Applied Technology and Best Practices in CEE
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Society of Petroleum Engineers

Fluid-potential anomaly related hydrocarbon entrapment

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Objectives

- sedimentological discontinuities/heterogeneities
- fluid-potential anomalies
- Pannonian Basin – overpressure
- low-permeability environments – 'scale problem'
- secondary HC migration and entrapment

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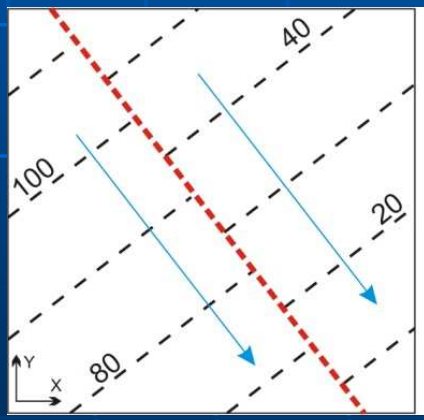
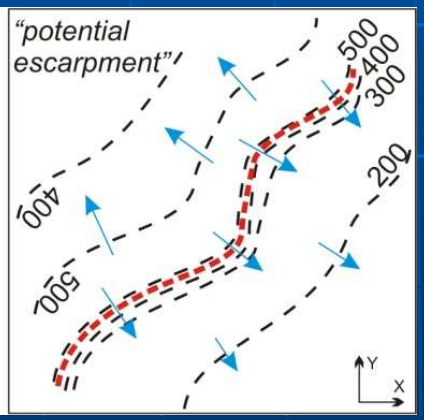
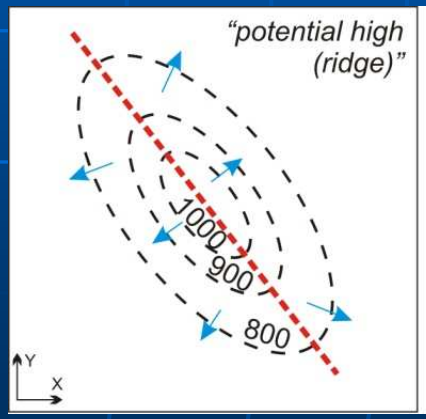
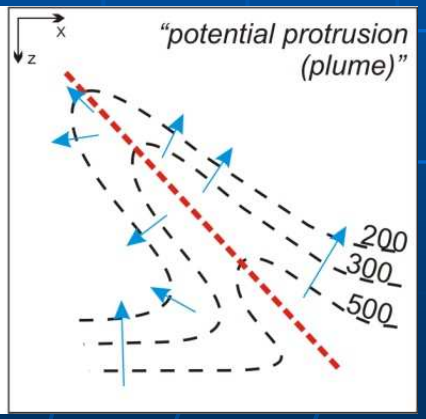
Barrier fault





Conduit fault





(Czauner & Mádl-Szőnyi, May 2011, AAPG Bulletin 95:795-811)

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- Hydrogeological methodology development on purpose to identify potential HC traps (hydraulic & hydrodynamic) for areas with differing data-supply, based on
  - the determination of diagnostic relationships
  - and geological analogies

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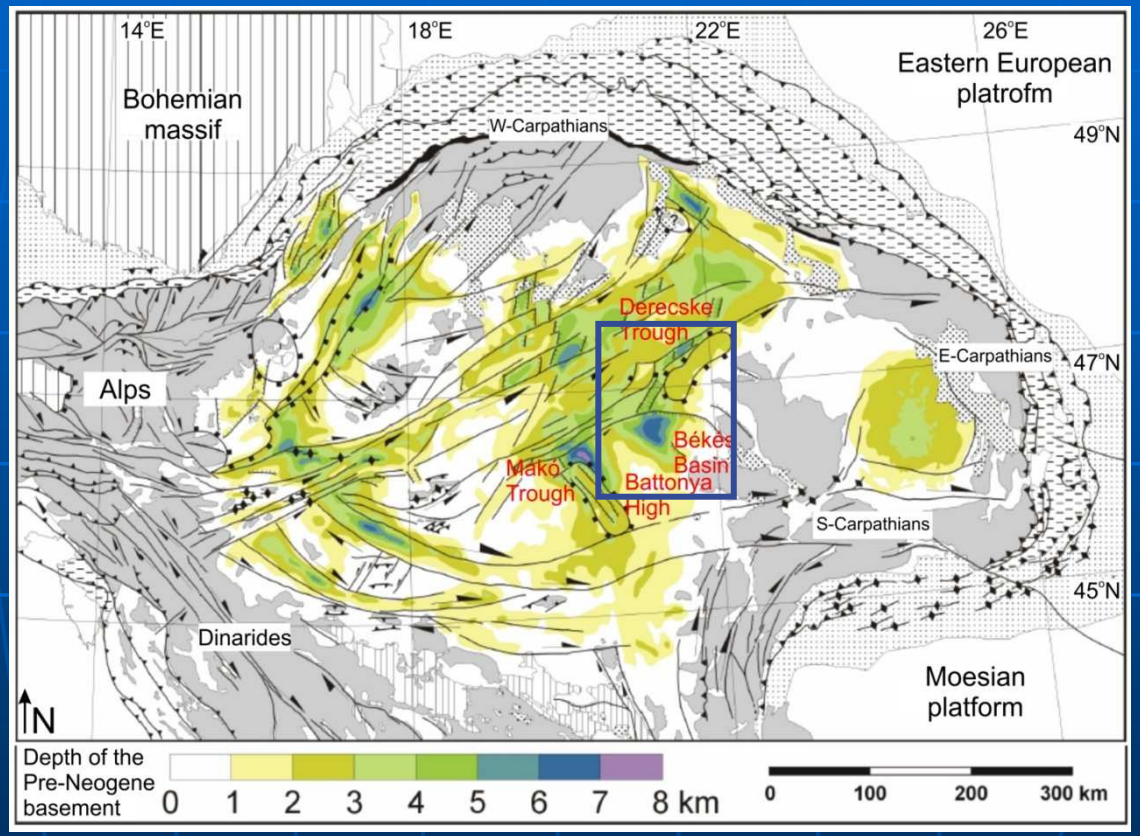
Study area



(modified after Horváth, 2007)

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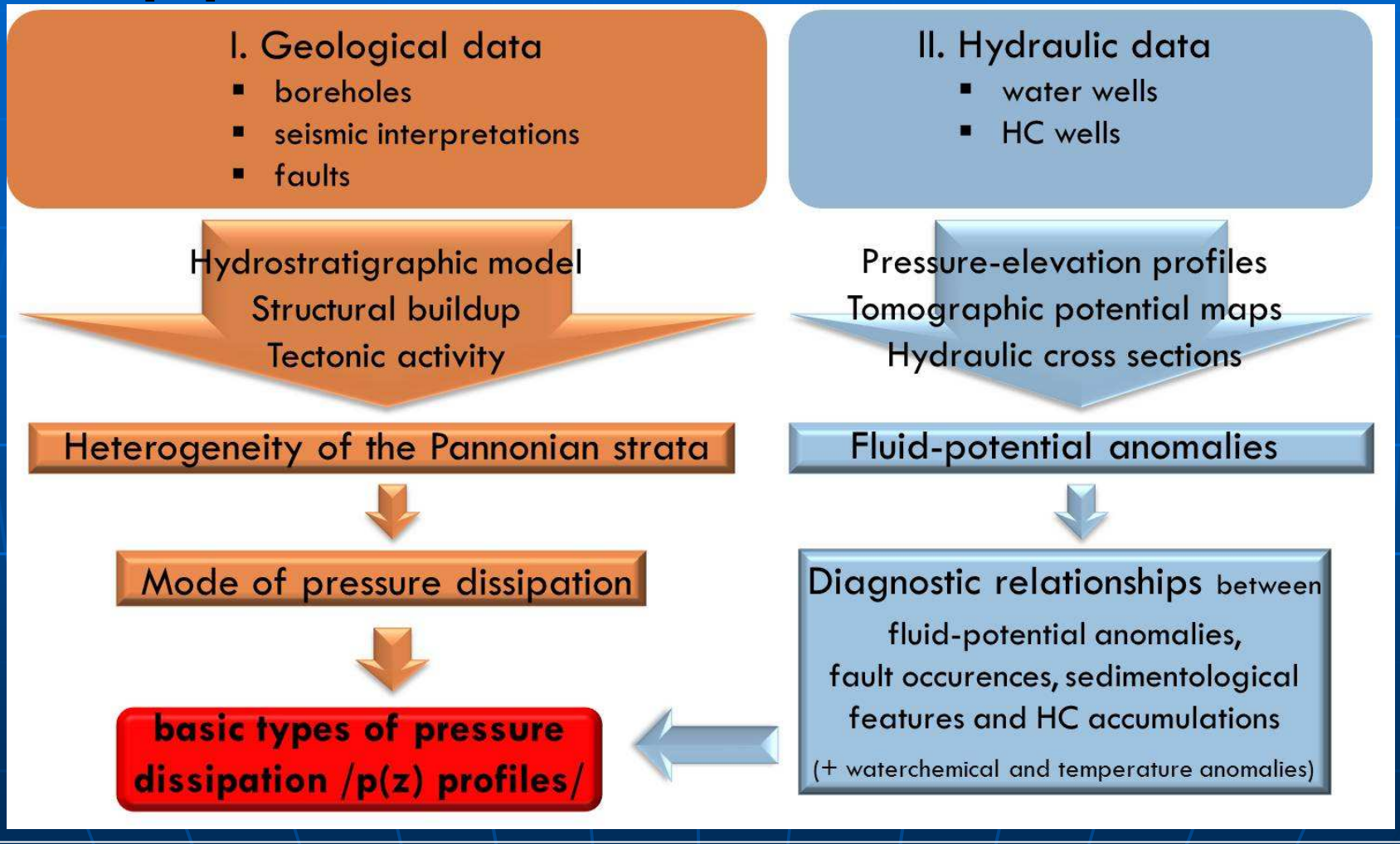
Applied data and methods



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Results

1. Regional scale hydrogeological characterization of the study areas, which can serve as a foundation for further local scale investigations and/or hydrodynamic modeling.

Age			Lithostratigraphic units in the Great Hungarian Plain (Juhász 1992)	Hydrostratigraphic units in the Great Hungarian Plain (Tóth and Almás 2001, Mádlné Szőnyi and Tóth 2007, Mádl Szőnyi and Tóth 2009) K (m/s)
Neogene	Holocene	Pleistocene	Quaternary Nagyalföld Fm.	Nagyalföld aquifer 10^{-5}
	Pliocene		Zagyva Fm.	
			Újfalu Fm.	
	Late Miocene		Algyő Fm.	Algyő aquitard 10^{-8}- 10^{-7}
			Szolnok Fm.	Szolnok aquifer 10^{-7}- 10^{-6}
			Endrőd Fm.	Endrőd aquitard 10^{-9}
	Middle Miocene		Prepannonian formations	Prepannonian aquifer 10^{-6}
	Early Miocene			
	Oligocene		Hiatus	
Paleogene	Eocene		Preneogene formations	?
Paleozoic Mezozoic				

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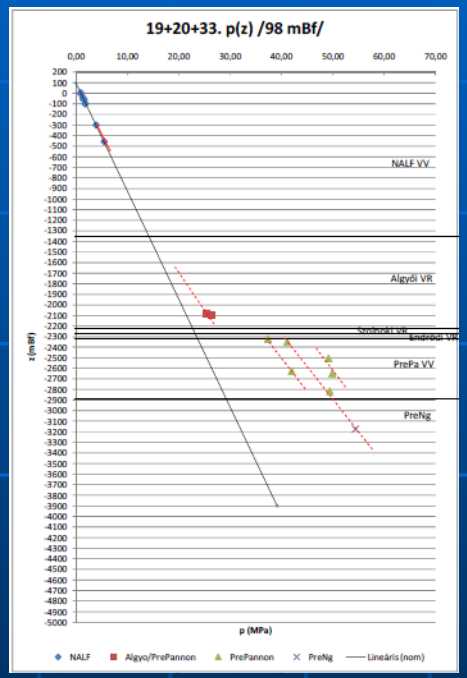

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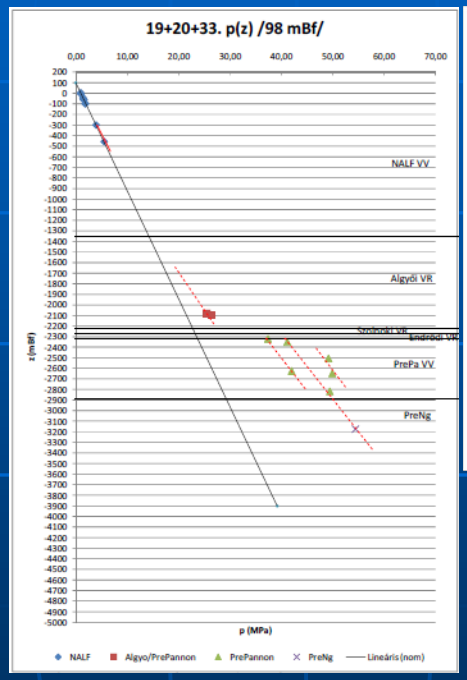

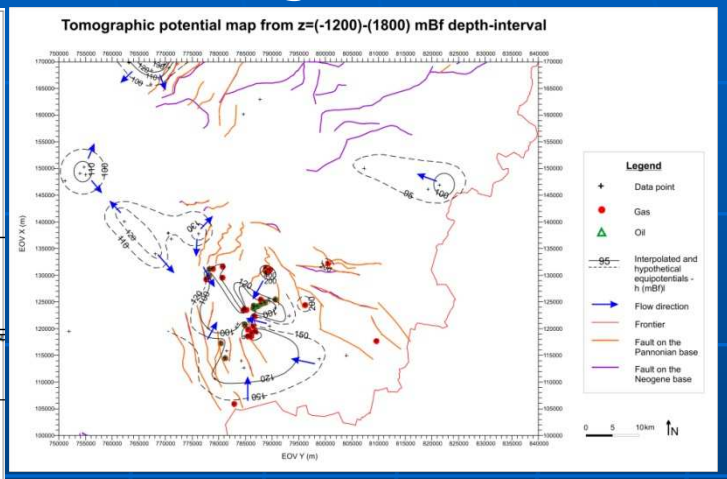

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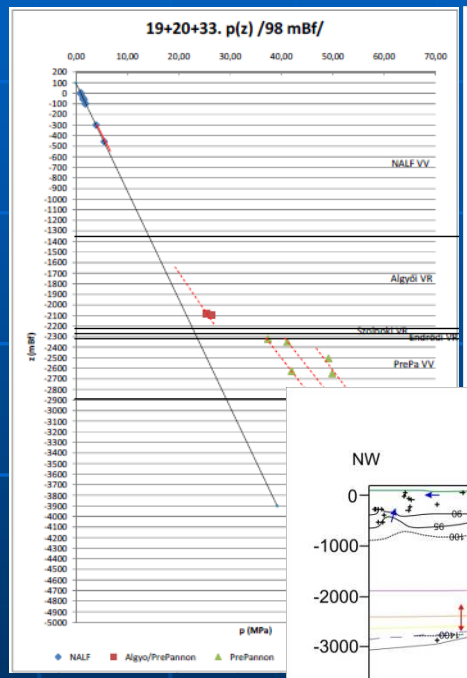

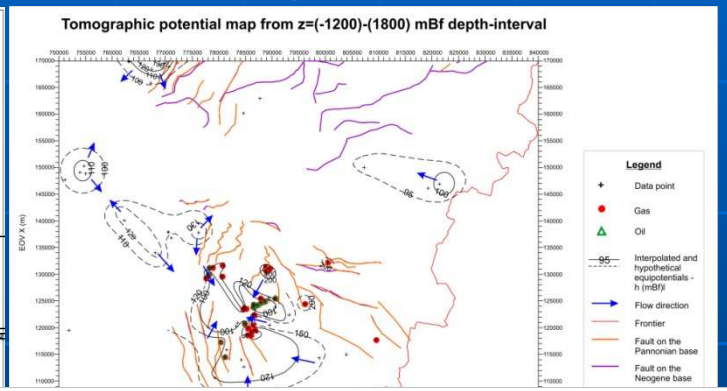

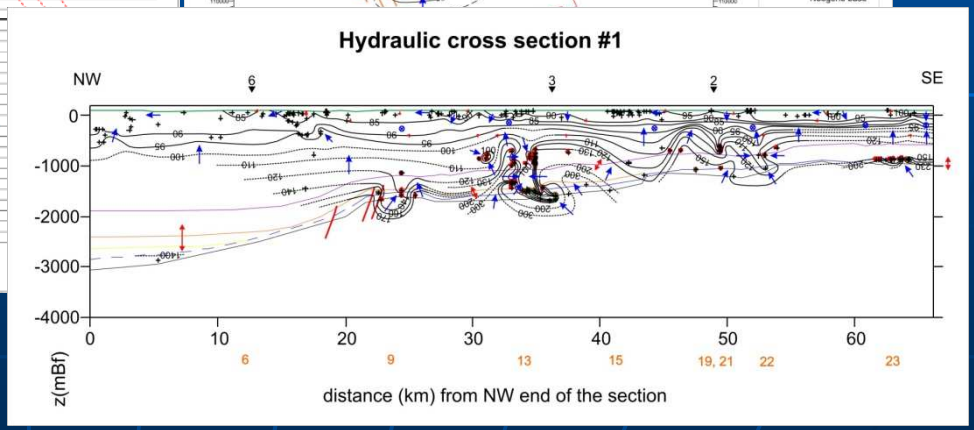

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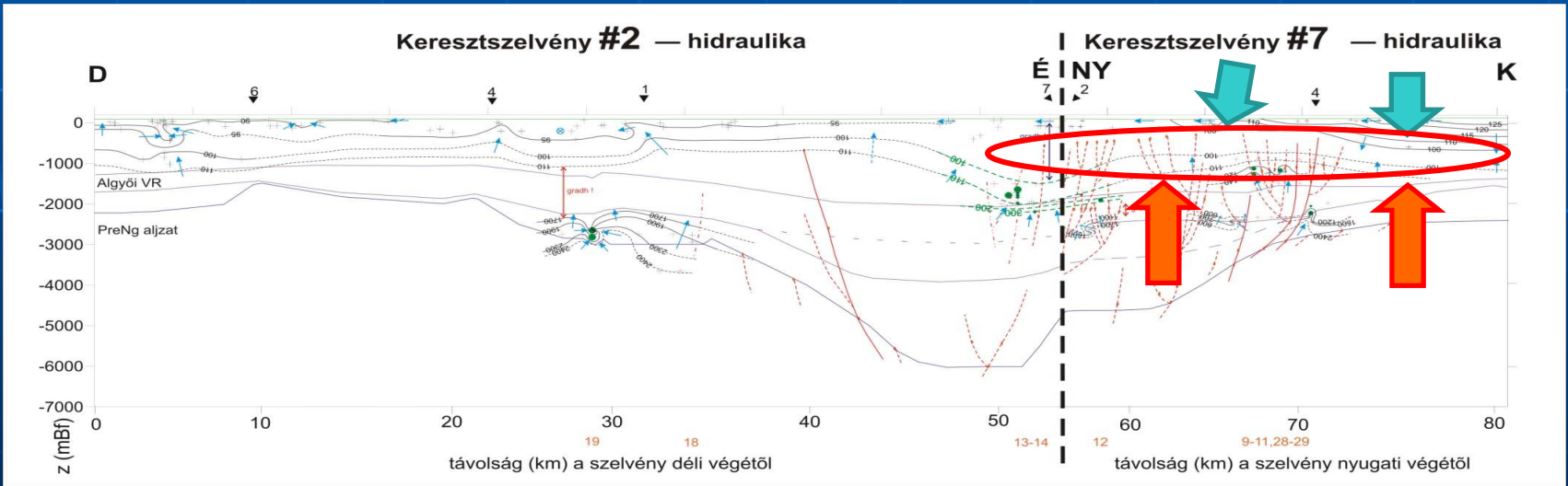
Results

1. Regional scale hydrogeological characterization of the study areas, which can serve as a foundation for further local scale investigations and/or hydrodynamic modeling.
2. Definition of the potential areas and depth intervals of hydraulic HC entrapment, or the uppermost boundary of vertical HC migration.



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3. Identification of diagnostic relationships between hydraulic, temperature and hydrochemical anomalies, as well as faults, sedimentological discontinuities and HC accumulations.

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3. Diagnostic relationships

- Regionally observable overpressure in the PreNeogene basement dissipates through and controlled by the Pannonian strata.
- **Pressure dissipation**

= subsurface energy distribution
= hydrodynamic conditions

↓

fluid (and gas) flow directions

↓

hydraulic and hydrodynamic traps (HC, geothermal)

depends on the geological buildup

→ diagnostic relationships between

- the heterogeneity of the Pannonian strata (i.e. faults, high/low permeability lenses),
- the subsurface fluid-potential (~energy) anomalies,
- and the HC accumulations.

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3. Identification of diagnostic relationships between hydraulic, temperature and hydrochemical anomalies, as well as faults, sedimentological discontinuities and HC accumulations.
4. Based on the hydraulic behavior of the Pannonian strata and faults, generalization of pressure-elevation type profiles or pressure dissipation modes/ways being typical of the study areas.

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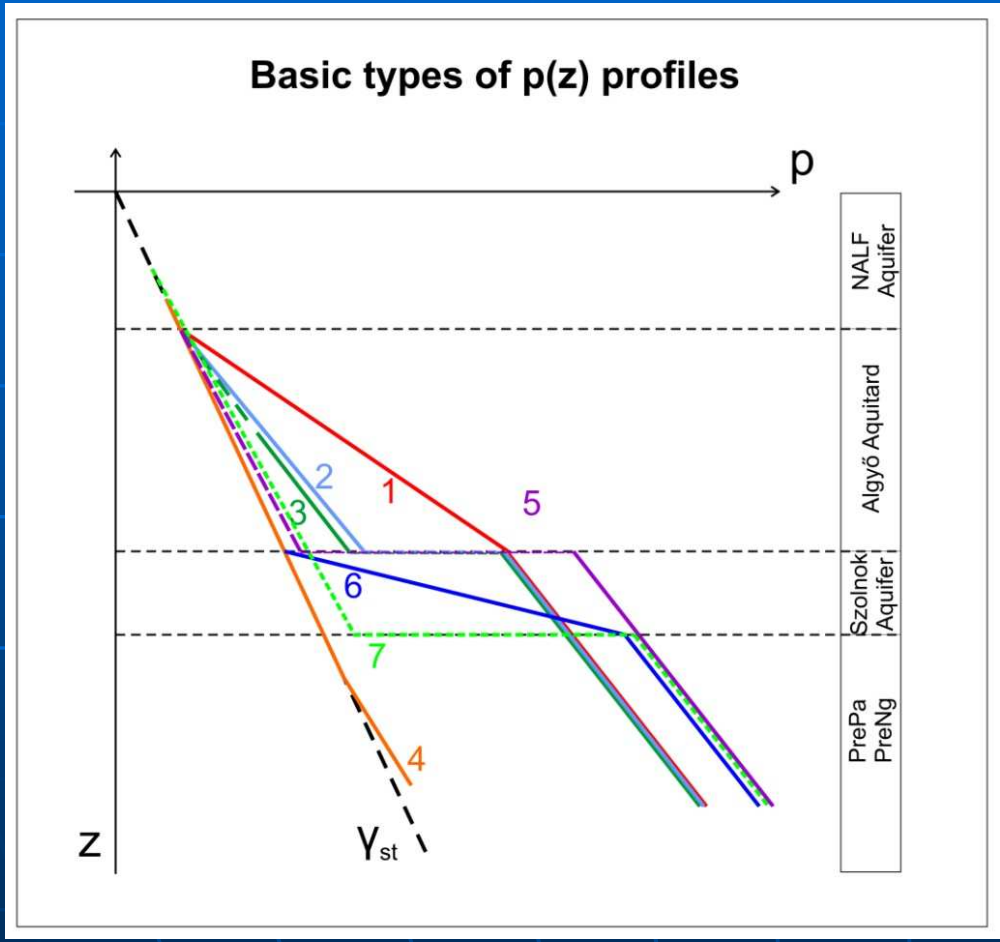
4. p(z) type profiles



- the way of pressure dissipation through the Neogene strata
- depends on the geological buildup
- causes differing and tipical potential, geothermal, hydrochemical features, and HC traps
- diagnostic relationships among fluid-potential anomalies, sedimentological discontinuities and HC occurrences

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2. Definition of the potential areas and depth intervals of hydraulic HC entrapment, or the uppermost boundary of vertical HC migration.
3. Identification of diagnostic relationships between hydraulic, temperature and hydrochemical anomalies, as well as faults, sedimentological discontinuities and HC accumulations.
4. Demonstration of the hydraulic behavior of the Pannonian strata – particularly the Algyő Aquitard – and faults, as well as generalization of pressure-elevation type profiles or pressure dissipation modes/ways being typical of the study areas.
5. Methodology development.

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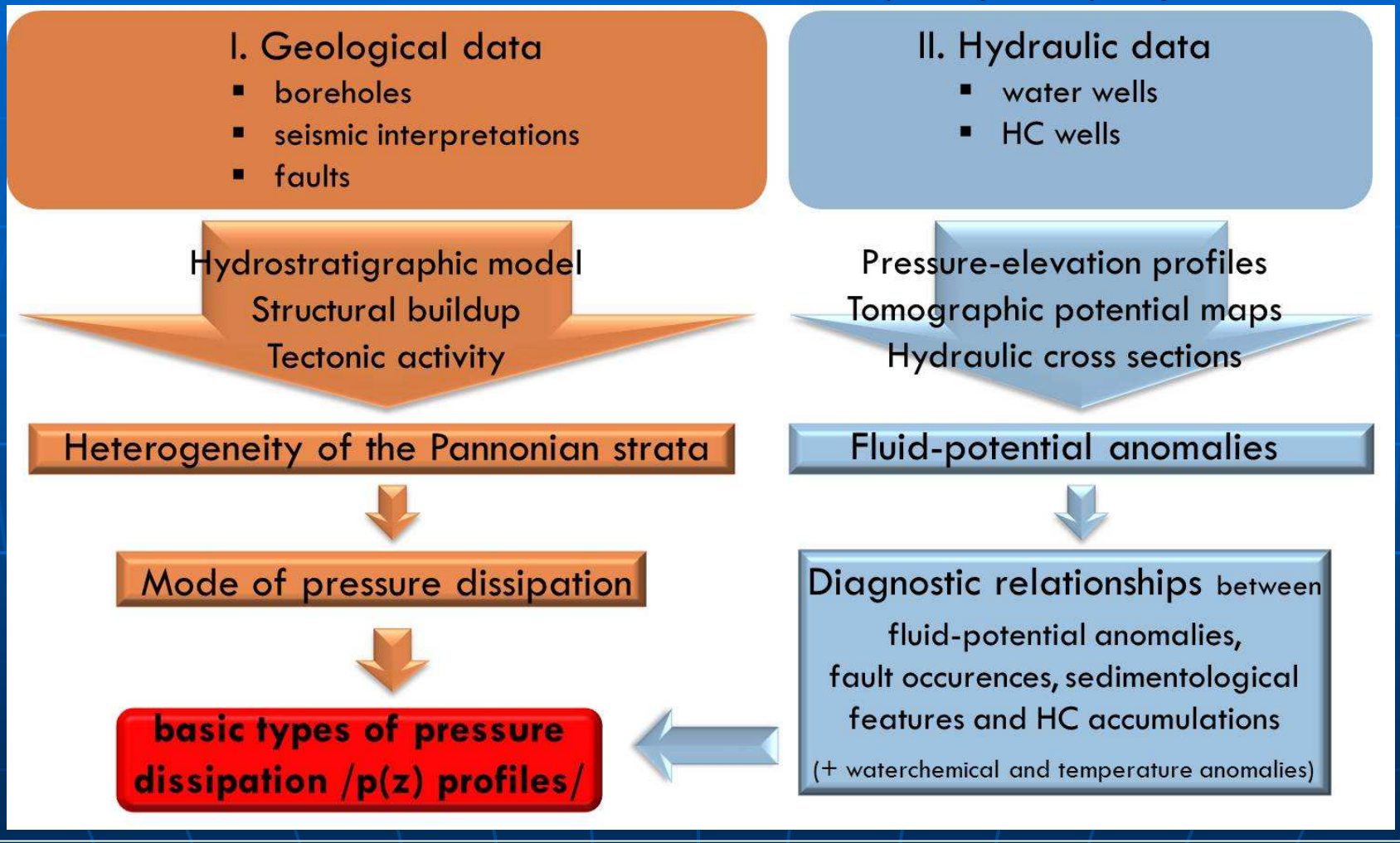
5. Methodology

5.1. DIRECT – in case of sufficient data quantity and quality



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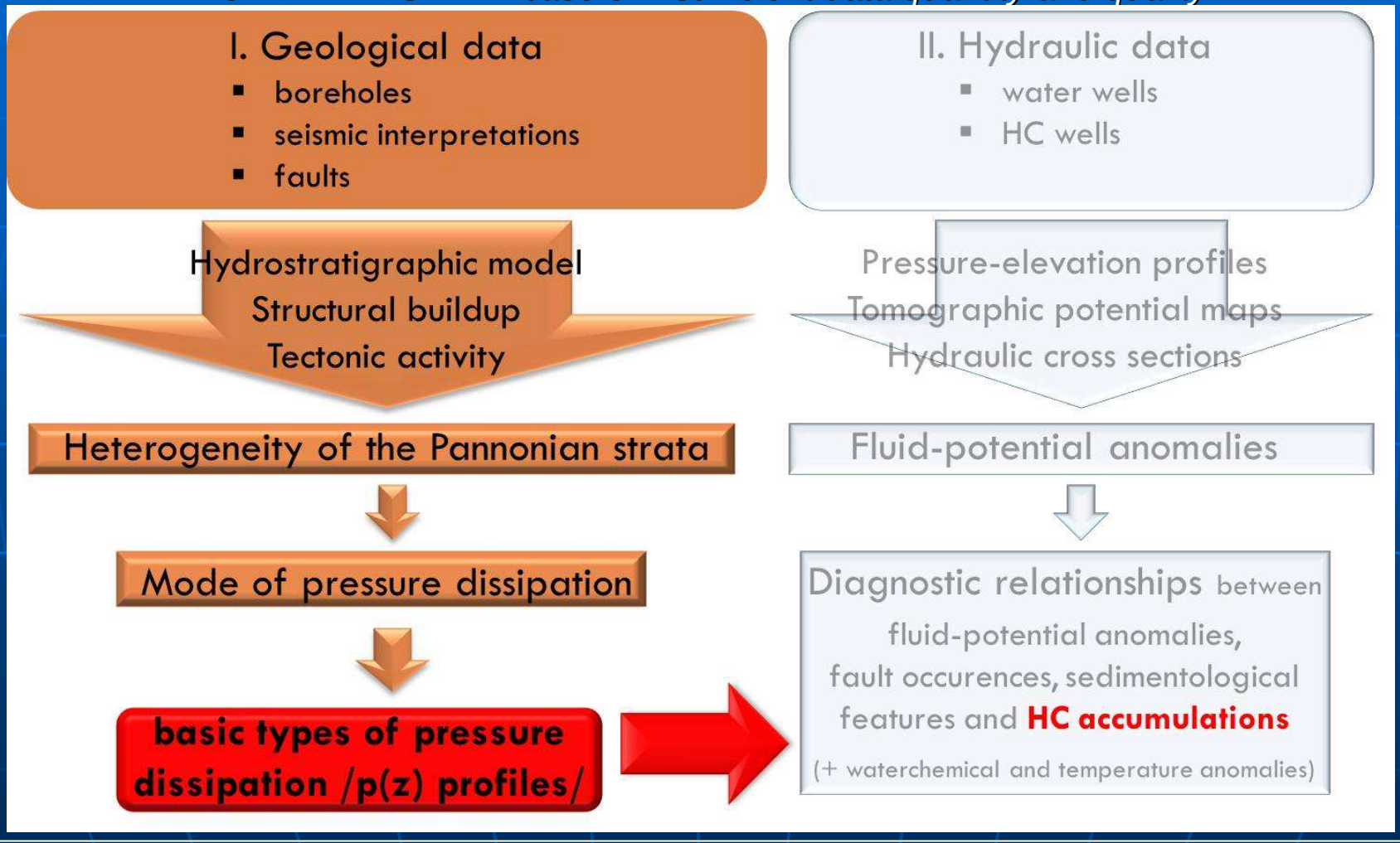
5. Methodology

5.2. INVERSE – in case of insufficient data quantity and quality



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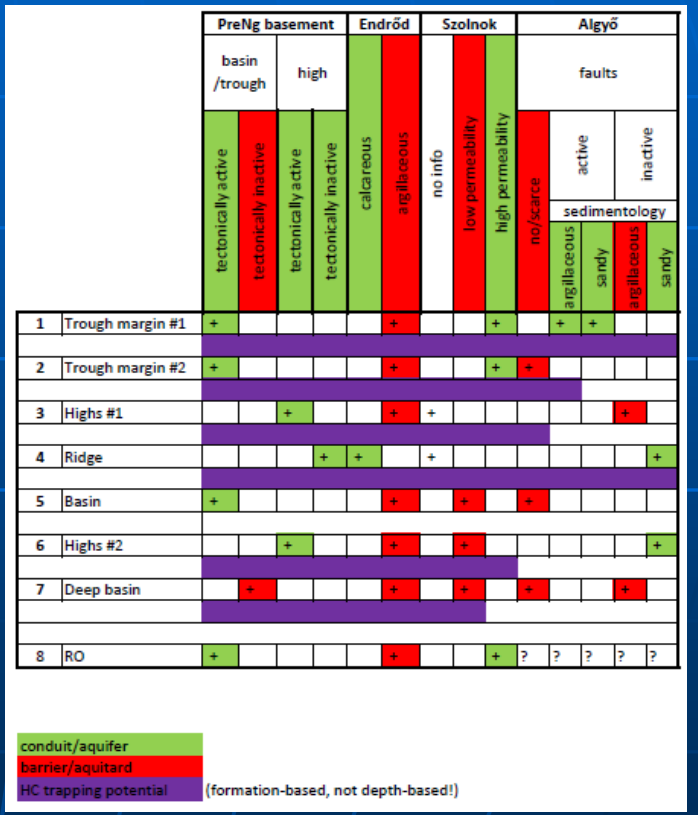
5. Methodology

5.2. INVERSE – in case of insufficient data quantity and quality

Proposed workflow

Required informations and Drawable conclusions

- Topographic conditions
- Preneogene basement depth and morphology
- Endrőd Fm (deep basin facies), Szolnok Fm (prodelta facies), and Algyő Fm (delta slope and front facies) characteristics



Pressure (energy) distribution and HC trapping potential could be estimated

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Summary

- Hydrogeology provides simple and effective methods for the regional scale characterization of geological formations' and faults' hydraulic function, particularly in low-permeability environments and in HC entrapment.

- Integrative and multiscale study well based on several data types and analysing methods.

- Generalized results
  - p(z) type-profiles
  - diagnostic relationships

→ theoretical and practical significance (→ methodologies)

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THANKS FOR YOUR ATTENTION!

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