

## Natural analogue study for safety of geological carbon sequestration

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The speed of disappearance of the arctic ice and abnormal weather disasters suggest that it passed over the tipping point of global warming. Coal is not only abundant in the proven deposits, but although there exist 10 to 100 times as much deep unminable coal deposits. When use of coal increases, however, global warming may be accelerated. In China, a coal-fired power plant is built every four days on the average. About 150 coal-fired power plants are planned in U.S.A. Carbon capture and storage (CCS) are globally expected as technology which makes zero most greenhouse gas emission of a coal-fired power plant. However, in order to store the huge quantity of carbon dioxide underground for global warming prevention, the concern to cost and safety has barred the early spread of carbon capture and storage (CCS) projects. Cost reduction and the advancement in safety of carbon capture and storage (CCS) are among the most important technological subjects globally. Carbon capture and storage (CCS) still have few cases of the operation with new technology. However, the natural gas reservoirs which are rich in carbon dioxide abundant worldwide. Natural carbon dioxide underground reservoirs exist in the Matsushiro area, Nagano City and in the Isobe area, Annaka City in Japan. The natural gas underground reservoirs of Matsushiro and Isobe in Japan are a dissolved type carbon dioxide underground reservoirs which carbon dioxide is dissolving in brine (high salt concentration groundwater). In Matsushiro and Isobe, although geological structure which serves as effective cap rock is not seen, discharge of the carbon dioxide to surface of the earth is spot-like, and is slight. The shallow light fresh water covers heavy brine and prevents the outflow of carbon dioxide. It is necessary to study the underground behavior of groundwater and gas further. Although carbon dioxide and brine erupted with the Matsushiro swarm earthquakes of about 40 years ago, no casualties were reported. In the comparative study with the Mammoth Mountain in the U.S.A., it is suggested that existence of surface water buffered and reduced damage. In order to develop the safety of carbon dioxide subterranean storage reflecting such natural analog research findings, micro-bubbles of carbon dioxide is dispersed in underground rocks to promote the dissolution to brine and the fixation into carbonates.