Resonance Acoustic Penetration (RAP) Profiling

‘A Sonic Frequency Analysis + Reflection Geophysical Technique’

(A Basic Description)

The technique is based on new approaches to the interpretation of acoustic signals and research carried out in the former USSR and other CIS countries. Compared to traditional seismic methods, RAP explores ground resonance responses to external shocks within a ***much wider frequency range***.

RAP has been in use by a couple of individuals over the past twenty-five years. Mr. Valery Lazebnik, one of the team of three original inventors of the method in the early 1990’s, has developed, refined and proven it applicable to a wide range of industrial and exploration applications. Results graphically show ***interface boundaries*** between different materials and structures as well as shear zones and sedimentary layering.

RAP surveys are carried out along profiles with 1 to 20 m spacing between measuring stations, depending on scenario’s requirements and local geology. Field 'calibration' is based on available known geological and other data from surface features and best, at least one drill hole. This allows a qualified user to accurately interpret the collected acoustic data produced.

RAP profiles are presented as raster images compiled by the correlation of processed discreet records into continuous cross-sections. The resultant cross-sections show variations in acoustic resonance properties (***not reflected properties as with conventional techniques***) and may be calibrated for real depths and interpreted in geological, hydrogeological and/or geotechnical terms based on available drilling data, pitting or other information. Once signatures and features have been physically defined, RAP profiles can be applied to infill, extrapolate and predict other features with confidence.

A number of standard data processing algorithms have been developed for some 'standard' geological situations and target features – e.g. for diatreme, alluvials, hydrogeological, vein, intrusive and other structures. Such algorithms make it possible to ***successfully use RAP in grass-roots exploration*** with very limited geological information. Basic subsurface features will be clearly identified. This allows drill hole positions to be ‘intelligently planned’, on detecting standard and anomalous characteristics. Where no variations in characteristics between holes occur, drill holes (and in-fill holes) are unnecessary.

Frequencies used to attain readable data are adjusted for different depths using different acoustic sensors and various recording times and frequencies. The technique has already been successfully used in primary and alluvial diamond exploration in Russia, Ukraine, Africa and Australia (pipes, sediments, dykes & alluvials) as well as on a number of environmental, geotechnical and hydrogeological projects.

RAP may be used as a cost-effective alternative/support to traditional geophysical techniques and core drilling in mining and exploration projects - in particular for the delineation of discovered geological bodies and search for their extensions, in testing magnetic/EM anomalies and paleochannel exploration.

The RAP depth range is from less than 1 m to more than 300 m. The resolution depends on surface conditions and geology and may be 'focused' for different depth ranges using available acoustic sensors and various recording time/frequencies.
The technique has already been successfully used in primary and alluvial diamond exploration in Russia, Ukraine, Africa and Australia (pipes and dykes & alluvials), manganese, and on a number of environmental, geotechnical and hydrogeological projects.

RAP may be used as a cost-effective alternative/support to traditional geophysical techniques and core drilling in mining and exploration projects - in particular for the delineation of discovered geological bodies and search for their extensions, in testing magnetic/EM anomalies and paleochannel exploration. There also are obvious and proven RAP applications in regolith research, applied civil engineering, geotechnical and environmental projects.

The advantages (USP's) of the technique are as follows:

- Very portable field equipment (less than 5 Kg, including 12V batteries) makes it possible to use RAP in remote areas without expensive ground clearing and gridding. Standard portable GPS/DGPS equipment is used for profile and station positioning. Development of palm top equipment (mobile phone) has enabled over the past few years. A single technician, with an operator can easily take a few hundred measurements per day along the lines of profiles.

- RAP's depth range is from less than 1 m to more than 300m.

- RAP may be used in areas where conventional electromagnetic (EM) techniques and Ground Penetrating Radar (GPR) fail to provide reliable results due to soil salinity and unfavorable hydrogeological conditions. Good interference resistance makes it possible to use RAP in urban environments.

- Interpretable results are produced from primary data processing. Annotated, presentable, graphic results are therefore available for inspection just a few hours after gathering data.

- Final presentation is easy to read and comprehensible, even to non-professionals. It is therefore suitable for promotional and fund-raising purposes (and immediate use in alluvial mine planning for example).

- There is applicability and potential for applicability, not only in exploration, for any stage of a project, even in underground, developed mines.

- Prices depend on the station spacing and ground conditions and include both field work and interpretation/reporting but are considerably less expensive than other methods.

- The method has never been commercially developed.

- Trials to re-prove the effectiveness of the method can be started at any time, anywhere.