

# Minex – Central Asia Forum

Astana – Kazakhstan, March 17-19 2015

“Integration of Remote Sensing,  
Satellite Data, Lidar and Geophysics  
into a Kazakhstan GIS”

Gary Tipper – Int. Business Development  
SkyTEM Surveys

Dr. Boris Geldyev – CEO  
TERRA Remote Sensing and GIS



# Minex Central Asia Forum 2015

- Introduction of SkyTEM and TERRA
- previous data availability in Kazakhstan
- advantages of data integration
- examples of remote sensing data types
- examples of airborne geophysical data
- discussion of new Geoportal GIS

# SkyTEM Surveys

- Established in 2004 – spin-off Aarhus University
- 40 people – Denmark, Canada, Australia, S.Africa
- Large R&D group



SkyTEM HQ - Aarhus, Denmark



# Terra Remote Sensing and GIS

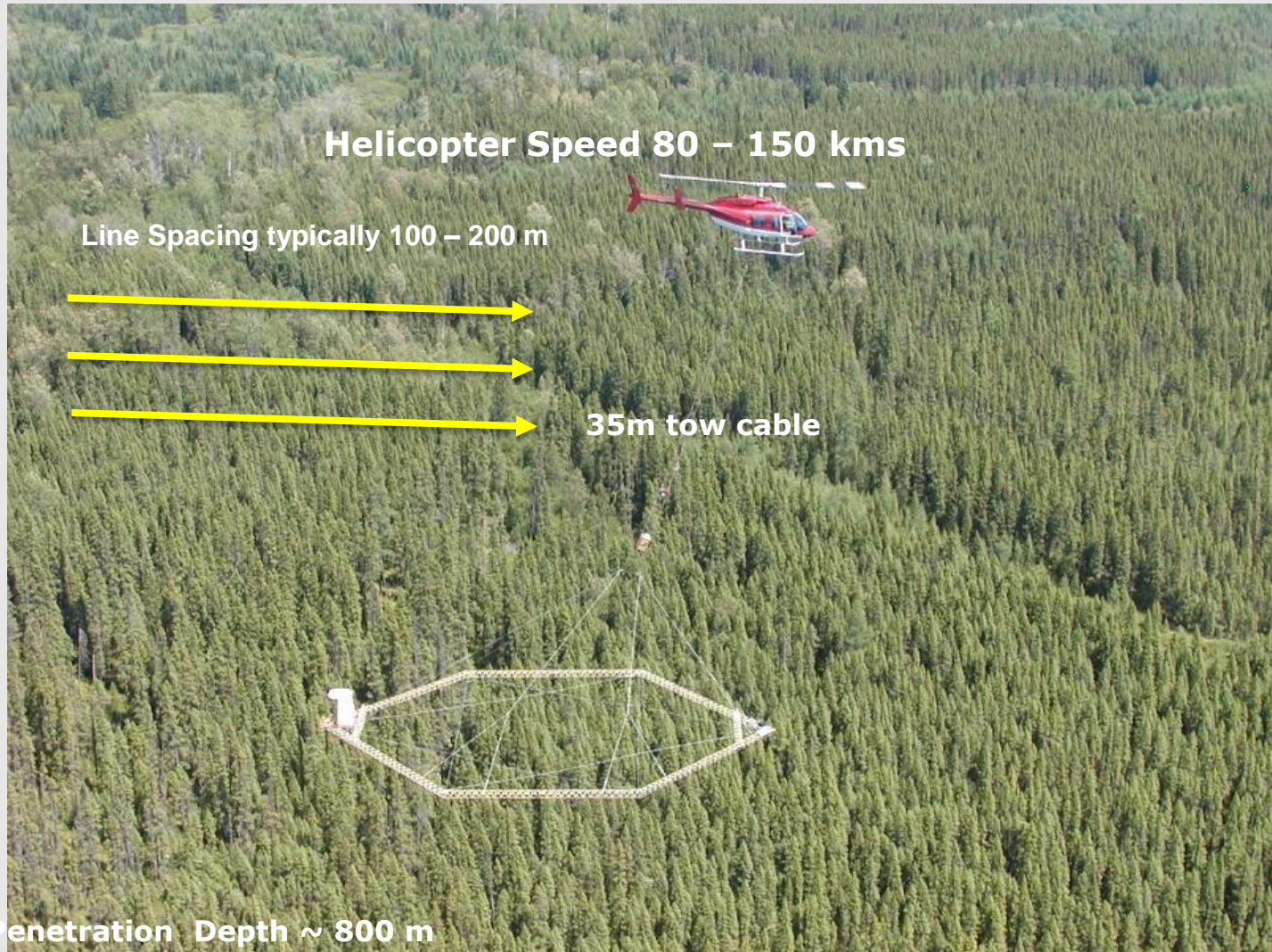
- based in Almaty Kazakhstan
- specializing in Remote Sensing, Satellite Imagery, Lidar, GIS
- field operations for conventional surveys, as built, DTM's
- expert staff in geology, geophysics and GIS
- Geomatics
- Aerial Photography
- Environmental Studies and Consulting
- Project Development
- well respected with existing Government and Private sector clients within Kazakhstan

# Geophysics, Remote Sensing and Lidar Definitions

- “Remote sensing - is the science of acquiring information about the Earth’s surface without actually being in contact with it.” [National Resources Canada](#)
- “Lidar – (Light detection and ranging) is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth”. [NOAA](#)
- “Geophysics – the physics of the Earth and it’s environment, including the physics of fields such as meteorology, oceanography, and seismology.” [Wikipedia](#)



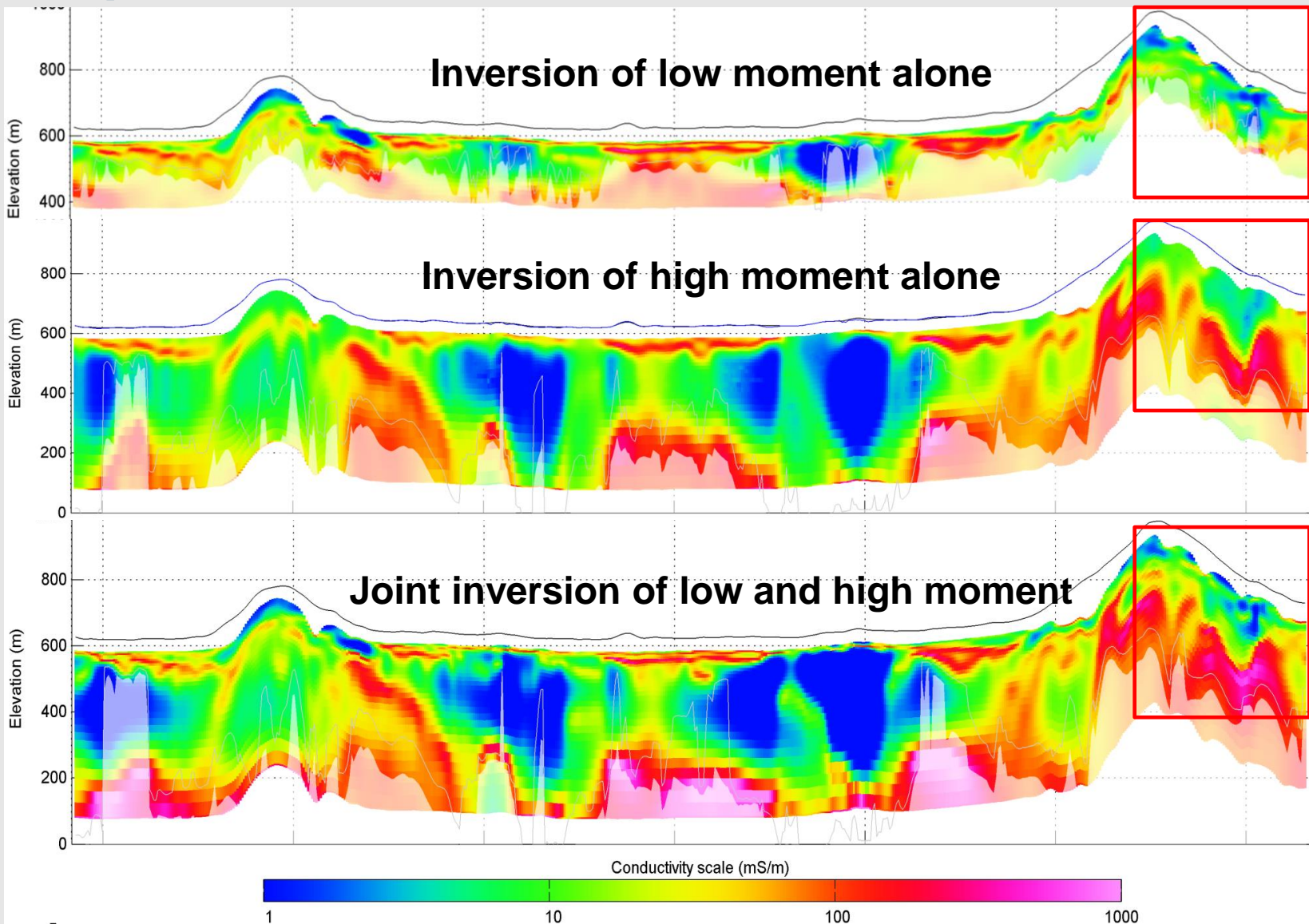
# SkyTEM – Time Domain EM/magnetics



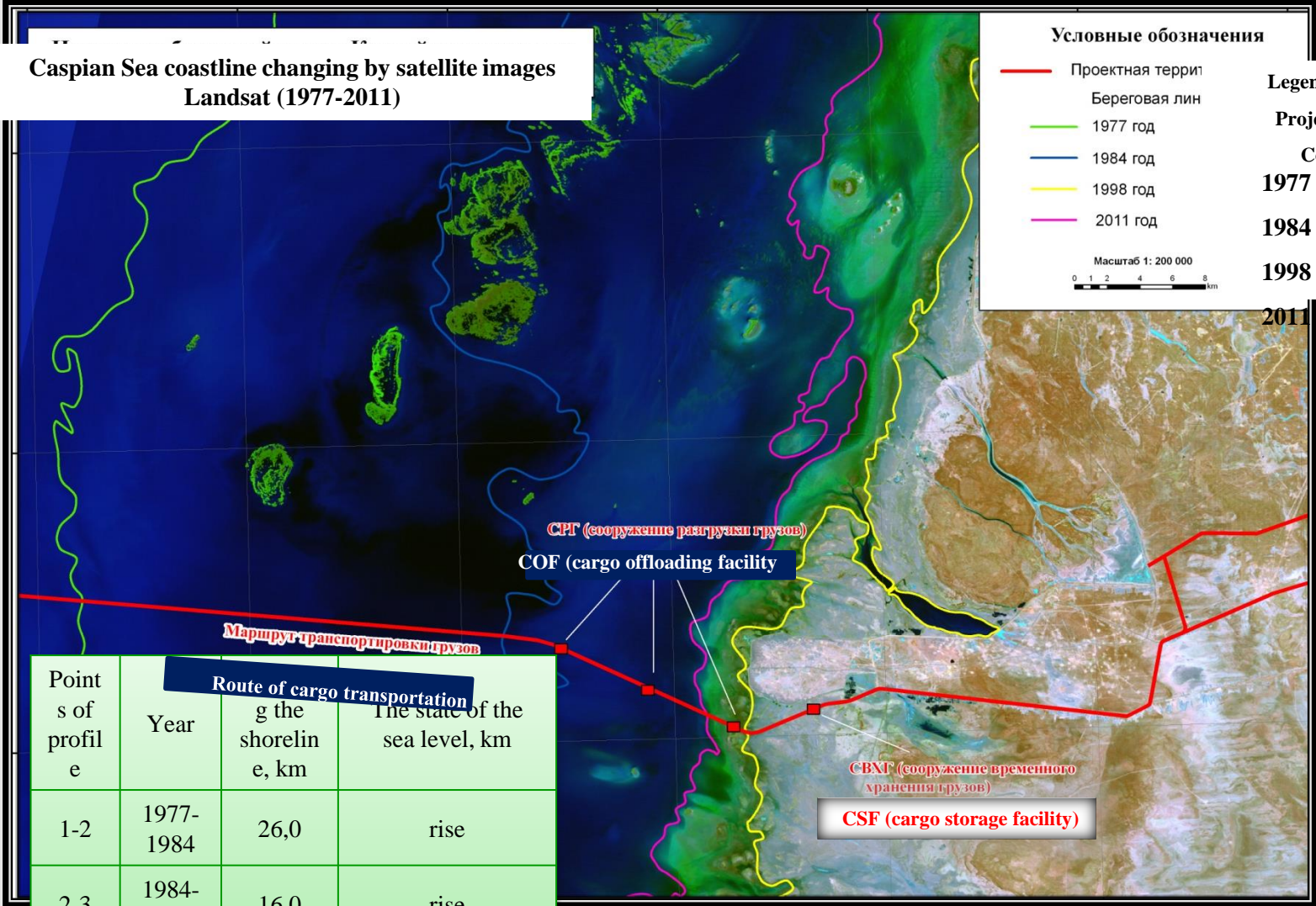


# MultiMoment SkyTEM508

## Layered earth



# Ecosystem classification using satellite data Landsat



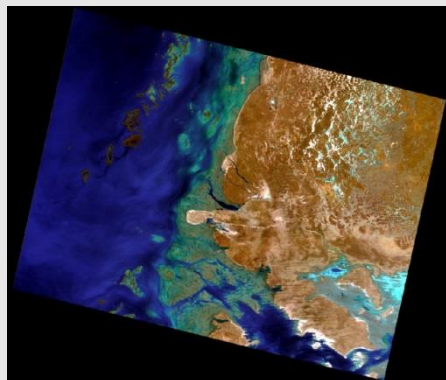
Caspian Sea coastline changing by satellite images Landsat (1977-2011)

Points of profile	Year	Route of cargo transportation along the shoreline, km	The state of the sea level, km
1-2	1977-1984	26,0	rise
2-3	1984-1989	16,0	rise
3-4	1989-2011	2,7	fall



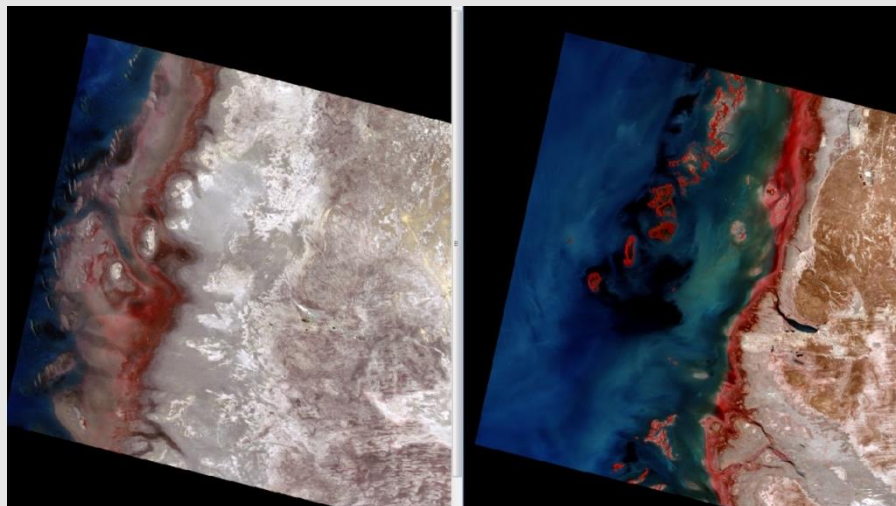
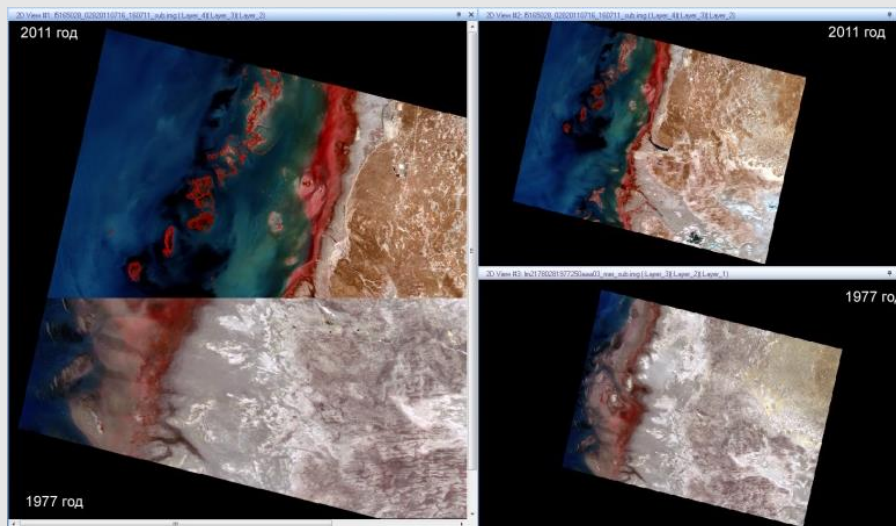


# Comparative analysis of Landsat satellite data for the period 1977-2013



Satellite image  
LANDSAT8.  
(multi-channel radiometer  
OLI (Operational Land  
Imager))

Date: May 2, 2013



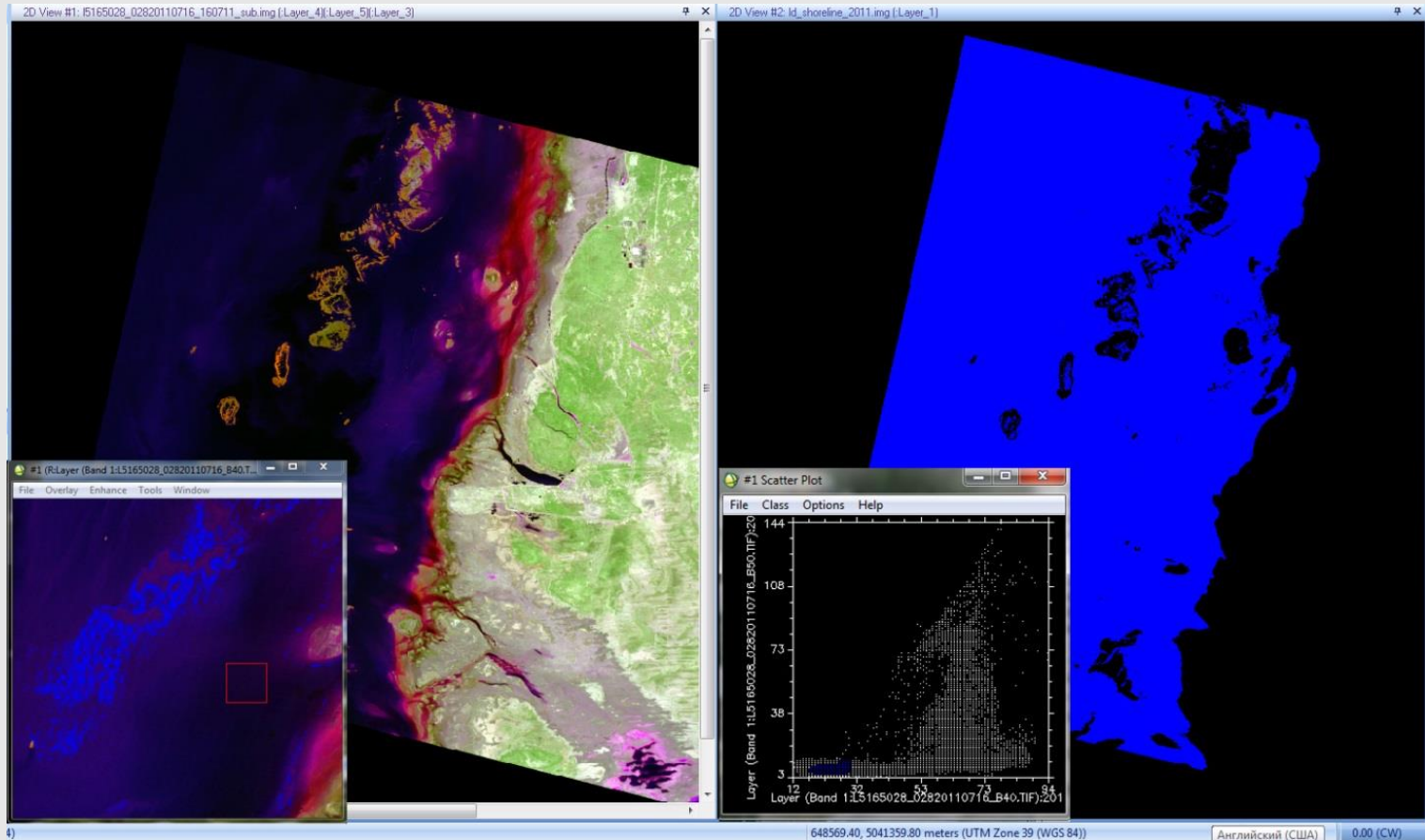
Satellite image Landsat-2 ERTS.  
Date: September 7, 1977

Satellite image Landsat-5 TM.  
Date: July 16, 2011

For the retrospective analysis of shoreline change were used Landsat data for the period from 1977 to 2011, characterized by significant fluctuations of the Caspian Sea.

# Creating a mask of the water surface

As a basis to obtain coastline for each separate year, was the mask of a space image, which is a process of isolation of pure class of water surface with the use spectral analysis tool 2-D Scatter Plots.



Satellite image Landsat-5 TM.

Date: July 16, 2011

Channels: R-4 G-5 B-3

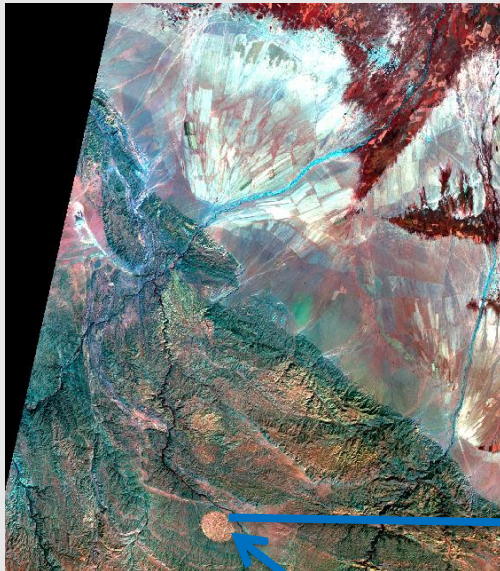
Mask of the water surface from satellite

imagery Landsat-5 TM.

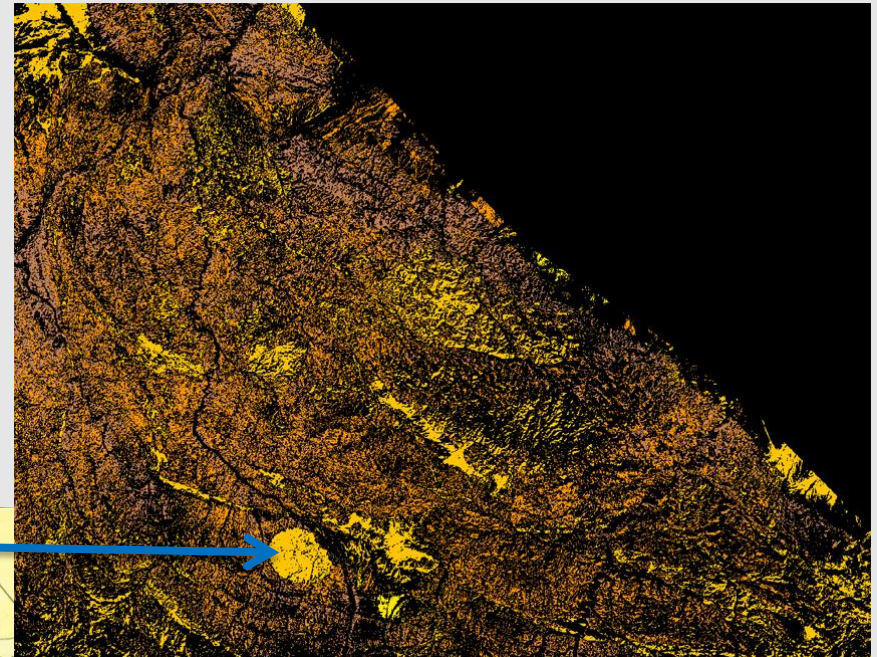
Date: July 16, 2011



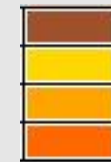
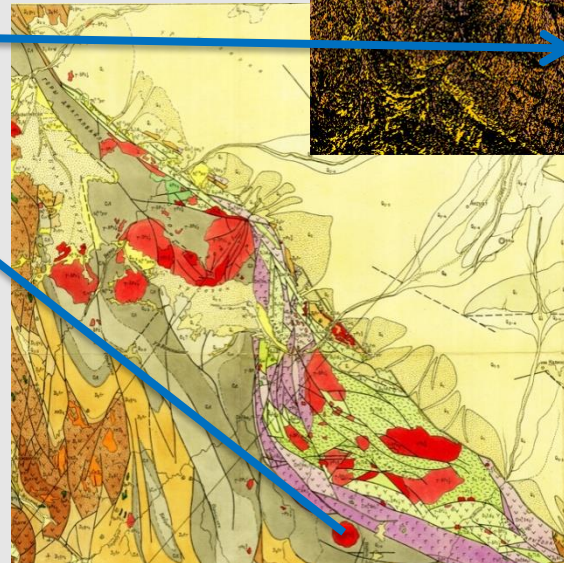
# Lithological interpretation of Remote Sensing Data



Landsat -8 (2013-09-02)



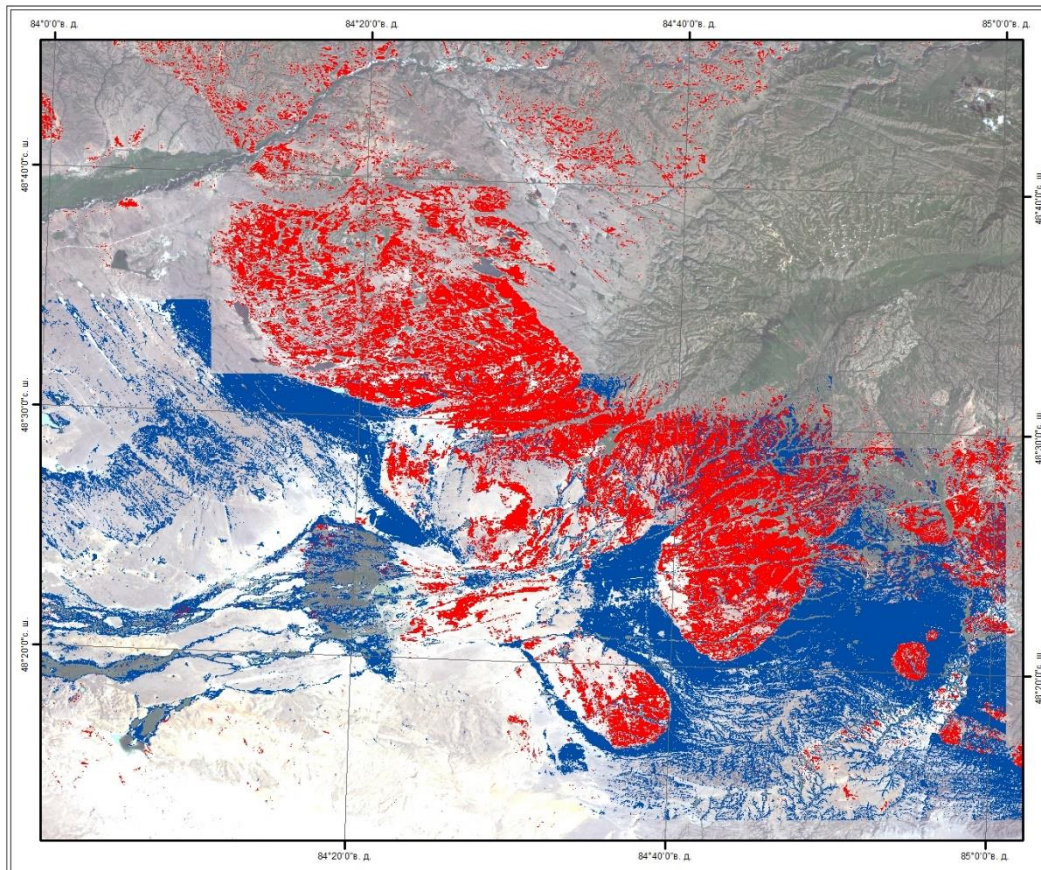
Comparative analysis of geological materials and satellite data



Effusives with different composition  
The Quaternary deposits  
Intrusions with acid composition  
Terrigenous deposits



# Map-Mask of hornfels distribution on the with granites





## Legend

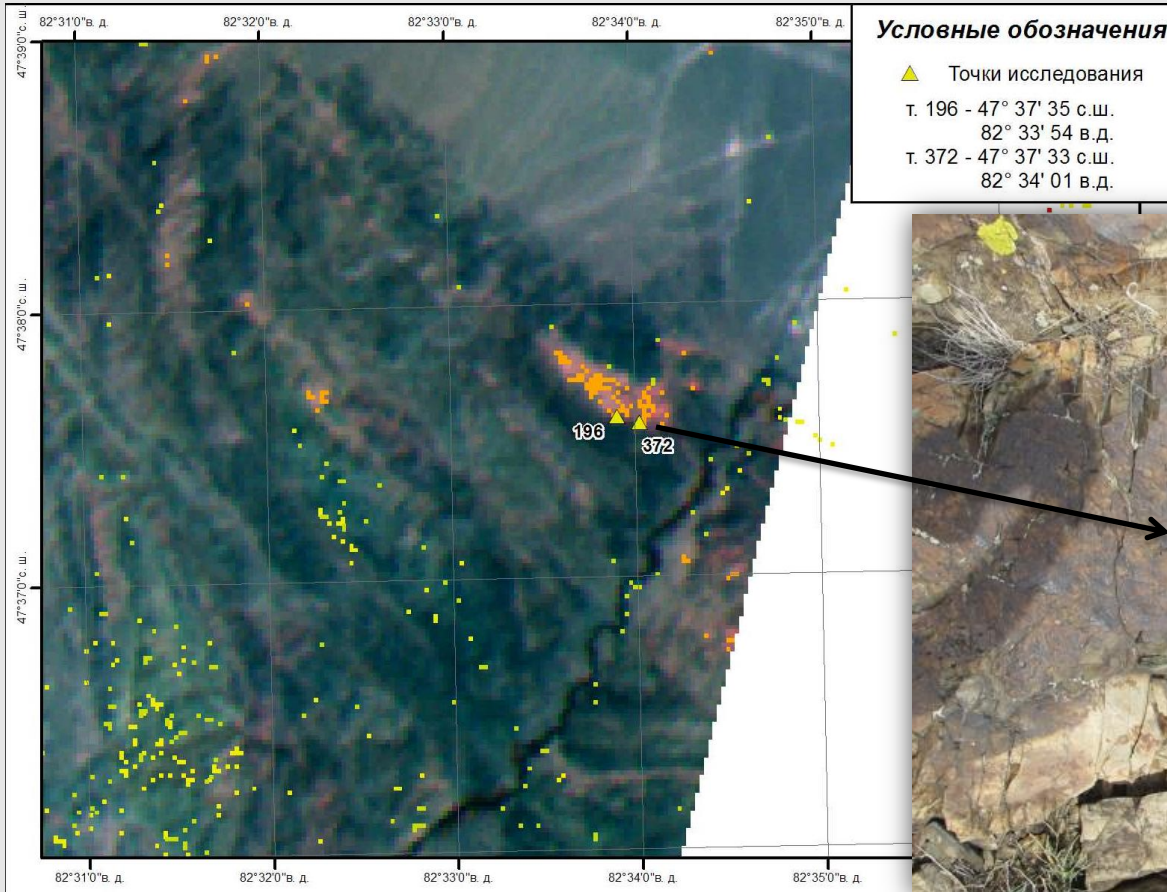
granites distribution area

hornfelsed rocks distribution  
area

*Условные обозначения*

-  площадь распространения гранитов
-  площадь распространения ороговикованных пород

# Verification of remote sensing data



**Desert varnish in the form of crust  
from hydroxides of iron**



**Map-mask the index of possible  
manifestations of iron**



# Airborne and ground geophysics

## Scope:

- **Technologies – magnetics, gravity, MT/AMT  
EM, Electro-Magnetics, IP(induced polarity)**
- **Industries - mining, petroleum, water, geothermal**
- **Mode - airborne, ground, borehole**
- **New leading edge technologies**

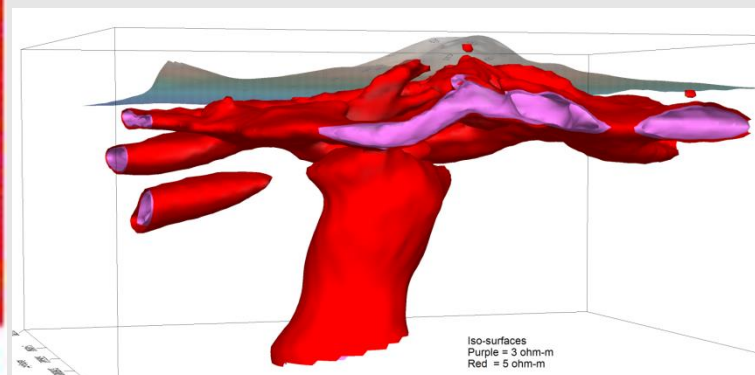
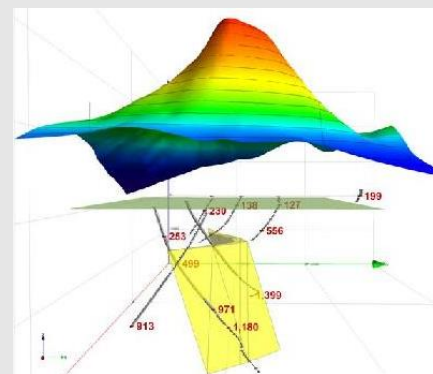
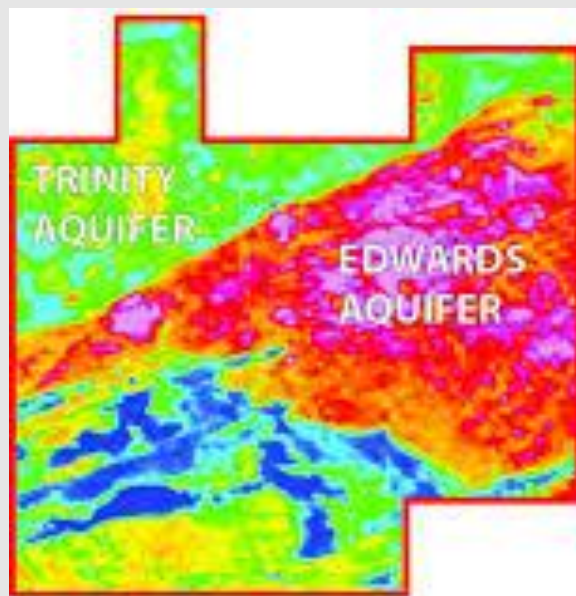
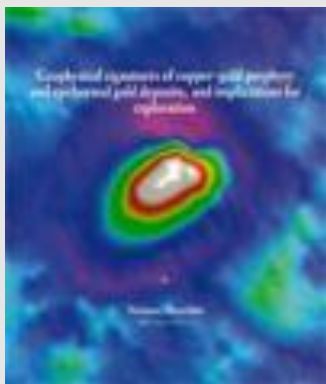




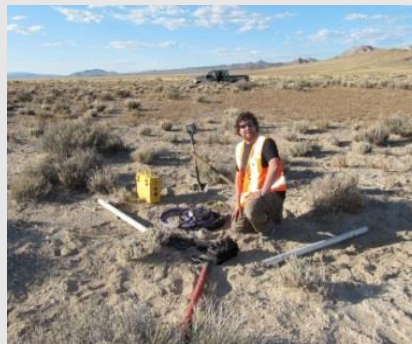
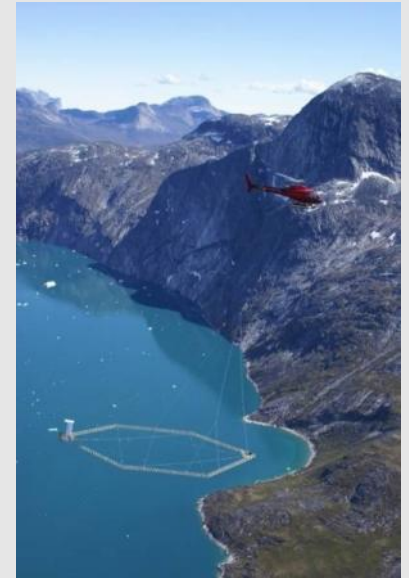
# Exploration - Разведка

Mining- Oil and Gas – Groundwater-Geothermal

- грунтовая вода
- горнорудная отрасль



# Integration of surface and subsurface data sets



# Data integration benefits

## Discover Resources

- Extend Existing Mines
- Advanced Exploration
- Regional Exploration
- Industry Exploration



## обнаружения ресурсов

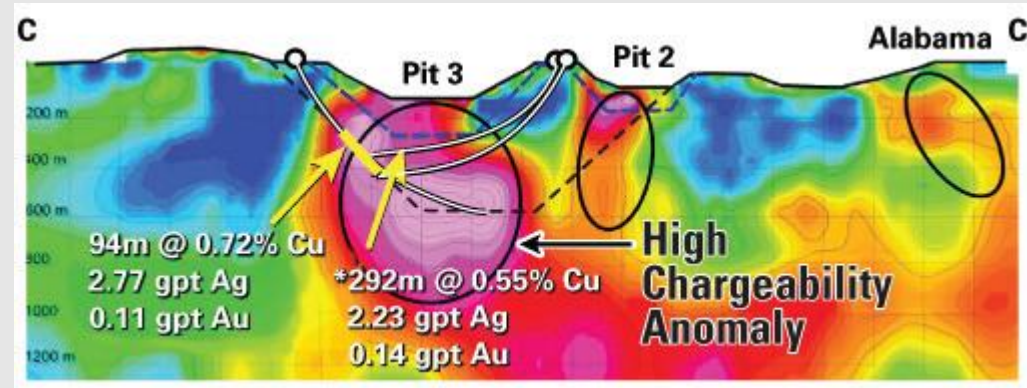
- Расширение существующих шахт
- Расширенные исследования
- региональная разведка
- отраслевая геологоразведка



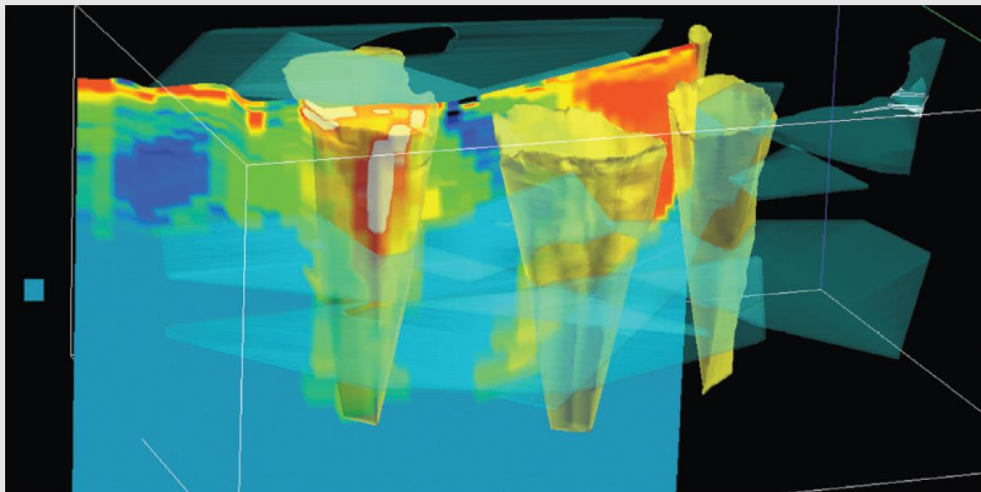
# Extend Existing Mines Расширение существующих шахт

Employment/Services

Social and economic impact



Copper Mountain, Canada



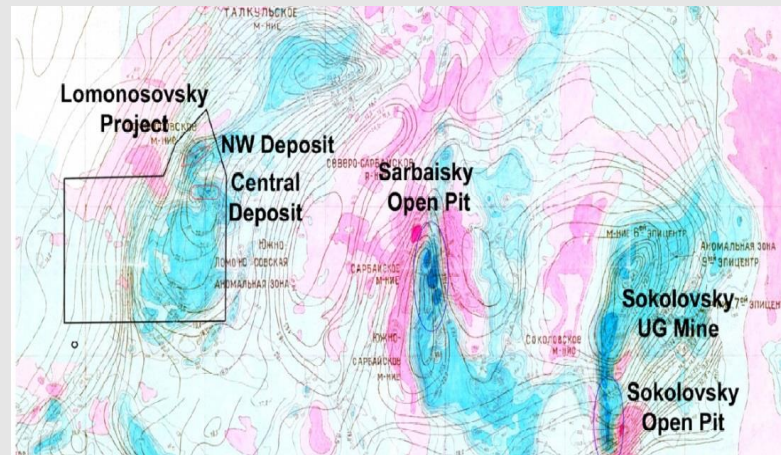
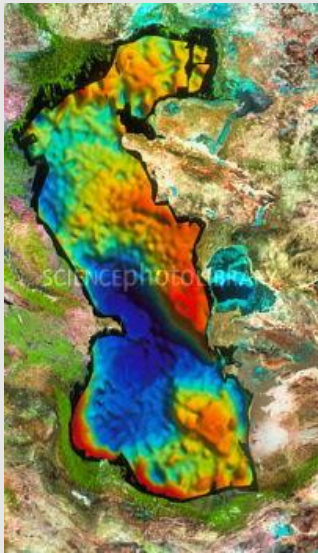
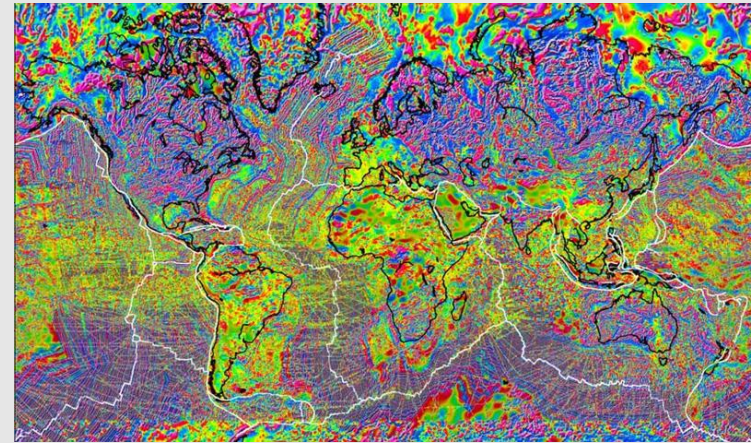
Jwaneng Diamond Mine, Botswana

Tax base/Revenue source

# Large Scale Mapping

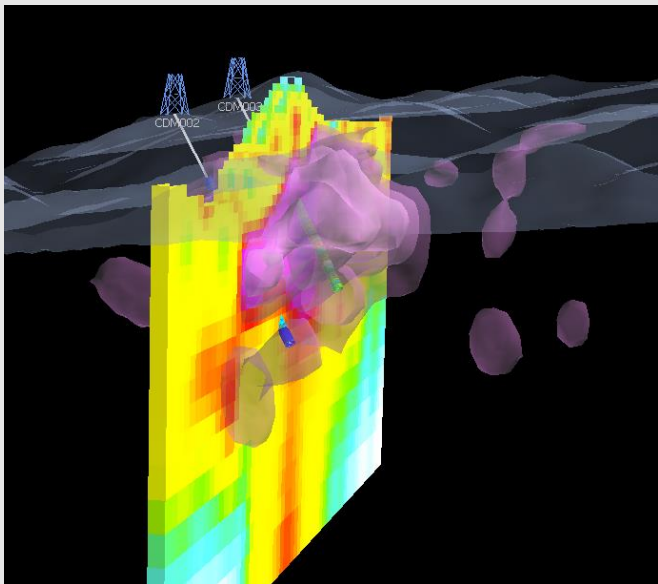
Региональная Разведка

Regional Exploration

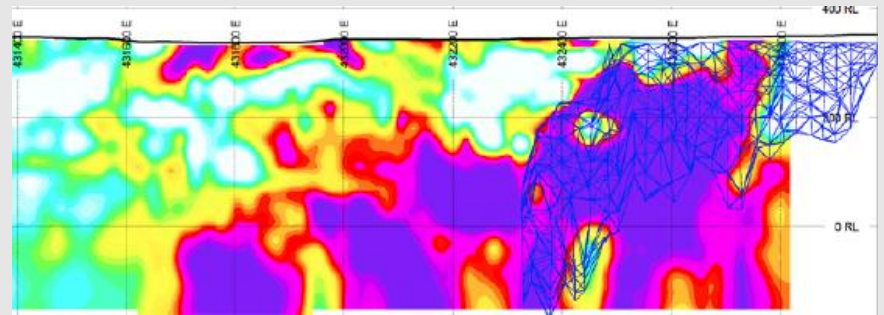


# Advanced Exploration

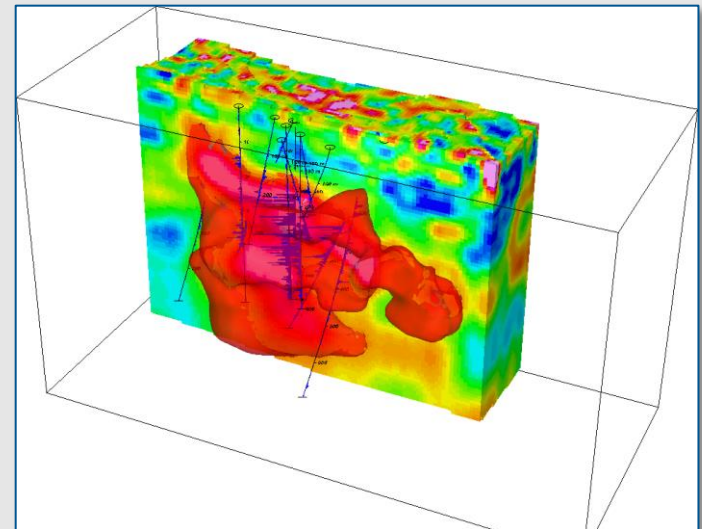
## Расширенные исследования



Santa Cecilia, Porphyry Chile



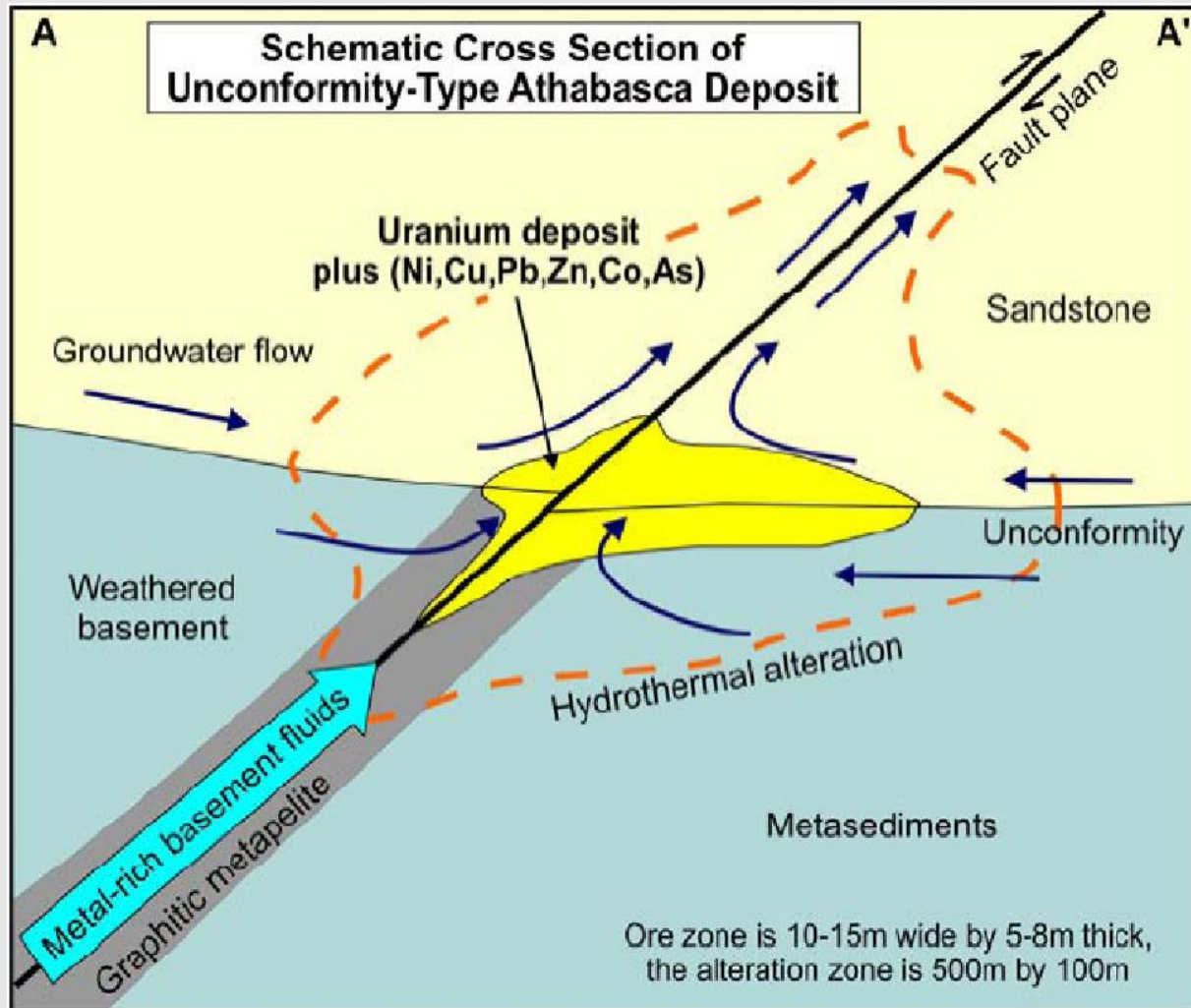
Junior Lake, Nickel, Canada



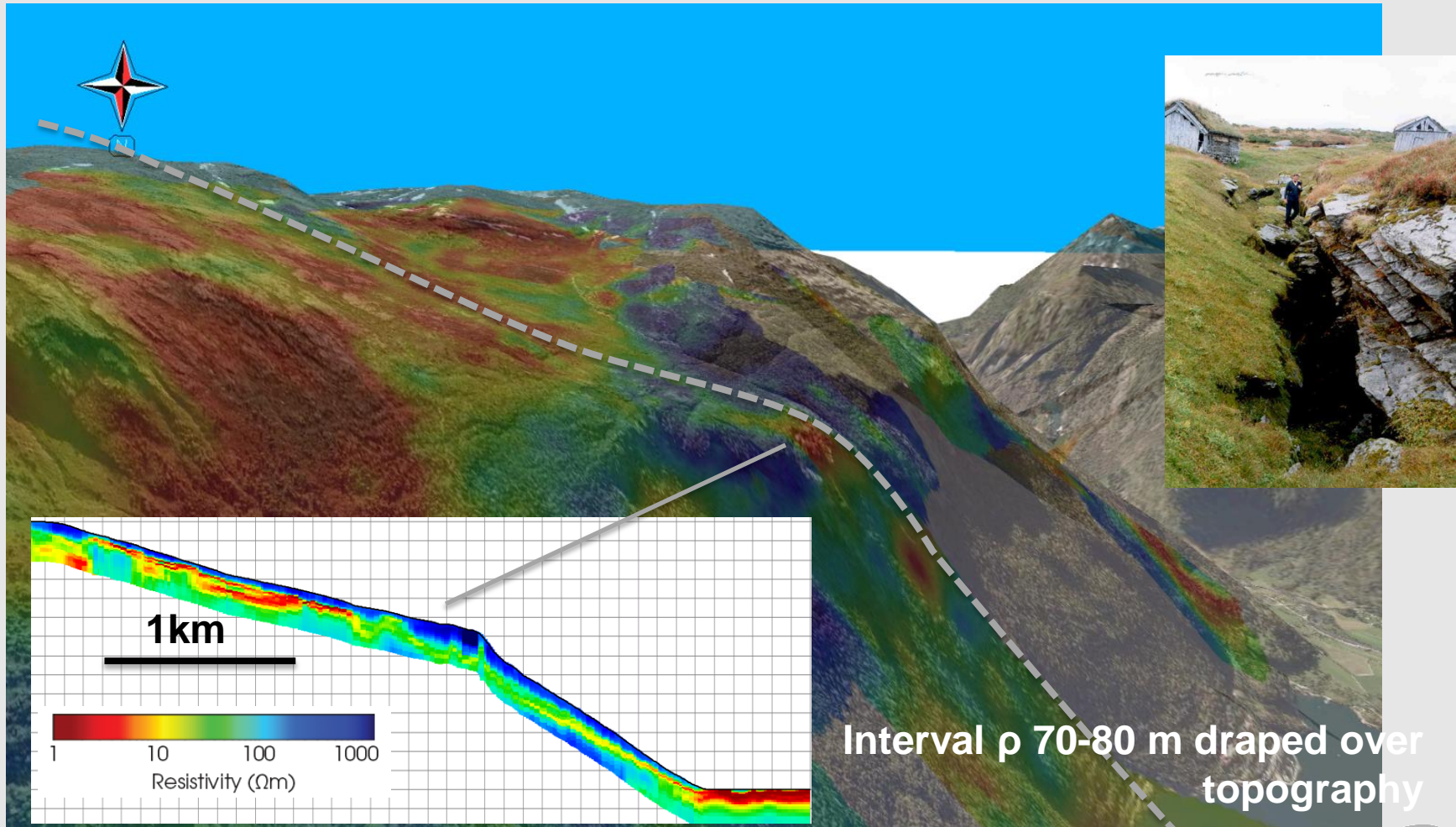
Mumbwa Copper IOCG, Zambia



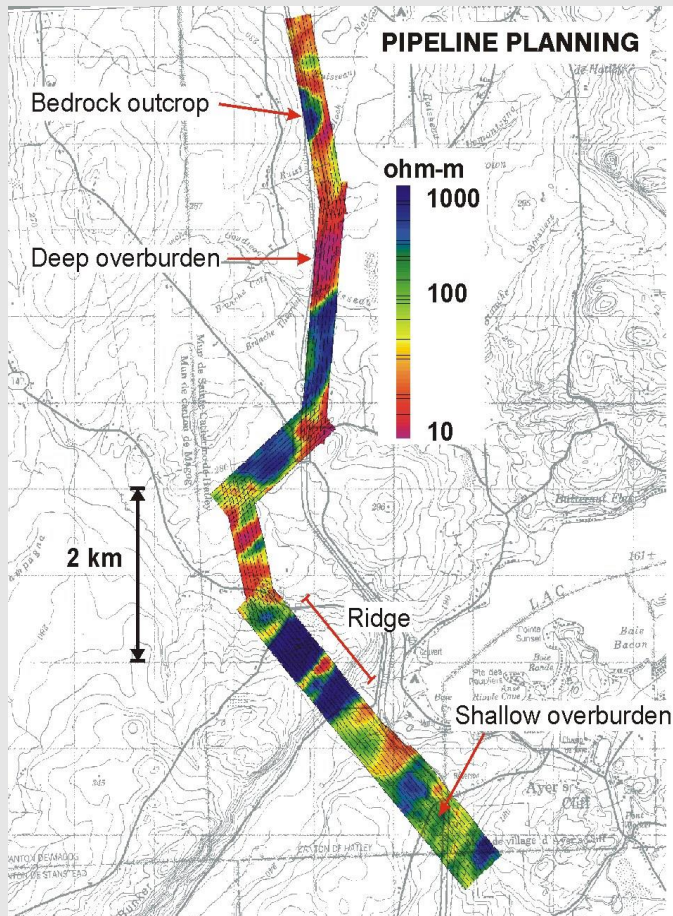
# Alteration Plumes – Uranium Analogy



# Engineering - Complex anomalies connected to rock slides



# Pipeline and route Planning & Detection

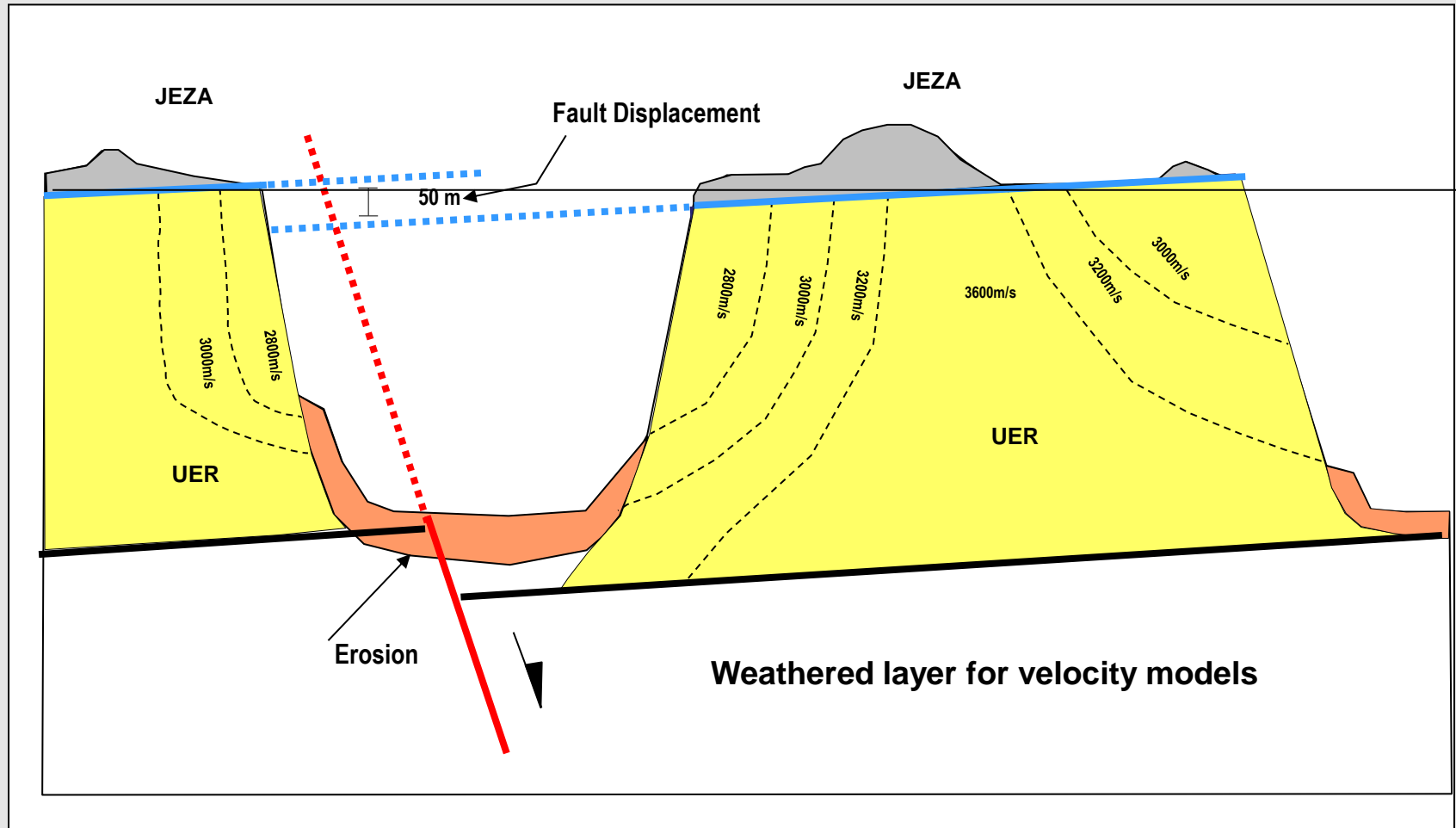


- Pipeline detection: horizontal gradient mag, low and slow acquisition.
- Pipeline corridor mapping
  - Identifying bedrock to minimize blasting cost
  - Map conductive geology for installation of cathodic protection



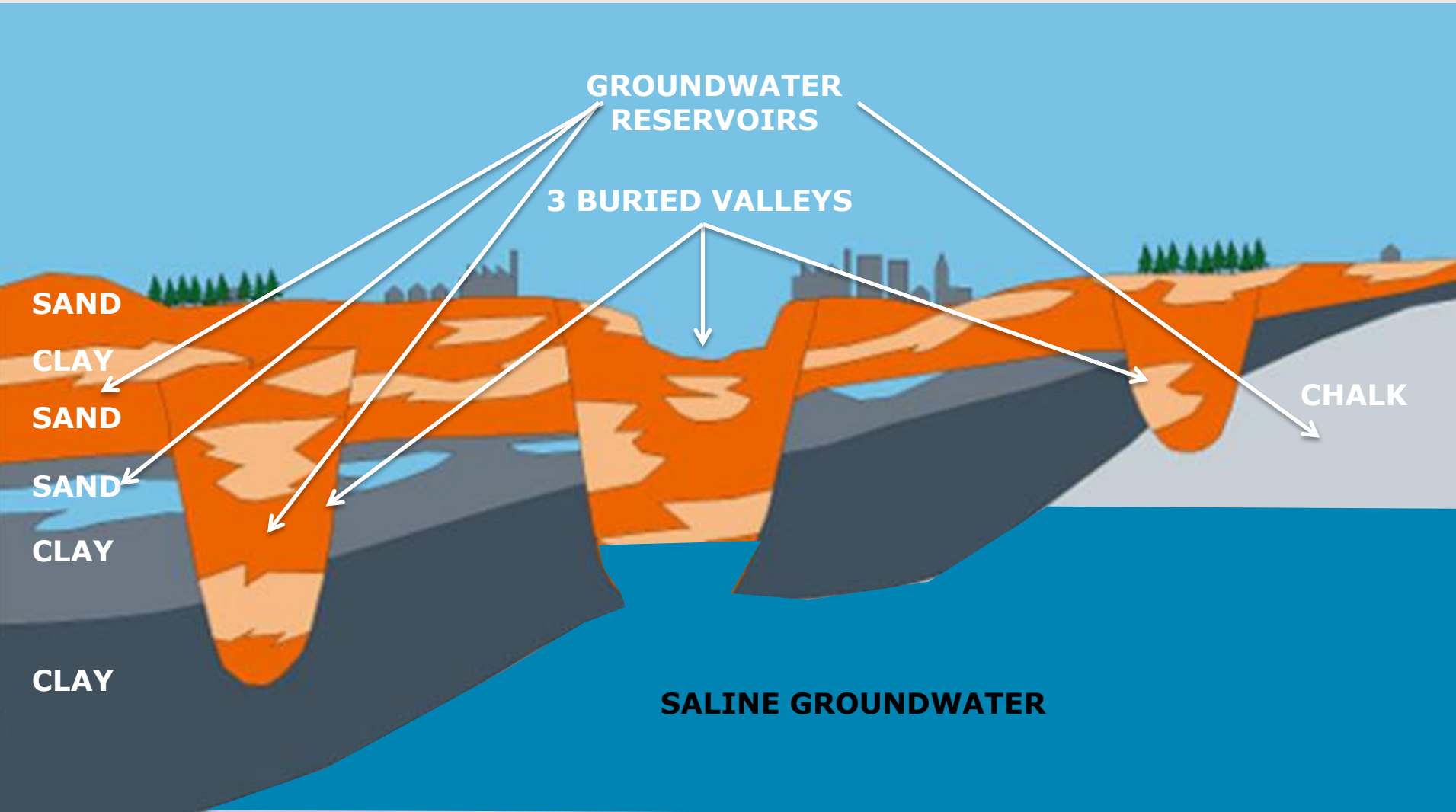
# Fault Displacement

Wadi erosion obscures fault.

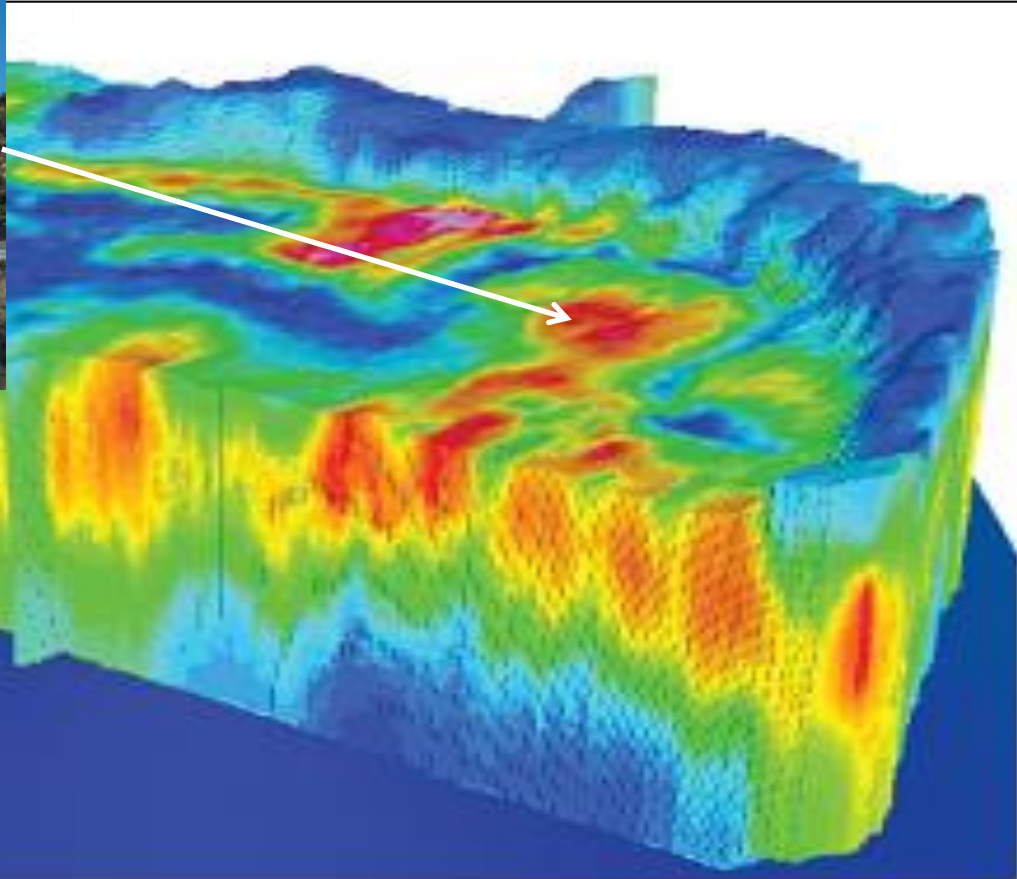


# Groundwater resources

25



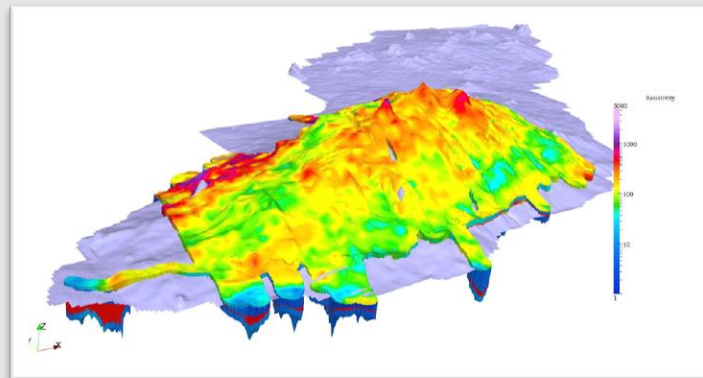
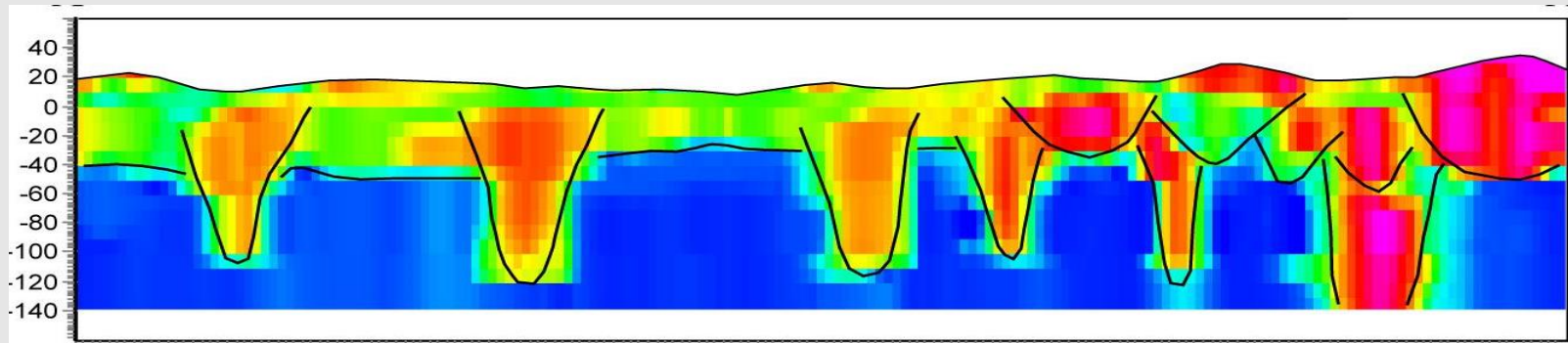
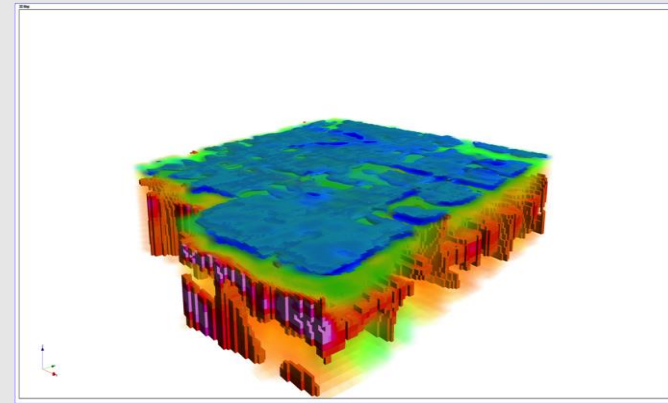
# Salinity Mapping Murray River, Australia





# Deliverables

- **Wide variety of products available**
- **1D, 2D and 3D imaging**
- **Quick delivery of preliminary data**



# Knowledge Transfer

Technology – Operations – Interpretation

## Передача знаний

Технология – операции- интерпретация

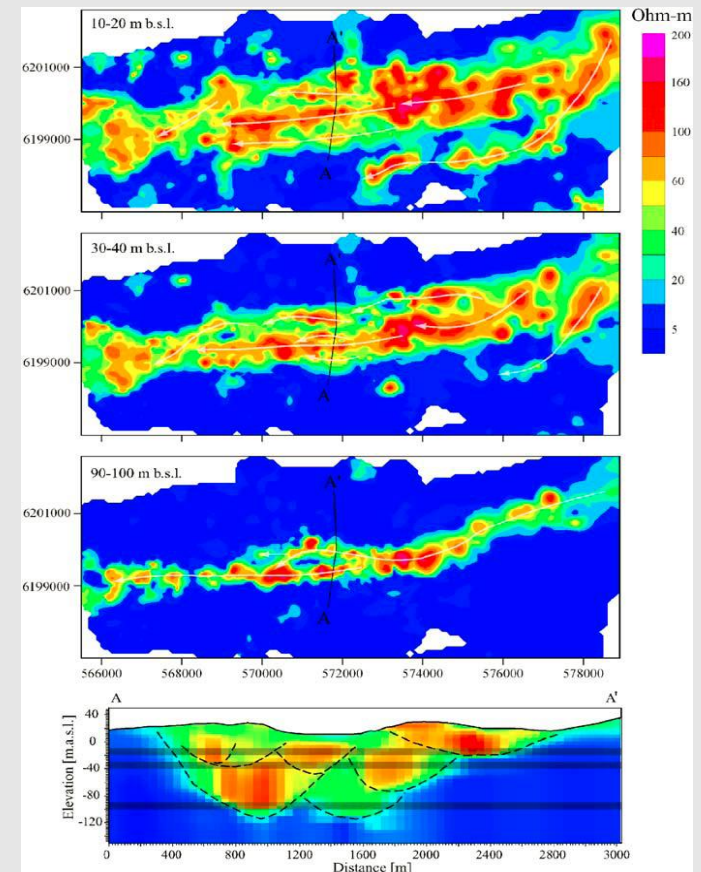
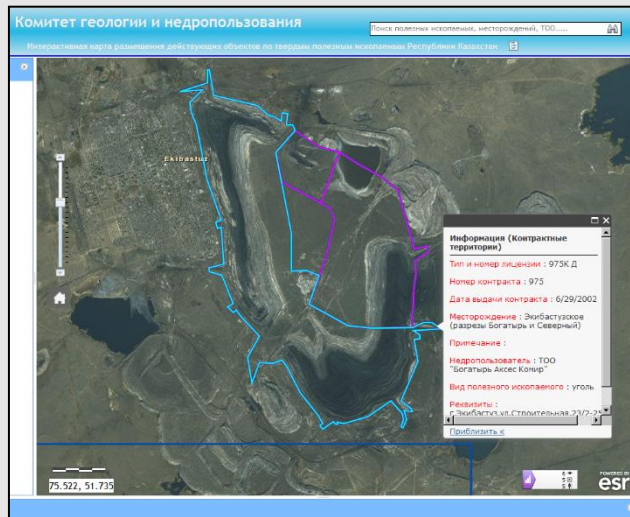
Develop relationships with local Universities  
Mentor geophysical interns and graduate students



# Opportunities of geoportal

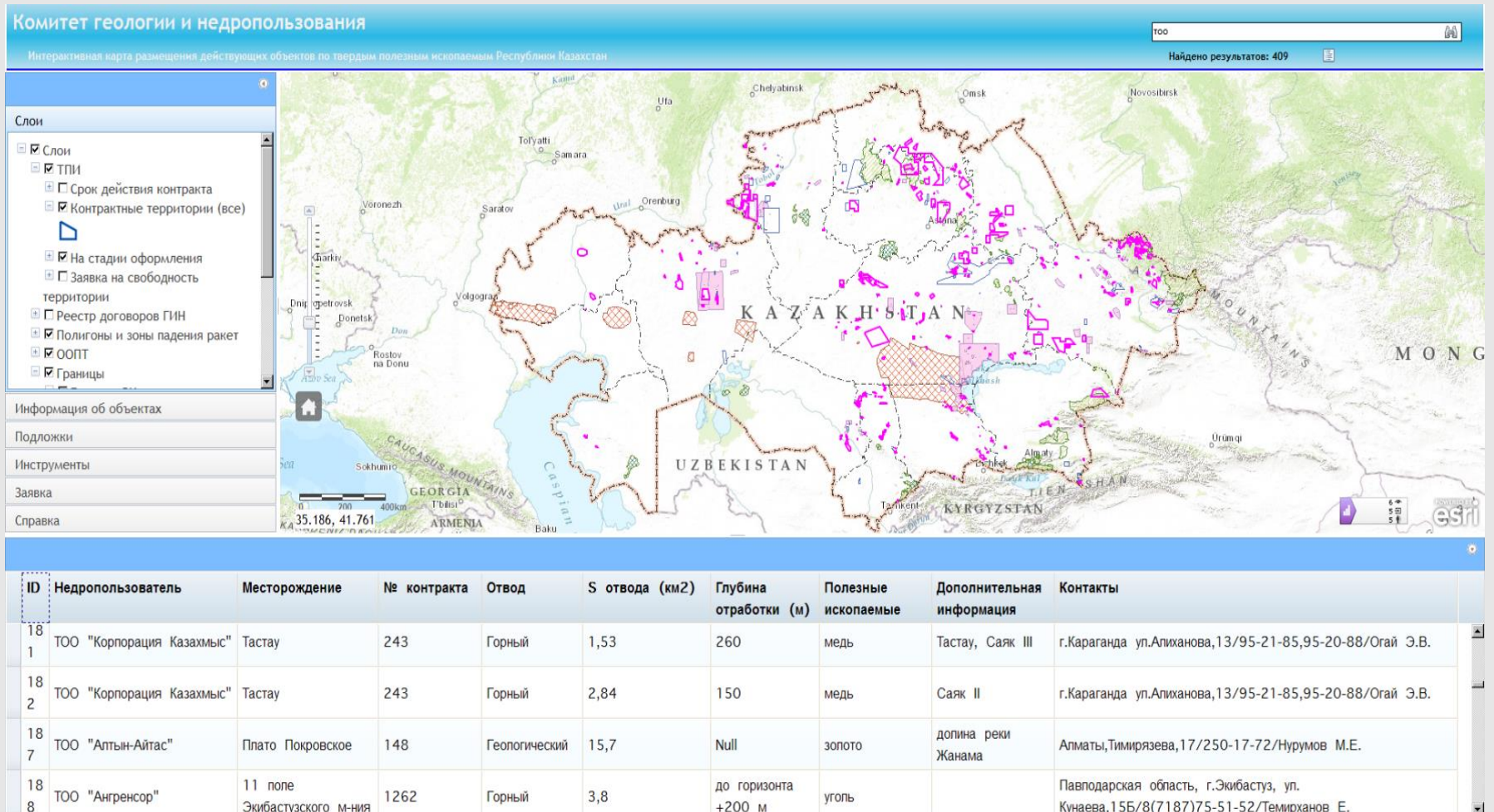
The project was developed on behalf of the Committee of Geology and Subsoil Use of RoK in 2013-2014 and continues today

- 1) Search of subsoil objects according to different criteria
- 2) Browse available information about the object
- 3) Formation of application for the development of a new object of subsoil
- 4) Drawing of the new subsoil object in the object drawing mode or by entering of the existing coordinates





# Opportunities of geoportal



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**Astana – Kazakhstan, March 17-19 2015**

- Thank you