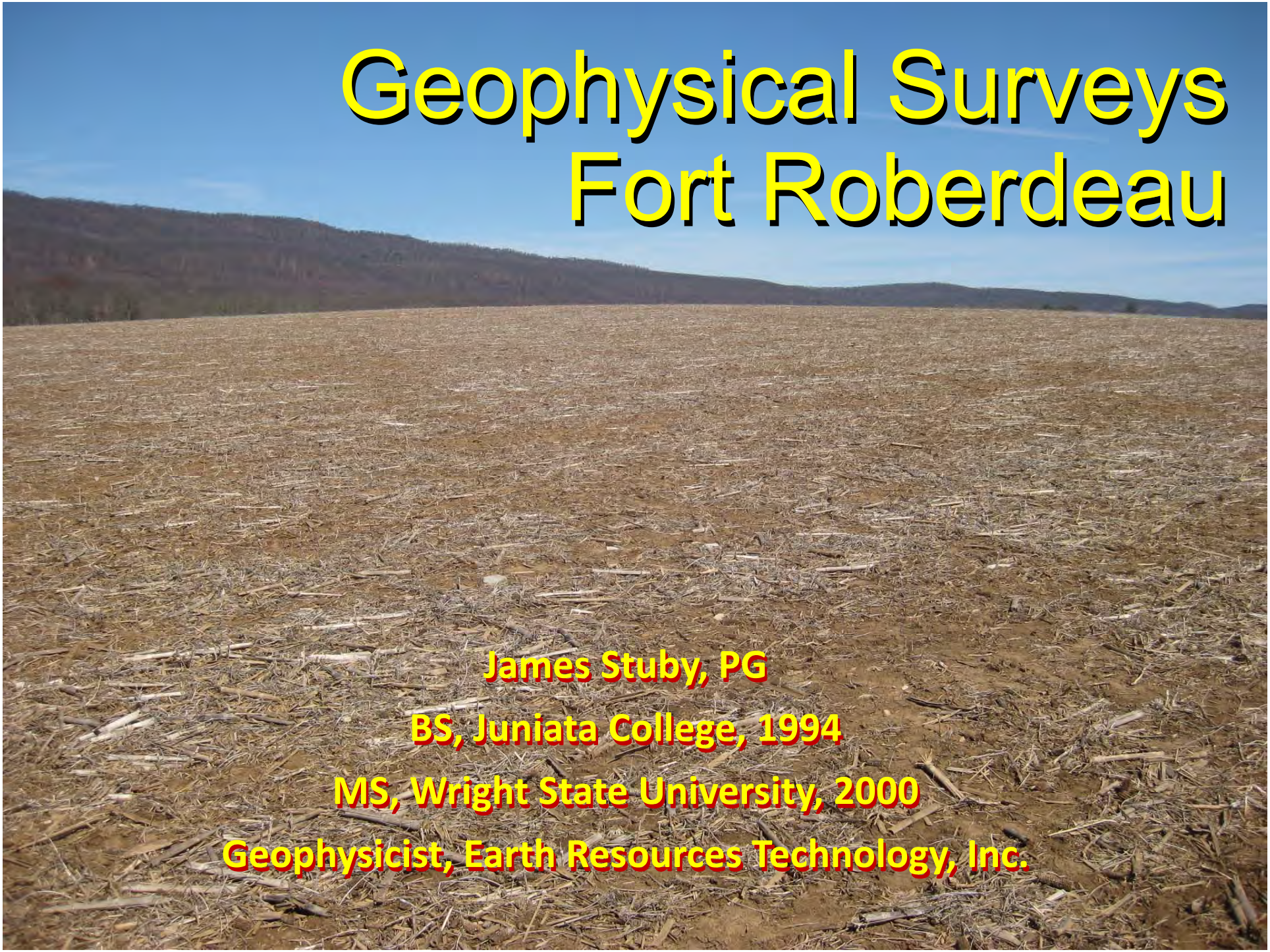
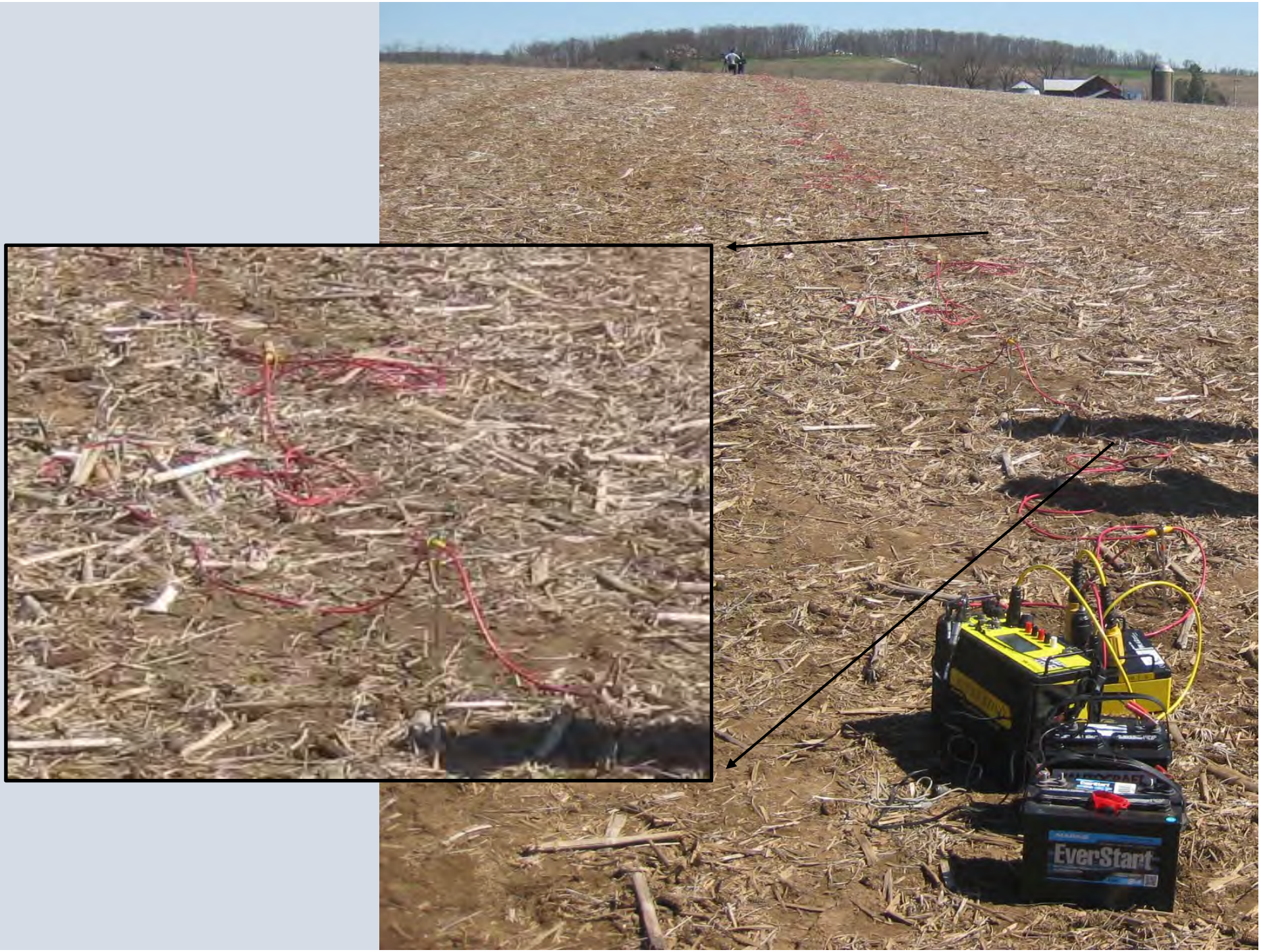

Geophysical Surveys
Fort Roberdeau
James Stuby, PG
BS, Juniata College, 1994
MS, Wright State University, 2000
Geophysicist, Earth Resources Technology, Inc.

Equipment

- AGI SuperSting R8 Earth Resistivity Meter
- GSSI SIR-3000 Ground Penetrating Radar with 400 MHz antenna
- Topcon HiperGA Real Time Kinematic Global Positioning System (base and rover)
- Hammers, measuring tapes, salt water


EverStart


TOPCON

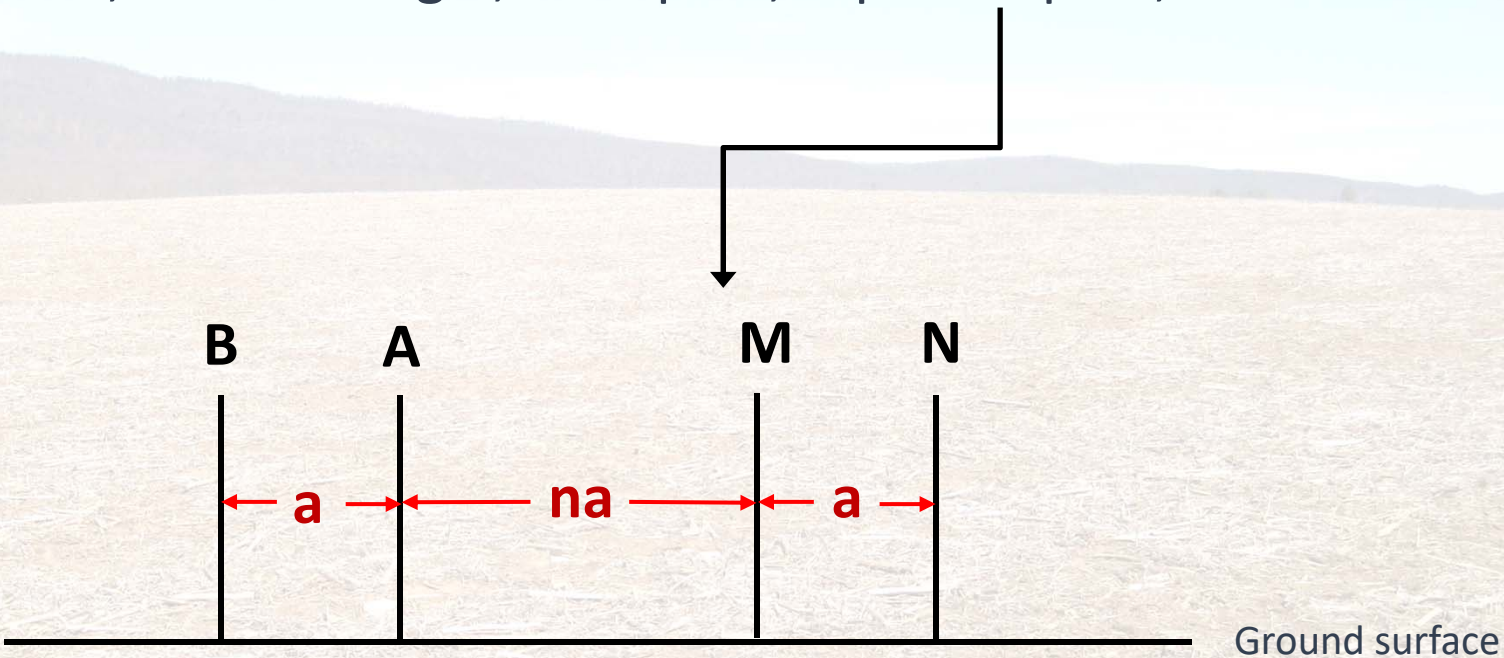
Resistivity Tomography Survey - Applications

- Depth to Bedrock
- Karst feature mapping (sinkholes, pinnacles/cutters, fractures)
- Void mapping
- Landfill Thickness Mapping
- Geologic Mapping

Caveat: Works very poorly in urban areas

Electrode Configurations

Wenner, Schlumberger, Pole-pole, Dipole-Dipole, etc.

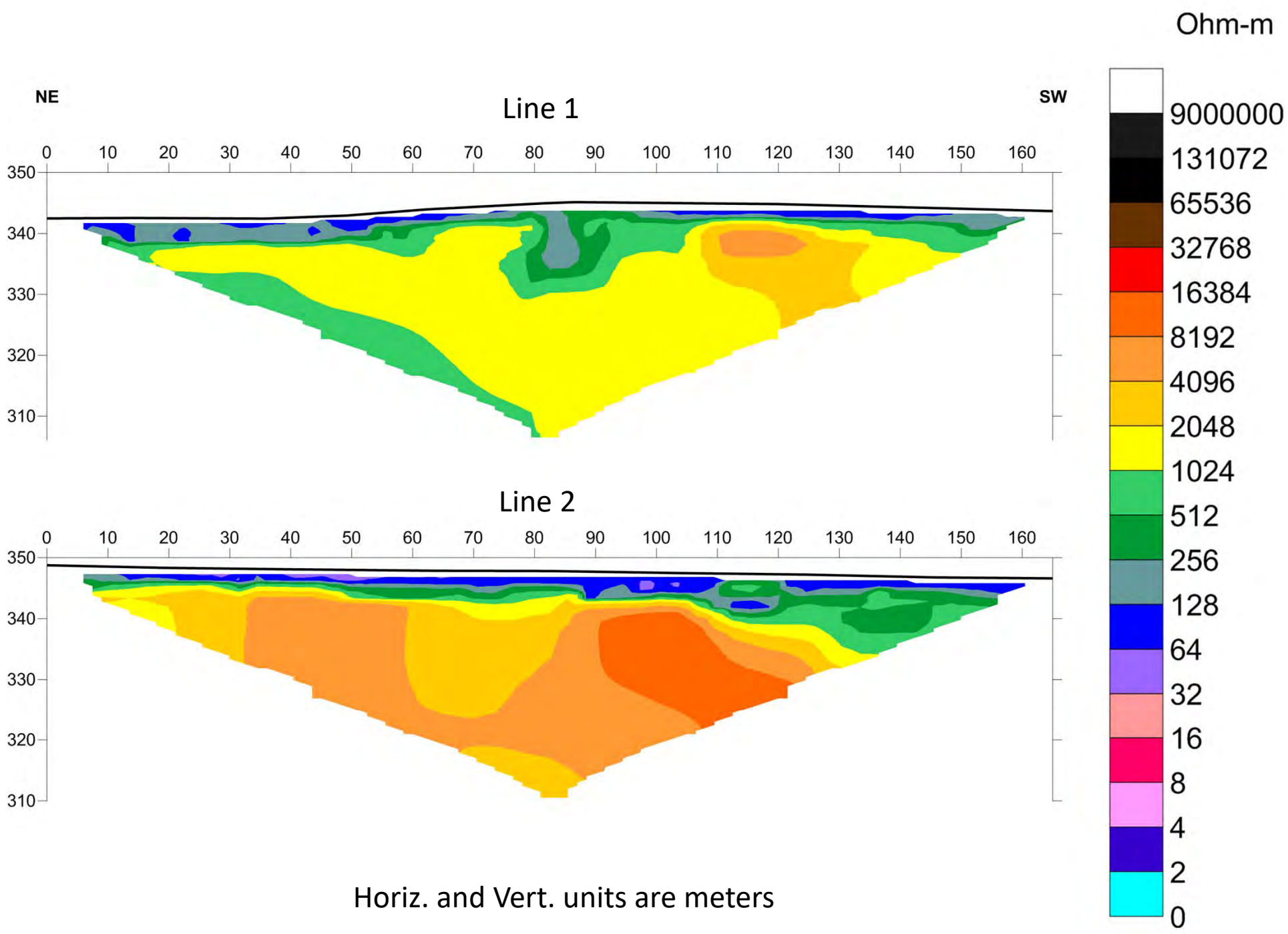


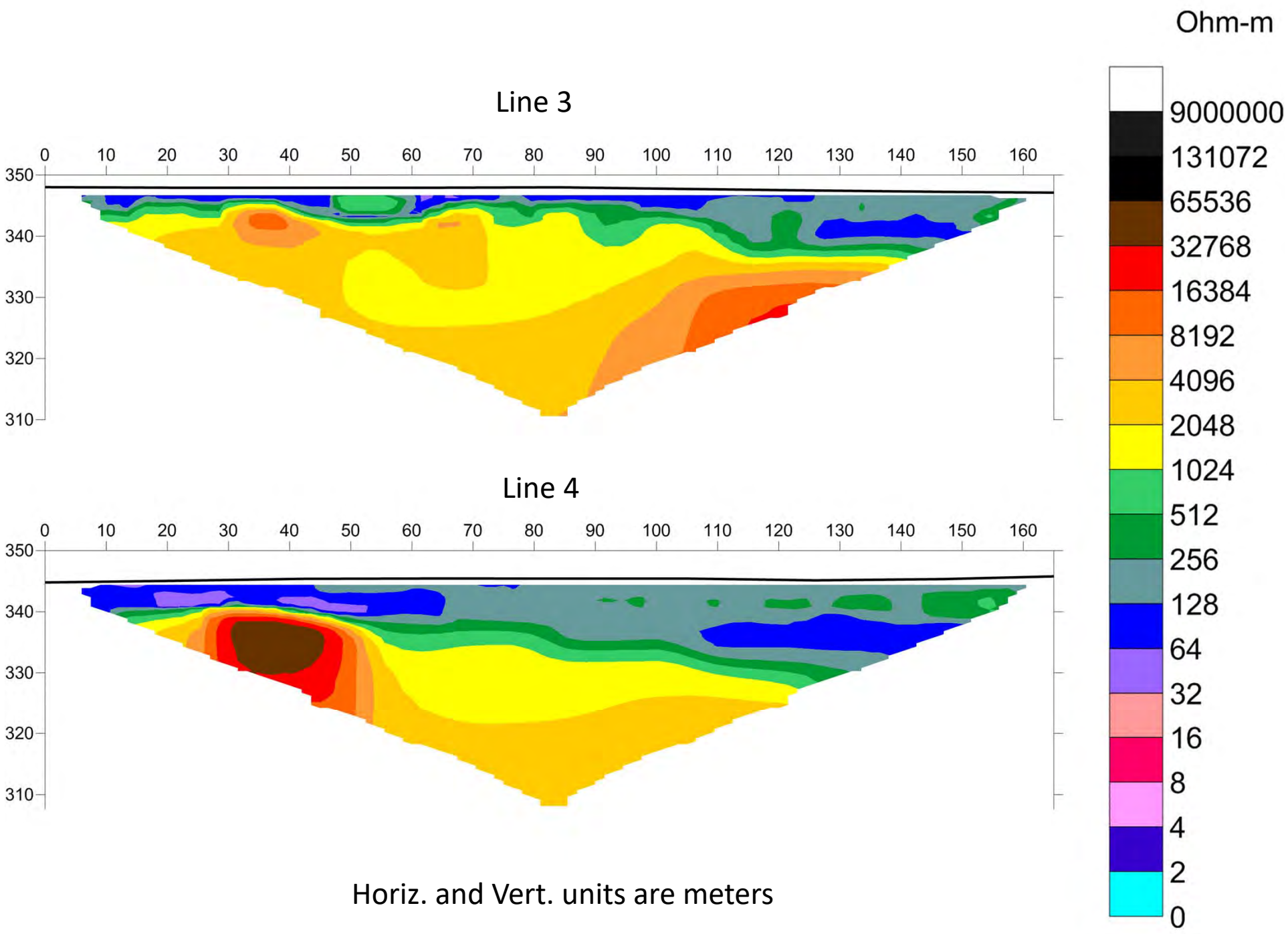
- data point

$$\rho_a = \pi\, n\, (n+1)\, (n+2)\, a\, (V/I)$$

where ρ_a is apparent resistivity (Ωm), n is n-spacing (m), a is a-spacing (m), V is potential (volts), and I is current (amperes).


456000
455500
455000
454500
454000
453500
453000
1822000
1822500
1823000
1823500
1824000
1824500
1825000
1825500
1826000
4
3
2
1

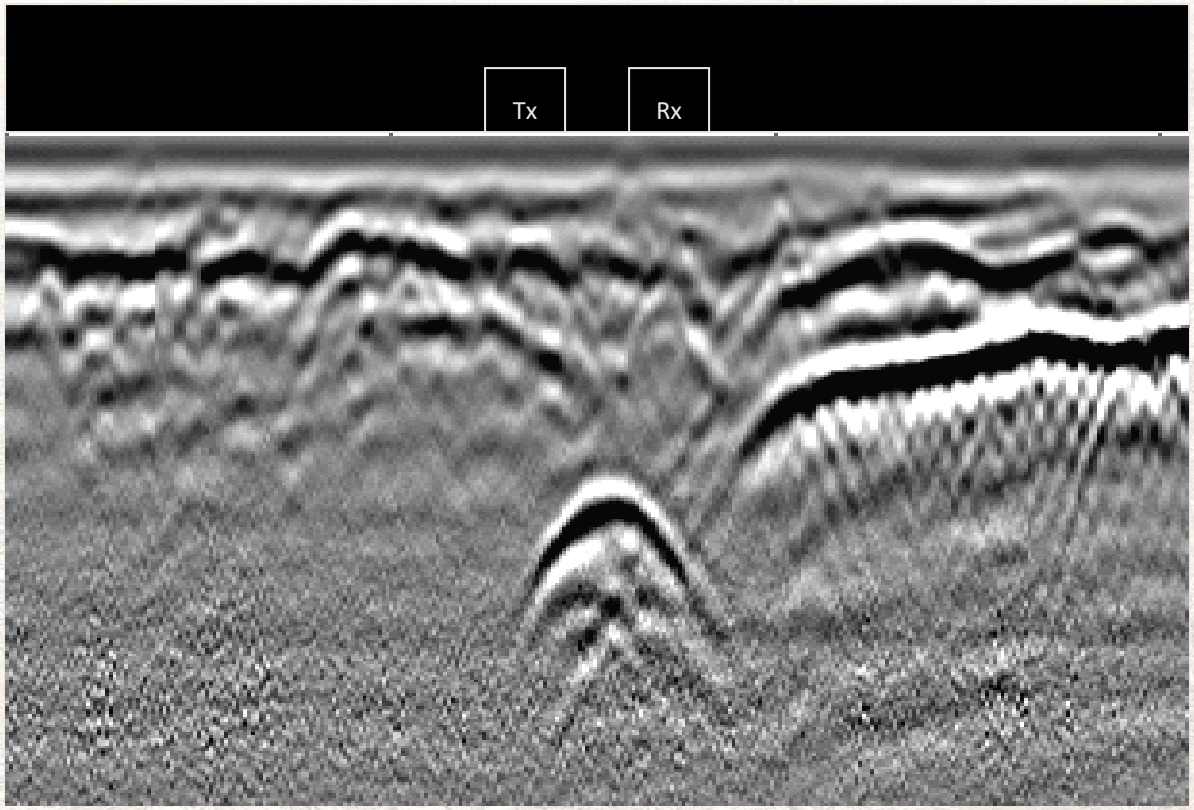

Ohm-m
9000000
131072
65536
32768
16384
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2
0
Line 1
NE
SW
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
350
340
330
320
310
Line 2
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
350
340
330
320
310
Horiz. and Vert. units are meters



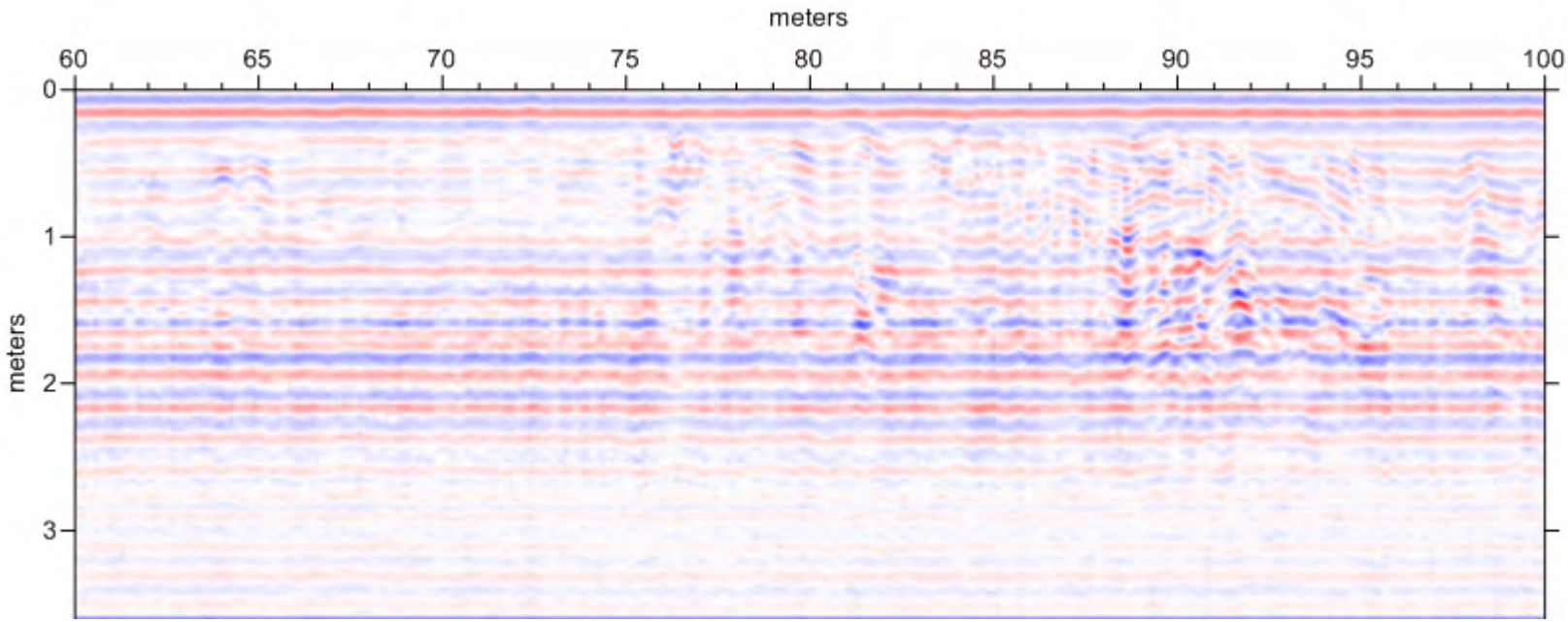
Horiz. and Vert. units are meters


Questions
About
Resistivity?

Ground Penetrating Radar – Physics

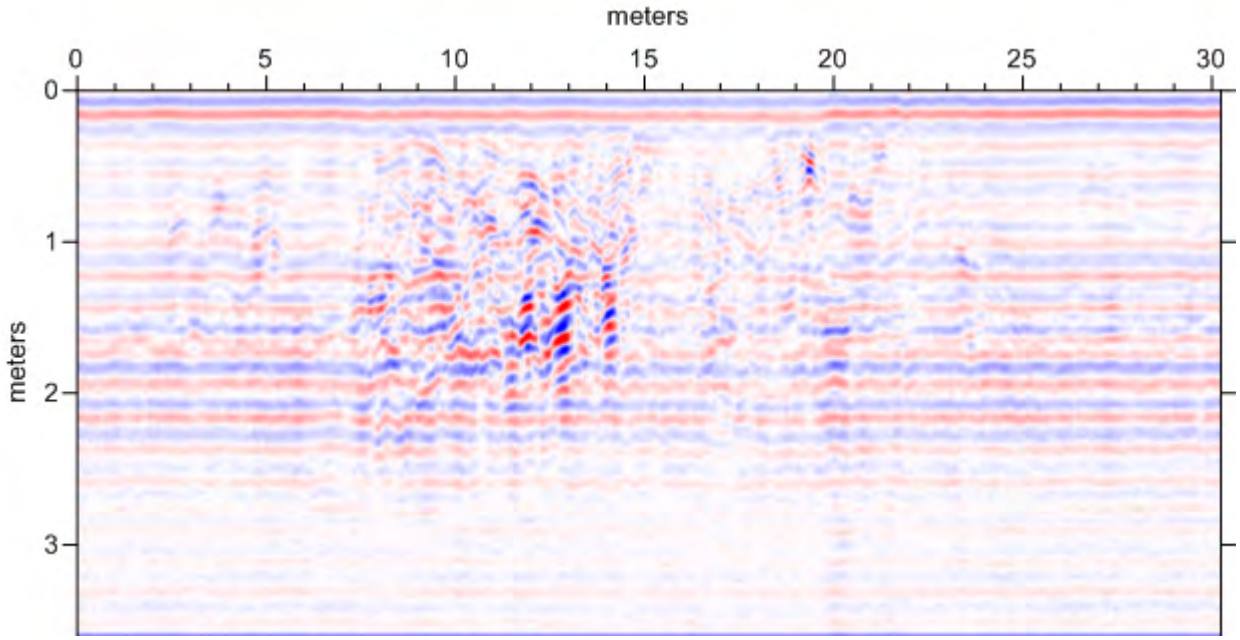


Part of “background” line
Random 40 m between road and bare spot

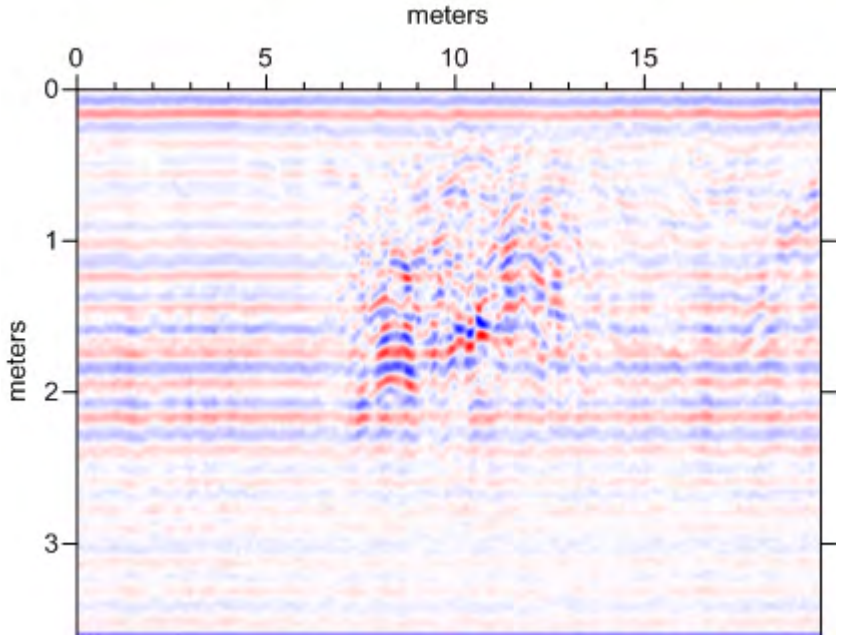


Lines over bare spot

Colinear with Resistivity Line 1



Perpendicular to Resistivity Line 1



Conclusion

- Resistivity Line 1 suggests the presence of shallow mine up to 10 m deep correlating with the bare spot
- Similar anomalies do not appear on Lines 2-4
- GPR also shows strong reflectors correlating with bare spot
- GPR survey is proof of concept – a more rigorous survey could be conducted
- Electromagnetic survey could rapidly cover a wide area, especially with 5 or 10 geophysics students taking turns as operator (~400 m x 400 m square/day?)


Questions
About
Anything?