Salt Partners

Introducing SEISMOSAL® a New Revolutionary Method of Prospecting for Salt

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The presentation is broadcasting on YouTube under the following link:
https://youtu.be/I-q1EKwsBg8

SMRI Fall 2018 Meeting, 24-25.9.2018, Hotel Hilton Belfast, North Ireland, UK

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Core sampling of salt deposit at Cape Cross, Namibia

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Core drilling is slow. At Cape Cross in 2013, it took several months.

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Core sampling of salt deposit at Cape Cross, Namibia

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Two day yield of salt and mud samples from relatively soft ground.

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In March 2016, Salt Partners were contacted by ATS New Zealand

ATS

ATS have been developing Geosuite, software-based geophysical tools for investigation of underground geological formations, with the prime purpose of discovering aquifers suitable for groundwater exploration.

ATS asked Salt Partners whether we would be interested to try their electro-seismic method for exploration of salt deposits.

We said yes.

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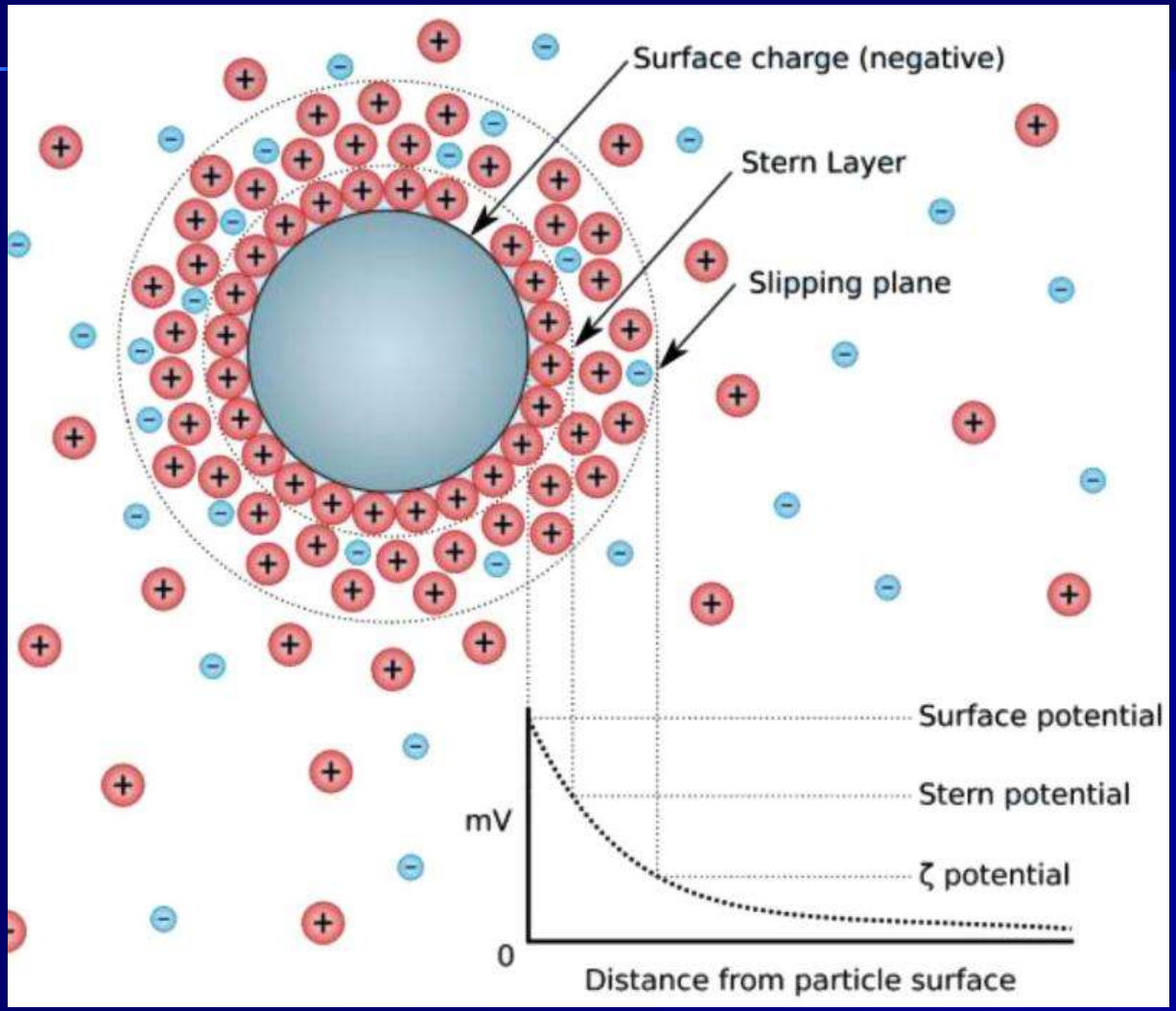
Physical principles of wet rock grain electrical properties



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Grain of rock is negatively charged.

Cations present in ground water form a firm layer on the grain (Gouy layer, strong Van der Waal forces).

Second, less firm layer of cations forms around the Gouy layer (Stern layer).

The seismic pressure wave causes slipping of the Stern layer, which induces electromagnetic wave.

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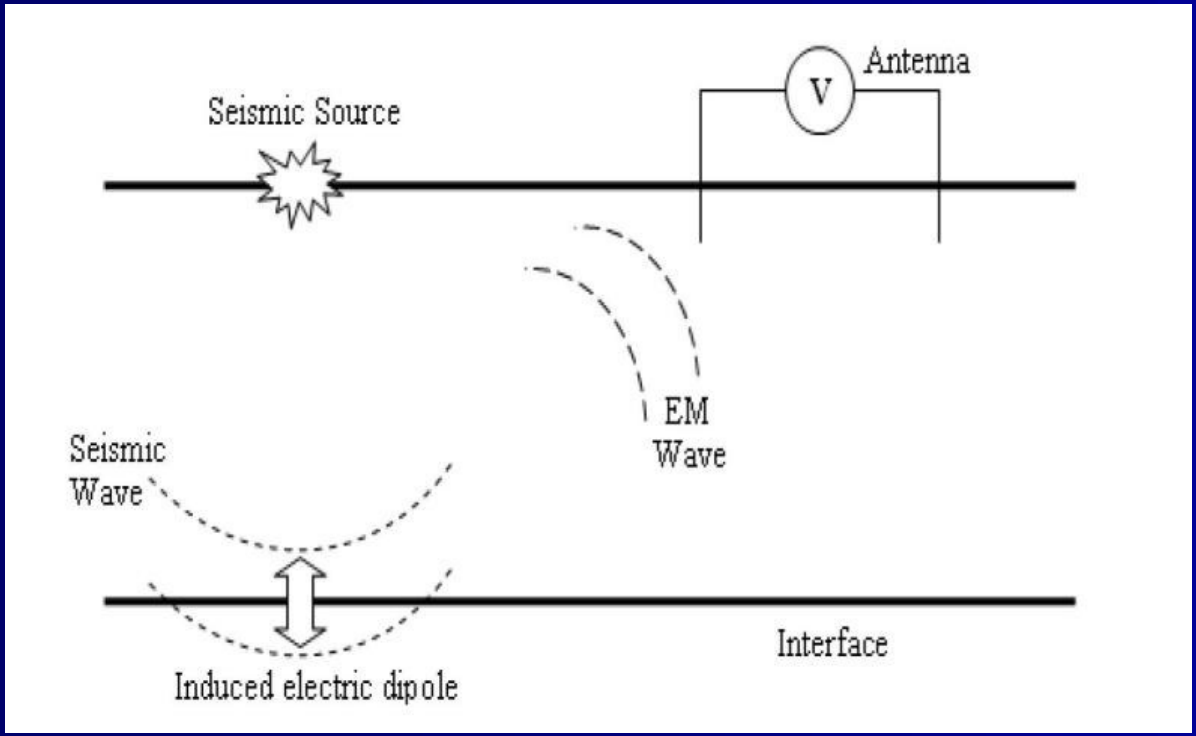
Physical principles of electro-seismics



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Seismic source produces seismic wave.

Seismic wave crossing an interface between two geological formations induces an electric dipole.

Induced electric dipole produces an electromagnetic wave.

The electromagnetic wave is detected by two electrodes and recorded.

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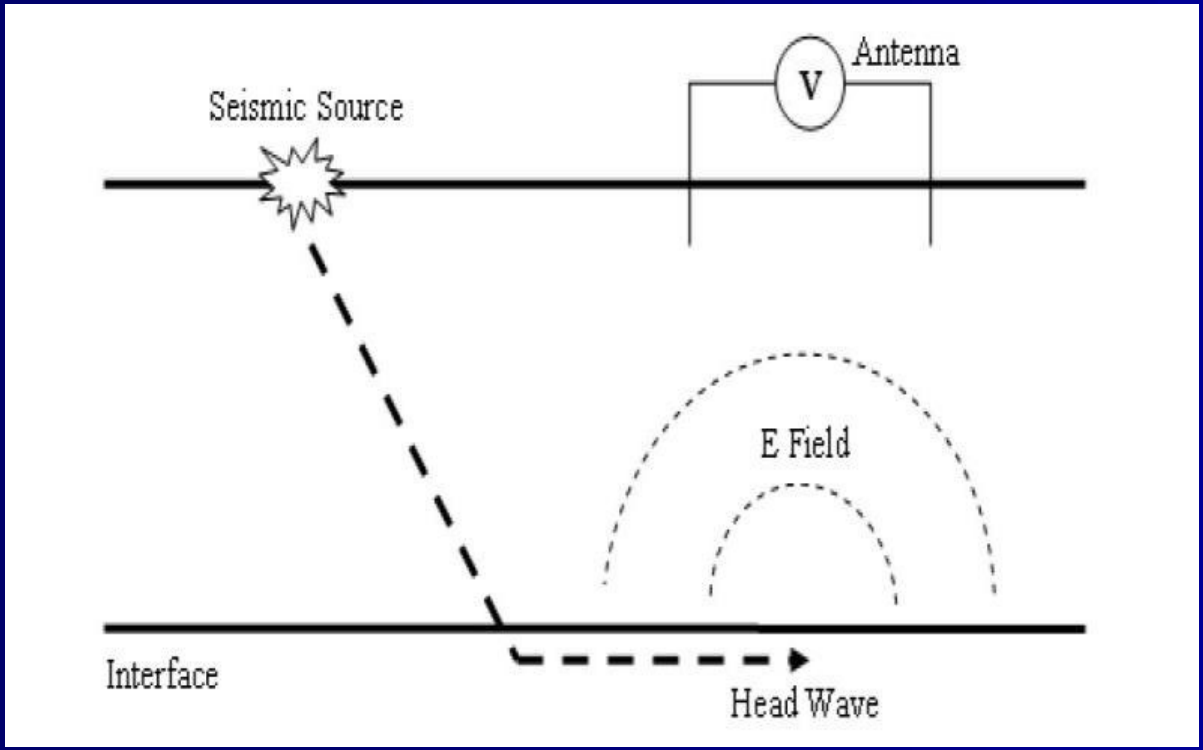
Physical principles of electro-tellurics



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Seismic source produces seismic wave.

Seismic wave reaches an interface between two geological formations and travels along the interface as a head wave.

The head wave generates an electrical field.

The electrical field is detected by two electrodes and recorded.

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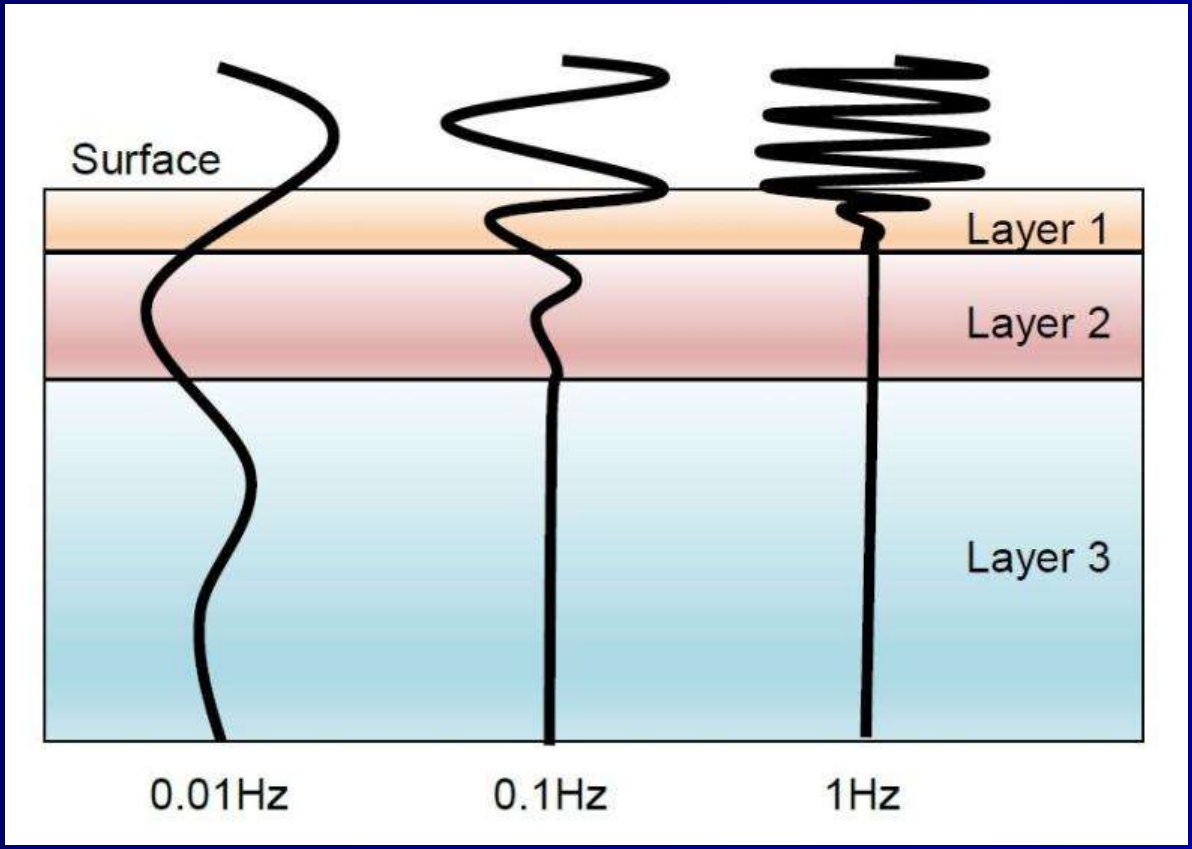
Physical principles of electro-tellurics



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Electro-telluric currents are geo-magnetically induced currents that flow through conductive formations in the subsurface.

The lower the frequency of the geomagnetic field disruption the deeper the EM field can penetrate into the subsurface to create a telluric current.

Thus the frequency of the detected electro-telluric current is directly proportional to its depth.

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Tools required for electro-seismic mapping

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Electro-seismic mapping tools are simple:

- Sledgehammer
- Steel pins and plate
- Cables
- Recorder
- Strong man
- Personal protection equipment

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Site selection: Swiss Saltworks, Riburg, North of Switzerland

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Site selection: Fields north of Swiss Saltworks at Riburg

The site is 660 m long and 200 m wide.

Salt Partners are grateful to Swiss Saltworks for cooperation and to Carlo Habich and his family for permission to carry out electro-seismic mapping at this property.

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Electro-seismic mapping at Neumatt, Riburg, on 22.6.16

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The temperature reached 35°C.

We refrained from using personal protection equipment – except for a strong sun lotion.

In the background, salt storage domes of Swiss Saltworks, wooden construction built by a Swiss company Häring, are visible.

The next day, the recordings and GPS data of 29 striking points were transmitted to ATS for evaluation.

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Salt deposit data provided by Swiss Saltworks

- Top of salt layer contour map;
- Bottom of salt layer contour map;
- Drilling logs at points R26 and R36 needed for method calibration;
- Salt layer profile interpolated from 8 exploratory drillings by Hauber;
- Locations of electrical cables;
- Locations of brine piping;
- Locations of water piping;
- Locations of existing brine caverns.

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Content of ATS electro-seismic evaluation report

- 99 pages;
- Introduction with theoretical part;
- 17 quality control evaluations for each strike point;
- 3 GPS location determinations for each strike point (lat. long. elev.);
- 24 electro-seismic and electro-telluric data renderings;
- 3-dimensional model of the data renderings;
- Salt layer profile by Hauber was incorporated in the 3D model;
- Detailed description and interpretation of the 24 data sets;
- 22 References.

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Scientific background publications

- **Butler, K. E., Russell, R. D. and Kepic, A. W. (1996) Measurement of the seismo-electric response from a shallow boundary. *Geophysics.***
  http://sep.stanford.edu/data/media/public/sep/berryman/Electroseis/Geoph01769.pdf
- **Garambois, S. and Dietrich, M. (2001) Seismo-electric wave conversion in porous media: Field measurements and transfer function analysis. *Geophysics*.**
  http://sep.stanford.edu/data/media/public/sep/berryman/Electroseis/Geoph01417.pdf
- **Haartsen, M. W. and Pride, S. R. (1997) Electroseismic waves from point sources in layered media. *Journal of Geophysical Research*.**
  http://onlinelibrary.wiley.com/doi/10.1029/97JB02936/abstract

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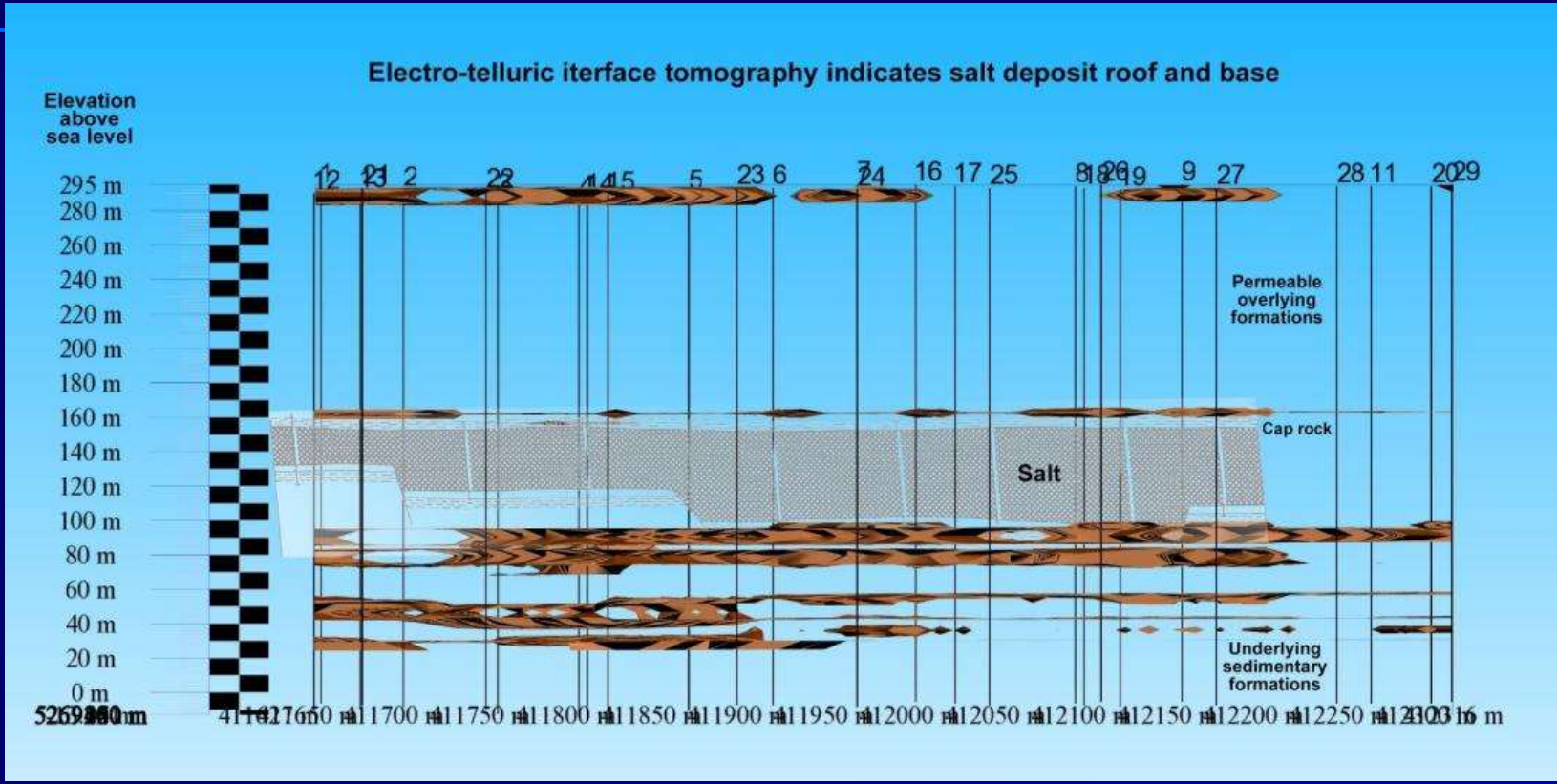
Electro-telluric salt layer determination



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The salt layer has been determined with an accuracy of approx. +/- 1 meter.

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Accuracy of salt layer determination

Electro-telluric interface tomography (ETIT) describes the position and depth of interface indicators that occur on the boundaries between two geological units with differing electrical conductivity. This calibrated data set locates the salt deposit with an accuracy of +/- 1 meter.

The salt is separated from the overlying sweet water aquifer by a cap rock consisting of impervious calcium sulphate, which protects the salt deposit from dissolution. Residual humidity in the cap rock facilitates migration of sodium and chloride ions to the overlying strata, causing increased electrical conductivity of the interface and conductivity differential to the overlying sweet water aquifer.

Enhanced density of telluric currents in this interface facilitates the identification of the salt deposit.

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Conclusions

29 strike points were carried out in one day;

100 strike points on an area of 1 square kilometre, matrix of 100 x 100 meters, can be carried out in 3 days;

Just one core drilling log is required for calibration;

The SEISMOSAL® electro-seismic method is accurate and significantly less expensive than conventional core drilling exploration method;

The capability and potential of the SEISMOSAL® electro-seismic method has been clearly demonstrated;

SEISMOSAL® is ready for commercial application.

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Why not turn your salt into gold?

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