Cost-effective exploration methods for landfills:
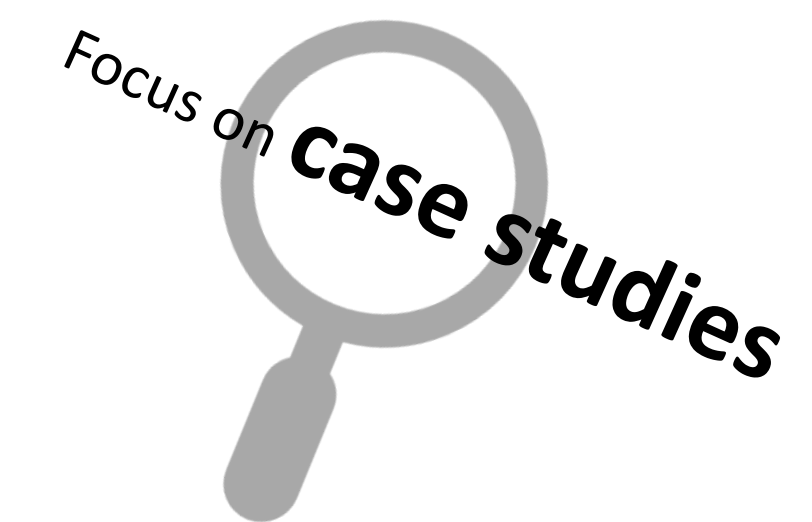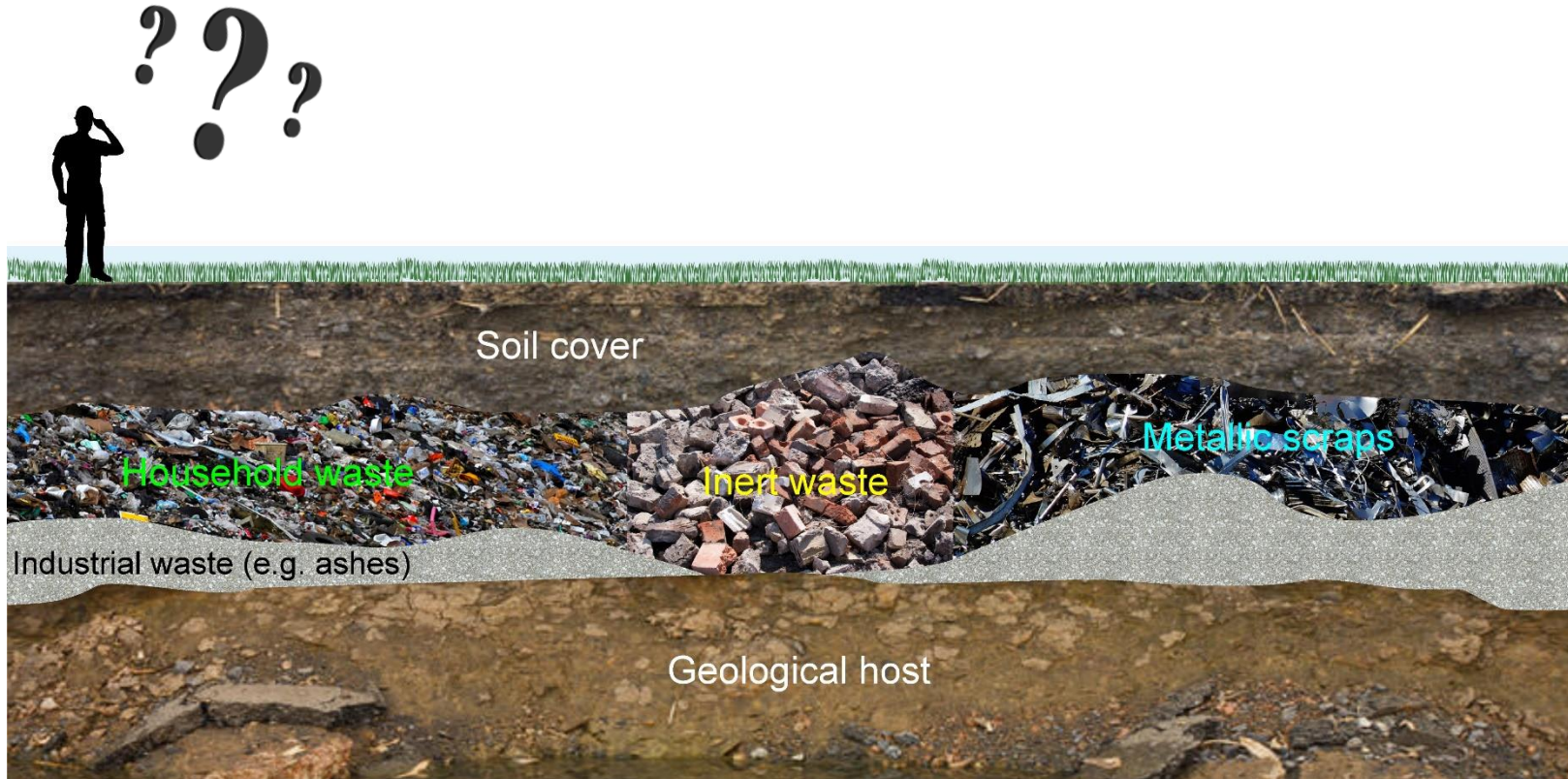# results from the RAWFILL project

Fred Nguyen, David Caterina, Itzel Manrique Isunza,

Tom Debouny
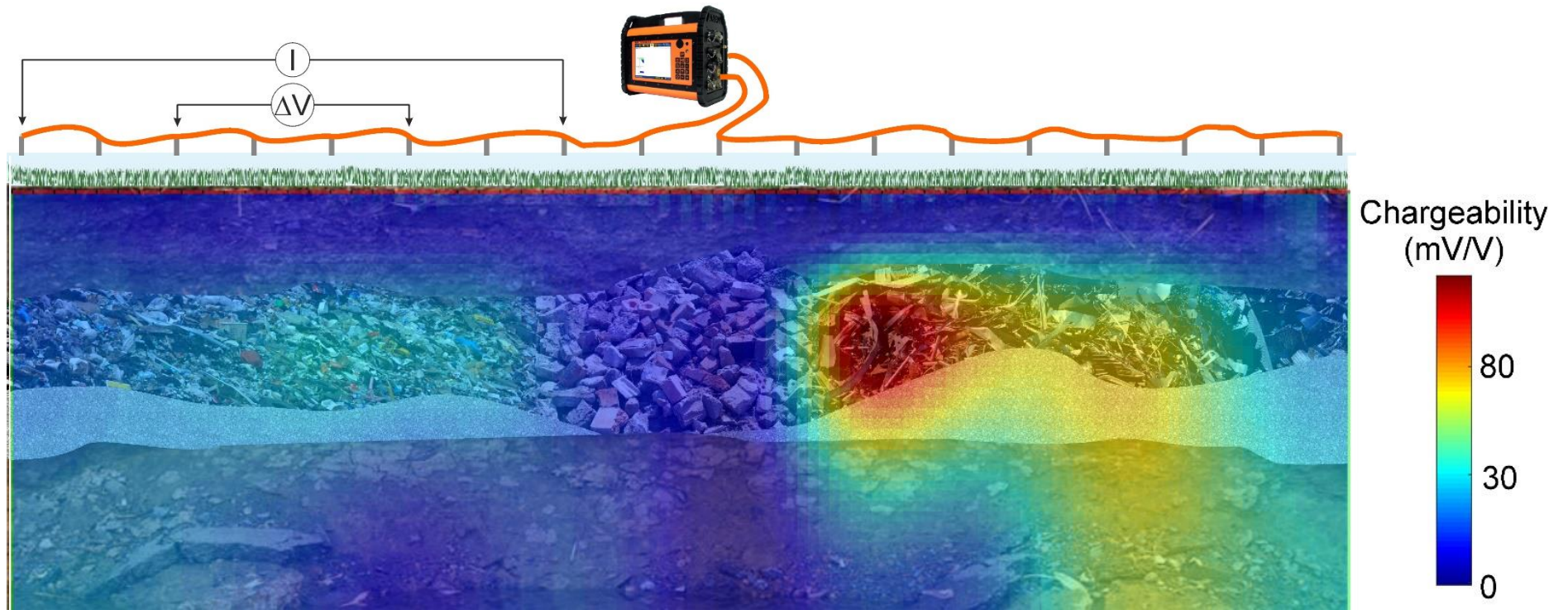
Agenda of the presentation

- **A short introduction to geophysics**

- Landfill investigation

- Take home message

Focus on **case studies**

Applied geophysics: a means to see through

Soil cover

Household waste

Inert waste

Metallic scraps

Industrial waste (e.g. ashes)

Geological host

Electrical resistivity tomography principles

Agenda of the presentation

- A short introduction to geophysics
- **Case study from RAWFILL**
  - **Site presentation**
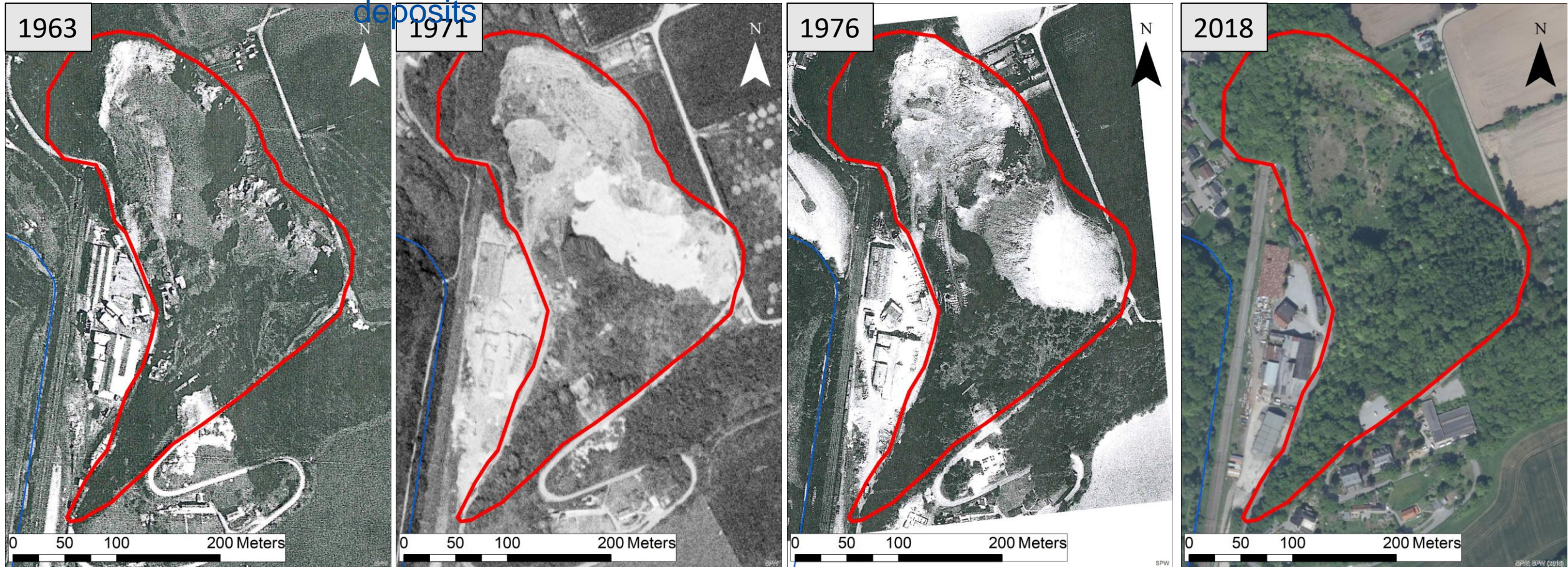 - Results
  - Model
- Take home message

Landfills investigated in RAWFILL

Onoz case study

Context: history

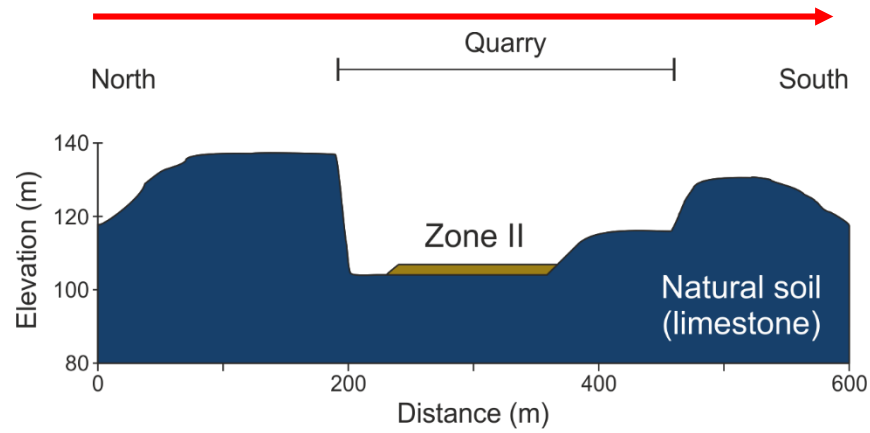1967-1976: slaked lime deposits followed by ashes deposits
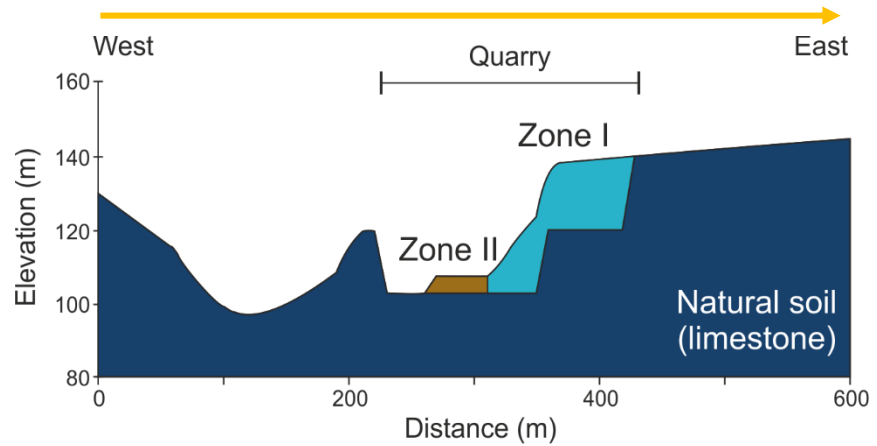
(SPW, 2019)

1902-1967: quarry (limestone extraction)

1982-1987: heterogeneous wastes (inert, tires, rubber, plastic, car parts, household...)
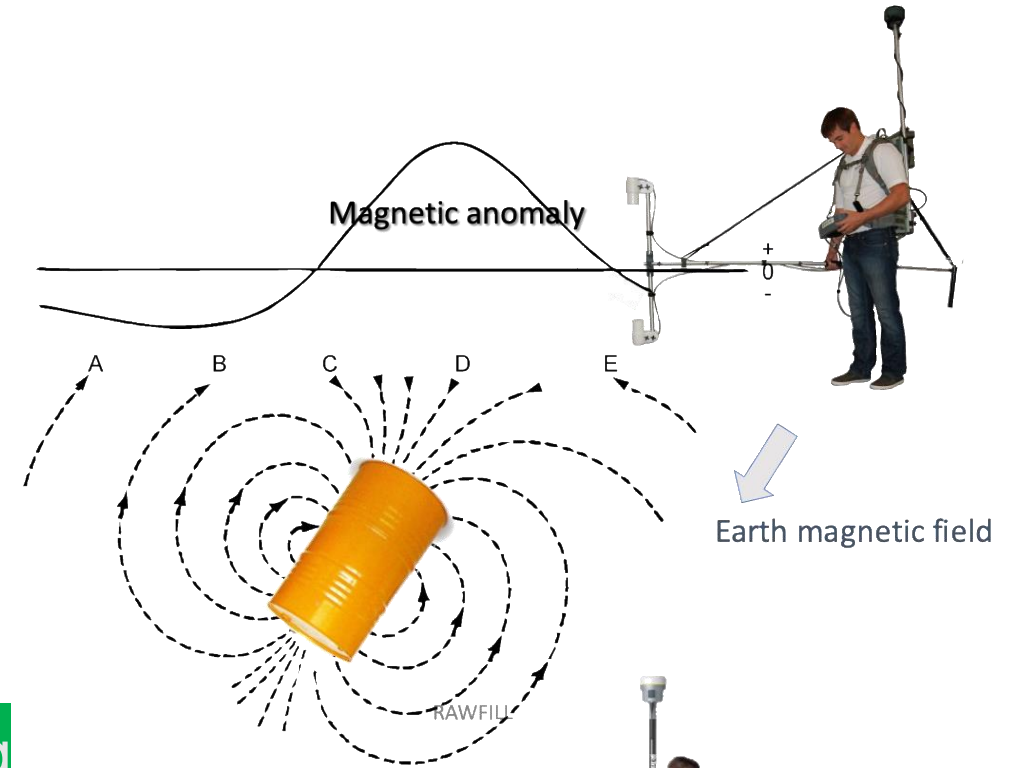
7

Site conceptual model
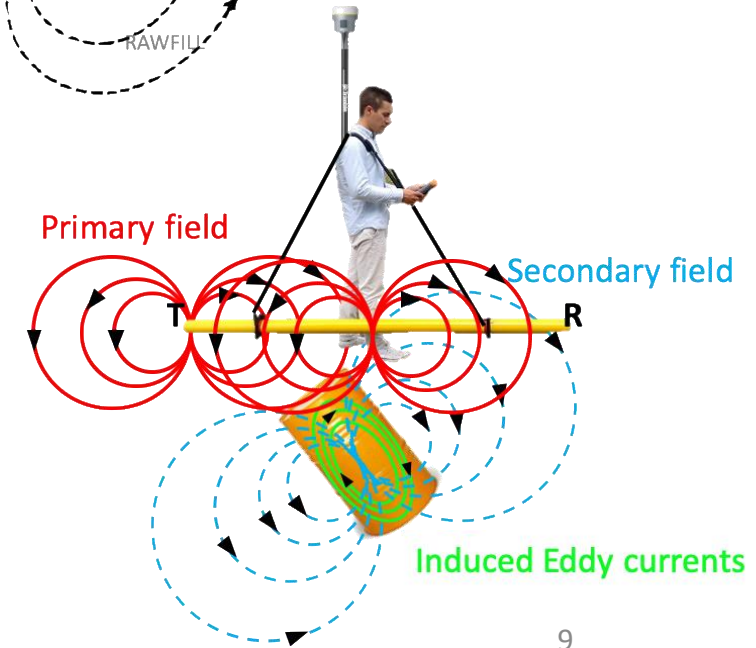
Selected geophysics

- Electromagnetic induction (EM)

- Magnetometry (MAG)

- Electrical Resistivity Tomography (ERT) and Induced Polarization (IP)

- Seismic method
  - Horizontal to Vertical Noise Spectral Ratio (HVNSR or H/V)

Mapping

Imaging

Sounding

Magnetic anomaly

A   B   C   D   E

Earth magnetic field

RAWFILL

Primary field

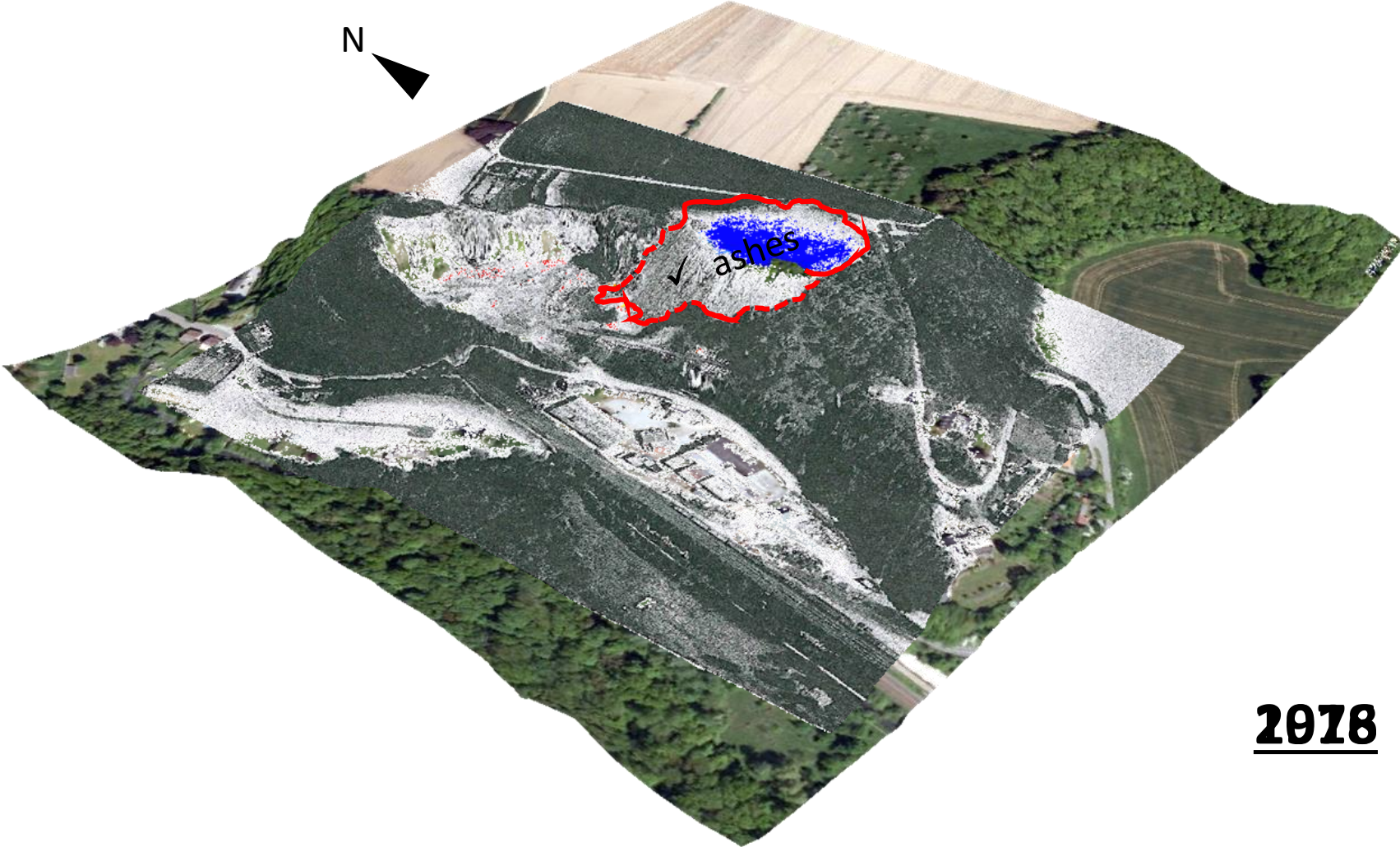Secondary field

T   R

Induced Eddy currents

9

Agenda of the presentation

- A short introduction to geophysics
- **Case study from RAWFILL**
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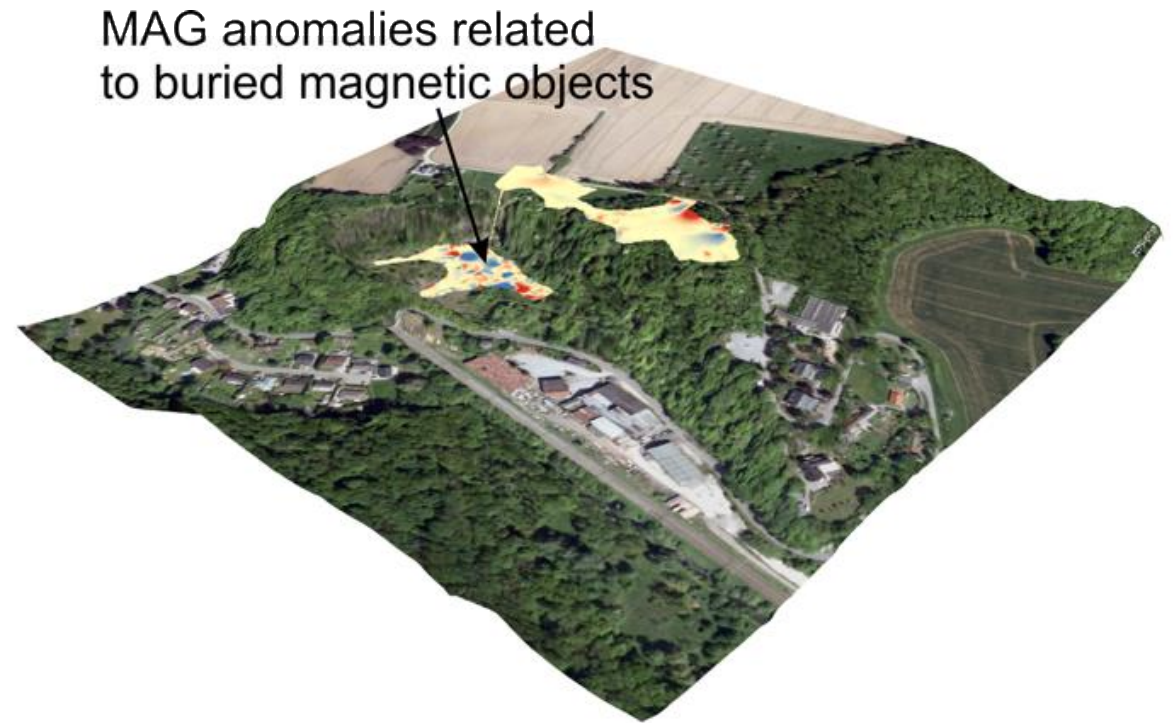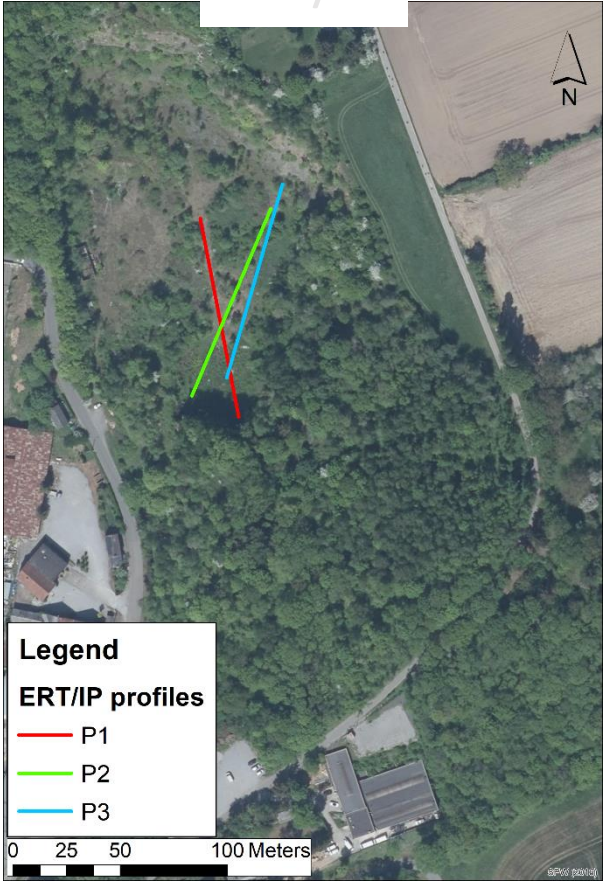
Coverage and EMI result

EMI coverage

Slaked lime and ash

Electrical conductivity
High
Medium
Low

E
M
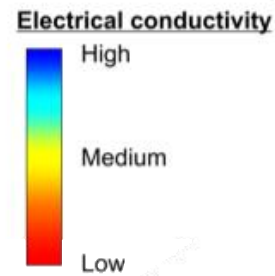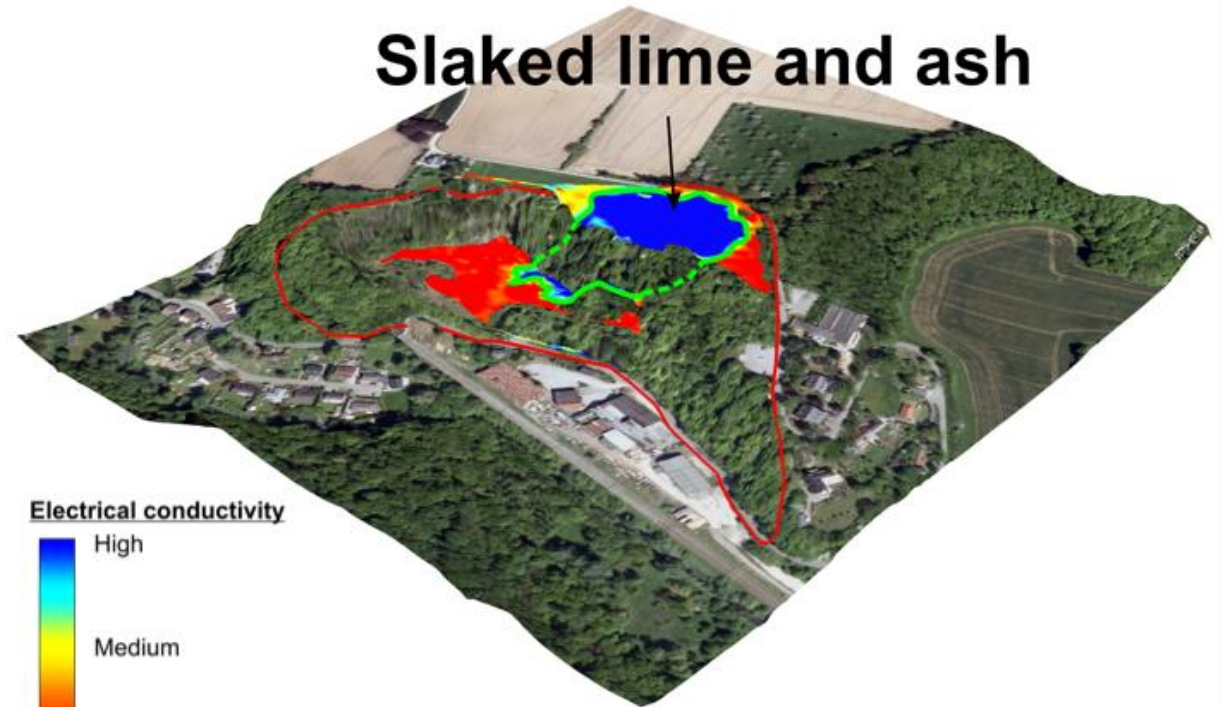
Interpretation: EM

N

ashes ✓

2018

Coverage and magnetometry result

MAG coverage
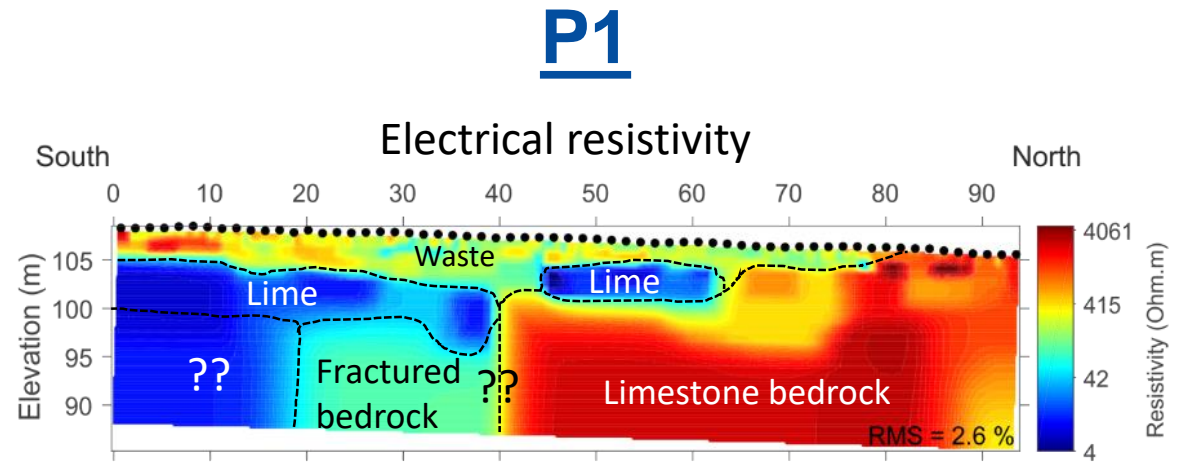
MAG anomalies related to buried magnetic objects

MAG

Tomography (resistivity and induced polarization)

ERT/IP

Legend

ERT/IP profiles

— P1
— P2
— P3

0   25   50   100 Meters

ERT lines

Electrical resistivity tomography result
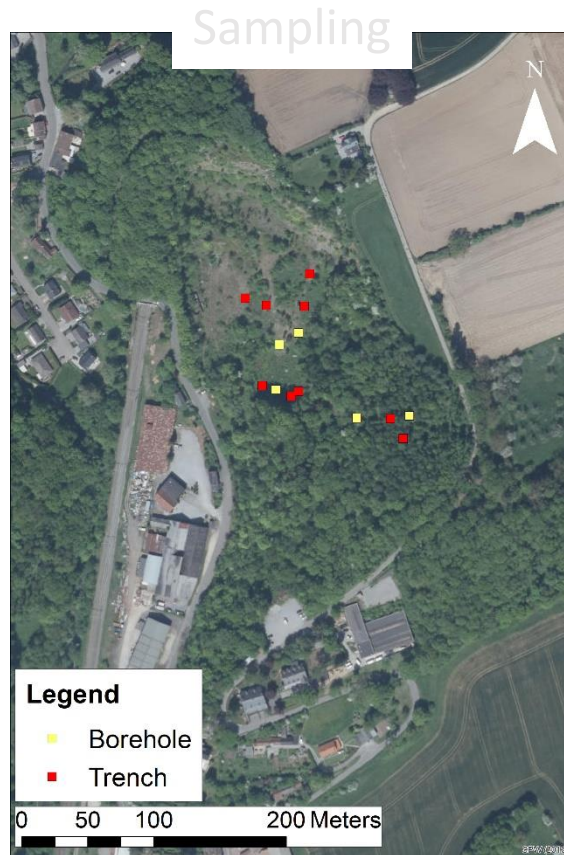

P1
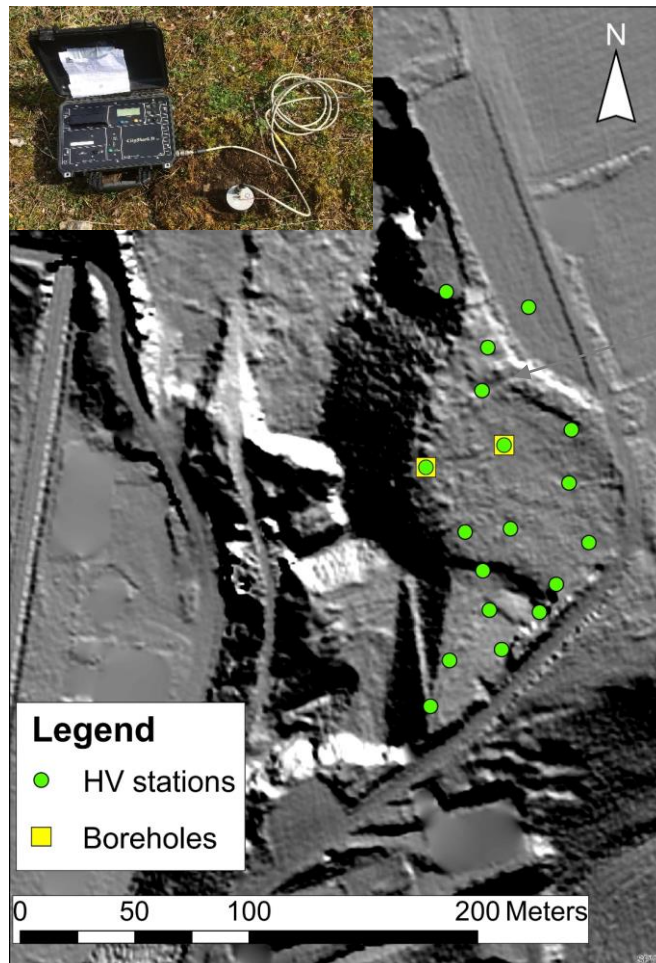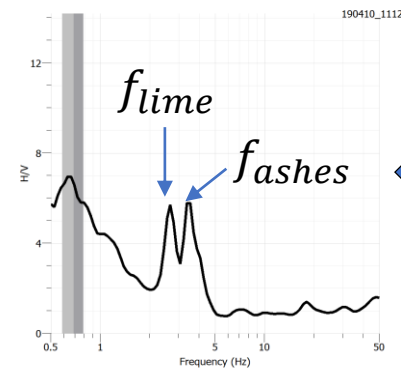
Electrical resistivity
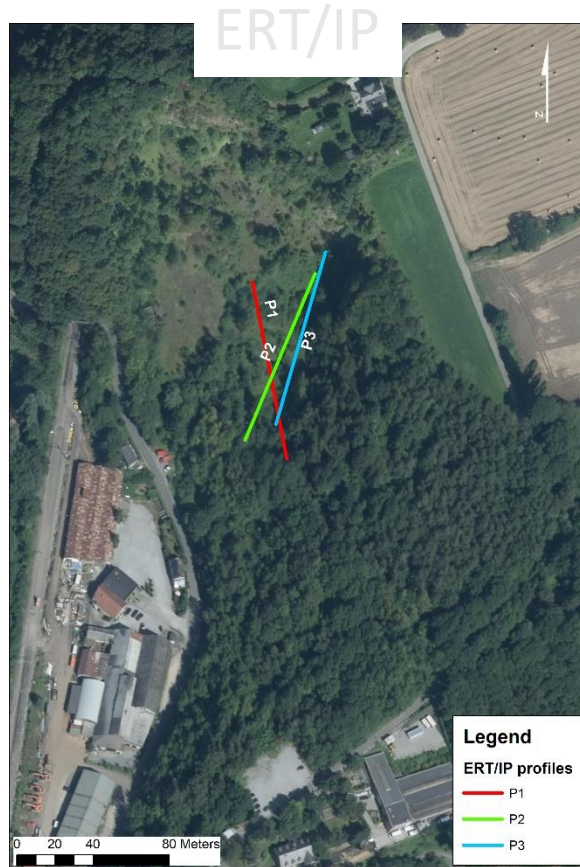
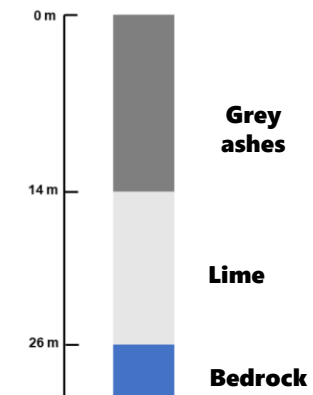# Electrical resistivity tomography vs validation
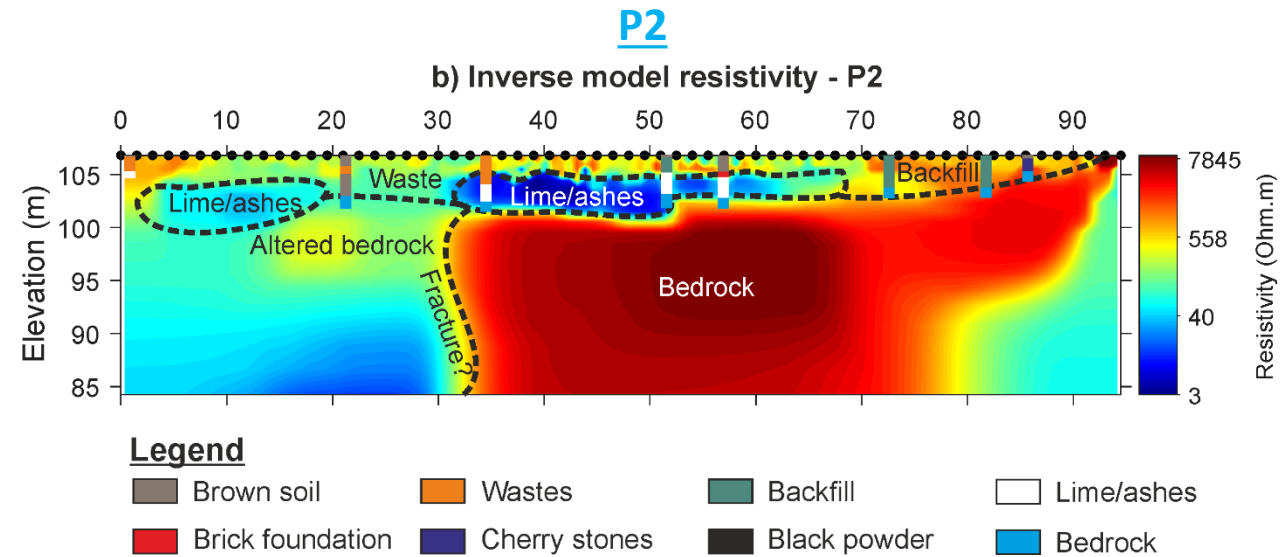
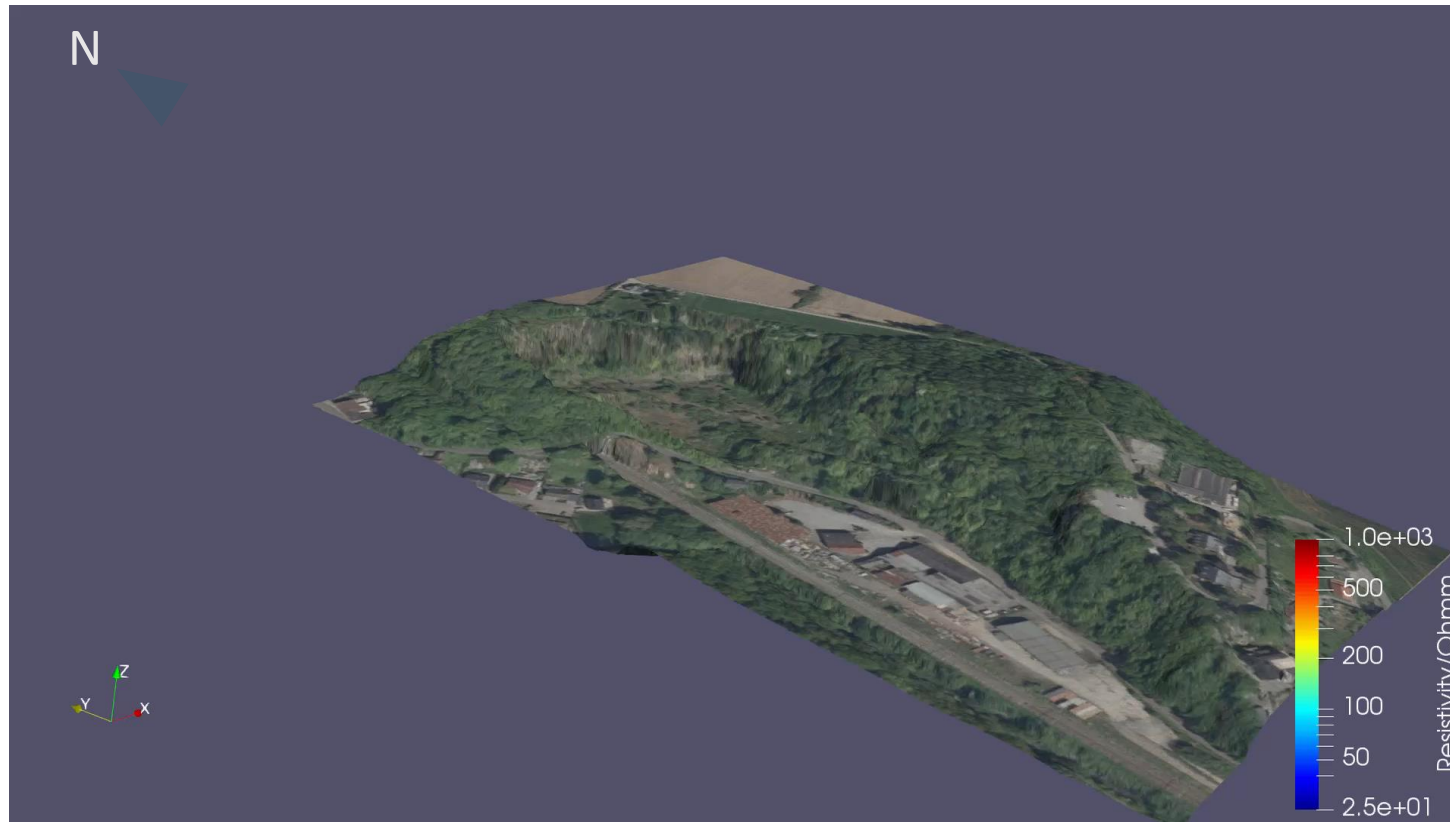# Using the resonance frequency to sound

H/V measurement

Borehole log

$$V_{s_{lime}} = 318\,\frac{m}{s}$$

$$V_{s_{ashes}} = 271\,\frac{m}{s}$$

Possible to estimate the thickness of ash and lime at other HV stations
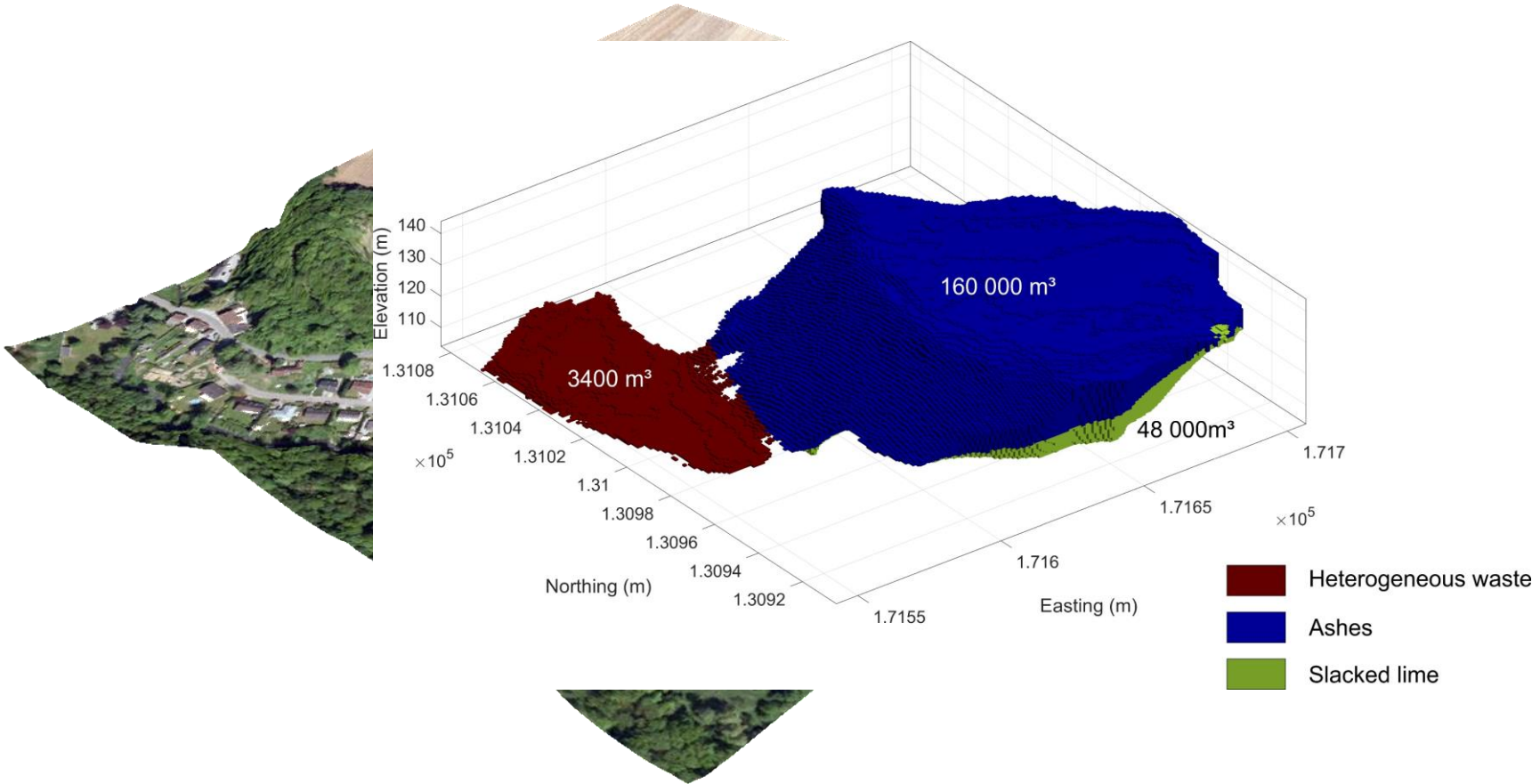
(Debouny, 2019)

From 2D to 3D tomography

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Translation in a quantified model

Take home message

Case successful here but not a silver bullet (no universal response), it needs to be assisted by complementary data

Landfills Hor./Vert. delimitation is demonstrated > **multi-methods very efficient**

For composition quantification: requires **careful and dedicated processing** and **laboratory petrophysics**

Outlook: Geophysical **monitoring** to follow **leachate injection, membrane leaking , biodegradation/bioleaching**

Thank you

Raw materials recovered from landfills

The Interreg North-West Europe Project is coordinated by SPAQuE and unites 8 partners from 4 EU regions.