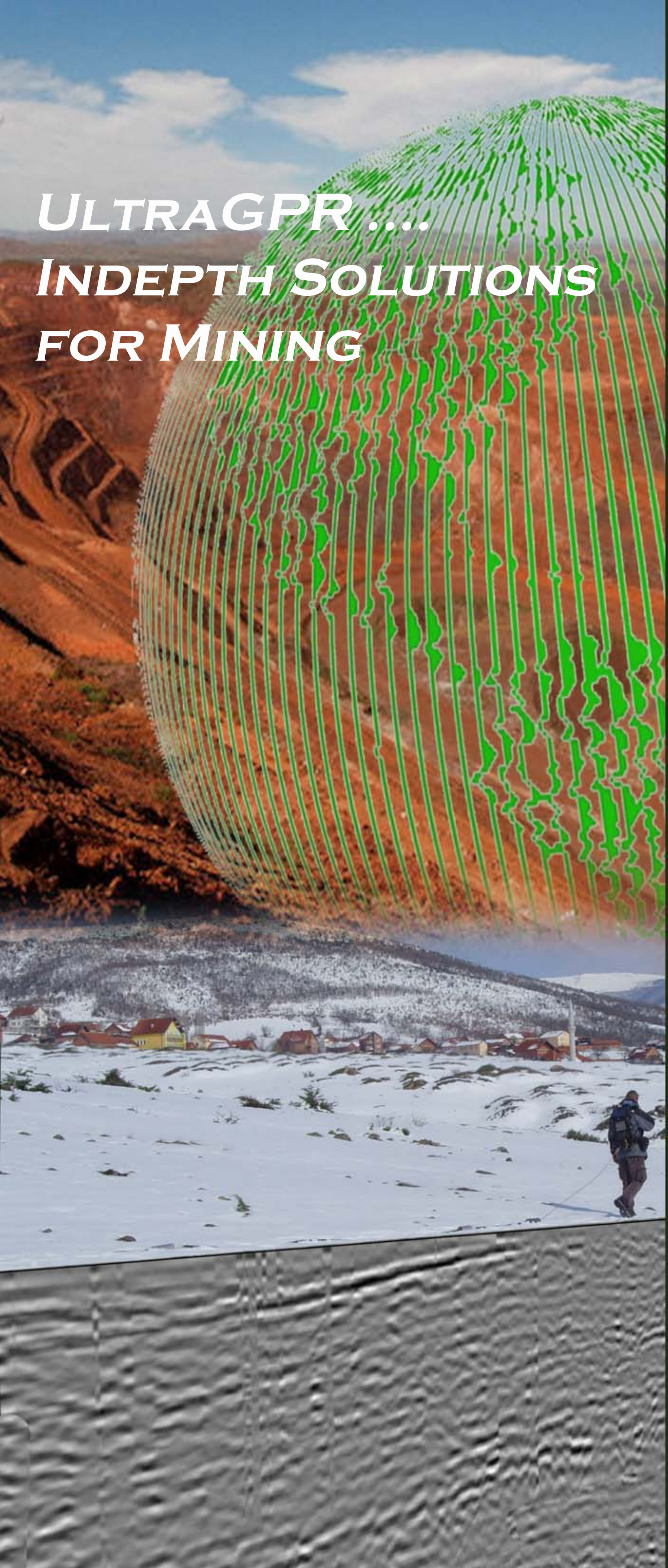
UltraGPR .... Indepth Solutions for Mining



Global Experience

Groundradar staff are the respected experts in the application of ground penetrating radar technology to mining exploration, development and geotechnical issues. Projects have been conducted over 17 years on every continent, in the most varied of environments.

Advanced GPR Systems

Since the advent of commercially-available GPR systems over two decades ago, the potential for its application as a cost-savings tool in mining has existed. Early radar systems were employed in underground coal and potash mines to monitor hanging wall thickness and detect parting planes. As instrumentation matured, the potential applications grew to shallow paleochannel mapping and aggregate resource studies. However, significant limitations remained. Low-frequency radar systems were bulky, fragile, slow and had their performance limited by US and European regulations on RF emissions. As such, until very recently, GPR has languished as a specialised tool in the mining industry, suitable only in the most favourable conditions.

UltraGPR has been designed from the ground-up to far exceed the performance, reliability, ruggedness and useability of any low-frequency radar system built. Combining the dramatic depth penetration gains achieved by real-time sampling technology with the durability gained by replacing all wires, fibre optics, computers and control units by wireless technology and handheld dataloggers, UltraGPR is the most advanced deep-penetrating GPR system available.

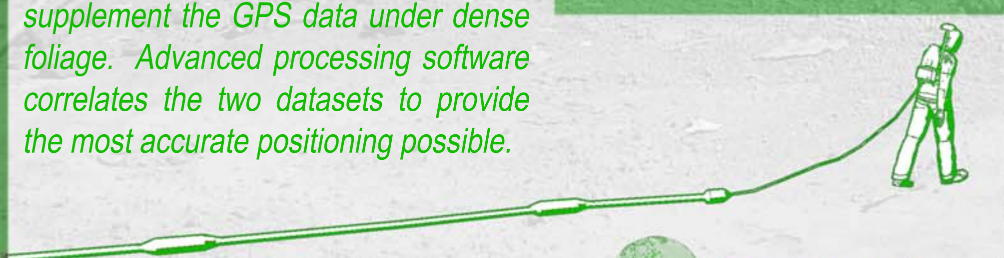
Groundradar
Measured resources

Real-Time Sampling GPR

The method by which GPR data are captured by the receiver is perhaps the most critical portion of a system's design. In the early 1990's, systems employed analogue recorders and electrostatic plotters to display the radar scans.

GPR signal sampling is inherently challenging due to the need to sample returned signals which are travelling near the speed of light. For example, for a system with a centre frequency of 40 MHz, the effective bandwidth is 20 MHz to 60 MHz. Nyqvist's sampling theory stipulates that the returned signal must then be sampled at 3X the centre frequency, in this case at 120 MHz.

Due to this limitation, all commercially-available low-frequency GPR systems are constructed using a sequential sampling method to significantly reduce the sampling frequency required. With this method, a single sample point is recorded for each radar transmission. The first sample is recorded at the top of the first trace. The transmitter is then re-fired and the second sample beneath the first sample is recorded, and so on. Thus, to complete a single scan of 256 points, the transmitter must be fired 256 times. However, to achieve a reasonable signal to noise ratio, the process must be repeated 32 or 64 times. This transmission and subsequent recording of 32,000 radar bursts require antennas to be stationary during the 0.5 seconds required for each complete scan. When hundreds of kilometres of data are to be acquired at 50 cm scan spacings, surveys can be costly and progress slowly.



Conversely, UltraGPR relies on real-time sampling technology, which captures the entire scan at once, effectively permitting 64,000 stacks to be acquired whilst the antennas are in constant motion. The ability to stack nearly 1,000 times more than other systems allows UltraGPR to be far more sensitive to subtle responses from distant reflectors. In most environments where comparative studies have been conducted, UltraGPR has imaged to significantly deeper depths than other systems.

Wireless Rugged Design

All wires and fibre optic links, a source of constant reliability issues on commercial systems, have been replaced by wireless connections. The system has also been designed to conserve power for use in remote environments, relying on advanced batteries which can power the system for more than 28 hours of continuous use.

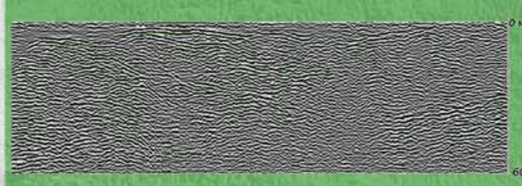
Miniaturisation was also a foremost priority using the design phase of the instrumentation. The entire system is housed within a flexible snake with two shielded pods for the receiver and transmitter electronics. No bulky control units or laptop computers are required. A handheld computer allows real-time display of the data and storage on Flash memory cards.

Accurate positioning is achieved using an embedded DGPS system with SBAS correction at 5 Hz. In addition, an accurate chain odometer is employed to supplement the GPS data under dense foliage. Advanced processing software correlates the two datasets to provide the most accurate positioning possible.

Applications for UltraGPR in the mining and geotechnical sectors have included nickel laterite exploration, bauxite delineation, mineral sands quantification, coal seam mapping, alluvial paleochannel and paleoterrace detection and grain-size distribution analysis, as well as the imaging of abandoned mine workings.

As with any radar technology, UltraGPR is most suitable in electrically-resistive environments. However, the presence of clays does not always exclude the suitability of GPR technology, as most clay-rich tropical weathering environments are opaque to UltraGPR energy to over 70 m depth.

Commercial GPR data



UltraGPR data

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