G7481
Magnetometry in geology and archaeology

Lecturer: Vojtěch Šešulka

spring 2010

Geophysical methods

- magnetometry
- gravimetry
- seismic
- geoelectric
- georadar
- geothermic

Magnetic method

of geophysical survey

- principal: measuring the Earth‘s magnetic field and its anomalies

- observed units:
  - total magnetic field T [nT]
  - magnetic field gradient [nT/m]
  - magnetic susceptibility n×10e-4]

Cesium magnetometer

SM-5 Navmag (Scintrex, Kanada)

Modes of measurements

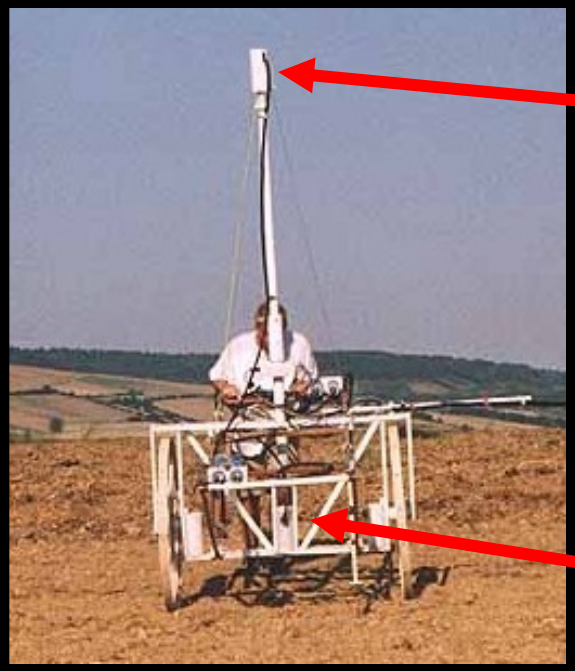
- gradiometer
  (magnetic field gradientΔT [nT/m])

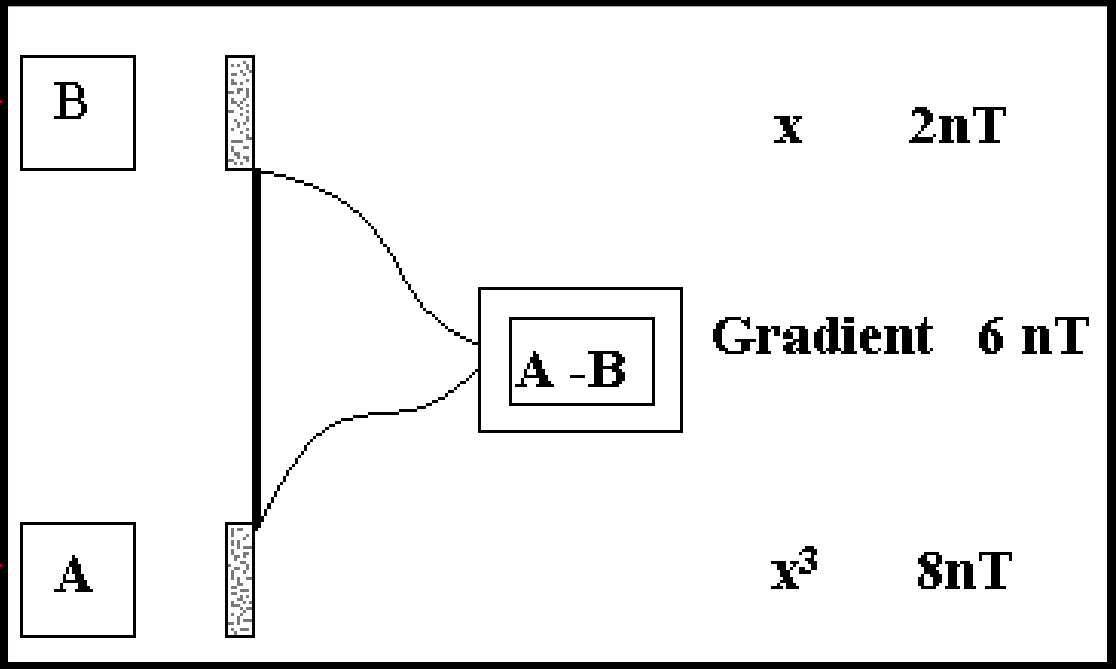
- variometer
  (total magnetic fieldT [nT])

Proton magnetometer PMG-1 fa in gradient mode, Geofyzika Brno

Gradiometer

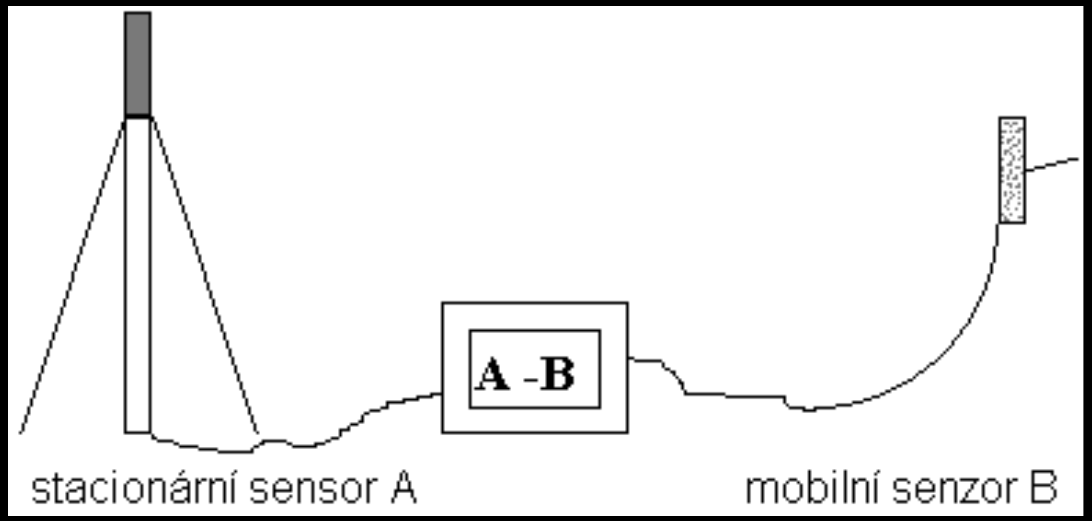
- two vertically placed sensors
- prevents the magnetic field variations error
- better for shallow objects and structures





Variometer

- data collected with only one sensor
- Earth‘s magnetic field variations error → neccesity of correction



Application

of magnetic method

- geological structures mapping
- mapping buried ferrous metal objects and other burned structures

Magnetometry

in archaeology

- <u>suitable:</u>
  - -countersunk objects
  - -fireplaces, ovens, furnaces, …
  - -line objects (ramparts, trenches, palisades, …)
  - -identification of metal objects
  - -detection of landfills and terrain formations

- <u>less suitable:</u>
  - -communications
  - -stone-made object (if is used the stone from the bedrock of the site)

Measurements types

- testing measurements

  (suitability of the method)

- areal measurements

  (several days long measurements)

- detail measurements

  (the most interesting objects)

Presumption

of successful project

- physical contrast between the object and surroundings
- good state of objects insitu
- size, shape, orientation and count of objects
- relief and vegetation
- absence of structures, which are not in our interest
- climatic conditions during the measurement
- suitable combination of several geophysical methods

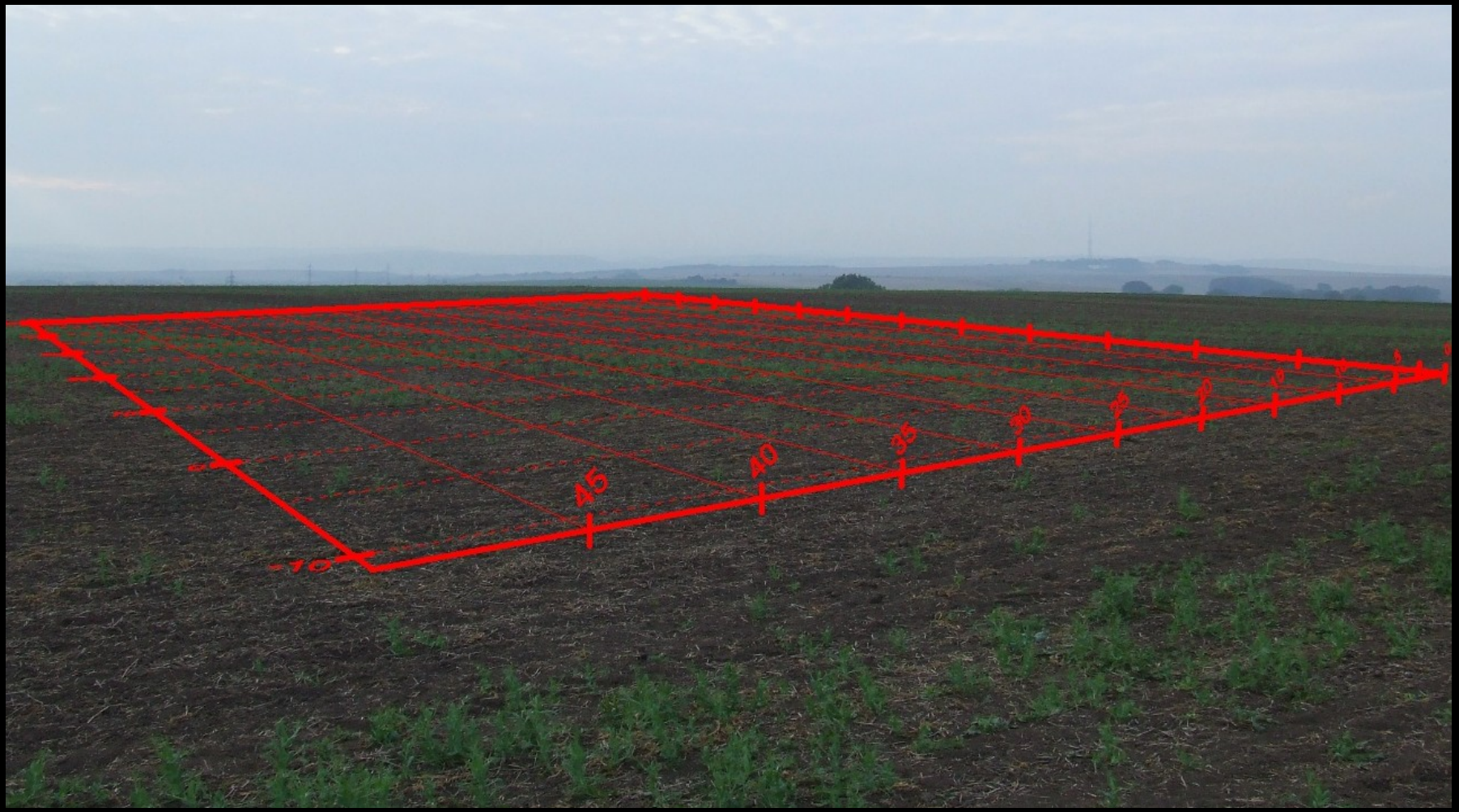
Magnetic method

of the geophysical survey

- the measurement runs in squares (often 50×50 m)
- suitable profiles orientation to the measured structure (best in N-S direction)
- density of recorded data up to 0,5×0,15 m (depend on our interest)

Magnetic method

field work



Magnetic method

interpretation

T1031D2006829 - Poznámkový blok

Soubor Úpravy Formát Zobrazení Nápověda

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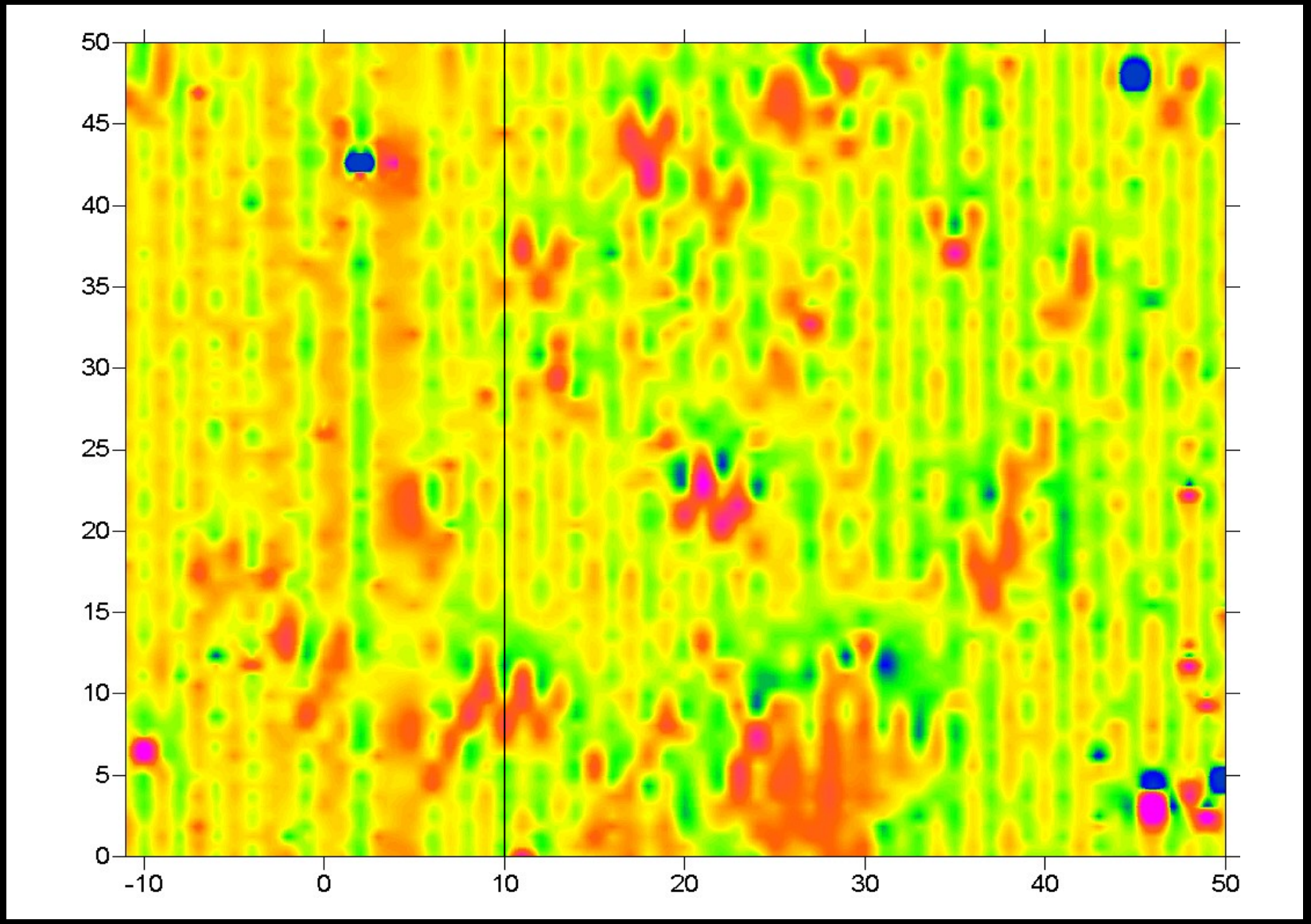

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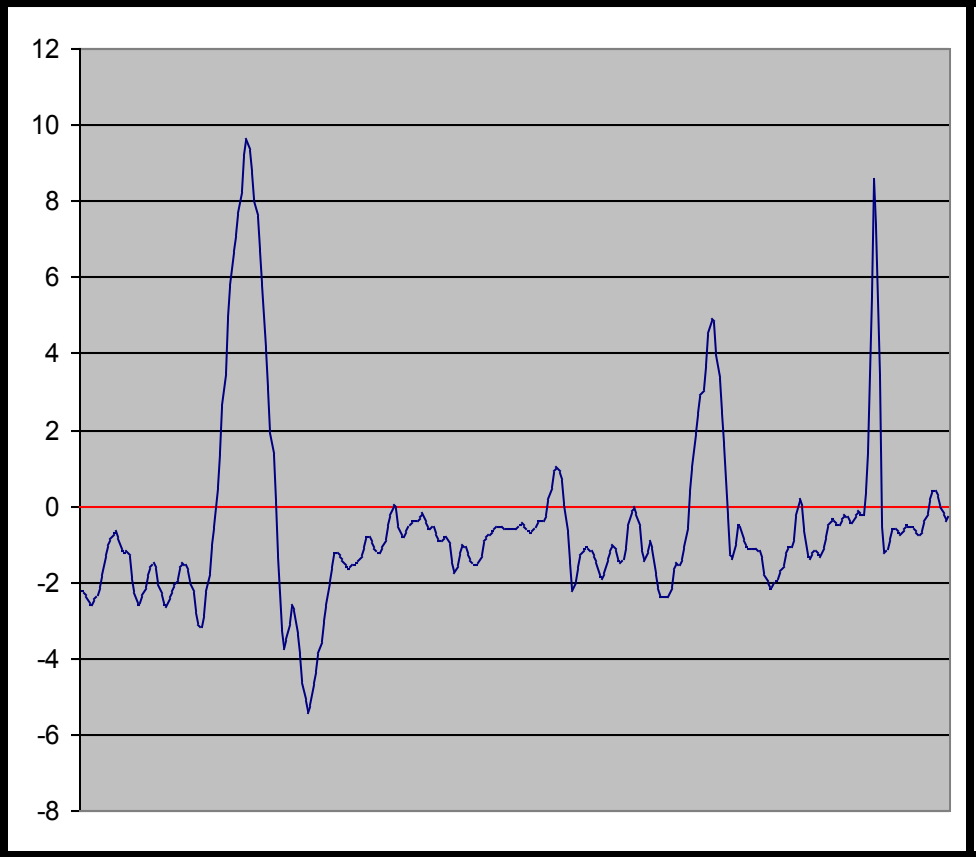
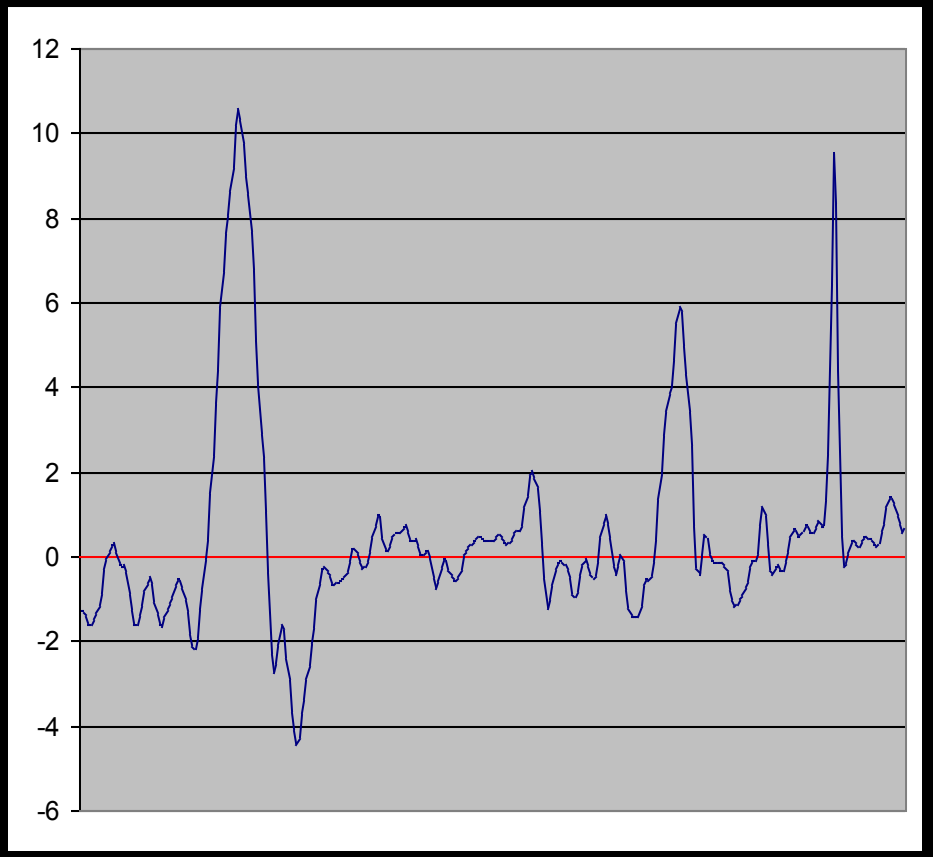
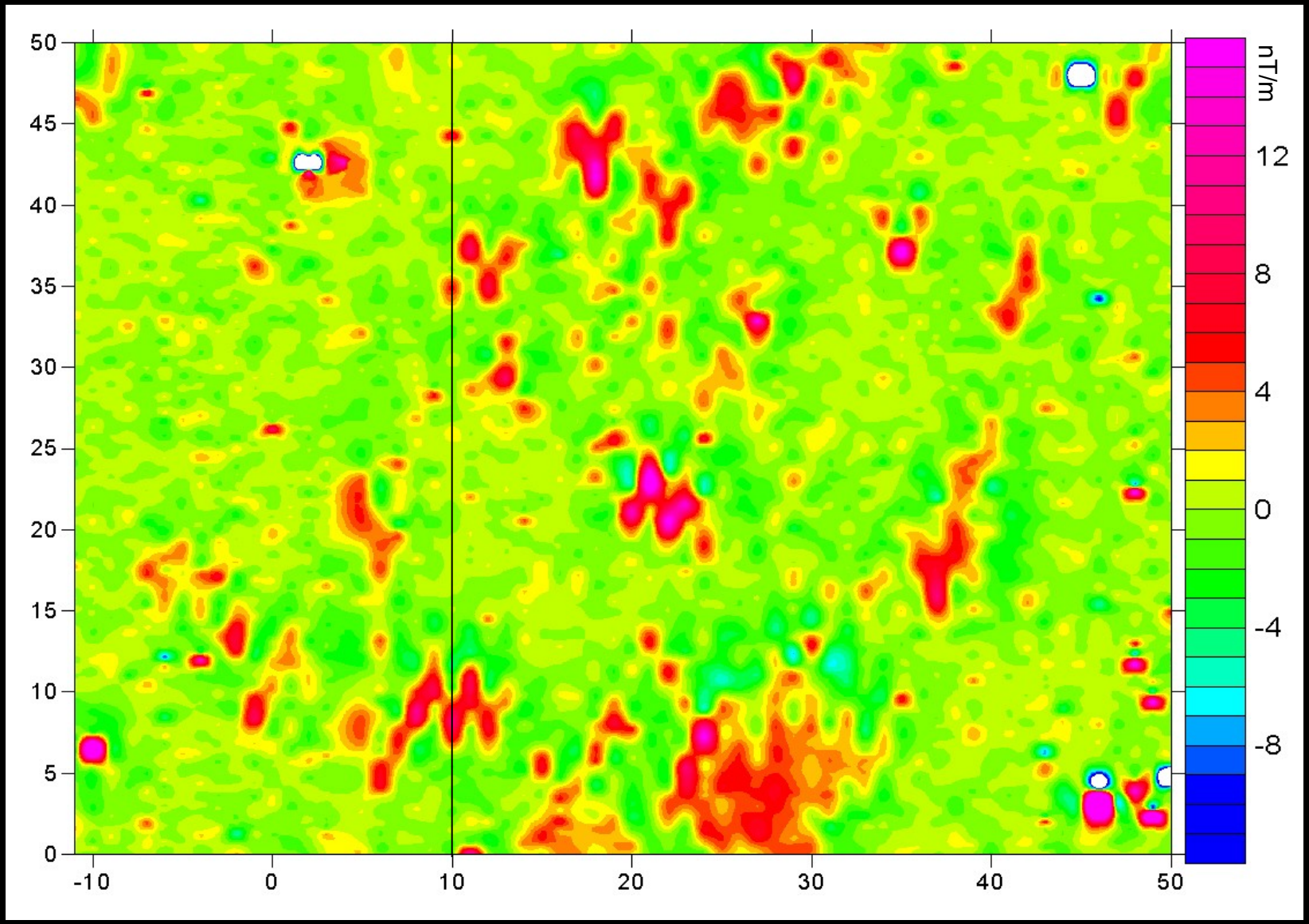
Apparature: SM-5 Navmag (Scintrex, Canada)
Author: V. Šešulka
19/09/2006





gradient T [nT/m] on the profile10 before (left) and after (right) the median correction



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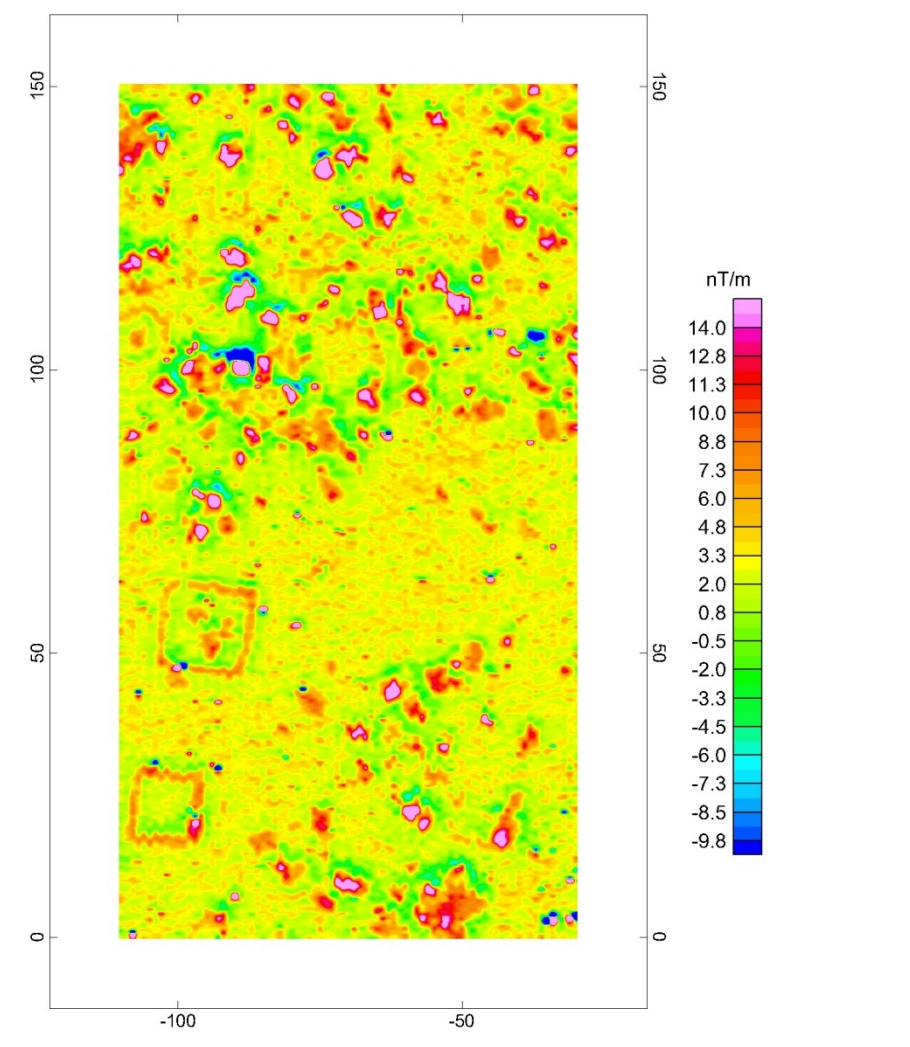
Apparature: SM-5 Navmag (Scintrex, Canada)
Author: V. Šešulka
19/09/2006

Magnetic method

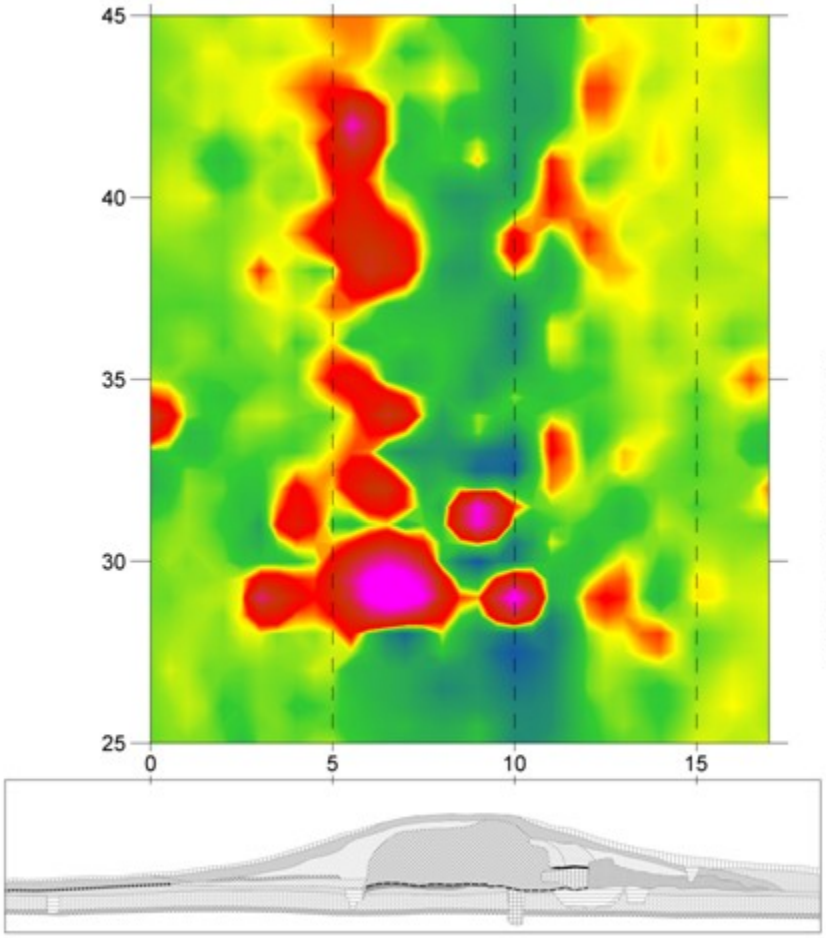
interpretation



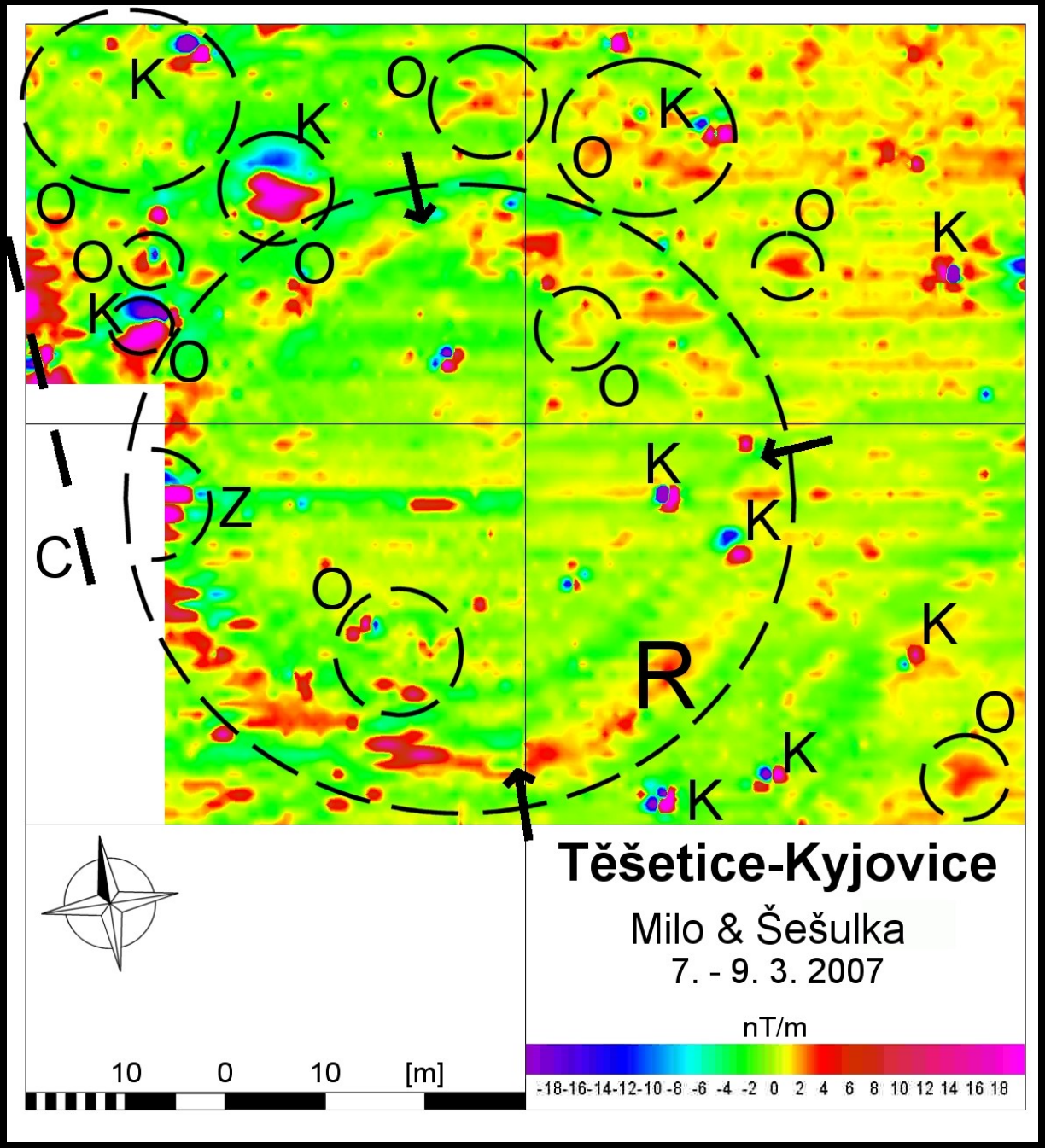
Site: Pohansko near Břeclavi
Apparature: Smartmag – 4g (Scintrex, Canada)
Author: R. Křivánek
19/09/2006

Magnetic method

interpretation



Milo & Šešulka – Pohansko near Břeclavi 28. 3. 2007 Comparison between the measured data and the cross-section across the rampart

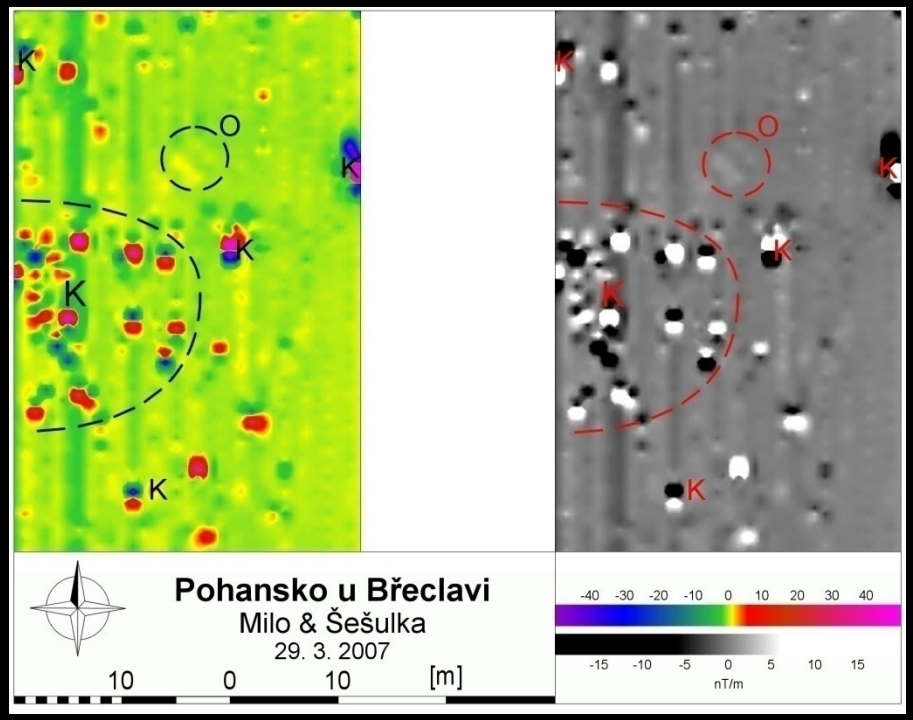


Milo & Šešulka
Těšetice-Kyjovice 7. 3. 2007

(R – roundel; O – object; K –metal; C –path; Z – earth-house)

Magnetic method

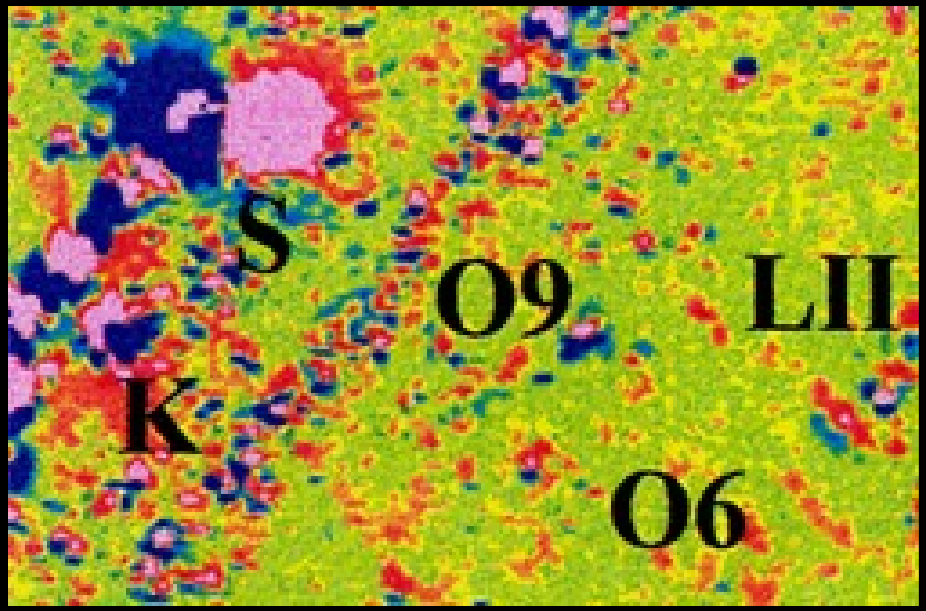
interpretation



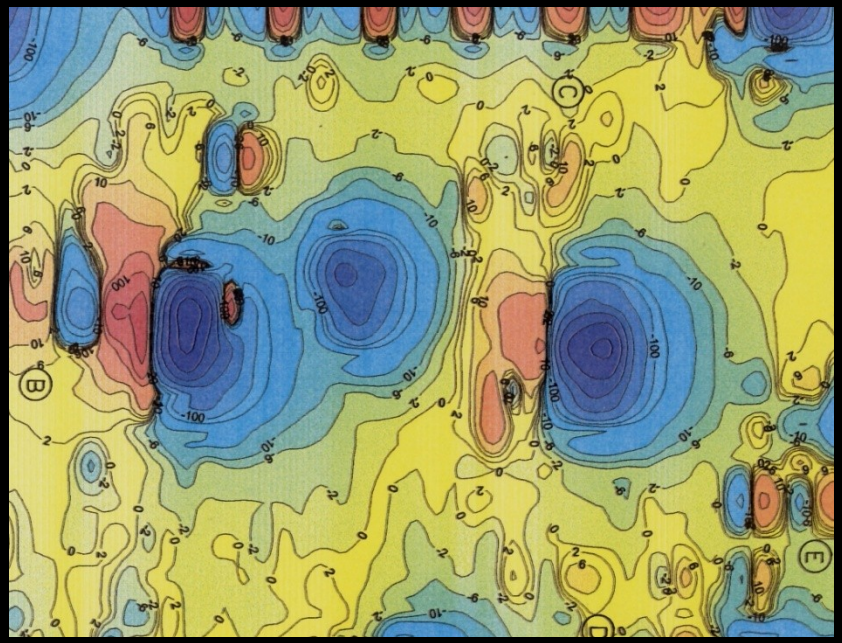
Milo & Šešulka – Pohansko near Břeclav 29. 3. 2007
(O - object; K – metal)

Magnetic method

interpretation



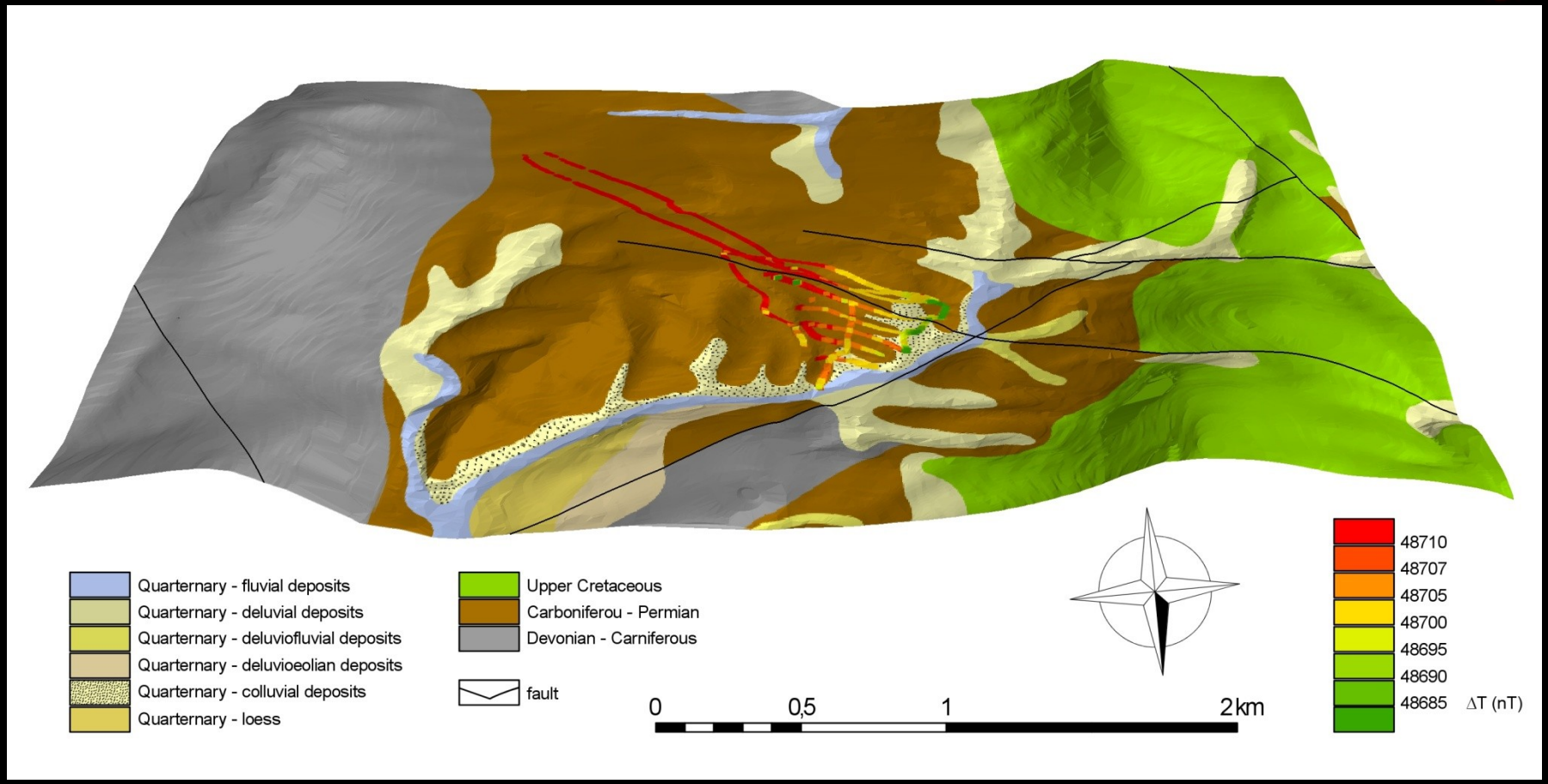
Site: Pohansko near Břeclav
Apparature: Smartmag-4g (Scintrex, Canada)
Author: R. Křivánek
21/08/2001



T_z gradient map (Fous et al. 2000)

Magnetic method

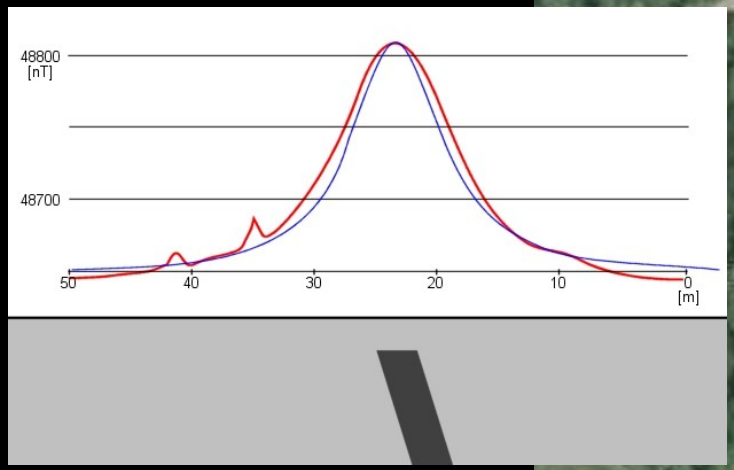
interpretation

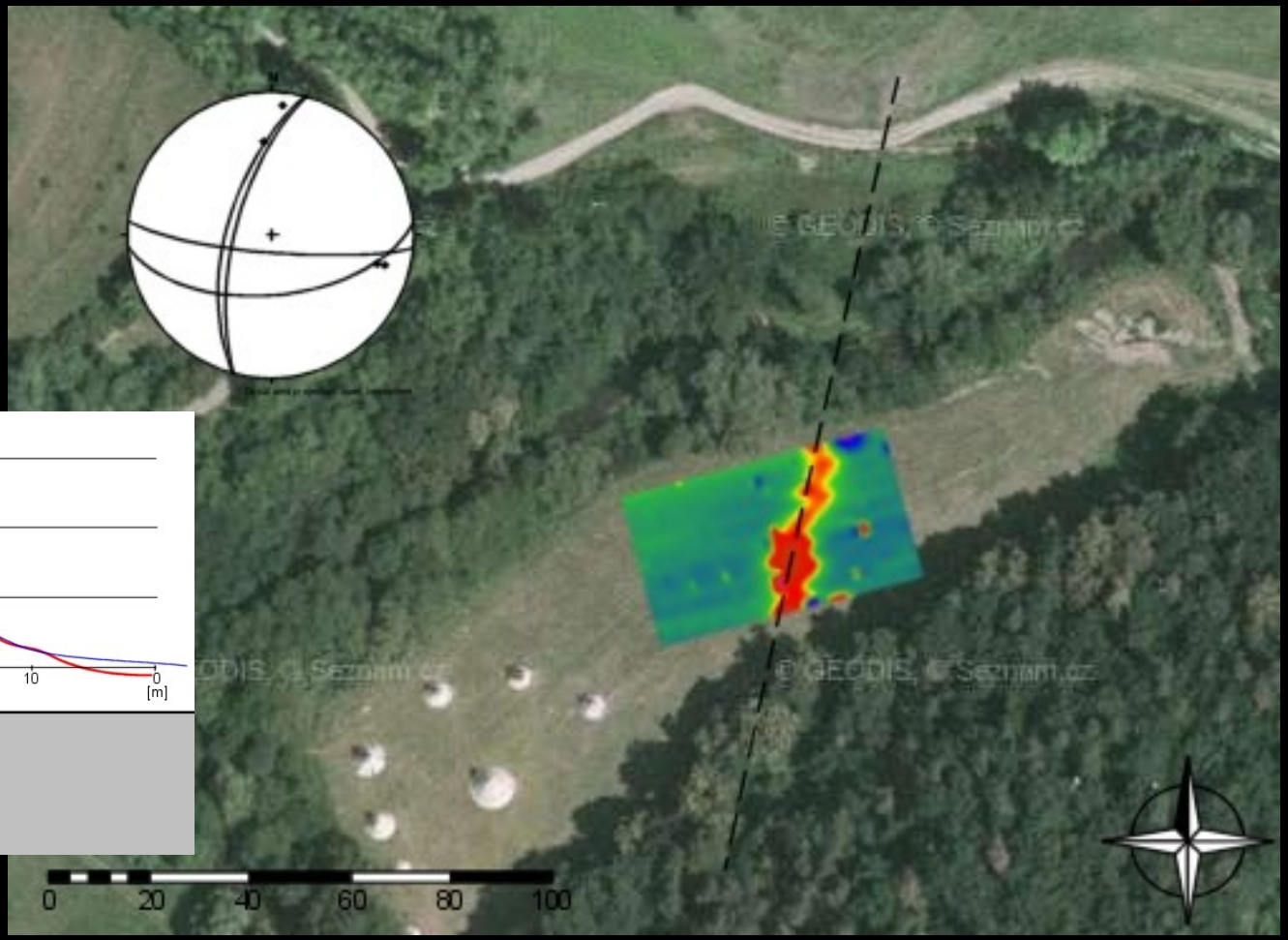


Site Přední Arnoštov, author V. Šešulka

Magnetic method

interpretation

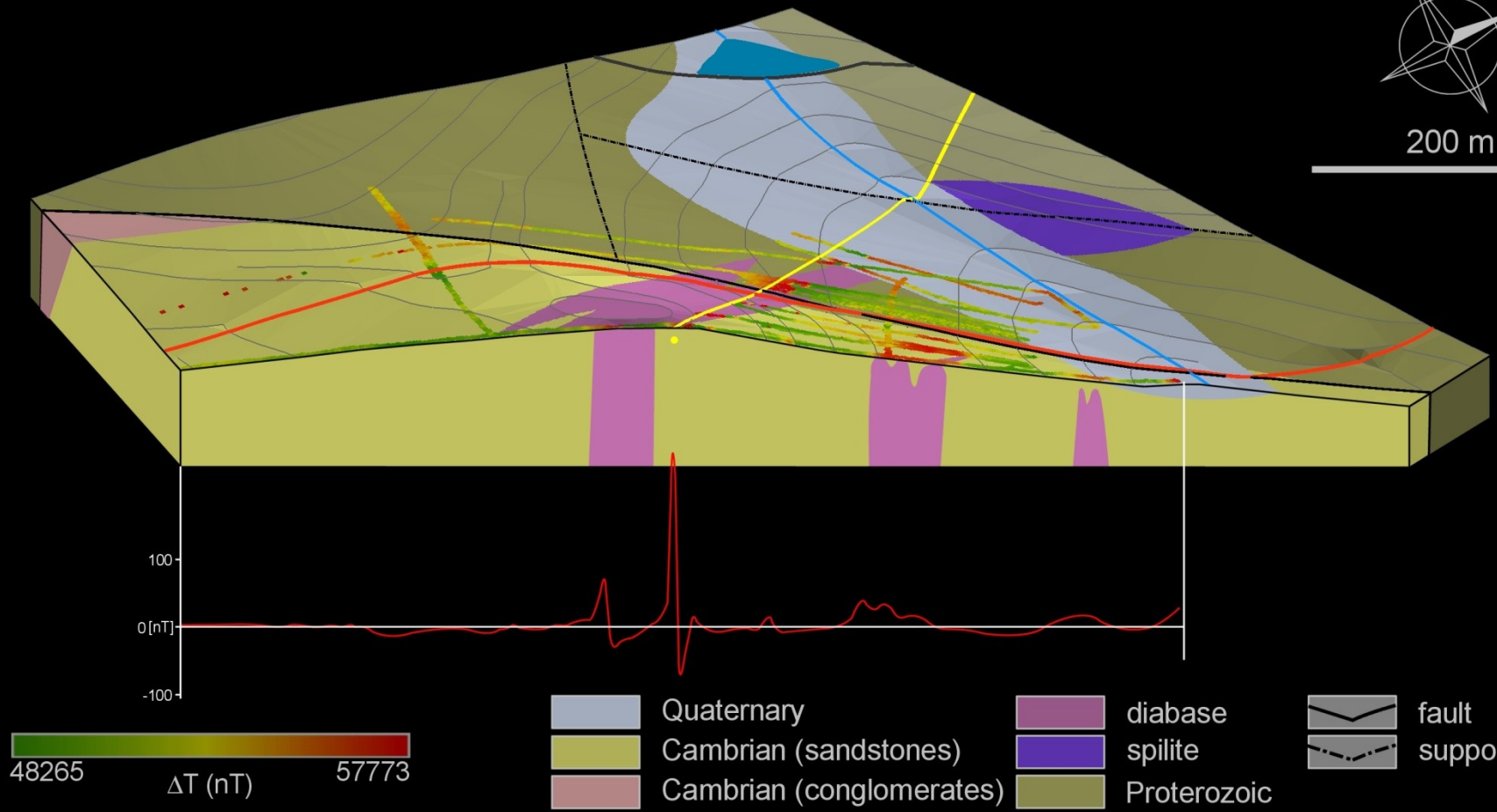




Site Budkovice, author V. Šešulka

Magnetic method

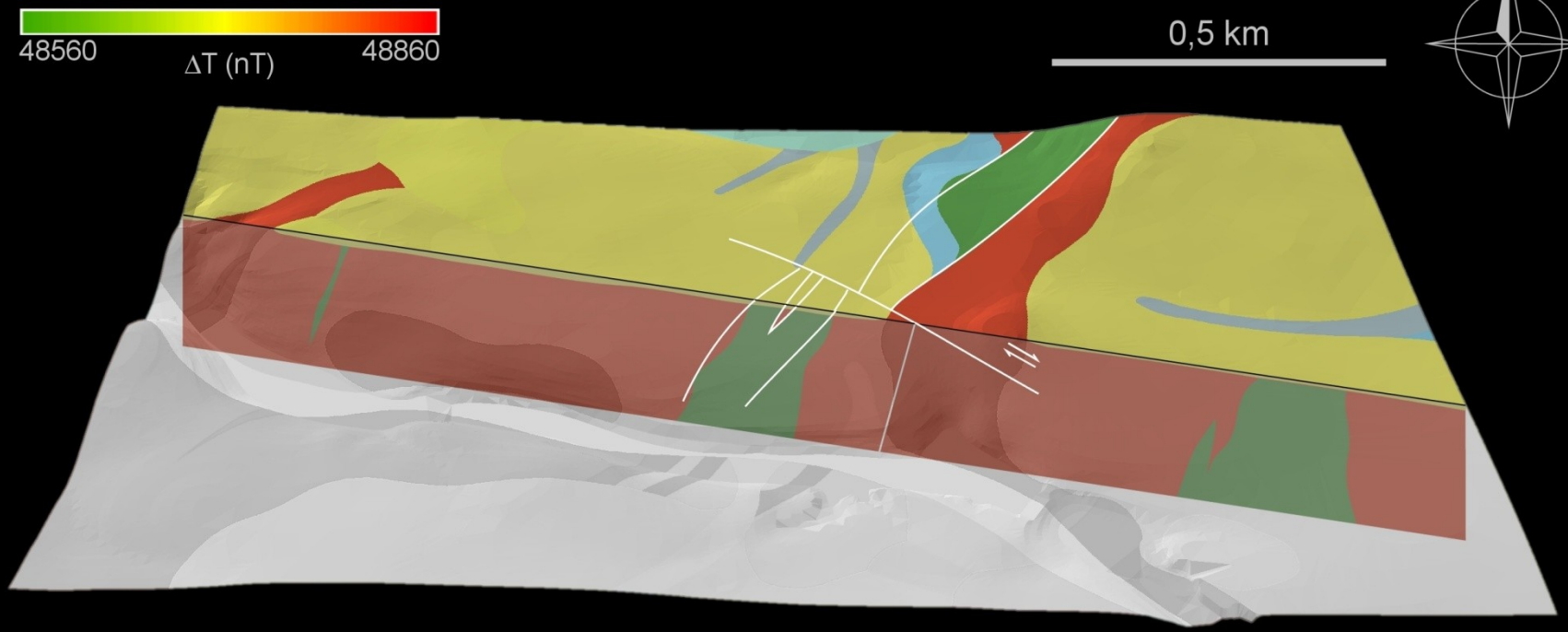
interpretation



Site Pičín, author V. Šešulka

Magnetic method

interpretation



Site Těšetice-Kyjovice, author V. Šešulka

Literature

used and recommended

- Fous A., Hašek V. & Záhora R. (2000): Zpráva o archeogeofyzikální prospekci na akci Břeclav-Pohansko. – MS, závěrečná zpráva. Ústav archeologie a muzeologie FF MU v Brně.

- Hašek V. & Měřínský Z. (1991): Geofyzikální metody v archeologii na Moravě. – MSV. Brno.

- Křivánek R. (2002): Závěrečná zpráva o geofyzikálním průzkumu prováděném na základě HS č. 792/02 na lokalitě Pohansko, okr. Břeclav. – Archiv ArÚ. Praha. č.j. 7486/02.

- Křivánek R. (2004): Geofyzikální metody. – In: Kuna M. (ed.): Nedestruktivní archeologie. – Academia. Praha.

- Kuna et al. (2004): Nedestruktivní archeologie. – Academia. Praha.