**An assessment on CO2 geosequestration in deep saline formations in the Taihsi Basin, central Taiwan**

Presenter : Mo-Si Cai Adviser : Andrew T. Lin

**Abstract**

Geological storage of carbon dioxide (CO2) is to inject and store a large amount of anthropogenic CO2 in deep and sealed porous rocks in order to mitigate the aggravated threat of global climate changes. Borehole and reflection seismic data are used to understand the spatial distribution of suitable CO2 reservoirs and cap rocks in the Taihsi Basin, central Taiwan, where the level of seismicity is low.

The Taihsi Basin was a rift basin during the Paleocene to Eocene, followed by a phase of post-rift subsidence during late Oligocene to late Miocene. The loading of the Taiwan mountain belt since late Miocene has turned the Taihsi Basin into a peripheral foreland basin, with strata gently dipping toward the mountain belts in the east. The coastal plain in central Taiwan (Changhua and Yunlin Counties) and its adjacent offshore areas are close to major CO2 emission sources and no active geological structures are found in these areas, making the study area a favorable CO2 storage site.

Spatial distribution of formation thickness and depth for CO2 reservoirs and cap rocks indicates three CO2 storage systems existed in the study area. They are: (1) late Miocene to Pliocene Nanchuang Formation and Kueichulin Formation (reservoirs)-Chinshui Shale (seals) system (hereafter abbreviated as NK-C system), (2) early to middle Miocene Shihti Formation and Peiliao Formation (reservoirs)-Talu Shale (seals) system (SP-T system), (3) early Miocene Mushan Formation (reservoirs)-Piling Shale (seals) system (M-P system).

The NK-C system contains multiple layers of porous sandstones from Nanchuang and Kueichulin formations, with total thickness around 210-280 m. In the vicinity of the northern bank of the Jhuoshuei River, reservoir top reaches a depth around 1850 m, with 60 m thick seal formation, the Chinshui Shale. However, the Chinshui Shale becomes sand-prone in the Changhua coastal and nearshore areas due to facies changes. The SP-T system consists of two porous sandstone layers from the Peiliao Formation and the underlying Shihti Formation, with thickness spanning in the range of 30-60 m and 40-60 m, respectively. Reservoir top reaches a depth around 2200 m, with average 150 m thick seal formation, the Talu Shale, in the vicinity of the northern bank of the Jhuoshuei River. The M-P system contains multiple layers of porous sandstones from Mushan Formation, with total thickness around 150-300 m. In the vicinity of the northern bank of the Jhuoshuei River and the southern bank of the Wu River, reservoir top reaches a depth around 2700 m and over 3000 m respectively, with 80-150 m thick seal formation, the Piling Shale. However, Mushan Formation thins southwardly toward the Peikang High and is locally absent in the vicinity of the southern bank of the Jhuoshuei River.

For the NK-C system, although it contains thick reservoirs the seal formation (i.e. the Chinshui Shale) becomes sand-prone due to facies changes, leading to a higher risk of sealing capability. For the SP-T and M-P systems, both reservoirs and seals are all thick enough to contain injected CO2, excluding a local area in the vicinity of southern bank of the Jhuoshuei River, where reservoir is absent for the M-P system. In addition, north of the study area and close to the Wu River, reservoirs for the M-P system reach a depth more than 3000 m, a depth too deep for storing CO2 economically. Our results indicate that the SP-T system is the most prominent option for CO2 geosequestration in terms of depths and formation thicknesses, with M-P and NK-C systems as alternative ones, respectively.

**Reference**

Bachu, S. (2002) Sequestration of CO2 in geological media in response to climate change: Road map for site selection using the transform of the geological space into the CO2 phase space. *Energy Conversion and Management*, 43(1), 87-102.

Chadwick, A., Arts, R., Bernstone, C., May, F., Thibeau, S. and Zweigel, P. (2007) Best Practice for the Storage of CO2 in Saline Aquifers： Observations and Guidelines from the SACS and CO2STORE Projects. European Union, 273 pp. [online available at： http：//www.co2store.org/]

Lin, C.K. (2008) Algorithm for determining optimum sequestration depth of CO2 trapped by residual gas and solubility trapping mechanisms in a deep saline formation. *Geofluids*, 8, 333–343.

Lin, A. T., & Watts, A. B. (2002) Origin of the West Taiwan basin by orogenic loading and flexure of a rifted continental margin. *Journal of Geophysical Research: Solid Earth (1978–2012)*, 107(B9), ETG-2.

Sasaki, K., Fujii, T., Nilbori, Y. (2008) Numerical simulation of supercritical CO2 injection into subsurface rock masses. *Energy Conversion and Management*, 49(1), 54-61.

Nagel, S., Castelltort, S., Wetzel, A., Willett, S. D., Mouthereau, F., Lin, A. T. (2013) Sedimentology and foreland basin paleogeography during Taiwan arc continent collision. *Journal of Asian Earth Sciences*, 62, 180-204.

邱維毅(2009) 台灣西北部漸新世至更新世盆地演化及層序地層。國立中央大學地球物理研究所碩士論文。