Modelling peat stratigraphy using integrated geophysics

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NATURAL ENVIRONMENT RESEARCH COUNCIL

Outline

The use and advantages of non-invasive techniques to investigate peat stratigraphy and its lateral extent

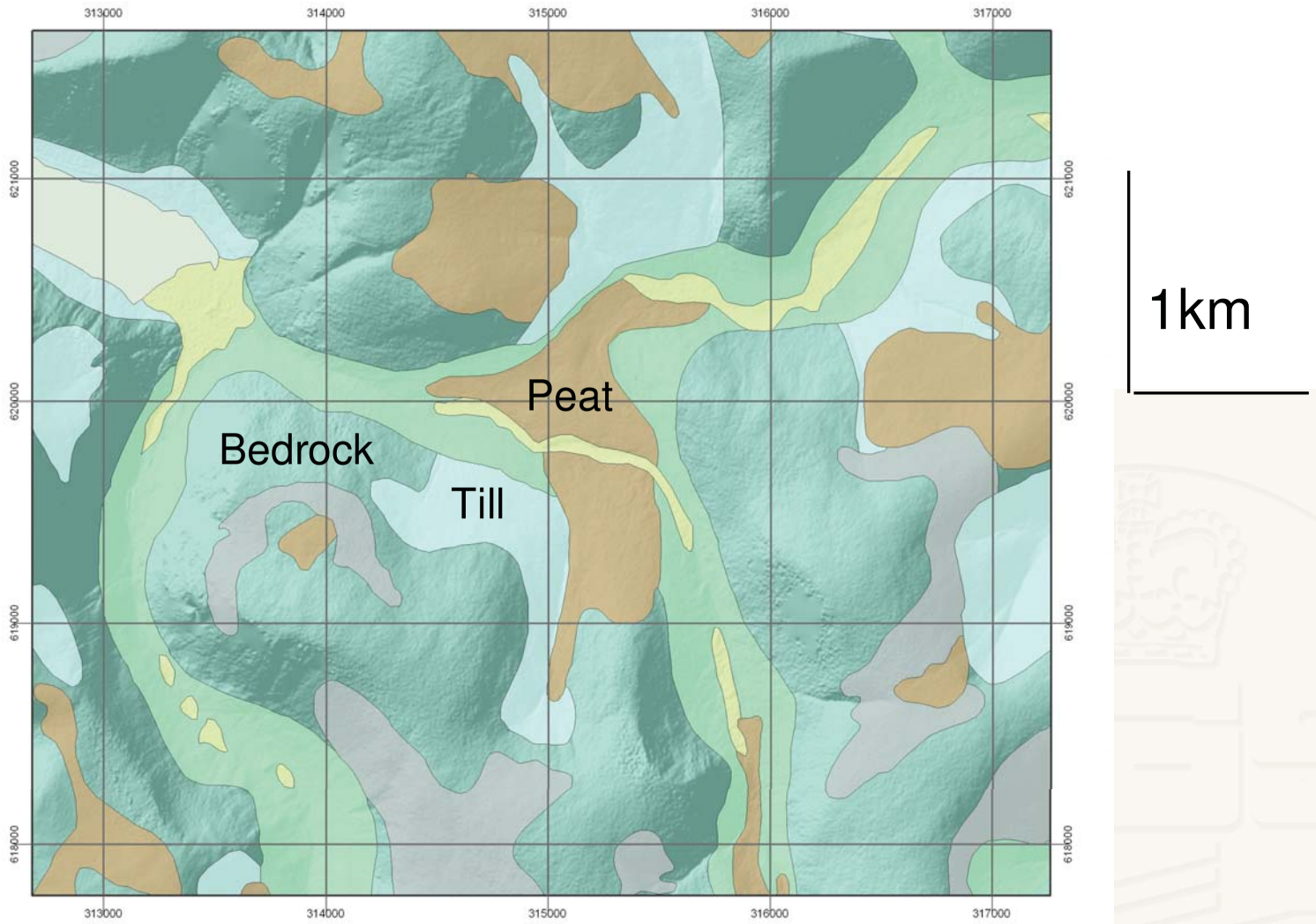
- BGS peat research
- Case study: Talla Research Site
  - Briefly discuss techniques & results
  - Evaluation of techniques
- Wider applications of this research

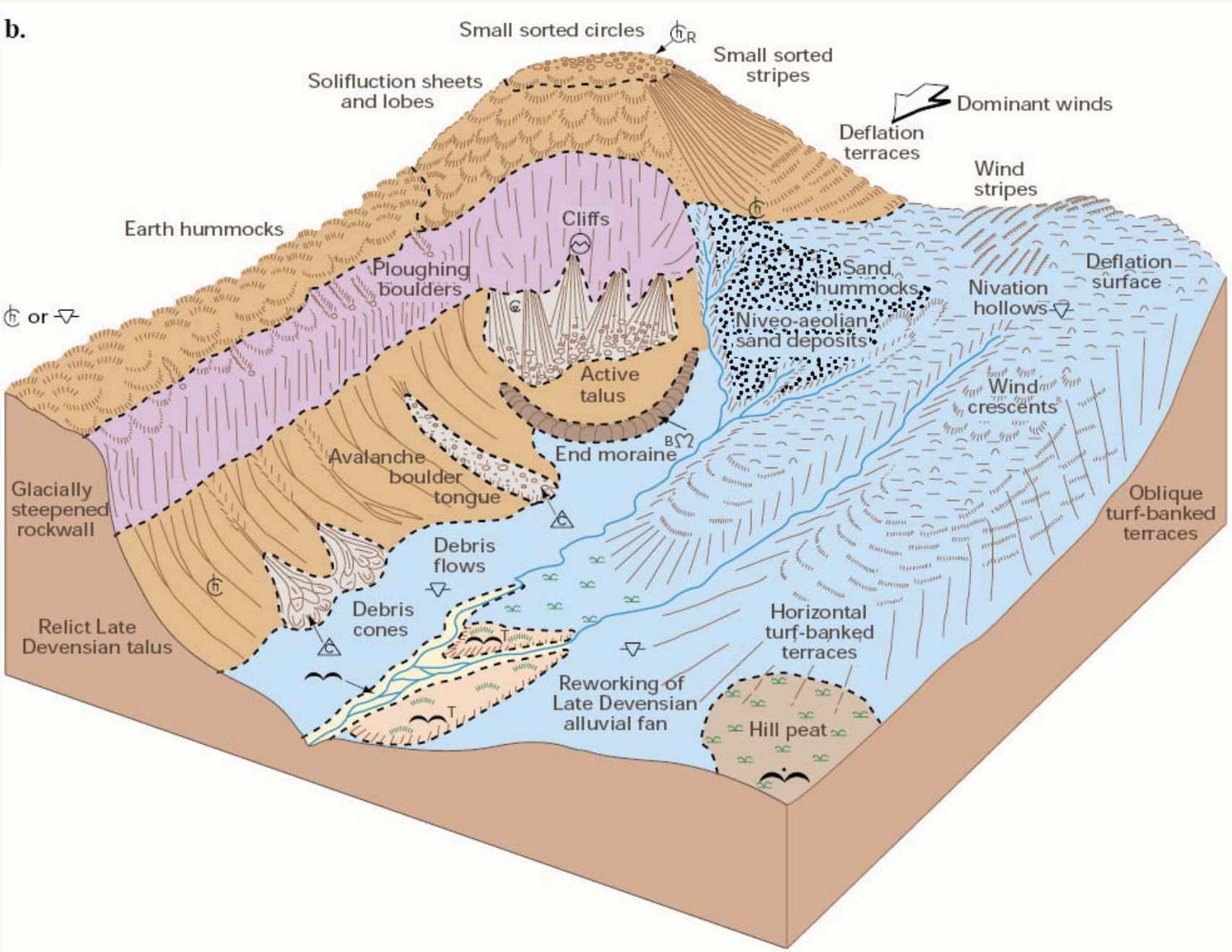
BGS' peat research

- Hydrogeological: water storage, quality
- Black Carbon: modelling reserves & sink capacity
- Methane production: greenhouse gas
- Geo-diversity: Habitats, environmental impacts

- Quaternary Climate Change: **Case Study**

Case Study:
Landscape Evolution of Talla Moss





Investigation Techniques

Geological Surveying & Soil mapping

- Complex quaternary deposits
- Augering Indicated variable thickness

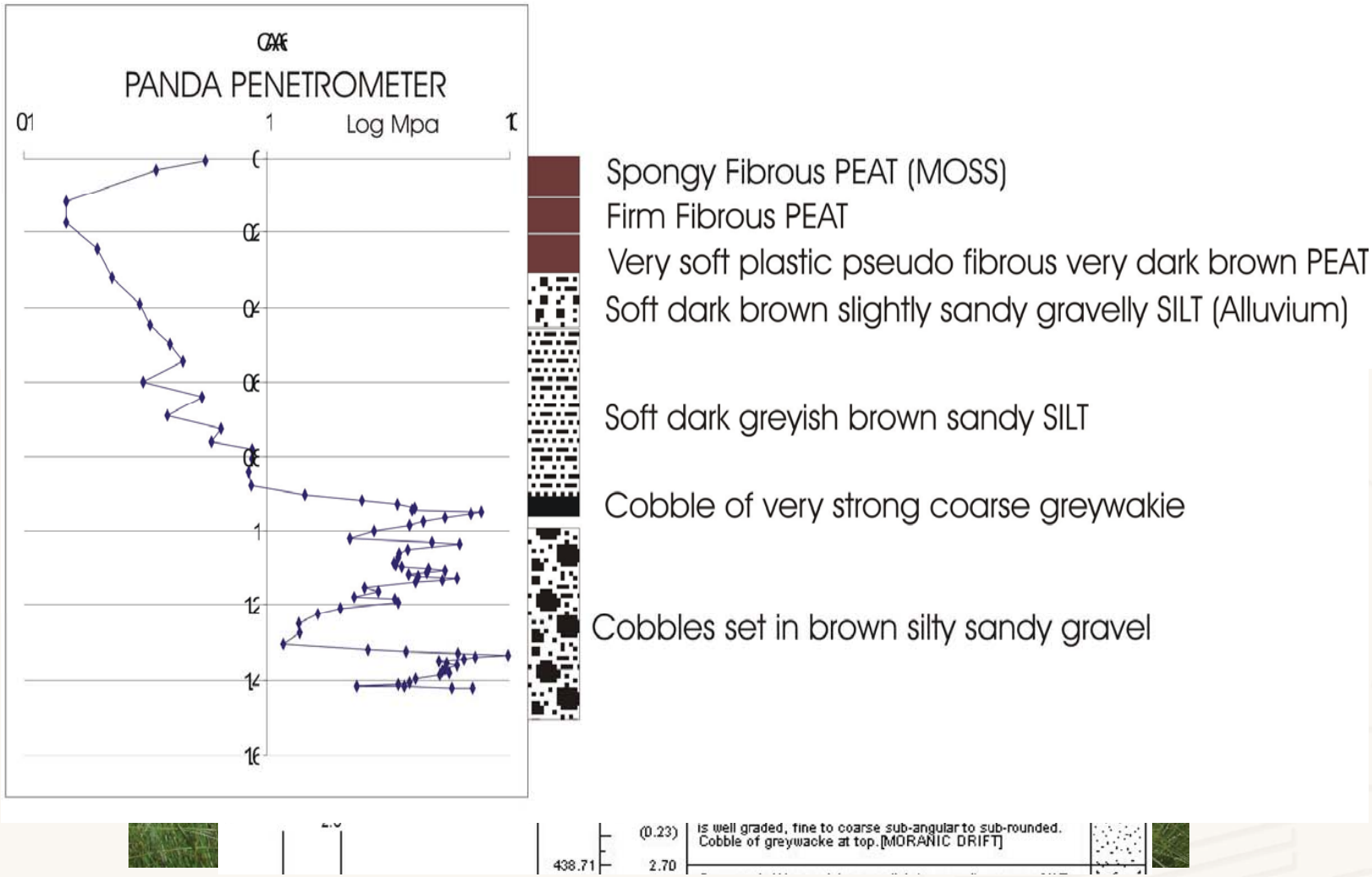
Boreholes & Trial Pits

- Sampling
- Access issues

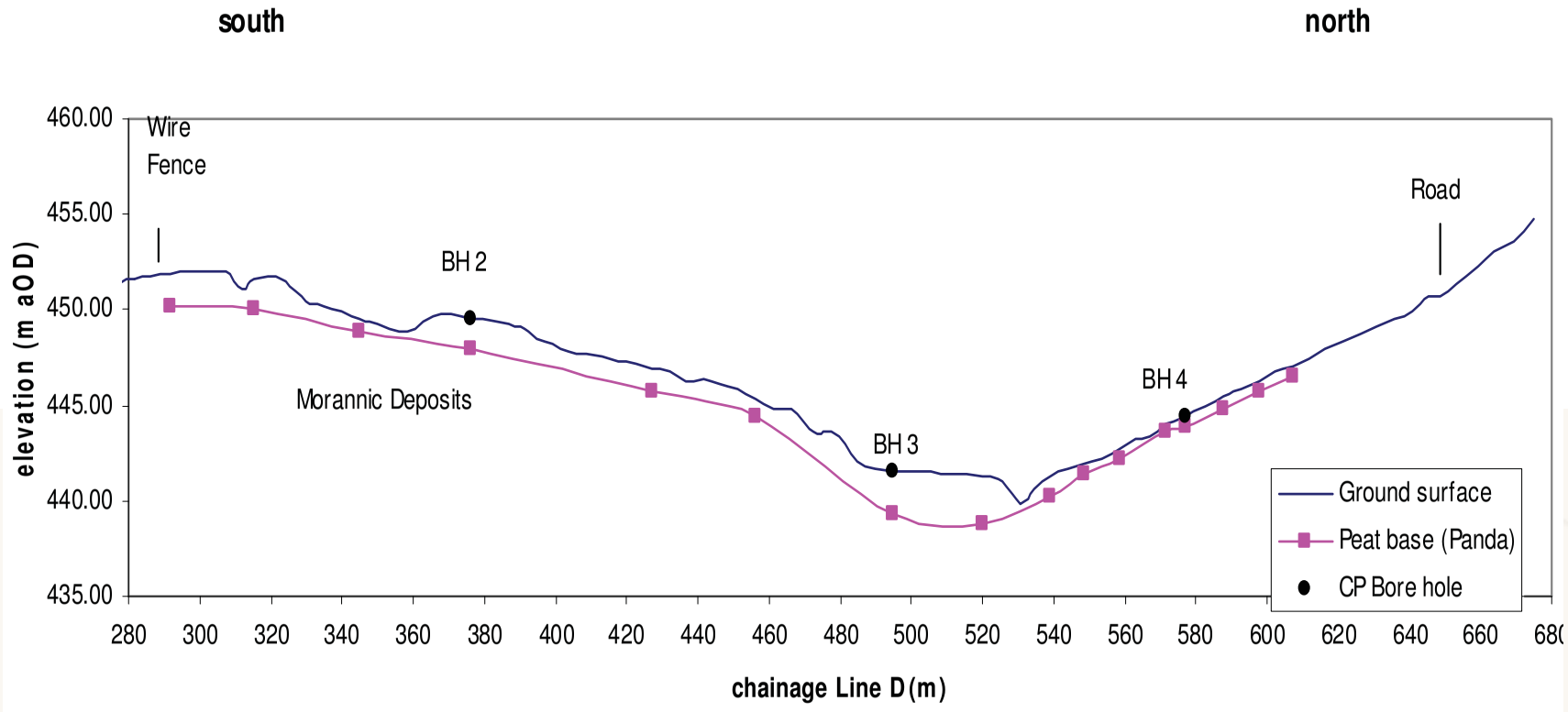
Insitu testing

- Hand Penetrometer

Peat Profiling: Panda Penetrometer



Penetrometer based x-section



- Depth control (<4m)
- Distinguish strength variability of underlying soils

Non-invasive Techniques

Geophysics

- ERT
- ARP
- Seismic
- GPR

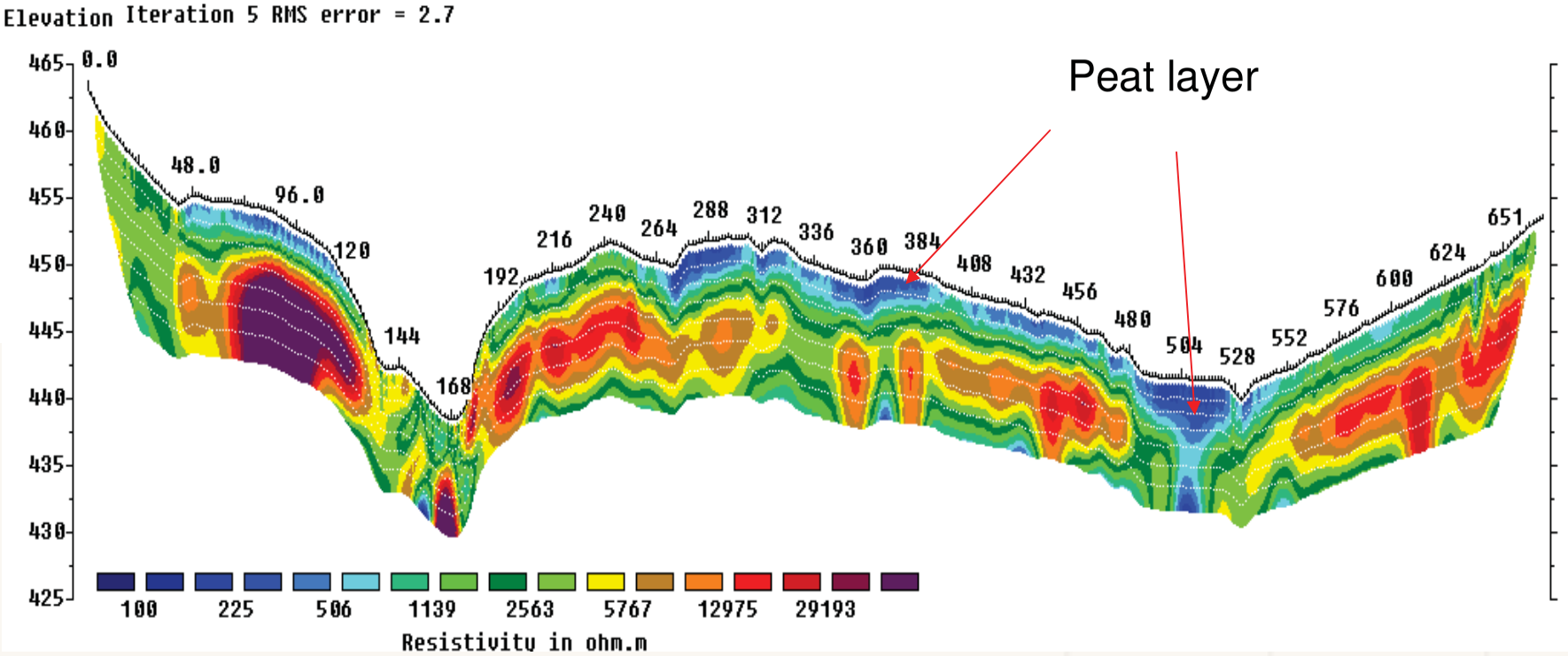
Advantages

- Continuous lateral and vertical profiling
- Locate thickest peats for dating

Electrical Resistivity Tomography (ERT)

Acquisition of high-resolution resistivity images in steep terrain

ERT - Results

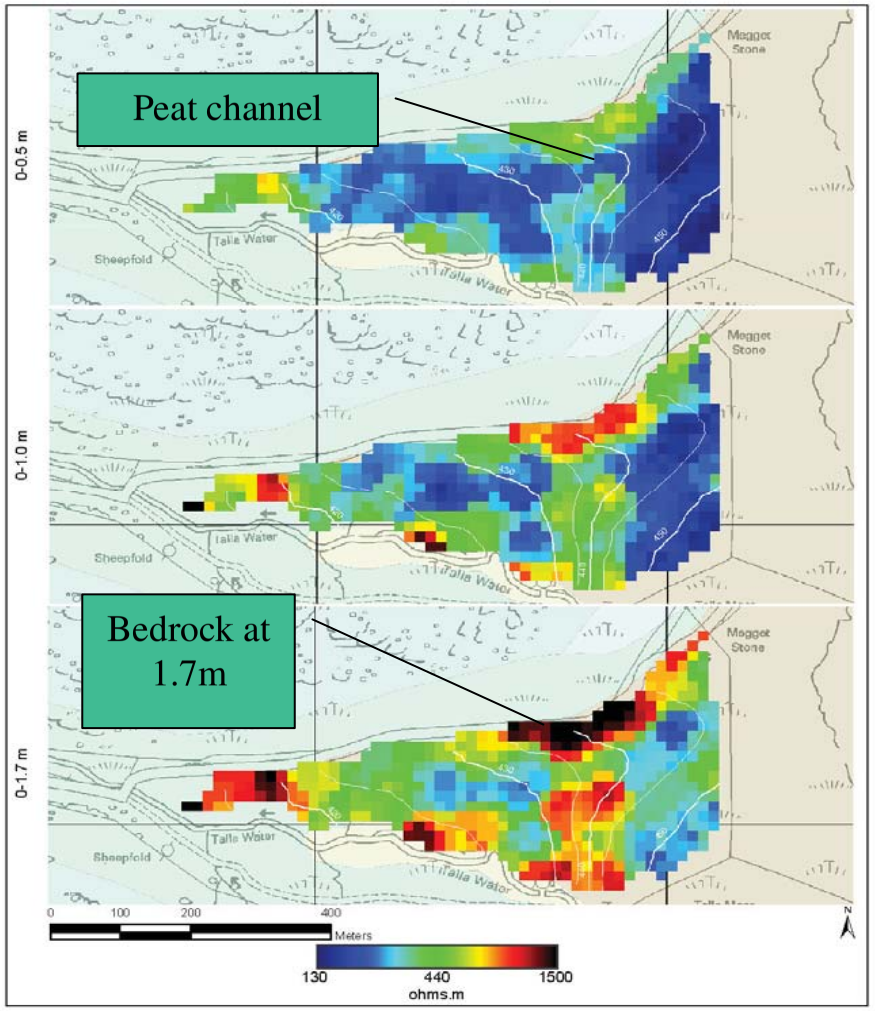


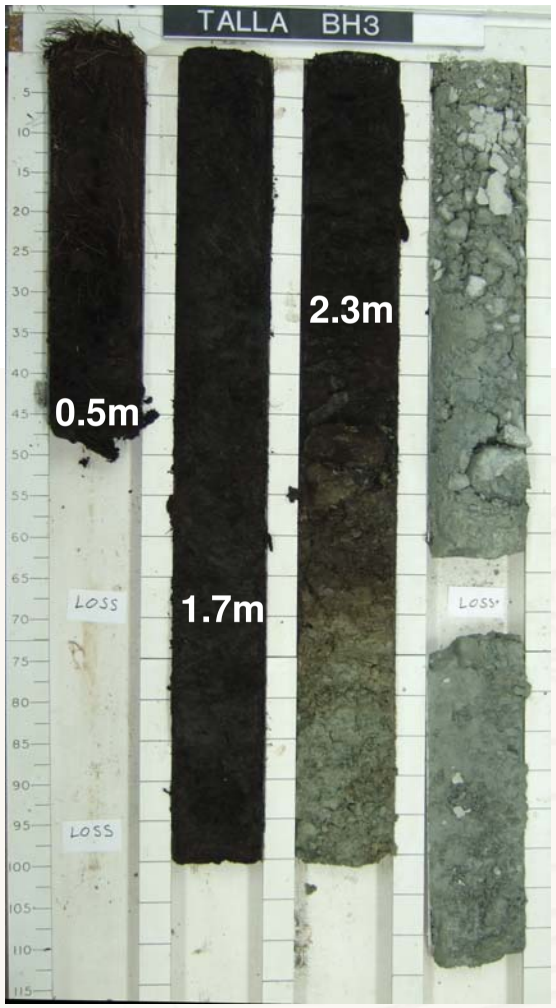
Mobile electrical mapping - ARP

Geocarta Automated Resistivity Profile (ARP) system:
Dynamic acquisition of apparent resistivity data

Mobile electrical mapping - Results

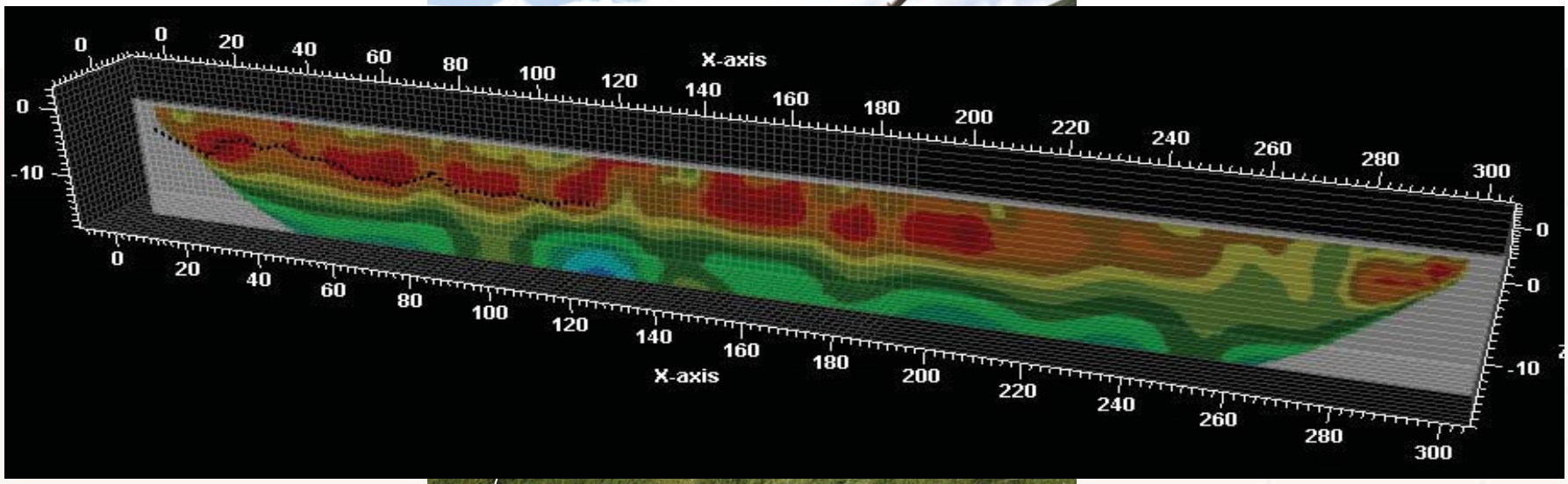
Horizontal sections of bulk resistivity





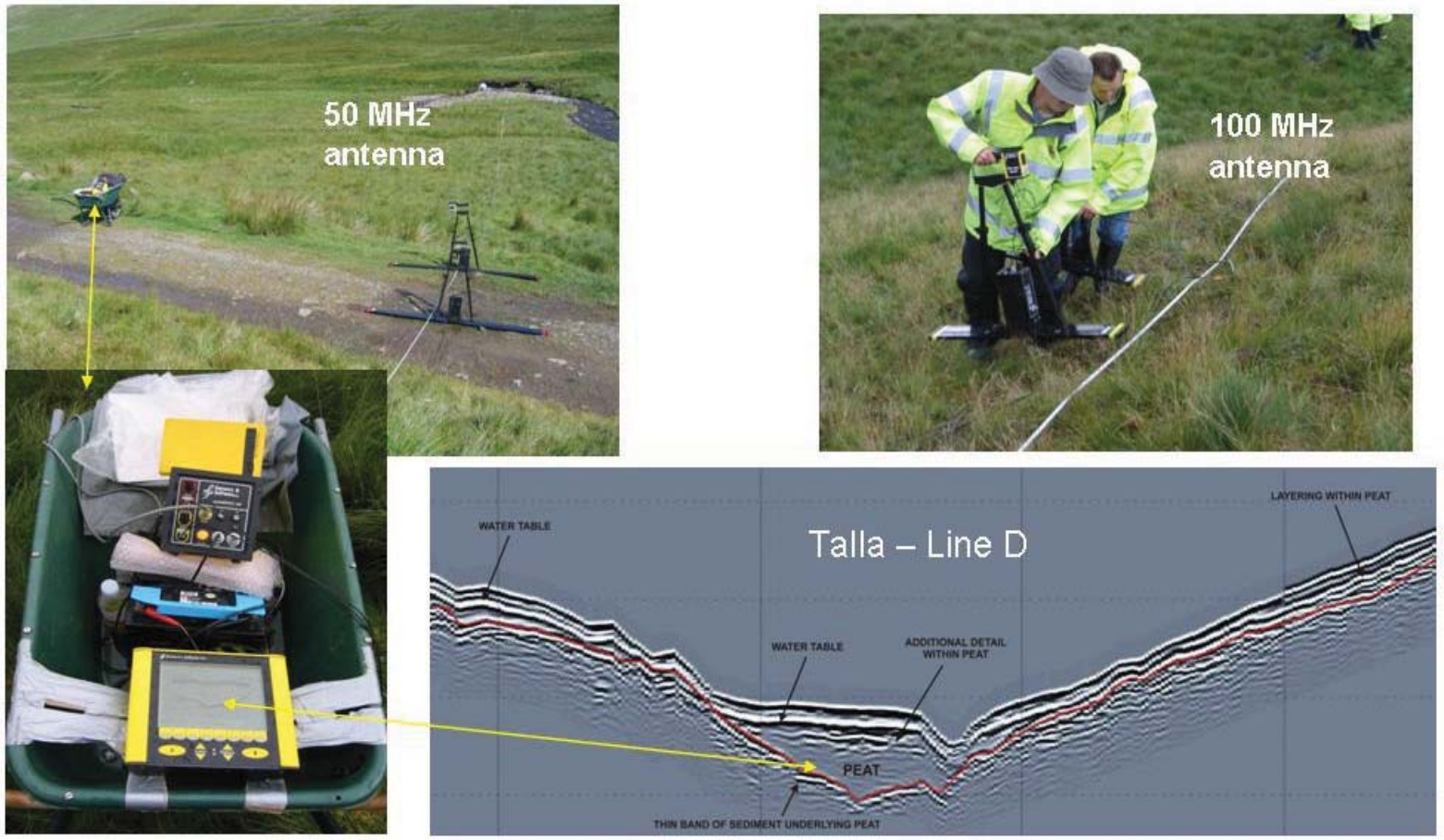
Seismic Refraction

- **Determining stratigraphy & depth of deeper deposits or bedrock**
- **Correlation of Seismic Refraction Data with Electrical Resistivity Tomography (ERT) –**
- **Peat absorbed energy – need stronger source**



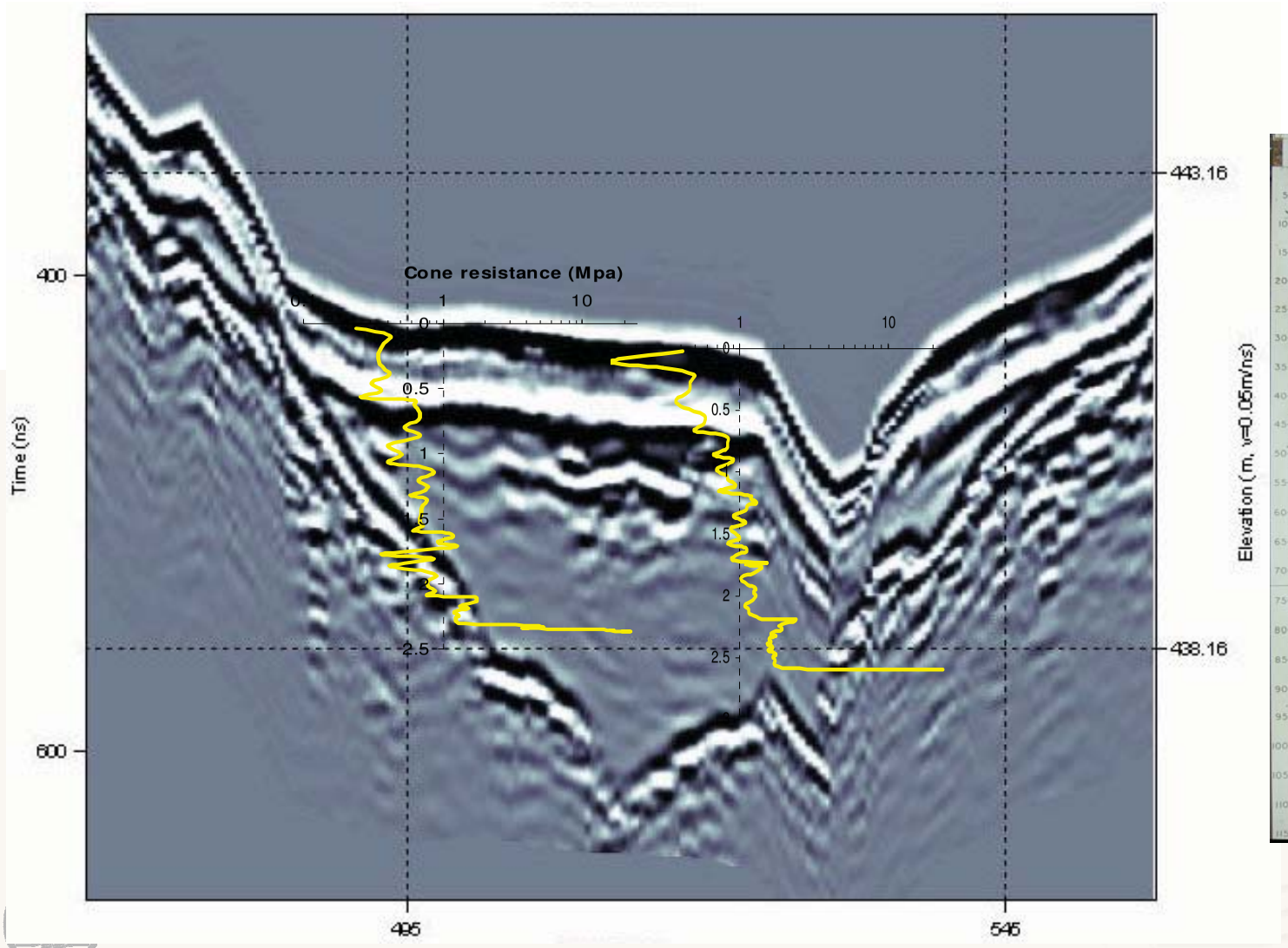
Dashed black line shows seismic velocity boundary. 'Slow' layer (1000 m/sec), overlying 'intermediate' layer (2,400 m/sec)

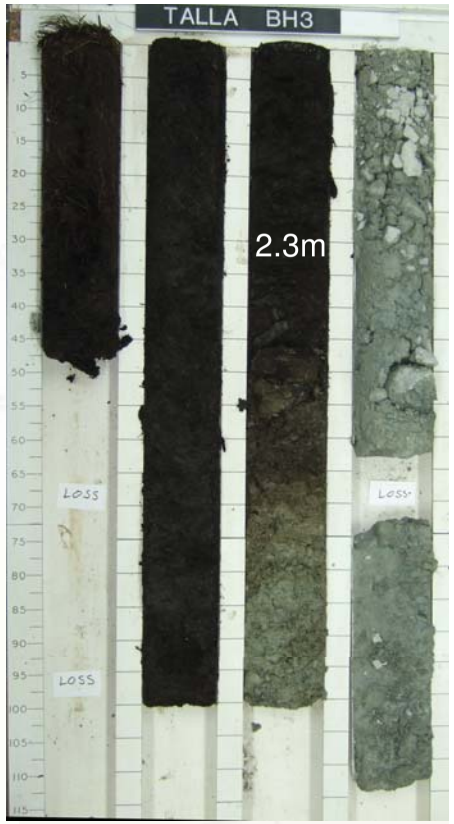
GPR - Results



GPR - 50 & 100 MHz antenna used to define thickness and lateral extent of peat deposits

GPR - Results





Conclusions - Techniques

Technique	Lateral detail	vertical detail	Depth to water table	See through clay layers
ERT (Resistivity)	✓	✓		✓
ARP - Mobile electrical mapping	✓ ✓		✗	
Seismic Refraction	✗		✓	✓
GPR (Radar)	✓ ✓	✓ ✓		✗

Summary – Best Techniques

GPR & ERT

- **Great lateral and vertical detail**
- **Environmentally benign**
- **Cost effective**

- **Interpretation enhanced by integration of techniques**

Summary –
Use of geophysics in peat

- **Essential for accurate peat volume calculation**

- **Increases confidence in ground model at minimal cost**

Acknowledgments:

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Holger Kessler, Clive Auton, Mike Raines, Oliver Kuras, Sarah Nice, Andrew Finlayson, Sarah Arkley, John Williams, Allan Weller, Steve Pearson & Others

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