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GEOPHYSICAL SERVICES



QUANTUM SCIENCE
GEOPHYSICAL SERVICES





APPLIED GEOPHYSICAL SERVICES

SEISMIC

Seismic Reflection, Refraction and MASW
Borehole Seismic Survey

ELECTRICAL

Electrical Resistivity & Tomography

GPR

Ground Penetrating Radar

POTENTIAL FIELD

Gravity
Magnetic

ELECTROMAGNETIC

Electromagnetic Technique

LOGGING

Geophysical Logging Technique

GEOLOGICAL HAZARD STUDIES

EARTHQUAKE MONITORING

STRONG MOTION MONITORING

VIBRATION MONITORING

ROCKFALL HAZARD MITIGATION

VOLCANIC HAZARD MITIGATION

GEO THERMAL & RENEWABLES

GEO THERMAL

RENEWABLE ENERGY

DRILLING & FIELD LOGISTICS

CONTENTS

INTRODUCTION

Quantum Science (QS) provides a complete range of specialized services, which include advanced geophysical and geological studies, as well as specialized geo-studies and surveying.

QS is an experienced geo-scientific firm that provides innovative services for various geoscience applications and immediate solutions to geological and geotechnical engineering problems.

Our highly qualified staff work on all phases of any project applying strict quality control procedures and following ASTM guidelines. We take the time to acquire data and report the results in a useful format for our clients.

QS covers a wide range of applications where our services can be utilized, which include:

- Applied Geophysical and Geotechnical Services
- Geo-hazard Study (Geological & Environmental)
- Geothermal & Renewable Energy Solutions
- Drilling & Field Logistics Services

QS aims to offer a high-quality service to its clients, whilst promoting the wider use of geoscience in existing and innovative geo-investigation applications.

The new technology allows Geophysical & Geotechnical methods to cover different important fields like:

- Geo-hazard Assessment
- Geothermal Reservoir Modelling
- Civil Engineering Investigations
- Environmental Investigations
- Hydrogeological Investigations
- Archaeological Investigations
- Forensic Investigations



SEISMIC METHODS

ELECTRICAL METHODS

GROUND PENETRATING RADAR

POTENTIAL FIELD METHODS

SURFACE SEISMIC SURVEY

- Seismic Refraction
- Seismic Reflection
- Seismic Refraction Tomography (SRT)
- Multi-channel Analysis Surface Waves (MASW)
- Spectral Analysis of Surface Waves (SASW)

Seismic Reflection, Refraction and MASW Technique Applications

Generating Seismic waves are generated using a source (Sledge Hammer or Accelerator). Seismic refraction surveys are used to determine:

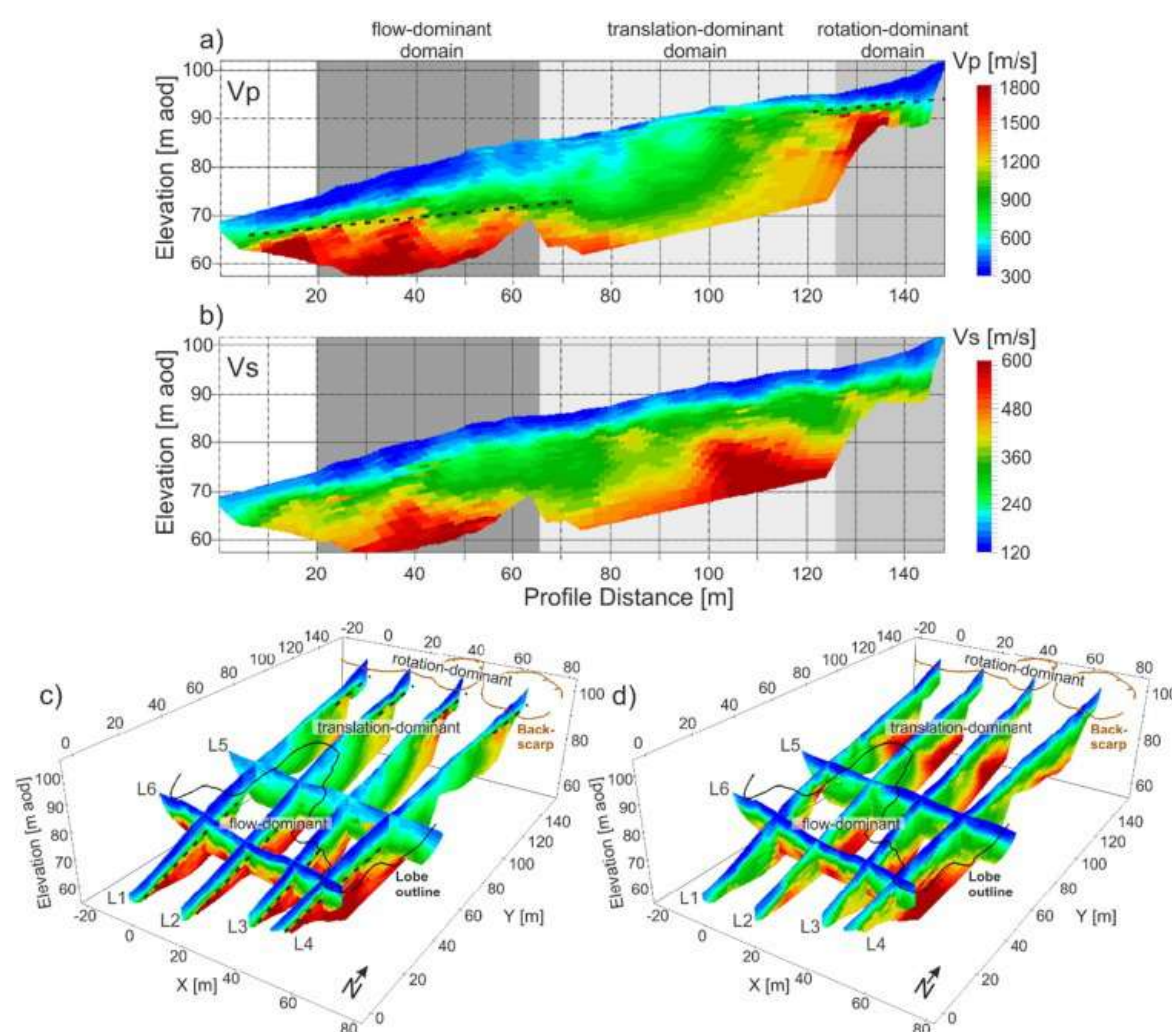
Bedrock profile, rock quality & depth, identification of geotechnical properties of the subsurface layers (Poisson ratio, Young Modulus, Shear Modulus), the presence of fractures and cavities, slope stability studies.

BOREHOLE SEISMIC SURVEY

- Full wave sonic logging
- Down-hole seismic test
- P&S wave suspension logging
- Cross-hole seismic test
- Cross-hole seismic tomography

Cross-hole & Down-hole Seismic Surveys

Cross-hole seismic surveys are used to derive information on the elastic properties of materials between two or more boreholes by measuring travel time of seismic energy depths.



APPLIED GEOPHYSICAL

ELECTRICAL METHODS

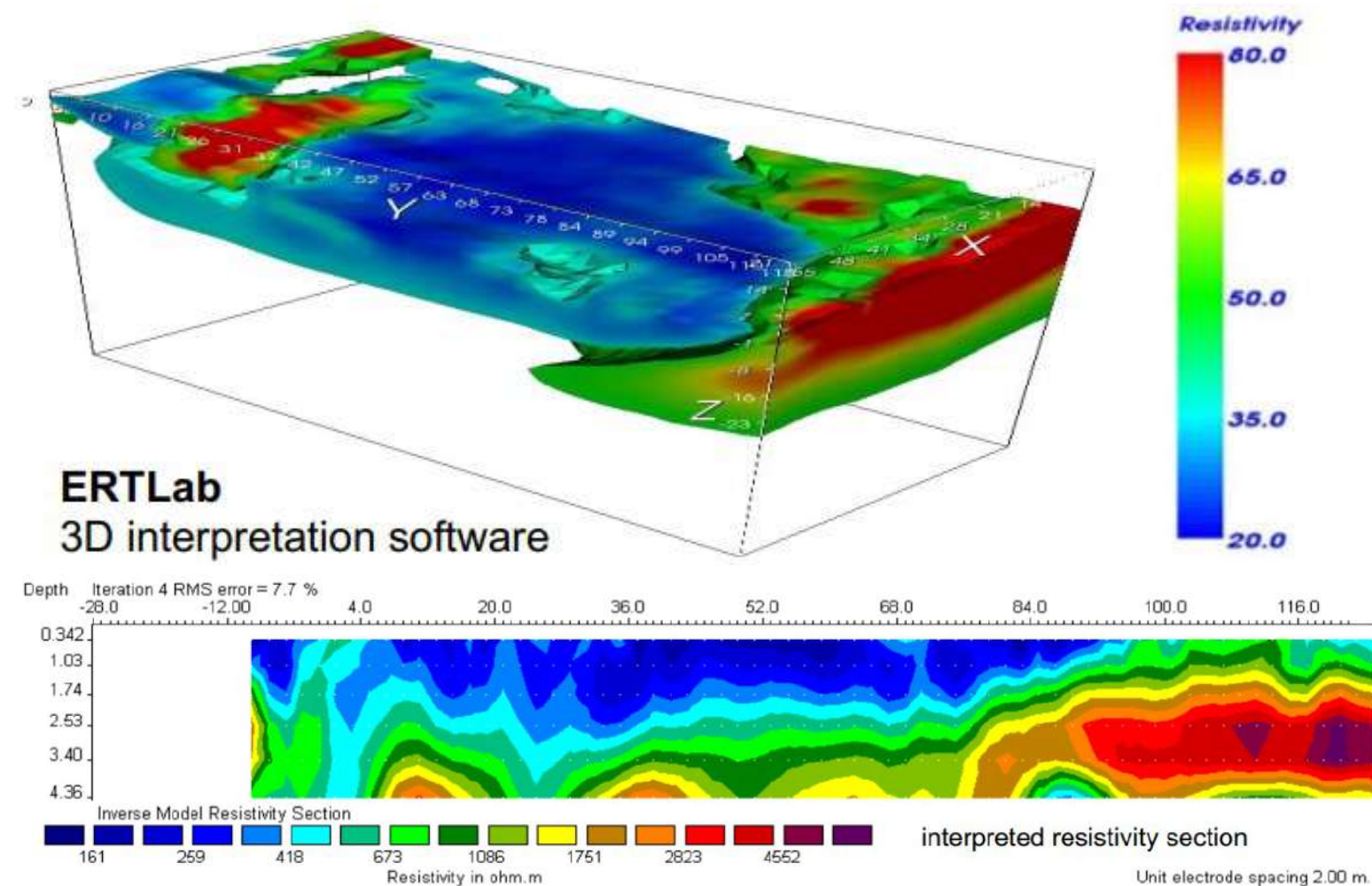
- Electrical Resistivity Tomography (ERT-2D/3D)
- Vertical Electrical Sounding (VES)
- Spontaneous/Self Potential (SP)
- Shallow Direct Current Electrical Resistivity
- Induced Polarization (IP)
- Thermal resistivity (IP)

1D/2D/3D Electrical Resistivity Sounding & Tomography Technique Applications

The electrical methods used for measurement of subsurface resistivity to the induced electric current using DC battery.

The electrical surveys are used in:

Groundwater exploration, determination of underground water resources, bedrock quality & depth measurements, pollution plumes mapping, mineral prospecting, detecting cavities, archaeology, dam structure analysis, and contamination sources detection.



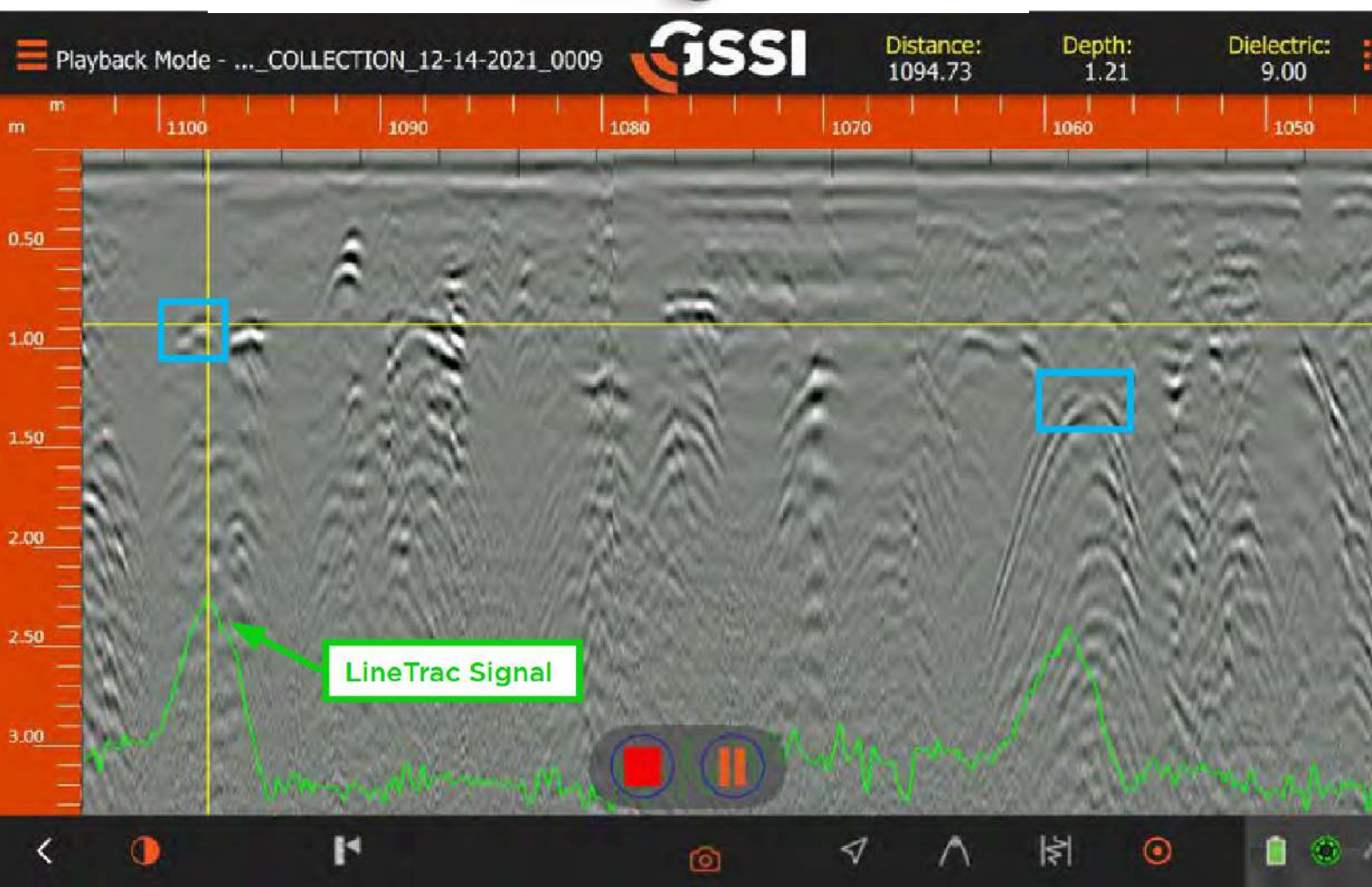


GROUND PENETRATING RADAR

- **Surface GPR Scanning**
16 MHz - 2600 MHz frequency
- **Borehole GPR Scanning**
2D & 3D scanning up to a depth of 30 m with a radius of 5 m

Ground Penetrating Radar (GPR) Applications

Detection & mapping of underground utilities, cavities & voids (structures - dams, bridges, weirs, barrages, etc.), road investigations, soil - bedrock interface, water table determination, archaeology & forensics, concrete inspection and structural inspection.



APPLIED GEOPHYSICAL

POTENTIAL FIELD METHODS

- Gravity Survey

Land Gravity
Absolute Gravity
Relative Gravity
Borehole Gravity
Marine Gravity
Airborne Gravity

- Magnetic Survey

Land Magnetics
Aerial Magnetics
Marine Magnetics

Gravity Methods

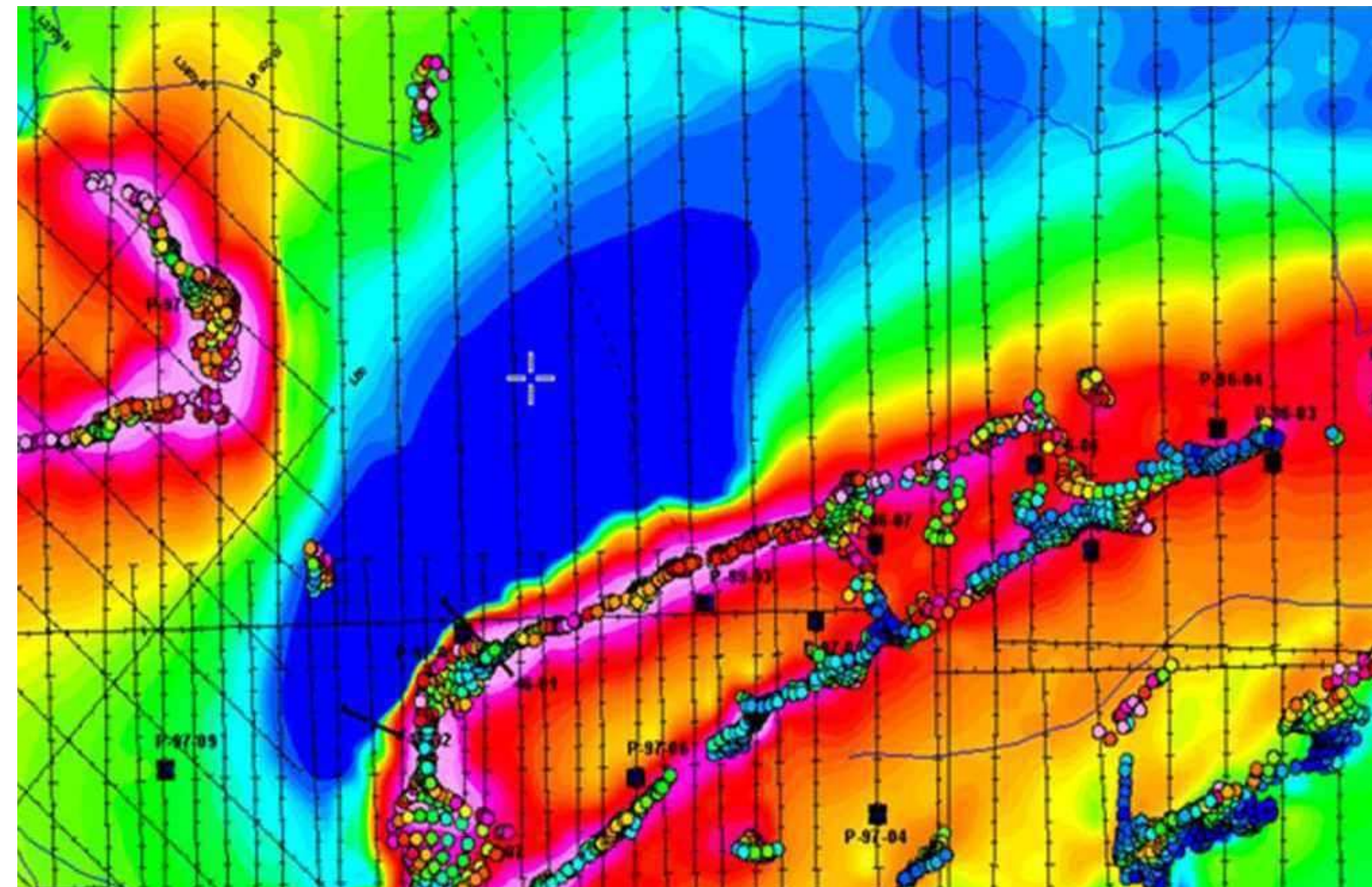
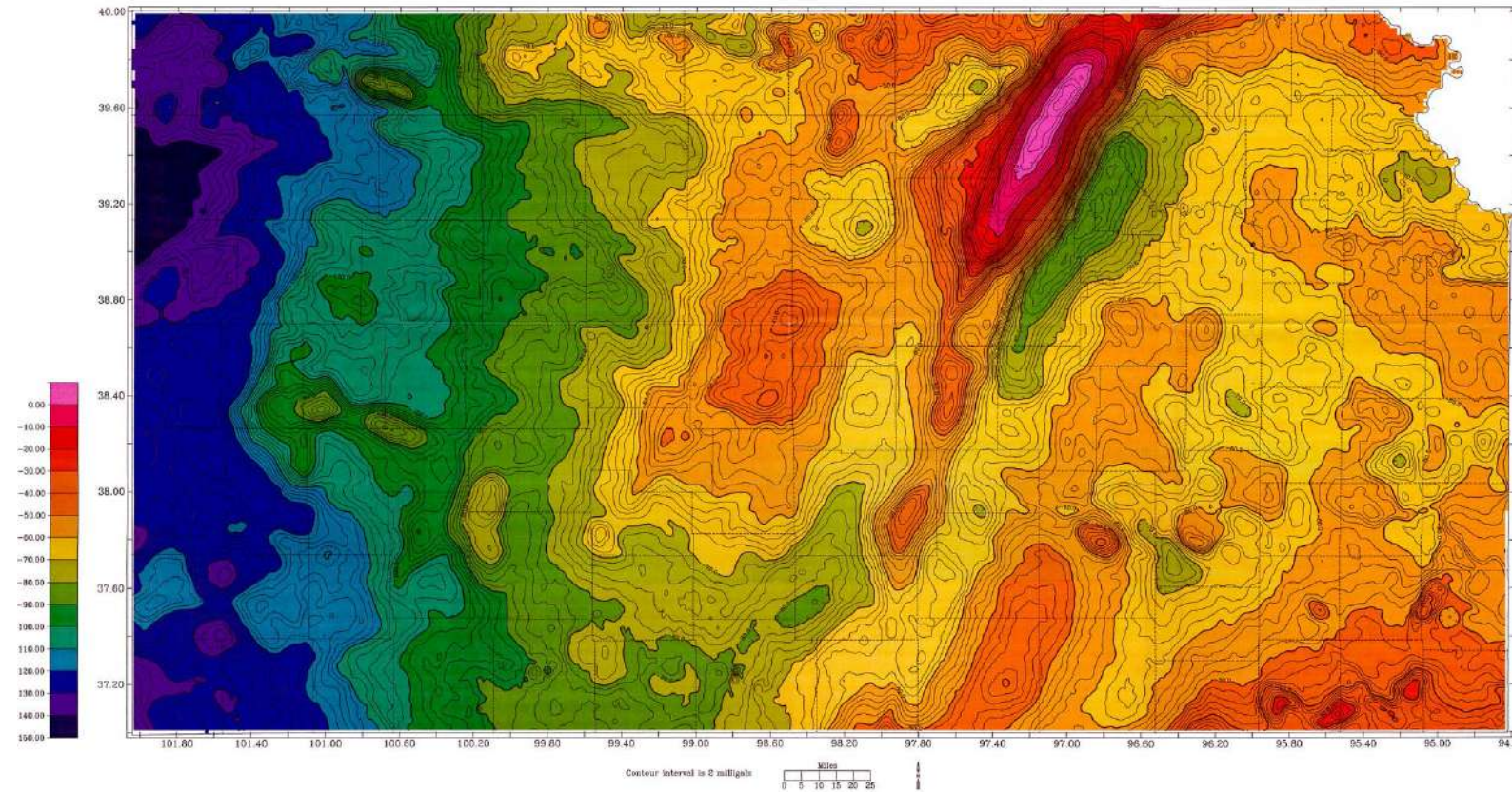
Gravity measurements are used to map density contrasts in geological formations. It is applied for the following purposes:

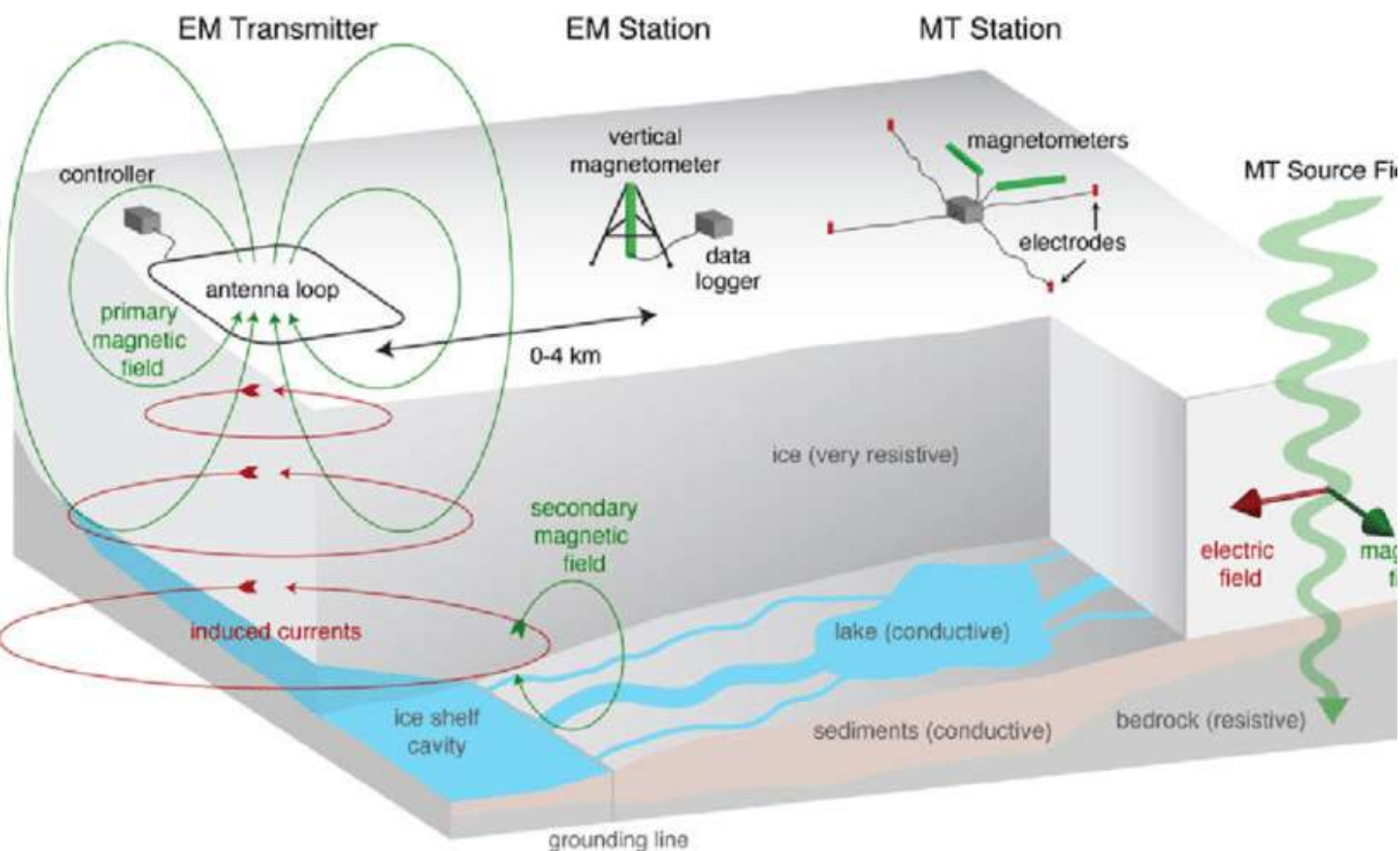
Bedrock topography under landfills, mapping large metallic mineral deposits, locating subsurface caverns, as well as cavities.

Magnetic Methods

Magnetometers can be used to map buried variations of magnetic susceptibilities. It is employed in many applications including:

Geological Mapping
Archaeology
Mineral Exploration





ELECTROMAGNETIC METHODS

- Frequency Domain EM
- Time Domain TDEM

Electromagnetic Technique Applications

Location of buried metal objects (eg. tanks & drums)
 Mineral exploration
 Archaeology
 Determination of sedimentary basin thickness

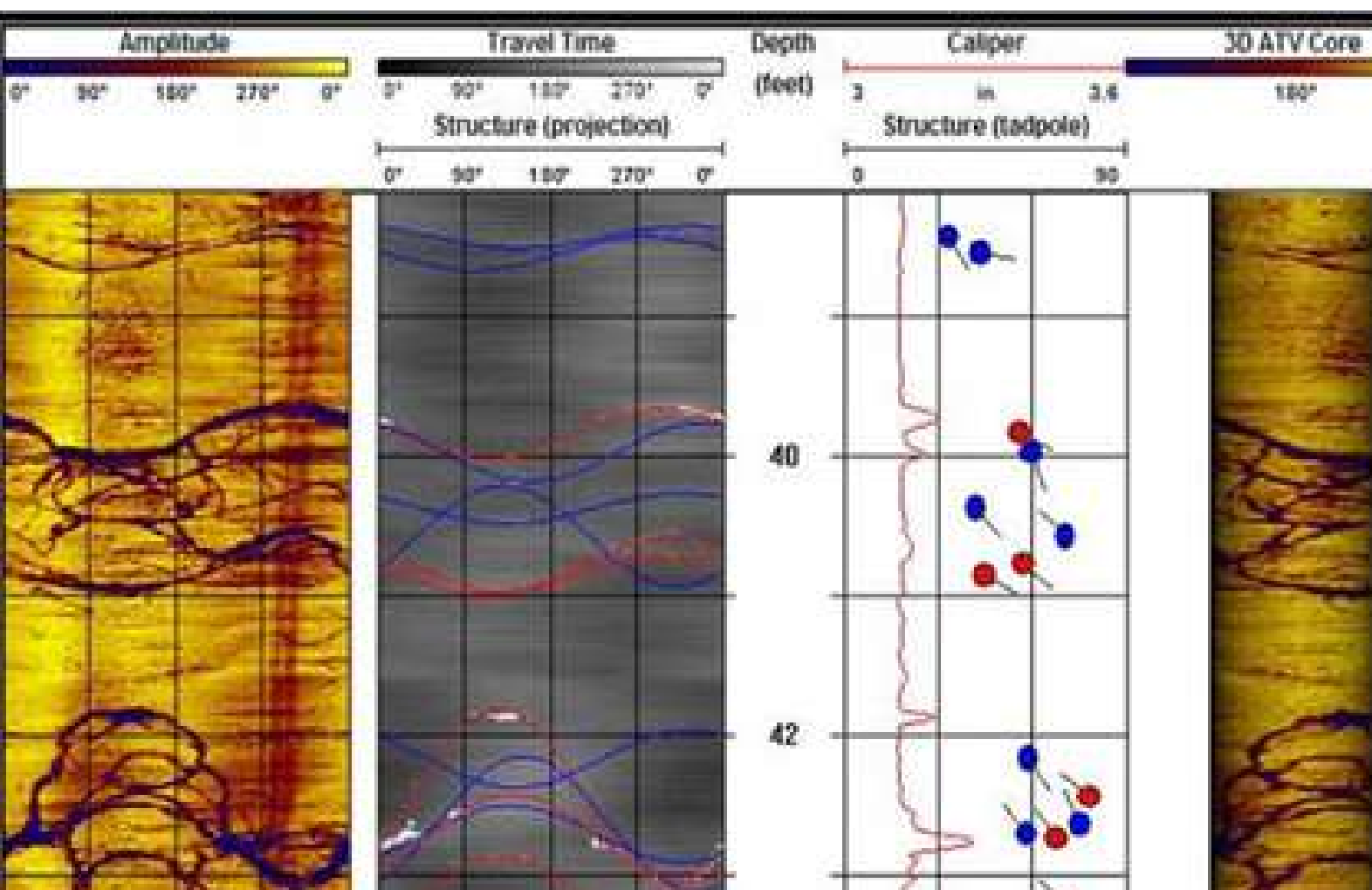
GEOPHYSICAL LOGGING METHODS

- Three-arm caliper logging
- Temperature conductivity logging
- Natural gamma logging
- Gamma-gamma (density) logging
- Impeller flow meter logging
- Electric logging
- Deviation logging

Geophysical Logging Technique Applications

Borehole logging provides continuous record of a wide range of formation's rock properties using geophysical techniques. Determination of rocks and formations elastic properties, resistivity, or radioactivity can be made using the geophysical well logging method. It is also used to:

Distinguish between sand and shale
 Detecting regions where the borehole walls are compromised



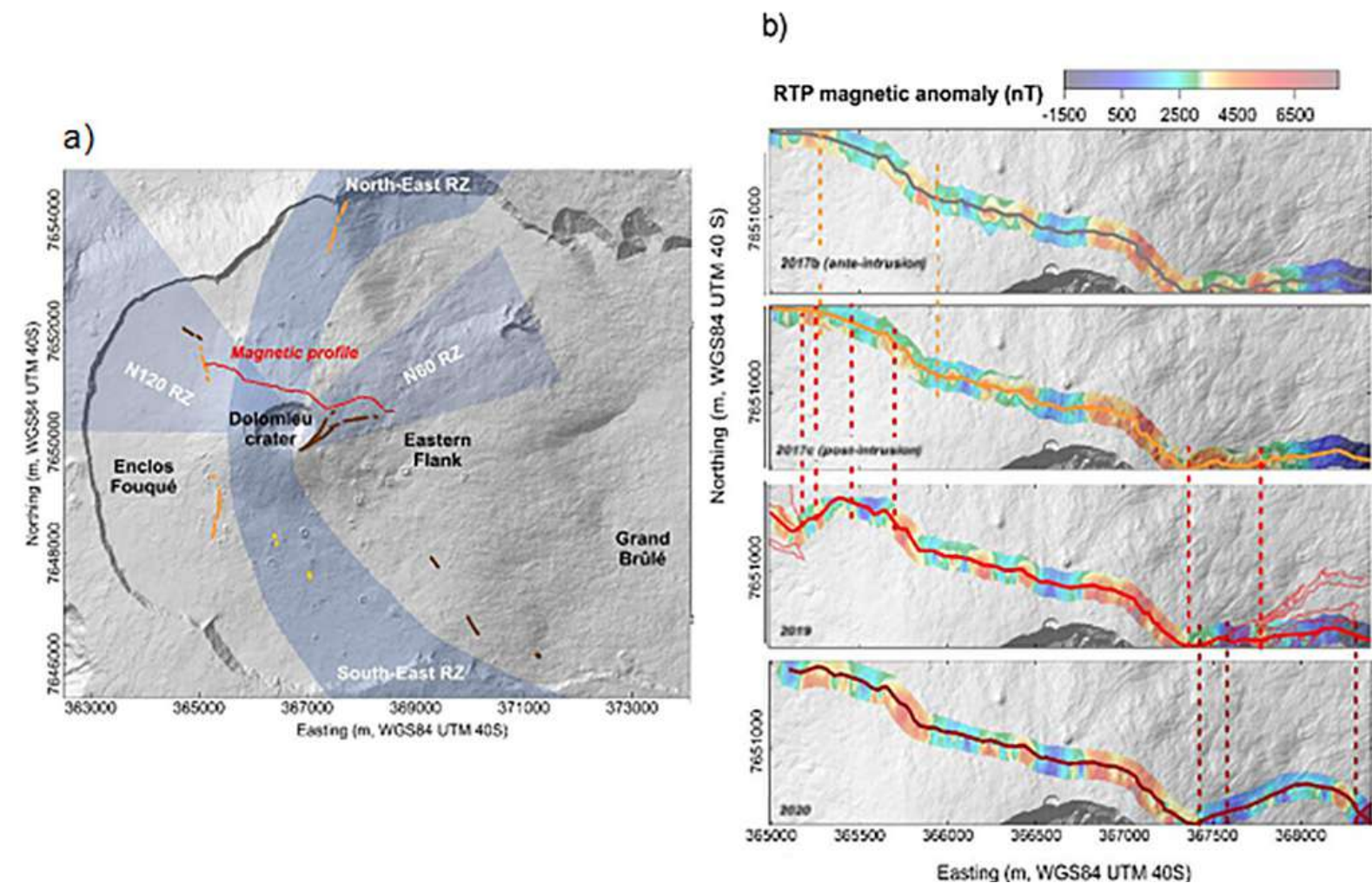
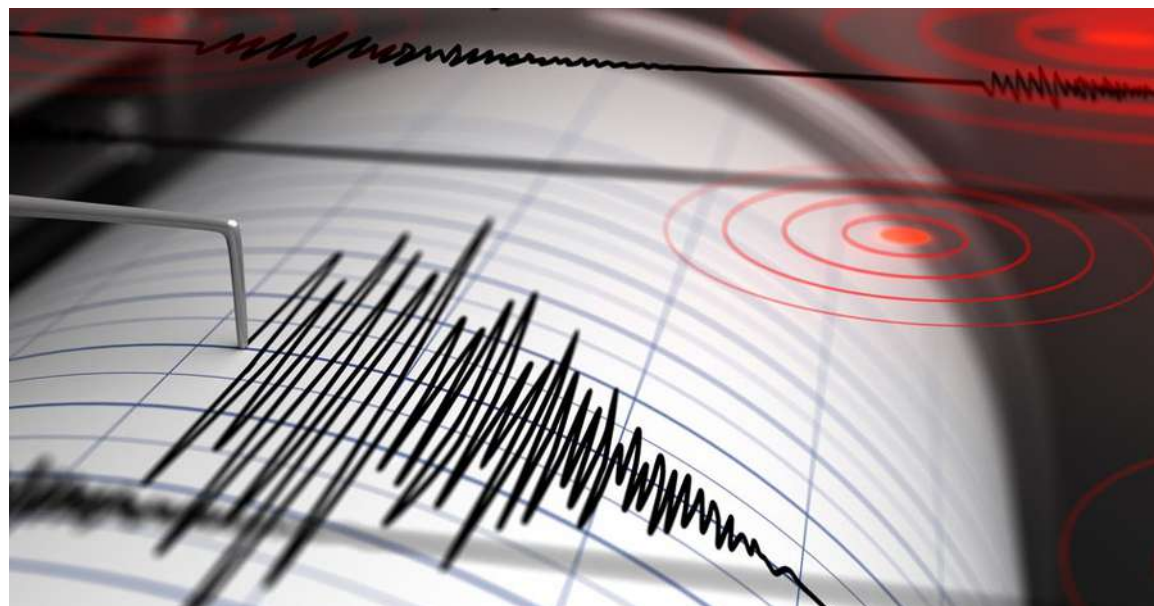
GEOLOGICAL HAZARDS

EARTHQUAKE MONITORING
STRONG MOTION MONITORING
VIBRATION MONITORING
ROCKFALL HAZARD MITIGATION

Quantum Science (QS) brings together a multi-disciplinary team with expertise in geology, geophysics, geomorphology, and geotechnical engineering with the ability to offer complete geo-hazard services covering:

- Identification
- Risk Assessment
- Analysis
- Solution Engineering
- Management

The most probable geologic hazards that may take place in the Middle East region are associated with earthquakes, floods, rockfalls and volcanic eruption.



EARTHQUAKE MONITORING

Seismology

The science of earthquakes - covers a broad range of applications. It not only measures the natural events, but also seismic monitoring stations can be used to detect, locate and identify man-made events.

Recent Earthquakes

The rapid provision of information on earthquakes, and the assessment of their damage potential, is of crucial significance for governmental and local authority agencies and organizations to enable them to implement the necessary emergency measures when required.

Earthquake Interpretation

Seismologists assess on a daily basis, latest seismic events.

Earthquake Statistics

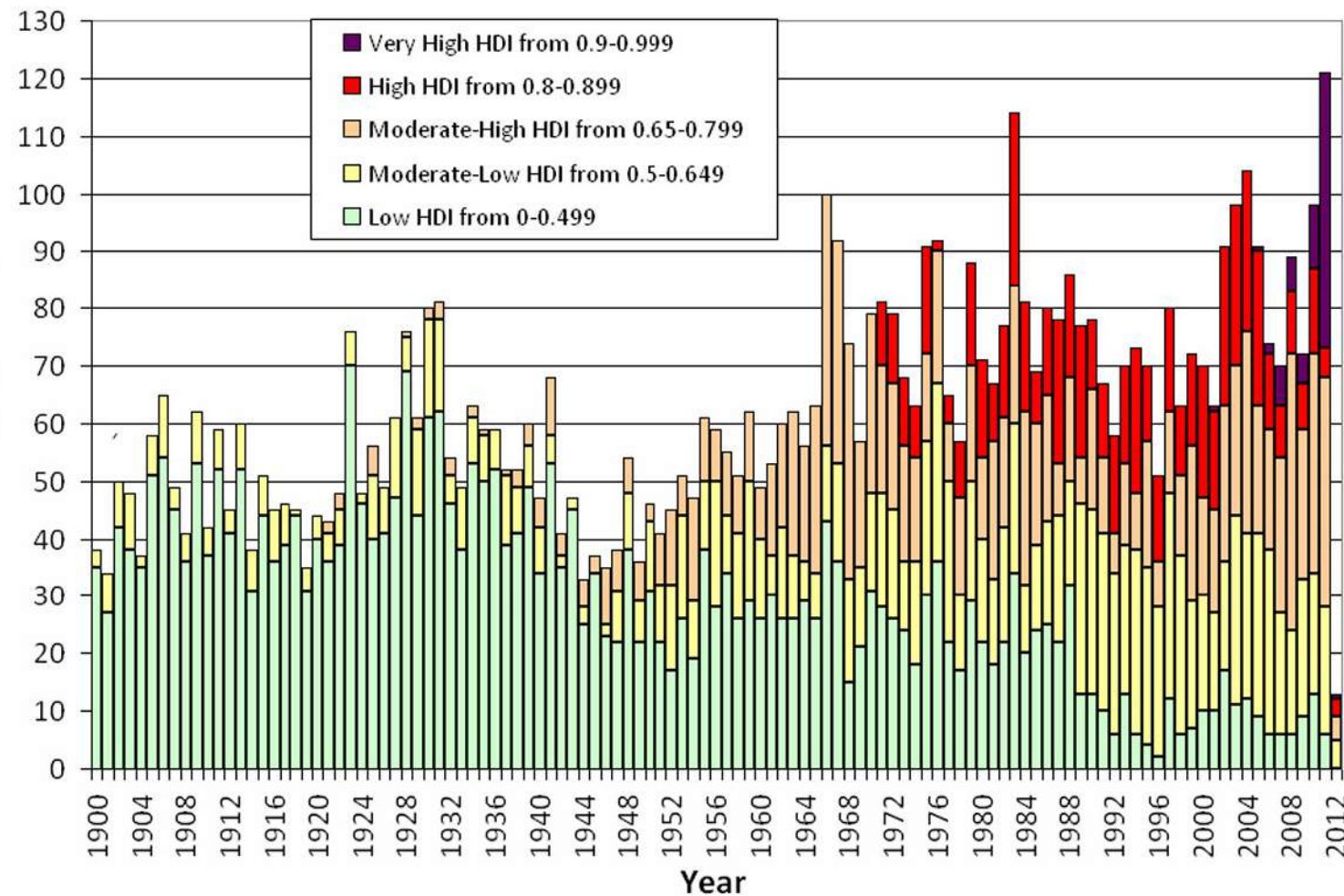
Number of earthquakes with different magnitudes are presented chronologically.

Seismological Measures for Hazard Mitigation

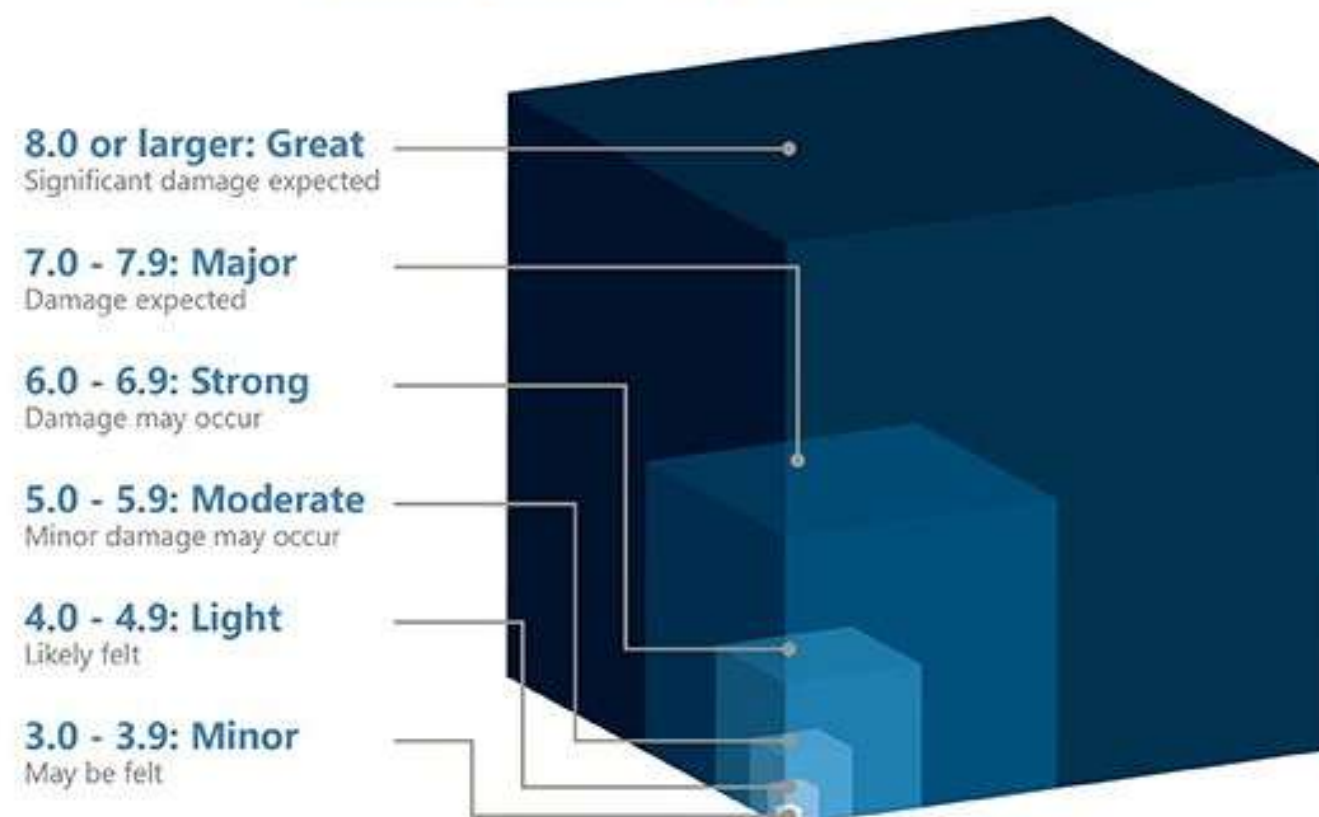
Detailed seismic sounding and geological investigation for fault systems along coastlines.

Establishment of National system for earthquake information and tsunami warning.

Education and training of earthquake and tsunami hazard preparedness for the population and community, calculation model for tsunami propagation and inundation.



Earthquake Magnitude Classes



GEOLOGICAL HAZARDS

STRONG MOTION MONITORING

Strong motion monitoring is obtaining reliable seismic data in real-time.

Applicable for large structures, civil engineering and research consulting, building monitoring, site surveys and analysis.

VIBRATION MONITORING

Related to road and railways, construction activities such as piling, blasting and tunneling, blast monitoring and construction monitoring.

ROCKFALL HAZARD MITIGATION & EARLY WARNING

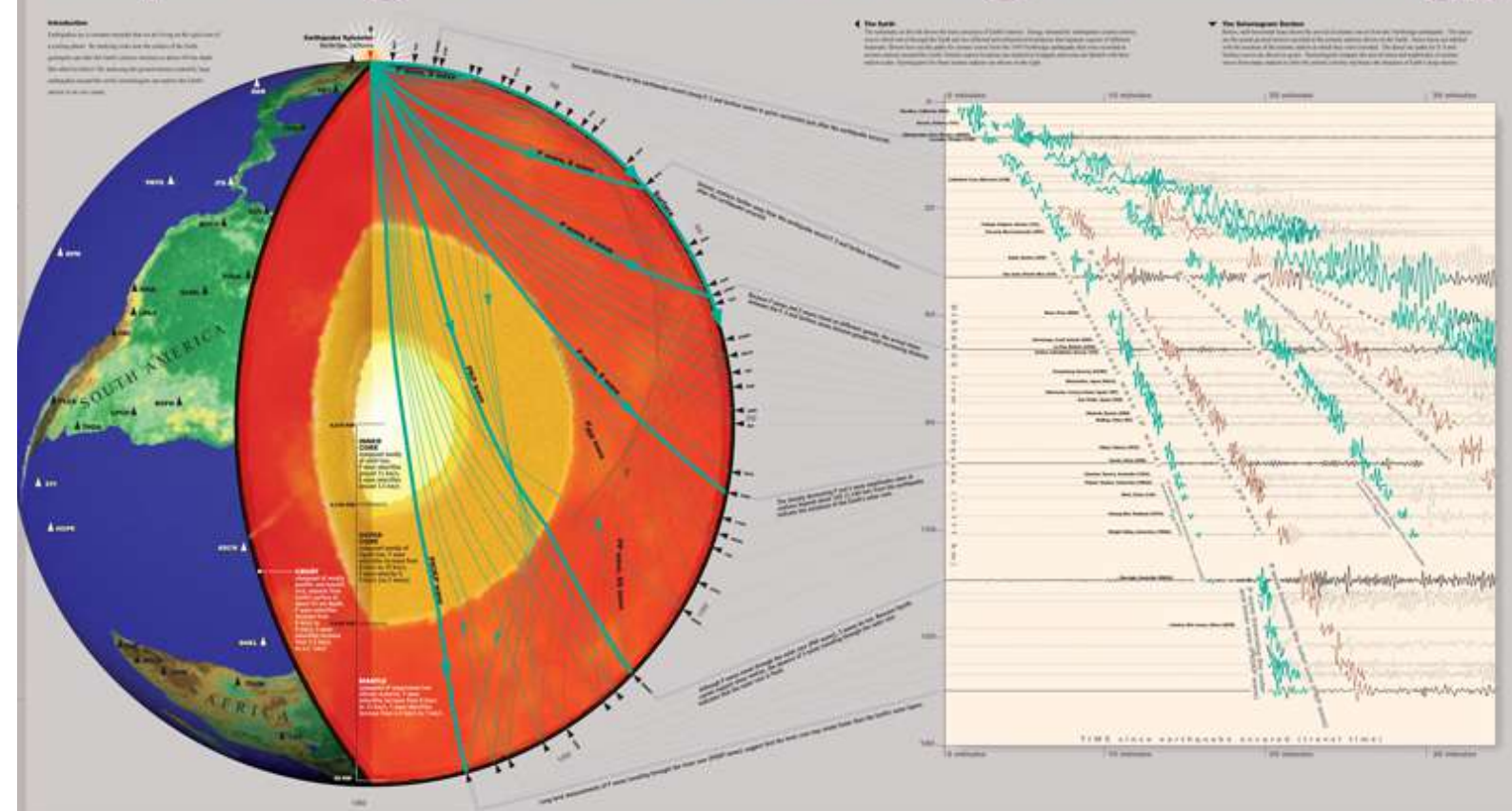
The growing impact of slope instability creates risks on society and with economic development calls for advanced and efficient monitoring methods, improved strategies for hazard mitigation and early warning systems which can only be achieved by enhanced interdisciplinary research.

VOLCANIC HAZARD MITIGATION

By monitoring seismic and geological activity, we may warn people ahead of time about impending danger.

Volcanologists can measure the size of an eruption in two ways, namely the eruption magnitude and eruption intensity. They may also use satellites and imagery to monitor activity.

Exploring the Earth Using Seismology





GEOTHERMAL RENEWABLES

GEOTHERMAL

QS offers geothermal services which includes a detailed study of the subsurface in search of viable active geothermal regions with the goal of building geothermal power plants, with hot fluids driving turbines to create energy. Exploration methods include a broad range of disciplines including geology, geophysics, geochemistry and engineering. Geophysical exploration of geothermal resources deals with measurements on the physical properties of the earth. The emphasis is mainly on parameters that are sensitive to the temperature and fluid content of the rocks influencing geothermal systems.

Geophysical Methods - Geothermal Reservoirs

- Electrical methods (DC, TEM & MT measurements)
- Magnetic measurements
- Gravity measurements
- Seismic methods
- Combined geophysical methods

RENEWABLE ENERGY

QS offers assessment, verification, testing and support services throughout the entire life of your renewable energy (solar & wind) projects, from the design phase to integration, installation and set-up.

The renewable energy site assessment tool aims to guide in assessing whether new infrastructure has the proper physical orientation to support future installation of a renewable energy system. The tool evaluates the proposed site's solar and wind resource potential based on location, shading effects and sufficient wind speeds.

ENERGY SOLUTIONS

DRILLING & FIELD

DRILLING & FIELD LOGISTICS SERVICES

QS has a resourceful crew capable of conducting various types of drilling and field services in all kinds of terrain. Our services include:

- Groundwater drilling
- Dewatering & shoring
- Core drilling & sampling
- Scientific & seismic observatory borehole drilling
- Remote communication facilities through VSAT, RF, GPRS & GSM
- Electrical & civil services for camping with field catering services
- Four wheel drive SUV's with navigation systems & guides with knowledge of the terrain





GEOSPATIAL & INSPECTION SERVICES

QS offers geospatial drone solutions, drone inspection and support services. Our services include:

- Surveying & Mapping
- Land, Cadastral & Magnetic Survey
- Urban Planning
- Construction, Mining & Agriculture
- Progress Management, |Earthwork, BIM, Preservation, |
- Agriculture
- Mining Survey, Facade, Asset Inspection, Site Safety
- Inspection & Support
- Electricity & Renewables Inspection
- Powerline, Substation, Photovoltaic Power Plant & Wind
- Turbine Inspection
- Oil Gas & Infrastructure
- Facility, Pipeline, Bridge & Roof Inspection



DRONE SERVICES