An example from central Alaska will show the effects of processing for visualization of paleochannels using GPR data for mineral exploration. Overall, understanding the successful implementation of GPR at these sites as well as common limitations of the method for lithologic mapping will guide practitioners in future work.