L217-P005 **Room: Poster Session Hall** **Time: May 23**

Risk assessment and safety control in CCS by a natural analogue study -Shallow drilling investigation in the Matsushiro field-

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Environmental (risk) assessment and safety control technique are quite important in CO_2 geological storage. However, they have to be evaluated for a very long period as CO_2 should be stored in a geological layer for more than 100 years. Therefore it is very hard to evaluate directly. To solve this problem a natural-analogue study, which inquires the environmental change at present by the comparison with a past geology phenomenon, is one of possible approaches.

At Matsushiro in Nagano Prefecture, earthquake swarm occurred at August, 1965, around Mt. Minakami and lasted for about two years. A lot of spring water accompanied by CO_2 gas was discharged along the crack and landslide caused by the earthquakes. Matsushiro should be one of the best fields to apply the natural-analogue approach to increase our knowledge about the CO_2 release from the ground and to apply the results to the risk and environmental assessments. We will make a conceptual model for the release of CO_2 and carry out the numerical simulation based on the model to understand the CO_2 movement and to make a guideline for the assessment and safety control. Deep groundwater contained much CO_2 gas gushed at the surface and was said to cause the Matsushiro earthquake swarm. If the deep groundwater is still gushing till now, CO_2 isolated from the deep groundwater may be blowing off at the surface. For this reason, we planned to drill the borehole for investigation of hydrogeology and geochemistry. The selected sites are located in the crack zone and landslide happened during the Matsushiro earthquake swarm. The thickness of talus and fan deposits is over dozens of meters, according to the existing data. We selected the borehole site which could be reached to basement rock overlain by the thick deposits. The borehole was carried out by non-core drilling from ground to 30m, and core drilling from 30m to 80m. Pumping test and water sampling were carried out at 30m depth and then casing cementing was conducted. The borehole was drilled to 80m depth and pumping test was carried out again. Top soil, landslide deposits and talus are observed from ground level to 24m, fan deposits are from 24-65m, and quartz diorite, basement rock is below 65m depth. The carbonate minerals which would be related to CO_2 behavior are not found but quartz in fractures.

Water table found in the surface ground during the earthquake swarm obviously decreases to the depth of 38m in the borehole at present. Permeability-thickness product (kh) is 0.3-1.5 darcy-m in talus and fan deposits below 30m and is 5.3-5.7 darcy-m in fan deposits and quartz diorite between 30 and 80m from the result of pumping test. Loggings of temperature, electrical conductivity, pH and ORP were carried out after pumping test. The logging data show that hydrogeological barrier exists between 60 and 65m due to differences of chemical properties. Groundwater samples were also taken from the depths of 52, 62 and 72m using sampler. The deepest sample indicates higher concentration of chloride and carbon-13 of -5.5 permil PDB which ranges between values of magmatic origin of carbon, resulting in groundwater with deep origin of CO_2. Deep groundwater with high concentration of CO_2 discharged during the earthquake swarm might be already flushed out by fresh water in the very shallow aquifer at present. However, CO_2 dissolved by groundwater in quartz diorite might be supplying from deeper zone or magmatic origin of carbon might be still remained. CO_2 leakage in the surface ground might be affected by lateral flow in the shallow aquifers from the hydrogeological point of view. This natural analogue study for CO_2 seepage could indicate an importance of understanding shallow hydrogeological characteristics in the CO_2 storage field. This study was carried out as a part of the international collaborative research project supported by METI.