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Natural Analogue of Long-term CO2 Storage in Western Taiwan

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CO_2 geo-sequestration is considered as the feasible method for the mitigation of CO_2 emission. It is usually very huge amount of natural carbon dioxide being stored in the substrata. There are many sources for natural carbon dioxide, including: magma related source, decomposition of carbonates in metamorphosed rocks, releasing of CO_2 dissolved fluids, and oxidation of organic matters, etc. Recent studies revealed that the storage time of natural carbon dioxides in the strata can be a wide range from very short time to up to several million years. It will be helpful to better understand the safety parameters of CO_2 injecting into the strata for storage, if we can study more natural analogue cases and know better about the residence time and the condition of CO_2 storage in natural cases.

Many CO_2 natural gases occur along active faults and/or drilling wells in western Taiwan, where does not have any signature of recent magma activity. However, elevated helium isotopic ratios (up to 6 Ra), carbon isotopes (δ^{13}C = -7 $\sim$ -4 $^{o}/_{oo}$) and high $CO_2/^3$He ratios (2*10^{-9} $\sim 10^{-10}$) of the natural gases strongly indicate that they were magmatic source in origin. Considering that the latest magmatic event occurred in Miocene (ca. 8 Ma), I propose that the CO_2 gases were degassing with the Miocene magmatism and consequently, they have been trapped in the strata until recent. We can reasonably assume that the original Miocene magmatic gas with helium isotopic composition of 6.5 Ra did not experience any lose of ^{3}He and ^{4}He, and was increasing the amount of ^{4}He from the radiogenic nuclei of host rocks through time. Then, the mass balance calculation of helium isotopic composition support that the gases could be stored in the strata up to 5 million years. Those “old” magmatic CO_2 gases were able to migrate to surface through the fault zones due to recent crust activity. It demonstrates that the CO_2 gas could be long-term stored in the strata safely under certain conditions.