Is Ocean Disposal Unnecessary Option in CCS?

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While carbon sequesteration can be accomplished by a variety of ways, the Urey reaction [1], $CaSiO_3$ + CO_2 -> $CaCO_3$ + SiO_2, is a key to the geochemical processes we can rely on in view of employment of geo-engineering or climate technology. "CCS technology" implies a more focused mitigation option than "carbon sequestration." It was originally proposed by Marchetti [2] and was defined as isolation technology of anthropogenic CO_2, mostly fossil-fuel derived CO_2, from the atmosphere. In IPCC Special Report on Carbon dioxide Capture and Storage [3], the CCS proponents who argue for underground storage options of CCS explicitly refer to the CO_2 mineral trapping, the product of the Urey reaction.

The fossil fuel reserves (CH_4, oil and coal) are the results of the other carbon sequestration process in Earth history, in other words, the reduced form of carbon buried in the deep earth brought about the oxygen accumulation in the atmosphere. Hence, if mankind uses all minable solid-form fossil fuel (*i.e.*, coal) and replaces it by carbonate for the sake of the climate stabilization, a consequence is some degree of depletion of atmospheric O_2. Whether or not we will have success in this scenario during fossil-fuel age of human civilization depends on the rate of carbonates formation in comparison with storage or formation rate of the carbonate minerals in the geochemical carbon cycle.

Whereas the saline aquifer CO_2 storage concept, originally Koide *et al*. [4] proposed provides the global storage capacity of at least 1000 $GtCO_2$, the amount of coal reserve is the same order of magnitude as large as the CO_2 storage capacity. However it takes several tens of thousand years for the stored CO_2 to be stabilized by the solubility trap mechnism, which is the pre-step to the miniral trapping.

To continue relying on fossil fuel energy resources with CCS technology, we need the ocean disposal options.

[1] Urey (1952) *Proc. Nat. Acad. Sci.* **38,** 351-363. [2] Marchetti (1977) *Climate Change,* **1,** 59-68. [3] IPCC (2005). [4] Koide *et al*. (1992) *Energy Convers. Mgmt*. **33**, 619-626.