



# Delineation of Unconventional Groundwater: II. Saline Geothermal Groundwater in Krabi, Southern Thailand



กองทุนพัฒนาน้ำบาดาล  
Groundwater Development Fund

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## Outline



- I** Hot Springs in Thailand, ...
- II** Saline Hot Spring in Thailand, ...
- III** Saline Hot Spring Explorations, ...
- IV** Conclusion and Remark

# Hot Springs in Thailand

*Do you know ? ...*

**Thailand has more than 112 hot springs !! ...**



*... Chilling out at the Krabi Hot Springs*

Geophysics Research Center (GRC), PSU, Thailand

*Ref. Ngansom and Duerrast, 2018*

03

## One is different - Saline Hot Spring



Man made structures for bathing



Natural hot spring inside mangrove

**KB4 was rapidly developed as a tourist attraction !**

Geophysics Research Center (GRC), PSU, Thailand

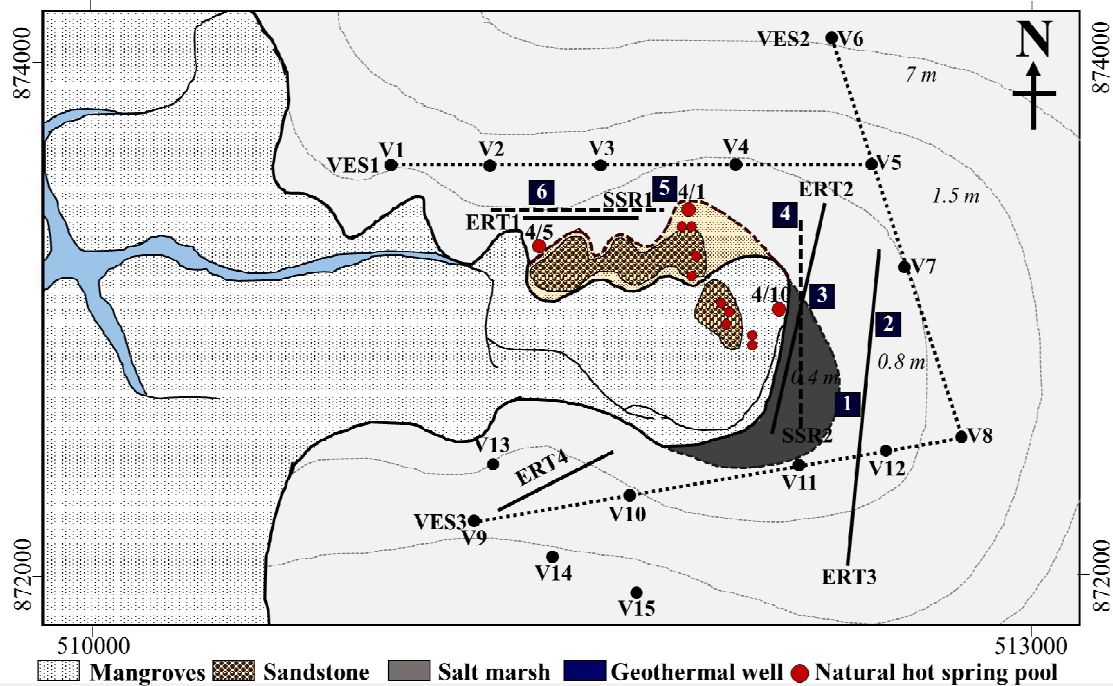
*Ref. Ngansom and Duerrast, 2018*

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# Saline Hot Spring ... called KB4

For the development we need  
understanding of geological and hydrogeological setting  
... **Geology + Geophysics + Geochemistry** ...

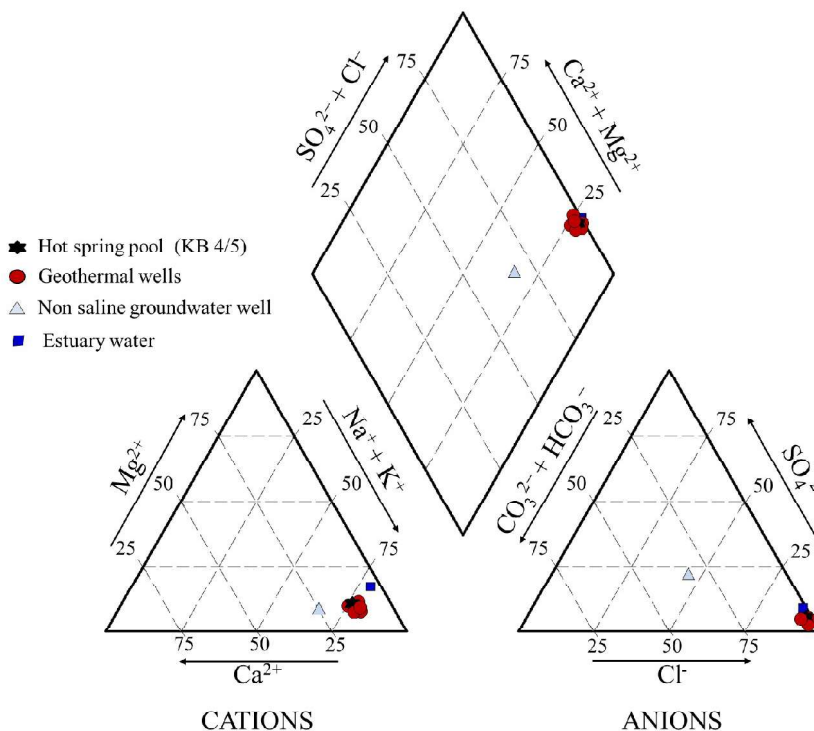


Geophysics Research Center (GRC), PSU, Thailand

Ref. Ngansom and Duerrast, 2018

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## Water Properties & Chemistry



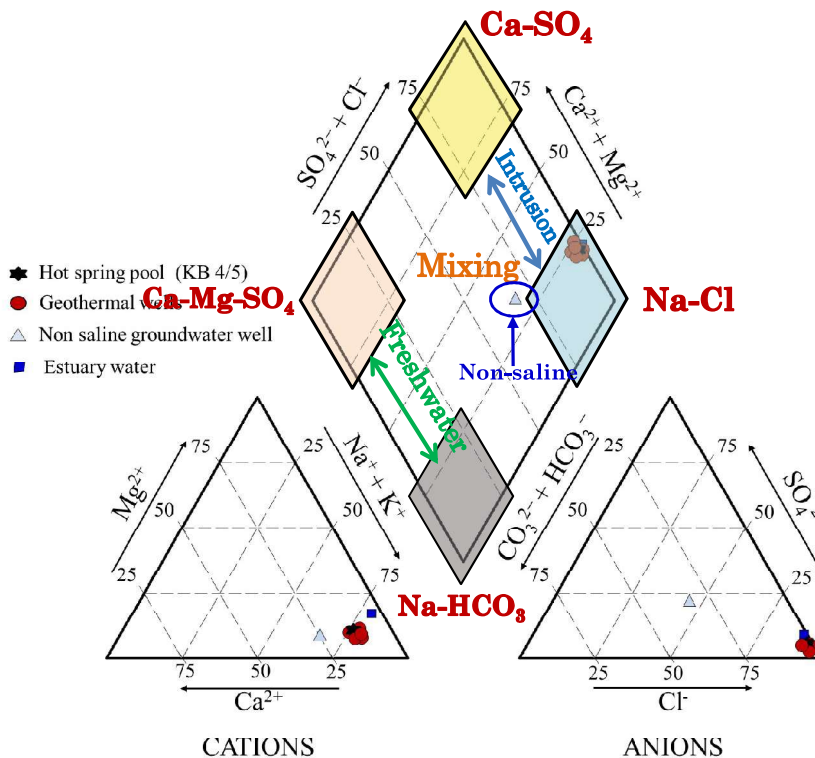
### Piper diagram of KB4

- KB4, geothermal wells and estuary waters are classified as the sodium chloride type water
- Non-saline groundwater sample plots clearly in bicarbonate region

Geophysics Research Center (GRC), PSU, Thailand

Ref. Ngansom and Duerrast, 2018

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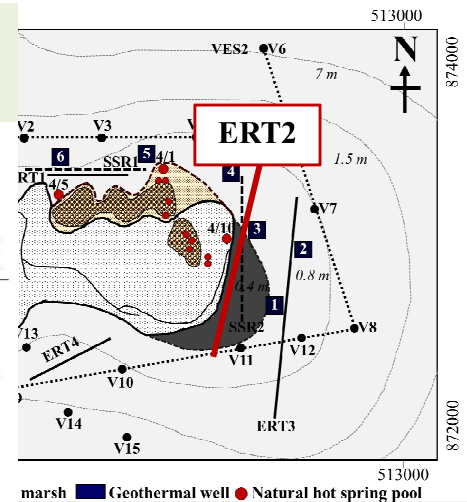
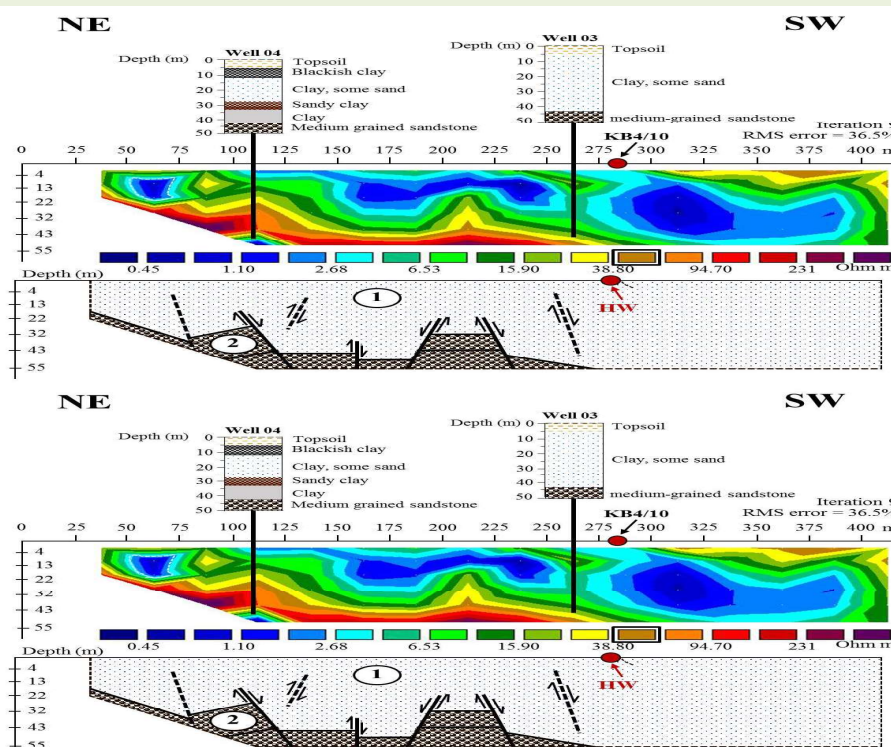


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# Electrical Resistivity Tomography

- ERT2 carried out in W close to KB4/10 and close to salt marsh
- very low resistivity in SW of KB4/10 interpreted as saline waterlogged zones

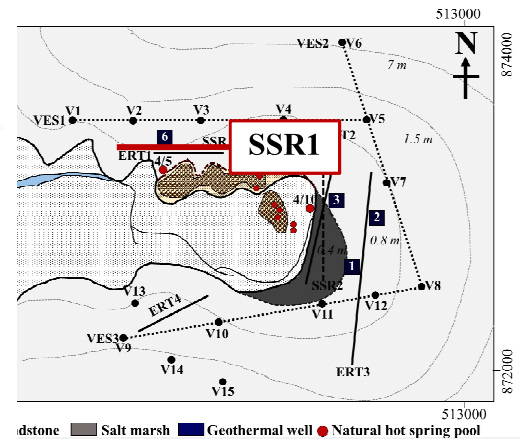
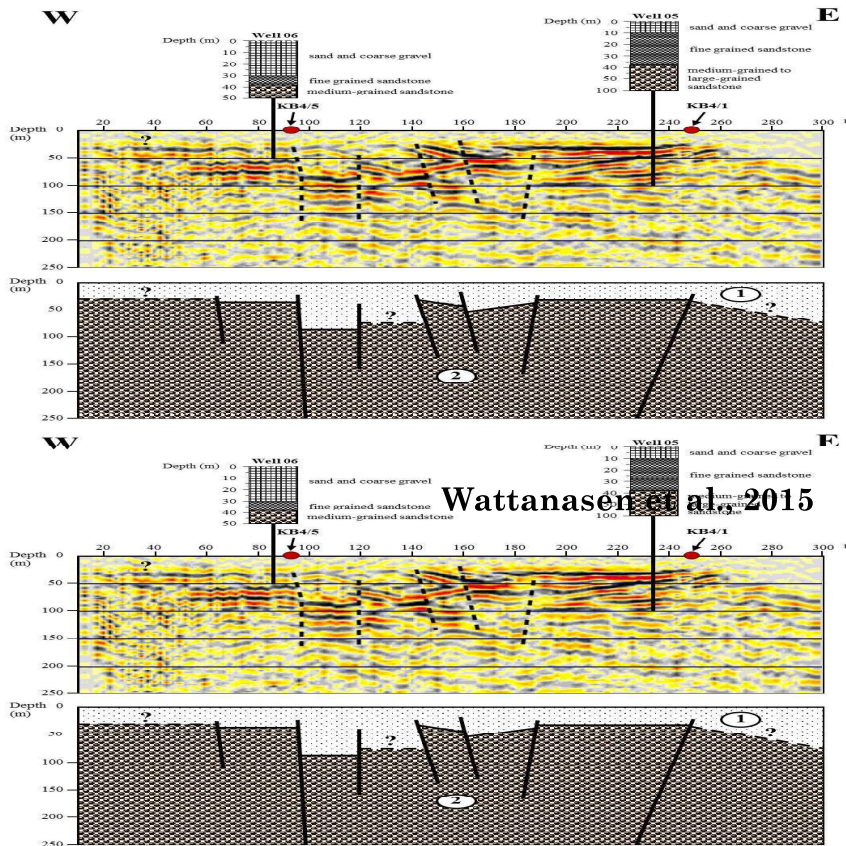


- clay/sand layers with saline water
- medium-grained sandstone

- clearly vertical boundaries between structures point to shallow faults



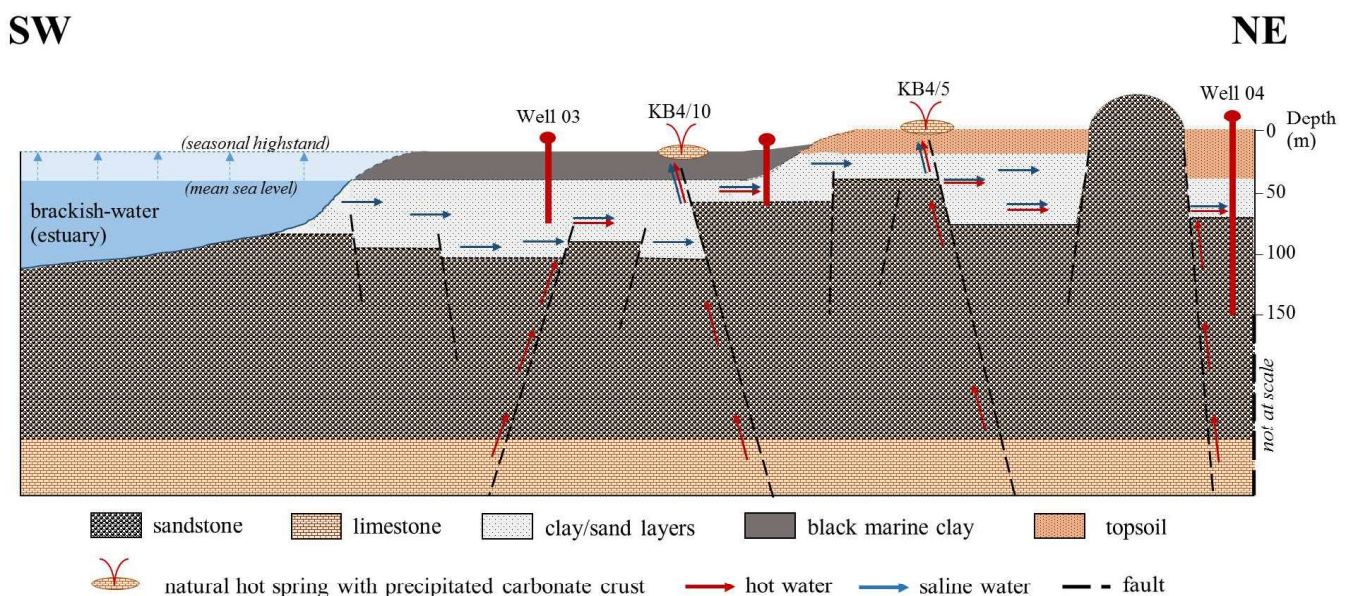
# Shallow Seismic Reflection



- SSR1 provide from W to E
- Structures have been identified by reflections and discontinuities
- Shallow parts filled with sediments corresponding to cutting of Well 03 to 06

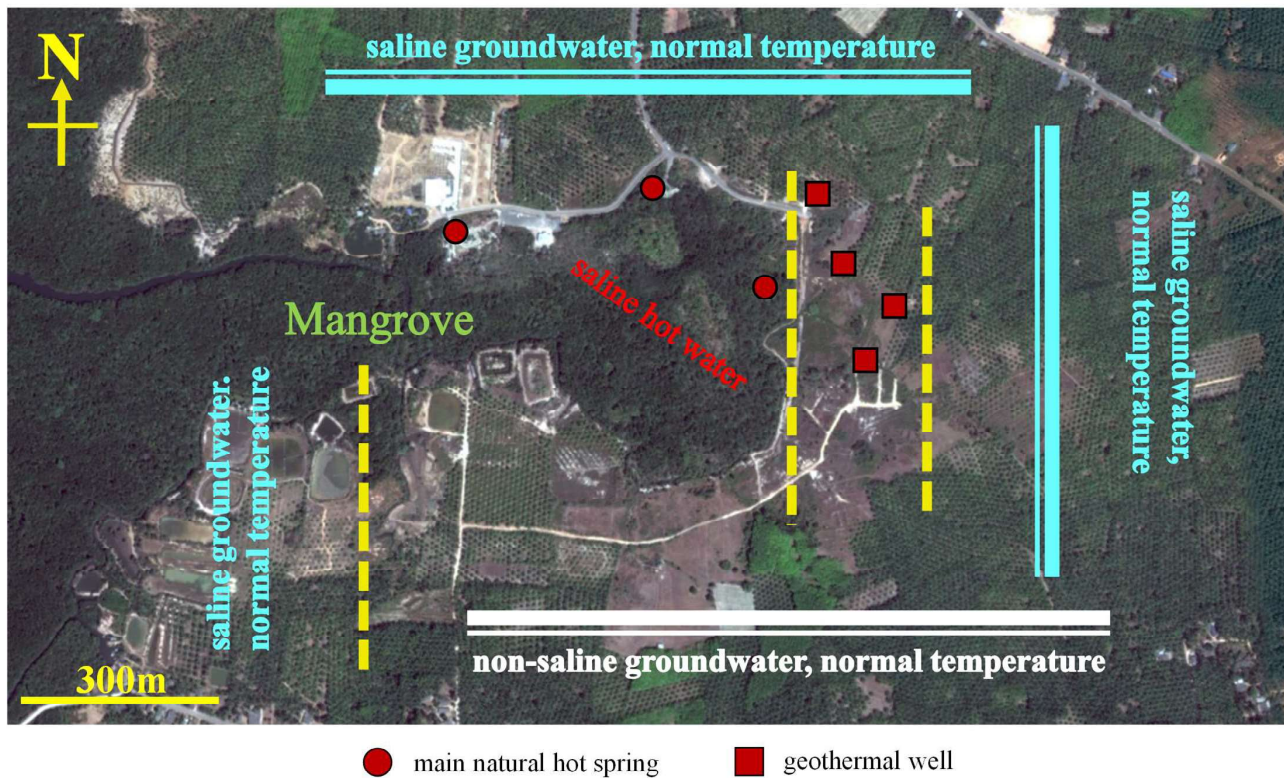
- 1) clay/sand with saline water
- 2) medium-grained sandstone

## Hydrogeological model of KB4



Hot water from deeper reservoir and salty water from estuary via intrusion into shallow groundwater layers are mixing and exiting at natural saline hot springs





## Conclusion & Remark

- KB4 is of unique occurrence and in real sense a saline hot spring, mixing of hot waters and saline groundwater is considered in shallow subsurface
- With better utilization and management KB4 can be used for human health purposes as well as for renewable energy production
- Continuous monitoring of the overall system will ensure a sustainable use of KB4, as well as of the surrounding common groundwater sources





**Thank you**

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**for your attention !**

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