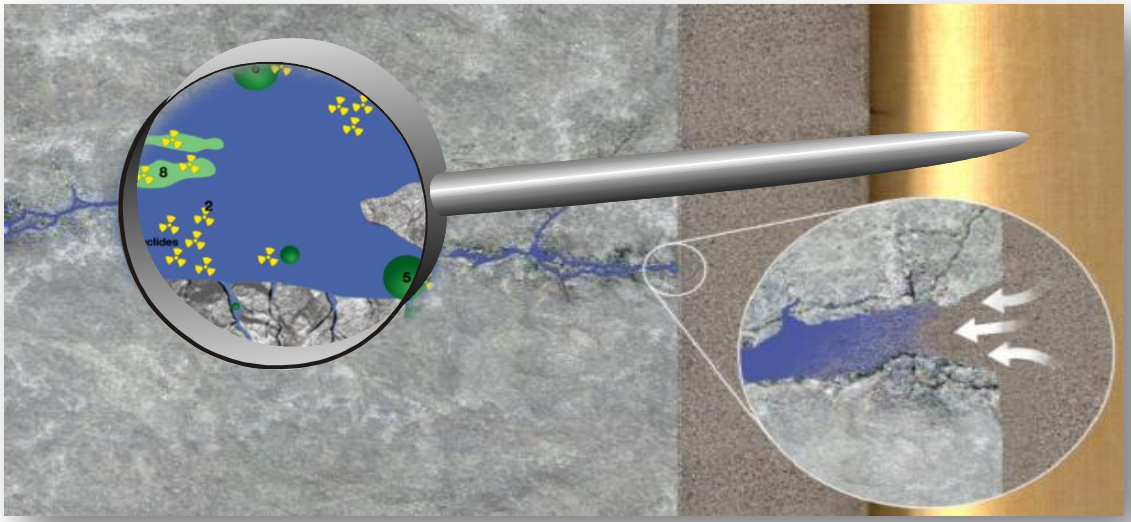
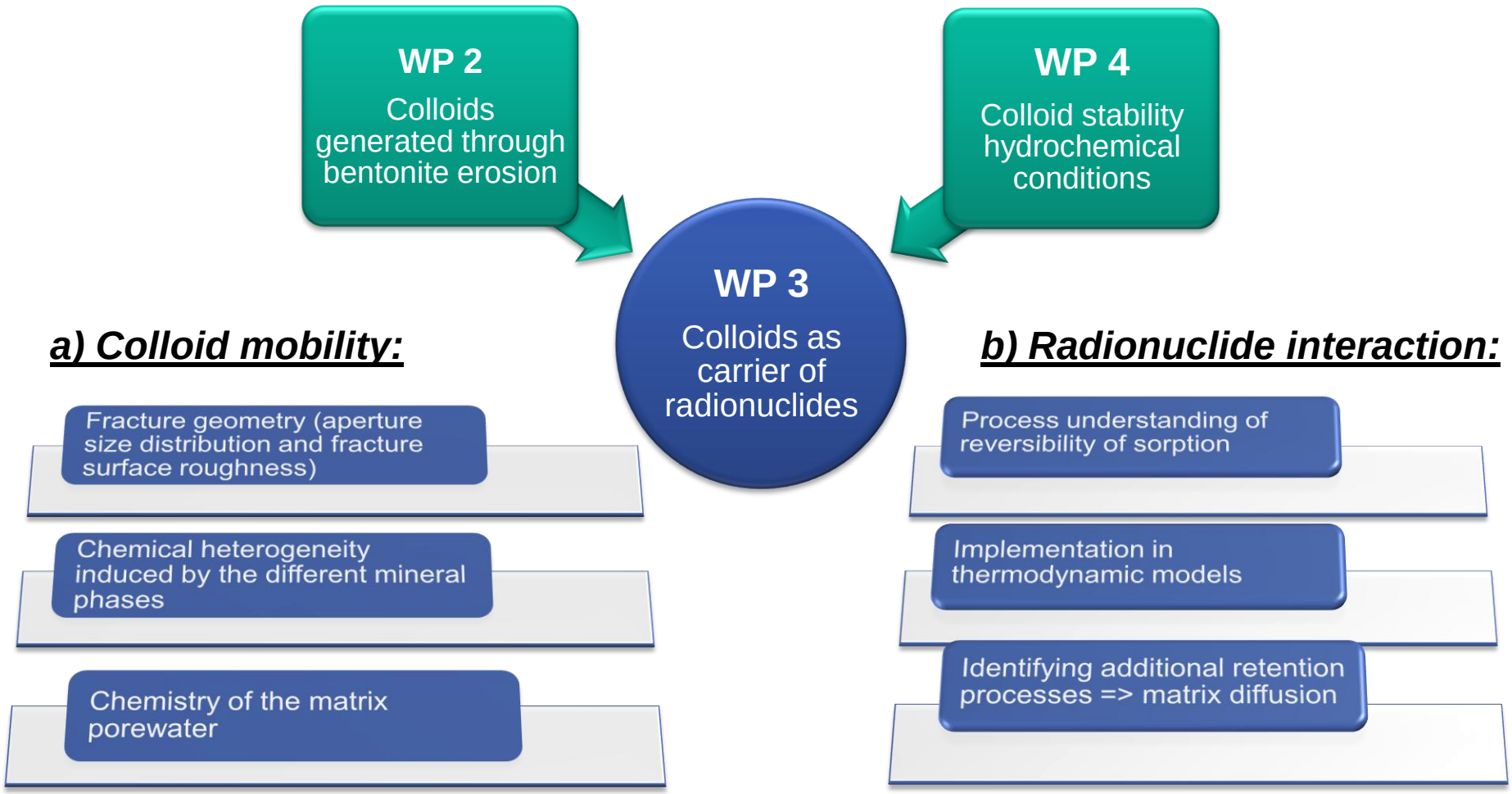
WP 3: Colloid radionuclide & host rock interaction

Thorsten Schäfer (KIT-INE)

Institute für Nukleare Entsorgung (INE)



Work package 3: Objectives



Work package 3: Partners & PM's

10 Partners, 6 partners producing data

Work package number	3			Start date or starting event:				Project Month 1	
	Colloid radionuclide & host rock interaction								
Activity Type	RTD								
Participant	CIEMAT	UNIMANCH	KIT-INE	NRI-REZ	MSU	SKB	ClayTech	NDA-RWMD	HU	KTH
Person-months for the participant	11	39	13	10	8	1	1	1	12	1

Partners ClayTech, SKB/KTH & NDA-RWMD participate on WP 3 meetings and in prep. of the final synthesis report through discussions or provide information of how the issue is handled in current assessment.

- **Microscale investigations** on colloid mobility controlling processes, here especially **CIEMAT, KIT, MSU and HU** are providing data.
- **Macroscale investigations** on colloid mobility in near-natural systems, here the partners **CIEMAT, KIT, NRI and HU** are involved.
- Process understanding of **radionuclide** colloid interaction with special emphasis on **sorption reversibility**; here partners **CIEMAT, KIT, UNIMANCH and HU** are contributing.
- **Mechanistical model** of RN colloid interaction; **all partners**.

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Colloid – mineral interaction

Colloid type:

Bentonite colloids (FEBEX, MX-80) & model colloids (CIEMAT)
Natural Rokle bentonite (NW Bohemia) (NRI)
Bentonite colloids(?) (MSU)
MX-80 bentonite colloids, powdered and compacted bentonite (HU)
Bentonite colloids (FEBEX, MX-80) & synthetic montmorillonite (KIT-INE)

Variation: colloid size, morphology, charge (CIEMAT)

Geological Formation:

- Grimsel granite (CIEMAT)
- Crushed granite from Czech Republic (NRI)
- Thin slices of Russian rocks proposed SNF/HLW repositories (MSU)
- Kuru Grey granite block (HU)
- Grimsel & Äspö granite + single minerals/Si-wafer (KIT-INE)

Microscopic Methods:

AFM, FESEM, µPIXE (CIEMAT)
DLS/PCS, AsFlFFF, FESEM), AFM, XRD, ICP-MS (HU)
Alpha-track analysis, SEM-EDX and AFM (MSU)
AFM force distance measurements, ESEM, XPS (KIT-INE)

Colloid – mineral interaction

Macroscopic:

Column migration or block scale studies (CIEMAT, NRI, KIT-INE, HU)
Batch-type studies on FFM (KIT-INE)

Parameters varied:

(Ca) concentration and fulvic acids (KIT-INE)
Na-Ca-Cl electrolyte solutions and Olkiluoto reference groundwater (OLSO) of different ionic strengths (HU)
SGW - synthetic groundwater (NRI)
f(I/pH) (MSU, CIEMAT)

Models:

DLVO theory (MSU)

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Radionulide interaction & mobility

Colloid type:

Bentonite colloids (FEBEX?) (CIEMAT)
Natural Rokle bentonite (NW Bohemia) (NRI)
Ca- /Na-Bentonite (Wyoming), FEBEX bentonite colloids (UNIMANCH)
MX-80 bentonite colloids, powdered and compacted bentonite (HU)
Bentonite colloids (FEBEX, MX-80) & synthetic montmorillonite (KIT-INE)

Variation: colloid size, morphology, charge (CIEMAT), size (KIT-INE)

Geological Formation:

- Grimsel granite (CIEMAT)
- Crushed granite from Czech Republic (NRI)
- Crushed granite single/simple phases (silica, quartz sand, etc.); Sherwood sandstone (study material for large UK CDZ project; BIGRAD) (UNIMANCH)
- Kuru Grey granite block (HU)
- Grimsel & Äspö granite + single minerals/Si-wafer (KIT-INE)

Microscopic Methods:

AFM, FESEM, µPIXE (CIEMAT)
DLS/PCS, AsFlFFF, FESEM), AFM, XRD, ICP-MS (HU)
AsFlFFF/ICP-MS, STEM-HAADF, CE/ICP-MS, isotope exchange studies, e.g. $^{228}Th/^{232}Th$

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Radionulide interaction & mobility

Macroscopic:

- Column migration studies (CIEMAT, NRI, HU)
- Batch-type ternary system studies (CIEMAT, HU)
- Resin competition & batch-type ternary system studies (UNIMANCH)

Radionuclides:

3 with different sorption behavior (CIEMAT)
^{134}Cs, ^{3}H (conservative tracer), Se (redox sensitive) => LTD (NRI)
Eu, Am, U(IV/VI) and Pu (IV/V) (UNIMANCH)
Sr, Cs, Eu, Np and/or other relevant radionuclides (HU)
Tri- and tetravalent actinides (KIT-INE)

Parameters varied:

Na-Ca-Cl electrolyte solutions and Olkiluoto reference groundwater (OLSO) of different ionic strengths (HU)
Variation of hydrochemical conditions, (pH, I) within the stability range of bentonite colloids (UNMANCH)

Model:

A mechanistical model of the RN-inorganic colloid interaction might be developed towards the end of the project. (UNIMANCH)

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Experimental overlap

Partner:	Bentonite type:	Granite type/competing ligand:	Radionuclide(s)	Experimental type:	Hydrochemistry:
CIEMAT	FEBEX, MX-80, Milos	Grimsel	three different RN	column & batch-type	GGW +?
NRI-REZ	Rokle , MX-80	crushed Czech granite (Melechov), FFM	^{134}Cs, ^{137}Cs, ^{85}Sr, ^{3}H, Eu	column	SGW - synthetic groundwater
UNIMANCH	MX-80	granite?, resin , minerals, sandstone	Eu, Am, U(IV/VI), Pu(IV/V)	batch-type	f(ph/I)
MSU	MX-80?	Russian granite	?	batch-type	?
HU	MX-80	Olkiluoto granite, Kuru grey granite?	Sr/Cs/Eu/Np/?	batch-type, column, block	OLSO ref gw + ?, f(pH, I)
KIT-INE	FEBEX, MX-80, synth. Mnt.	Grimsel, Äspö FFM	Am/Eu/Cm, Pu(IV), Th, Np(V), Cs, Tc	column & batch-type	GGW, Äspö and f(pH, I)
ClayTech	-*	-*	-*	-*	-*

*: will not perform an experimental program within the WP3

- **Suggestion to have one system of overlap, e.g. MX-80, Eu, synth. GGW for comparison of different methodological approaches.**

Deliverables

Work Package 3					
D3.1	WP3 partners state of the art report on colloid rock interaction and radionuclide interaction	**KIT-INE**	R	PU	6
D3.2	Progress report on microscale investigations on colloid mobility controlling processes.	**MSU**, CIEMAT, KIT-INE,	R	RE	15
D3.3	Macroscale investigations on colloid mobility in near-natural systems	**HU**, UJV/REZ, CIEMAT,KIT-INE	R	RE	15
D3.4	Process understanding of radionuclide colloid interaction with special emphasis on sorption reversibility	**UNIMANCH**, CIEMAT, KIT, HU	R	RE	15
D3.5	Progress report on microscale investigations on colloid mobility controlling processes.	**MSU**, CIEMAT, KIT-INE,	R	RE	27
D3.6	Macroscale investigations on colloid mobility in near-natural systems	**HU**, UJV/REZ, CIEMAT, KIT-INE	R	RE	27
D3.7	Process understanding of radionuclide colloid interaction with special emphasis on sorption reversibility	**UNIMANCH**, CIEMAT, KIT, HU	R	RE	27
D3.8	Progress report on microscale investigations on colloid mobility controlling processes.	**MSU**, CIEMAT, KIT-INE,	R	RE	39
D3.9	Macroscale investigations on colloid mobility in near-natural systems	**HU**, UJV/REZ, CIEMAT,KIT-INE	R	RE	39
D3.10	Process understanding of radionuclide colloid interaction with special emphasis on sorption reversibility	**UNIMANCH**, CIEMAT, KIT, HU	R	RE	39
D3.11	Mechanistical model of radionuclide colloid interaction	**UNIMANCH**, CIEMAT, KIT, HU	R	RE	39
D3.12	WP3 partners final report on experimental results on micro- to macroscale colloid rock interaction and colloid radionuclide interaction	**KIT-INE**	R	PU	44

- **Organisatorial points**
  - **Suggestion on WP3 Meetings on semi-annual basis in conjunction with international conferences to minimize traveling!**
  - **Lunch meeting in the period October 22th to 25th 2012, Montpellier**

Thank you for your attention!