Carbon sequestration and control of carbon cycle in geosphere

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An enormous amount of methane accumulates in shallow subsurface formations in the world. Most of the natural gas resources, however, are hardly economically recoverable as methane is adsorbed in coal seams, trapped in hydrate clathrate or dissolved in saline groundwater. Shallow accumulation of methane is even a hidden threat of explosive global warming. Enhanced gas recovery by subsurface CO2 injection (CO2-EGR) is a practicable solution for the greenhouse gas control with efficient use of potential energy resources. CO2 injection with counter extraction of coal mine methane and coalbed methane makes CO2-emission free closed-circuit power generation possible. Coal seams in Japan and under seabed around Japan may adsorb about 10 Gton of CO2 replacing 2.5 trillion cubic meters of coalbed methane. About 12 Gton of CO2 may be trapped in hydrate layers replacing 6 trillion cubic meters of methane hydrate under deep seabed around Japan. About 26 Gton of CO2 may be dissolved in saline groundwater replacing 6 trillion cubic meters of methane in sedimentary basins in Japan. Enhanced gas recovery by subsurface CO2 injection (CO2-EGR) can sequestrate total 48 Gton of CO2 in and around the Japanese Islands with the counter production of nearly ten trillion cubic meters of methane.

Reapplication of CO2-EGR for subsurface biogenic methane that is converted from disposed CO2 makes the carbon recycling possible. Extensive mining of fossil fuels enhances artificially discharging sectors of carbon cycle in the geosphere. Carbon sequestration may adjust the balance of carbon cycle in the geosphere. Subsurface ecosystem is somewhat similar to archaic ecosystem that is adapted to anoxic CO2-rich atmosphere under high pressure and temperature. Bionic methanogenesis is active even in deep basaltic aquifers. Subsurface biogeochemical carbon recycling may realize greenhouse gas control with restoration of energy resources.