Geophysical alluvial exploration using the Aquare Resisitivity method

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www.demco-surveys.com
Alluvial exploration

Drilling - boreholes
- Expensive – time consuming
- Discontinuous information
- Sampling – concentrations

Geophysics
- Fast - Economical
- Continuous information (high density)
- Defining geological structures – sampling locations

Mining = Finding!!!
Geophysical Methods

Quantitative methods (sediment thicknesses/depths)

- Reflection seismics *(diffractions in gravel!)*
  (boomer/chirp/parametric echosounder/sparker)
- Resistivity

Qualitative methods (rock/sediment qualities)

- Refraction seismics *(inaccurate thicknesses)*
- Electromagnetics *(limited penetration in high-conductive environments)*
- Resistivity
Enhanced (advanced) geophysics

High quality geophysical methods generating accurate quantitative as well as qualitative information in a georeferenced 4D model

<table>
<thead>
<tr>
<th>geology</th>
<th>seismic reflection</th>
<th>seismic refraction</th>
<th>advanced geophysics (Aquares)</th>
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<tbody>
<tr>
<td>water</td>
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<td>clay</td>
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<td>sand</td>
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<td>cemented rock</td>
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<td>fractured rock</td>
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**Aquares:**
Seabed towed cables -> high quality
Accuracy: no acoustic velocity information required
Quantitative: depths and thicknesses
Qualitative: resistivity value distinguishes between different rock and sediment qualities
4D model: every point in space has a resistivity value attached to it
Principles of Electrical Sounding
Applications

- Dredging geological exploration
- Sand searches – reclamation projects
- Port Design
- Pipe/Cable route surveys
- Alluvial mineral exploration (diamond / gold / gravel)
Geophysical Equipment
4D resistivity modelling
Port of Limbe, Cameroon
4D modelling
Ghana – Water intake
Surfzones resistivity surveys
Combining resistivity with seismic reflection and sidescan sonar
Luderitz - Namibia
Importance of geophysics versus boreholes

Hawar sand search

[Map showing horizontal resistivity section 1 m below seabed level with boreholes BH01 to BH40 indicated, some labeled as borehole with sand (BH39) and some as borehole without sand (BH40).]

[Map of the Persian Gulf region.]
Resistivity Sand Search
Kamsar – Guinea Conakry
Sankuru River Resistivity Survey

Horizontal resistivity section 2 m below river bed level

Gravel thickness (pothole map)
Tshikapa River
Resistivity Survey
Tractor Resistivity Survey
Noordkaap, South-Africa

- Marine sediments
- Channel sediments with diamondiferous gravel
- Rock
Conclusion

Aquares resistivity alluvial exploration:

- Marine applications
- Land applications
- Beach applications
- High resolution 4D Modelling

“We are finally done with the guess work!”
(US Army Corps of Engineers 2004 - Duval County beach renourishment sand search)