Multioffset Ground Penetrating Radar – Lessons Learned for Improved Geological and Archaeological Imaging and Interpretation

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Abstract

Multioffset ground penetrating radar (GPR) data is acquired using seismic reflection techniques as an analogue. Multioffset data offers numerous benefits over common offset data, such as improved depth penetration, increased signal-to-noise ratio, and enhanced reflector continuity. However, the large multioffset acquisition times often discourages its use. To significantly reduce acquisition time, traces are recorded continuously as common source gathers; this is called rapid multioffset acquisition. Rapid multioffset acquisition uses the existing bistatic GPR system, is cost-effective, and easily acquires a high fold while maintaining signal quality and positioning accuracy. An unstressed benefit of multioffset data is its improved lateral imaging capabilities. This is via offset dependant reflectivity, as certain structures and/or reflector horizons are not necessarily highest amplitude or best imaged at near offset. An example from a Native American site in Fish Creek Provincial Park, Calgary, highlights how multioffset data provides a better estimate of the lateral density of possible archaeological material. Similarly, multioffset data from a Roman bathhouse in Portugal reveals greater lateral structural detail, and improved dip imaging and maximum site depth estimates than comparable common offset data. An important caveat of multioffset acquisition is having suitable near surface conditions to realize improved data quality. Common offset reflectivity is very sensitive to changes in water saturation, and multioffset data even more so due to the additional dependence of reflectivity on the multiple angles of investigation. Acquiring a multioffset dataset under drier conditions can produce little imaging improvement over common offset data.