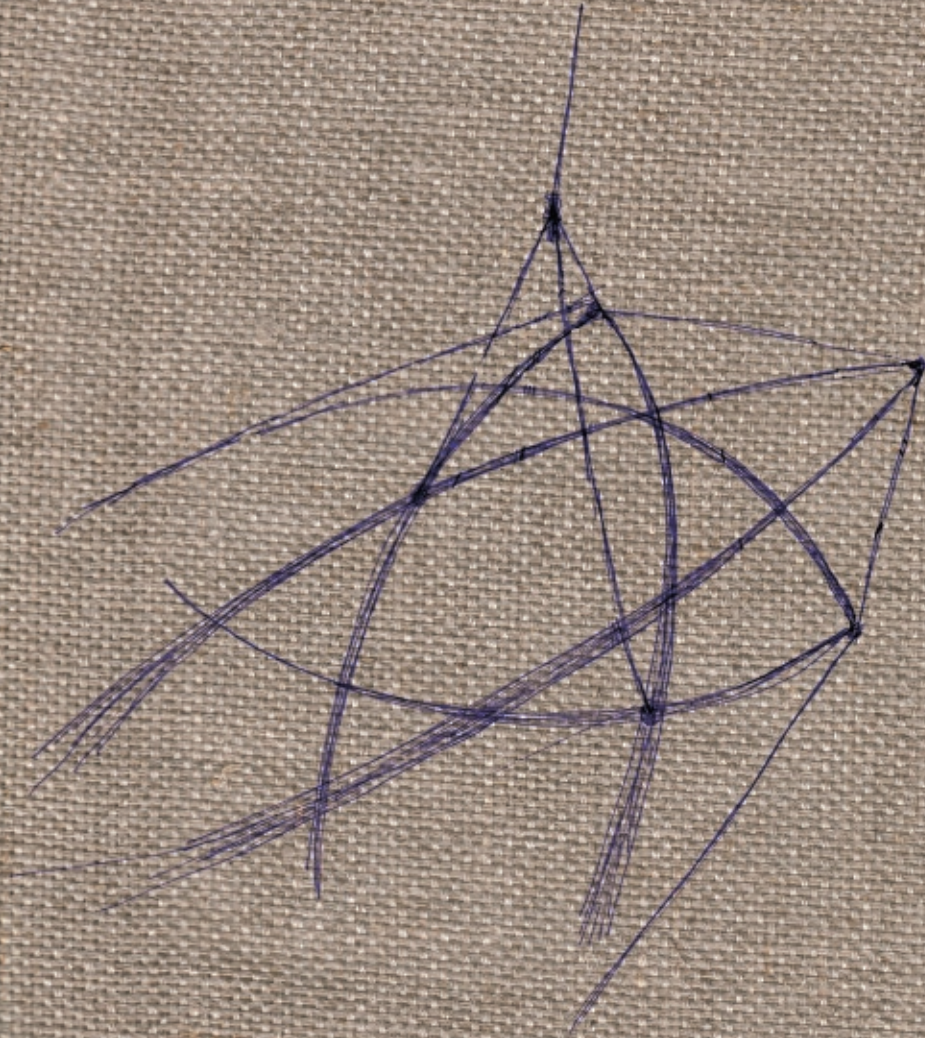


# **GEO TECHNOLOGIES**





# TO BEGIN WITH...

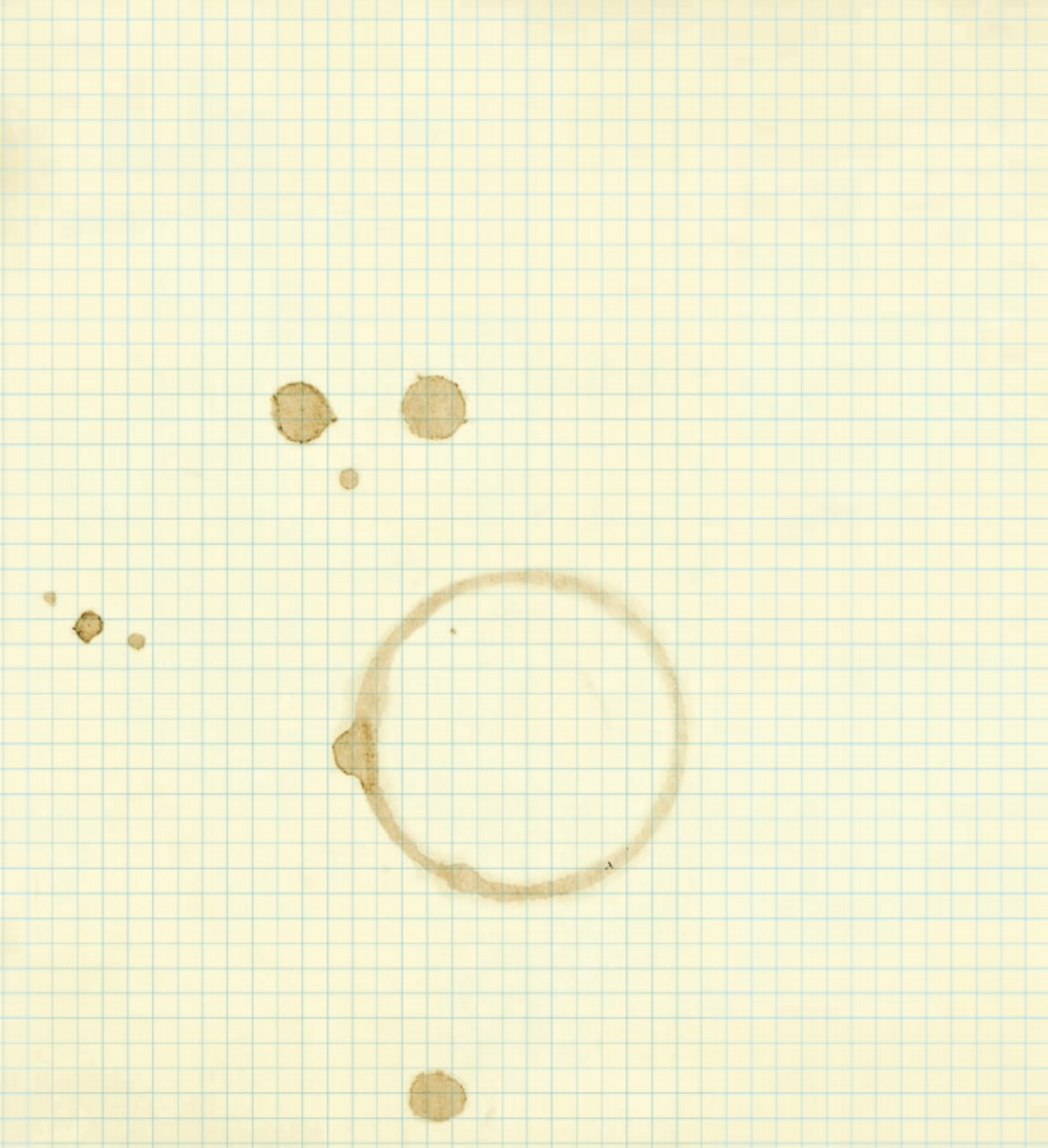
Our group is known for a long time due to  
our activity in geophysical technologies  
development.

Since 2005 we are **GEOTECHNOLOGIES**

Sense of purpose, solidarity and experience  
allow us to be always on top!

We hope you will be interested in these  
pages.







# AIRBORNE ELECTROMAGNETICS



Do you want to survey up to  
**1000 km** in a day?  
**NOT A PROBLEM!**  
Just have a look  
on these  
pictures



70 m long tow cable

Transmitter loop

This is **EM-4H** - the most popular airborne EM-system in Russia



What else?

**EM-4H** is a  
frequency domain  
system, bandwidth from  
130Hz to 8kHz  
Monitoring of system  
geometry with the  
accuracy of 10 cm.



Towed  
weight about 30 kg

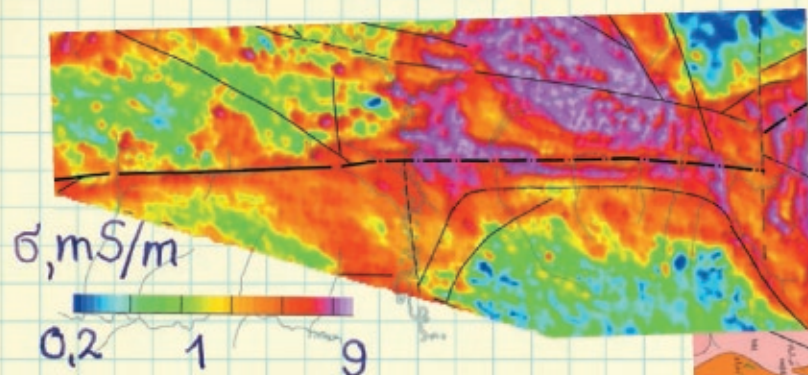
**AND LOOK!** We've got very interesting pictures here!



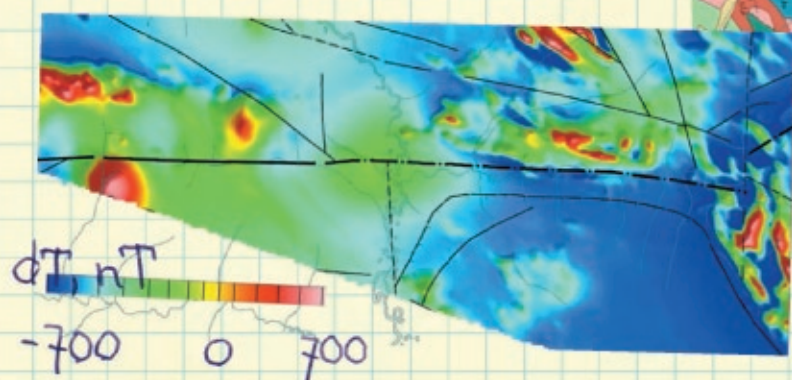
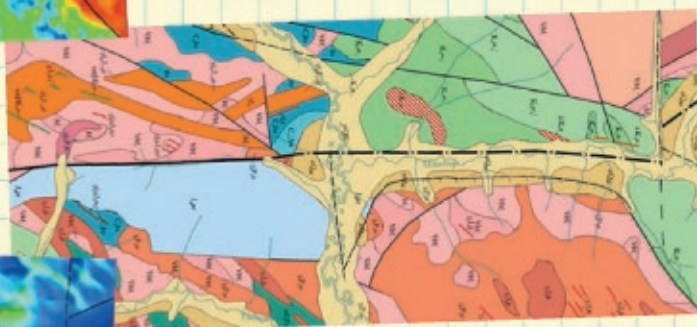
# AIRBORNE ELECTROMAGNETICS

EM-4H measures full response vector as precise as 1% and here are some results (courtesy of NF VSEGEI,

[www.nfvsegei.com](http://www.nfvsegei.com))

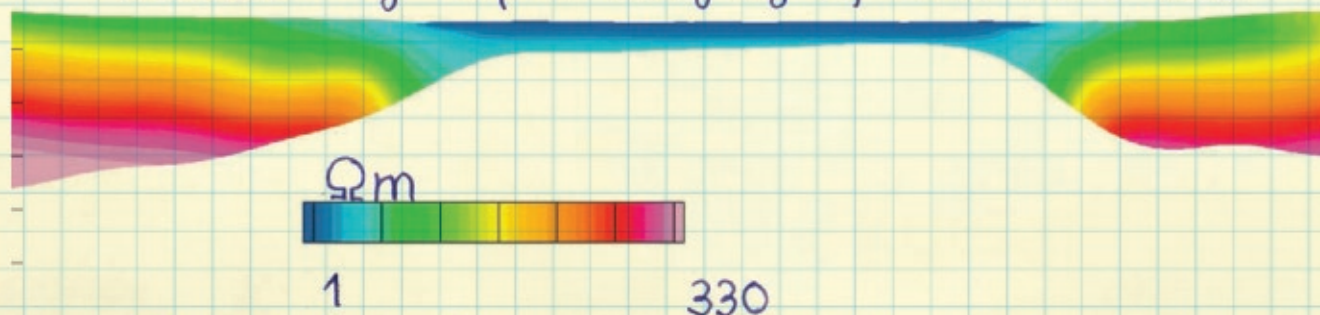


8 kHz conductivity map



Magnetic anomaly map

Resistivity depth imaging of salt lake Tus

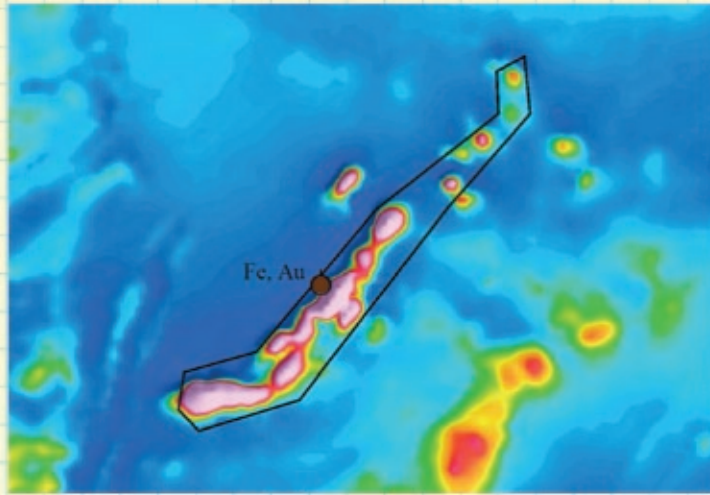


Geotechnologies — [gp.gtcomp.ru](http://gp.gtcomp.ru) —



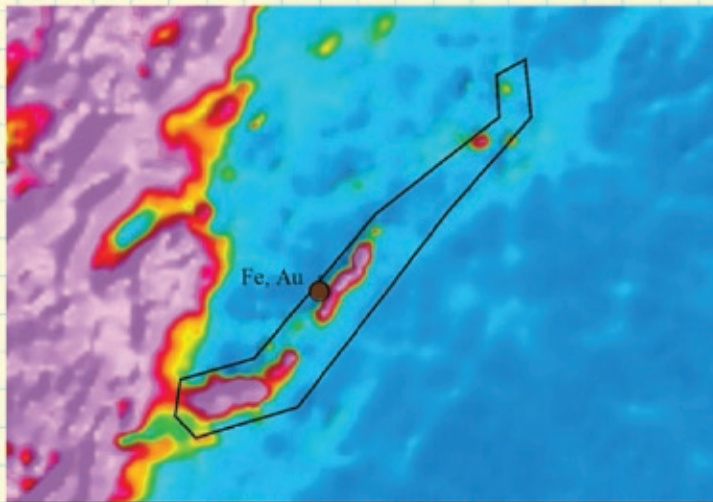
# AIRBORNE ELECTROMAGNETICS

## Magnetic anomaly map



$\Delta T, \text{nT}$  -2000 500 1000 15000

## 2080 Hz conductivity map



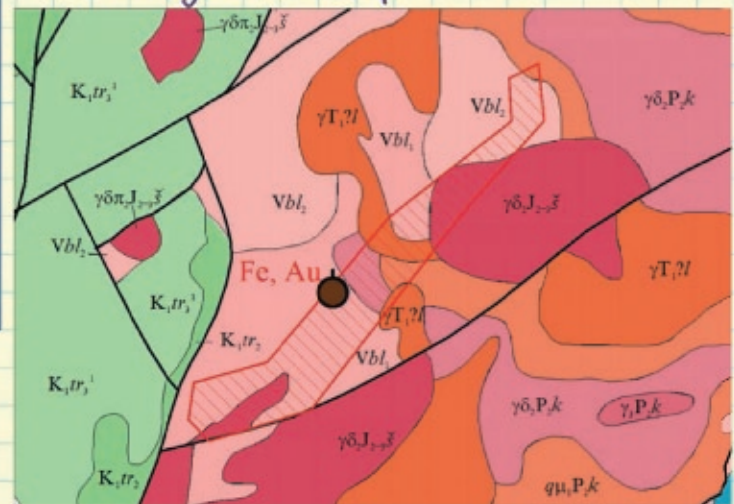
$\sigma, \text{S/m}$  0,0001 0,0012 0,1  
2,5 0 2,5 km

Boron-iron-ore deposit Zheleznii ridge is a contact metasomatic type of the deposit. It includes discontinuous magnetite ore bodies in sedimentary-metamorphic isolator layer along its' contact with granitoids.

86 ore bodies were located on deposit area. Their thickness variates from 5 to 50 m. The mixture of massive and impregnation ores mainly consists of ludwigite-magnetite and pyrrhotite-magnetite. Also there are gold-sulphide and pyrrhotite ores. Total iron in ores (tenor) is 53.3%. Total  $\text{B}_2\text{O}_3$  in ludwigite-magnetite ores is up to 4.61%. Total sulfur variates from 3-7 to 20%. Single gold-ore bodies were picked out with total gold from 1-3 to 12.7 gram per ton.

Highly gold linear residual soil up to 10-15 m depth was picked out in mineralized zones. Its average concentrate of gold is 37.2 gram per ton.

## Geological map



Thanks to NF VSEGEI [www.nfvsegei.com](http://www.nfvsegei.com)

Geotechnologies [gp.gtcomp.ru](http://gp.gtcomp.ru)



# AIRBORNE ELECTROMAGNETICS

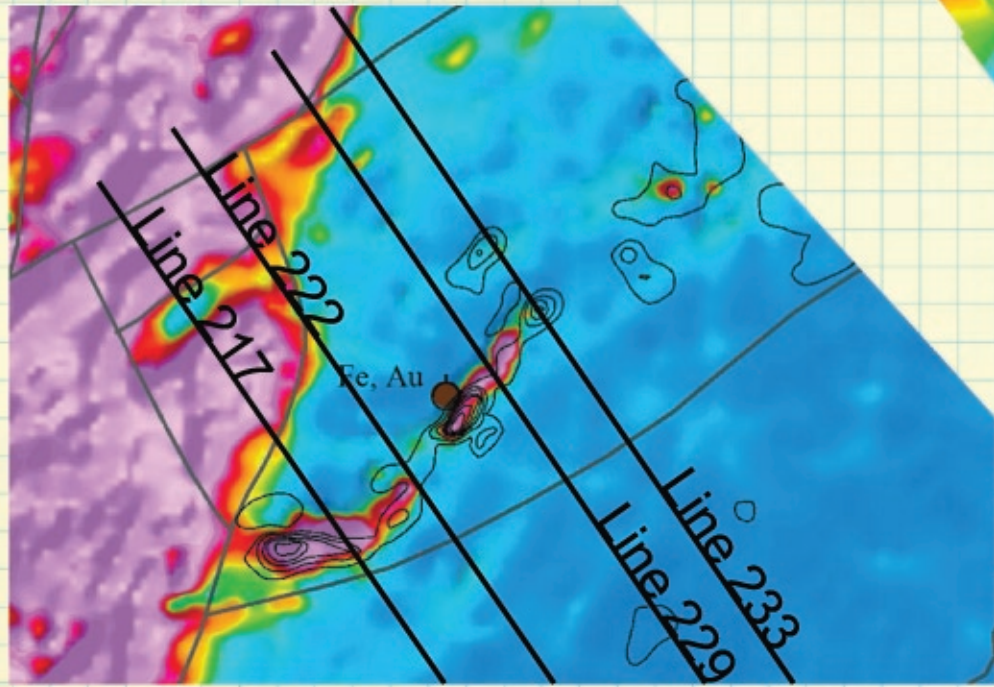
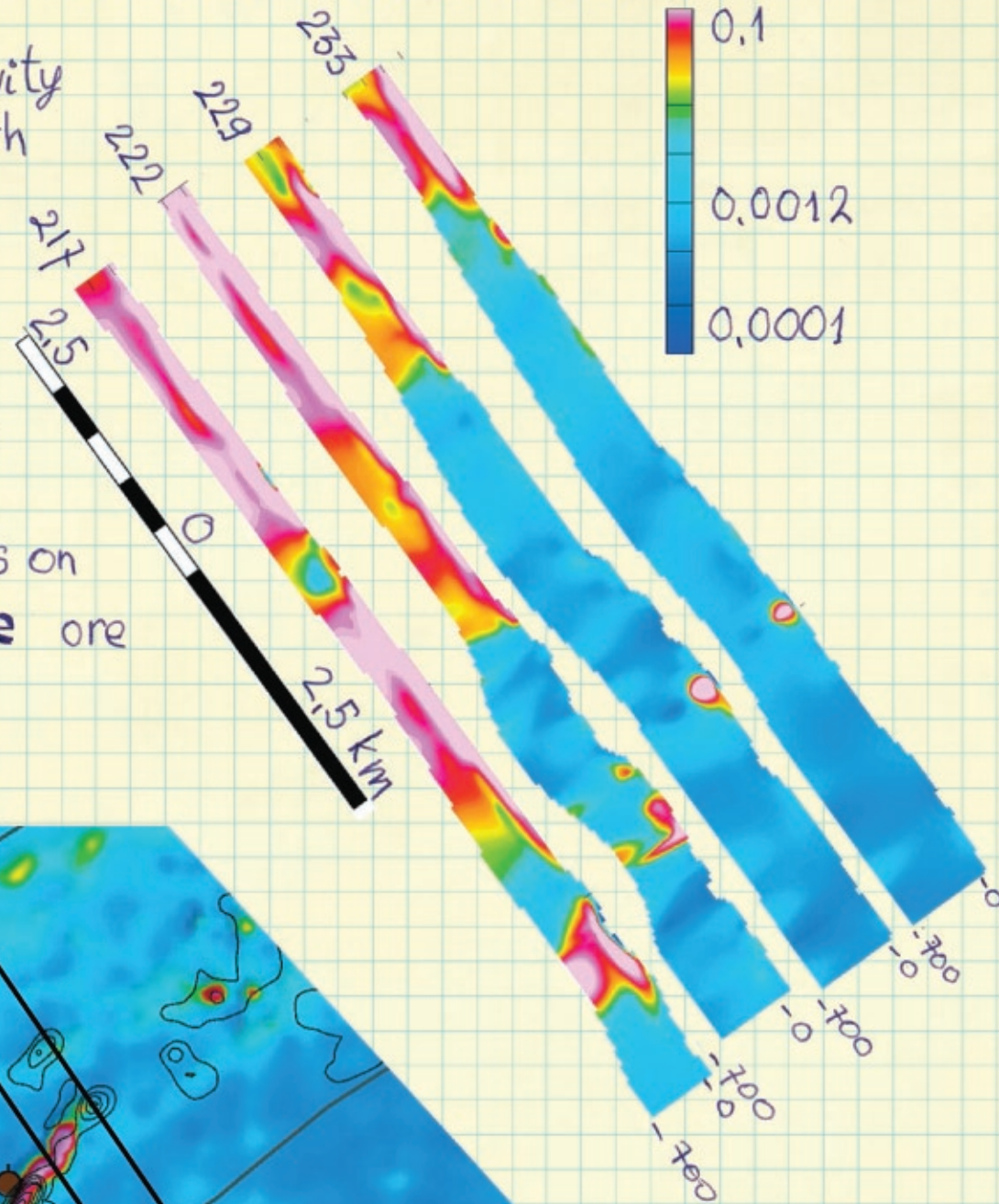
$\sigma$ , S/m



Apparent conductivity map combined with anomaly magnetic field,

outlines of main tectonic structures

and pseudosections on **Zheleznii ridge** ore deposit



Thanks to  
NF VSEGETI  
[www.nfvsegei.com](http://www.nfvsegei.com)

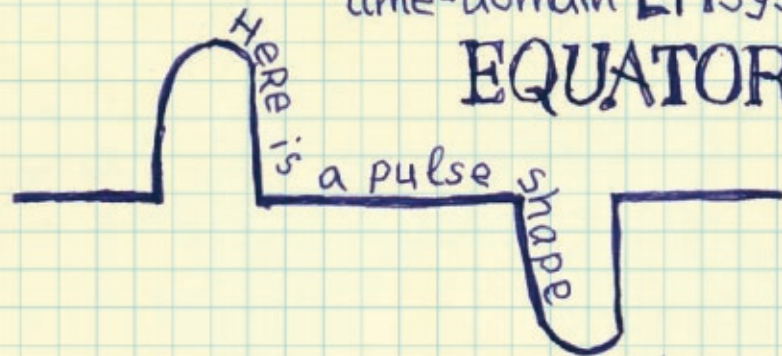


# AIRBORNE ELECTROMAGNETICS

There is something really new!

Let us introduce  
time-domain EM system

## EQUATOR



77Hz base frequency coupled with  
high-frequency signal analysis gives  
deep penetration and good resolution  
even at subsurface.



But the most interesting features are  
on the next pages!

— Geotechnologies — [gp.gtcomp.R4](http://gp.gtcomp.R4) —





# AIRBORNE ELECTROMAGNETICS

Survey speed can vary from 0 to 170 km/hr!

How it works:



We transport it  
by a car...

...then we mount it  
in 4 hours...



...and carry it to a flight  
start position



# AIRBORNE ELECTROMAGNETICS

## Specifications:

- Transmitter coil diameter 7.5 m
- Peak dipole moment 100 000 Am<sup>2</sup>
- Calibration is required only once per flight due to unique system of signal stabilization
- Tow cable 70 m
- Total system weight 250 kg

Receiver and magnetometer



Transmitter loop

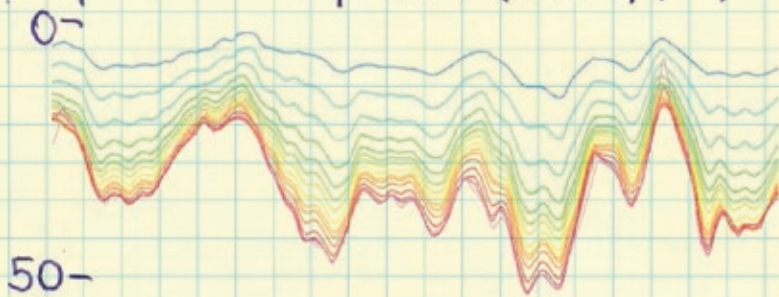


# AIRBORNE ELECTROMAGNETICS

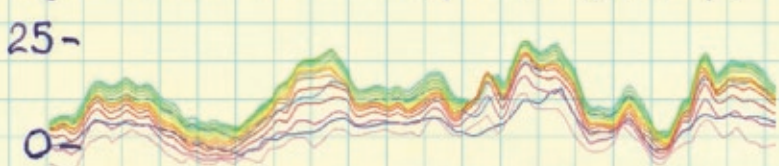
Here are some flight test results in quite conductive region.

Due to full-time measurements frequency analysis is possible in a bandwidth from 77 Hz to 12 kHz

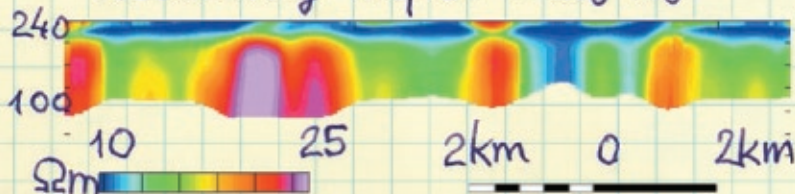
Inphase response (1000 ppm)



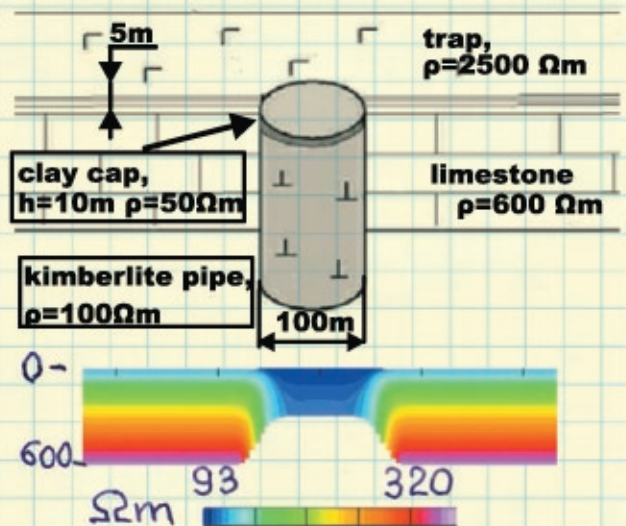
Quadrature response (1000 ppm)



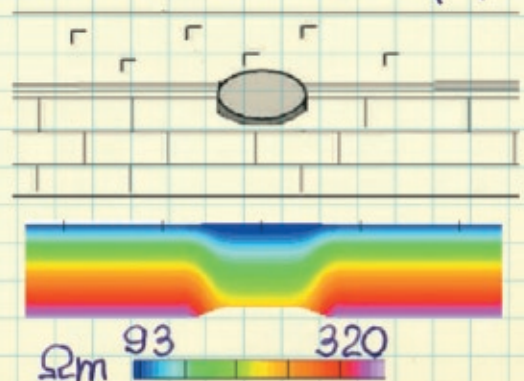
Resistivity depth imaging



Here is the result of EQUATOR response modeling for Yakutia typical kimberlite pipe covered by trap.



The same model but without kimberlite pipe





# Innovations In traditional methods

# MAGNETICS

**PROBLEM:** Industrial noise

**ANSWER:**

Magnetometer **GT-MVS-SB**

**WHY?** Because its sample rate is up to **500** samples per second. This allows to remove **50** or **60Hz** noise.



Other details:  
Internal GPS receiver  
USB flash drive for data recording.

Weight (including batteries) 10kg  
Sensitivity:  $0,2 \text{ pT}/\sqrt{\text{Hz}}$

**LOOK!**

There's no wires: for all operations Wi-Fi connection is used and an operator uses PDA

Survey results are on the next pages





# MAGNETICS

## Archeological investigations



This survey was conducted in the Luzhnetsky monastery (Russia, Mozhaysk town) in 2009

- survey area
- electric power line
- burnt building

Recent photo

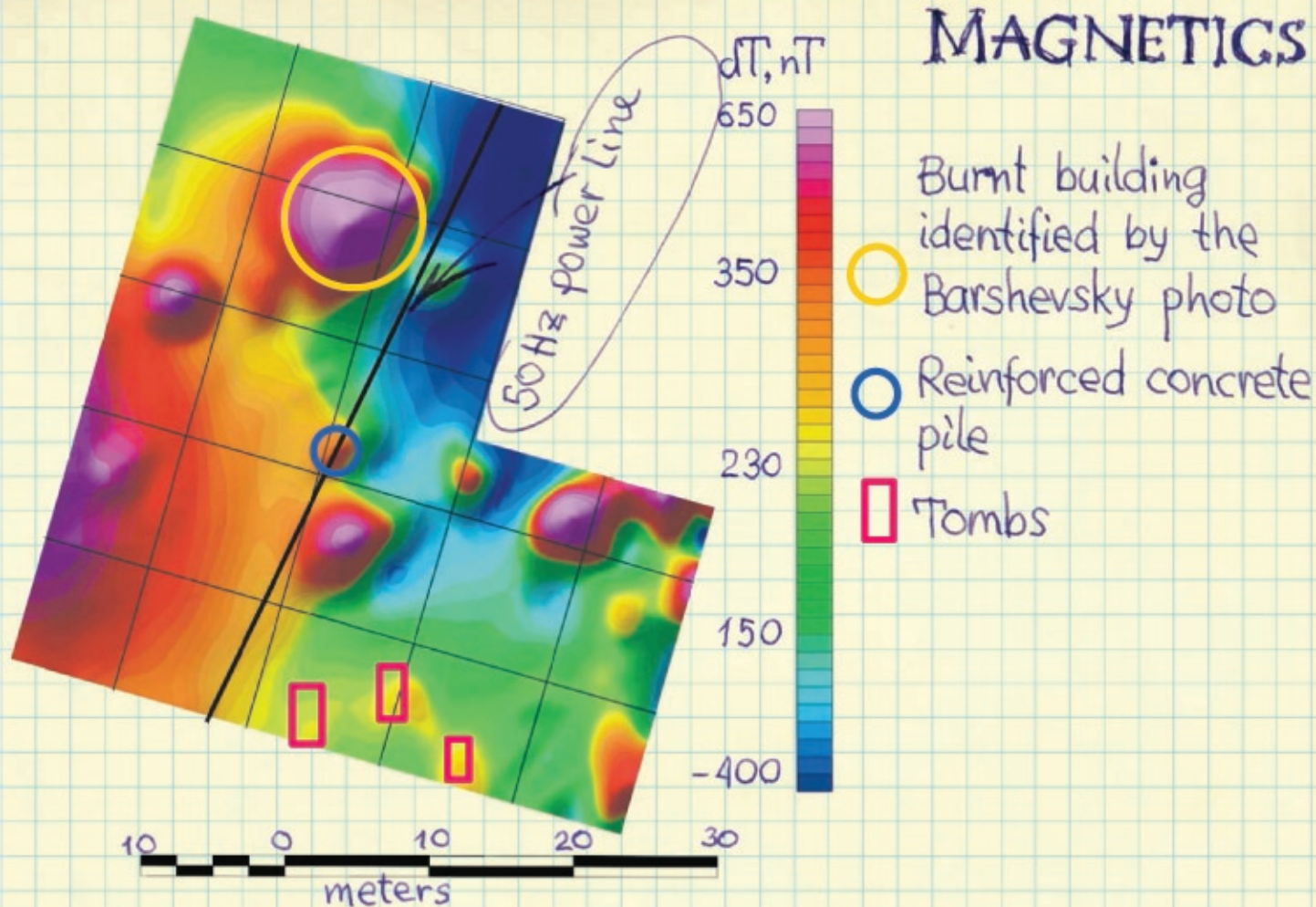
photo taken in 1890 by Barshevsky.



Внутренний вид Лужецкого монастыря  
Фотография И.Ф. Баршевского. 1890 г.  
Государственный исторический музей

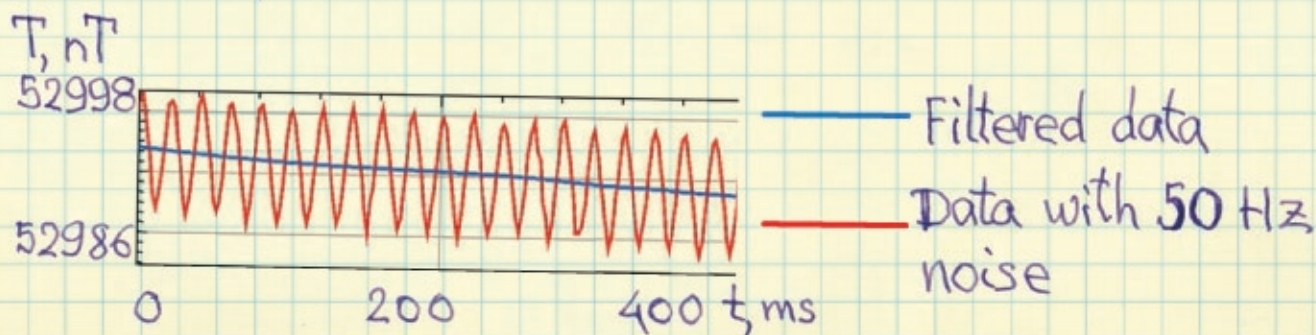


# MAGNETICS



## Data processing

Only high sample rate of recorded data allowed to get the map above.

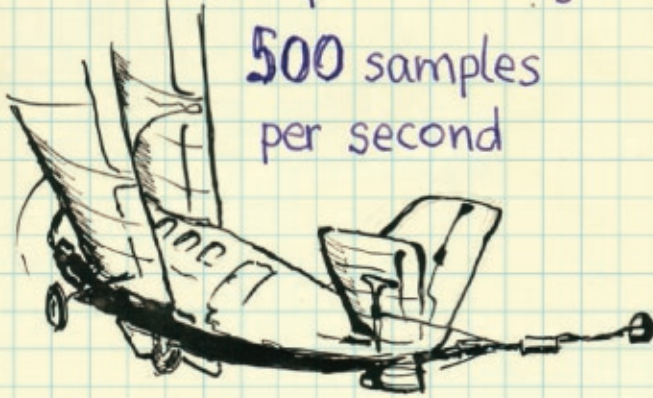




# MAGNETICS

Airborne survey

500 samples  
per second



Flux-gate  
sensor

Cesium vapor  
sensor



Our system NAVDat is used  
for data integration and  
navigation. REINMAG  
software provides real-time  
compensation

High sample rate and  
special signal processing  
algorithms result in high  
accuracy and high spatial  
resolution



Our base station  
GT-MVS-SB



# AIRBORNE INFRARED IMAGING

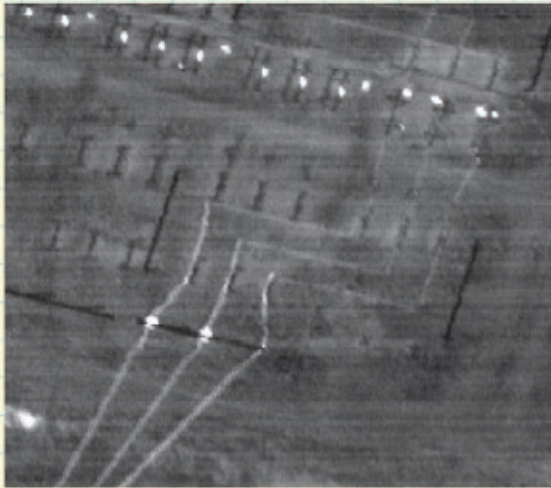
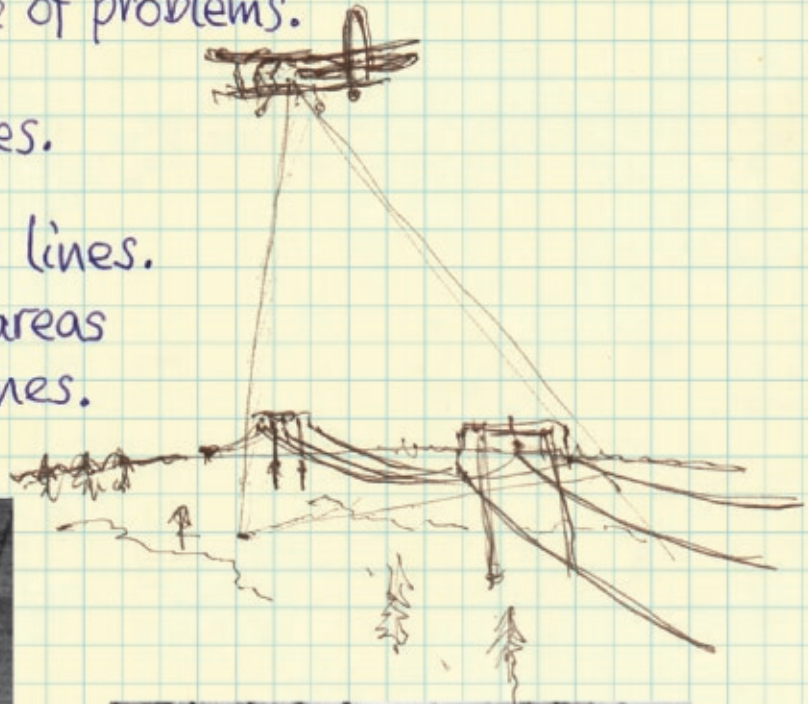


This is an airborne infrared scanner **SCAN-T**

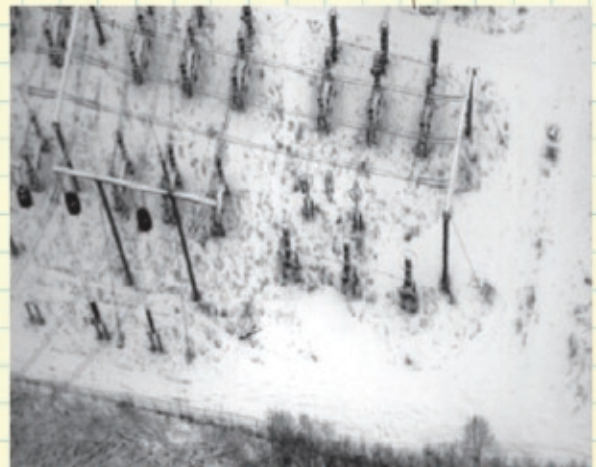
It can solve a wide range of problems.

Here are some examples.

Electric loss in power lines.  
We can detect problem areas  
by flying along power lines.



Infrared thermal image

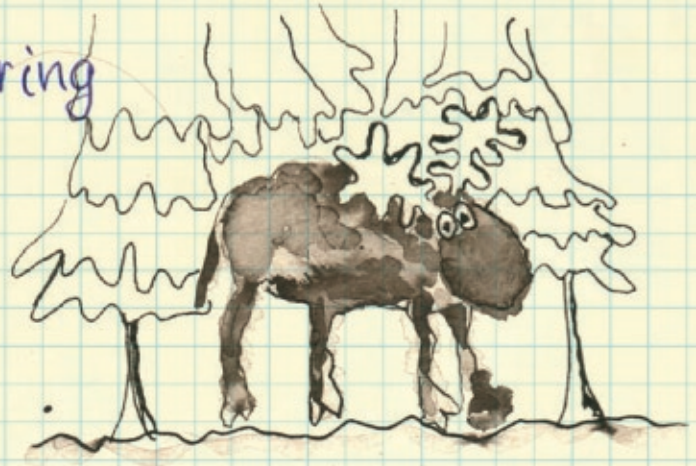
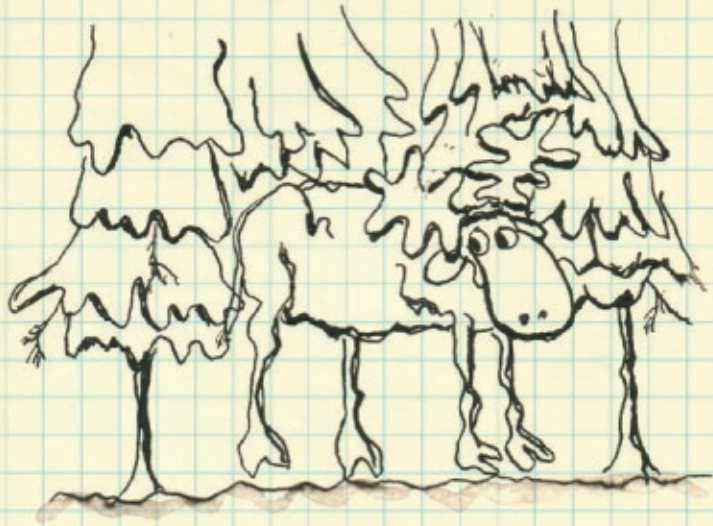


Photo



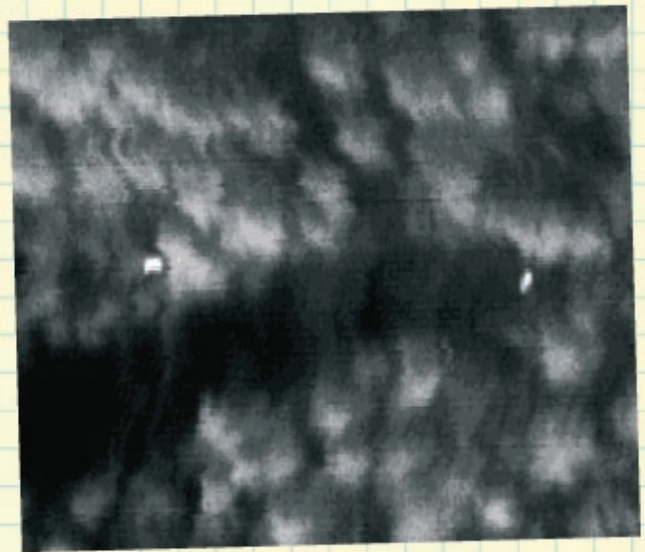
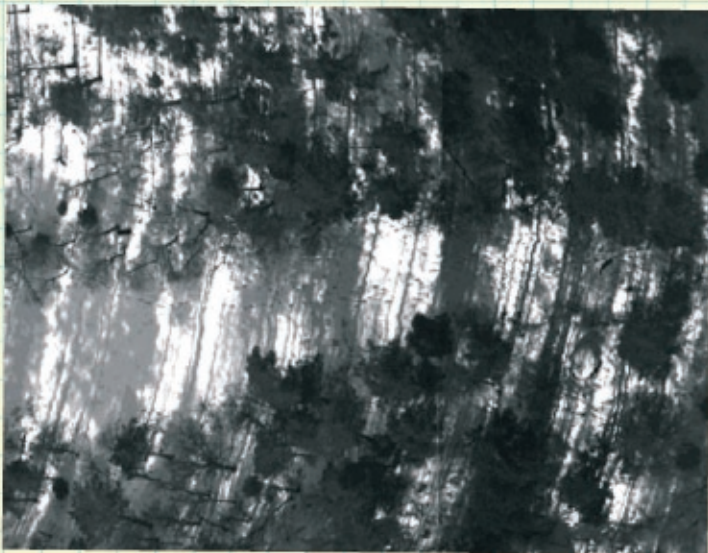
# AIRBORNE INFRARED IMAGING

Animal population monitoring



Heat emission allows to locate animals.

Try to spot elks on this photo. It's rather difficult. Isn't it?

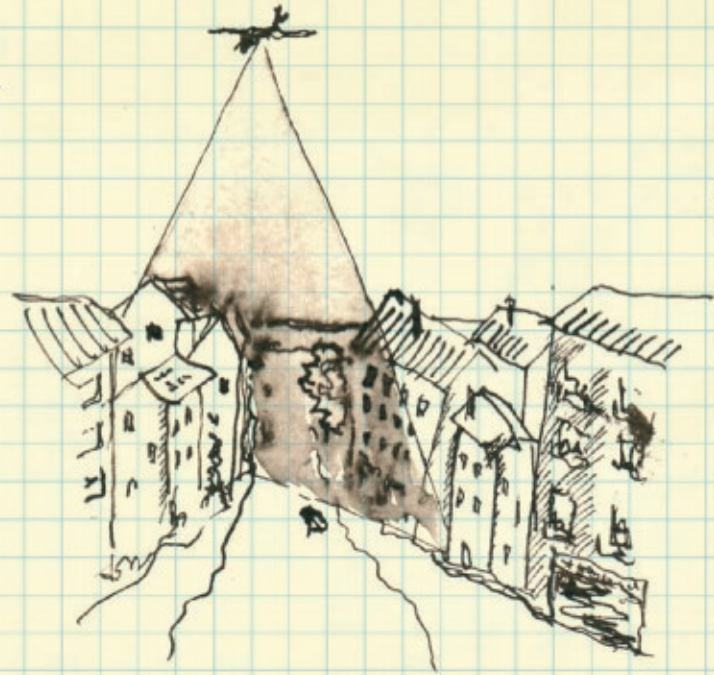


But look on the infrared image. Here they are!



# AIRBORNE INFRARED IMAGING

Heat supply network  
monitoring



Problem zones of  
underground network

In addition:

SCAN-T can be installed in  
light aircraft inside or outside  
fuselage with ease.

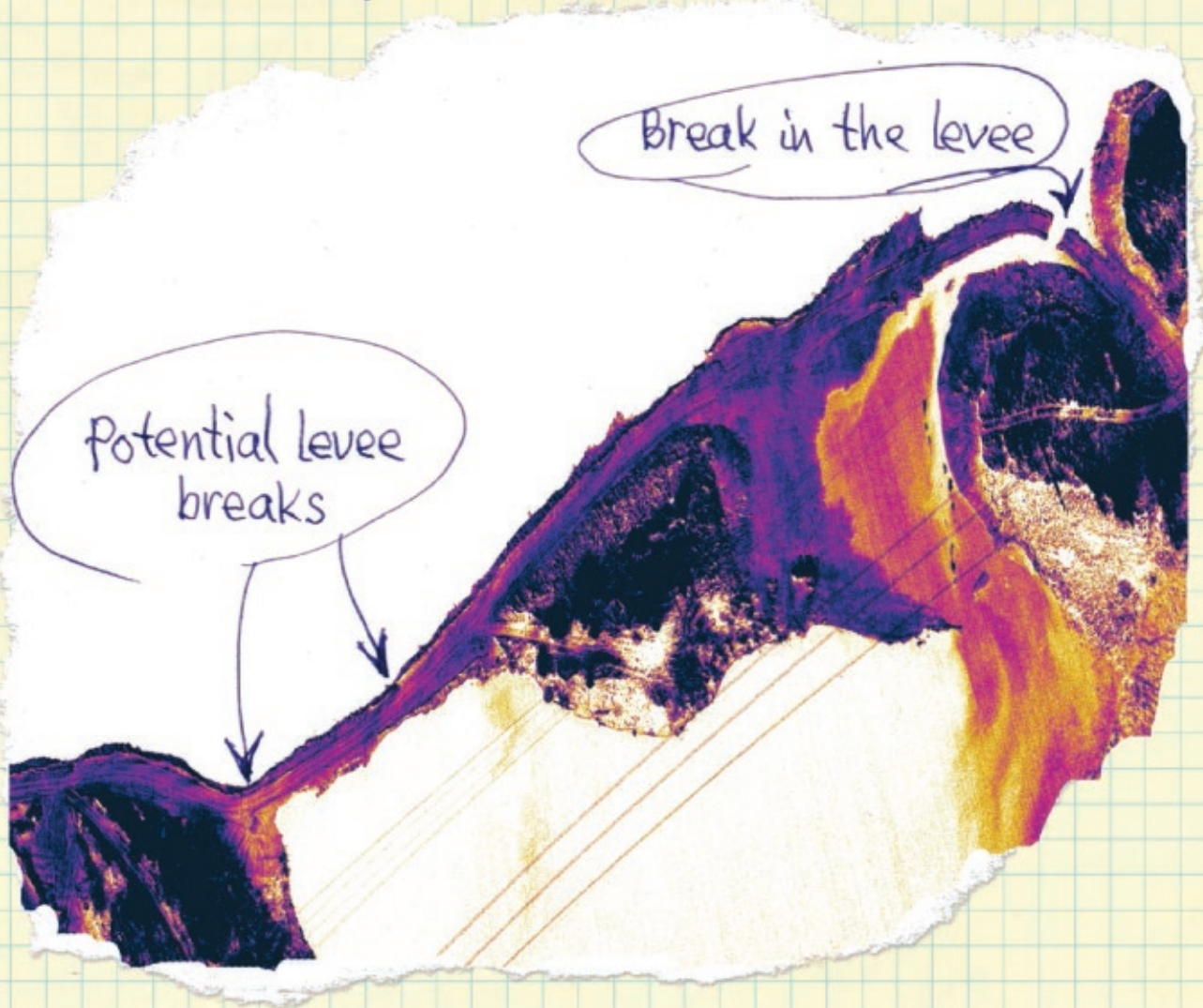
We provide full software  
support including automatic  
georeferencing





# AIRBORNE INFRARED IMAGING

Hydrogeology and engineering geology



Different heat capacity of soil and water allows to detect places of water penetration on infrared images.



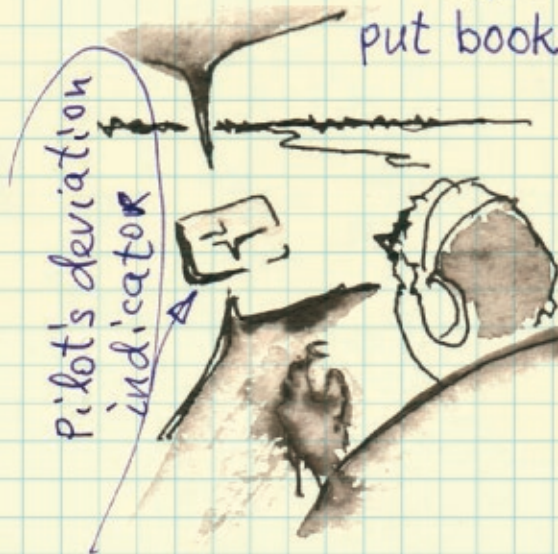
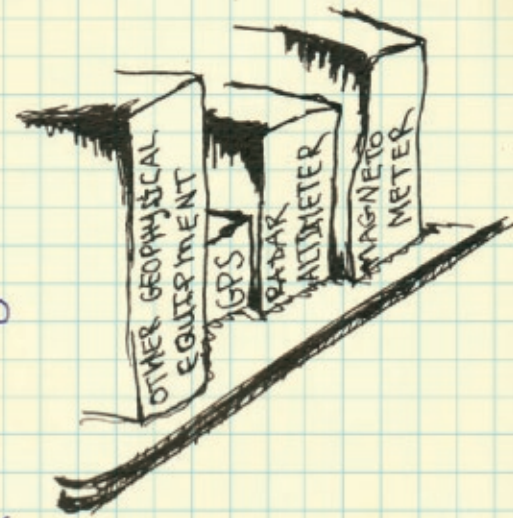
# NAVIGATION AND DATA ACQUISITION SOFTWARE

Airborne surveys employ one or more geophysical devices and requires very accurate navigation. That's why we developed system NAVDAT

Its main functions are:

Geophysical equipment integration

is almost as simple as to put books on a shelf



Navigation:

To approach and follow a route a pilot should keep the needle of the deviation indicator in zero position during all flight

Survey process

monitoring:

operator observes all measured signals and inspects navigation accuracy



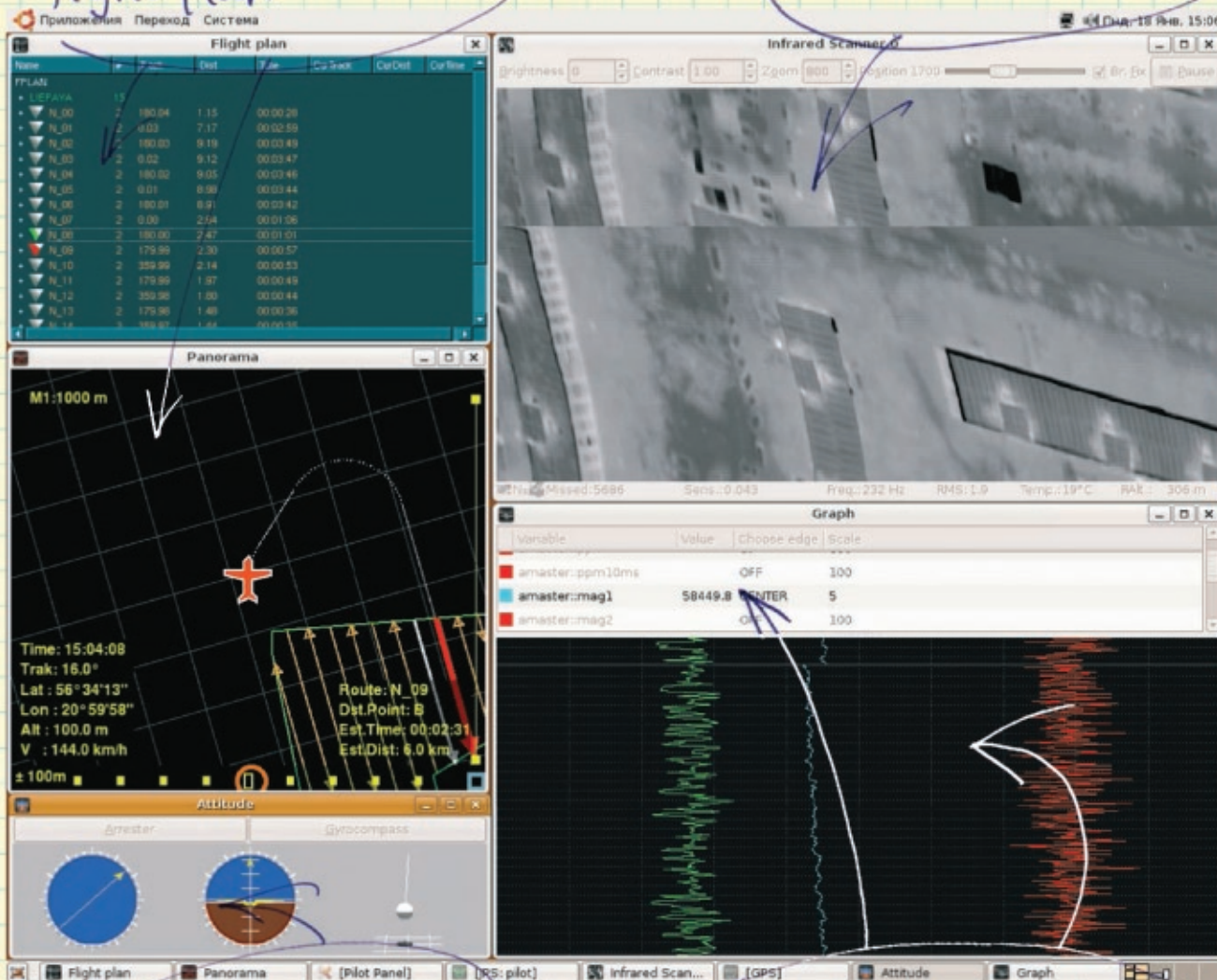


# NAVIGATION AND DATA ACQUISITION SOFTWARE

There's an example of **NAVDAT** screen. It consists of several windows, which displays following information.

Navigation map and flight plan

Infrared image in real-time



Gyro system parameters

Measured parameters list and charts



# NAVIGATION AND DATA ACQUISITION SOFTWARE

Sometimes operator's workspace looks like that



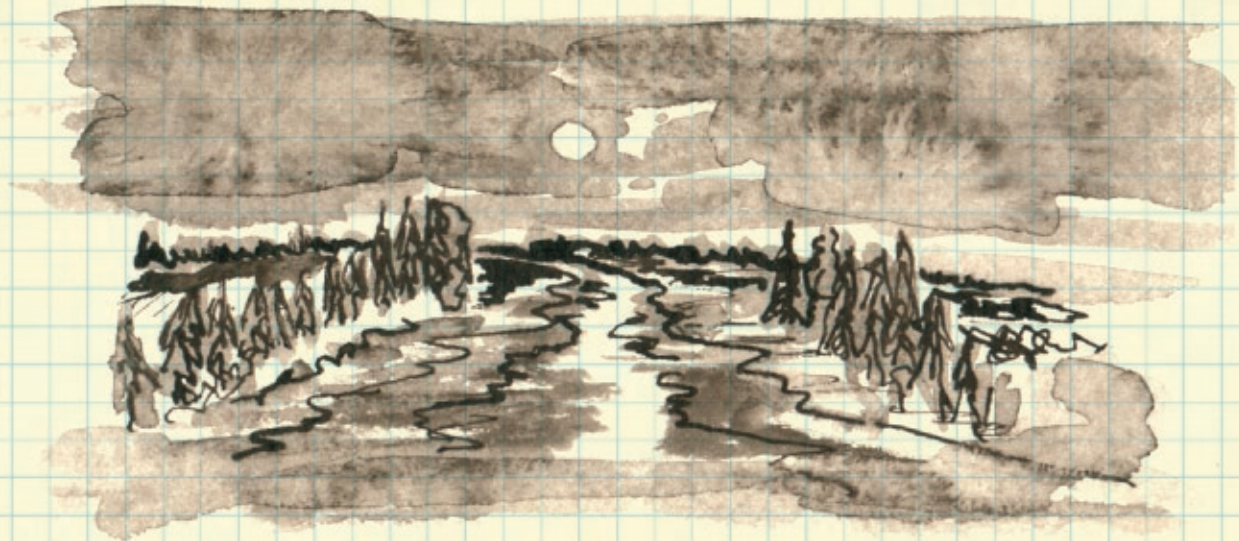
In this situation it would be better if operator looked like this one



So we tried to ease operator's work while developing NAVDAT. Here is the result



# ~~THE END~~



We hope, this is the beginning of a long  
friendship.

Our contacts  
+7 495 334 71 68  
gp@gtcomp.ru  
117049, 1 Derbenevskaya Street,  
Moscow, Russia



Editor: Tatiana Vovenko <vovenko@rbcmail.ru>  
Pictures by Andrey Volkovitsky <avolkovitsky@yandex.ru>  
Designer: Kirill Volkovitsky <volkovitsky.k@gmail.com>