The Ability of EM Conductivity and Vertical-Gradient Magnetic Surveys to Locate Hydrologic and Geologic Features in an Underground Gold Mine

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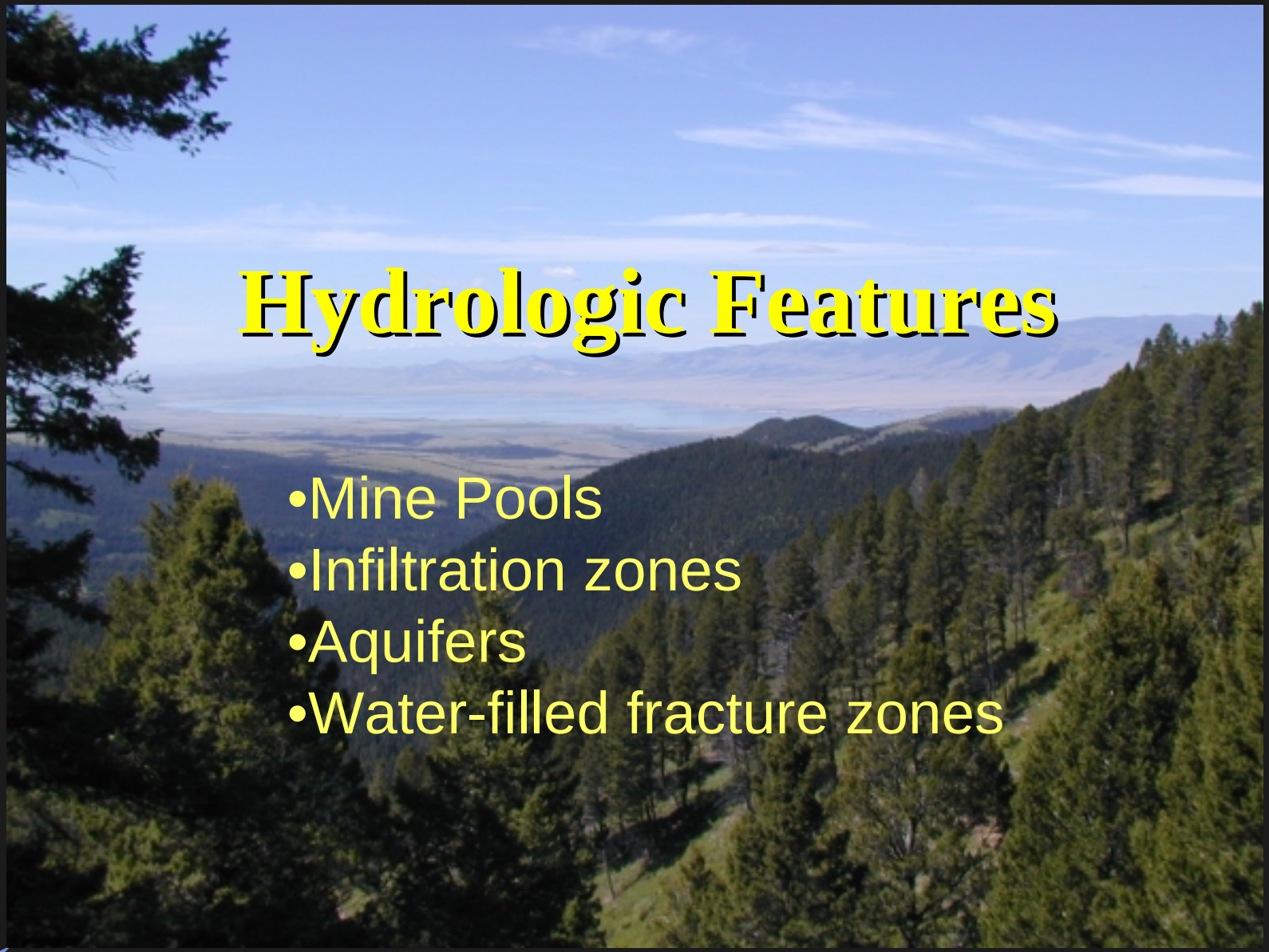
MSE Technology Applications

Objective

To test the utility of geophysical techniques for remotely identifying hydrologic and geologic features in underground mines


Hydrologic Features
•Mine Pools
•Infiltration zones
•Aquifers
•Water-filled fracture zones

Miller Mine

Lowest Level-Miller Mine

Water-Filled Winze

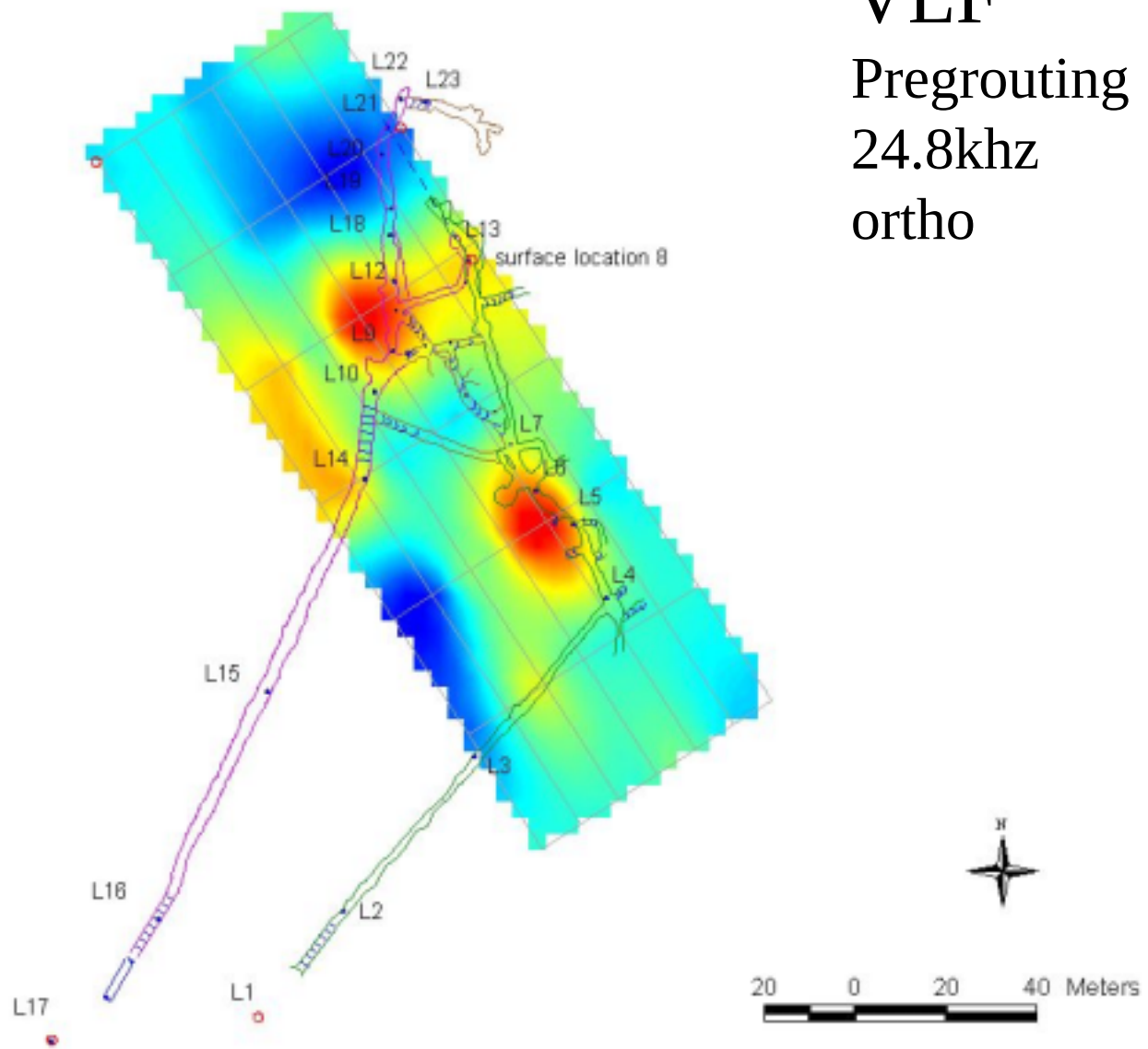
VLF-Very Low Frequency

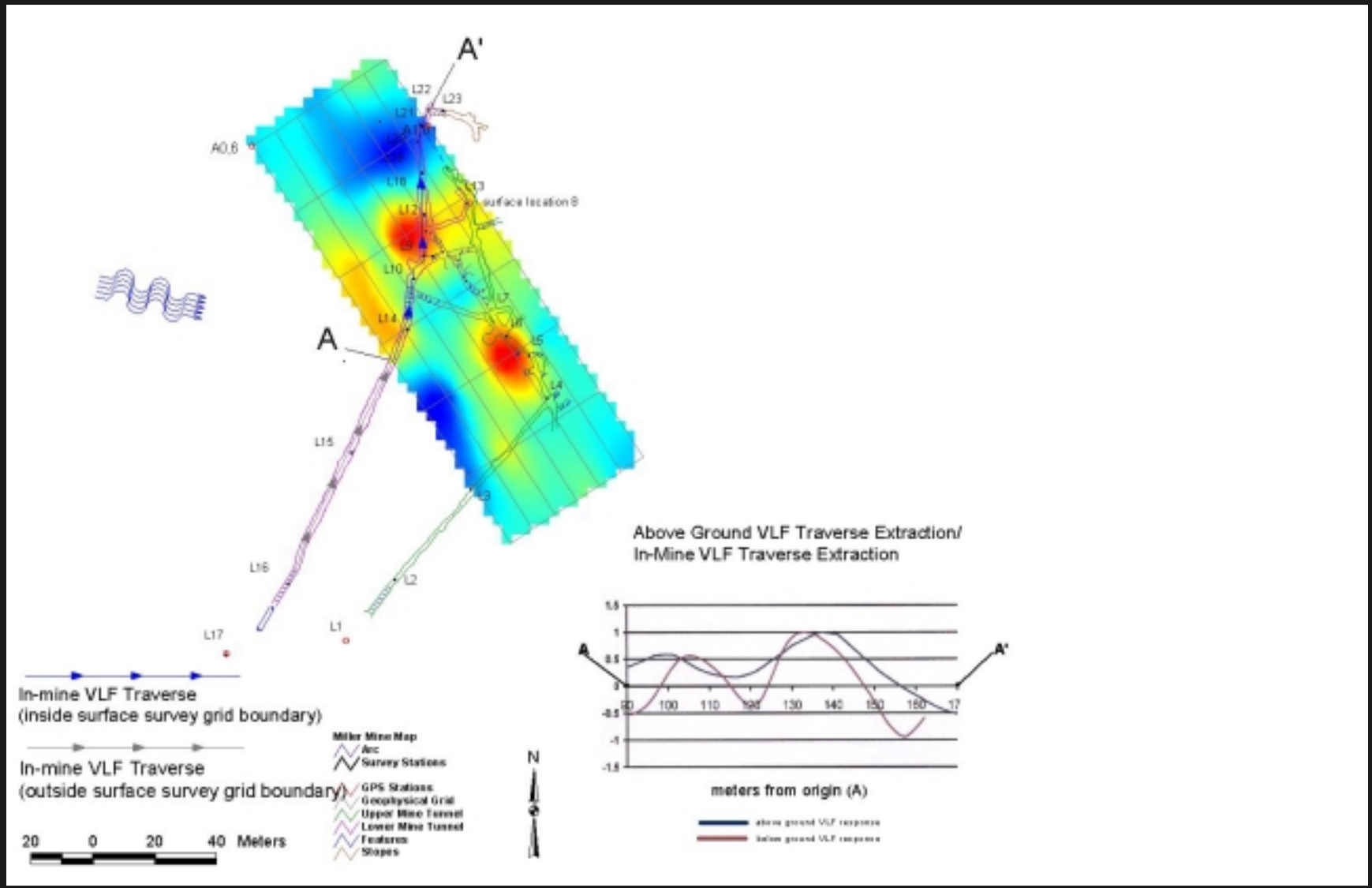
VLF

Pregrouting

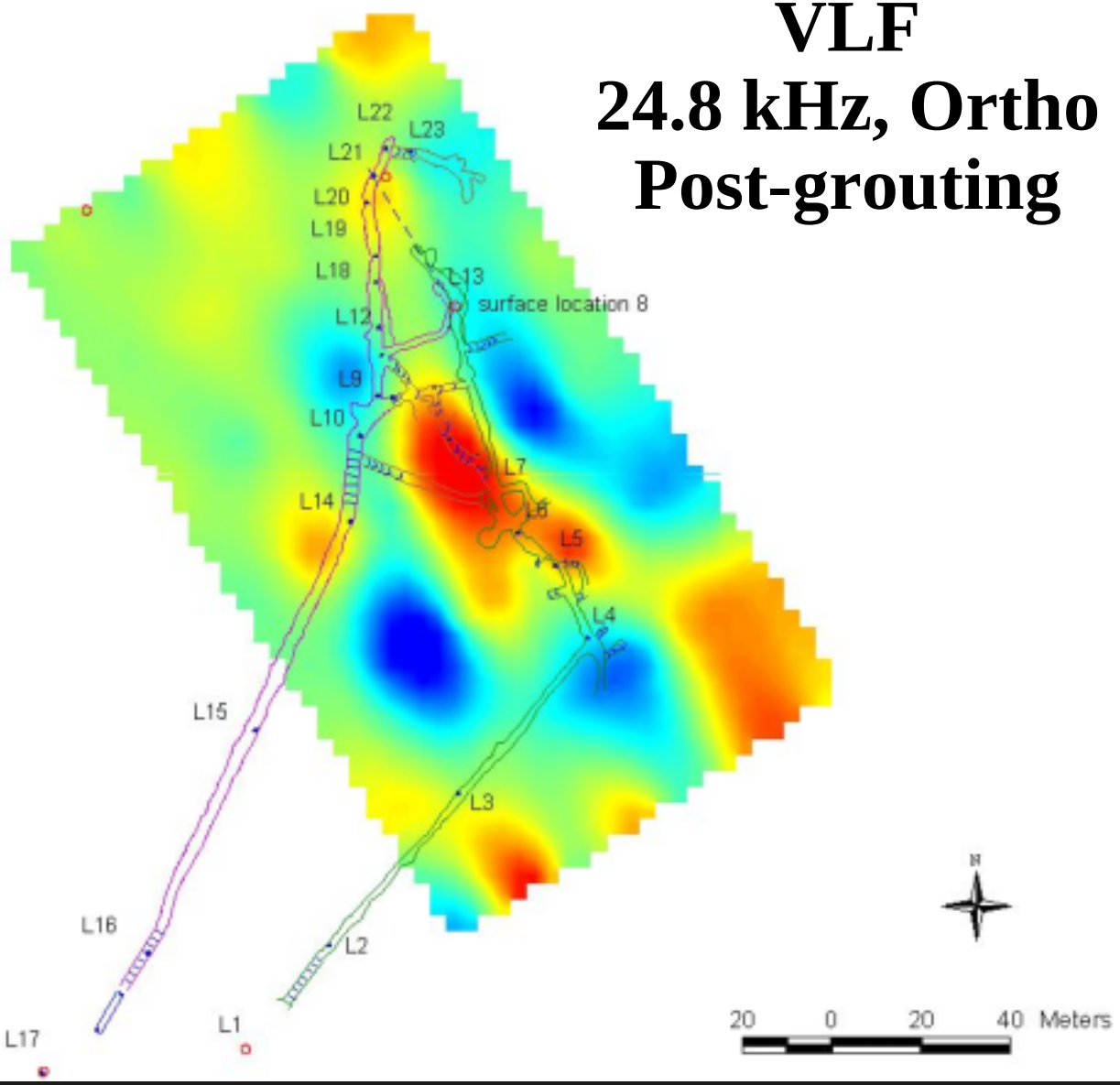
24.8khz

ortho

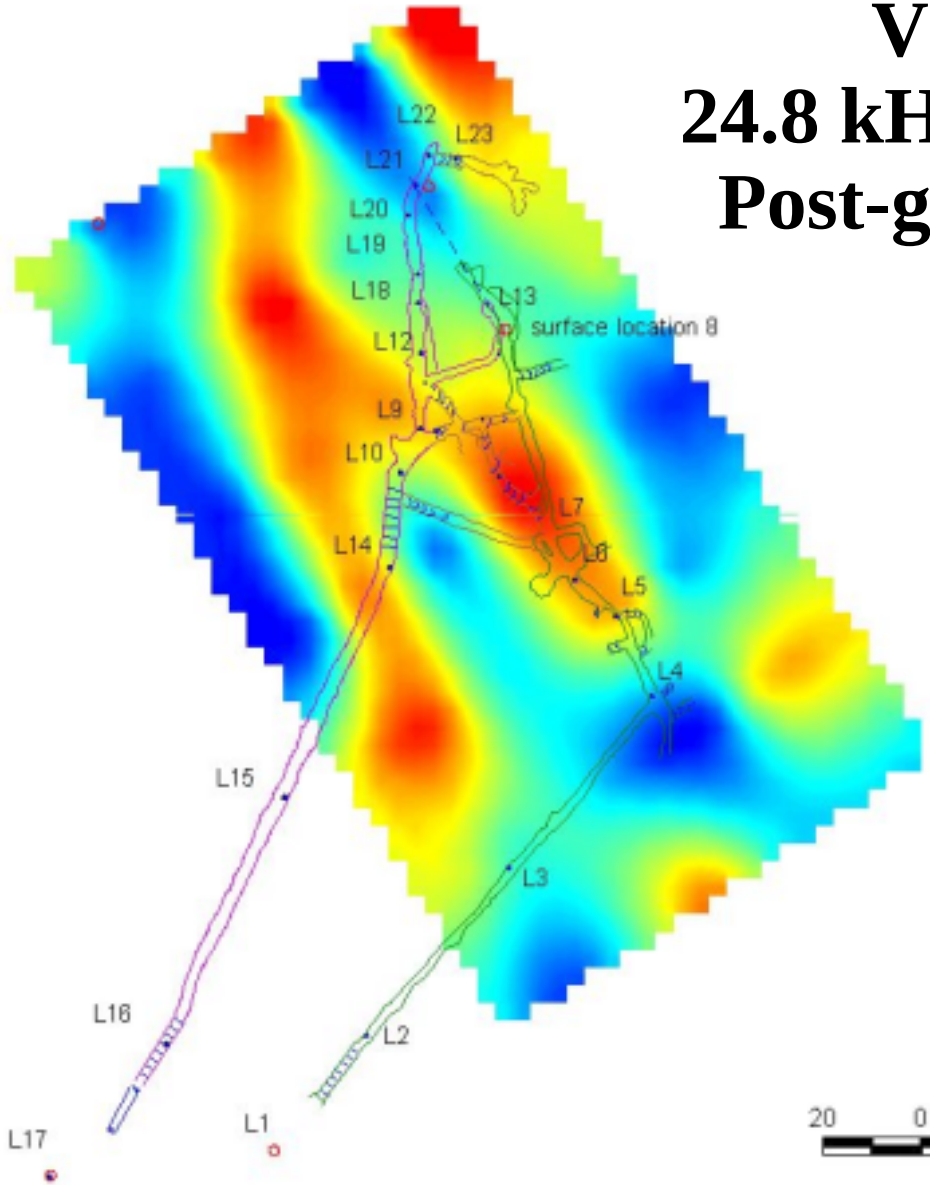



A'
A
L22
L23
L21
L18
L13
L12
L10
L7
L14
L15
L16
L17
L1
L2
L3
L4
L5
A0.6
surface location B
In-mine VLF Traverse
(inside surface survey grid boundary)
In-mine VLF Traverse
(outside surface survey grid boundary)
20 0 20 40 Meters
Miller Mine Map
Arc
Survey Stations
GPS Stations
Geophysical Grid
Upper Mine Tunnel
Lower Mine Tunnel
Features
Slopes
N
Above Ground VLF Traverse Extraction/
In-Mine VLF Traverse Extraction
A
A'
meters from origin (A)

VLF
24.8 kHz, Ortho
Post-grouting

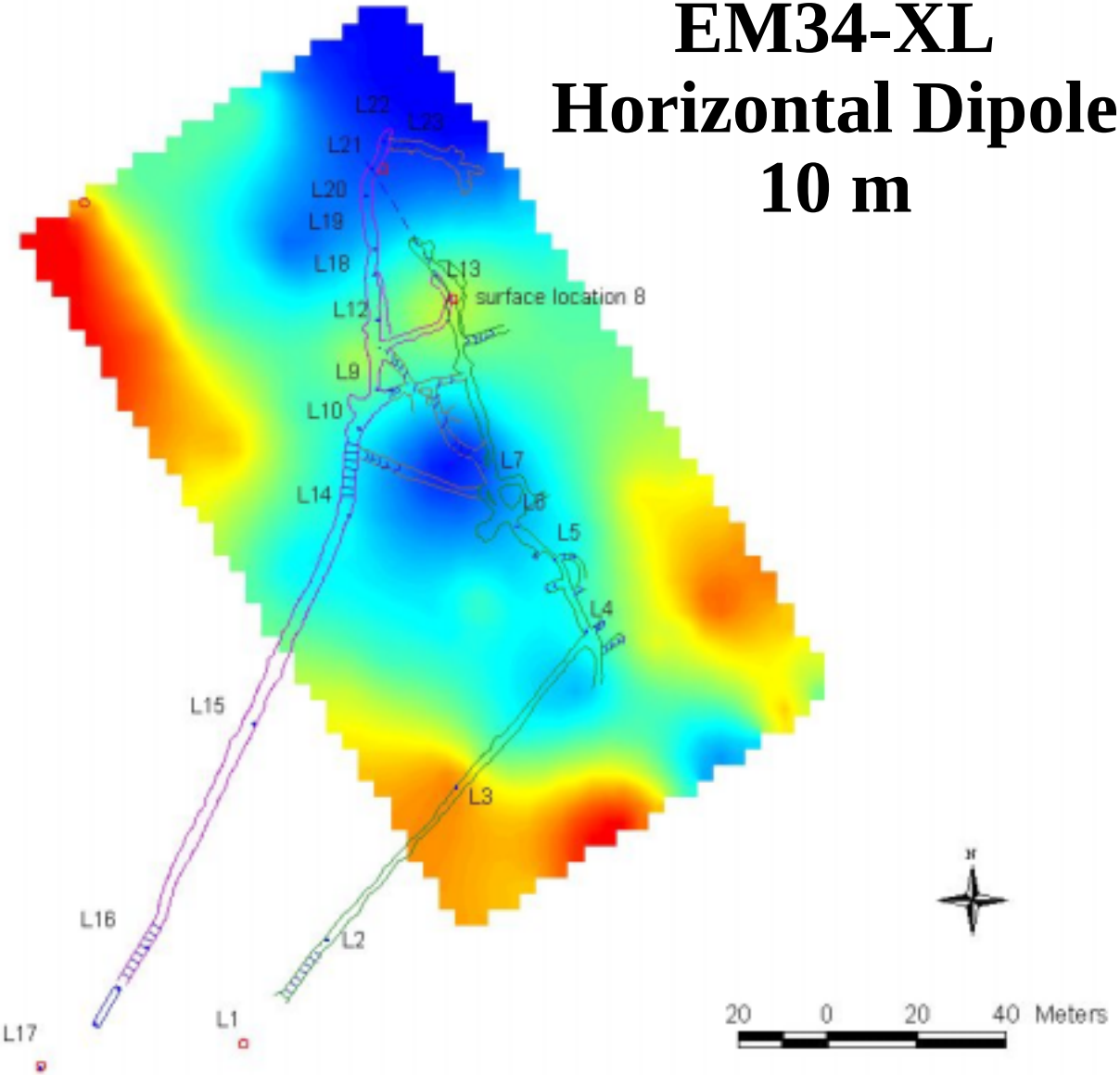


VLF
24.8 kHz, Inline
Post-grouting

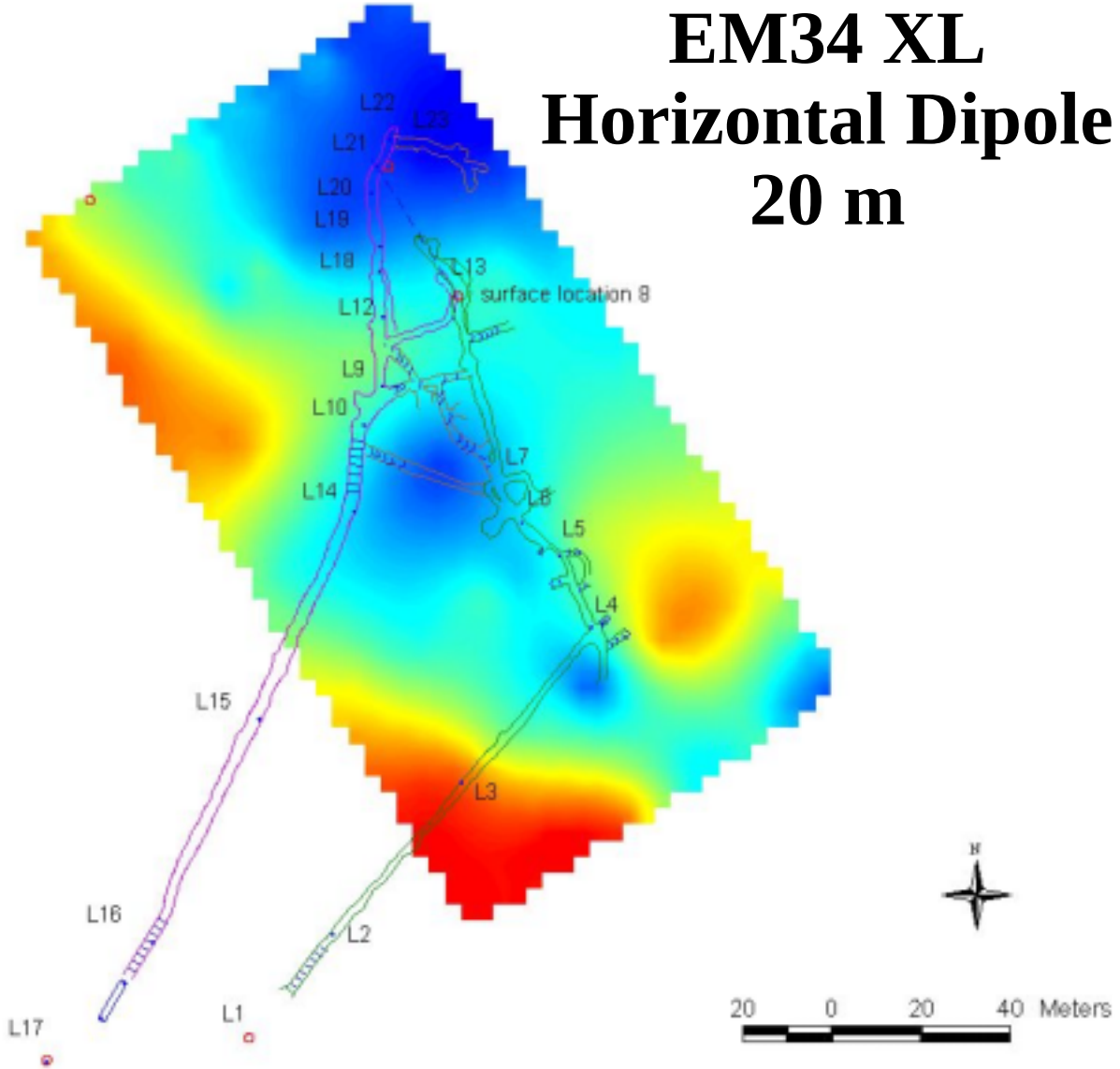


EM-34
Horizontal Dipole
10, 20, and 40-m Separation

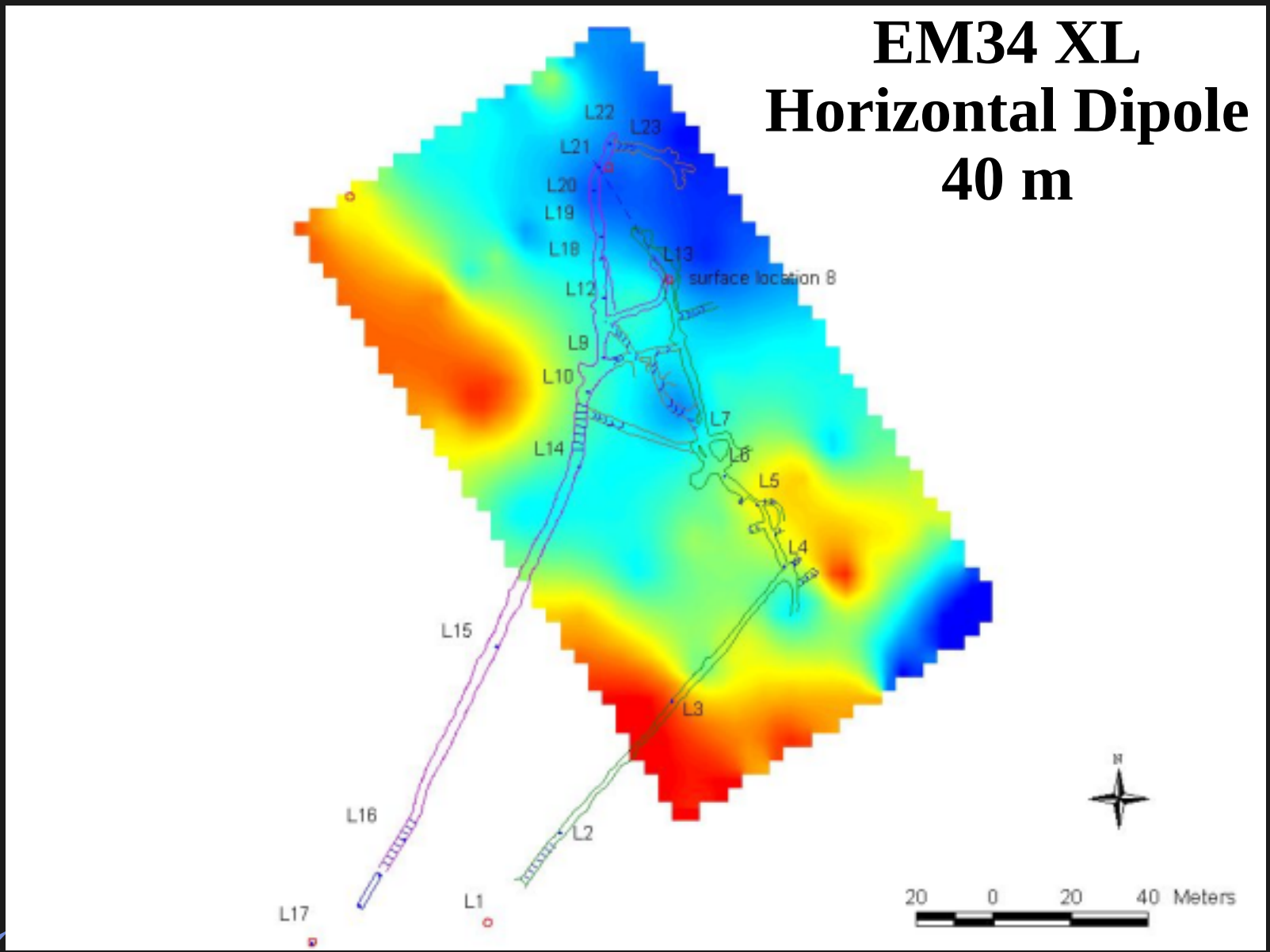
EM34-XL Horizontal Dipole 10 m



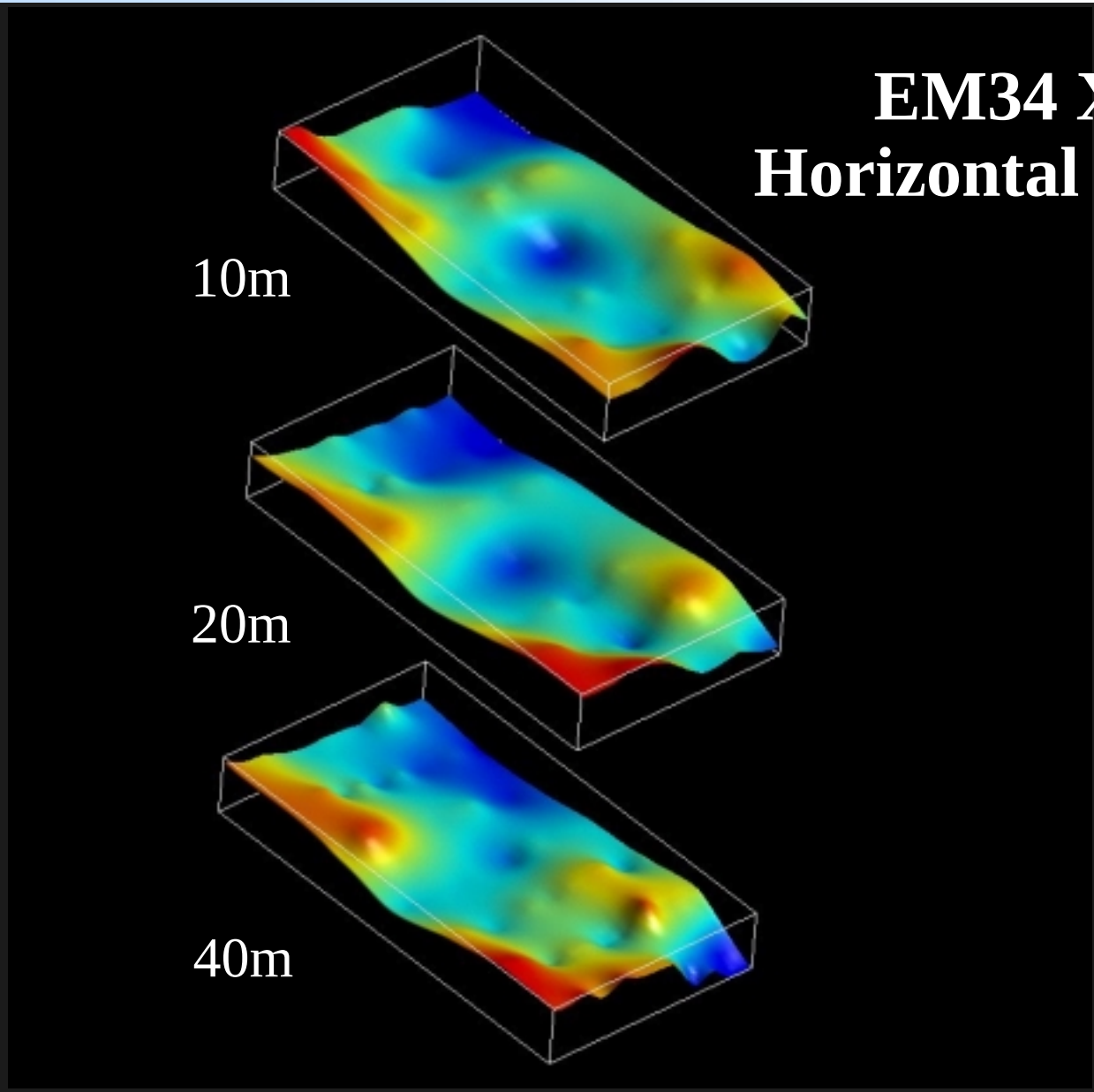
EM34 XL Horizontal Dipole 20 m



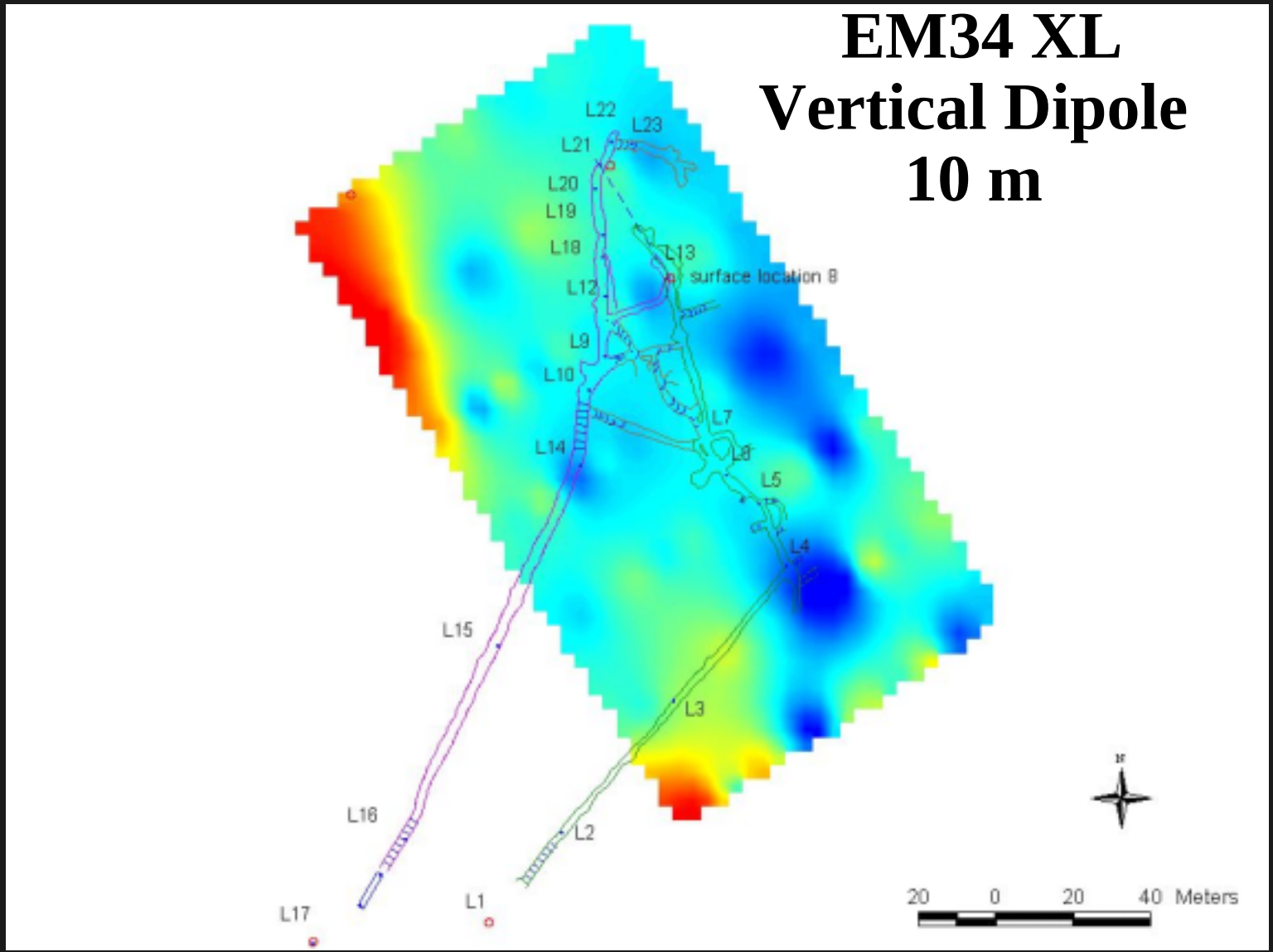
EM34 XL Horizontal Dipole 40 m



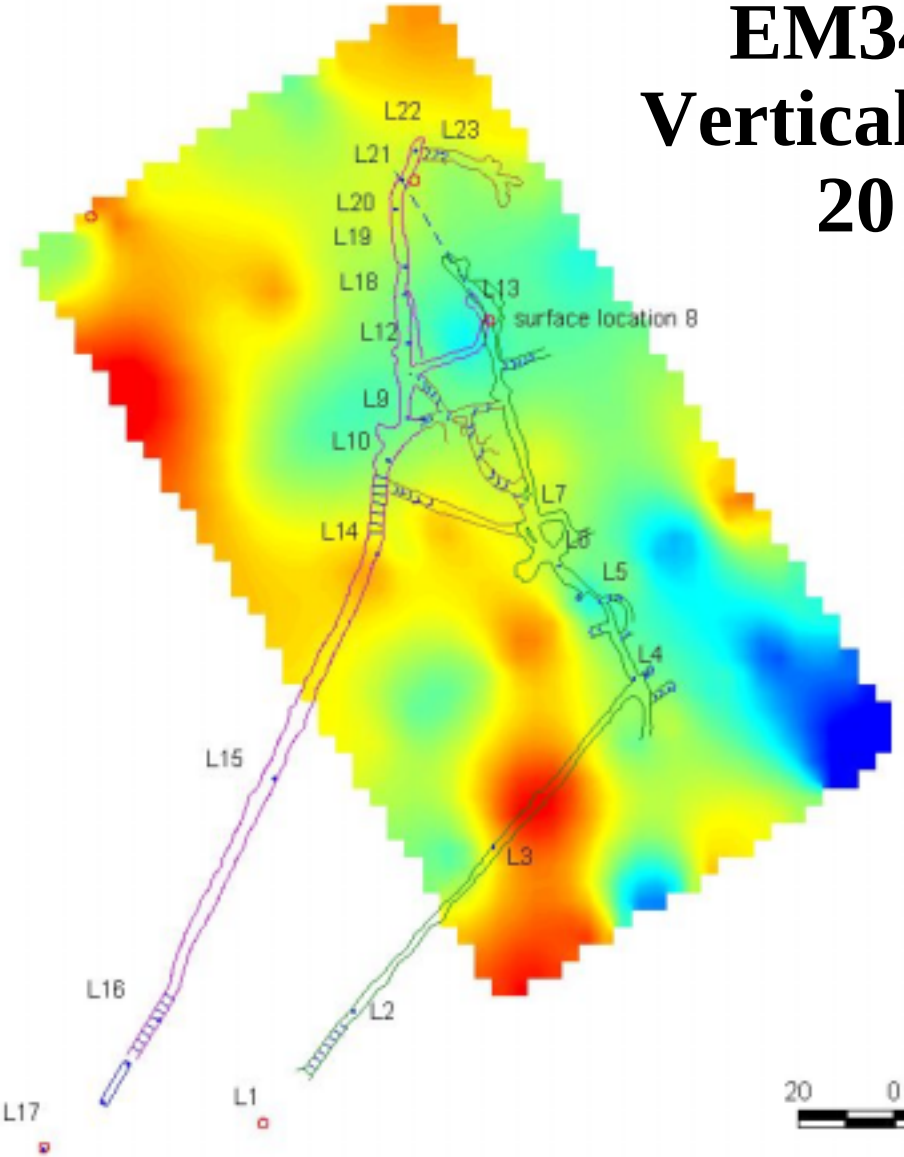
EM34 XL
Horizontal Dipole



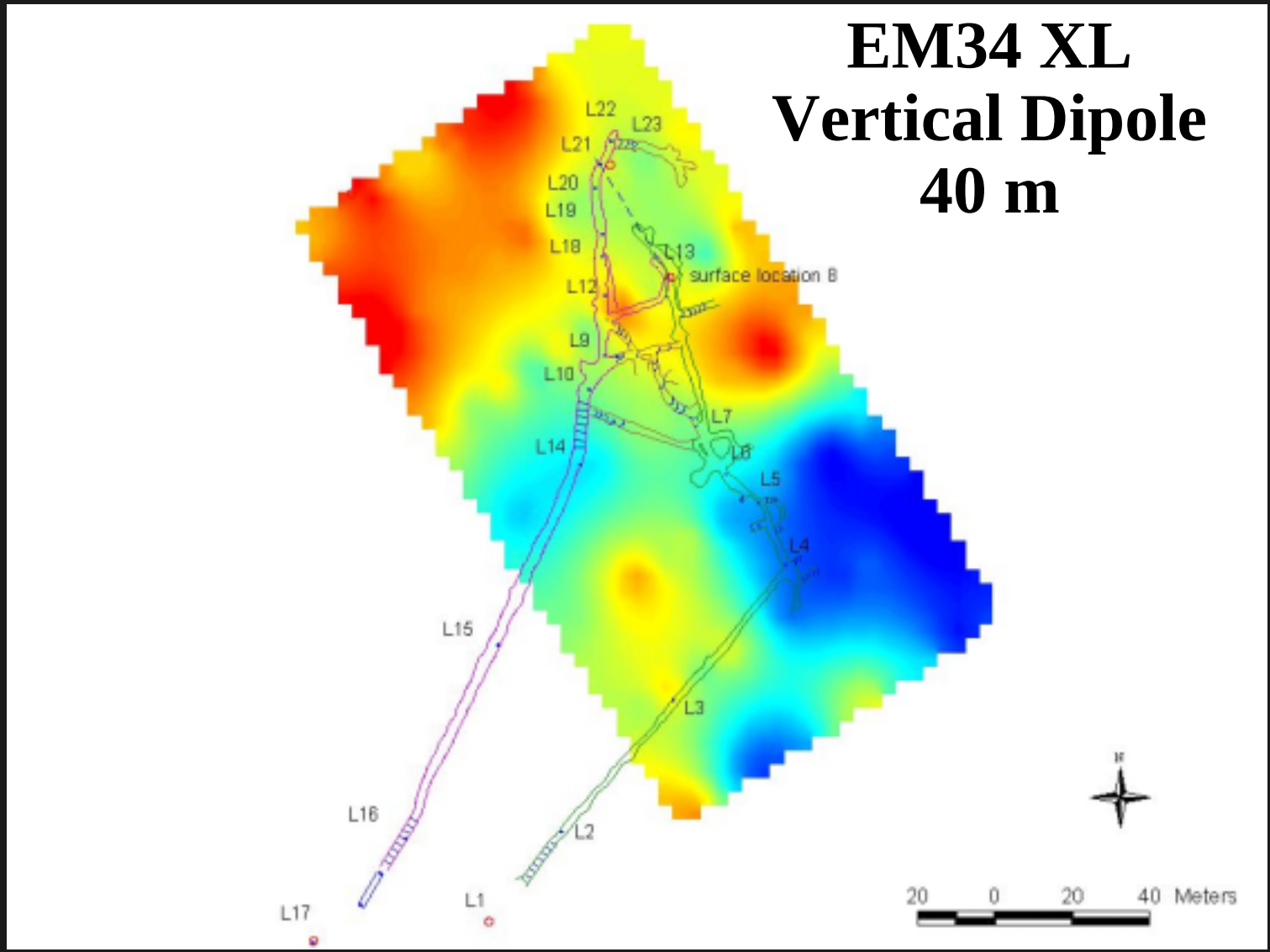
EM34 XL Vertical Dipole 10 m



EM34 XL Vertical Dipole 20 m

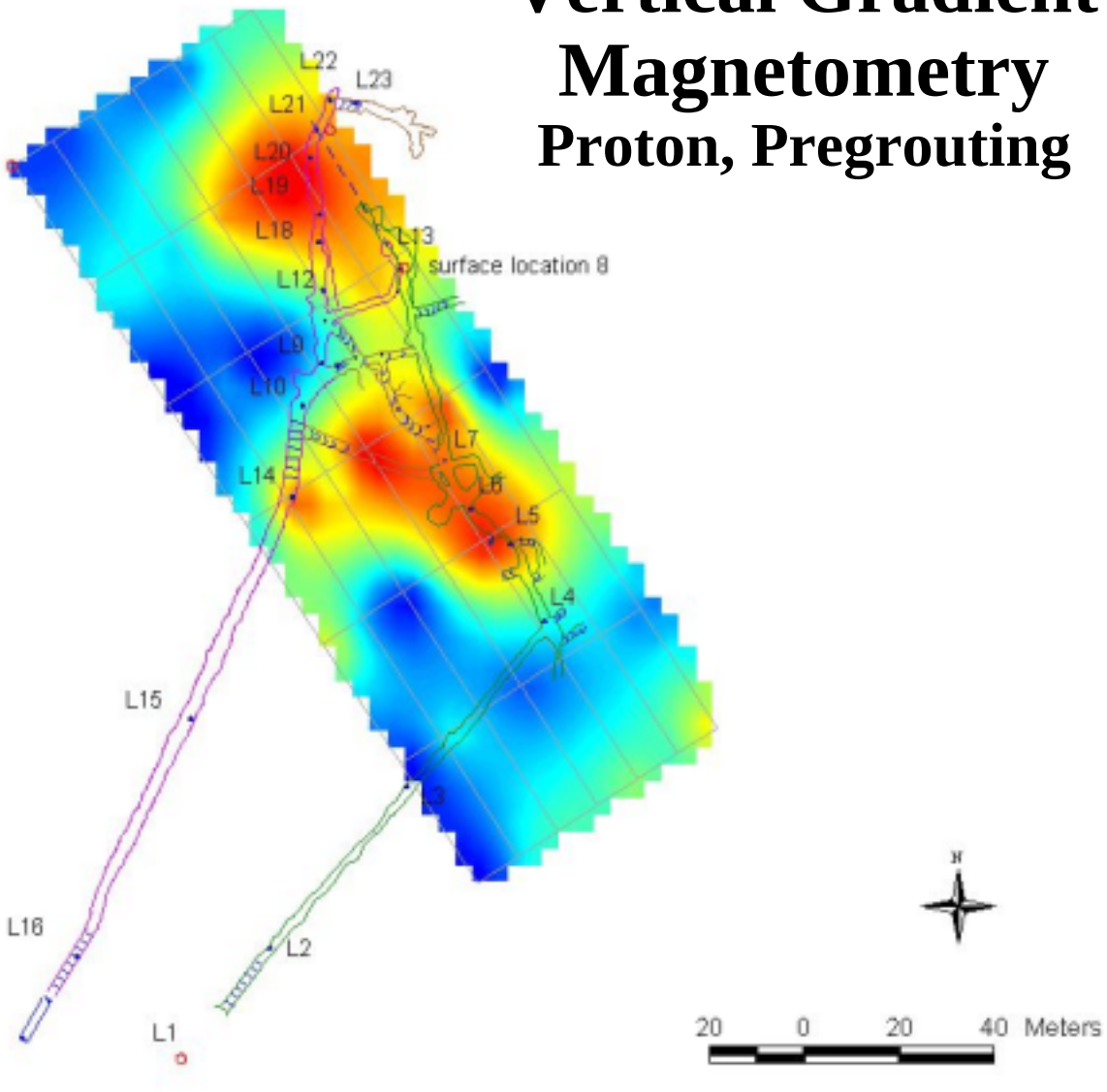


EM34 XL Vertical Dipole 40 m



Descriptor - include initials, /org/date

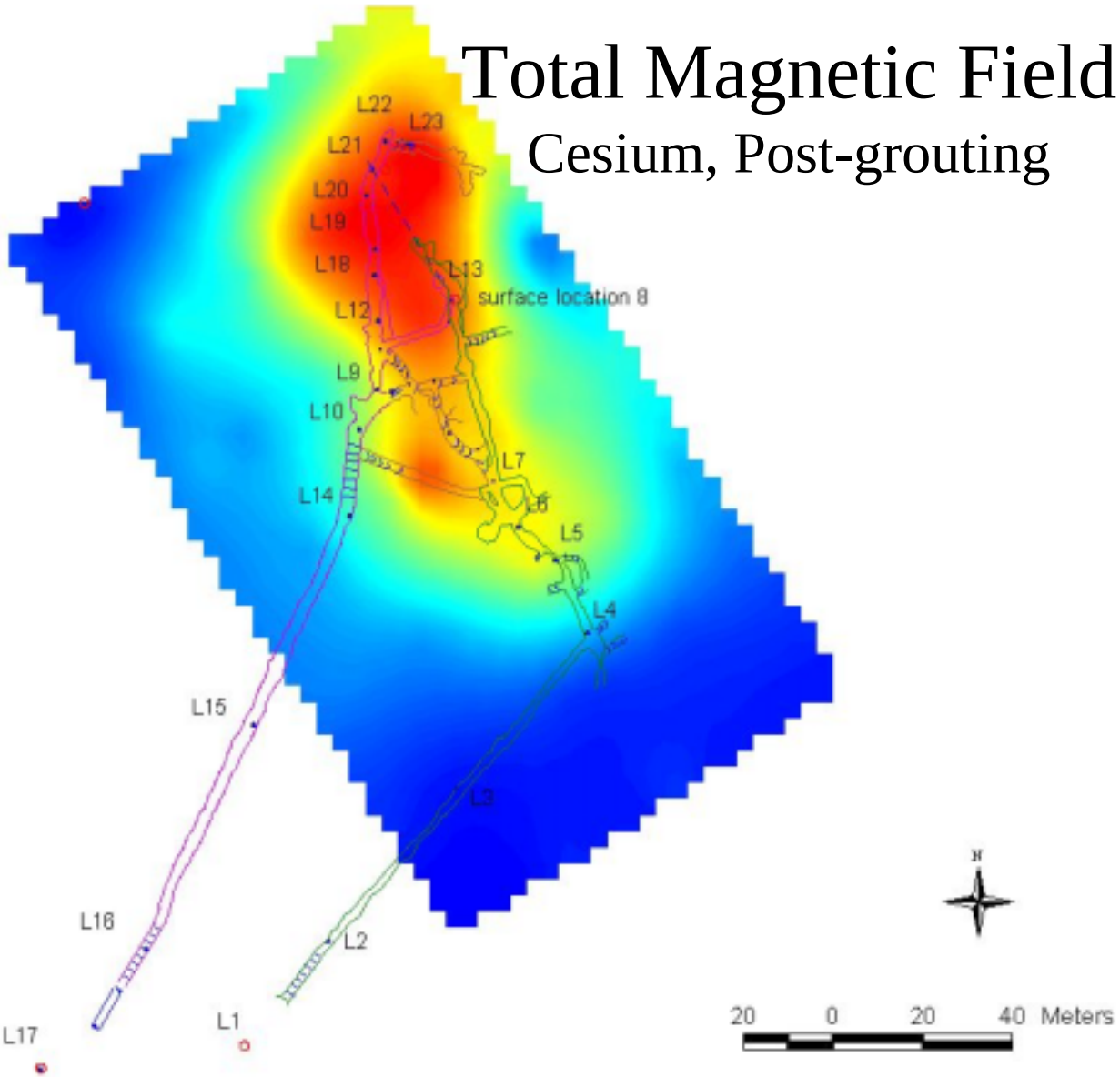
Vertical Gradient Magnetometry
Proton, Pregrouting

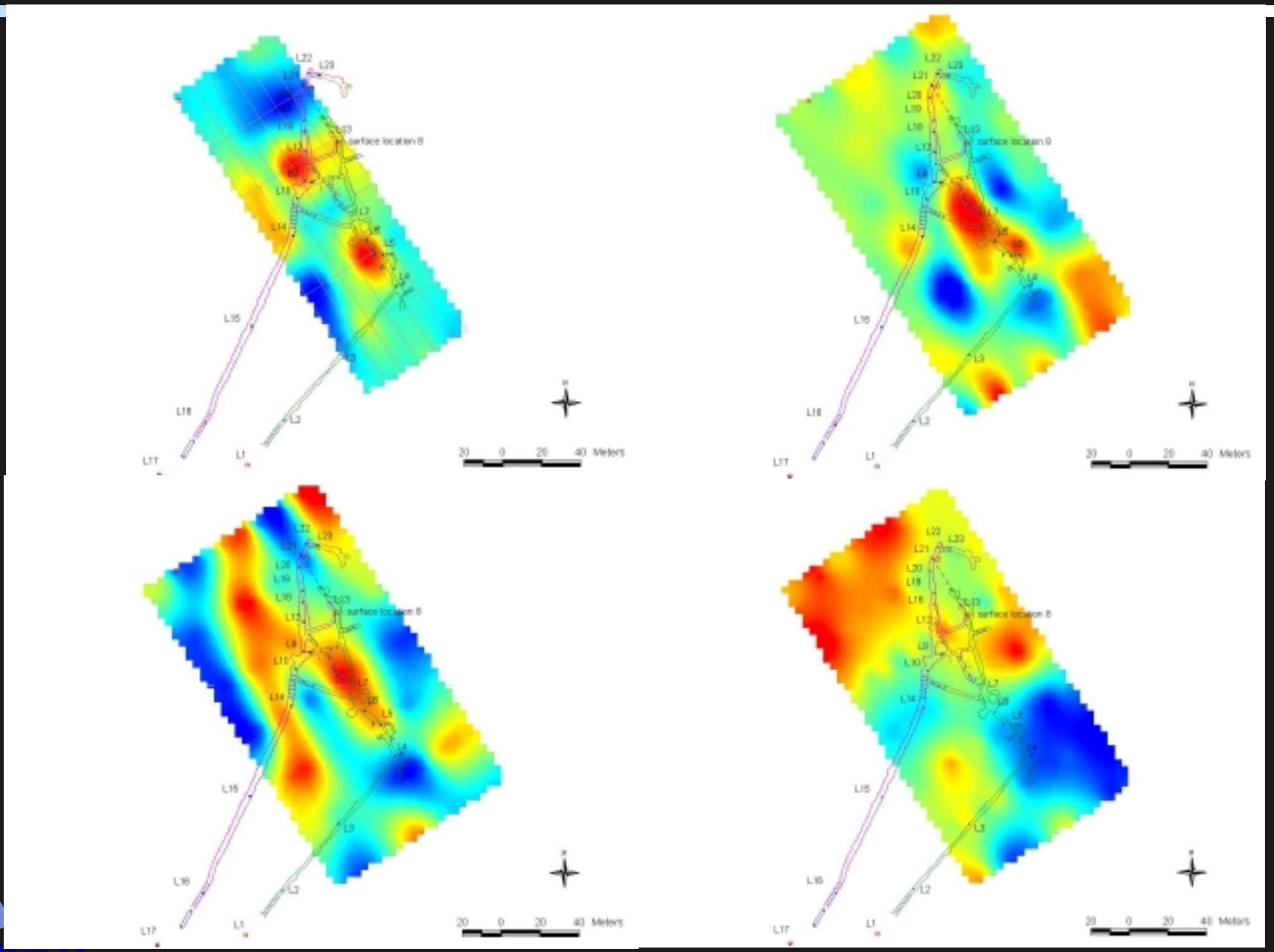


Cesium Magnetometer
Vertical Gradient

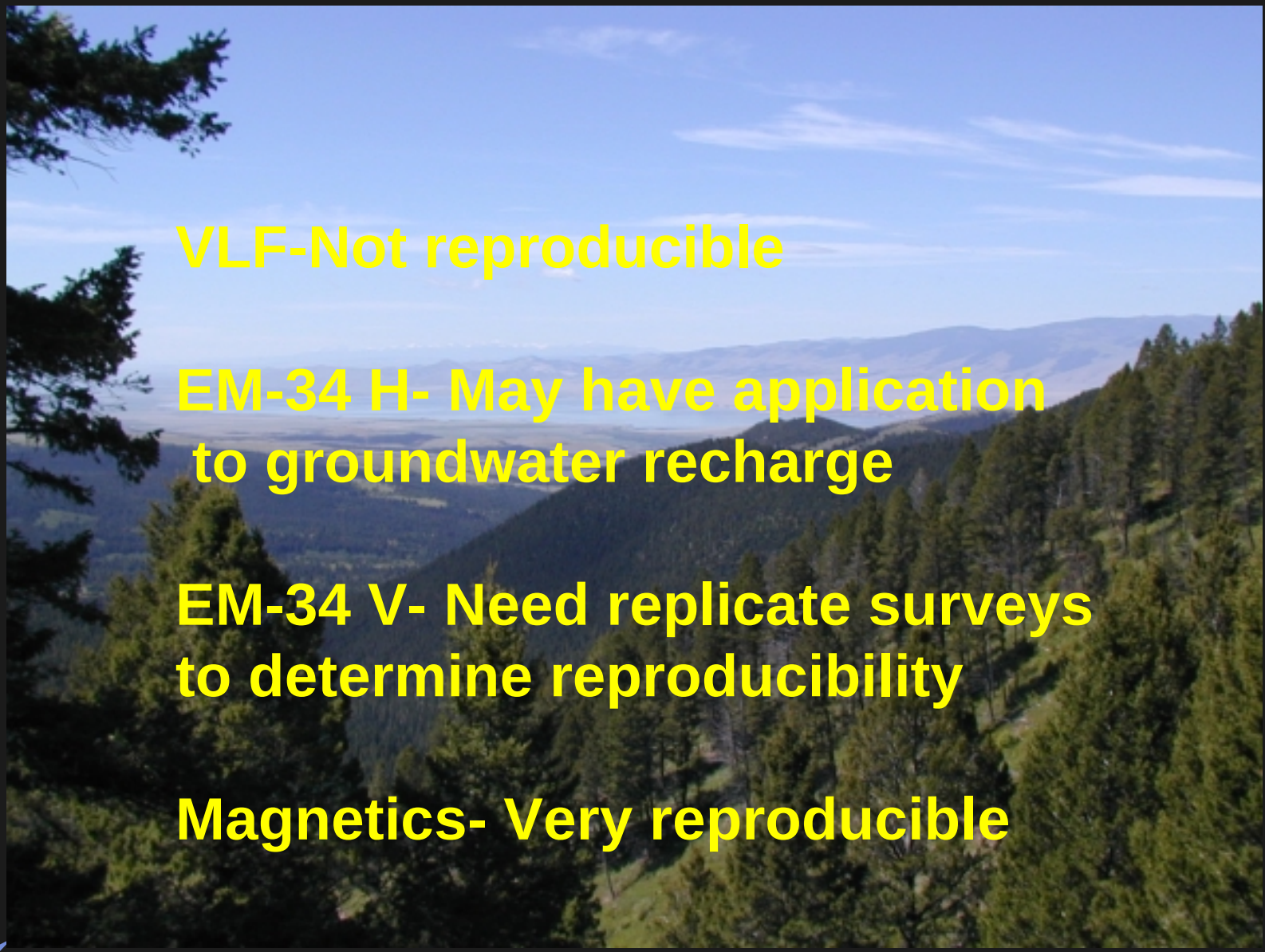
Total Magnetic Field

Cesium, Post-grouting




surface location 0
20 0 20 40 Meters

Surface Grid


VLF-Not reproducible
EM-34 H- May have application to groundwater recharge
EM-34 V- Need replicate surveys to determine reproducibility
Magnetics- Very reproducible