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Geological Carbon Storage Site Screening and Characterization by Using PETREL Integrated Platform

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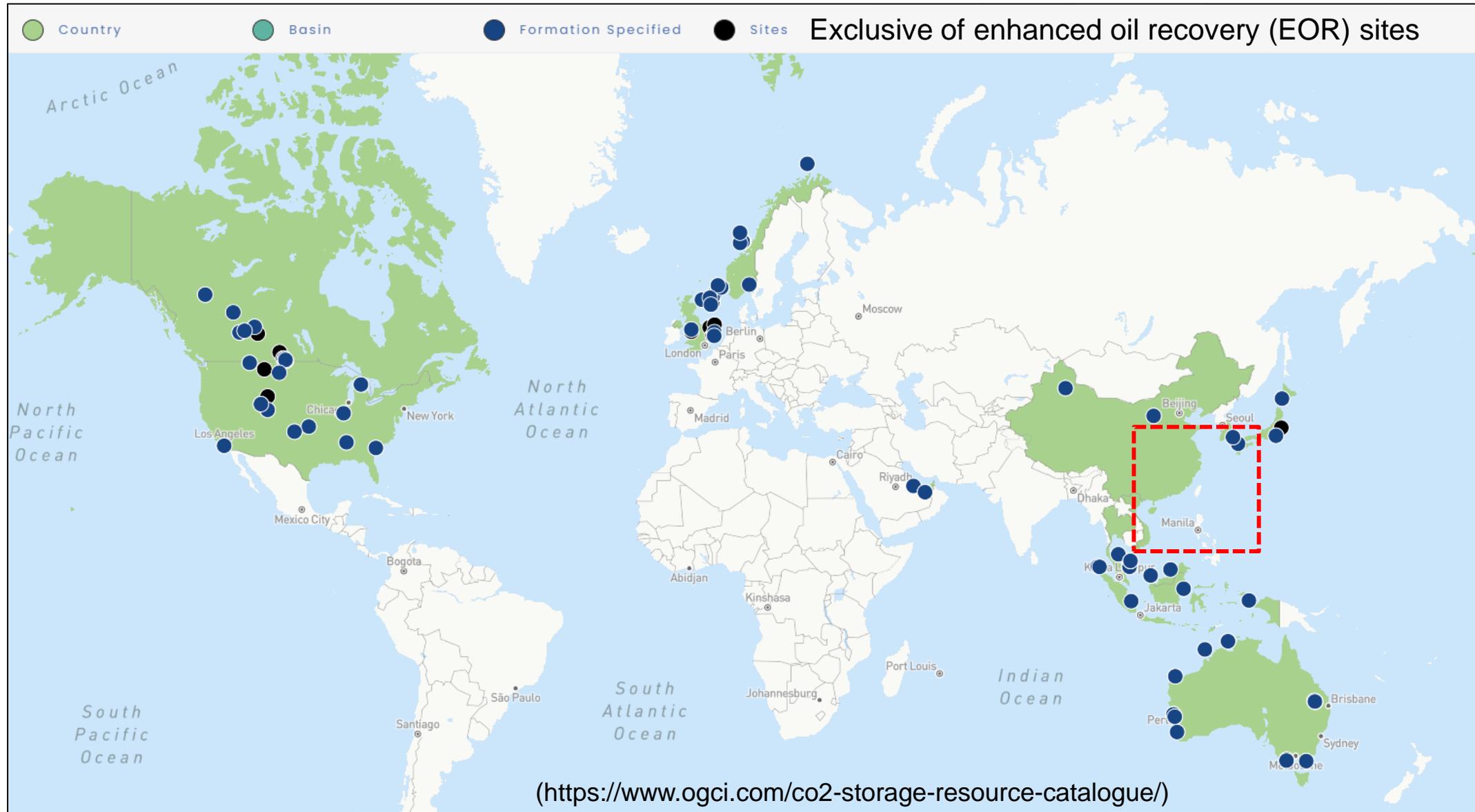


Outline

- Taiwan geological carbon storage concept
- Site screening criteria
- Site characterization
- Conceptual monitoring plan
- Conclusion

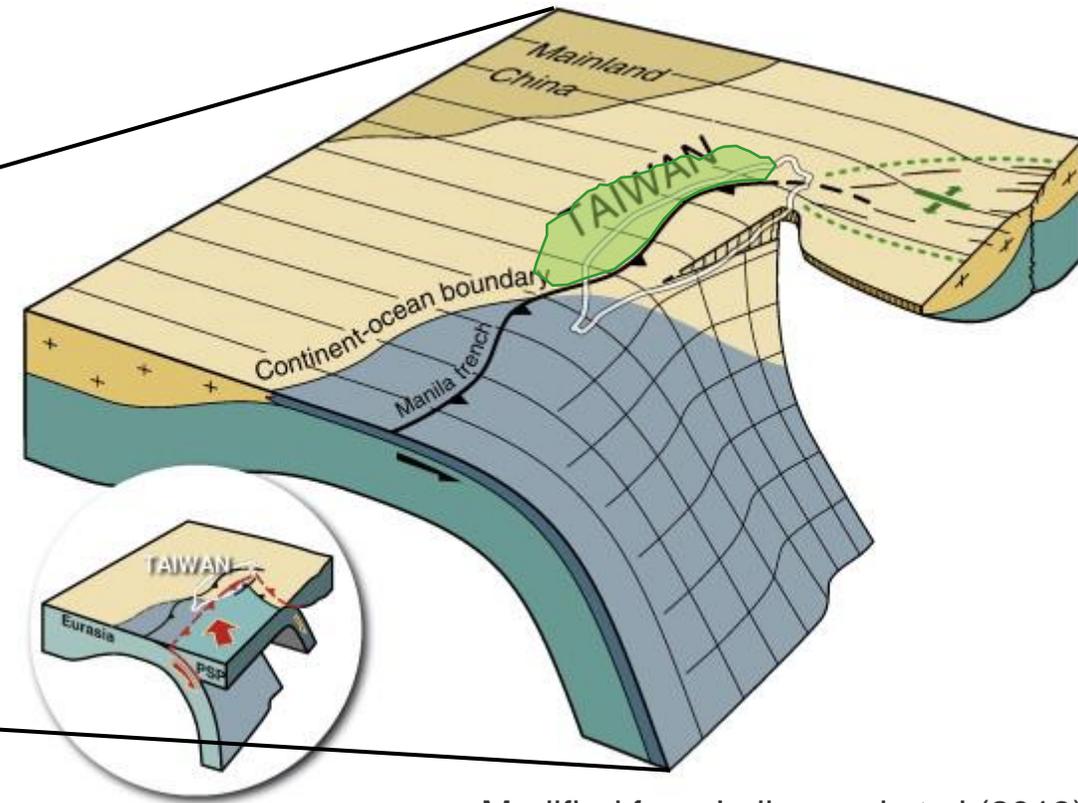
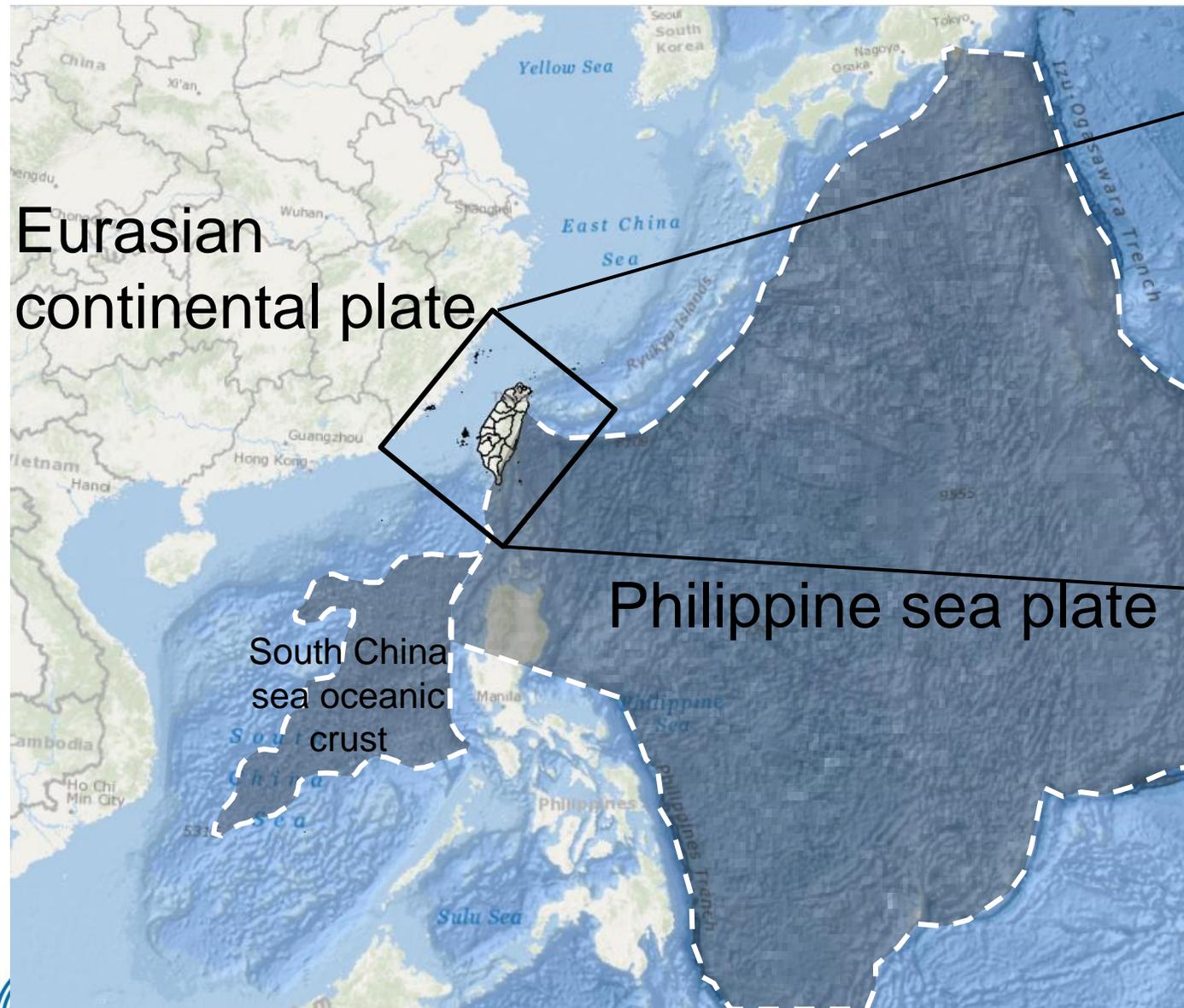


Worldwide geological carbon storage(GCS) sites



Taiwan tectonic and GCS potential

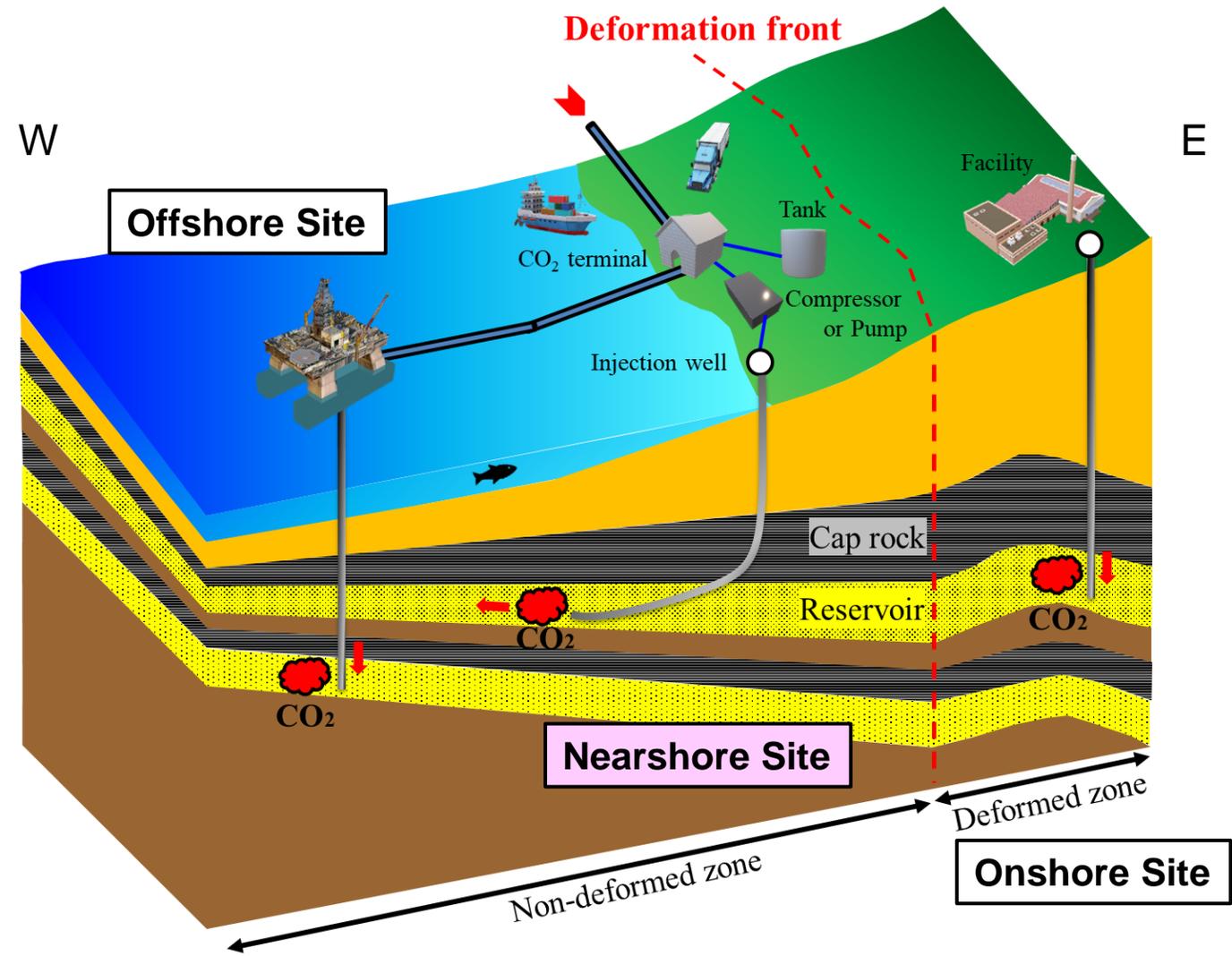
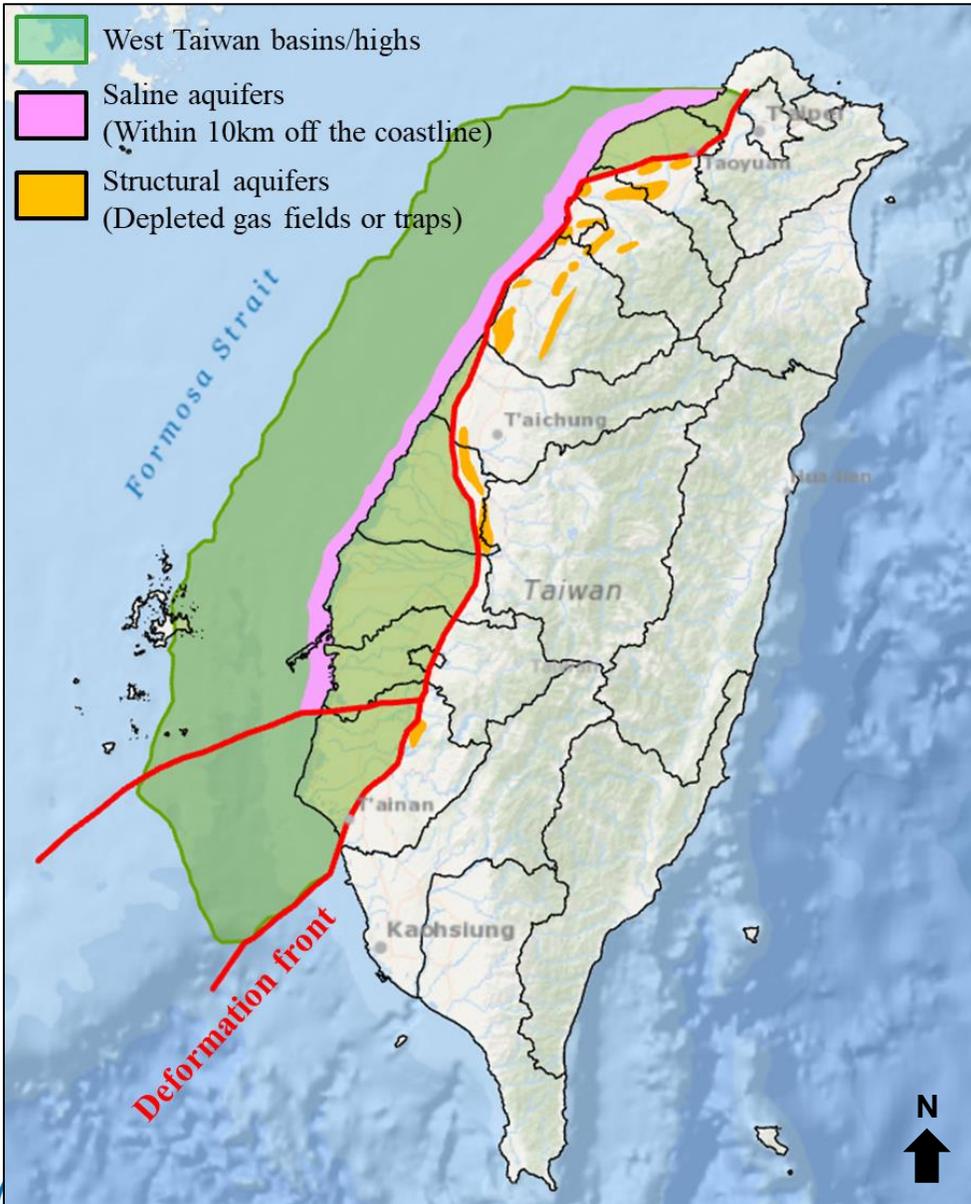
West Taiwan basins/highs



Modified from Lallemand et al.(2013)

- Active volcanic arc, orogeny and basalt oceanic crust constrain to store CO₂ in East Asia.
- West Taiwan basins/highs contain potentially 45.9Gt CO₂ storage capacity in 800~3000m saline aquifer.

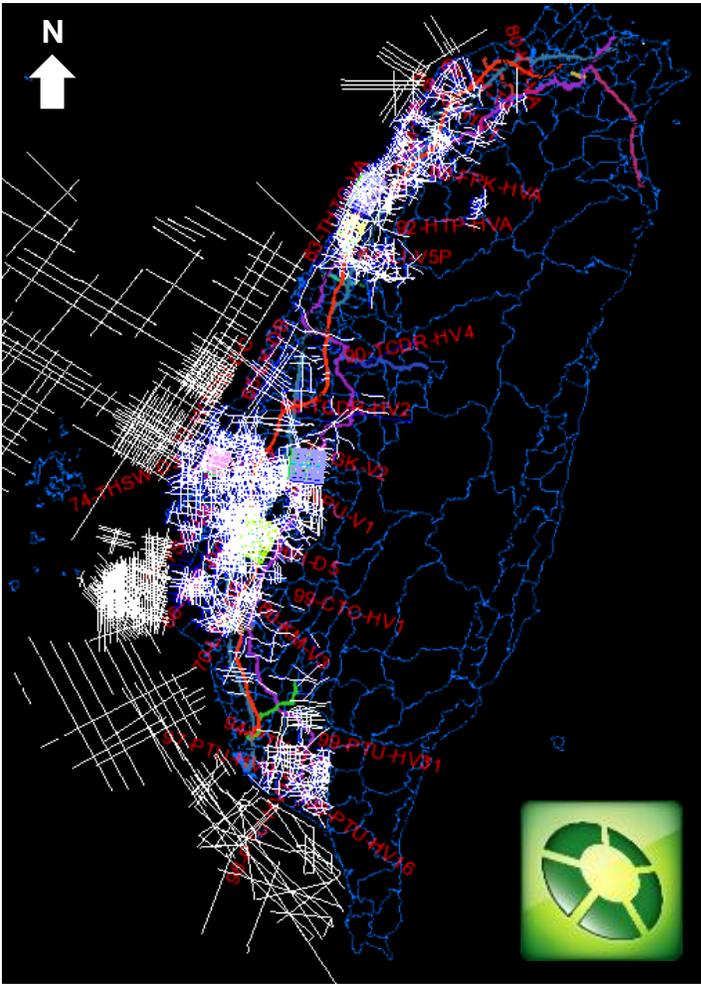
Taiwan GCS concept



- Onshore structural traps → Pilot site
- Nearshore saline aquifers → Demonstration and local-scale site
- Offshore basins → Regional-scale hub



Nearshore site screening

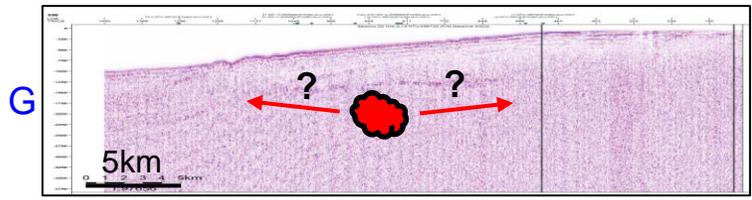
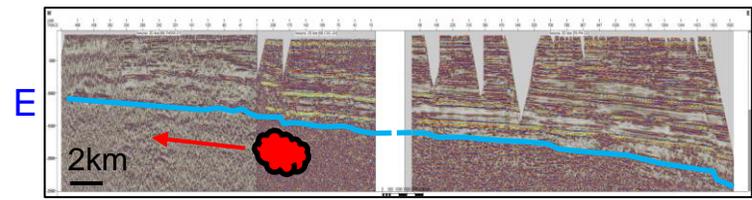
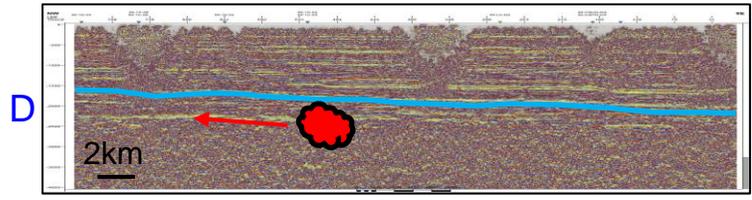
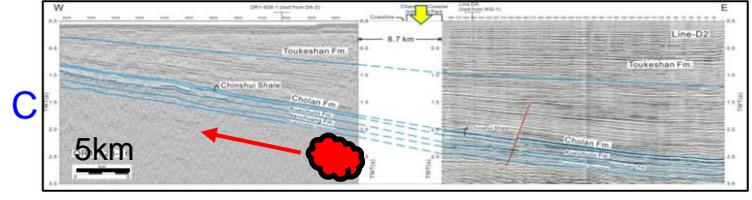
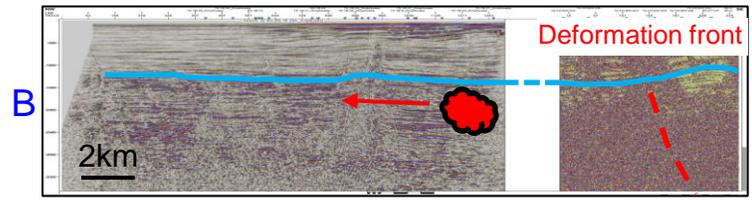
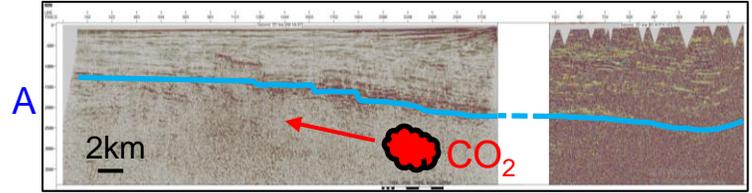
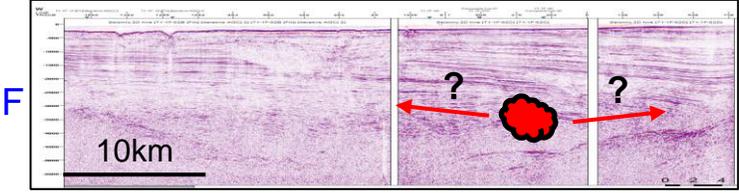
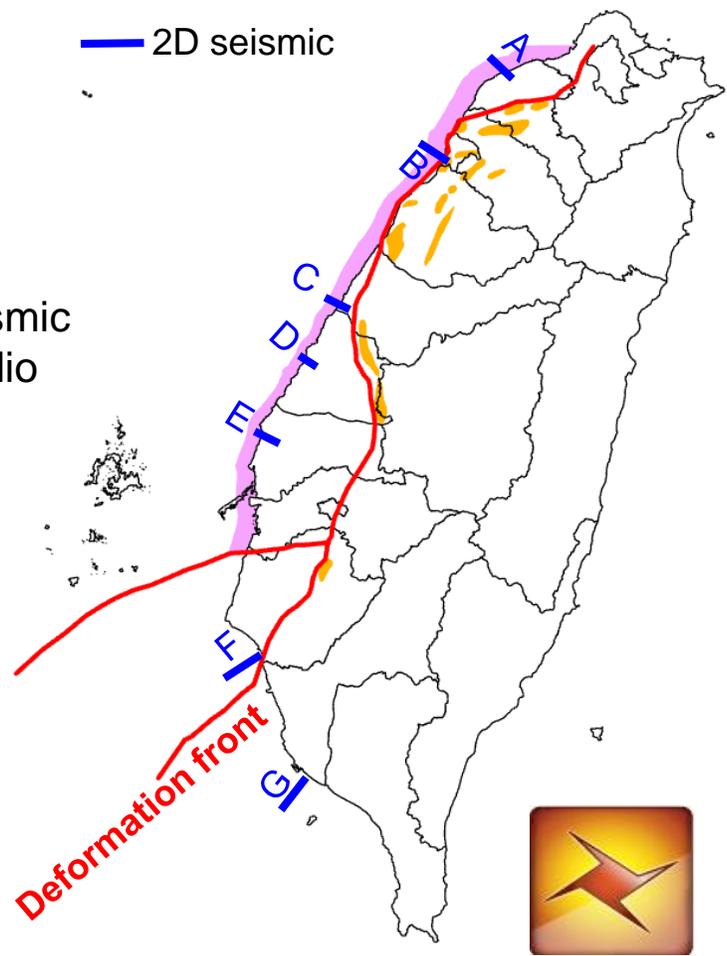


2000 2D seismic lines and a few 3D seismic cubes in CPC Studio database

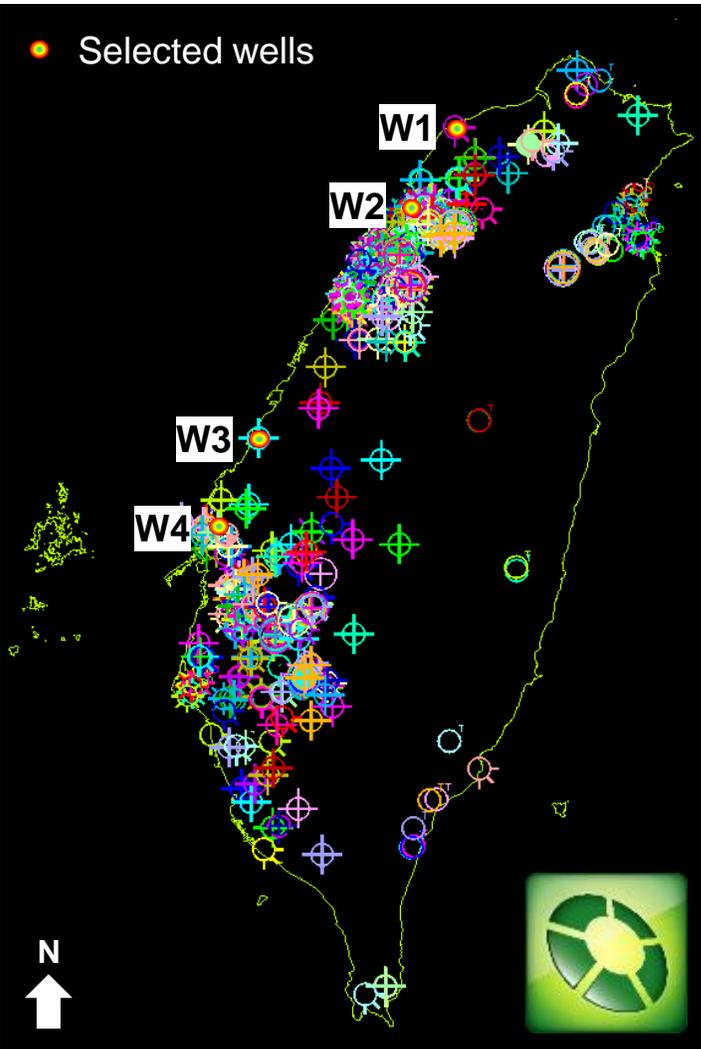
Retrieve nearshore seismic data from Studio



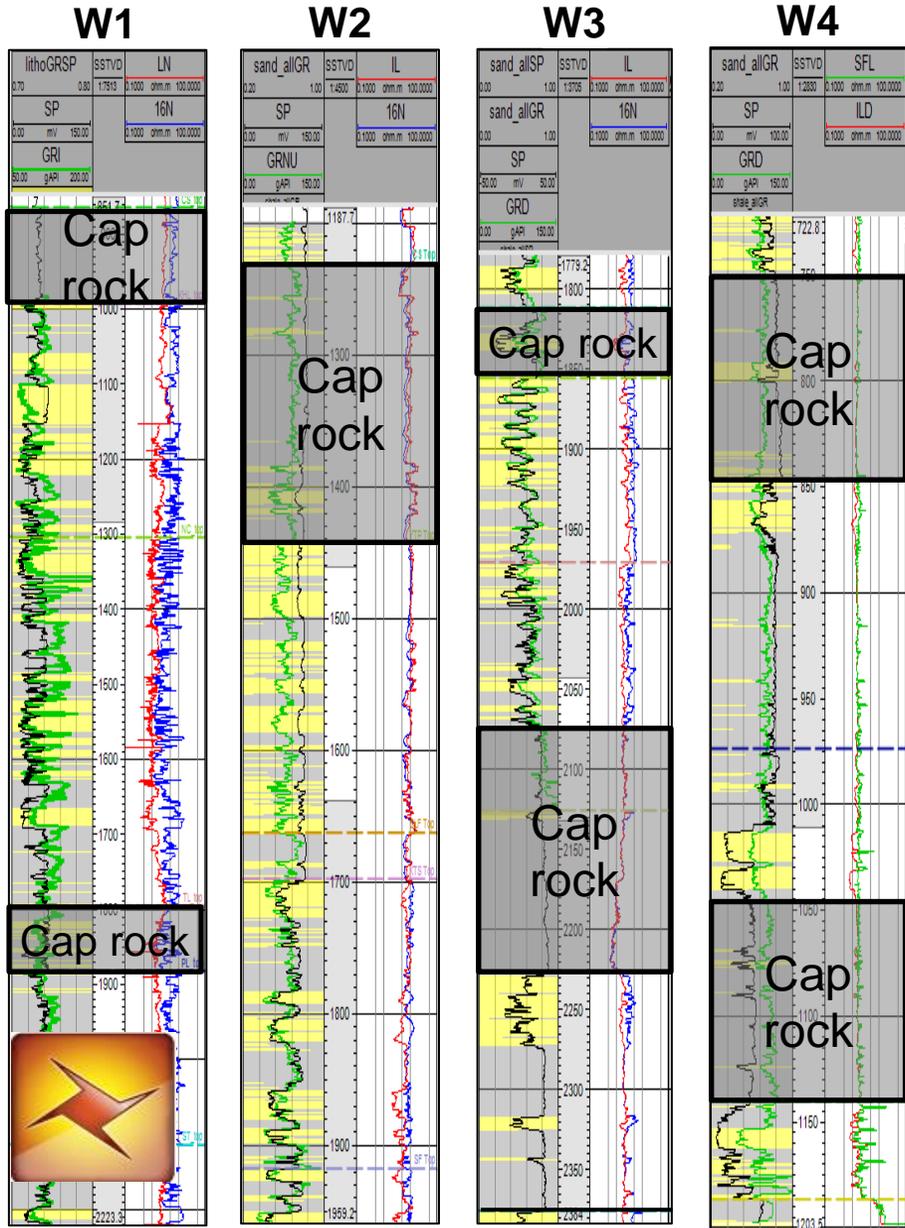
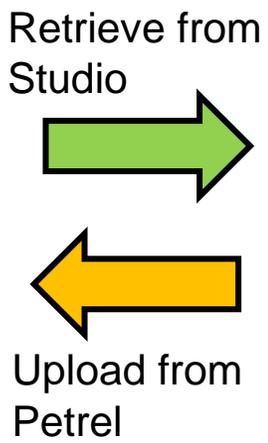
Upload data from Petrel



Nearshore site screening



700 exploration or production wells in CPC Studio database



Reservoir-seal assemblage



Core data

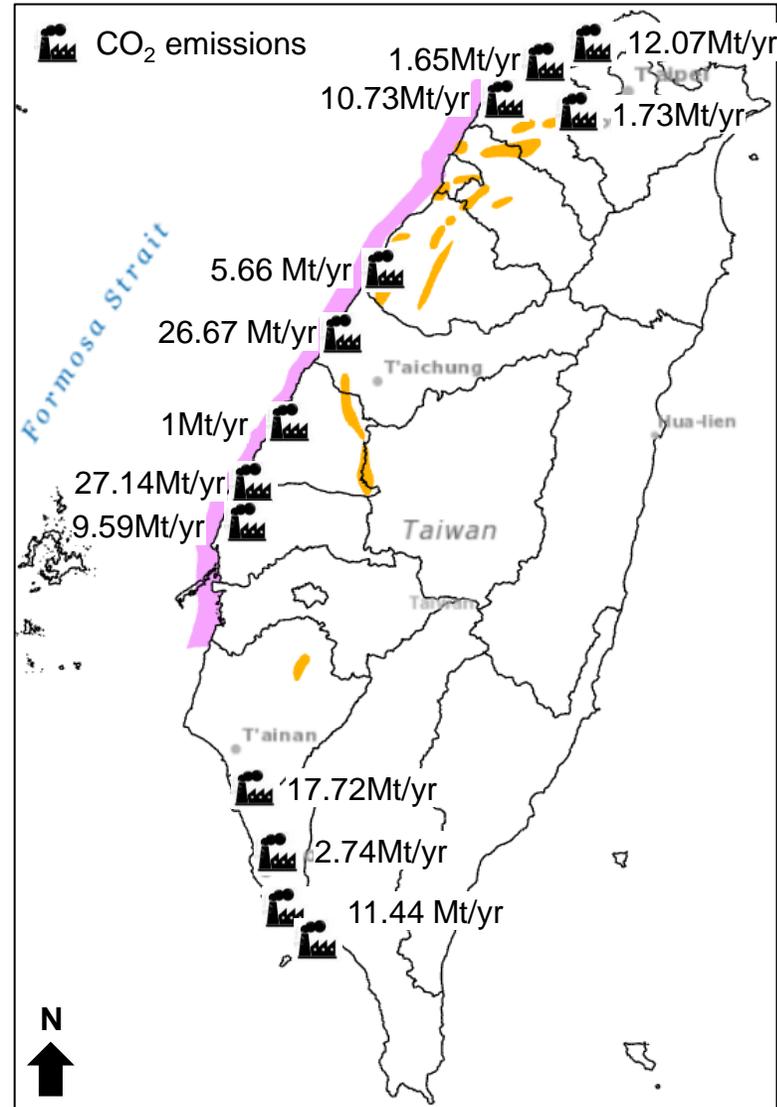
Nearshore site ranking and selection

Score range for each factor : 1~5

Candidate site / Screening factor	Non-deformed zone					Deformed zone	
	A	B	C	D	E	F	G
Geological condition	15	7	7	12	12	7	7
Containment	5	1	4	5	5	3*	3*
Capacity	5	3	2	4	3	2*	2*
Injectivity	5	3	1	3	4	2*	2*
Nearness to CO₂ emitters	5	1	4	2	4	4	5
Land accessibility	1	5	1	1	1	1	1
Total score	21	13	12	15	17	12	13

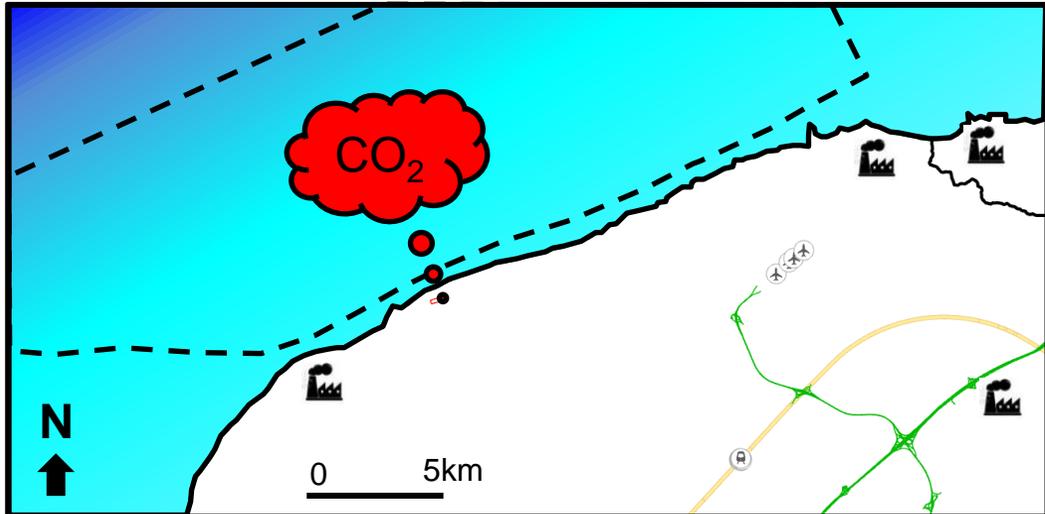
* to be further evaluated

Taiwan EPA(2019)

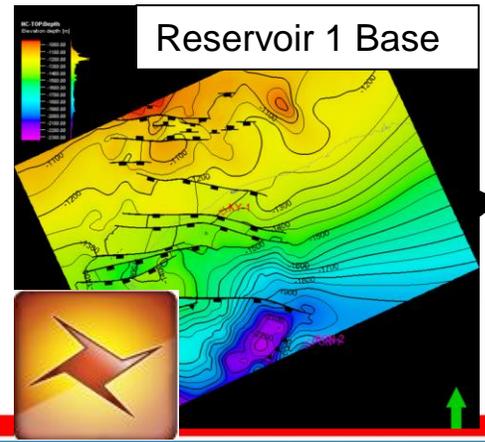
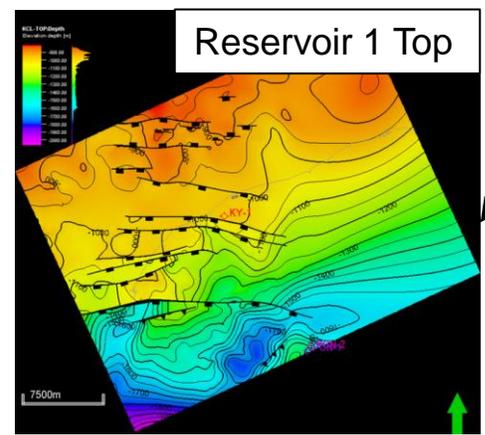
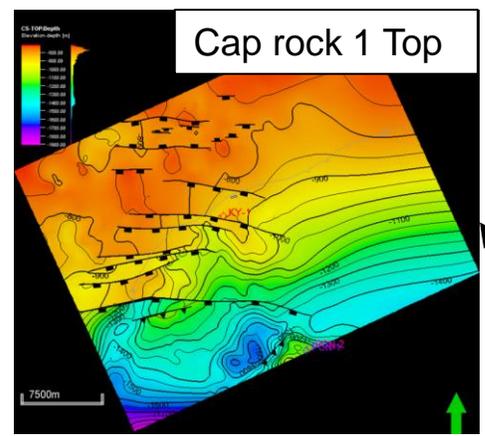


Taiwan main CO₂ emissions

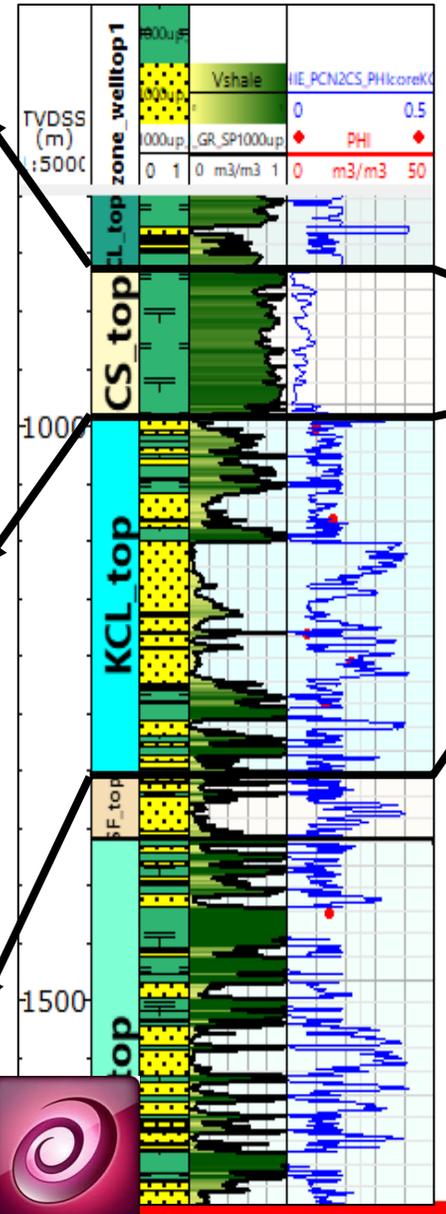
Site characterization



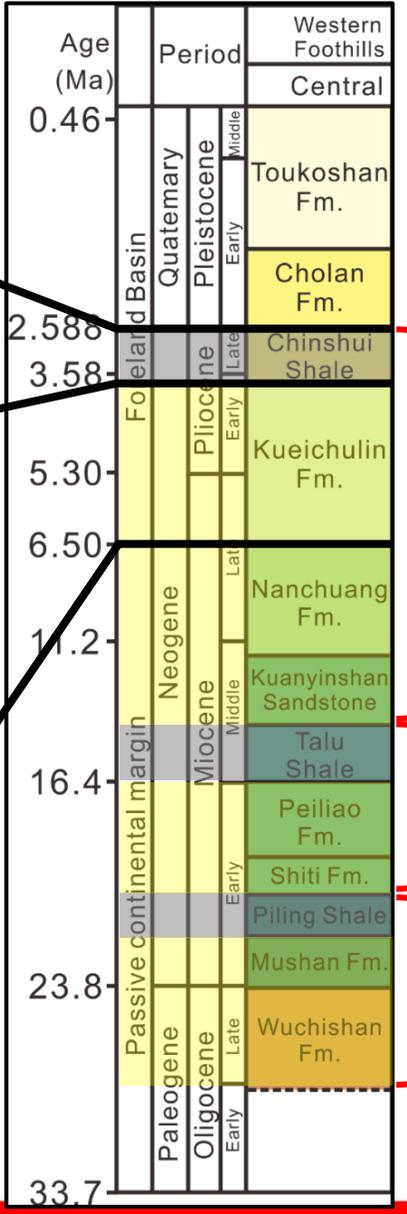
- 3 CO₂ GCS systems lying in between 800m~3000m depth
 - Late Miocene to Pliocene(R1)
 - Early to middle Miocene(R2)
 - Late Oligocene to early Miocene(R3)
- Through seismic and logging interpretation, there are many blocky sandstones between 1000-1500m with a 100m thick overburden shale in R1 system



Logging interpretation

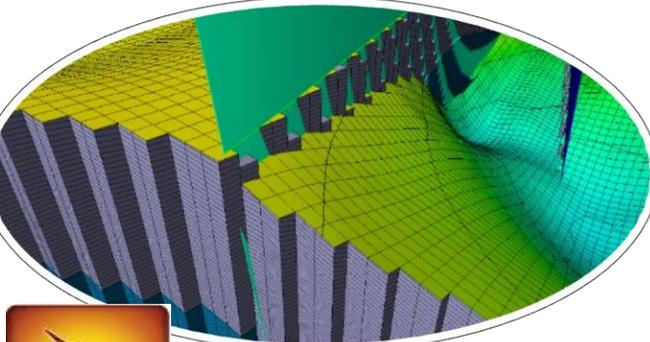
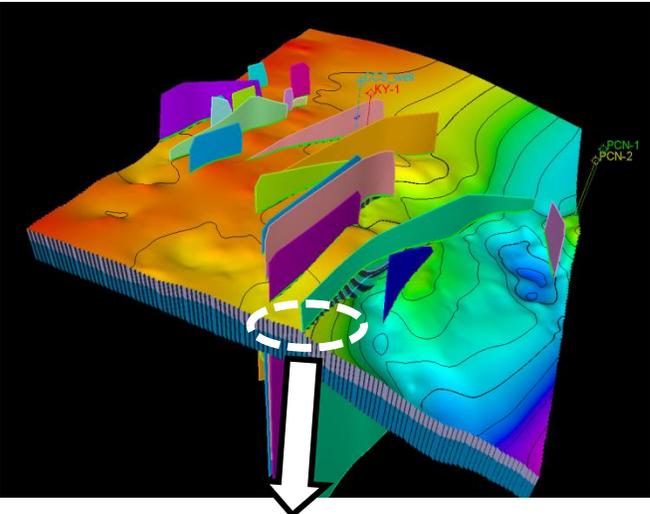


Taiwan Stratigraphic chart

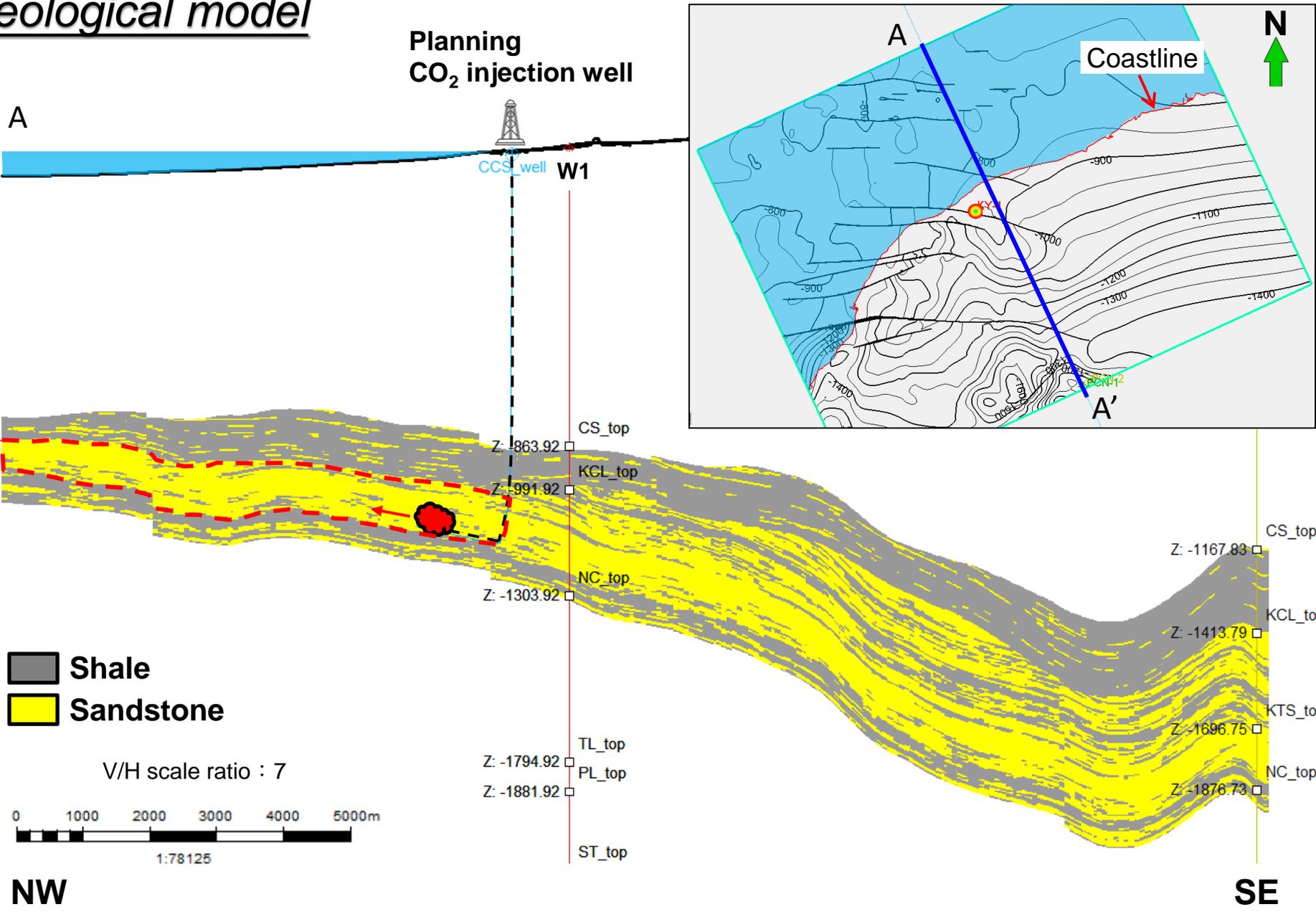


R1
R2
R3

Site characterization: Geological model



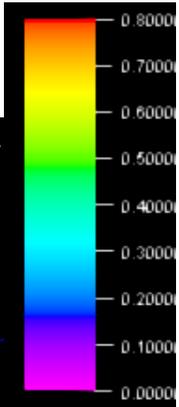
➤ Structural and property modeling



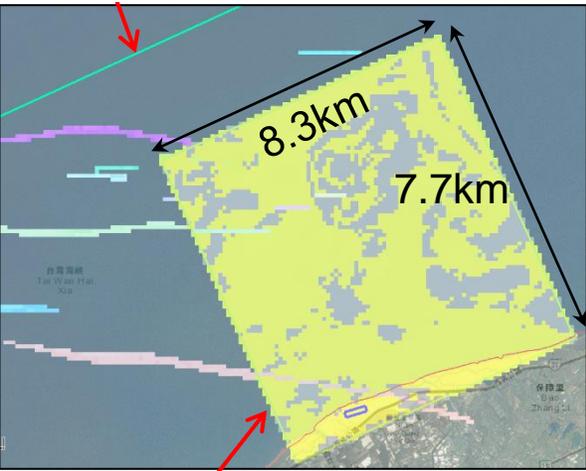
Site characterization: Numerical simulation



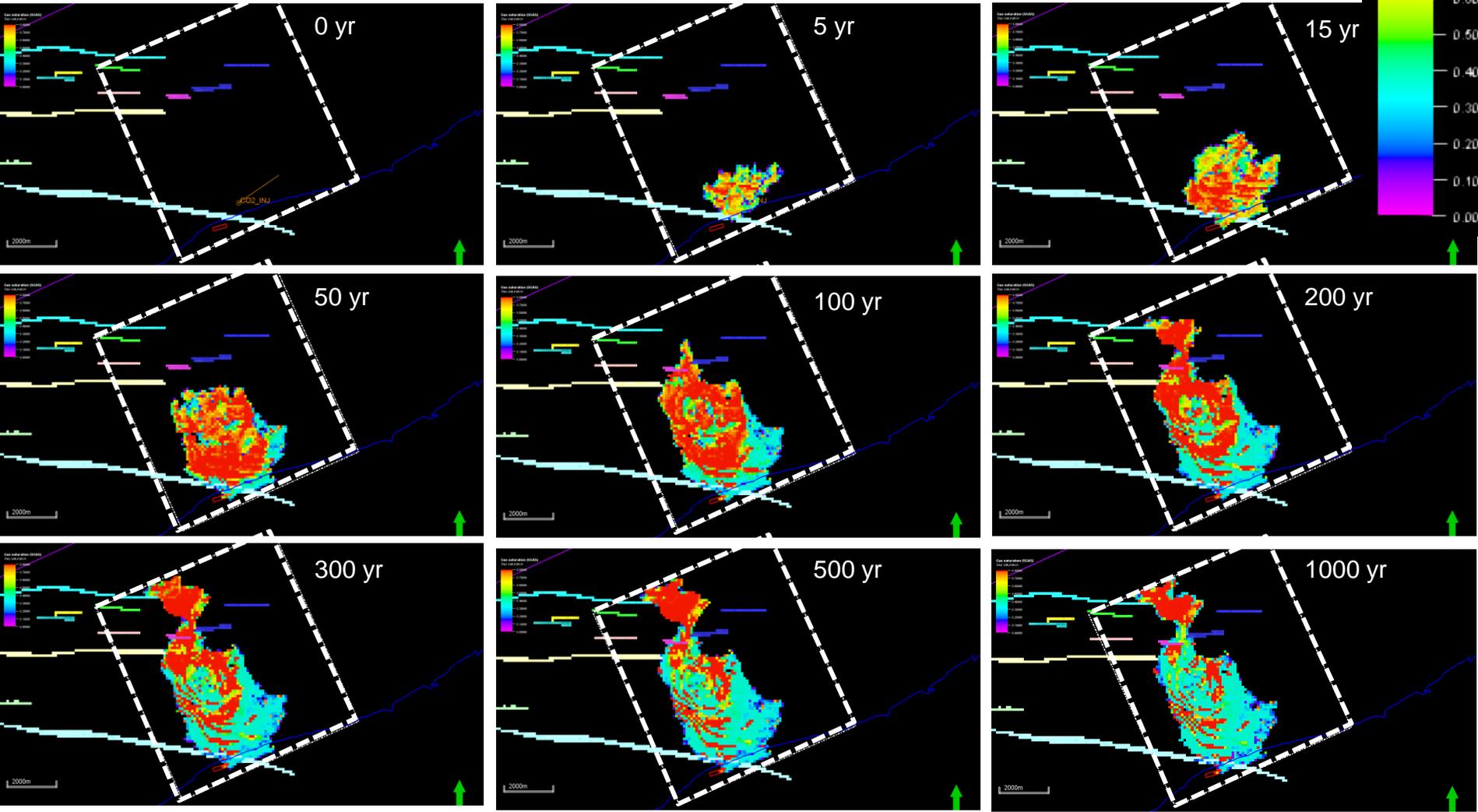
CO₂ Saturation



Geological model boundary



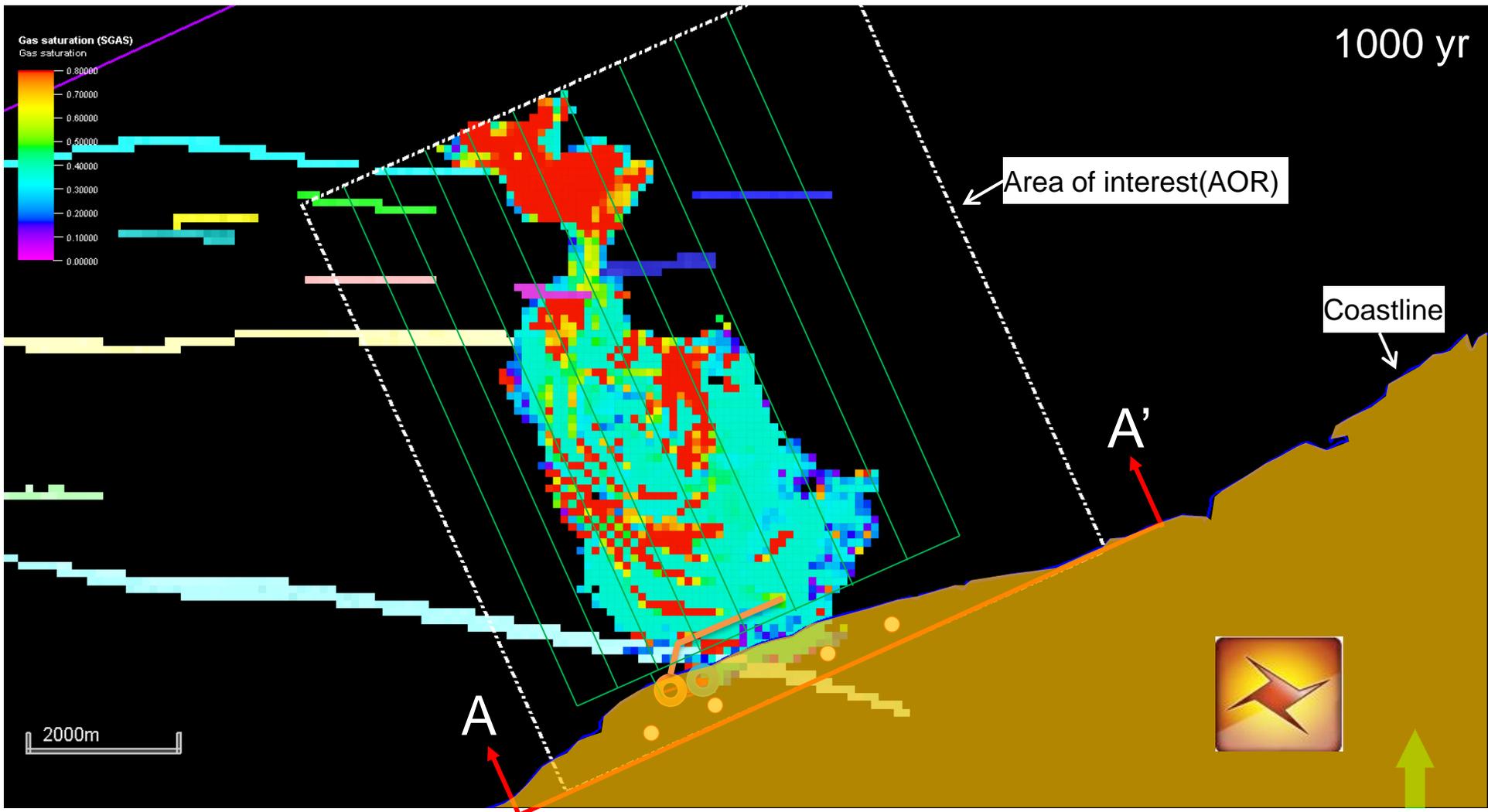
Simulation boundary



- Injection rate : 1Mt/yr
- Injection period : 15yrs
- CO₂ plume migrates to offshore, away from the populated area
- Effective capacity of reservoir 1 : 0.3Gt



Conceptual monitoring plan layout



- Actual location of injection wells and AOR will be defined by extensive CO₂ numerical simulation
- Considering fishing boat activity and channel, it's more effective to replace offshore monitoring well with OBC
- Marine environmental survey should be conducted based on Taiwan regulation

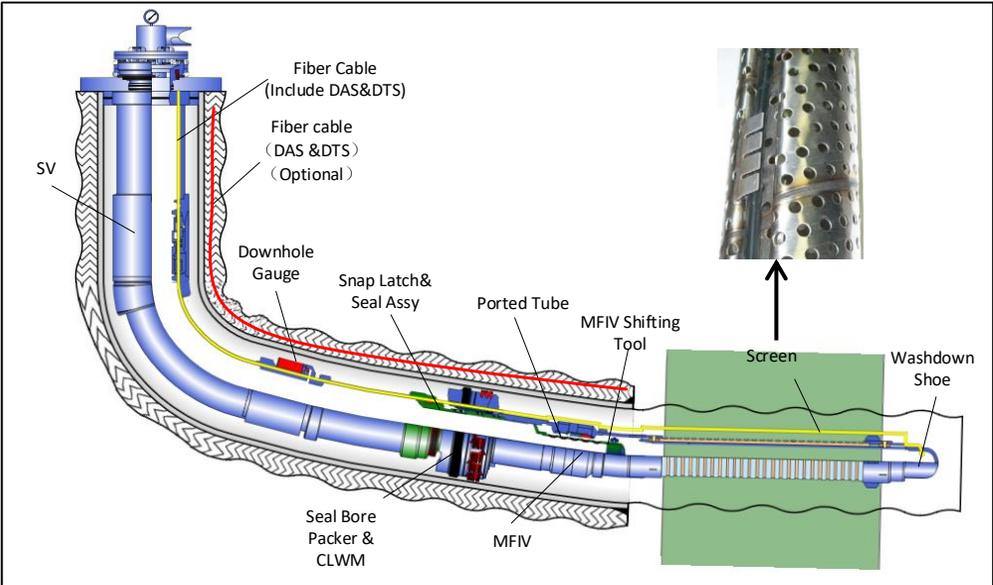
○ CO₂ injection well(horizontal)
 ○ CO₂ monitoring well
 ○ Groundwater monitoring well
— Ocean bottom cable(OBC)



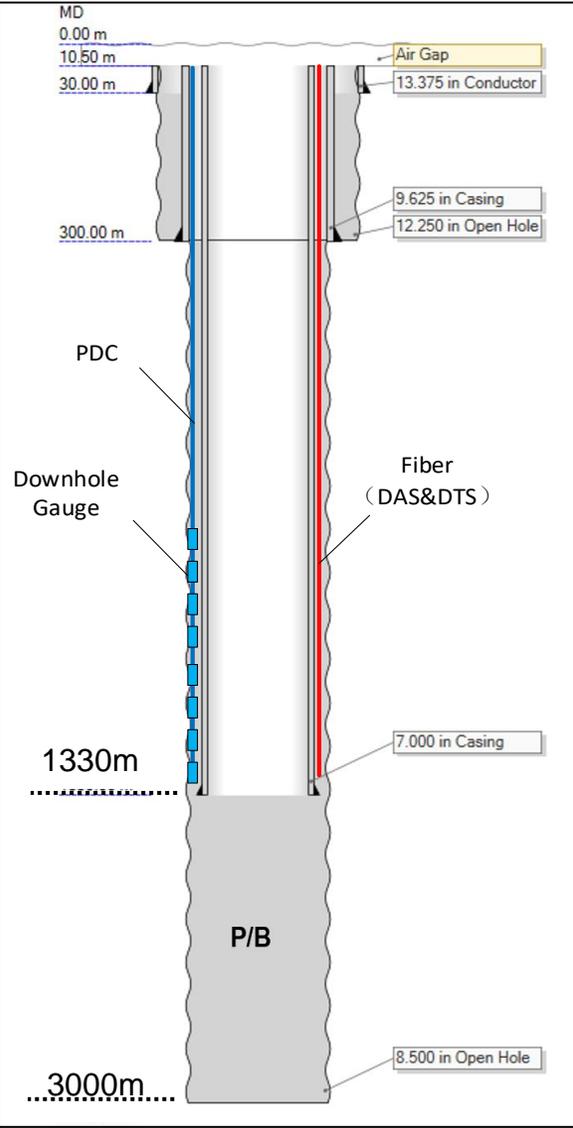
Conceptual borehole monitoring design

- The total depth of the monitoring well might be up to 3000m for stratigraphic data acquisition purpose
- The horizontal section of the injection well may reach 2000m for enhancing CO₂ injectivity
- Both of monitoring and injection wells use DAS, DTS and P/T equipment

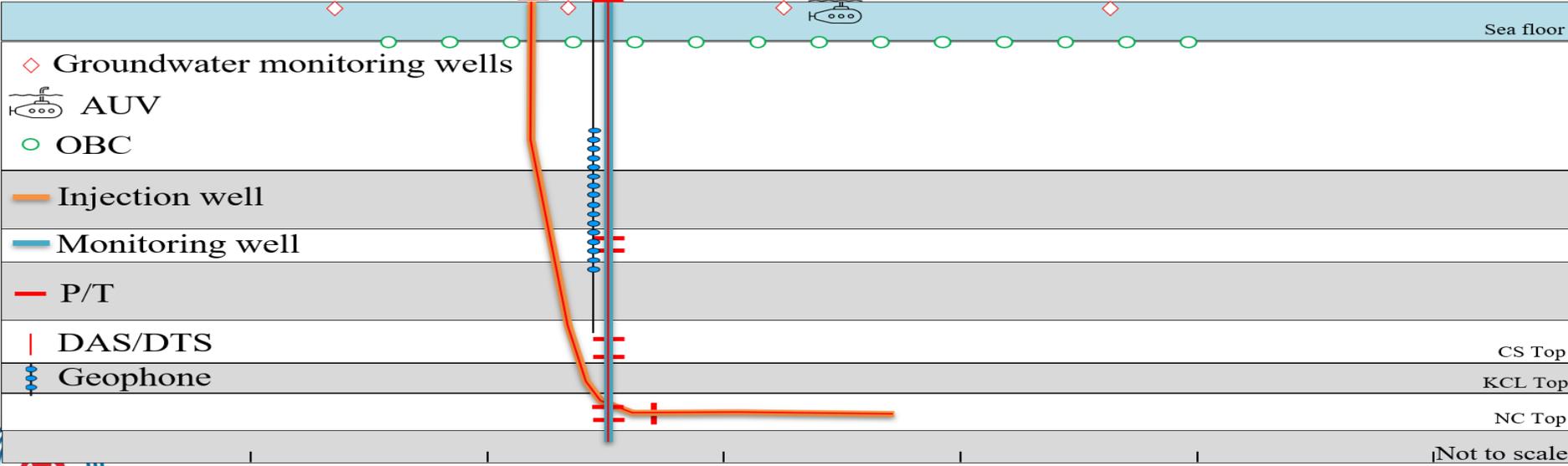
Injection well design



Monitoring well design

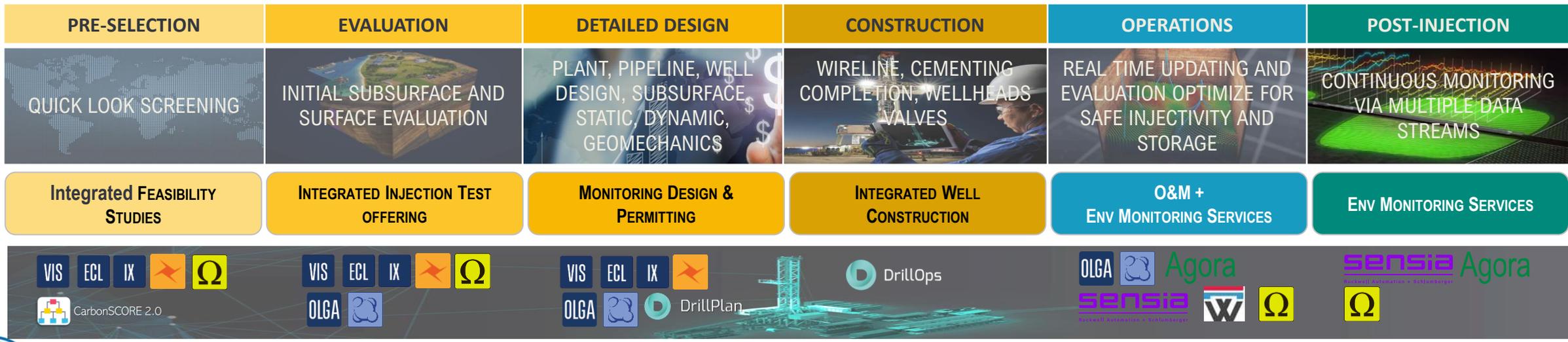


IW MW



Conclusion

- The CO₂ storage potential of West Taiwan basins/highs is close to 45.9 Gt capacity in 800~3000m underground saline aquifer.
- Based on the experience of onshore pilot test, CPC is going to construct a nearshore site in Taiwan, and promote to build an offshore hub located in Taiwan Strait in the future.
- Petrel integrated platform including Techlog/Studio/Eclipse is a useful and effective tool to evaluate geological carbon storage potential.





Thank you for listening

