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Identification of Dissolved CO2 Brine by Time-lapse Logging

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SUMMARY

As is well known, CCS is considering one of effective approaches to global warming problem and many pilot projects are executing around the world. At Japan, RITE (Research Institute of Innovation Technology of the Earth) had executed a pilot CO2 injection project at Nagaoka site in Niigata Prefecture. At Nagaoka pilot site, total 10,400 ton of CO2 was injected at 1110m deep saline aquifer.
In order to developing geophysical monitoring technology, time-lapse seismic tomography and time-lapse sonic and induction logging were conducted at observation wells. CO2 breakthrough was observed after 8 months of the CO2 injection at 40 m apart observation well. The evidences of breakthrough are (1) a moderate increase in resistivity by induction data (2) a drastic decrease in P-wave velocity by sonic data (3) a decrease in neutron porosity. The time-lapse logging had continued after the end of injection to investigate post-injection CO2 behavior. Total 37 time-lapse were conducted during 2 years injection period and 3 years post-injection period.
Injected CO2 is trapped physically under the cap rock and also CO2 is dissolved into the brine and CO2 is chemically trapped at reservoir water. These two trapping mechanize might be identified by using resistivity data since the supercritical CO2 is almost insulating body, but CO2 dissolved brine becomes low resistivity values. The density of CO2 dissolved brine becomes larger than undissolved brine, therefore dissolved brine will move down ward at the reservoir zone. The time-lapsed induction logging shows the resistivity value increase at deeper part of reservoir after the CO2 breakthrough after 3 years. This shows the CO2 dissolved brine migration process at post injection phase.