Geology survey/Stratigraphy application

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Introduction

These kind of surveys are done to determine ground conditions - more precisely layers, disturbance, homogeneity, water table levels etc. The two things that need to be achieved in this kind of surveys are depth of interest and satisfying vertical resolution.

Traces per unit can be lowered as much as possible due to the characteristics of the target (layers usually don't change abruptly in a few cm).

Survey example

A good example of a real life and ever more frequent survey niche in Sweden is bedrock location for the passive ground heat thermal pump systems (GHTPS) . Top most soil here is sand,silt and gravel permafrost and in order to achieve a reasonable efficiency coefficient out of these systems one has to reach the solid stone. For the GPR technology it is quite a simple and quick survey. That makes it economic and time cost acceptable survey for the heat system constructors to test the area before the drilling begins.

In addition to providing the information for the GHTPS, information for the building foundation calculations and position of the water table can be delivered from a single survey.

Equipment for the job

Antenna name	Recommended settings			Size of target (m)	Recommended area of application
	HP(MHz)	LP(MHz)	Range (ns)		
GCB100	50	200	50-350	0.5	Geology and deep utility survey

GCB100 is a full shielded ground coupled antenna with excellent balance between high penetration and good resolution. Compared to the same frequency range antennas from other manufacturers it is made much more compact (1/3 of the size of others). This great reduction in size makes the antenna easier to use even on rough terrains or in a confined space. The suggested areas of application for this antenna are geology surveys (stratigraphy) and deep utility surveys. Depths of interest vary from 5-30 meters and shallow objects are disregarded due to antennas ”blind zone”.

The ”Blind zone” exists for all antennas. The zone stretches from zero depth to the depth equal to 1.5 wavelengths in material. Due to the larger wavelengths, this zone is more noticeable for low frequency antennas. In this part of the recorded data any reflected signal gets superimposed by the direct coupling wave. This effect causes the interpretation of the data hard or even impossible in some cases. The ignorance about this effect caused wrong interpretations and confusion for many surveyors. The GPR practitioners disregarding this fact either declared the zone to be a homogeneous layer or were desperately trying to locate known elements in the data.

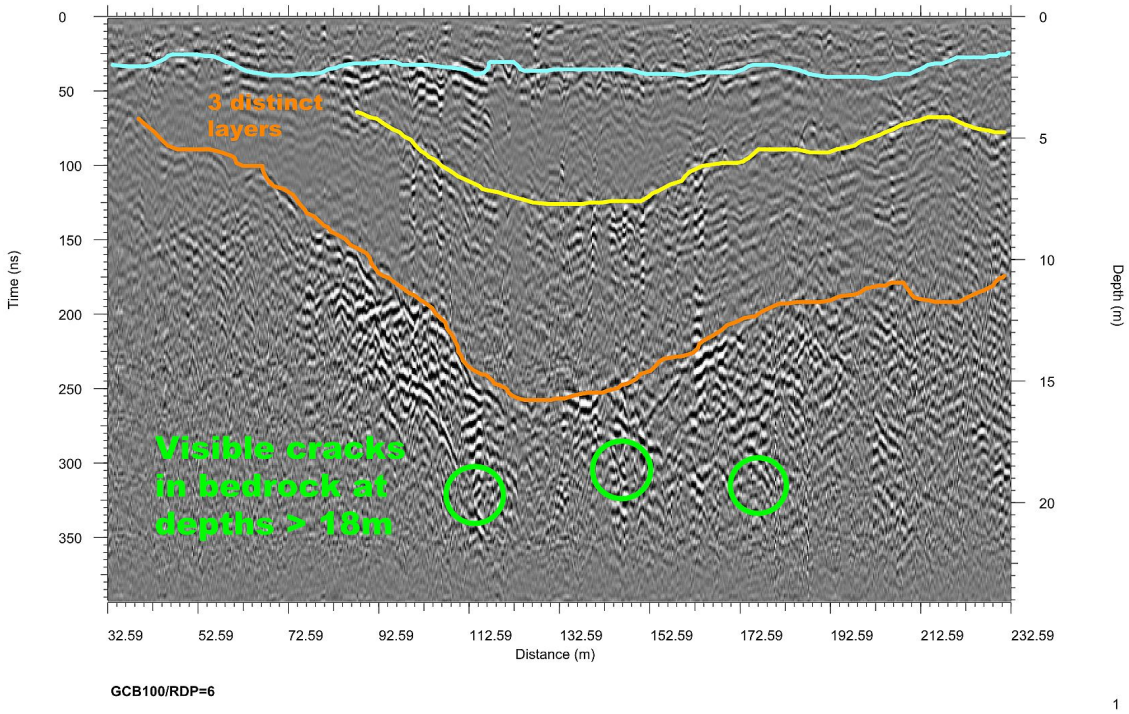
Small size and full shielded body of the GCB100 make this antenna resilient to the EM noise and easier to manipulate when collecting data. Therefore it is chosen by many companies in the world for deep utility surveys. Antenna is quickly mounted on a group of cart or tow systems like any of our antennas. This makes it more maneuverable and easy to use.

Conducting the survey

In the given site that we surveyed, we were able to use a standard 4 wheel cart for the GCB100 most of the time. For the parts where the vegetation was too thick to move with that kind of vehicle we reverted to the Scorpio system and chose a number of shorter profile lines. Profiles with the cart are 400 meters long and the one with the Scorpio tow system are 100 meters long.

Processing and Conclusions

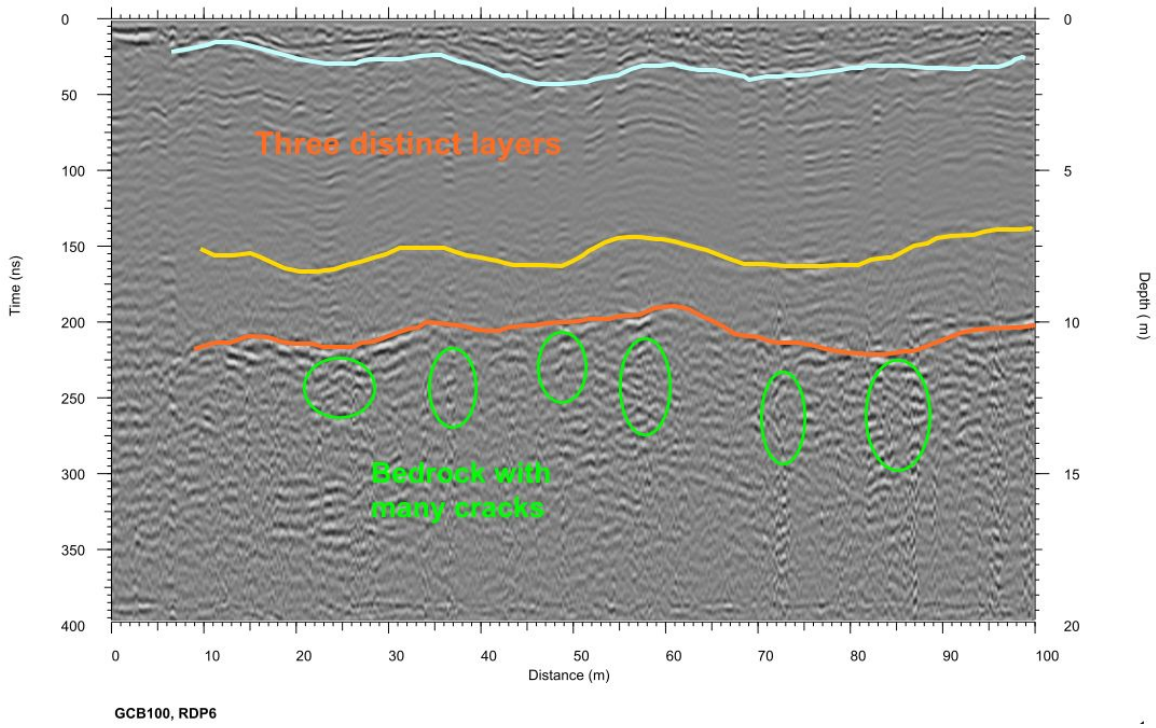
The results of the survey are simple to read and demand very little effort in the post processing and interpretation stages.



Long file along the road

In the pictures above one can see that the difference in depth varies highly along the longer profiles and has values between 5-16 meters. Also there are some cracks one can observe at the deepest position.

The shorter profiles are done perpendicular to the longer ones and show that the layers don't change much laterally for at least 50 meters . It is safe to say that the long files show the true nature of the location's stratigraphy. However, the short files were not a waste of time because they have shown an increase of cracking in the bedrock in the lower section of the survey field.



Short file perpendicular to the road