

Issue 1, August 2012

Newsletter

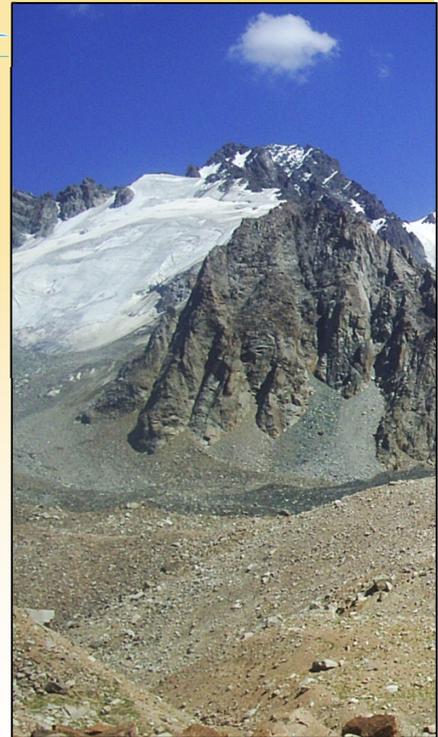
CROCK (Crystalline Rock Retention Processes) project

The Collaborative CROCK project is funded by the European Commission under the 7th Framework Programme of the European Atomic Energy Community (EURATOM) for research activities in support of implementation of geological disposal. The project started on 1st January 2011 and will last 2 years and a half.

This month will mark the passage of a little more than a half of the project. Since the start of the project remarkable achievements have been reported by the project members. Moreover, a number of related activities, such as the 1st project workshop and the presentation of the project at international conferences have been done during this period.

The overall objective of CROCK is to develop a methodology for decreasing the uncertainty in the long-term prediction of the radionuclide migration in the crystalline rock far-field.

CP-CROCK builds on the output and main conclusions of the 6th FP IP FUNMIG project (www.funmig.com/) and the Swedish site selection program. The experimental program reaches from the nano-resolution to the Performance Assessment (PA) relevant real site scale, delineating physical and chemical retention processes. Existing and new analytical information provided within the project is used to set up step-wise methodologies for up-scaling of processes from the nano-scale through to the PA relevant km-scale. Modelling includes testing up-scaling process and parameters for the application to PA and in particular, the reduction of uncertainty.



Content

About the project	1
Project Organization	2
WP1 activities	3
WP2 activities	4
WP3 activities	5
WP4 activities	6
WP5 activities	8
WP6 activities	9
WP7 activities	8
Events	10

Further information can be found at the CROCK website:

www.crockproject.eu

Newsletter submitting organization:

Amphos 21
Passeig Garcia i Fària 49-51
E08019 Barcelona,
Spain



Project Organization

The scientific-technical work program of the project is structured along six RTD (Research and Technological Development) workpackages (WP1-6).

The RTD WPs include different activities and are designed to cover the whole range of scales of interest of the project. Moreover, WP related with the knowledge management, dissemination and training (WP7), and with the project management itself (WP8) are also included in the work programme.

Brief WP descriptions, including the main objectives and their current state will be explained in this newsletter.

“10 Beneficiaries consisting of large European Research Institutions, Universities and SME’s from countries with dedicated crystalline host-rock disposal programs are collaborating in the CP-CROCK project”

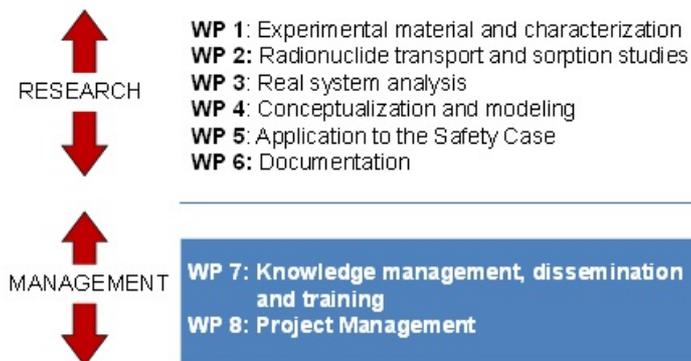
Beneficiaries



EUCG members



Different tasks are included in each workpackage:



The project is implemented by a consortium with 10 **Beneficiaries** consisting of large European Research Institutions, Universities and SME's from countries with dedicated crystalline host-rock disposal programs and particular competence in this field. National Waste Management organizations participate as end user consulting group (**EUCG**), contributing with co-funding to beneficiaries, infrastructure, knowledge and information. They also contribute together with national regulators to guidance with respect to application of the project to the disposal Safety Case and scientific-technical review.

The project is open for additional organizations entering into formal cooperation and participation via Associated Group agreement.



WP1: Experimental material and characterization

The main objectives of this workpackage are to provide and characterize new crystalline rock material over different scales. The work of this workpackage started on January 2011 and will be extended up to the end of 2012.

The first activities have been to organize new samples of fracture crystalline rock drill cores at Äspö. On March 2011, a first meeting for the CP-CROCK drilling campaign was organized. Based on the outcome of this meeting, the drilling campaign was initiated the first week of May 2011. Sampling was performed taking into account the needs of each beneficiary. All the samples were transferred directly after the drilling campaign to KIT-INE and were stored under Ar atmosphere (slight overpressure). Natural groundwater samples from Äspö site were also collected. Groundwater analysis was obtained in KIT-INE laboratories and no on site analysis of the waters was performed. The characterization of the experimental material has also been started.

Detailed information on the progress of this WP can be found in the public area of the project webpage (www.crockproject.eu).



Different sample images obtained from the beneficiaries working in WP1.

WP leader:

Thomas Rabung

KIT-INE



Recent Activities

The most recent activities of WP1 include:

KIT-INE has characterized crystalline rock samples by using: XRF (X-Ray Fluorescence Spectroscopy), SEM-EDX (Scanning Electron Microcopy with Energy-dispersive X-ray spectroscopy), XPS (X-Ray Photoelectron Spectroscopy) and N₂-BET.

CIEMAT has focused its work on updating the "block-scale" experiments designed for the FP6-FUNMIG project. Sorption data for three different tracers (HTO, ³⁶Cl, ¹³⁷Cs⁺) have been obtained.

MSU has characterized rock samples from areas of the proposed Russian HLW and SNF repository.

CTH has contributed in the characterization of the rock samples by BET measurements of specific surface area of sections of drill cores and crushed material.



WP leader:

Tiziana Missana

CIEMAT

Recent Activities

CIEMAT has been mainly working on the sorption of Cs on crushed biotites from different origins and in other granitic minerals. Moreover sorption of uranium on non-crushed Äspö diorite has been preliminary tested. First modeling results were presented during the 1st CP CROCK workshop (May 2012).

Sorption and desorption studies of ¹³⁷Cs(I), ¹⁵²Eu(III) and ²³³U(VI) onto Äspö Diorite (oxidized and non-oxidized material) have been performed by KIT-INE.

HZDR have been focused on sorption studies of redox sensitive elements, U(VI) and Np(V), onto Äspö diorite samples by means of batch experiments.

Se sorption experiments on Äspö rock samples have been performed by NRI in anaerobic and oxidic conditions. Se surface speciation has been also determined.

MSU has been carrying on preliminary Cs sorption experiments onto those Russian rock samples characterized in the frame of WP1.

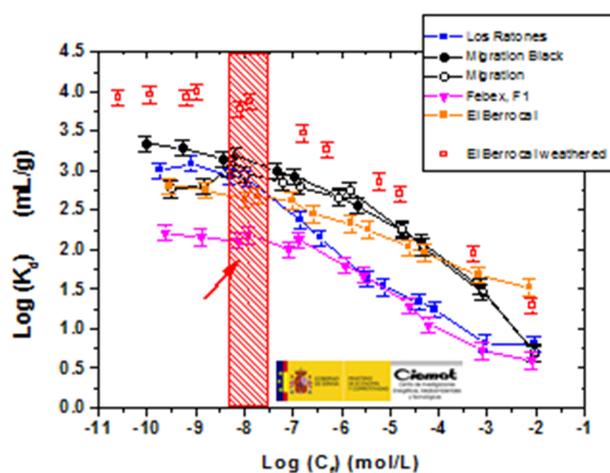
WP2: Radionuclide transport and sorption studies

The work of this workpackage started on July 2011 and will be extended up to March 2013. Main objectives of this WP are to determine radionuclide (RN) transport properties in crystalline rocks over different spatial scales.

For this purpose, the beneficiaries involved in WP2 (CIEMAT, KIT-INE, HZDR, NRI, CTH, and MSU) are performing sorption, desorption and diffusion experiments over different rock samples: fracture filling material and host rock matrix from Äspö, granite from GTS (Febex Tunnel), and finally fracture samples from different nuclear waste disposal sites in Russia.

Detailed information on the progress of this WP can be found in the public area of the project webpage (www.crockproject.eu).

Results of this WP have been presented at the 1st CP CROCK workshop (May 2012) by the different beneficiaries involved. As illustration of the work performed, below is represented the sorption isotherms of Cs determined in different granites by CIEMAT under similar chemical conditions (pH = 7 and low saline waters). One of the conclusions is that in all cases is observed a non-linear sorption suggesting the presence of two different sorption sites.



Sorption isotherms of cesium determined by CIEMAT in the analysed granites



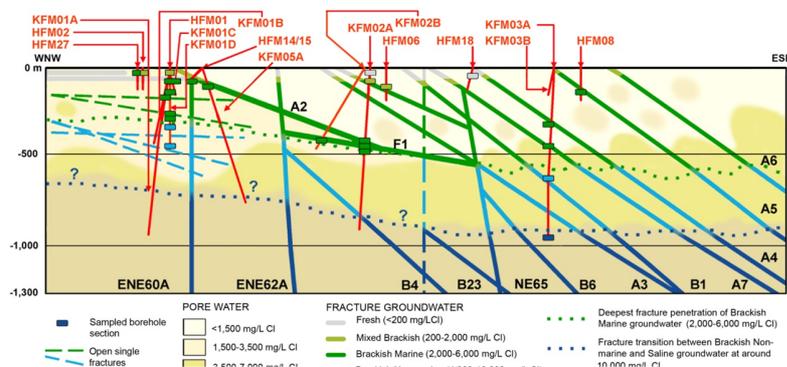
WP3: Real systems analysis

Main activities of this workpackage started on March 2011 and will be extended up to March 2013. Main objectives of WP3 are

- To assess matrix diffusion processes based on in situ natural inert tracer profiles analysed in rock matrix pore waters away from fracture surfaces into the adjacent bedrock.
- Based on this assessment, to study the behavior of radionuclides in fractured crystalline rock as a far-field analogy to a deep radioactive waste disposal system

During the first months of the project, CONTERRA has supplied all relevant background sources of the analytical and field pore water data, together with interpretations, from the recently completed Swedish site characterisation programme with a focus on matrix diffusion. Two areas in Sweden, Forsmark and Laxemar, have been studied to identify a suitable site for deep geological disposal of nuclear spent fuel waste. Both sites are located close to the Baltic Sea coast and their hydrogeochemistry is well documented. All data are available in the various SKB (and some International Journal) publications resulting from the site characterization programme.

Further information on the progress of this WP can be found in the public area of the project webpage (www.crockproject.eu).



Forsmark site visualisation of the hydrochemical data along cross-section WNW-ESE (Smellie et al., 2008, SKB R-Report (R-08-84)).

WP leader:

John Smellie

CONTERRA AB

Recent Activities

During the 1st CP CROCK workshop (May 2012) mainly two different works were exposed in the frame of this WP.

First at all, KEMAKTA explained how electrical resistivity measurements can be used to estimate in-situ formation factors. In the other hand AMPHOS highlight the relevance of matrix diffusion for determining the hydrochemical stability of deep geological repositories.



WP leader:
James Crawford
KEMAKTA

Recent Activities

VTT has initiated the molecular modelling, revisiting the experimental data and modelling from the FP6-FUNMIG project. A first attempt to implement the surface complexation model within the COMSOL Multiphysics platform has been initiated.

KEMAKTA has reinterpreted laboratory sorption data that were previously the focus of the Forsmark and Laxemar site investigations.

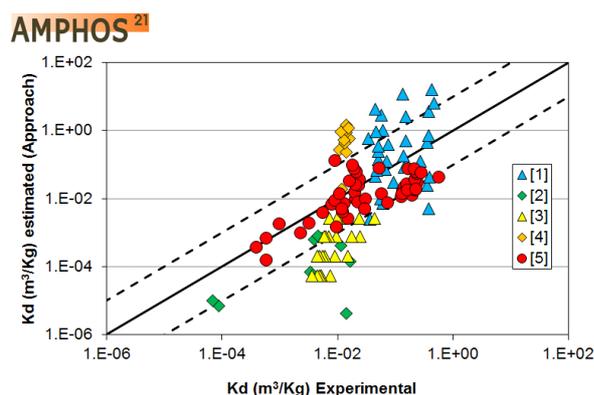
AMPHOS has performed a literature research of experimental data concerning adsorption experiments of Cs, Eu and U on fracture filling materials (iron oxyhydroxides, calcite, illite, SiO_2), and granitic materials, and first modeling attempts have been done.

WP4: Conceptualization and modelling

The technical work of this WP started in July 2011 and will be extended up to March 2013. The overall objectives of this WP are to conceptualize and model radionuclide transport processes on (fractured rock) systems at different scales.

During this period, by using literature information and also by reviewing the data generated in other projects (RETROCK, FP6-FUNMIG and NEA-SORB), beneficiaries are developing conceptual models over different spatial scales with the aim of deriving a consistent description of sorption processes encompassing all relevant spatial scales from the atomistic (VTT), to micro-scale domain (KIT-INE), macroscopic lab-scale (KEMAKTA/AMPHOS), to the site-scale domain (KEMAKTA/AMPHOS).

Detailed information on the progress of this WP can be found in the public area of the project webpage (www.crockproject.eu). As example, below is illustrated the work of AMPHOS which developed an approach base on previously defined surface complexation models to estimate the best K_d values for a given geochemical system. At this moment, they are mainly focus in the retention of Cs in magnetite.



Correlation between estimated K_d and experimental K_d values of Cs sorption onto magnetite



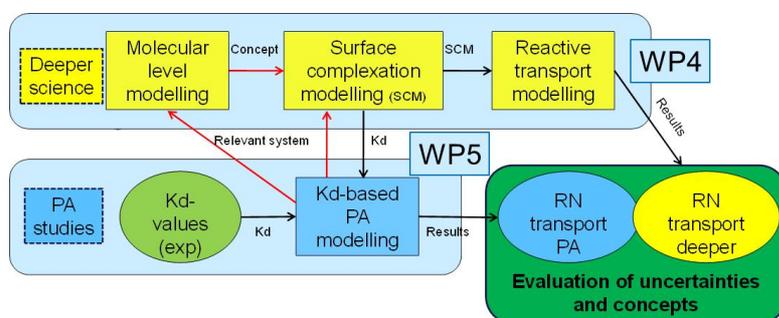
WP5: Application to the safety case

WP5 started on July 2011 and will be extended up to March 2013. Main objective within this WP is to describe how the outcome of the other WP's can be brought forward to application in the Safety Assessment, and describe how the overall findings can be applied in future site characterizations.

In close collaboration with WP4 activities, conceptual models are now being developed. Specifically, VTT has performed a number of sensitivity analysis on the Kd values computed in WP4 in order to identify the governing retention zones at the PA scale. Below is schematized the approach followed where the interrelationship between WP4 and WP5 is illustrated.

In order to verify and validate the simplified models and data applied by PA models, some deeper scientific analysis based either on experimental work or modelling have to be carried out. VTT are applying basically three different spatial levels: molecular level (less than 100 atoms), surface complexation (0-dimensional, laboratory scale) and fracture transport modelling (3D, scale about 100x100x1 m³).

Detailed information on the progress of this WP can be found in the public area of the project webpage (www.crockproject.eu) and in the presentation of the 1st Annual workshop of the project.



Scheme of the interrelationship between WP4 and WP5 in the work performed by VTT

WP leader:

Jorge Molinero

Amphos 21

Recent Activities

KEMAKTA has created a reactive transport template using the reactive transport simulation code CrunchFlow. This template will be used for the interpretation of laboratory experiments. Additionally, a simplified transport model to simulate the reactive transport of radionuclides decoupled from the temporal and spatial evolution of the major chemical components in the groundwater has tested.

AMPHOS has developed a methodology for the calculation of "intelligent" Kd values. Moreover, a numerical tool denoted as MC-PHREEQC has also been developed in order to test the intelligent Kd and increase the knowledge on Kd sensitivity.

VTT has conceptualised the system to be applied in testing PA based models against more detailed science based models to be developed in WP4.



WP leader:
Andrés Idiart
Amphos 21

Recent Activities

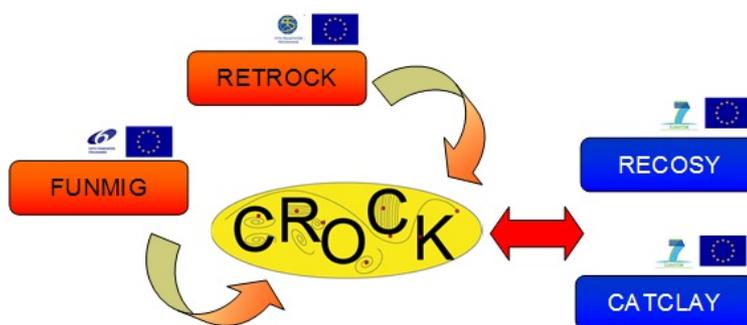
A questionnaire has been generated and circulated among the project beneficiaries in order to collect the information currently being or expected to be generated during the CROCK project. Next activities concerning WP6 progress will be focused on reviewing new trends and methods related to CROCK activities together with the preparation of a short note suggesting possible ways of generated results application in PA's.

WP6: Documentation

The overall objective of this WP is to document the State-of-the-art. The first work has been a) the identification and description of the main conceptual models available in the scientific literature to describe radionuclide transport modeling and b) to identify how sorption has been treated and modeled in previous Performance Assessment (PA) exercises. These report, will be updated together with the project achievements. The technical work of this WP will be performed during the whole CP-CROCK running, from January 2011 to June 2013.

Up to now, an initial state of the art has been documented. Specifically two previous projects on the transport and retention of radionuclides in the far-field of nuclear waste repositories, namely the [RETROCK project](#) (2001-2004) and the [FUNMIG project](#) (2005-2008), have been reviewed. Particular attention has been paid to the PA exercises done by the Finnish and Swedish radioactive waste management organisations (Posiva and SKB, respectively).

A complete description on the work performed in the frame of this WP can be found in the public area of the project webpage (www.crockproject.eu).



Preceding experiences and parallel projects



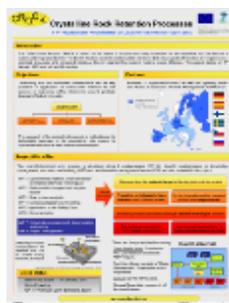
WP7: Knowledge management, dissemination and training

The main objectives within this WP are to provide management and dissemination of knowledge together with the organization of the project workshops and the training activities.

In order to disseminate the knowledge generated in the frame of the CP CROCK, different tools have been developed. Among these tools, one of the most important has been the establishment of a project web portal (www.crockproject.eu); which gives the opportunity to disseminate to the public audience the project's results and make the project known by possible end-users.



Furthermore the generic project poster and the project presentation, available in the project web page (www.crockproject.eu), have been generated. It should be mentioned that on September 2011 the project poster was presented in the 13th International Conference on the Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere, held in Beijing, China.



A complete description on the work performed in the frame of this WP can be found in the public area of the project webpage (www.crockproject.eu).

WP leader:

David García

Amphos 21

Recent Activities

The most recent activities concerning this workpackage have been the organization of the 1st CP CROCK workshop. As an example of the activities carried on, the workshop announcement is shown below these lines.





Final Workshop of the
CP CROCK will be
held in **Karlsruhe**,
Germany
14th-16th May, 2013



Organized by

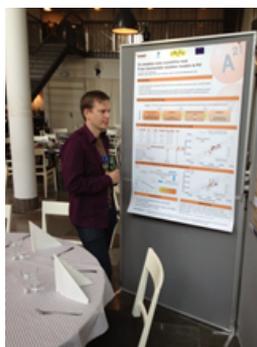


Events

The 1st Workshop of the CP CROCK was held in Stockholm (Sweden), from 22nd to 24th May 2012 at the SKB Head Office (www.skb.se).



The main focus of the Workshop was to present and discuss the scientific and technical project achievements until that moment. The workshop was structured in several plenary sessions. Additionally, a poster session was organized with the aim of facilitating the communication between all the participants and to be used as a training action for the younger scientists.



In association with the workshop, a Topical Session was also held on “Reactive transport modeling” with presentations from several experts on that field.

The Final CP CROCK Workshop will be held in Karlsruhe (Germany), in May 2013. The workshop will be organized by KIT-INE (www.ine.kit.edu/). Detailed information on the final Workshop organization will be provided in the project website (www.crockproject.eu/).