[JJ] Evening Poster | H (Human Geosciences) | H-SC Social Earth Sciences & Civil/Urban System Sciences

[H-SC05]CCUS (Carbon Dioxide Capture, Utilization, and Storage) for Climate Mitigation

convener:Masao Sorai(Institute for Geo-Resources and Environment, National Institute of Advanced Industrial Science and Technology), Ziqiu Xue(Research Institute of Innovative Tech for the Earth), Masaatsu Aichi(東京大学大学院新領域創成科学研究科)

Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

The prevention of the global warming, which is the urgent challenge facing the world, requires the full-out efforts of science and technology. This session focuses on the CCUS (Carbon Dioxide Capture, Utilization, and Storage) as one of the useful countermeasures for the CO2 emission reduction. It not only targets various scientific phenomenon caused by the capture and storage of CO2, CO2 utilization, and CO2-EOR/EGR, but also discusses the latest R&D developments of each method for the environmental impact assessment, safety assessment, the measuring, monitoring and verification (MMV), and public acceptance.
The main theme is the recognition of key issues toward the practical use of CCUS, in addition to the deepening of our knowledge about the CO2 behavior on the underground.

[HSC05-P01]Changes in self-potential observed around gas injection wells and their interpretations based upon “geobattery” numerical simulations

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The self-potential postprocessor calculates changes in subsurface electrical potential induced by pressure disturbances through electrokinetic coupling (Ishido &Pritchett, 1999). In addition to electrokinetic coupling, SP anomalies may be generated by various other mechanisms such as thermoelectric coupling, electrochemical diffusion potential, etc. In particular, SP anomalies of negative polarity, which are frequently observed near wells, appear to be caused by an underground electrochemical mechanism similar to a galvanic cell known as a “geobattery” (e.g. Bigalke &Grabner, 1997): the metallic well casing acts as a vertical electronic conductor connecting regions of differing redox potential. Electrons flow upward though the casing from a deeper reducing environment to a shallower oxidizing environment, and simultaneously a compensating vertical flow of ions is induced in the surrounding formation to maintain charge neutrality. If the redox potential in the deeper region is then increased by injecting an oxidizing substance, the difference in redox potential between the shallower and deeper regions will be reduced, resulting in an SP increase near the wellhead.

We will report the results of SP measurements during gas (CO_2 or air) injections at test sites in Japan and their interpretations based upon numerical simulations carried out using the extended SP postprocessor, which incorporates the above “geobattery” mechanism in addition to electrokinetic coupling. When air was injected into a 100-meter well in the Sumikawa geothermal field, a clear simultaneous increase in SP centered on the wellhead was observed. A small but unmistakable SP increase also took place near the wellhead when CO_2 was injected slowly, which we believe was caused by local pH reduction at depth resulting from dissolution of the injected CO_2 in the subsurface liquid water.

SP changes were also observed around a deep well at the Yubari test site in Japan (Tosha et al., 2008), where CO_2 was injected into a coal bed and the CO_2 content of the fluid produced from a nearby well was monitored. SP increased substantially around the injection wellhead during about six months of CO_2 injection, but no significant SP changes attributable to the injection were observed near the production wellhead. This is consistent with the observation that CO_2 did not break through into the production well during the experiment.