

Groundwater dependent ecosystems in the Duna Valley



Viktor Dániel Balogh

Geology MSc, Eötvös Loránd University

Szilvia Simon

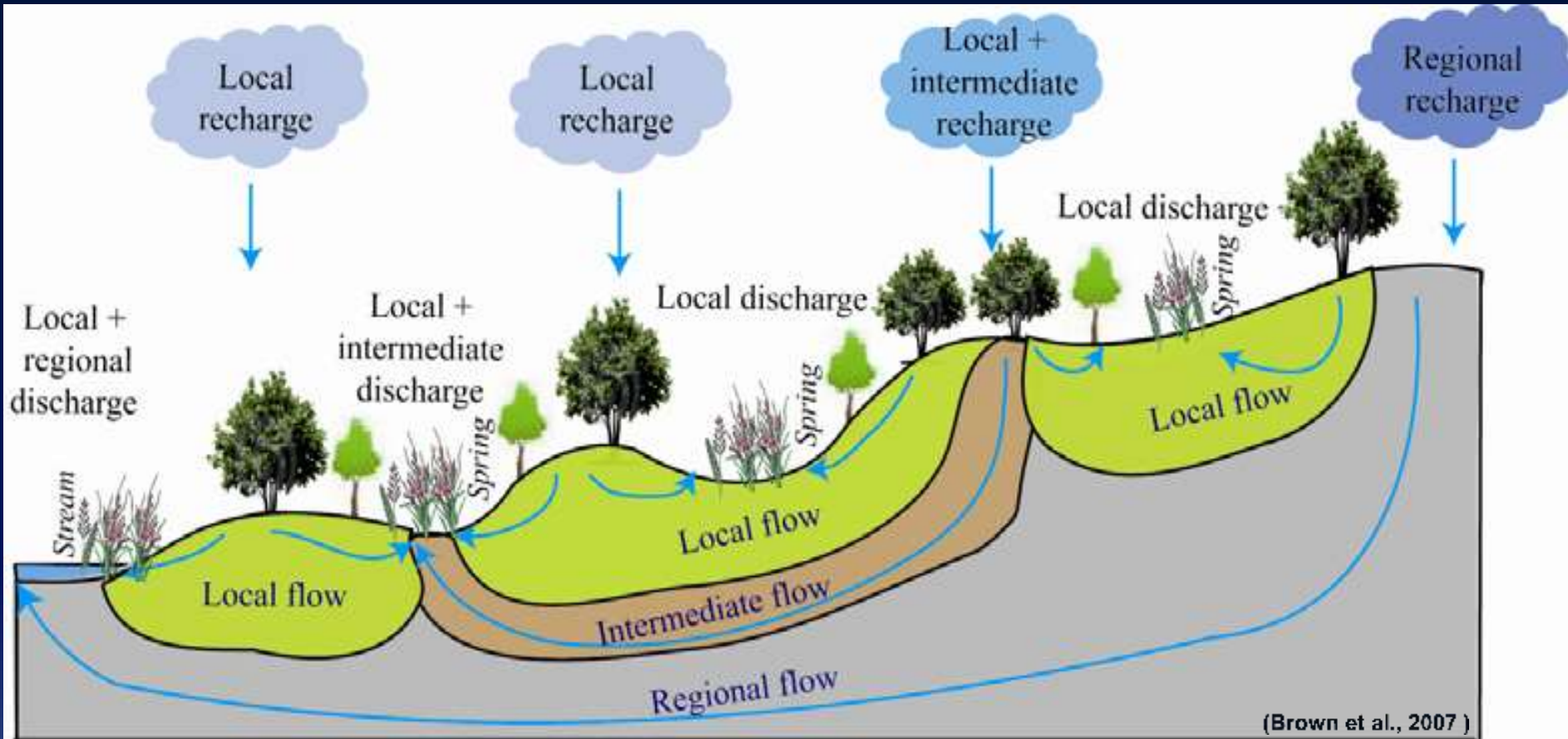
Assistant lecturer, Department of
Physical and Applied Geology, Eötvös
Loránd University

Marianna Biró

assistant research fellow, MTA Centre for
Ecological Research, Institute of Ecology
and Botany

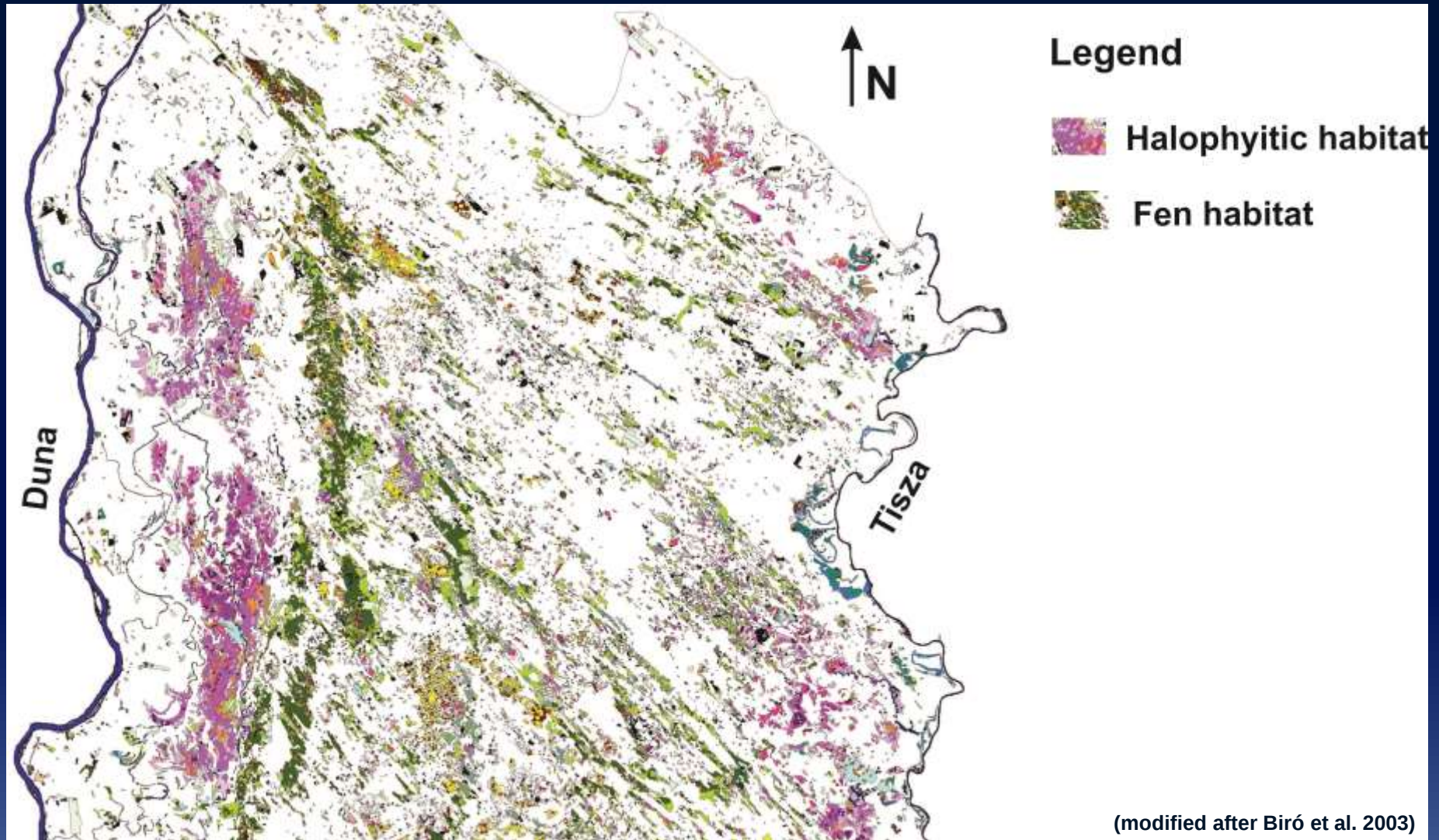
Meeting of Young Geoscientists, 2014

Groundwater dependent ecosystems hypothesis



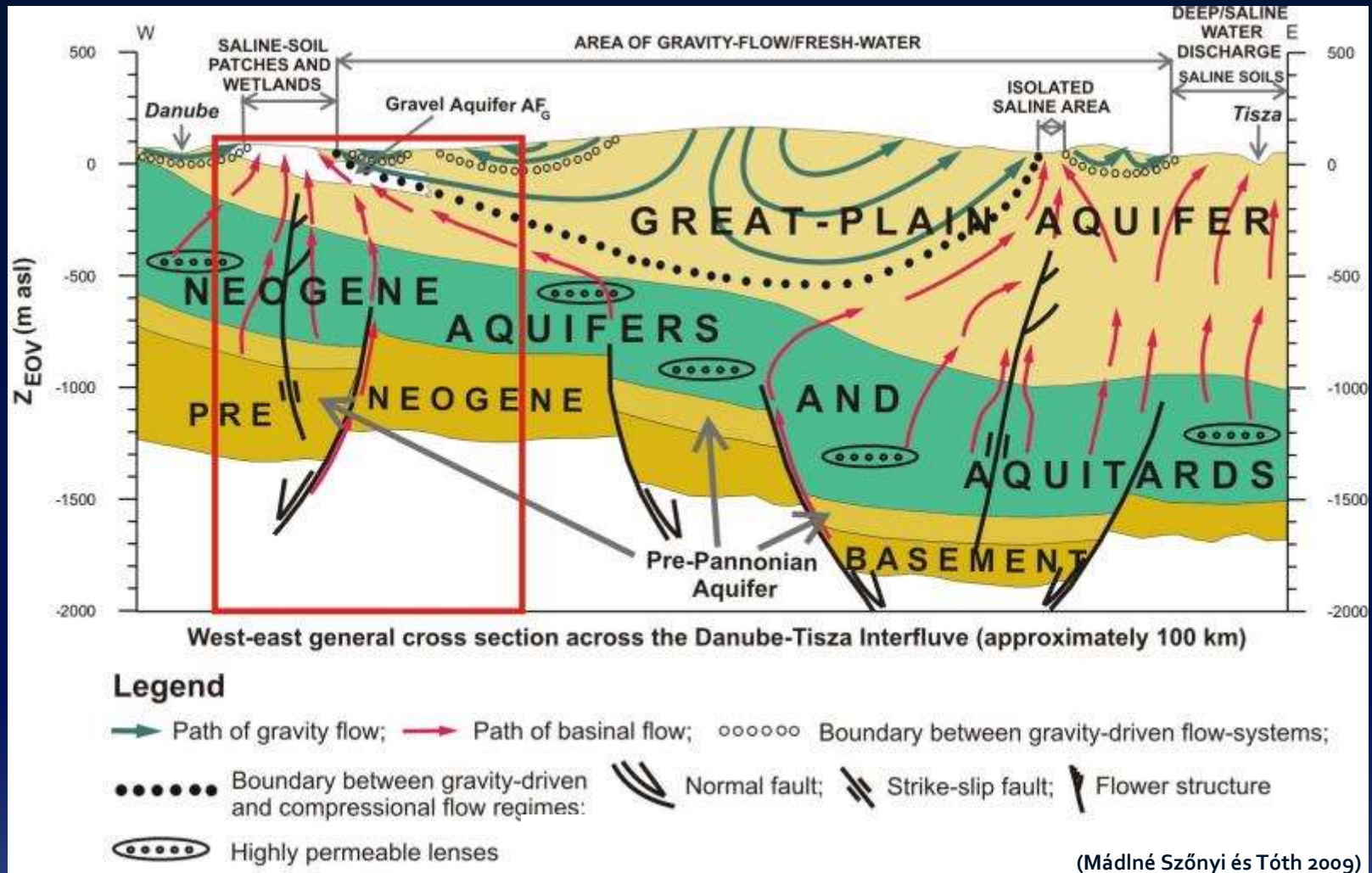
Wetlands and their vegetation are highly influenced by their position in the groundwater flow system.

Vegetation types of the Duna-Tisza Intefluve



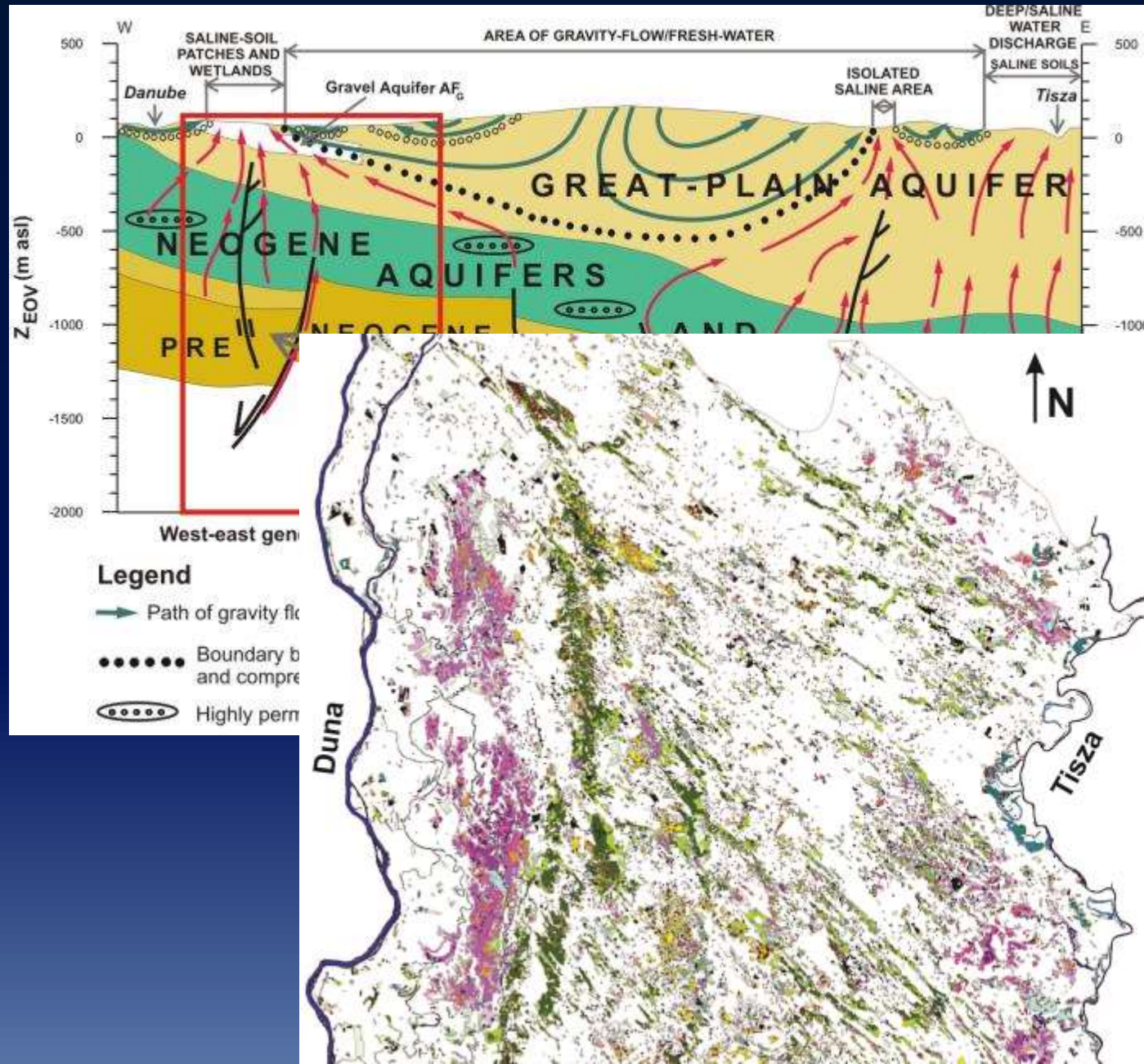
There are two typical types of vegetation : halophytic and fen-marshy habitats

Hydrogeological settings of Duna-Tisza Interfluve

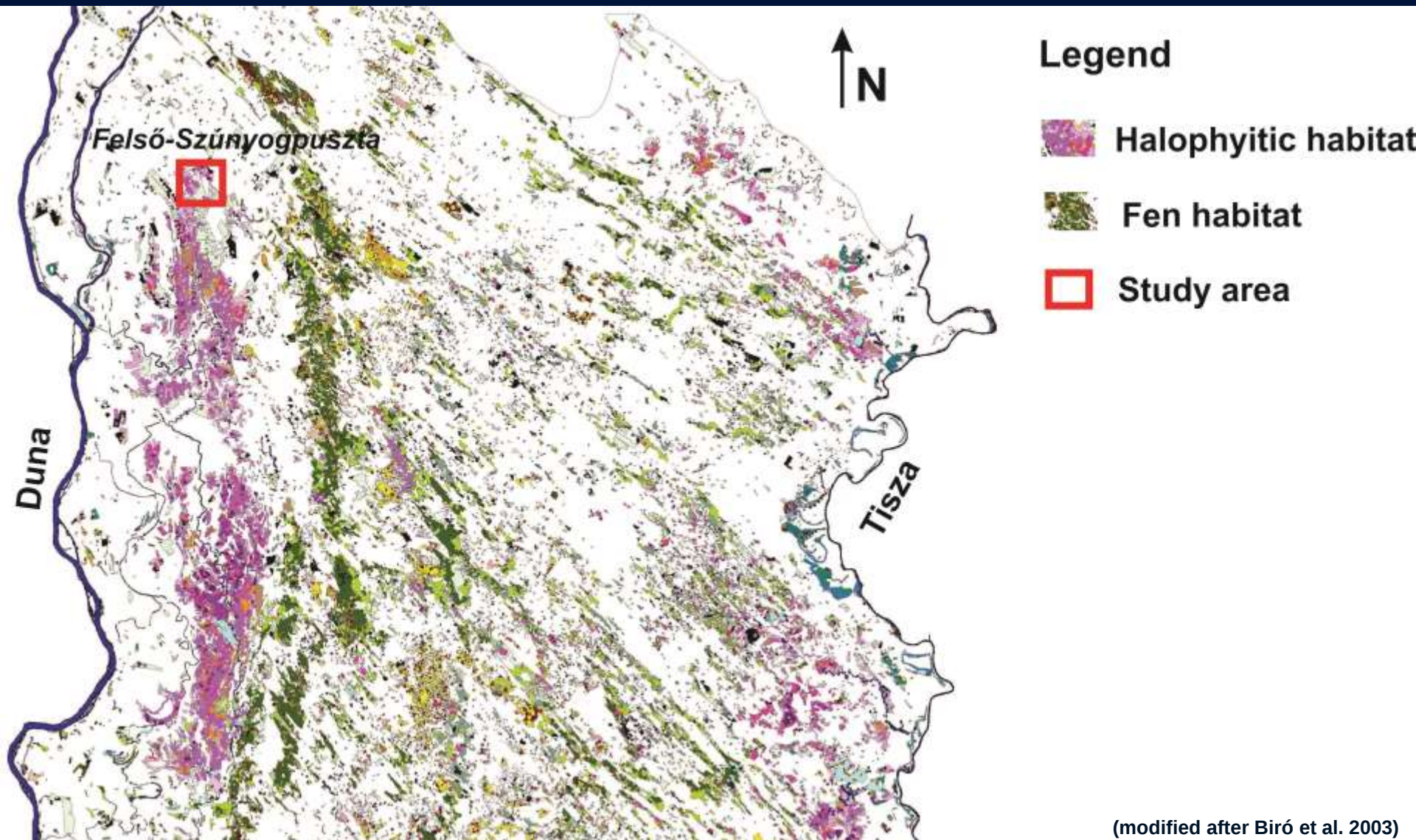


Two main flow systems can be separated: a shallow gravity-driven fresh water-type flow system and an over-pressured deep regime of saline groundwater

Connection between flow systems and vegetation



Study area

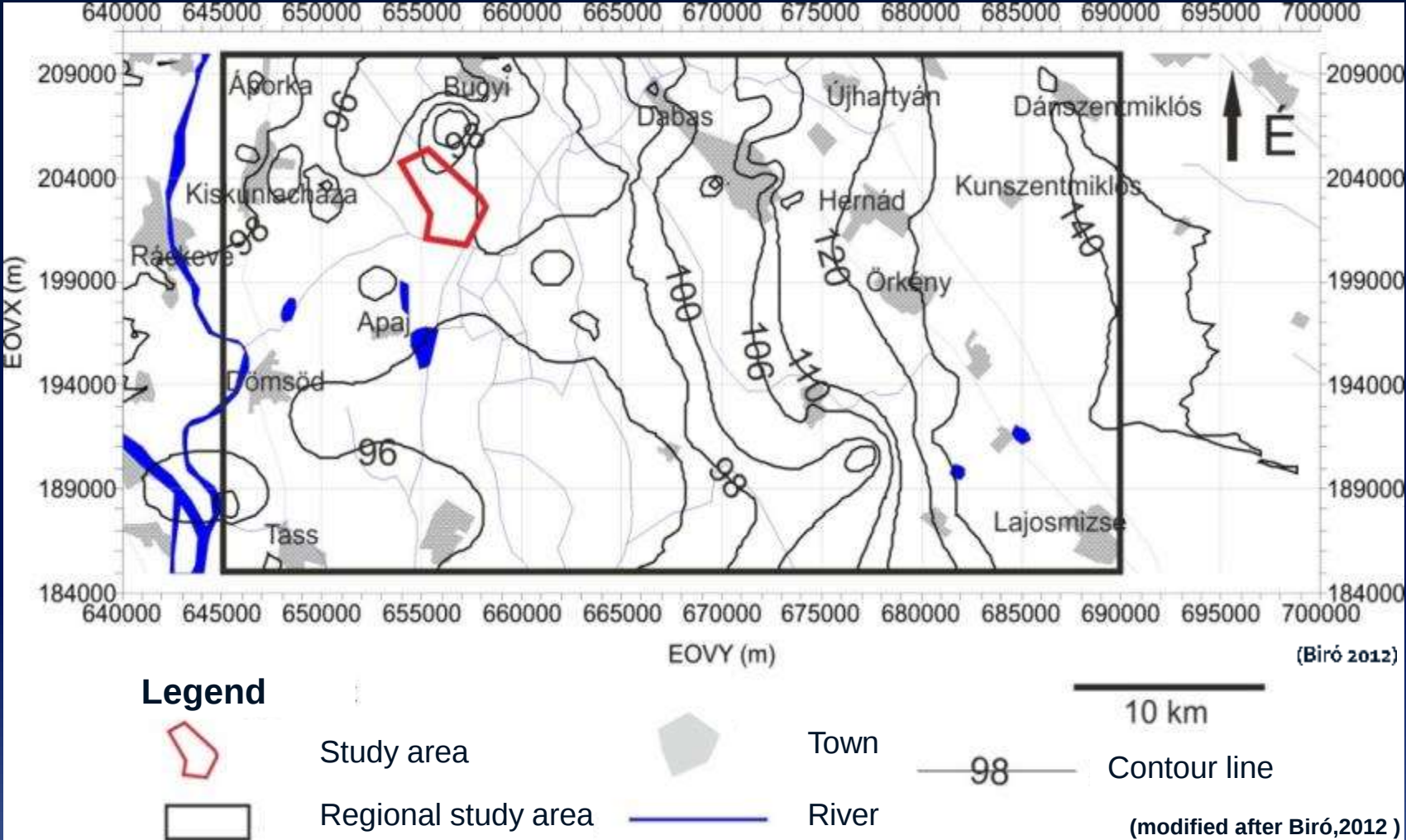


(modified after Biró et al. 2003)

Main questions

- Can the main flow systems be detected and identified based on their differing chemical character in local scale?
- What is the connection between the vegetation pattern and groundwater chemistry in the study area? Are the main flow systems responsible for the complex vegetation pattern in the area?

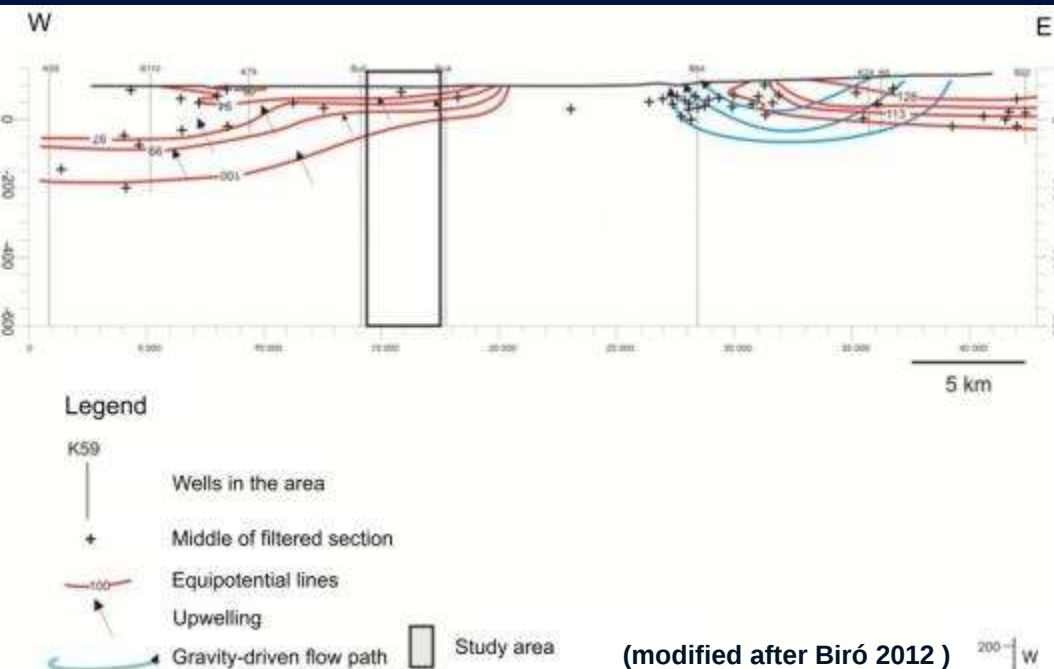
Location of Felső-Szűnyogpuszta



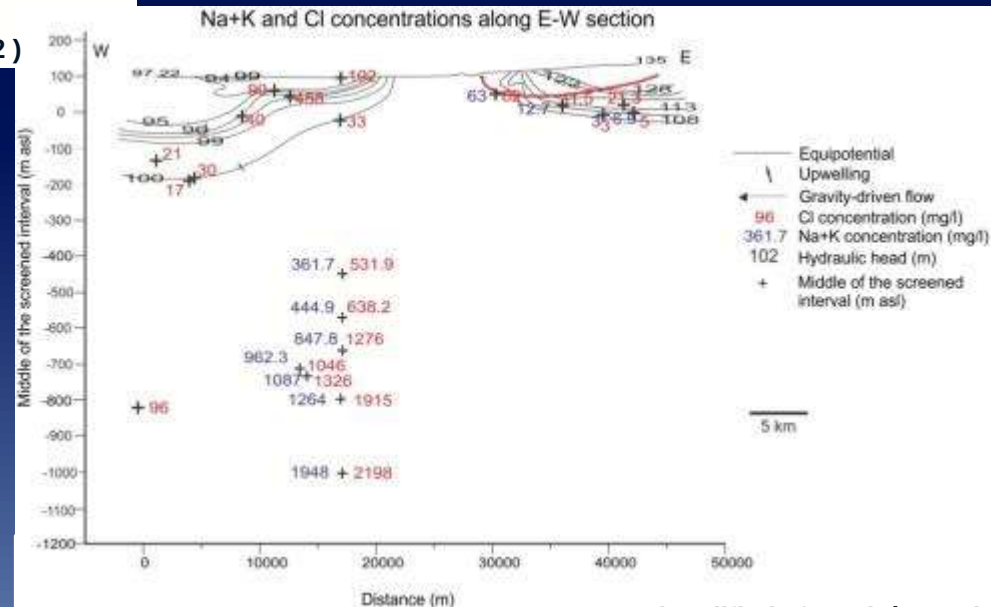
Felső-Szűnyogpuszta is located in the deepest part of the Duna Valley.

Hydrogeological settings

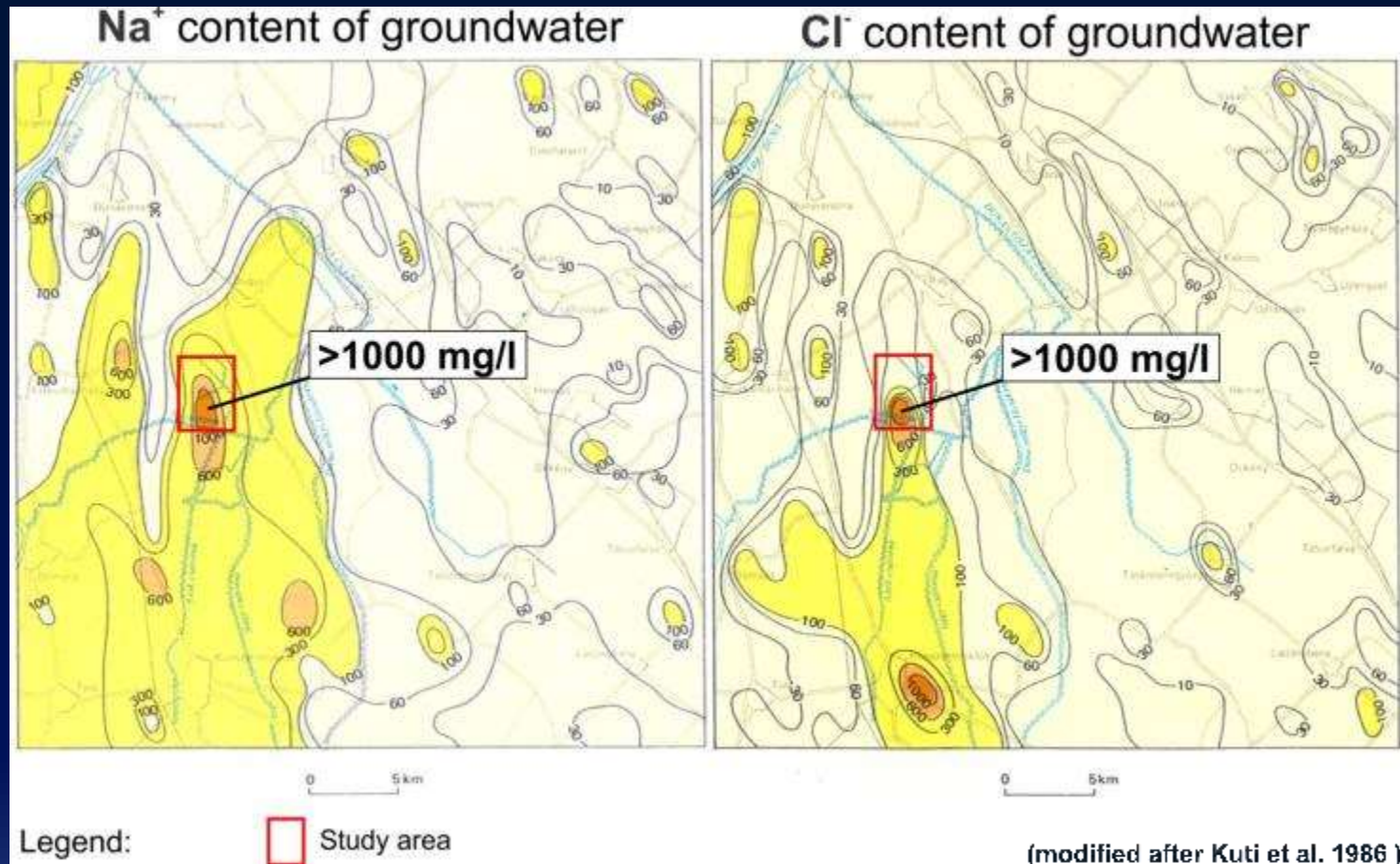
- Study area is supposedly located at the boundary of the two main flow systems.



- Upwelling of the deep saline water is supported by the distribution of water chemistry. It can be connected to Bugyi High and the intersecting faults.

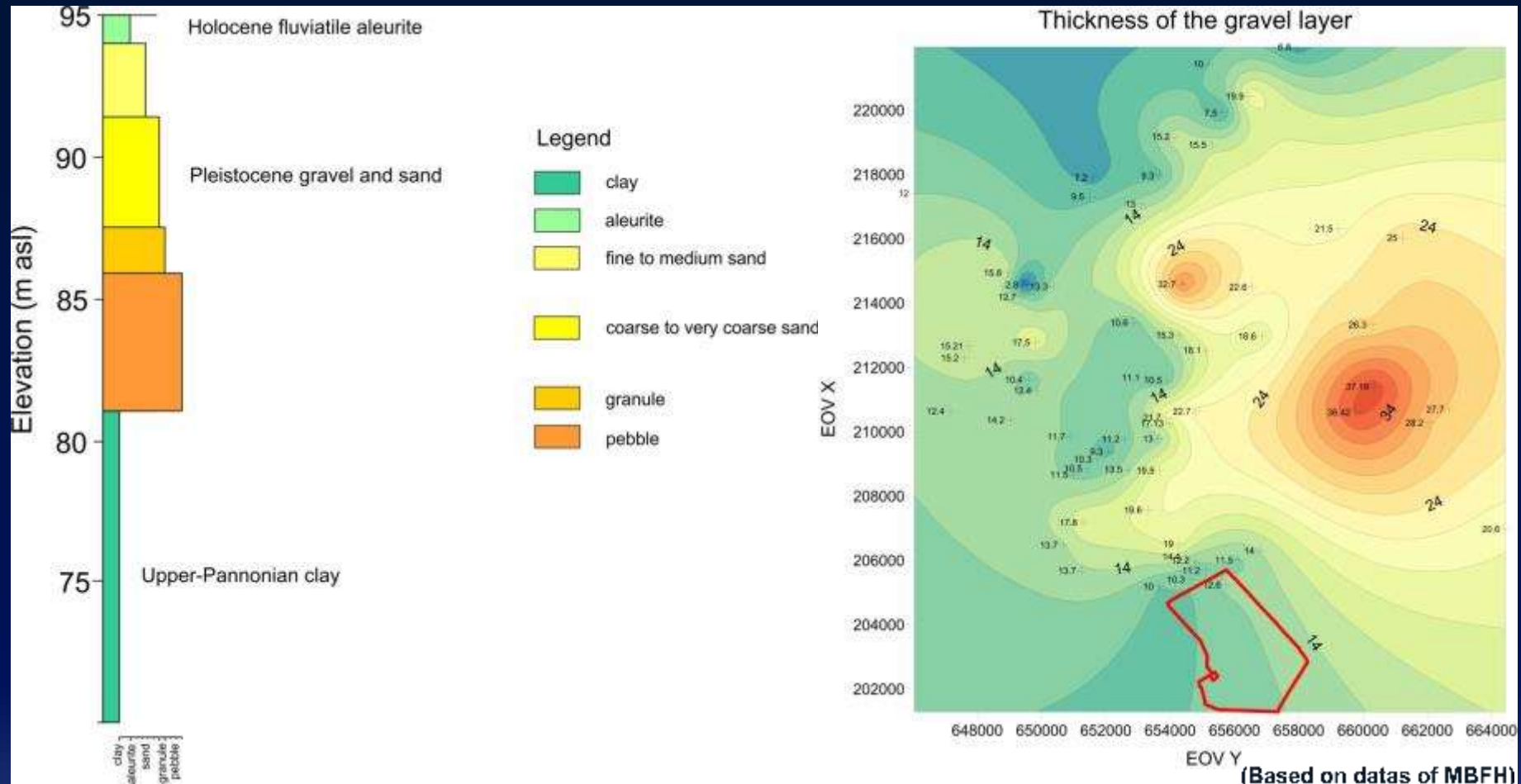


Hydrogeological settings



- Na⁺ and Cl⁻ content reach their maximum at the study area, with >1000 mg/l
- TDS content of groundwater is also the largest in the area, ~1000-2000 mg/l

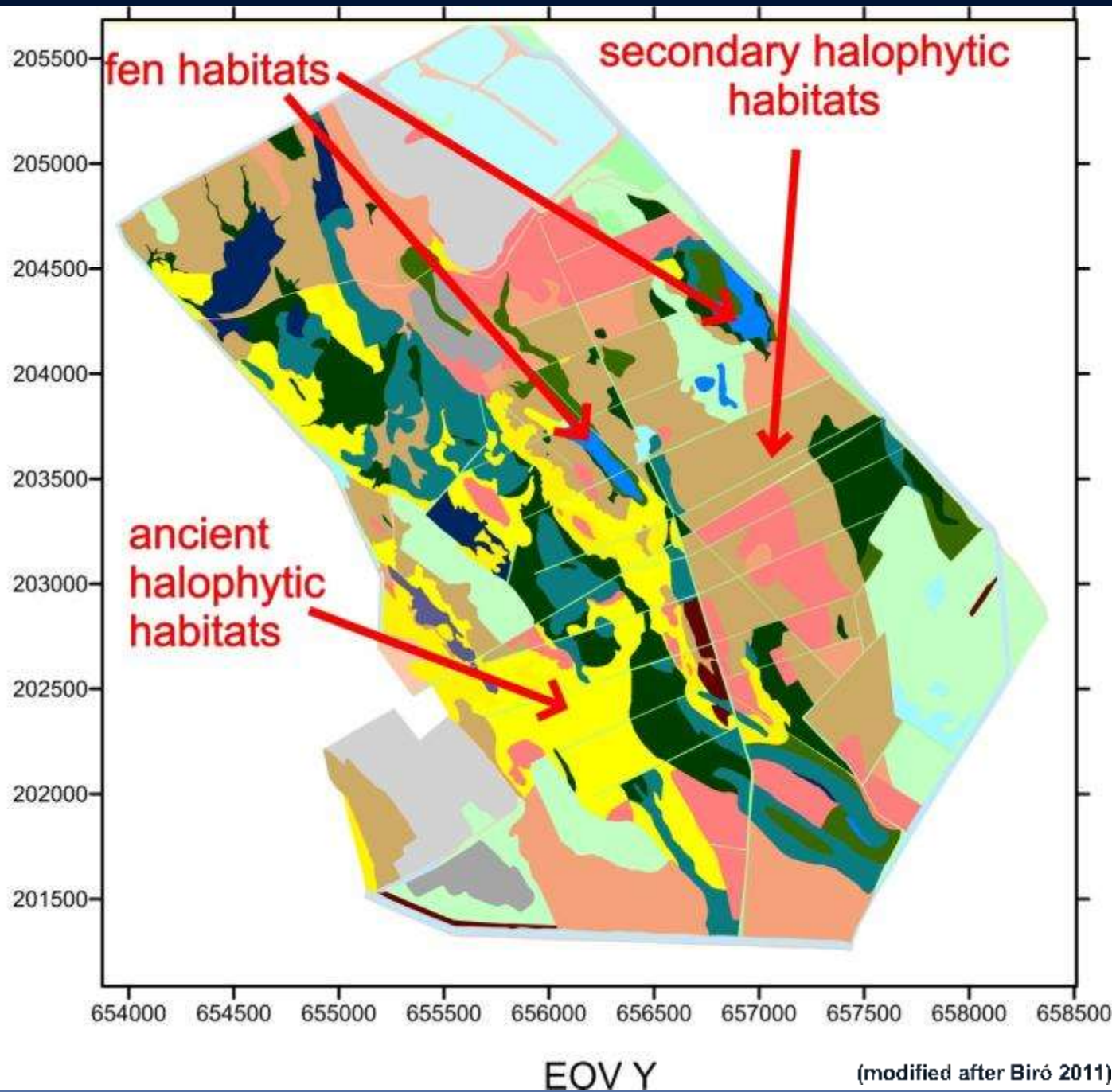
Geological setting



- Thickness of Quaternary deposits are approximately 15-20 m. These layers consist of Pleistocene gravel and Holocene sand.
- Grain size of deposits decreases gradually up to the surface.
- Below Quaternary layers Upper-Pannonian clay can be found.

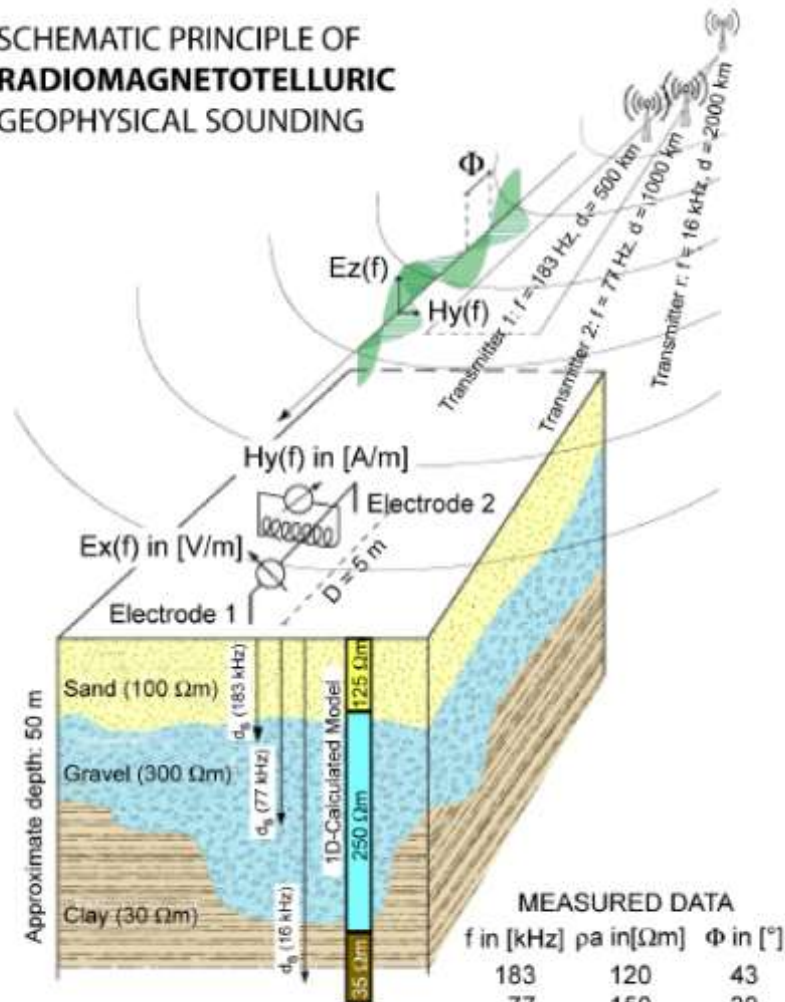
Vegetation

EOV X



Applied methods: Radio-magnetotellurics (RMT)

SCHEMATIC PRINCIPLE OF
RADIOMAGNETOTELLURIC
GEOPHYSICAL SOUNDING



(Bosch 2002)

- It measures apparent resistivity and phase shift using radiowaves.
- Penetration depth is around 30-40 m.



Photo: Á. Tóth

Applied methods: Field measurements in wells

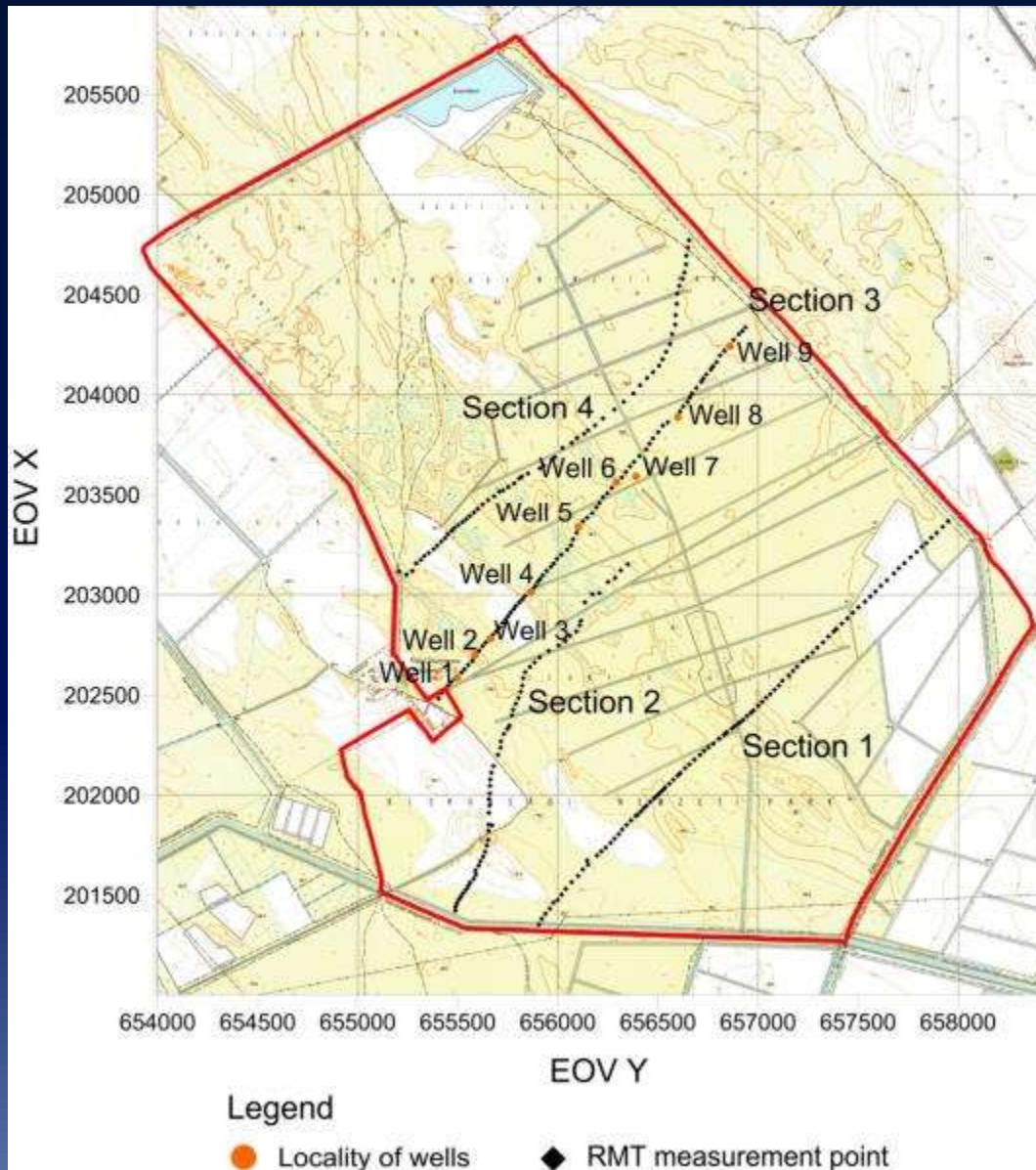


Parameters:

- Water-level
- Total Dissolved Solids content
- pH
- Cl⁻ content

Photo: E. Pável

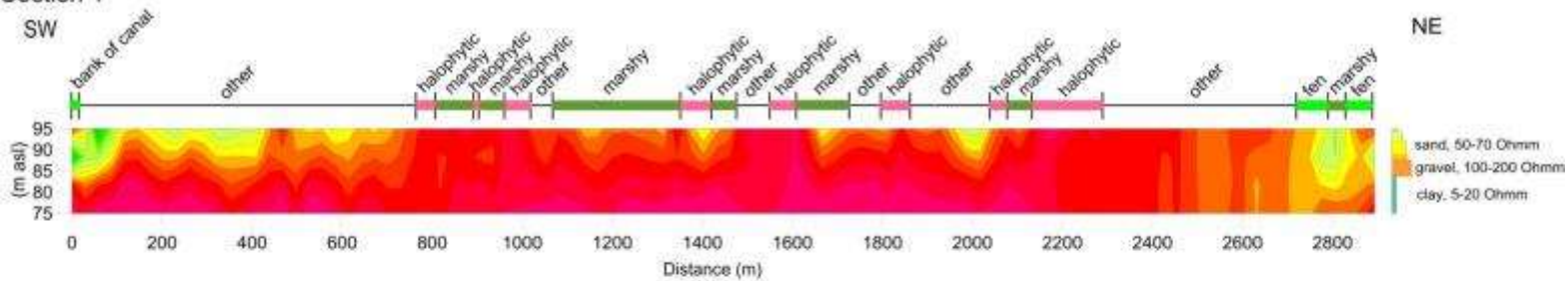
Location of measurements



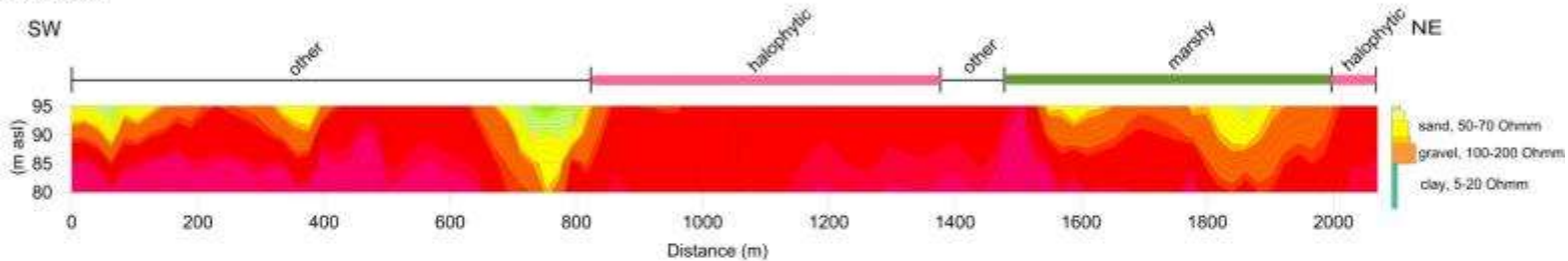
- 4 geophysical section, at perpendicular to zonation of vegetation
- 9 wells along Section 3, parallel with geophysical sections

Geophysical sections

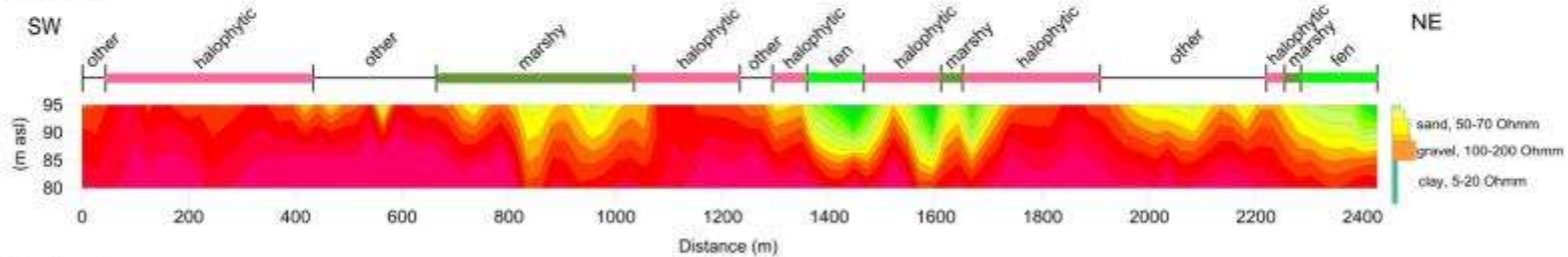
Section 1



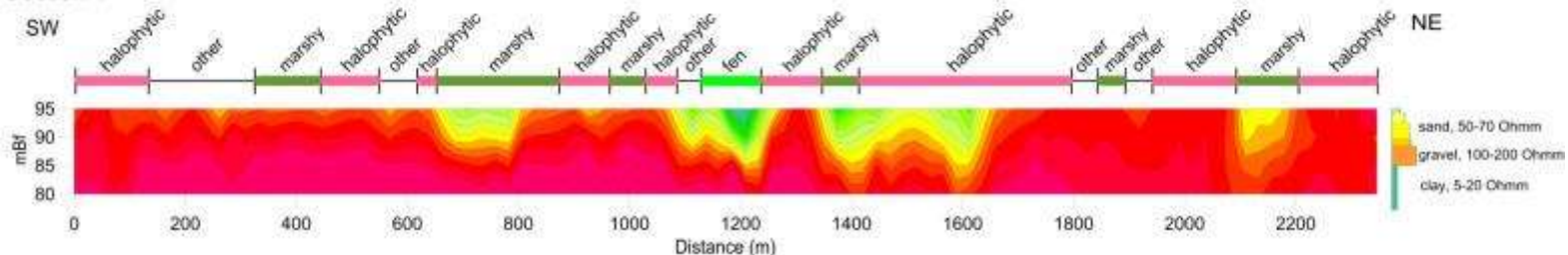
Section 2



Section 3

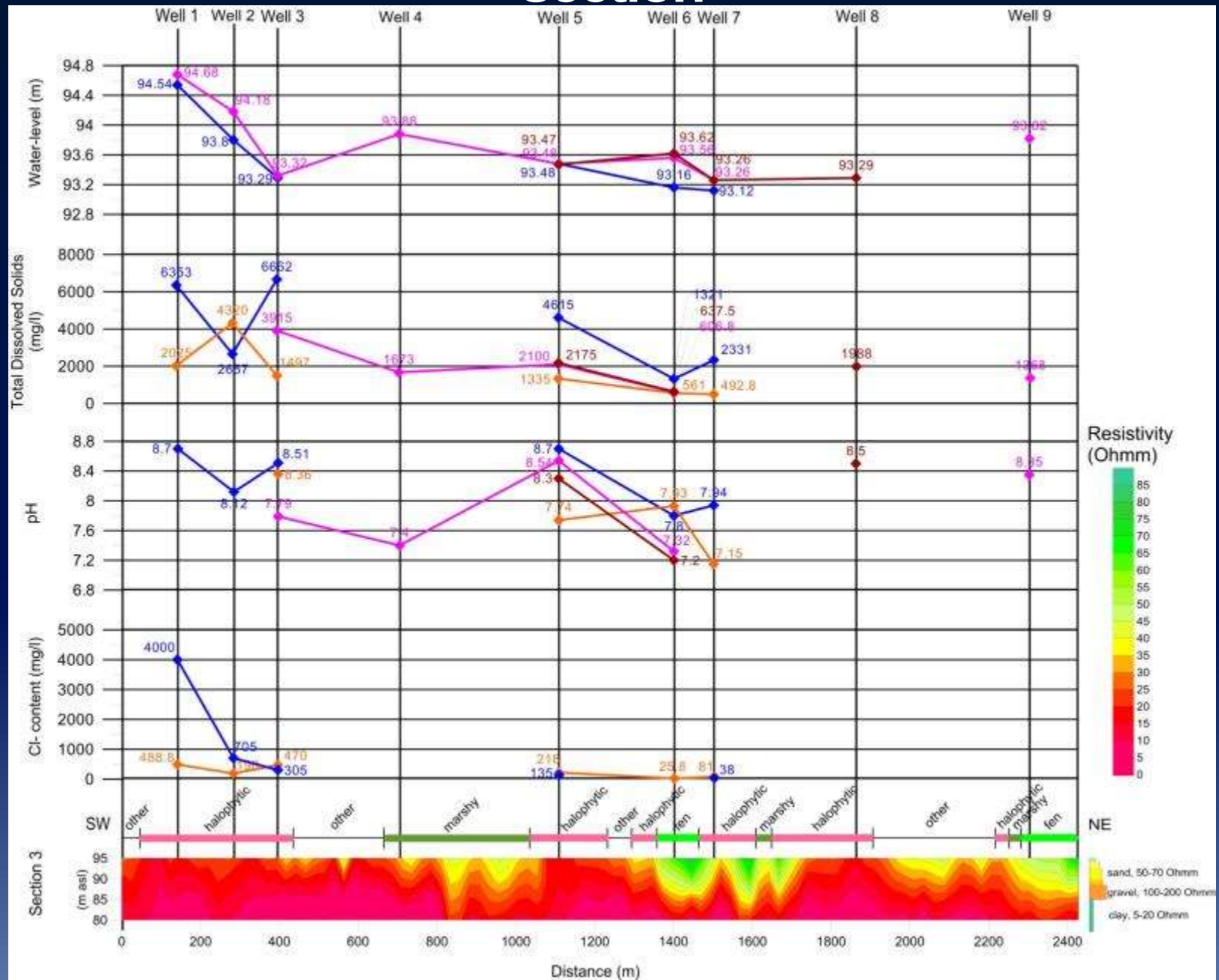


Section 4



Rock	Resistivity [Ωm]
Clay	2 – 20
Wet gravel	50 – 1 000
Wet sand	20 – 100
Salt watered sand	1 – 5

Hydrogeochemical data compared with the geophysical section



Summary

Applying hydrogeochemical and geophysical measurement three main units could be differentiated in the area:

- **Low resistivity, high TDS, basic pH and high content of Cl⁻ indicate saline water with deep origin beneath the ancient halophytic habitats.**
- **High resistivity, low TDS, neutral pH and low content of Cl⁻ characterize freshwater lenses of meteoric origin and these are connected to fen and marshy habitats.**
- **Low resistivity, high TDS, basic pH, but low content of Cl⁻ signifies water beneath secondary halophytic habitats, which can be result of mixing of deep saline and gravity-driven freshwater flow systems.**

Acknowledgement

I would like to express my very great appreciation to Szilvia Simon for her leadership during the project and for her great support during the measurements.

Useful advices given by Ádám Tóth and prof. Imre Müller has been a great help in geophysical measurements.

I wish to acknowledge the support provided by Marianna Biró for her instructions about vegetation.

Thank you for your attention!