SCG61-P01 Room:Convention Hall Time:May 20 14:00-15:00

Characteristics of fracture and fracture fillings in sedimentary rocks-Example of Shimanto belt, Eastern part of Kyusyu-

OSHIMA, Akihiro[1*], YOSHIDA, Hidekazu[2], Yukihisa Nishizono[1]

[1]West Japan Engineering Consultants, Inc., [2]Nagoya University Museum

The long-term behavior of underground environment is important in geological disposal systems for radioactive waste, underground storage of CO_2 and liquefied petroleum gas (LPG). Fracture, fracture fillings and redox front have been studied for this evaluation (ex.Yoshida et al., 2004). However, the most of previous papers have been discussed to igneous rocks such as granite.

In this study, those characteristics are investigated in drilling core of Paleogene sedimentary rocks, Shimanto belt distributed at eastern part of Kyushu district.

The depth of drilling core is 120m, and is coherent sequence of accretionary prism which mainly consists of sandstone and shale. Fractures are defined as the discontinuity planes of the drilling core in this study. Redox front is formed with minerals oxidized by permeation of oxidative groundwater (Berner, 1981; Hoffman, 1999). Drilling core observation shows that brown colored rock is oxidized zone, and except for one is host rock zone. The boundary of both is recognized as the redox front. Fractures have characters such as brown colored alteration or mineral filling. Those are classified into the following two types based on the occurrence of fracture fillings and contact condition.

Type A sealed by filling mineral partially, and is easily separated along the fracture planes.

Type B sealed by filling mineral perfectly, and is contacted tightly together.

Type A fracture generally exists in all depth, and brown colored alteration along the fracture surface is remarkable in the depth of 0-60m. In the depth of 60-120m, that is filled by carbonate mineral which is patchy or euhedral shaped. Type B fracture frequency exists in the depth of 60-120m.

Oxidized zone distributes along the fracture in the depth of 0-35m. In this range, the rocks including of fractures are almost altered in brown color. The flesh host rock is rare. Around the depth of 35-50m, brown colored alteration is restricted to fracture surface only, and whole rock alteration is rare. Only a part of fracture surfaces are altered with depth deeper than 60 meters. This alteration is probably due to iron hydroxide occurred by the oxidative groundwater permeated.

Fracture filling minerals are iron hydroxide, calcite, ankerite and pyrite. Calcite and quartz mainly exist deeper than oxidized zone. Ankerite is frequency produced around shale.

In this presentation, we discuss the movement of elements and microstructure of minerals based on the data of chemical analysis and microscopic observation. Furthermore, the relation among the water permeability of a base rock, fracture and fracture filling mineral is also considered.

Keywords: fracture, fracture fillings, redox front, sedimentary rock

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG61-P02 Room:Convention Hall Time:May 20 14:00-15:00

Characterization of flow-path structure at the deep geological environment-A case study of Toki granite-

ISHIBASHI, Masayuki[1*], Tadahiko Tsuruta[1], Yuguchi Takashi[1], NISHIMOTO, Shoji[2], SASAO, Eiji[1], YOSHIDA, Hidekazu[3]

[1]Japan Atomic Energy Agency Tono Geoscientific Research Unit, [2]Nagoya City Science Museum, [3]Nagoya University Museum

In order to evaluate deep geological environment for geological disposal of high level radioactive waste (HLW), understanding water conducting features such as flow-path fractures are important. We report the character of flow-path fractures at the -300m levels of Mizunami Underground research laboratory (MIU). Flow-path fractures occupy about 11% of all fractures at the -300m level.

At the MIU site, wall rock alteration around fractures is estimated to control water conductivity along fractures. We will describe the alteration characters and fracture-fillings and then characterize water-conducting fractures in future study.

Keywords: flow-path fractures, Toki granite

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG61-P03 Room:Convention Hall Time:May 20 14:00-15:00

Development of hydrologic characterization technology of fault zones: field validation of methodology

GOTO, Junichi[1*], Toshifumi Moriya[1], Kimitaka Yoshimura[1], Seiichiro Murano[1], Hiroyuki Tsuchi[1], Kenzi Karasaki[2], Kenzo Kiho[3]

[1]NUMO, [2]LBNL, [3]CRIEPI

The Nuclear Waste Management Organization of Japan (NUMO) will select a site for HLW and TRU waste repository through the three-staged program, namely, the Literature Surveys, the Preliminary Investigations and the Detailed Investigations. Areas that are susceptible to natural hazards such as volcanism, faulting and significant uplift/erosion will be eliminated at first. Then, sites that have more favorable geological environment will be selected with respect to the repository design and long-term safety after closure. It is internationally acknowledged that hydrologic features of faults are of special concern in the above respects. It is highly likely from the experiences of site characterization worldwide that one could encounter numerous faults in an area of one hundred square kilometer assumed for the Preliminary Investigations. Efficient and practical investigation programs, and reliable models/parameters for the repository design and safety analysis are important aspects for implementers. A comprehensive methodology including strategies and procedures for characterizing such faults should thus be prepared prior to the actual investigations. Surveys on the results of site characterization in the world indicate potential relevance of geological features of faults such as host lithology, geometry, slip direction, internal structure and alteration to the fault hydrology. Therefore, NUMO, in collaboration with Lawrence Berkeley National Laboratory (LBNL), started a 5-year project in 2007 involving field investigations to develop a comprehensive methodology for hydrologic characterization of faults, with emphasis on the relationship between geological and hydrologic features of faults. A series of field investigations including ground geophysics, geological mapping, trench surveys, borehole investigations, hydrochemical analyses and hydrologic monitoring have been carried out on the Wildcat Fault that runs along the Berkeley Hills, California. The project will be completed by the end of this year to compile all the results into a comprehensive methodology.

Keywords: fault, hydrology, groundwater, geological disposal, site characterization, repository siting

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG61-P04 Room:Convention Hall Time:May 20 14:00-15:00

Sorption analysis of Cesium and Iodide ions on un-weathered Pumic Tuff

RAJIB, Mohammad[1*], Takayuki Sasaki[2]

[1]Graduate School of Science and Engineering, Saitama University, [2]Department of Nuclear Engineering, Kyoto University

Understanding and modeling of the sorption behavior onto the host rock under various groundwater conditions are indispensable in the reliable safety assessment of radioactive waste disposal. Pumice tuff has been considered as a potential host rock for geological disposal of radioactive waste. As such, sorption mechanism of two very important nuclides, Cesium (Cs) and Iodine (I), on the pumice tuff under various subsurface geochemical environment e.g. the influence of pH, ionic strength, and the initial concentrations on the sorption of Cs and I on tuff and pumice isolated from the original, unweathered pumice tuff rock was investigated by batch method at an aging period of about 10 weeks. It was observed that for both rocks, the proton concentration has little effect on the distribution coefficient, K_d values for Cs in the pH range 3?10. As the ionic strength of the solution increases in the presence of sodium perchlorate as a matrix ion, the K_d value of cesium apparently decreases, reflecting the competition of the electrolyte Na^+ with the specific sorption of Cs^+ on the negatively charged sites. In contrast, no significant dependence of ionic strength on the K_d of anionic iodine was found. A simple surface complexation model without considering electrostatic works was applied to simulate the sorption of ions on rocks, and the model parameters were determined. The K_d values at the given chemical conditions were estimated using the parameters and compared with the ones in the literature.

Keywords: Cesium, Iodide, Sorption, Surface complexation model, Tuff, Pumice

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG61-P05 Room:Convention Hall Time:May 20 14:00-15:00

A case for systematization of coastal geological environments

MATSUZAKI, Tatsuji[1*], IWATSUKI, Teruki[1], NIIZATO, Tadafumi[1], TOKIWA, Tetsuya[1], OHYAMA, Takuya[1], YABUUCHI, Satoshi[1]

[1]Japan atomic energy agency

a

Keywords: geological disposal, preliminary investigation, planning method, site descriptive model, coastal zone

SCG61-P06 Room:Convention Hall Time:May 20 14:00-15:00

Present state and future challenges of deep all-core drilling in coastal zones

KOSHIGAI, Masaru[1*], YOSHIOKA, Masamitsu[2], MARUI, Atsunao[1]

[1]Geological Survey of Japan, AIST, [2]Suncoh Consultants Co., Ltd.

Information on the geological environment of a region is essential for designing urban infrastructure, selecting industrial locations, devising disaster plans, etc. Recently, interest in such geological information for regions at a depth of over several 100 m has been rising because such information is useful for the utilization of underground spaces and the exploration of undeveloped natural resources. All-core drilling and core analysis are necessary to obtain information on subsurface geological environments. However, many technological challenges exist in the deep all-core drilling of sedimentary soft rocks, which are thickly distributed in coastal zones, where economic and social activities are concentrated. Herein, we review some previous studies and report the present state and future challenges of deep all-core drilling in coastal zones.

Keywords: Deep all-core drilling, Coastal area, Sedimentary soft rocks

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SCG61-P07 Room:Convention Hall Time:May 20 14:00-15:00

Characterization of mass transport based on in-situ crosshole tracer tests in a sedimentary rock

YOKOTA, Hideharu[1*], YAMAMOTO, Youichi[1], TANAKA, Shingo[1]

[1]Japan Atomic Energy Agency

For performance assessing the geological disposal of high-level radioactive waste, it is important to appropriately understand characteristics of mass transport into the hostrock as natural barrier. Therefore, it is need to obtain various parameters contributing for advection, dispersion, and diffusion into the hostrock by carrying out in-situ tracer tests.

On the Horonobe Underground Research Laboratory Project by Japan Atomic Energy Agency in the Horonobe area, northern Hokkaido, underground facilities have been constructed. As of Jan. 2012, the Ventilation Shaft, the East Access Shaft and the West Access Shaft have been drilled up to the depth of about 345 m, 310 m and 47 m respectively. And the drifts, connecting the shafts, at 140 m and 250 m in the depth have been excavated. In this study, in-situ crosshole tracer tests were carried out at the 250 m drift to confirm applicability of the in-situ crosshole tracer test equipment and establish methodologies of the in-situ tracer test at the sedimentary hostrock such as the Horonobe area.

The test location is in 250 m Niche off the Ventilation Shaft No.1. From the bottom of this niche, 3 boreholes were drilled (direction: N45 degrees E, dip: 60 degrees downward, diameter: 106 mm, length: about 30 m, arrangement of boreholes: regular triangular prism shape, distance between boreholes: 1m). And then, core observation, physical and fluid loggings and in-situ hydraulic tests were carried out. The in-situ tracer test is implemented by using fractures (T: 10^{-8} to 10^{-6} m^2/sec) extracted based on results of these tests and geological judgments.

Tracers used in this study are Uranine, Deuterium, Anion (Iodine, Bromine and etc.), Cation (Cesium, Strontium and etc.), and rare-earth elements (Europium and etc.) which are stable isotopes. The equipment is composed of rods and packers, and has a test interval of 15 cm length. In addition, for in-situ on-line fluorometric analysis by optical fiber system, flow cells are installed into injection and withdrawal lines in test intervals respectively. Dipole tracer test was implemented, and withdrawal water samples were taken by a fraction collector. Without the on-line analysis, a spectrofluoro-photometer for Uranine, an absorption spectrophotometer for Deuterium, and an ICP-MS or Ion chromatographer for other tracers have used to analyze concentration of tracers.

Results of dipole tracer tests (injection flow rate: 60mL/min., extraction flow rate: 60mL/min.) repeatedly executed showed that the recovered tracer is 20 to 25% (max. 52%), peak arrival time by the on-line analysis is 800 to 900 sec., one by the water sampling analysis is 1400 to 1500 sec., and the first detection time by the on-line analysis is about 550 sec., one by the water sampling analysis is about 1000 sec. after tracer injection beginning. Execution of tests by various dipole ratios had not influenced values of the recovered tracer. Accordingly, it is guessed that the direction from injection interval to extraction one crosses the background flow direction at right or high angles. Because peak arrival times of runs by using Uranine and Deuterium are almost corresponding, it has been clear that Uranine functions as non-sorbing tracer on these conditions at the Horonobe URL.

On the in-situ crosshole tracer tests in this study, from results of Uranine and Deuterium measurement, the applicability of the in-situ crosshole tracer test equipment and the approvability of the tests had been confirmed. Also, it had been confirmed that the test methods including countermeasures against degas from groundwater is effective. The analyses of sorbing tracers have been executed, and then, it is planed that characteristics of mass transport are evaluated based on that analytical result. Achievement of this study will be reflected in the next in-situ tracer experiment which will be carried out at drifts of the Horonobe URL at 350 m in the depth.

SCG61-P08 Room:Convention Hall Time:May 20 14:00-15:00

Application of landscape evolution models in the geological disposal and its problems.

INOUE, Shin[1*], HORIO, Atsushi[1], YOSHIMURA, Miyoshi[1], HATAYA, Ryuta[2]

[1]Dia Consultants Co.,Ltd, [2]Nuclear Waste Management Organization of Japan

Prolonged topographic change is impotant issue to discuss the safety of geological disposal after closure of the site. There are two methods to predict topographic change. One is based on historical geomorphology and the other is based on computer simulation. The latter is called Landscape Evolution Models (LEMs).In this study, we aimed to apply the LEMs for geological disposal and carried out the followings; (1) development of a LEMs, (2) extraction of problems by applying the LEMs for a coastal area and provision of the solution, and (3) summarization of the merit of LEMs for safety assessment.

First, we developed theLEMs based on the Grid-based Landscape Evolution Model (GGM; Tanaka, 2011) so that the LEMs expressed uplift and subsidence, river incision, movement of sediment on slope, and sea erosion.

Second, we applied the LEMs for an actual topography and extracted the following problems.

1. Because the width of the river was fixed in the LEMs, the width of channel was overestimated in an upstream area and underestimated in a downstream area. Thus, the erosion in the upstream area was underestimated, and that in the downstream area was overestimated.

2. Because the difference of erosion resistance by sediments was not considered in the LEMs, the top of the ridge got rounded.

3. Because sedimentation in sea areas was not considered in the LEMs , the amount of sea erosion was overestimated.

Furthermore, as a problem to apply LEMs for safety assessment, the following two points were extracted.

1. Because the target area and period is too wide and long, respectively, we cannot narrow down each parameter to one value.

2. Because a depositional and erosional zone are not distinguishable in the target area, it is not necessarily led to a conservative evaluation, even if we set the parameters to increase the amount of topographic change.

These problems may be solved by a method like ensemble prediction.

LEMs calculates the amount of water in the rivers and the sediment passing through each cell per unit time. It should be an advantage of LEMs, because the method based on historical geomorphology cannot provide such data. Therefore, LEMs should be one of the important tools to lead advanced safety assessment.

This study was carried out as a part of the commissioned research from the Nuclear Waste Management Organization of Japan (NUMO).

Y. Tanaka, (2011) Development of Grid-based Landscape Evolution Model (GGM): Annual Meeting of the Association of Japanese Geographers, Spring, 79: 319.

Keywords: geological disposal, landform development, Landscape Evolution Models