



# Electrical Resistivity Tomography at Construction Sites in Northeast Thailand with Implications for Building Foundation Design

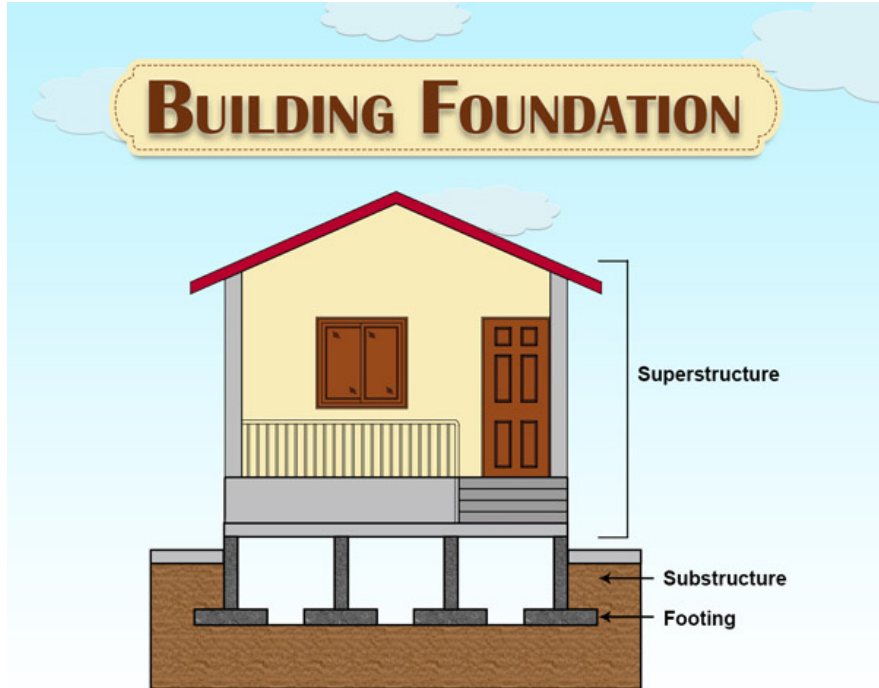
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Co- Advisor: Prof. Ping-Yu Chang

# Building Foundation



Transferring Load Structure in the ground

## Stunning footage of foundation failure that causes 3-story building to collapse in India

Jun, 13, 2020 Shallow Foundations , News On Natural Disasters / Failures India, Nischinta Pur  
Authored by: Geoengineer.org



## ENGINEERING Miami Building Collapse Could Profoundly Change Engineering

To pin down causes of the structure's failure, investigators will probably gather its original design drawings, test its remains and run simulations of how well it could withstand forces

By Robin Lloyd on June 30, 2021



Search-and-rescue teams look for possible survivors in the partially collapsed 12-story Champlain Towers South condo building on June 29, 2021, in Surfside, Fla. Credit: Joe Raedle/Getty Images

Designers of foundations should have a thorough understanding of the ground condition at a building site prior to construct

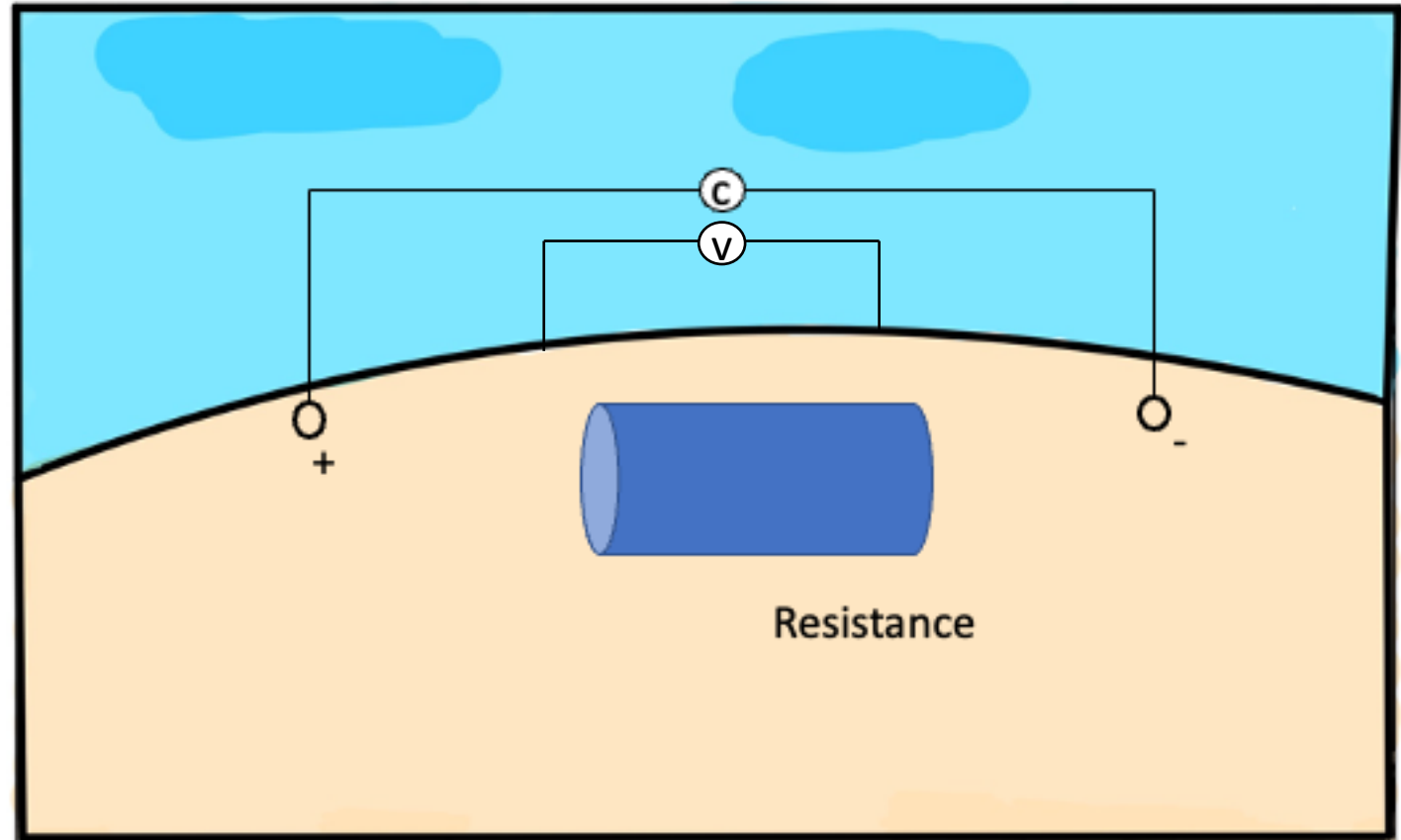
## Electrical Resistivity Tomography (ERT)

- Electrical resistivity is an intrinsic property that **quantifies how strong** a given material opposes the flow of electric current

supply a current into the earth

A material is conductive if it contains free carriers (current flow)

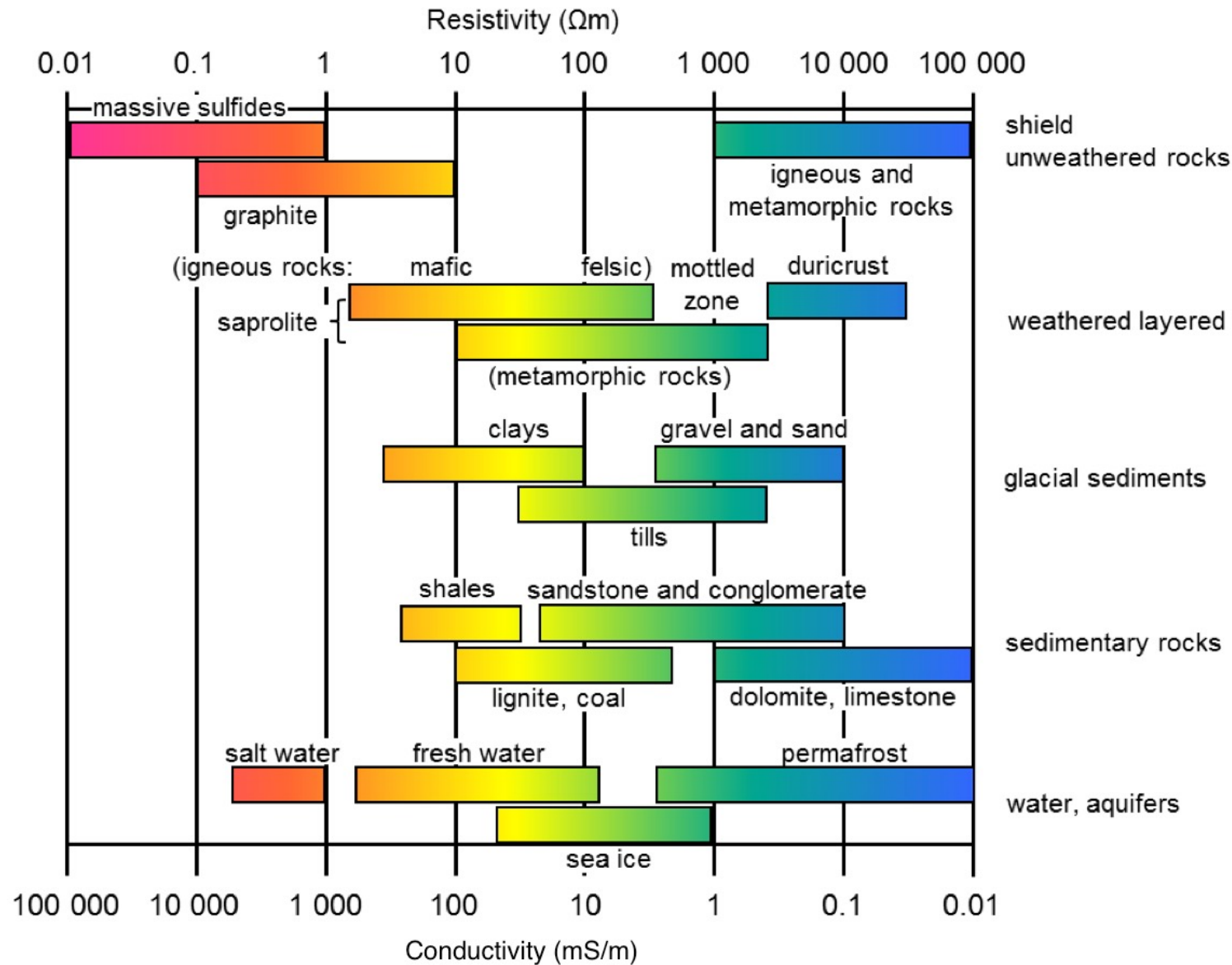
Resistance occurs in the ground, electrical potential differences can be measured



Ⓢ current electrodes

Ⓥ potential electrodes

Resistivity value



The limitation of ERT

Data Acquisition

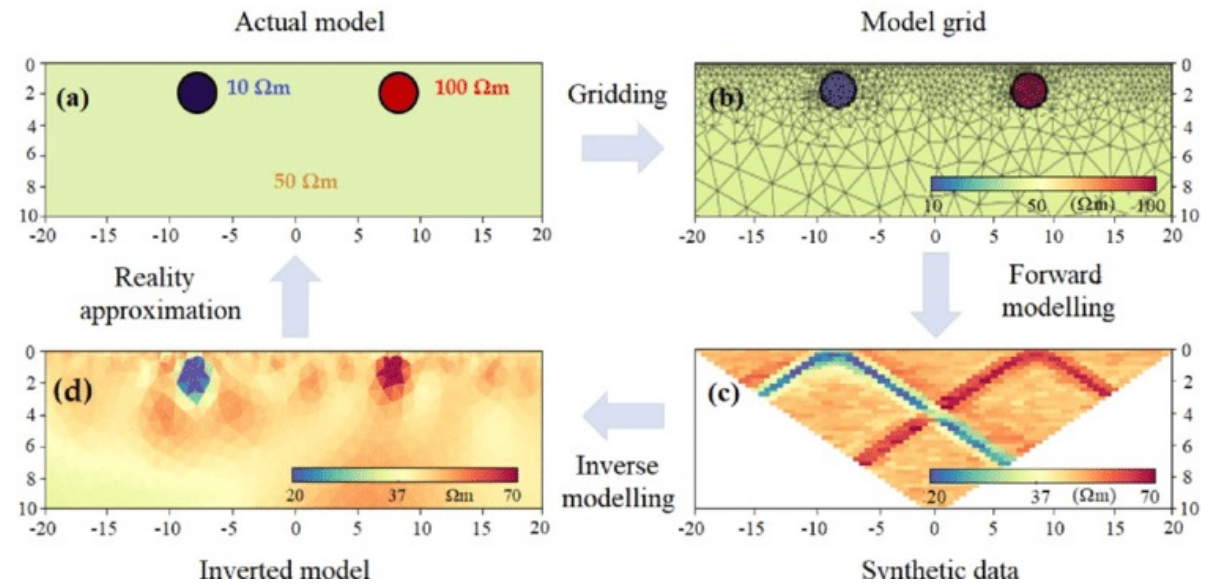


Electricity pole



Heavy rain

Interpretation of result

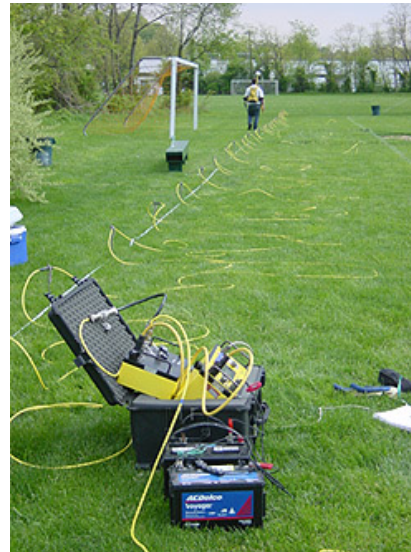
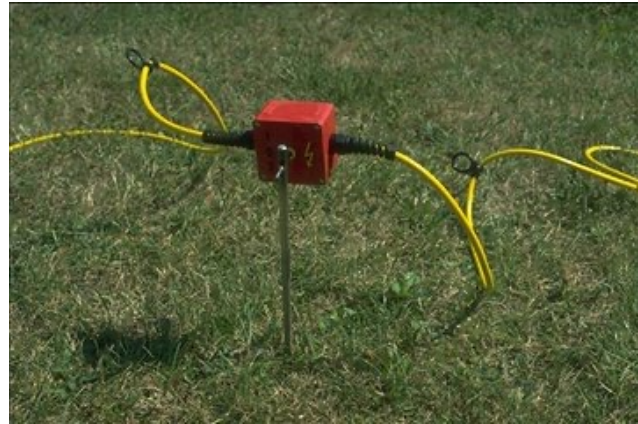


## Acquisition data

Equipment: SyscalPro imaging system

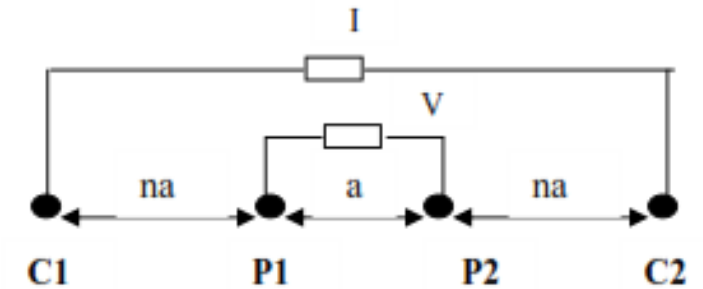


96 steel electrodes

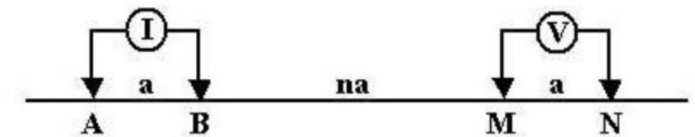


Configurations

Wenner-Schlumberger Array



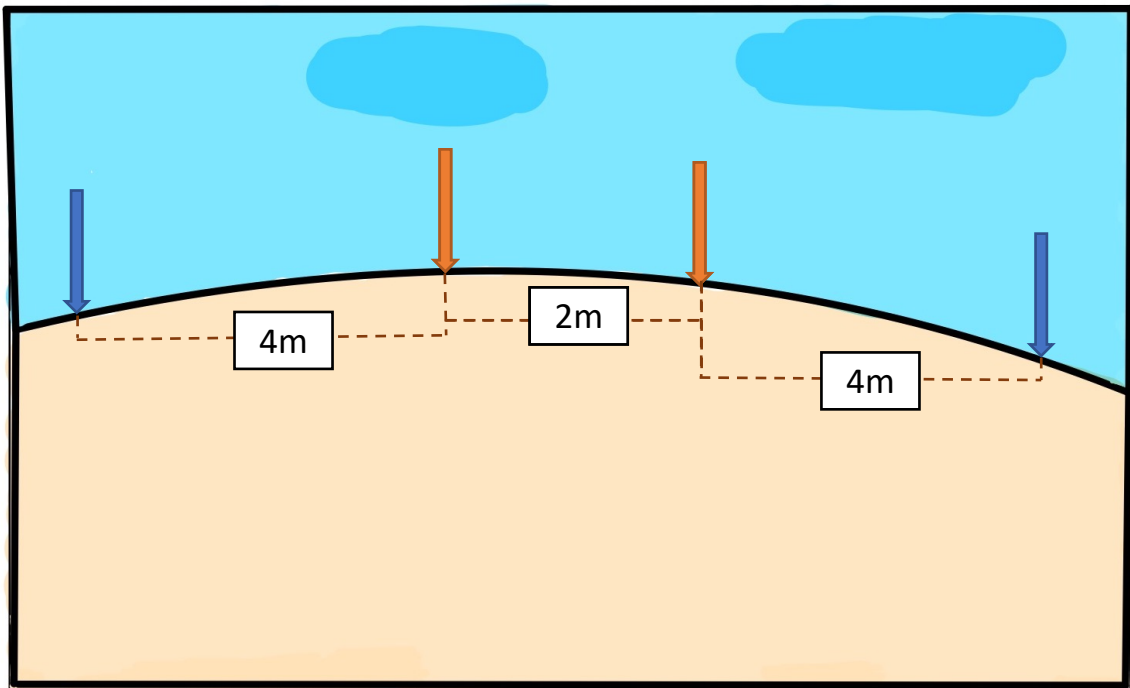
Dipole-Dipole Array



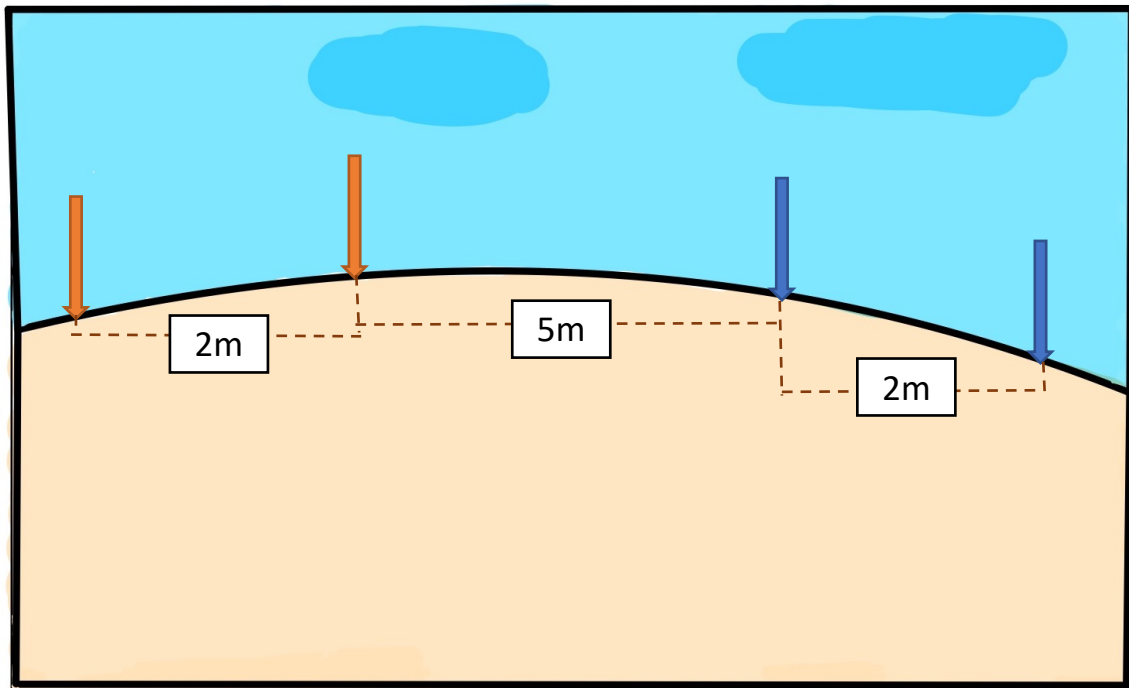
Spacing electrode = 2m  
profile length = 190m

Configurations

Wenner-Schlumberger



Dipole-Dipole

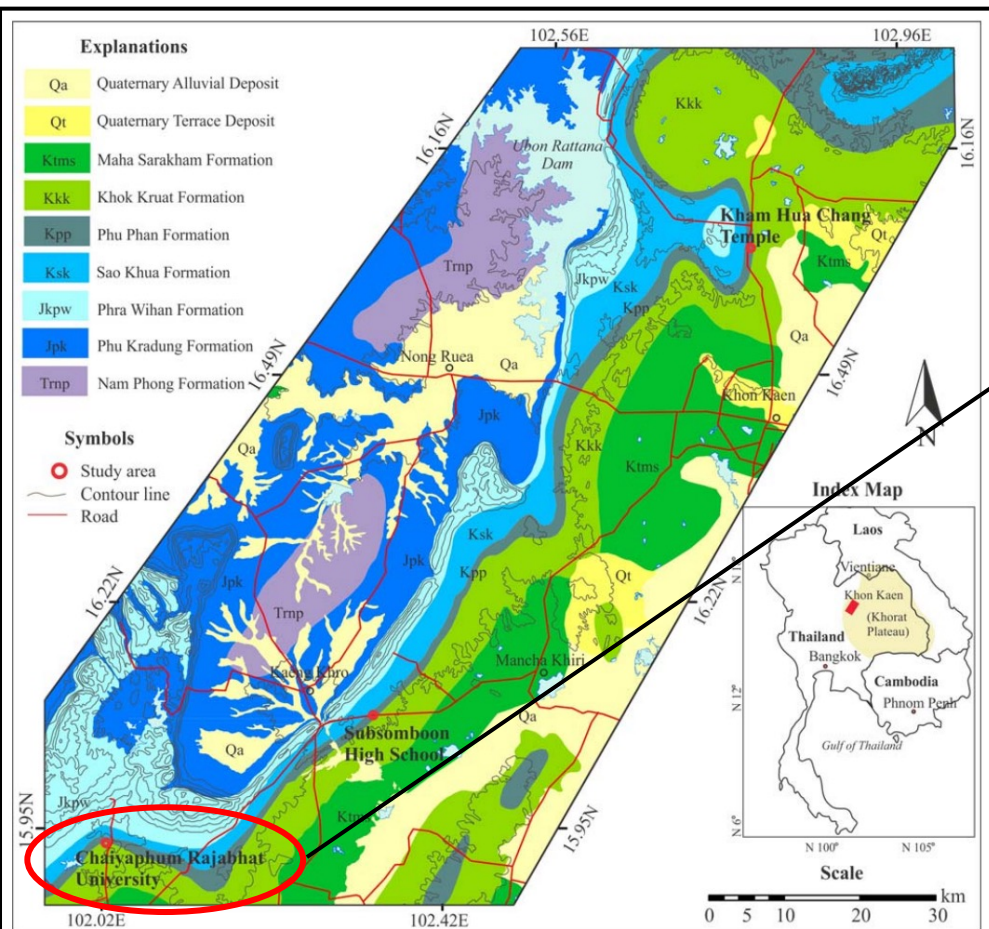


Current Electrodes



Potential electrodes

# Research Area



Site investigation at three construction sites in northeast Thailand

(DMR, 2007)

# Chaiyaphum Rajabhat University



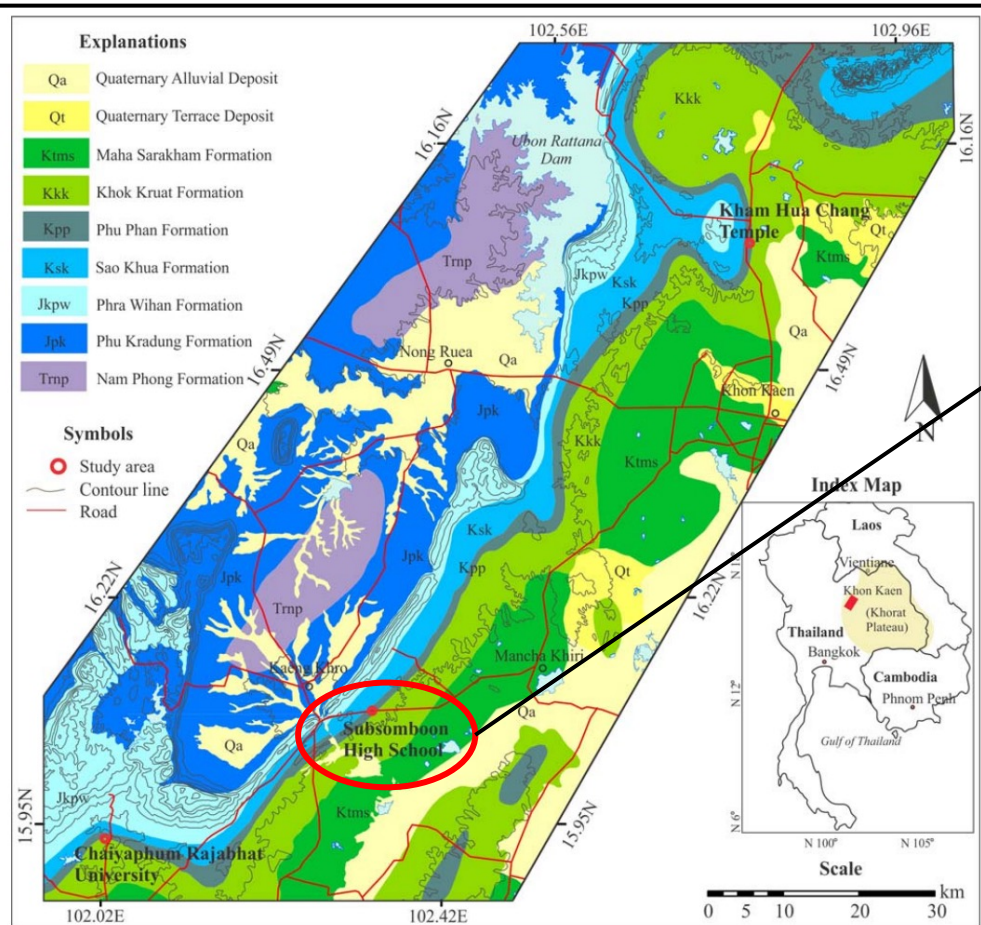
Two ERT Profiles (ChU1 & ChU2) oriented in N-S and W-E alignment



The conglomeratic sandstone bedrock slopes gently toward the south



Research Area



Site investigation at three construction sites in northeast Thailand (DMR, 2007)

The Subsomboon High School

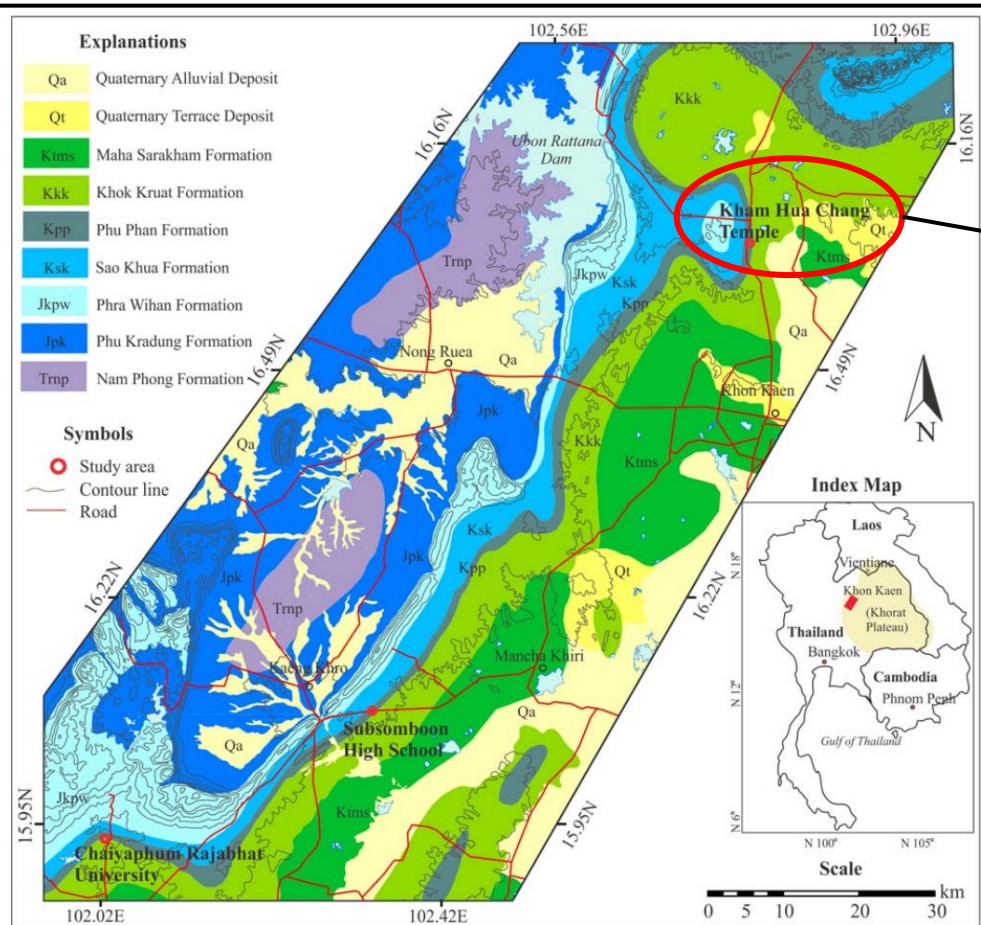


Two ERT Profiles (SB1 & SB2) oriented in E-W and N-S alignment



A thin sandy soil cover is present across most of the campus, SE-dipping Phu Phan bedrock is exposed to the southeast

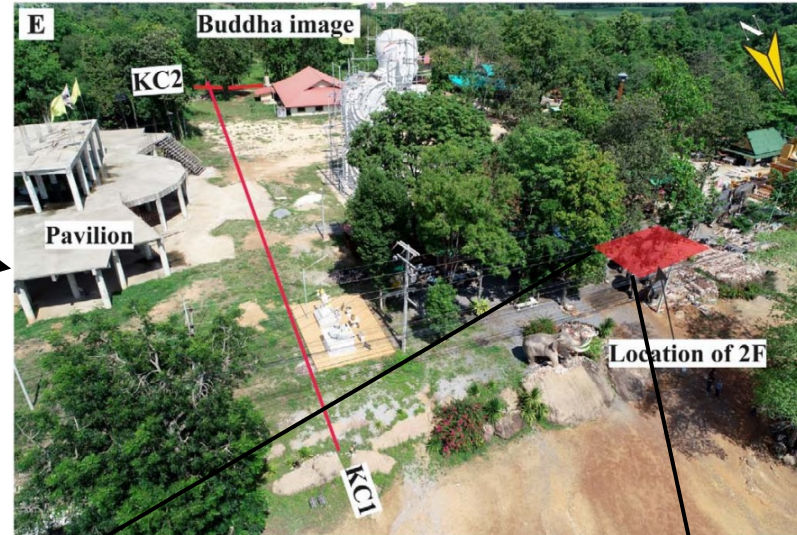
# Research Area



Site investigation at three construction sites in northeast Thailand

(DMR, 2007)

# Kham Hau Chang Temple

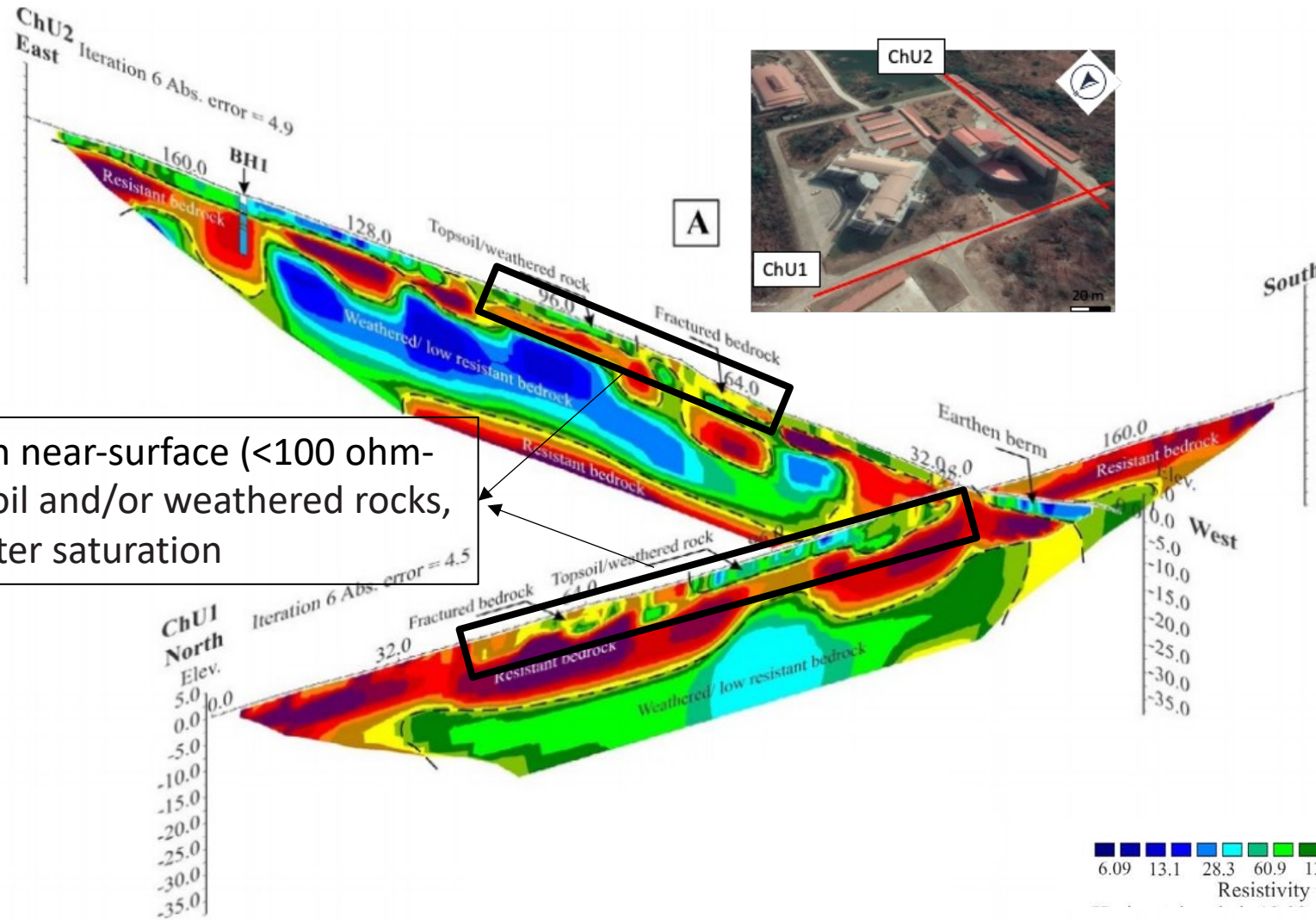


Two ERT Profiles (KC1 & KC2) oriented in W-E and N-S alignment



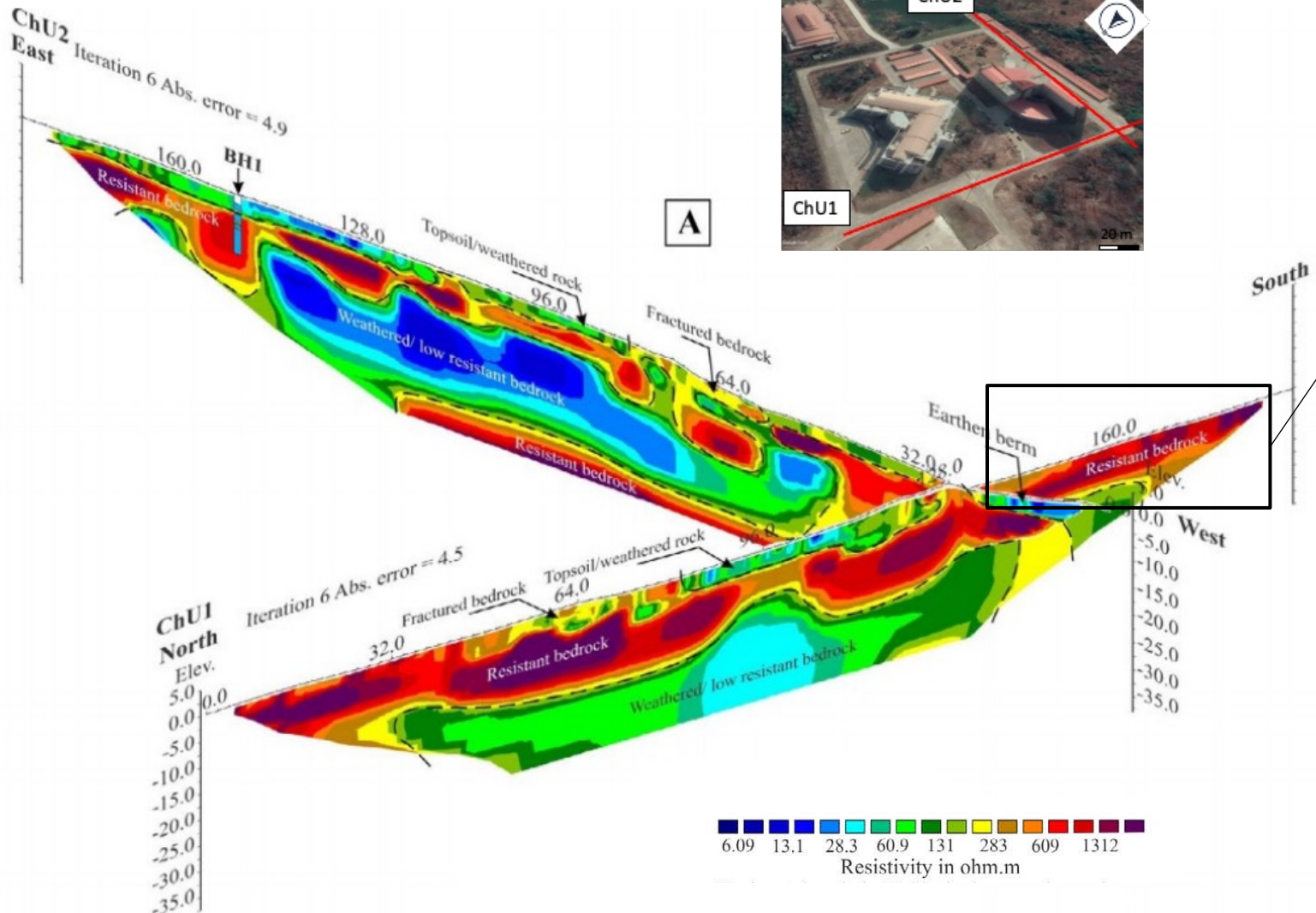
The conglomeratic sandstone bedrock that overlies much of the site is well-exposed and slopes gently toward the south.

Chaiyaphum Rajabhat University



Low Resistivity zone in near-surface (<100 ohm-m) Represent as topsoil and/or weathered rocks, possibly with high water saturation

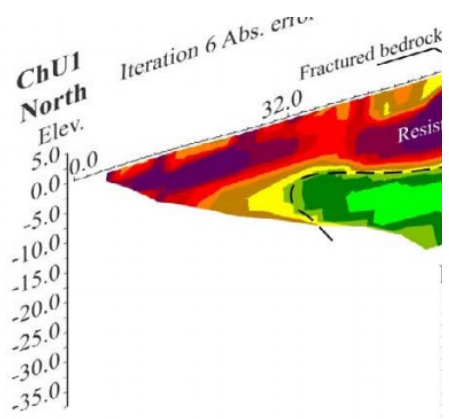
Chaiyaphum Rajabhat University



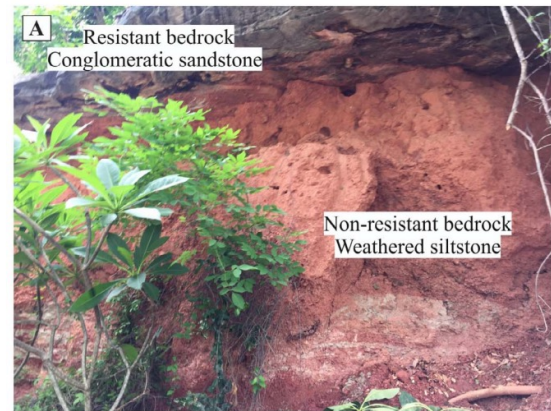
High resistivity zone on the surface, consistent with the observed location of bedrock



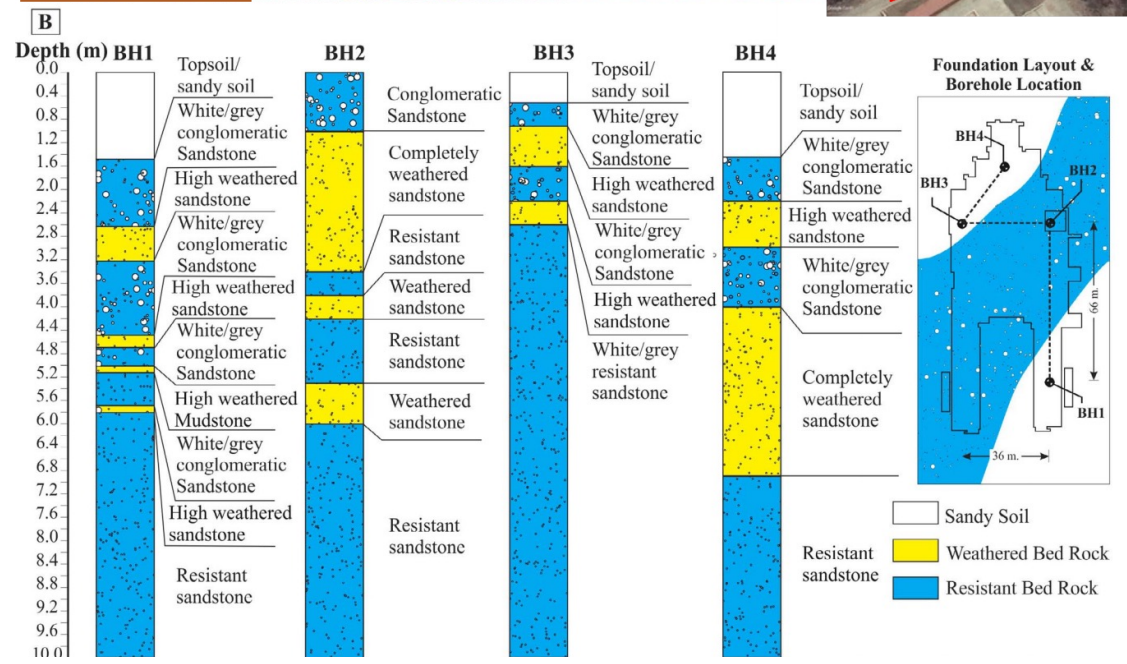
# Chaiyaphum Rajabhat University



Resistance bedrock  
Non-Resistance bedrock



## Borehole



resistant and heavily-weathered bedrock units

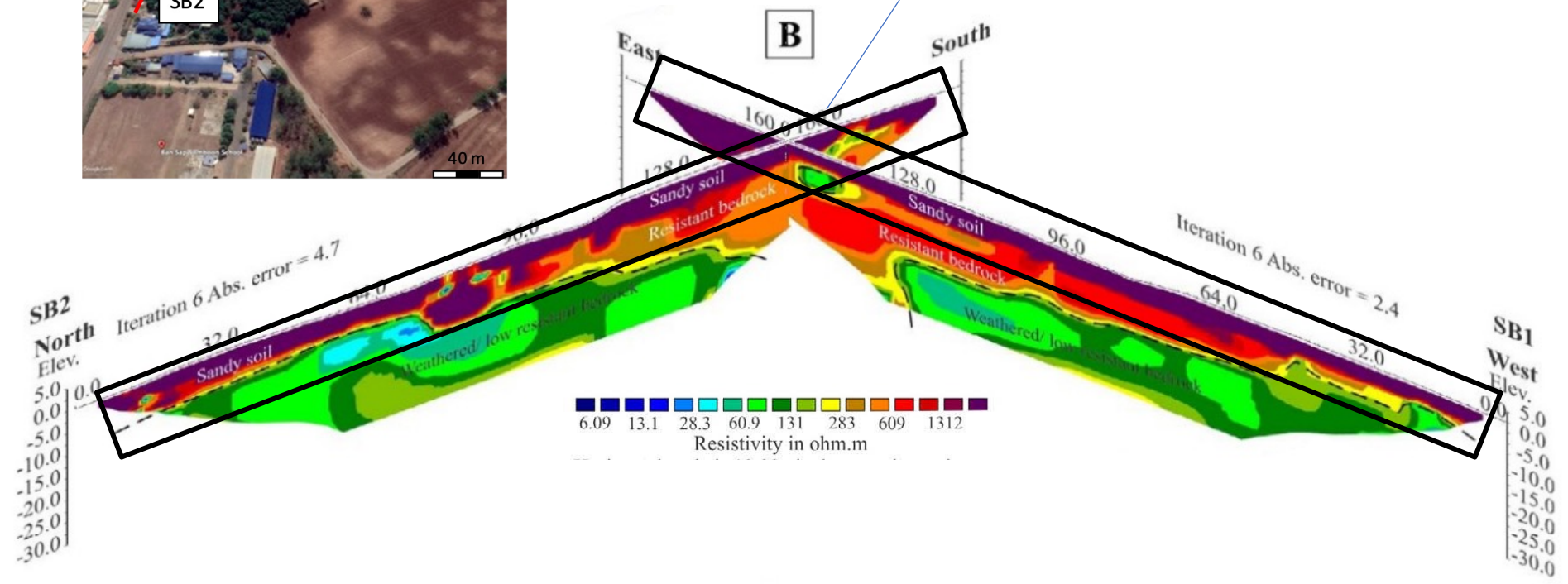
The ERT does not image each of the thin layers individually



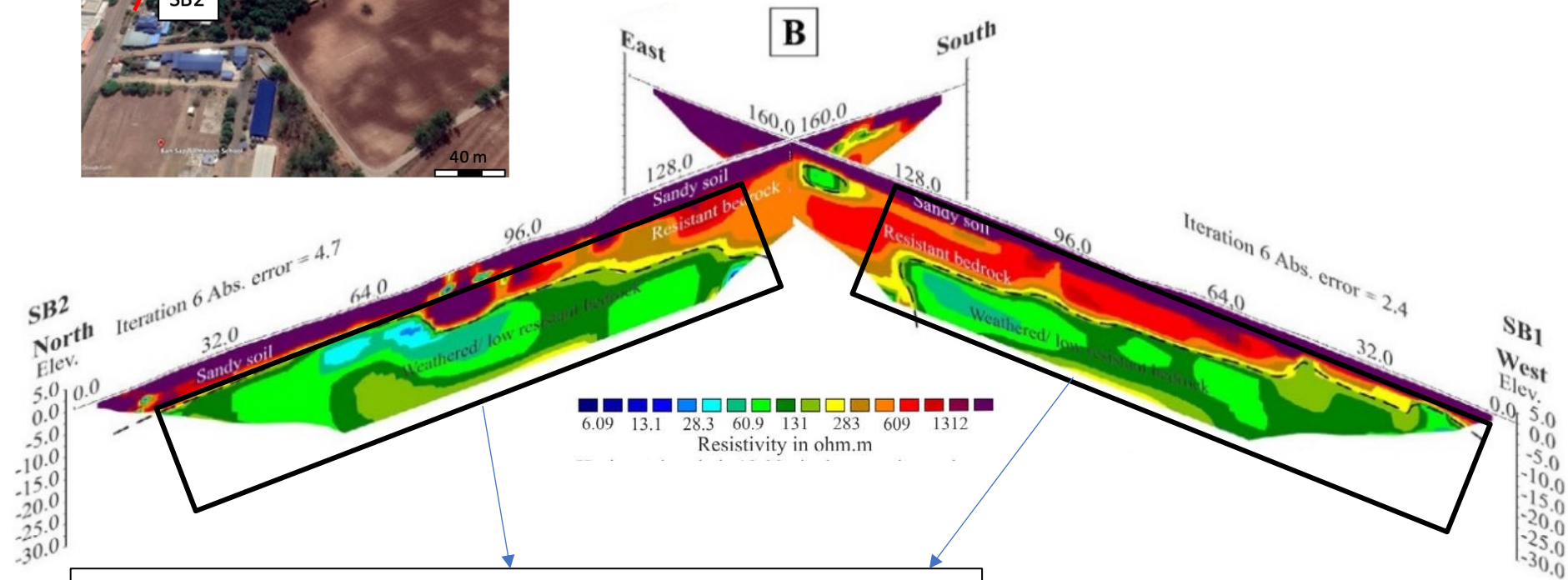
# The Subsomboon High School



High Resistivity zone in near-surface (200-5000 ohm-m) on the depth, 5m represents as resistance bed rock



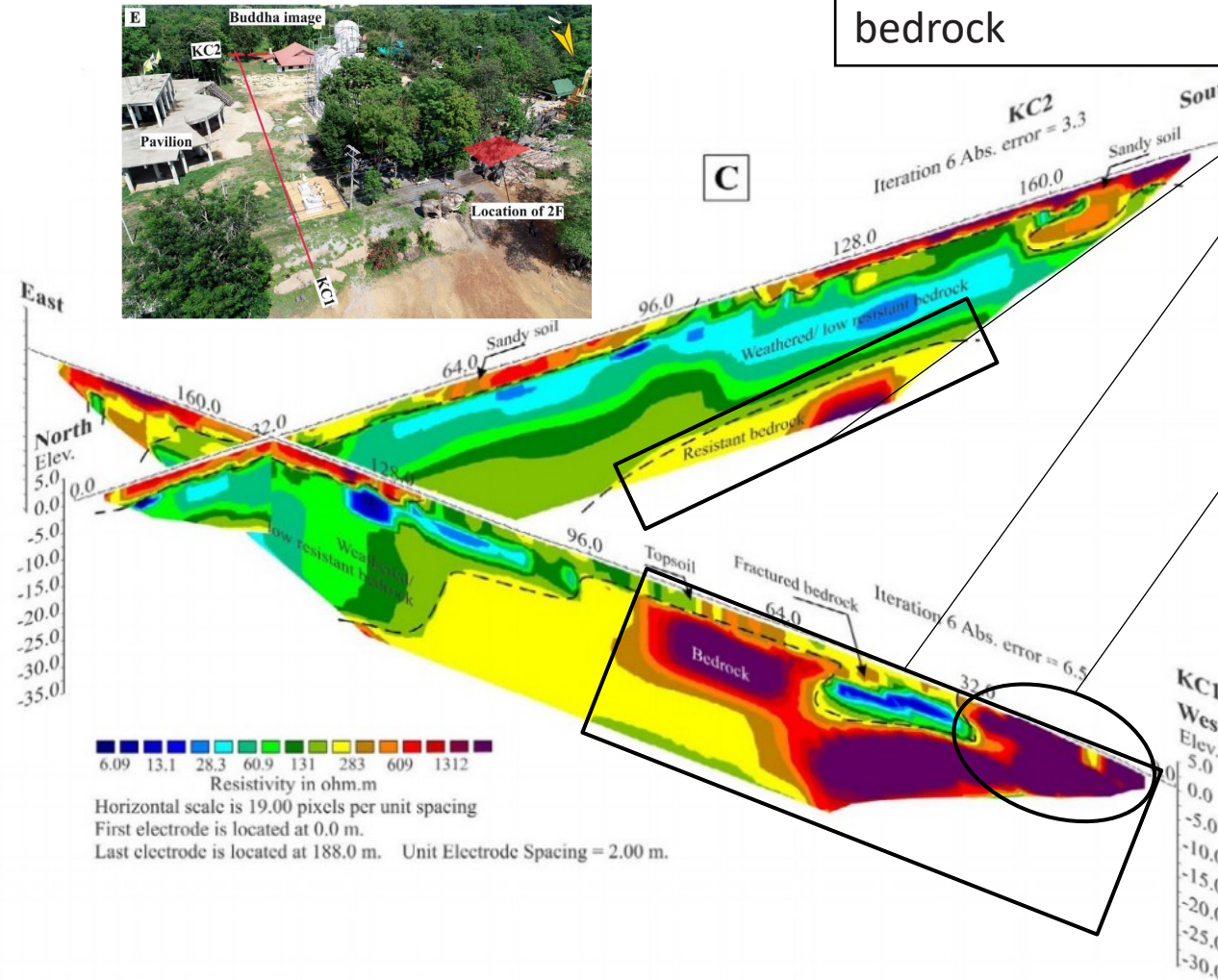
# The Subsomboon High School



The low Resistivity zone in the bottom (<200ohm-m) represents weathered rock with high water saturation

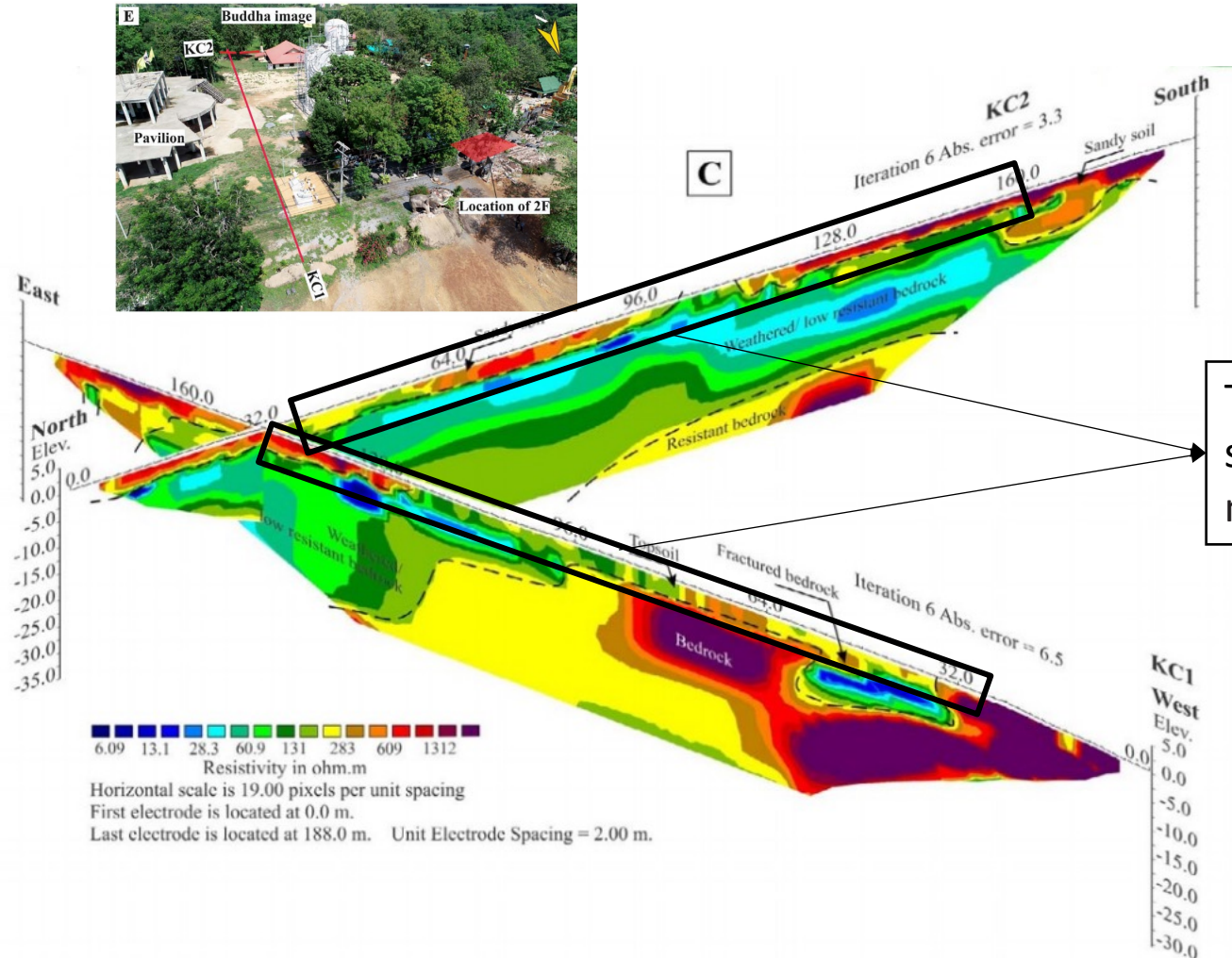
# Kham Hau Chang Temple

The high Resistivity zone in the near-surface (> 1000 ohm-m) on the depth of 30 m represents resistance bedrock





# Kham Hau Chang Temple



The low Resistivity zone in the near-surface (< 5 ohm-m) on the depth of 5-15 m represents a weathered mudstone

1. The ERT result from Chaiyaphum Rajabhat University, Subsomboon School, and Kham Hau Chang Temple reveal intact bedrock overlying a relatively weak weathered layer of sandstone-siltstone.
2. The depth of bedrock can help determine an appropriate foundation for a given building.
  - Chaiyaphum Rajabhat University= 5-10m
  - Subsomboon School= 0-10m
  - Kham Hau Chang Temple= 10-30 m

THANK YOU

