JDS International Seminar 2013

Research Topic

Groundwater flows system at Cu Lao Dung Island, Soc Trang Province, Vietnam

Student: ***Tran Dang An, M2***
Supervisor: ***Prof. Tsujimura***

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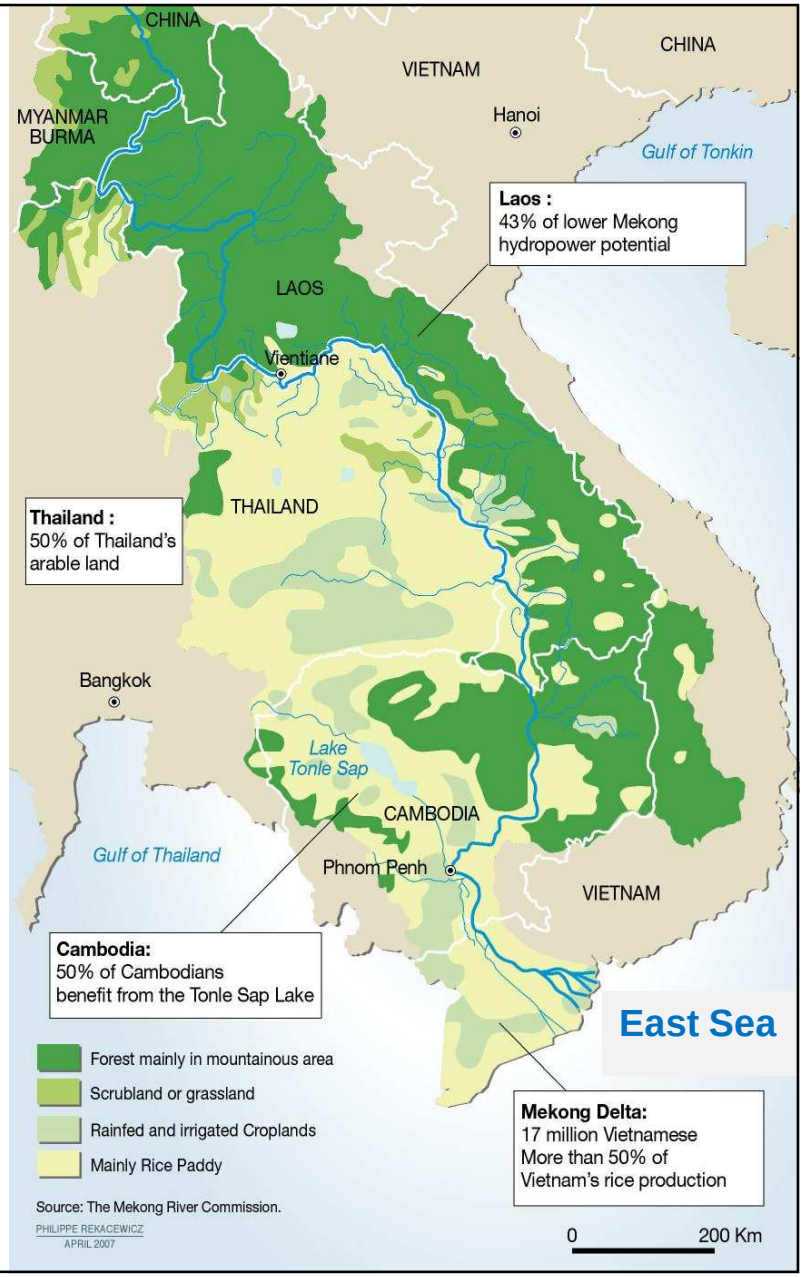


Introduction: Mekong Delta (MD)

Mekong river Basin: The biggest river and the richest biodiversities in the world (WWF, 2012).

Mekong Delta:

- Very important role for **food security,** accounting for over 50% national food production of Vietnam (Anh et al., 2010)
- Many issues due to hydropower plants (Tyson R. Roberts, 2000; R. Edward Grumbine et. at, 2011; Jennifer Sills, 2012; Claudia Kuenzer et. Al, 2012).

1.Social issues:

Serious impacts on livelihoods **(18 mil.)**

2.Environmental issues:

Lost biodiversities; water contaminations, seawater intrusion **=> Water scarcity**

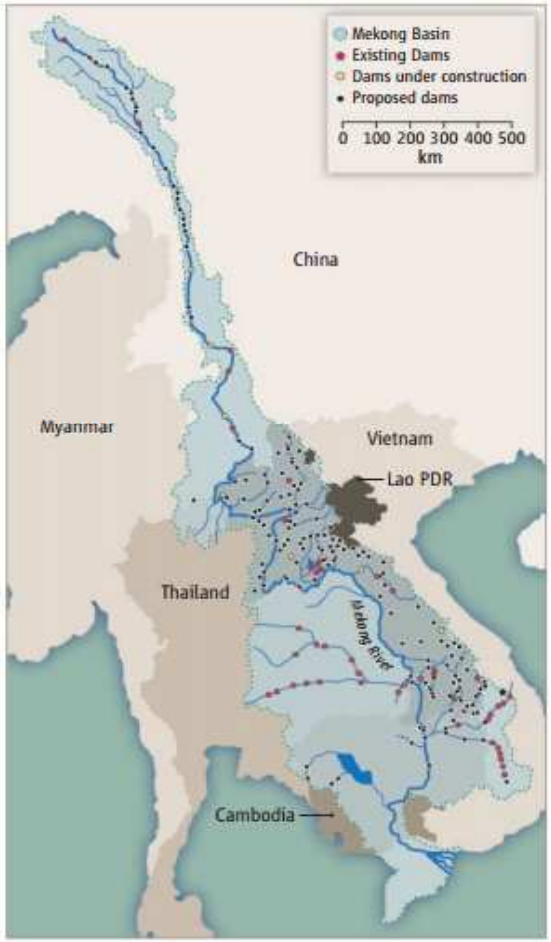


Fig.1.1 Mekong Basin Hydropower plant s (R. Edward Grumbine et. al, 2011)

Introduction: Current problems in MD

1. **Surface water and soil pollution:**

- **POPs:** DDT, PCBs affected seriously on Mekong river and its aquatic environments (Carvalho et al., 2008; Ikemoto et al., 2008; Minh et al., 2007; Sudaryanto et al., 2011; Toan et al., 2013)
- **Heavy mental and chemical fertilized:** Pb, Mo, Rb and As influenced seriously on aquatic environment, particularly fish production (Yamaguchi et al., 2007).

Chemical fertilizers also discharged into agricultural soil, river water and sediments (Toan et al., 2013).

Introduction: Previous researchs

2. Groundwater contamination:

- Urban areas: Holocene aquifer is heavily polluted with microbial and inorganic pollutants and considered unfit for drinking water purposes (Tuan, 2004; Danh, 2008).
- **Arsenic pollution** causing severe health problems (S. Fendorf et al.,2010; Erban et.al, 2013).

3. Seawater intrusion:

- Serious issues in Mekong delta (Ho et al., 1991; Buschmann et al., 2007).

Objectives

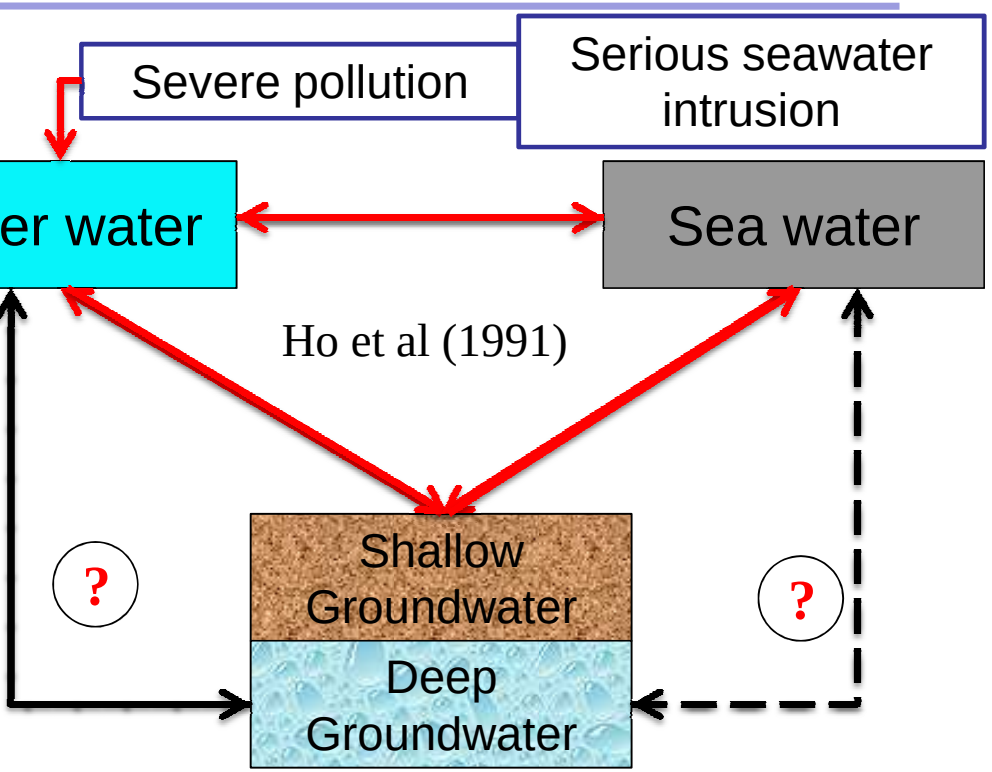
- **The questions :**

Chemical pollution

Arsenic contamination

Over groundwater exploitation
（Inappropriate management ）

Seawater intrusion



- **To answer :**

It is necessary to know Groundwater flow system in coastal aquifers (Hydro-geochemical processes)

Study site: Cu Lao Dung Island

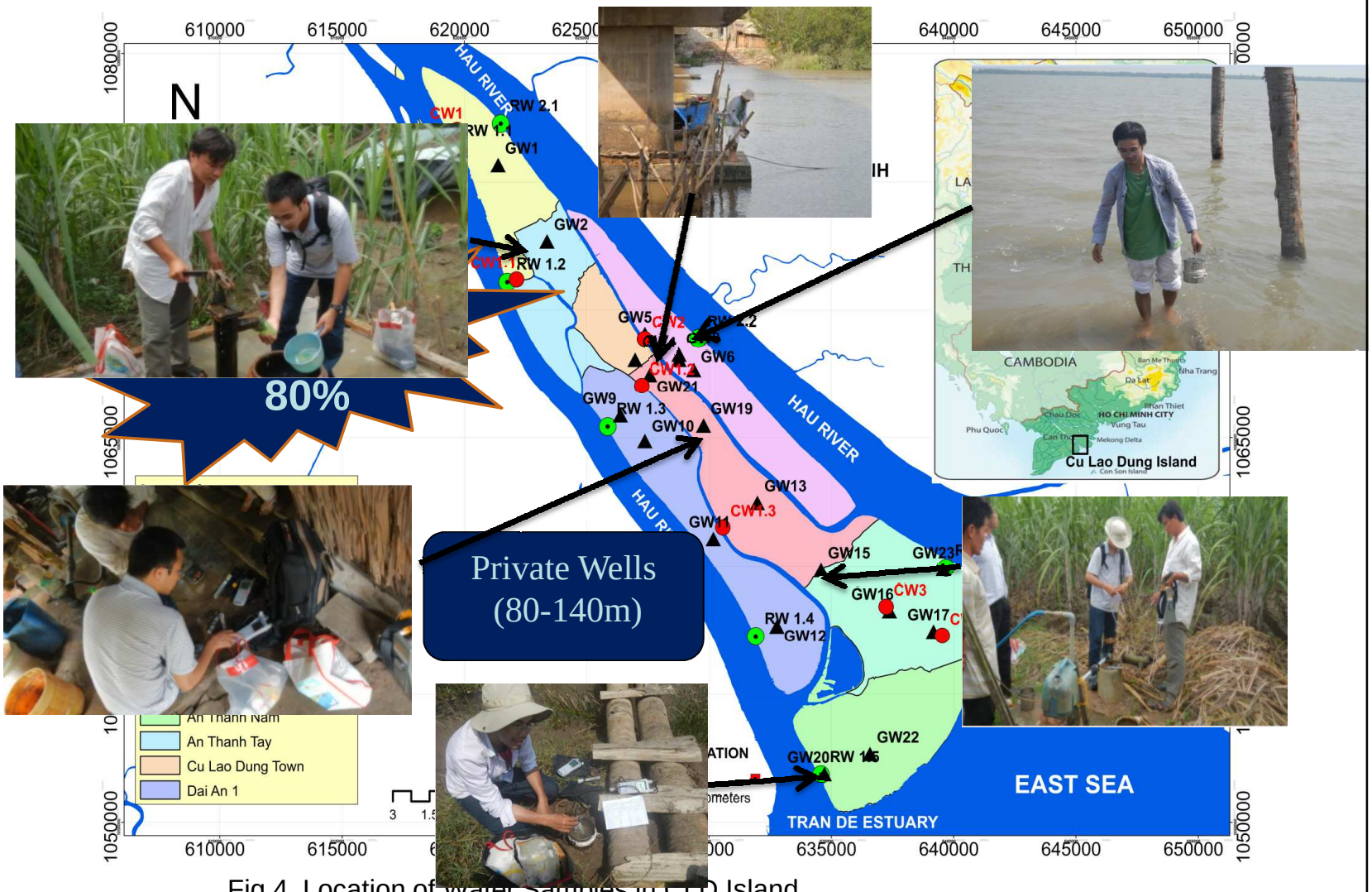


Fig.4. Location of Water Samples in CLD Island

Study site: Soc Trang province

Groundwater: 54 samples
River and canal water : 19 samples

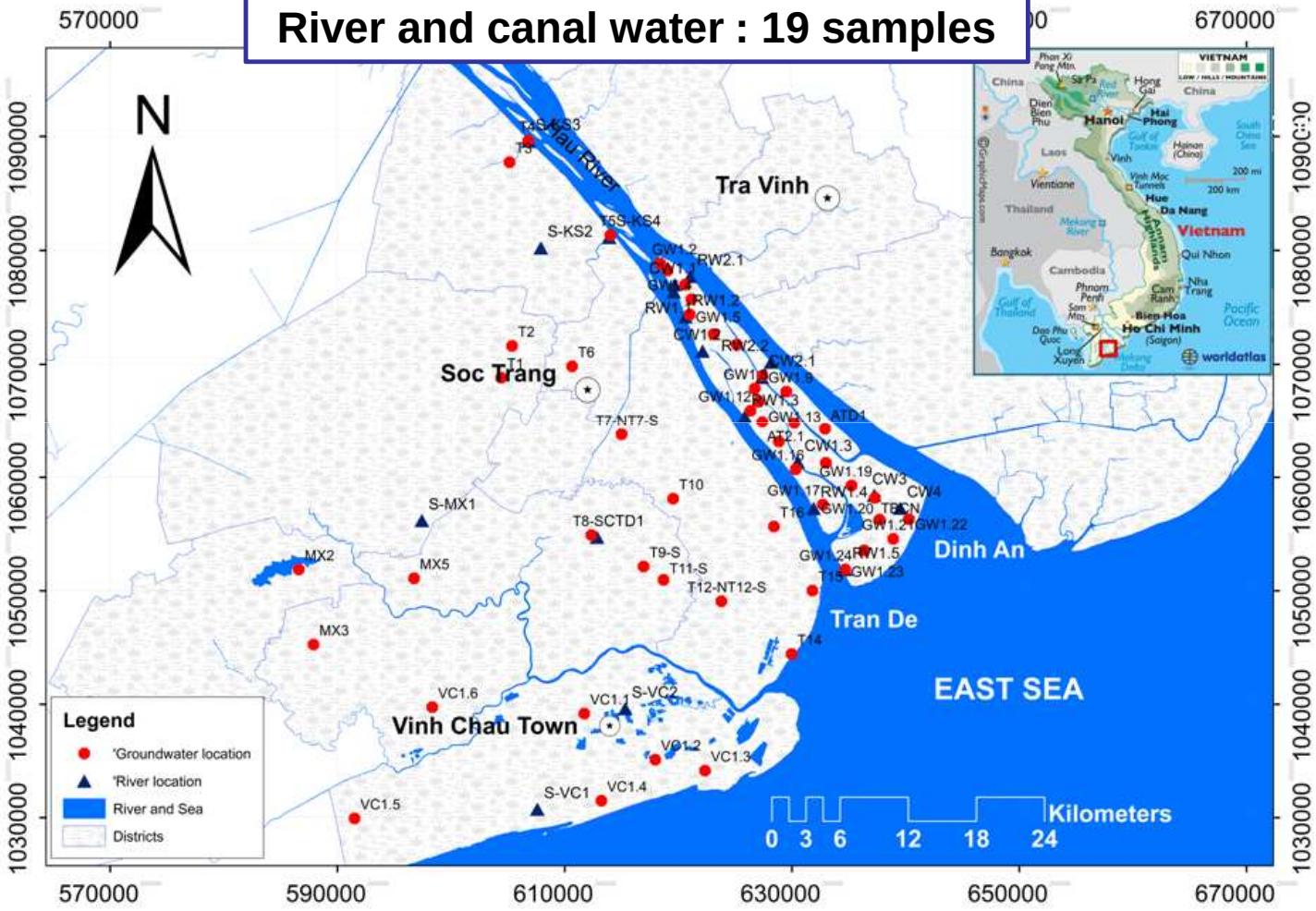
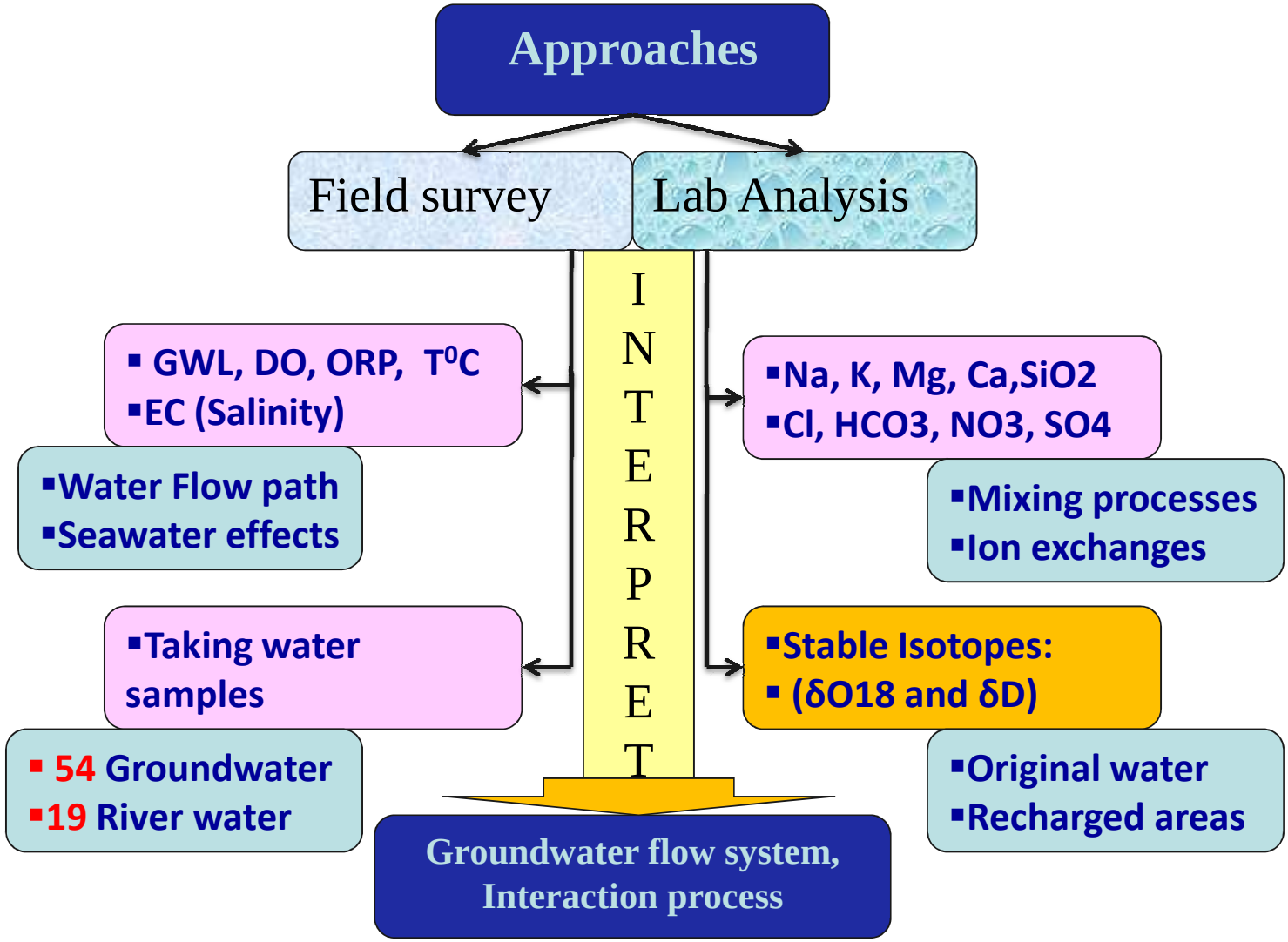


Fig.5.4. Samples locations of water samples at Soc Trang Province, Vietnam

Methodology



Results and Discussion

Water types and relationship among water sources

Legend

I - Calcium Magnesium Sulphate Chloride;
II –Sodium Chloride Sulphate
III–Sodium Bicarbonate;
IV –Calcium Magnesium Bicarbonate
A–Mixed Zone; **B** –Magnesium;
C –Sodium Potassium; **D** –Calcium
E–Mixed Zone; **F** –Sulphate;
G –Chloride; **H** -Bicarbonate

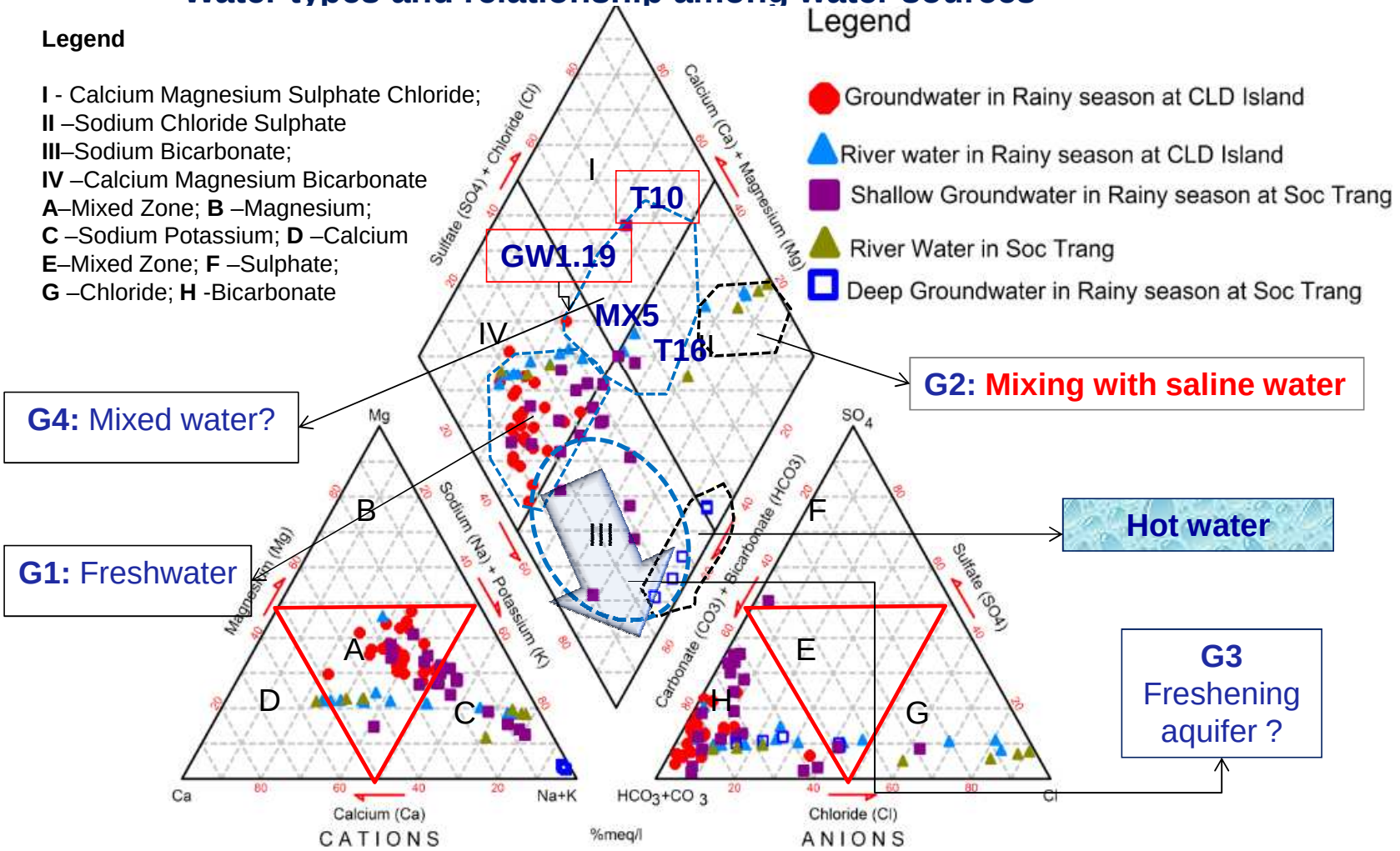
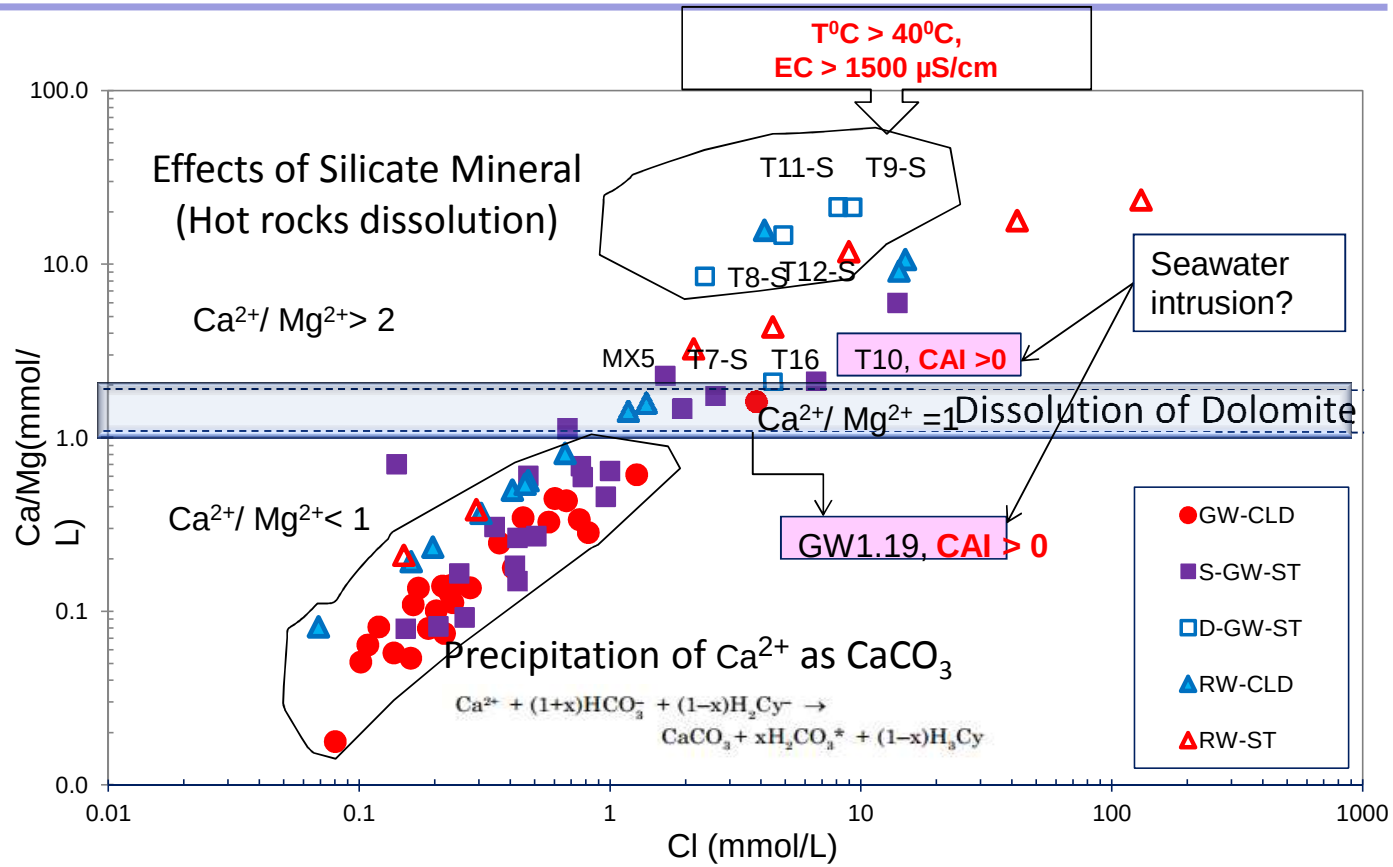


Fig.5.1. Piper diagram of water samples at Soc Trang Province, August . 2013.

Result and Discussion



Most of samples: **CAI <0**, **Mg, Ca of water** exchanged with **Na, K of Rock**

S-VC1, S-VC2, CTD1, **T10,GW1.19**: **CAI >0**, **Na, K of water** exchanged with **Mg, Ca of Rocks**

Seawater intrusion ?

Fig.5.2. Ratio of Ca/Mg versus Cl (mmol/L)

Results and Discussion

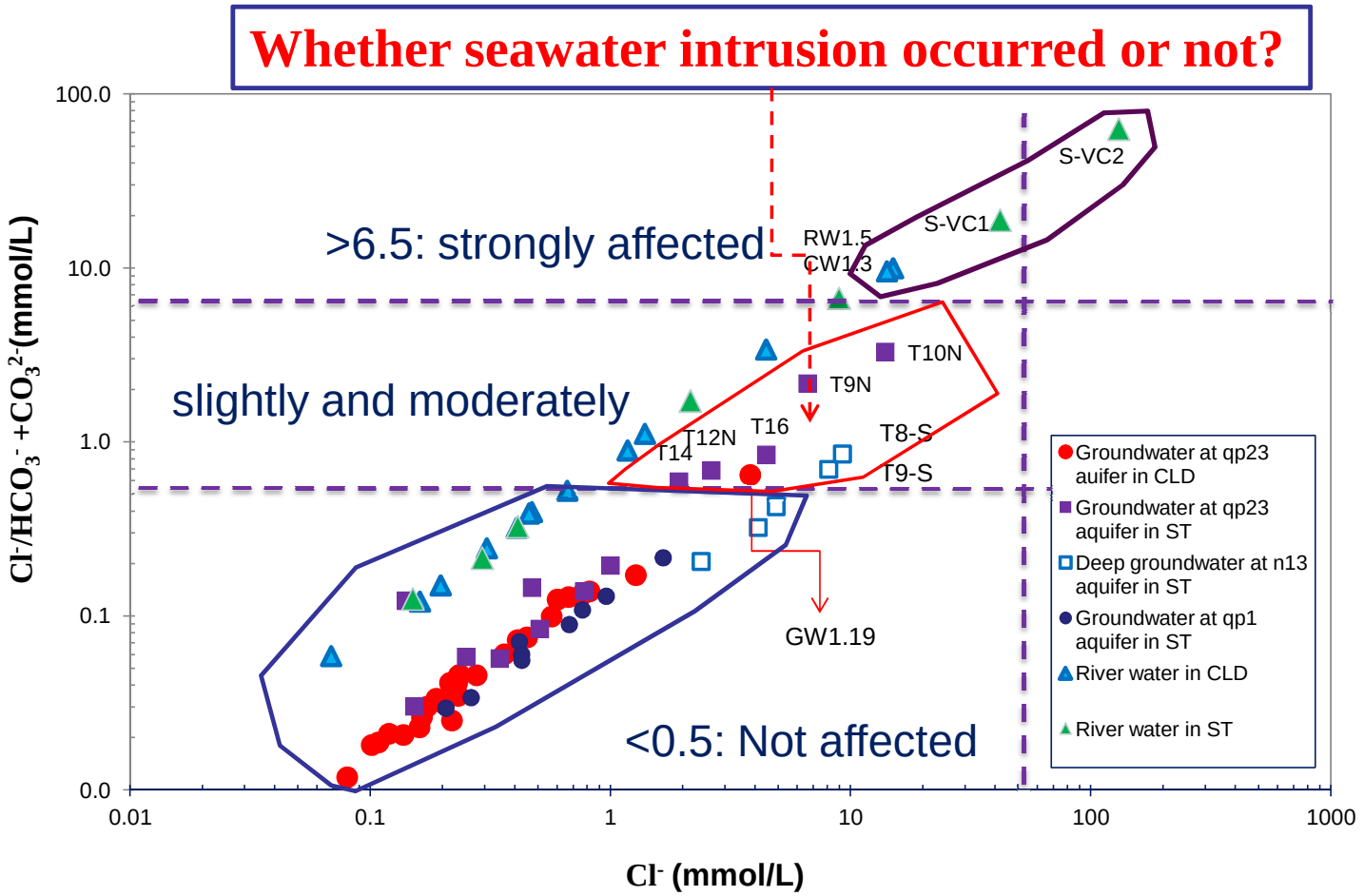


Fig.5.3. The $Cl^-/HCO_3^- + CO_3^{2-}$ versus Cl^-

Results and Discussion

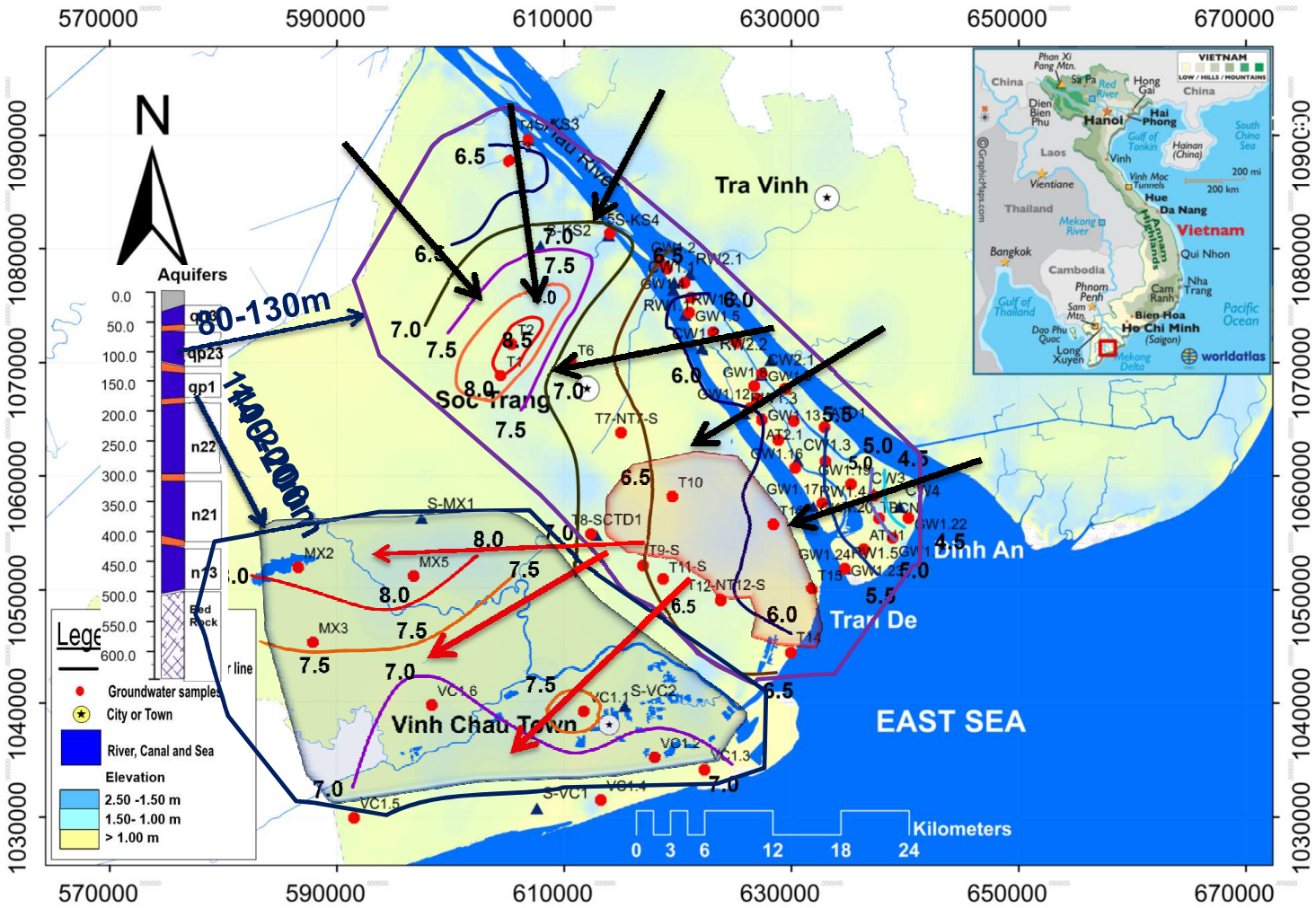


Fig.5.4. Groundwater flow paths at Soc Trang Province, August, 2013.

Result and Discussion

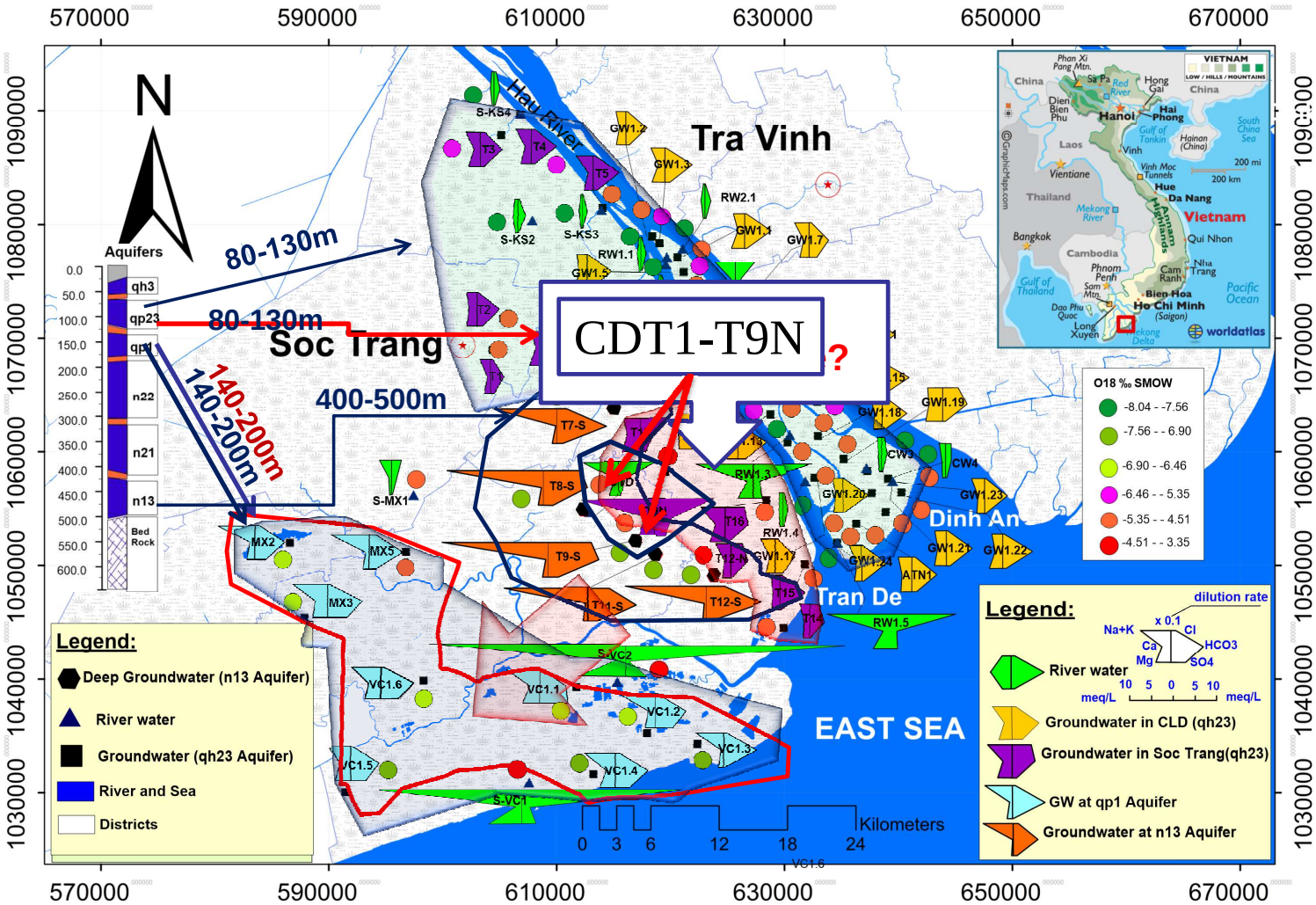


Fig.5.5. Spatial distribution of Hexa diagram and δO^{18} of water samples at Soc Trang Province, August, 2013.

Results and Discussion

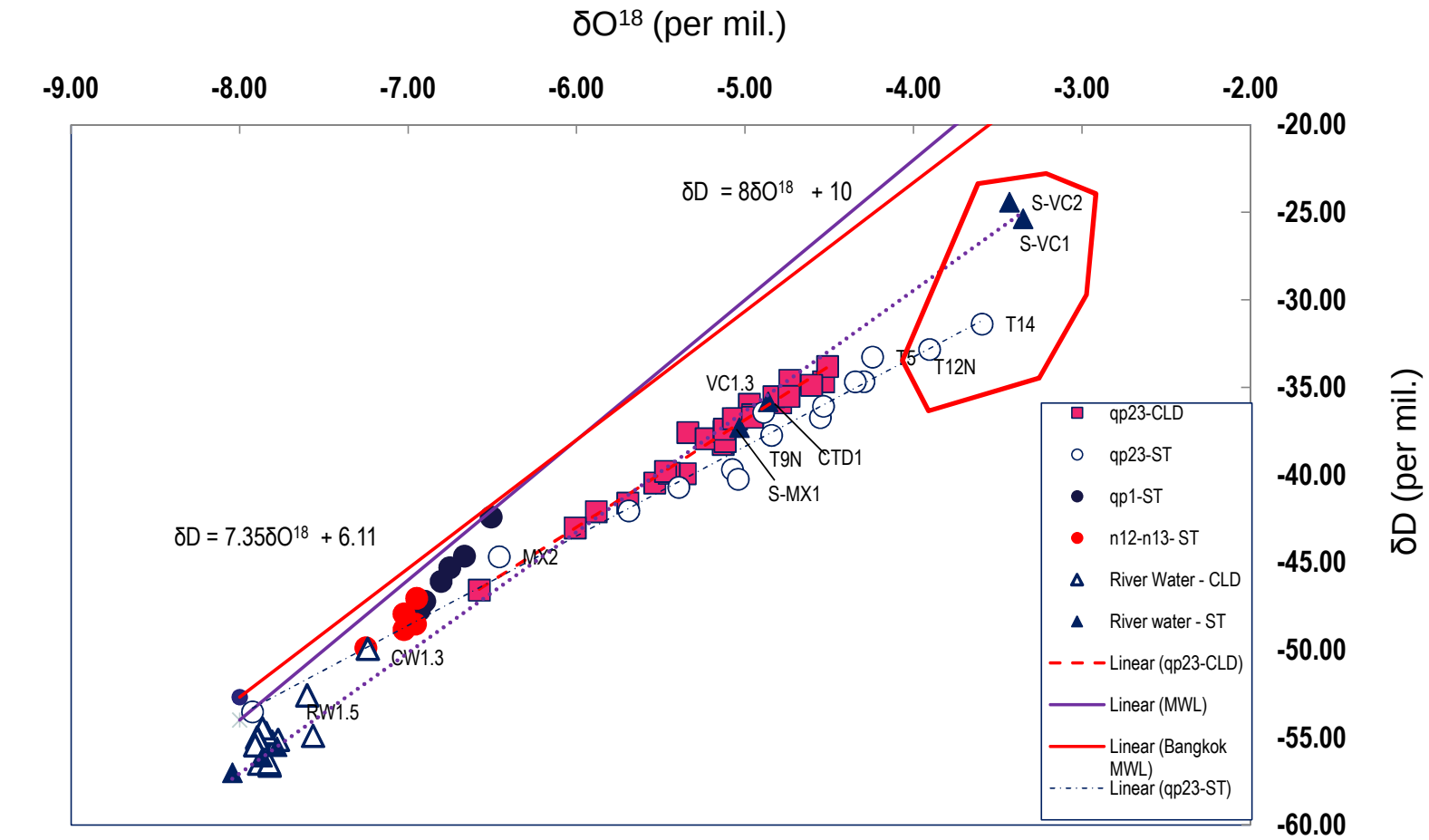


Fig.5.6 .Groundwater flow paths at Soc Trang Province, August, 2013.

Results and Discussion

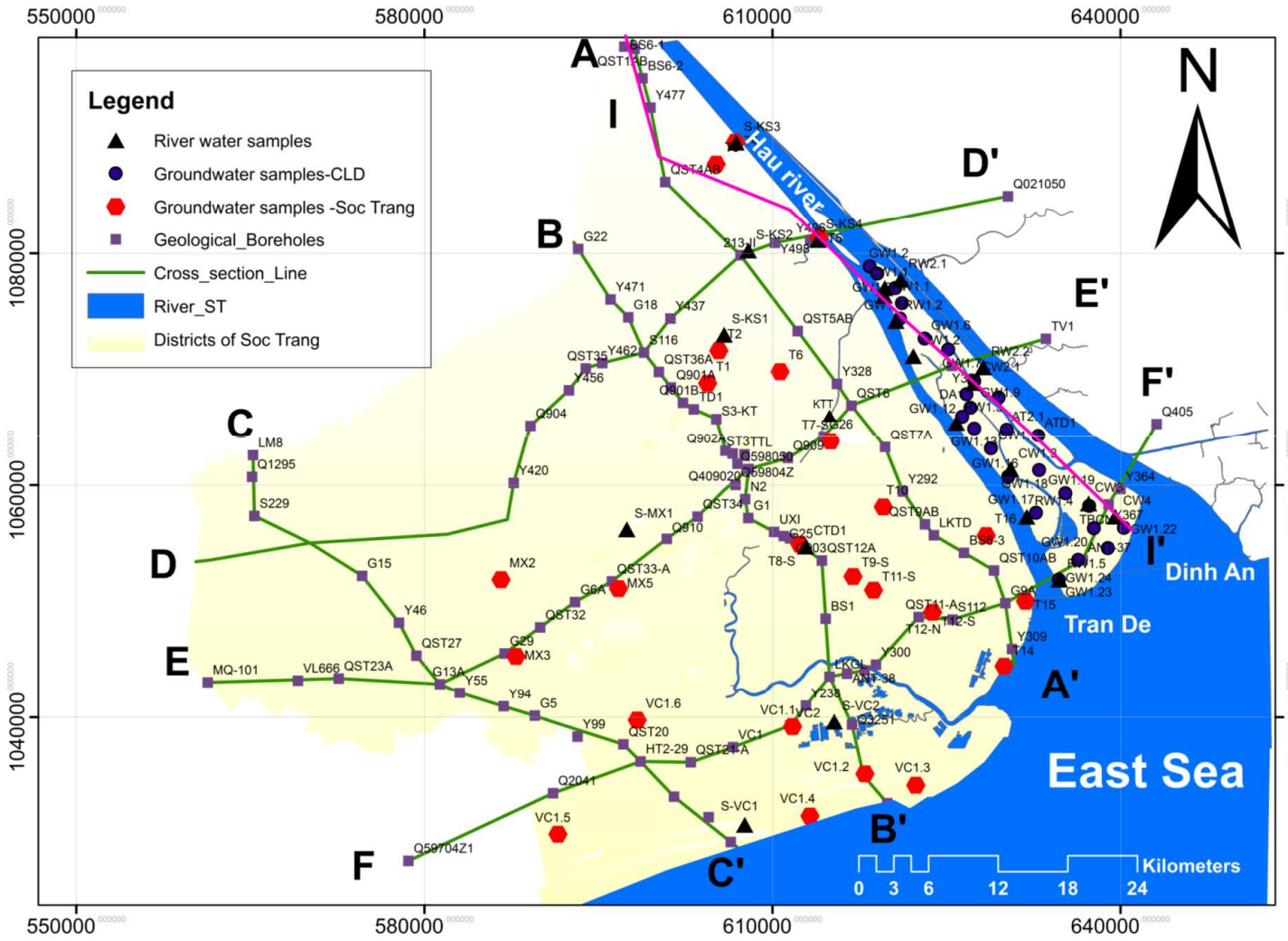


Fig.5.7. Hydro-geological cross section, Soc Trang Province, Vietnam.

Results and Discussion

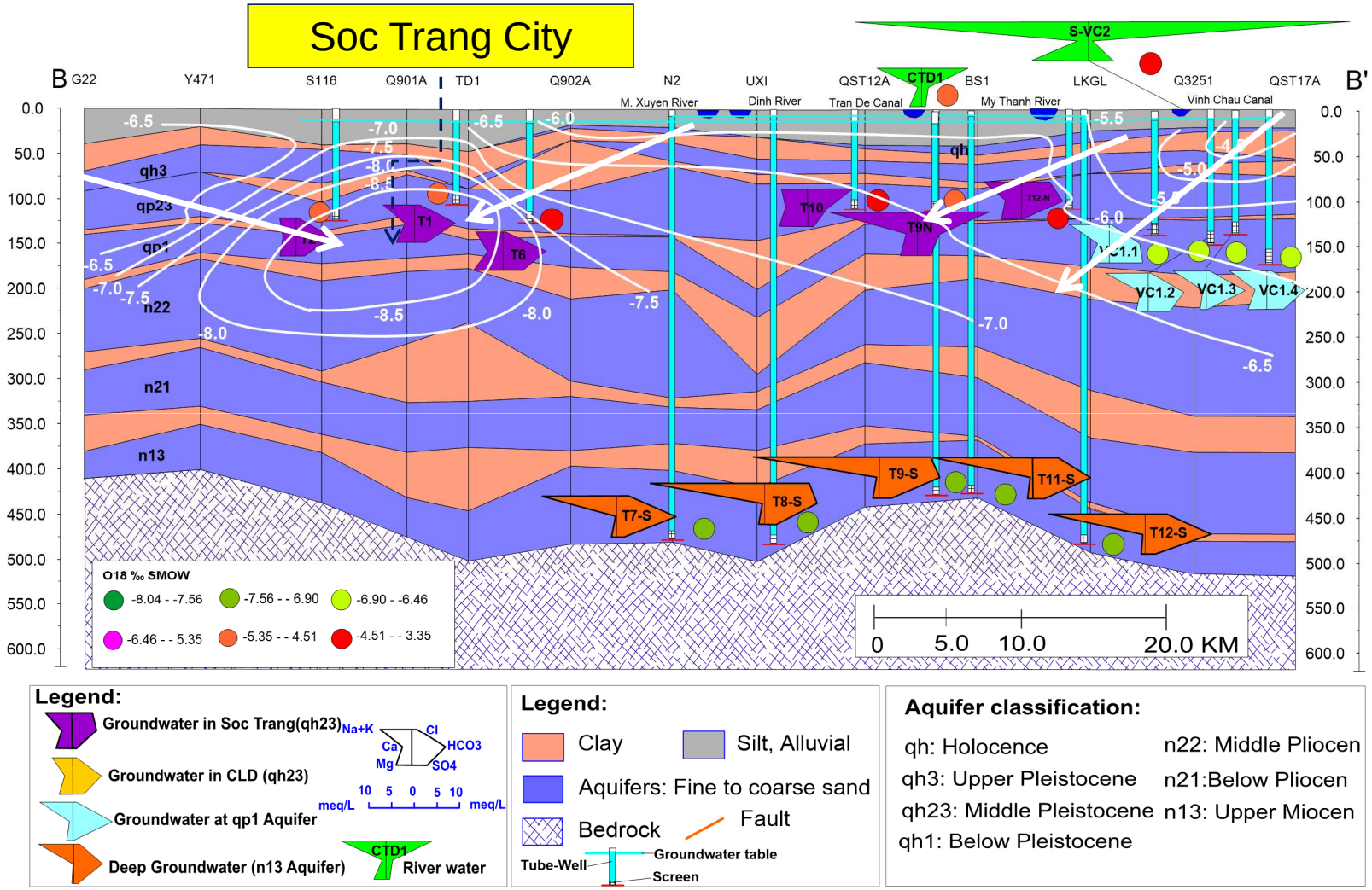


Fig.5.8. Profile Hexa diagram and of water samples following depth of wells in Soc Trang, August, 2013

Cross section B-B

Results and Discussion

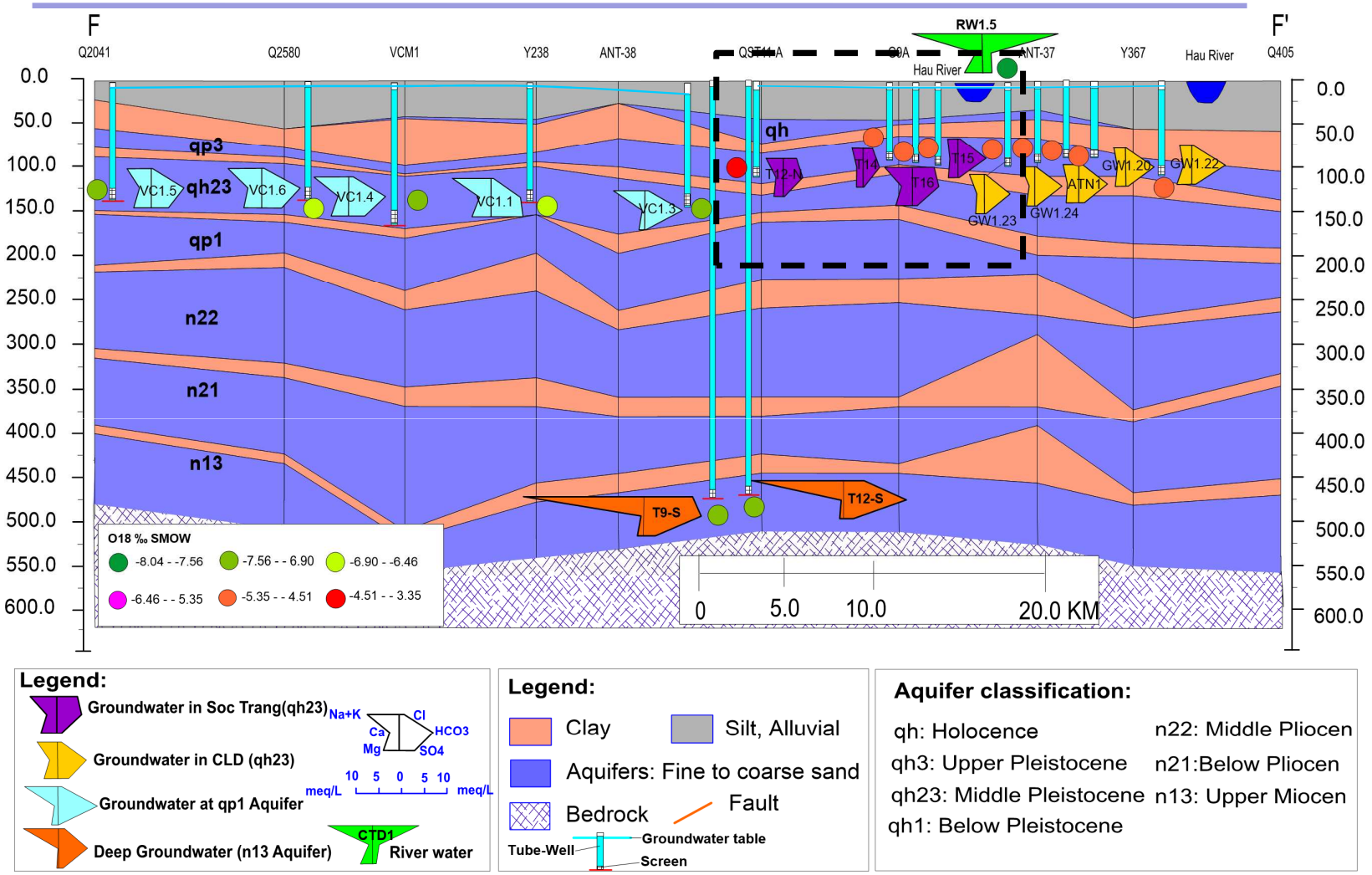


Fig.5.9. Profile Hexa diagram and of water samples following depth of wells in Soc Trang, August, 2013

Cross section F-F

Results and Discussion

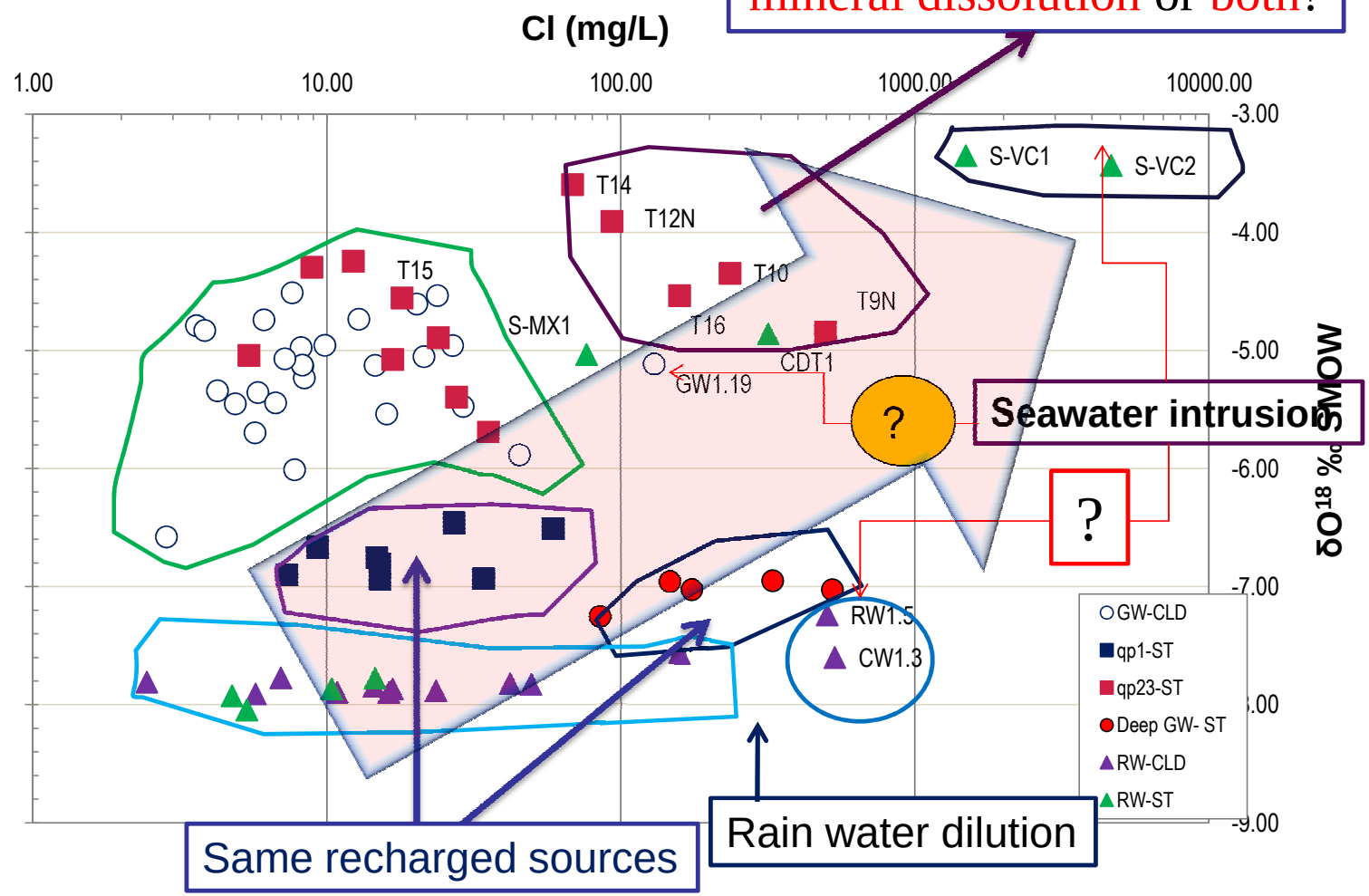


Fig.5.10. Chloride concentration versus δO^{18}

Results and Discussion

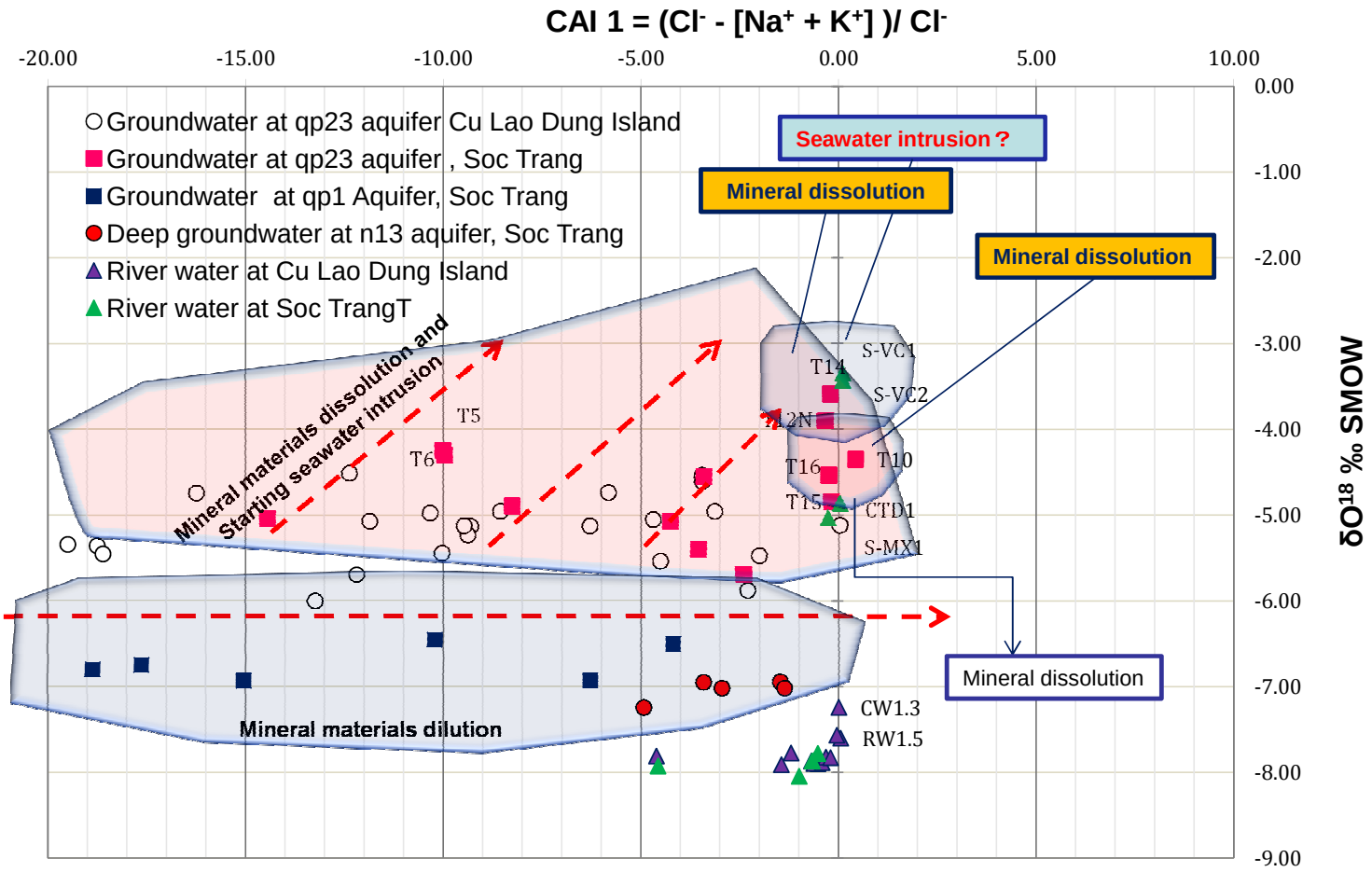


Fig.5.11. CAI 1 index versus δO^{18}

Results and Discussion

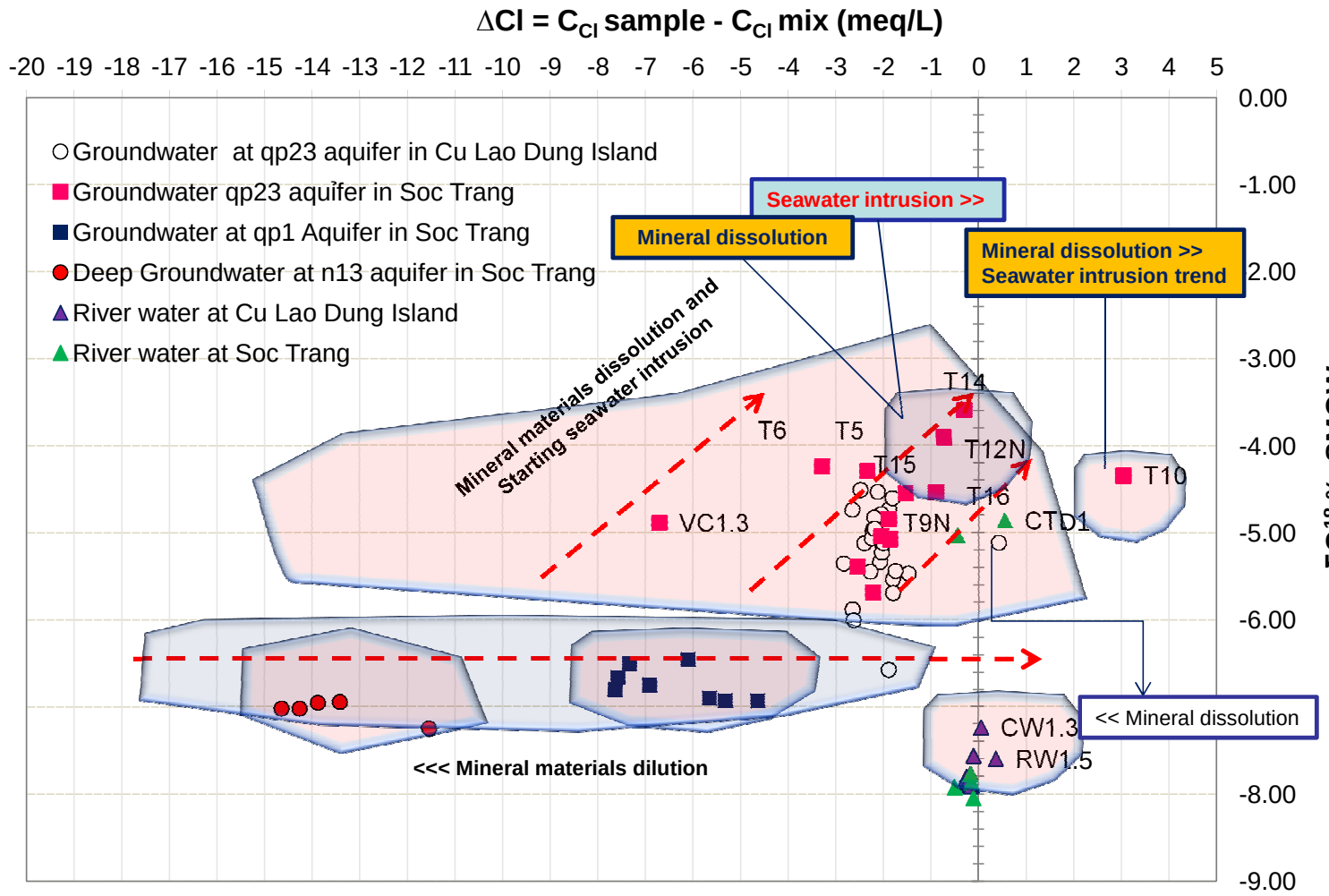


Fig.5.12. Chloride concentration versus δO^{18}

Conclusions

1- Water types:

a. Groundwater, 3 group:

- **qp23 Aquifer:** Ca-Mg(CO3)2,
- **qp1 and n13 Aquifers:** Na-HCO3, most of samples at n13 aquifer is hot water

b. River and canal water:

- Na-Cl, Ca-Mg(CO3)2

2. Interaction between Surface water and Groundwater:

- River water **(CTD1)** and Groundwater **(T9N)** mixing together
- Groundwater: some parts of ST **may be** affected by seawater

Conclusions

3. Recharged sources:

a. Groundwater at qp1 and n13 aquifers

- **Have same original water sources**
- **Mineral dissolution process is dominantly occurred at deep Groundwater**

b. Groundwater at qp23 aquifer

- **Have same original water sources**
- **Two hydro-geological processes:**

(1) Mineral materials dissolution

(2) Strongly dissolution saline soils and seawater intrusion maybe starting at groundwater sample T14 => Due to intensive pumping.

Future work

- Data processing and interpreting
- Writing master thesis.

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Thank you for your
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