
Appendix 2

Raw data

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A2.1 Complexation tests

IN: inside dialysis bag; OUT: outside dialysis bag; TOC: total organic carbon; SBCW: synthetic Boom Clay water.

Samples	pH	U IN mol·l ⁻¹	U OUT mol·l ⁻¹	TOC IN mg·l ⁻¹	TOC OUT mg·l ⁻¹	Humic acids (HA)	Atmosphere % volume	Solution
Cp 2-1	8.1	7.94×10 ⁻⁷	2.95×10 ⁻⁷	640	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-2	8.1	7.81×10 ⁻⁷	3.11×10 ⁻⁷	574	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-3	8.1	7.30×10 ⁻⁷	3.18×10 ⁻⁷	480	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-4	8.1	6.48×10 ⁻⁷	3.33×10 ⁻⁷	420	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-5	8.1	6.18×10 ⁻⁷	3.46×10 ⁻⁷	413	10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-6	8.1	5.45×10 ⁻⁷	3.57×10 ⁻⁷	305	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-7	8.1	4.81×10 ⁻⁷	3.71×10 ⁻⁷	262	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-8	8.1	4.72×10 ⁻⁷	3.79×10 ⁻⁷	178	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-9	8.1	4.46×10 ⁻⁷	3.74×10 ⁻⁷	121	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-10	8.1	4.29×10 ⁻⁷	3.95×10 ⁻⁷	64.4	< 10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 2-Blank	8.1	3.97×10 ⁻⁷	3.91×10 ⁻⁷	< 10	< 10	—	Ar – 0.4% CO ₂	SBCW
Cp 3-1	8.1	7.77×10 ⁻⁷	3.55×10 ⁻⁷	414	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-2	8.1	7.06×10 ⁻⁷	3.68×10 ⁻⁷	369	<10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-3	8.1	6.85×10 ⁻⁷	3.73×10 ⁻⁷	334	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-4	8.1	6.39×10 ⁻⁷	3.84×10 ⁻⁷	280	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-5	8.1	6.05×10 ⁻⁷	3.90×10 ⁻⁷	251	<10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-6	8.1	5.55×10 ⁻⁷	4.05×10 ⁻⁷	205	<10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-7	8.1	5.29×10 ⁻⁷	4.00×10 ⁻⁷	166	<10	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-8	8.1	4.96×10 ⁻⁷	4.14×10 ⁻⁷	126	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-9	8.1	4.66×10 ⁻⁷	4.14×10 ⁻⁷	86.7	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-10	8.1	4.58×10 ⁻⁷	4.29×10 ⁻⁷	47.7	<11	Aldrich	Ar – 0.4% CO ₂	SBCW
Cp 3-Blank	8.1	4.29×10 ⁻⁷	4.29×10 ⁻⁷	<10	<11	—	Ar – 0.4% CO ₂	SBCW

Appendix 2: Raw data

IN: inside dialysis bag; OUT: outside dialysis bag; TOC: total organic carbon; ox.: oxidised; non-ox.: non-oxidised; SBCW: synthetic Boom Clay water.

Samples	pH	U IN mol·l ⁻¹	U OUT mol·l ⁻¹	TOC IN mg·l ⁻¹	TOC OUT mg·l ⁻¹	Humic acids (HA)	Atmosphere % volume	Solution
Cp 5-1	8.2	6.40×10 ⁻⁷	3.82×10 ⁻⁷	590	14	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-2	8.2	6.20×10 ⁻⁷	3.81×10 ⁻⁷	520	< 12	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-3	8.2	6.07×10 ⁻⁷	3.86×10 ⁻⁷	490	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-4	8.1	5.72×10 ⁻⁷	3.88×10 ⁻⁷	430	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-5	8.1	5.27×10 ⁻⁷	3.94×10 ⁻⁷	370	< 12	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-6	8.1	5.24×10 ⁻⁷	4.06×10 ⁻⁷	310	< 12	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-7	8.1	4.95×10 ⁻⁷	4.10×10 ⁻⁷	250	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-8	8.1	4.66×10 ⁻⁷	4.19×10 ⁻⁷	200	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-9	8.2	4.60×10 ⁻⁷	4.20×10 ⁻⁷	130	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-10	8.1	4.38×10 ⁻⁷	4.22×10 ⁻⁷	67	< 11	Boom Clay – ox.	Ar – 0.4% CO ₂	SBCW
Cp 5-Blank	8.1	4.22×10 ⁻⁷	4.22×10 ⁻⁷	< 11	< 11	—	Ar – 0.4% CO ₂	SBCW
Cp 6-1	8.1	6.32×10 ⁻⁷	3.87×10 ⁻⁷	560	< 12	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-2	8.1	6.06×10 ⁻⁷	3.90×10 ⁻⁷	494	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-3	8.1	5.97×10 ⁻⁷	3.88×10 ⁻⁷	440	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-4	8.1	5.62×10 ⁻⁷	3.99×10 ⁻⁷	393	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-5	8.1	5.40×10 ⁻⁷	4.00×10 ⁻⁷	328	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-6	8.1	5.22×10 ⁻⁷	4.07×10 ⁻⁷	275	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-7	8.1	4.94×10 ⁻⁷	4.11×10 ⁻⁷	219	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-8	8.2	4.71×10 ⁻⁷	4.19×10 ⁻⁷	170	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-9	8.2	4.55×10 ⁻⁷	4.19×10 ⁻⁷	116	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-10	8.2	4.36×10 ⁻⁷	4.22×10 ⁻⁷	64	< 11	Boom clay – non-ox.	Ar – 0.4% CO ₂	SBCW
Cp 6-Blank	8.2	4.42×10 ⁻⁷	4.44×10 ⁻⁷	< 11	< 11	—	Ar – 0.4% CO ₂	SBCW

Appendix 2: Raw data

IN: inside dialysis bag; OUT: outside dialysis bag; TOC: total organic carbon; BCW: Boom Clay pore water; ox.: oxidised; non-ox.: non-oxidised; SBCW: synthetic Boom Clay water.

Samples	pH	U IN mol·l ⁻¹	U OUT mol·l ⁻¹	TOC IN mg·l ⁻¹	TOC OUT mg·l ⁻¹	Organic matter (OM)	Atmosphere % volume	Solution
Cp 7-1	8.2	9.95E-08	1.05E-07	60	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-2	8.2	2.72E-07	2.84E-07	61	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-3	8.2	5.64E-07	5.04E-07	60	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-4	8.2	7.12E-07	7.24E-07	62	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-5	8.2	9.53E-07	9.70E-07	63	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-6	8.2	1.01E-05	1.02E-05	60	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-7	8.6	9.50E-05	9.54E-05	62	< 12	BCW – non ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-8	8.2	1.29E-07	1.19E-07	67	< 12	BCW – ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-9	8.2	9.54E-07	9.46E-07	61	< 12	BCW – ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-10	8.2	1.02E-05	1.00E-05	66	< 12	BCW – ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-11	8.5	8.28E-05	8.28E-05	62	< 12	BCW – ox.	Ar – 0.4% CO ₂	SBCW
Cp 7-Blank	8.2	9.66E-07	9.51E-07	—	—	—	Ar – 0.4% CO ₂	SBCW

Appendix 2: Raw data

IN: inside dialysis bag; OUT: outside dialysis bag; TOC: total organic carbon; ox.: oxidised.

Samples	pH	U IN mol·l ⁻¹	U OUT mol·l ⁻¹	TOC IN mg·l ⁻¹	TOC OUT mg·l ⁻¹	Humic acids (HA)	Atmosphere	Solution
Cp 8-1	7.8	1.17×10 ⁻⁶	1.96×10 ⁻⁷	790	10	Boom Clay – ox.	air	pure water
Cp 8-2	7.8	1.69×10 ⁻⁶	5.84×10 ⁻⁸	620	4	Boom Clay – ox.	air	pure water
Cp 8-3	8.1	1.13×10 ⁻⁶	2.17×10 ⁻⁷	490	10	Boom Clay – ox.	air	pure water
Cp 8-4	7.9	1.70×10 ⁻⁶	7.94×10 ⁻⁸	330	3	Boom Clay – ox.	air	pure water
Cp 8-5	7.7	1.53×10 ⁻⁶	1.29×10 ⁻⁷	171	5	Boom Clay – ox.	air	pure water
Cp 8-6	7.9	2.03×10 ⁻⁶	1.60×10 ⁻⁸	90	< 2	Boom Clay – ox.	air	pure water
Cp 8-Blank	7.9	9.45×10 ⁻⁸	1.06×10 ⁻⁷	—	—	Boom Clay – ox.	air	pure water
Cp 9-1	8.2	7.98×10 ⁻⁷	2.86×10 ⁻⁷	730	251	Boom Clay – ox.	air	pure water
Cp 9-2	8.1	1.41×10 ⁻⁶	1.31×10 ⁻⁷	700	244	Boom Clay – ox.	air	pure water
Cp 9-3	8.1	1.58×10 ⁻⁶	1.05×10 ⁻⁷	580	245	Boom Clay – ox.	air	pure water
Cp 9-4	8.1	1.20×10 ⁻⁶	1.82×10 ⁻⁷	540	244	Boom Clay – ox.	air	pure water
Cp 9-5	8.1	1.42×10 ⁻⁶	1.35×10 ⁻⁷	490	245	Boom Clay – ox.	air	pure water
Cp 9-6	8.1	1.79×10 ⁻⁶	3.61×10 ⁻⁸	400	241	Boom Clay – ox.	air	pure water
Cp 9-7	8.1	1.66×10 ⁻⁶	8.32×10 ⁻⁸	350	244	Boom Clay – ox.	air	pure water
Cp 9-8	8.1	1.75×10 ⁻⁶	4.71×10 ⁻⁸	294	244	Boom Clay – ox.	air	pure water
Cp 9-Blank	8.1	7.48×10 ⁻⁸	7.27×10 ⁻⁸	242	242	Boom Clay – ox.	air	pure water

A2.2 Solubility tests

A2.2.1 Uranium

0.45 μm : micro-filtration at 0.45 μm ; 2 nm: ultra-filtration at 2 nm; TOC: total organic carbon; SBCW: synthetic Boom Clay water; BCW: Boom Clay pore water.

Samples	pH	U 0.45 μm $\text{mol}\cdot\text{l}^{-1}$	U 2 nm $\text{mol}\cdot\text{l}^{-1}$	TOC initial $\text{mg}\cdot\text{l}^{-1}$	TOC 0.45 μm $\text{mg}\cdot\text{l}^{-1}$	TOC 2 nm $\text{mg}\cdot\text{l}^{-1}$	Reducing agents	Time days	Solution
S 5-1	8.0	6.72×10^{-7}	6.89×10^{-8}	—	<6	<6	dithionite	15	SBCW
S 5-2	8.1	1.24×10^{-6}	4.96×10^{-8}	—	8	<7	dithionite	15	SBCW
S 5-3	8.0	1.08×10^{-6}	3.32×10^{-8}	—	7	<7	dithionite	15	SBCW
S 5-4	8.0	9.75×10^{-7}	6.89×10^{-8}	—	<8	<8	dithionite	15	SBCW
S 5-5	8.4	9.54×10^{-7}	4.16×10^{-8}	—	5	6	Fe(0)	30	SBCW
S 5-6	8.2	8.03×10^{-7}	7.02×10^{-9}	—	5	<5	Fe(0)	30	SBCW
S 5-7	8.5	1.01×10^{-6}	1.31×10^{-8}	—	5	6	Fe(0)	30	SBCW
S 5-8	8.4	1.06×10^{-6}	3.91×10^{-8}	—	5	6	Fe(0)	30	SBCW
S 6-1	7.9	6.34×10^{-6}	1.20×10^{-8}	110	28	29	—	60	BCW
S 6-2	8.0	6.51×10^{-6}	1.13×10^{-8}	110	29	31	—	60	BCW
S 6-3	8.0	7.69×10^{-6}	5.34×10^{-9}	110	30	31	—	60	BCW
S 6-4	8.2	7.86×10^{-6}	1.55×10^{-7}	110	33	32	dithionite	15	BCW
S 6-5	8.1	5.97×10^{-6}	3.49×10^{-8}	110	36	34	dithionite	15	BCW
S 6-6	8.1	9.37×10^{-6}	5.50×10^{-8}	110	33	31	dithionite	15	BCW
S 6-7	8.1	5.63×10^{-6}	1.90×10^{-8}	110	29	29	Fe(0)	30	BCW
S 6-8	8.3	8.49×10^{-6}	2.77×10^{-8}	110	35	34	Fe(0)	30	BCW
S 6-9	8.1	5.97×10^{-6}	1.39×10^{-8}	110	32	29	Fe(0)	30	BCW

Appendix 2: Raw data

0.45 μm : micro-filtration at 0.45 μm ; 2 nm: ultra-filtration at 2 nm; TOC: total organic carbon; SBCW: synthetic Boom Clay water; HA: humic acids; BCW: Boom Clay pore water.

Samples	pH	U 0.45 μm $\text{mol}\cdot\text{l}^{-1}$	U 2 nm $\text{mol}\cdot\text{l}^{-1}$	TOC initial $\text{mg}\cdot\text{l}^{-1}$	TOC 0.45 μm $\text{mg}\cdot\text{l}^{-1}$	TOC 2 nm $\text{mg}\cdot\text{l}^{-1}$	Reducing agents	Time days	Solution
S 7-1	8.1	3.99×10^{-6}	6.85×10^{-8}	33	6	6	dithionite	15	SBCW + Boom Clay HA
S 7-2	8.1	4.03×10^{-6}	8.28×10^{-8}	64	6	7	dithionite	15	SBCW + Boom Clay HA
S 7-3	8.1	4.54×10^{-6}	3.40×10^{-8}	122	9	9	dithionite	15	SBCW + Boom Clay HA
S 7-4	8.2	8.28×10^{-6}	3.03×10^{-8}	180	14	11	dithionite	15	SBCW + Boom Clay HA
S 7-5	8.2	9.96×10^{-6}	1.18×10^{-7}	280	24	24	dithionite	15	SBCW + Boom Clay HA
S 7-6	8.3	1.99×10^{-5}	2.12×10^{-7}	420	53	37	dithionite	15	SBCW + Boom Clay HA
S 7-7	8.4	2.61×10^{-5}	1.51×10^{-7}	560	94	62	dithionite	15	SBCW + Boom Clay HA
S 7-8	8.5	4.29×10^{-5}	1.26×10^{-7}	850	240	121	dithionite	15	SBCW + Boom Clay HA
S 8-1	8.5	3.24×10^{-6}	2.39×10^{-8}	15	7	8	Fe(0)	30	SBCW + Boom Clay HA
S 8-2	7.9	2.48×10^{-6}	7.65×10^{-9}	57	7	6	Fe(0)	30	SBCW + Boom Clay HA
S 8-3	7.8	3.07×10^{-6}	2.28×10^{-8}	110	7	6	Fe(0)	30	SBCW + Boom Clay HA
S 8-4	8.0	8.57×10^{-6}	1.03×10^{-8}	170	8	8	Fe(0)	30	SBCW + Boom Clay HA
S 8-5	8.1	3.15×10^{-5}	2.82×10^{-8}	270	14	10	Fe(0)	30	SBCW + Boom Clay HA
S 8-6	8.2	3.91×10^{-5}	1.67×10^{-8}	400	35	19	Fe(0)	30	SBCW + Boom Clay HA
S 8-7	8.4	5.67×10^{-5}	1.11×10^{-8}	560	65	28	Fe(0)	30	SBCW + Boom Clay HA
S 8-8	8.5	1.51×10^{-4}	2.65×10^{-8}	830	187	77	Fe(0)	30	SBCW + Boom Clay HA
S 11-1	8.1	2.94×10^{-5}	1.11×10^{-8}	120	59	50	dithionite	15	BCW
S 11-2	8.4	2.49×10^{-5}	8.40×10^{-9}	120	56	49	dithionite	15	BCW
S 11-3	8.5	1.67×10^{-5}	4.33×10^{-9}	120	57	52	dithionite	15	BCW
S 11-4	8.7	1.05×10^{-5}	8.57×10^{-9}	120	60	53	dithionite	15	BCW
S 11-5	9.4	2.65×10^{-5}	3.07×10^{-8}	120	94	79	Fe(0)	30	BCW
S 11-6	9.4	2.11×10^{-5}	1.16×10^{-8}	120	93	80	Fe(0)	30	BCW
S 11-7	9.4	2.06×10^{-5}	1.03×10^{-8}	120	97	82	Fe(0)	30	BCW
S 11-8	9.2	2.69×10^{-5}	1.63×10^{-8}	120	105	84	Fe(0)	30	BCW

Appendix 2: Raw data

0.45 μm : micro-filtration at 0.45 μm ; 2 nm: ultra-filtration at 2 nm; TOC: total organic carbon; SBCW: synthetic Boom Clay water; HA: humic acids.

Samples	pH	U 0.45 μm $\text{mol}\cdot\text{l}^{-1}$	U 2 nm $\text{mol}\cdot\text{l}^{-1}$	TOC initial $\text{mg}\cdot\text{l}^{-1}$	TOC 0.45 μm $\text{mg}\cdot\text{l}^{-1}$	TOC 2 nm $\text{mg}\cdot\text{l}^{-1}$	Reducing agents	Time days	Solution
S 12-1	8.3	2.82×10^{-6}	4.29×10^{-9}	—	< 8	< 8	dithionite	15	SBCW
S 12-2	8.4	3.07×10^{-6}	6.97×10^{-9}	—	< 7	< 8	dithionite	15	SBCW
S 12-3	8.4	5.17×10^{-6}	9.08×10^{-9}	24	8	8	dithionite	15	SBCW + Boom Clay HA
S 12-4	8.1	2.04×10^{-5}	4.96×10^{-9}	39	12	13	dithionite	15	SBCW + Boom Clay HA
S 12-5	8.2	3.11×10^{-5}	3.99×10^{-9}	72	20	19	dithionite	15	SBCW + Boom Clay HA
S 12-6	8.4	2.77×10^{-5}	2.44×10^{-9}	108	28	27	dithionite	15	SBCW + Boom Clay HA
S 12-7	8.4	4.24×10^{-5}	2.52×10^{-8}	180	47	42	dithionite	15	SBCW + Boom Clay HA
S 12-8	8.7	4.41×10^{-5}	1.20×10^{-8}	260	176	65	dithionite	15	SBCW + Boom Clay HA
S 12-9	8.5	5.29×10^{-5}	3.53×10^{-8}	350	131	107	dithionite	15	SBCW + Boom Clay HA
S 12-10	8.0	3.24×10^{-5}	7.86×10^{-8}	520	360	180	dithionite	15	SBCW + Boom Clay HA
S 13-1	8.8	1.68×10^{-6}	5.88×10^{-9}	—	<9	<9	Fe(0)	30	SBCW
S 13-2	9.0	3.78×10^{-6}	8.03×10^{-9}	—	<8	<9	Fe(0)	30	SBCW
S 13-3	8.9	6.60×10^{-6}	1.26×10^{-8}	19	9	9	Fe(0)	30	SBCW + Boom Clay HA
S 13-4	8.9	1.53×10^{-5}	6.55×10^{-9}	36	14	13	Fe(0)	30	SBCW + Boom Clay HA
S 13-5	8.7	3.70×10^{-5}	4.33×10^{-9}	71	28	23	Fe(0)	30	SBCW + Boom Clay HA
S 13-6	8.9	5.00×10^{-5}	4.16×10^{-9}	110	40	33	Fe(0)	30	SBCW + Boom Clay HA
S 13-7	8.5	5.55×10^{-5}	2.18×10^{-8}	170	84	65	Fe(0)	30	SBCW + Boom Clay HA
S 13-8	8.6	5.92×10^{-5}	3.15×10^{-8}	260	107	73	Fe(0)	30	SBCW + Boom Clay HA
S 13-9	8.3	6.68×10^{-5}	1.69×10^{-8}	350	220	130	Fe(0)	30	SBCW + Boom Clay HA
S 13-10	8.5	6.64×10^{-5}	4.29×10^{-8}	520	310	220	Fe(0)	30	SBCW + Boom Clay HA

A2.2.2 Thorium

0.45 μm : micro-filtration at 0.45 μm ; 2 nm: ultra-filtration at 2 nm; TOC: total organic carbon; SBCW: synthetic Boom Clay water; HA: humic acids.

Samples	pH	U 0.45 μm $\text{mol}\cdot\text{l}^{-1}$	U 2 nm $\text{mol}\cdot\text{l}^{-1}$	TOC initial $\text{mg}\cdot\text{l}^{-1}$	TOC 0.45 μm $\text{mg}\cdot\text{l}^{-1}$	TOC 2 nm $\text{mg}\cdot\text{l}^{-1}$	Reducing agents	Time days	Solution
S 9-1	8.2	$< 4.31\times 10^{-9}$	$< 4.31\times 10^{-9}$	—	< 11	< 12	—	15	SBCW
S 9-2	8.2	$< 4.31\times 10^{-9}$	$< 4.31\times 10^{-9}$	—	< 11	< 12	—	15	SBCW
S 9-3	8.2	6.90×10^{-6}	7.72×10^{-9}	23	18	< 12	—	15	SBCW + Aldrich HA
S 9-4	8.2	2.80×10^{-6}	$< 4.31\times 10^{-9}$	46	37	14	—	15	SBCW + Aldrich HA
S 9-5	8.2	2.07×10^{-6}	$< 4.31\times 10^{-9}$	93	76	18	—	15	SBCW + Aldrich HA
S 9-6	8.3	2.93×10^{-6}	$< 4.31\times 10^{-9}$	139	120	28	—	15	SBCW + Aldrich HA
S 9-7	8.3	4.78×10^{-6}	4.40×10^{-9}	232	190	37	—	15	SBCW + Aldrich HA
S 9-8	8.3	1.98×10^{-6}	8.41×10^{-9}	464	390	64	—	15	SBCW + Aldrich HA
S 9-9	8.3	2.28×10^{-6}	1.72×10^{-8}	696	590	90	—	15	SBCW + Aldrich HA
S 10-1	8.2	$< 4.31\times 10^{-9}$	$< 4.31\times 10^{-9}$	—	< 11	< 11	—	15	SBCW
S 10-2	8.2	$< 4.31\times 10^{-9}$	$< 4.31\times 10^{-9}$	—	< 11	< 11	—	15	SBCW
S 10-3	8.3	4.61×10^{-6}	$< 4.31\times 10^{-9}$	34	27	21	—	15	SBCW + Boom Clay HA
S 10-4	8.3	3.94×10^{-6}	1.51×10^{-8}	60	54	36	—	15	SBCW + Boom Clay HA
S 10-5	8.2	5.52×10^{-6}	4.27×10^{-9}	120	110	73	—	15	SBCW + Boom Clay HA
S 10-6	8.2	5.78×10^{-6}	1.03×10^{-8}	170	160	84	—	15	SBCW + Boom Clay HA
S 10-7	8.2	3.71×10^{-6}	4.09×10^{-9}	270	270	120	—	15	SBCW + Boom Clay HA
S 10-8	8.2	3.62×10^{-6}	4.70×10^{-9}	580	550	260	—	15	SBCW + Boom Clay HA
S 10-9	8.2	5.13×10^{-6}	7.72×10^{-9}	830	810	390	—	15	SBCW + Boom Clay HA

A2.2.3 Uranium and humic acids retention on the filter

A2.2.3.1 Micro-filtration at 0.45 μm

0.45 μm : micro-filtration at 0.45 μm ; TOC: total organic carbon; SBCW: synthetic Boom Clay water; HA: humic acids; BCW: Boom Clay pore water.

Samples	pH	U 0.45 μm $\text{mol}\cdot\text{l}^{-1}$	U 0.45 μm bis $\text{mol}\cdot\text{l}^{-1}$	TOC 0.45 μm $\text{mg}\cdot\text{l}^{-1}$	TOC 0.45 μm bis $\text{mg}\cdot\text{l}^{-1}$	Reducing agents	Time days	Solution
S 5-4	8.0	9.75×10^{-7}	7.52×10^{-7}	<8	—	dithionite	15	SBCW
S 5-5	8.4	9.54×10^{-7}	1.23×10^{-6}	5	5	Fe(0)	30	SBCW
S 6-1	7.9	6.34×10^{-6}	5.50×10^{-6}	28	31	—	60	BCW
S 6-4	8.2	7.86×10^{-6}	1.29×10^{-5}	33	—	dithionite	15	BCW
S 6-7	8.1	5.63×10^{-6}	3.70×10^{-6}	29	—	Fe(0)	30	BCW
S 7-1	8.1	3.99×10^{-6}	3.49×10^{-6}	<6	—	dithionite	15	SBCW + Boom Clay HA
S 7-8	8.5	4.29×10^{-5}	5.80×10^{-5}	240	—	dithionite	15	SBCW + Boom Clay HA
S 8-2	7.9	3.24×10^{-6}	3.11×10^{-6}	7	—	Fe(0)	30	SBCW + Boom Clay HA
S 8-7	8.4	5.67×10^{-5}	7.65×10^{-5}	65	—	Fe(0)	30	SBCW + Boom Clay HA
S 11-1	8.1	2.94×10^{-5}	2.09×10^{-5}	59	62	dithionite	15	BCW
S 11-5	9.4	2.65×10^{-5}	8.74×10^{-6}	94	93	Fe(0)	30	BCW
S 12-1	8.3	2.82×10^{-6}	1.28×10^{-6}	< 8	< 8	dithionite	15	SBCW
S 12-3	8.4	5.17×10^{-6}	1.19×10^{-6}	< 8	9	dithionite	15	SBCW + Boom Clay HA
S 12-10	8.0	3.24×10^{-5}	3.36×10^{-5}	360	340	dithionite	15	SBCW + Boom Clay HA
S 13-1	8.8	1.68×10^{-6}	6.01×10^{-7}	<9	<9	Fe(0)	30	SBCW
S 13-3	8.9	6.60×10^{-6}	7.52×10^{-6}	9	10	Fe(0)	30	SBCW + Boom Clay HA
S 13-10	8.5	6.64×10^{-5}	8.03×10^{-5}	310	300	Fe(0)	30	SBCW + Boom Clay HA

A2.2.3.2 Ultra-filtration at 2 nm

2 nm: ultra-filtration at 2 nm; TOC: total organic carbon; SBCW: synthetic Boom Clay water; HA: humic acids; BCW: Boom Clay pore water.

Samples	pH	U 2 nm mol·l ⁻¹	U 2 nm bis mol·l ⁻¹	TOC 2 nm mg·l ⁻¹	TOC 2 nm bis mg·l ⁻¹	Reducing agents	Time days	Solution
S 5-1	8.0	6.89×10 ⁻⁸	4.16×10 ⁻⁸	<6	7	dithionite	15	SBCW
S 5-8	8.4	3.91×10 ⁻⁸	1.76×10 ⁻⁸	6	/	Fe(0)	30	SBCW
S 6-3	8.0	5.34×10 ⁻⁹	1.34×10 ⁻⁹	31	31	—	60	BCW
S 6-6	8.1	5.50×10 ⁻⁸	7.52×10 ⁻⁸	31	31	dithionite	15	BCW
S 6-9	8.1	1.39×10 ⁻⁸	3.24×10 ⁻⁸	29	30	Fe(0)	30	BCW
S 7-2	8.1	8.28×10 ⁻⁸	4.50×10 ⁻⁸	<7	<7	dithionite	15	SBCW + Boom Clay HA
S 7-7	8.4	1.51×10 ⁻⁷	6.51×10 ⁻⁸	62	54	dithionite	15	SBCW + Boom Clay HA
S 8-1	8.5	2.39×10 ⁻⁸	1.60×10 ⁻⁸	8	8	Fe(0)	30	SBCW + Boom Clay HA
S 8-8	8.5	2.65×10 ⁻⁸	2.94×10 ⁻⁸	77	69	Fe(0)	30	SBCW + Boom Clay HA
S 11-4	8.7	8.57×10 ⁻⁹	7.18×10 ⁻⁹	53	56	dithionite	15	BCW
S 11-8	9.2	1.63×10 ⁻⁸	4.96×10 ⁻⁹	84	91	Fe(0)	30	BCW
S 12-2	8.4	6.97×10 ⁻⁹	4.29×10 ⁻⁹	< 8	< 8	dithionite	15	SBCW
S 12-4	8.1	4.96×10 ⁻⁹	6.81×10 ⁻⁹	13	12	dithionite	15	SBCW + Boom Clay HA
S 12-9	8.5	3.53×10 ⁻⁸	3.74×10 ⁻⁸	107	103	dithionite	15	SBCW + Boom Clay HA
S 13-2	9.0	8.03×10 ⁻⁹	2.48×10 ⁻⁹	<9	<9	Fe(0)	30	SBCW
S 13-4	8.9	6.55×10 ⁻⁹	7.9×10 ⁻⁹	13	14	Fe(0)	30	SBCW + Boom Clay HA
S 13-9	8.3	1.69×10 ⁻⁸	2.52×10 ⁻⁸	130	150	Fe(0)	30	SBCW + Boom Clay HA

A2.3 Sorption tests

A2.3.1 Uranium(VI)

SBCW: synthetic Boom Clay water; BCW: Boom Clay pore water; m_{pyrite} : mass of pyrite; C_0 : U(VI) concentration in the stock solution; V_{residual} : volume of the residual solution left from the third wash; V_0 : volume of the U(VI) stock solution; V_{tot} : total volume of solution; C_f : concentration of uranium remaining in solution after contact with pyrite; 0.22 μm : concentration measured after filtration at 0.22 μm ; 2 nm: concentration measured after filtration at 2 nm.

Samples	Solution	Time days	pH	E_h mV	m_{pyrite} g	C_0 $\text{mol}\cdot\text{l}^{-1}$	V_{residual} ml	V_0 ml	V_{tot} ml	Solution/solid ratio $\text{ml}\cdot\text{g}^{-1}$	C_f 0.22 μm $\text{mol}\cdot\text{l}^{-1}$	C_f 2nm $\text{mol}\cdot\text{l}^{-1}$
Blank	SBCW	32	8.2	—	—	9.45×10^{-6}	—	10.008	10.008	—	—	9.29×10^{-6}
Sp 1-1	SBCW	1	8.2	-192	0.513	9.09×10^{-6}	0.398	9.500	9.898	19.29	1.71×10^{-6}	1.63×10^{-6}
Sp 1-2	SBCW	4	8.3	-194	0.502	9.09×10^{-6}	0.506	9.351	9.857	19.64	3.82×10^{-7}	3.57×10^{-7}
Sp 1-3	SBCW	8	8.5	-228	0.509	9.09×10^{-6}	0.589	9.518	10.107	19.86	7.98×10^{-8}	8.15×10^{-8}
Sp 1-4	SBCW	16	8.6	-245	0.518	9.09×10^{-6}	0.598	9.386	9.984	19.27	4.71×10^{-8}	4.08×10^{-8}
Sp 1-5	SBCW	32	8.8	-250	0.503	9.09×10^{-6}	0.648	9.353	10.001	19.88	1.18×10^{-7}	1.03×10^{-7}
Sp 1-6	SBCW	46	9.0	-245	0.512	9.24×10^{-4}	0.689	9.500	10.189	19.90	2.38×10^{-7}	2.28×10^{-7}
Blank	BCW	32	8.2	—	—	9.87×10^{-6}	—	9.950	9.950	—	—	9.20×10^{-6}
Sp 2-1	BCW	1	8.2	-219	0.511	9.44×10^{-6}	0.534	9.460	9.994	19.56	4.50×10^{-6}	4.24×10^{-6}
Sp 2-2	BCW	4	8.3	-238	0.508	9.44×10^{-6}	0.740	9.471	10.211	20.10	5.25×10^{-7}	4.83×10^{-7}
Sp 2-3	BCW	8	8.7	-287	0.505	9.44×10^{-6}	0.280	9.403	9.683	19.17	3.70×10^{-7}	2.65×10^{-7}
Sp 2-4	BCW	16	9.1	-317	0.501	9.44×10^{-6}	0.650	9.409	10.059	20.08	3.36×10^{-7}	1.44×10^{-7}
Sp 2-5	BCW	32	9.3	-325	0.510	9.44×10^{-6}	0.681	9.426	10.107	19.82	3.49×10^{-7}	6.97×10^{-8}
Sp 2-6	BCW	46	9.5	-356	0.505	9.26×10^{-4}	0.702	9.506	10.208	20.21	6.26×10^{-7}	1.84×10^{-7}

A2.3.2 Uranium(IV)

BCW: Boom Clay pore water; wet m_{minerals} : wet mass of mineral; H_2O : moisture content; dried m_{minerals} : dried mass of mineral; C_0 : uranium concentration in the stock solution; V_{residual} : volume of the residual solution left from the third wash; V_0 : volume of the U(IV) stock solution; V_{tot} : total volume of solution; C_f : concentration of uranium remaining in solution after sorption on mineral; $0.22 \mu\text{m}$: concentration measured after filtration at $0.22 \mu\text{m}$.

Samples	minerals	Solution	Time days	pH	Wet m_{minerals} g	H_2O wt. %	Dried m_{minerals} g	C_0 $\text{mol}\cdot\text{l}^{-1}$	V_{residual} ml	V_0 ml	V_{tot} ml	Solution/solid ratio $\text{ml}\cdot\text{g}^{-1}$	C_f $0.22 \mu\text{m}$ $\text{mol}\cdot\text{l}^{-1}$
Blank	—	BCW	10	8.1	—	—	—	2.87×10^{-7}	—	8.983	8.983	—	1.62×10^{-7}
Sp 4-1	kaolinite	BCW	10	8.2	0.509	0.39	0.507	2.87×10^{-7}	0.735	8.954	9.689	19.11	2.50×10^{-8}
Sp 4-2	kaolinite	BCW	10	8.1	0.503	1.87	0.501	2.87×10^{-7}	0.538	8.954	9.492	18.94	8.85×10^{-8}
Sp 4-3	illite	BCW	10	8.1	0.515	4.61	0.505	2.87×10^{-7}	0.468	8.959	9.427	18.65	1.09×10^{-8}
Sp 4-4	illite	BCW	10	8.1	0.524	0.20	0.514	2.87×10^{-7}	0.461	8.934	9.395	18.27	9.07×10^{-9}
Sp 4-5	montmorillonite	BCW	10	7.7	0.508	0.03	0.485	2.87×10^{-7}	4.933	8.856	13.789	28.45	3.41×10^{-7}
Sp 4-6	montmorillonite	BCW	10	7.7	0.512	0.06	0.488	2.87×10^{-7}	4.698	8.932	13.630	27.91	1.39×10^{-7}
Sp 4-7	illite-smectie m.l. [§]	BCW	10	8.0	0.499	0.03	0.485	2.87×10^{-7}	1.110	8.940	10.050	20.72	7.21×10^{-9}
Sp 4-8	illite-smectie m.l. [§]	BCW	10	7.9	0.527	0.03	0.512	2.87×10^{-7}	0.914	8.891	9.805	19.14	6.89×10^{-9}
Sp 4-9	ripidolite	BCW	10	8.2	0.514	0.20	0.513	2.87×10^{-7}	1.356	8.849	10.205	19.89	1.17×10^{-8}
Sp 4-10	ripidolite	BCW	10	8.3	0.500	0.03	0.499	2.87×10^{-7}	1.043	8.816	9.859	19.76	1.47×10^{-8}
Sp 4-11	rutile	BCW	10	8.1	0.512	0.03	0.512	2.87×10^{-7}	0.519	8.725	9.244	18.06	1.23×10^{-7}
Sp 4-12	rutile	BCW	10	8.1	0.509	0.03	0.509	2.87×10^{-7}	0.317	8.595	8.912	17.51	1.43×10^{-7}
Sp 4-13	Ca-carbonate	BCW	10	8.2	0.508	0.06	0.508	2.87×10^{-7}	0.448	8.364	8.812	17.36	3.58×10^{-8}
Sp 4-14	Ca-carbonate	BCW	10	8.2	0.524	0.06	0.524	2.87×10^{-7}	0.473	7.638	8.111	15.49	2.59×10^{-8}
Sp 4-15	apatite	BCW	10	8.3	0.515	0.03	0.515	2.87×10^{-7}	0.397	9.014	9.411	18.28	6.17×10^{-8}
Sp 4-16	apatite	BCW	10	8.3	0.527	0.03	0.527	2.87×10^{-7}	0.770	8.948	9.718	18.45	6.19×10^{-8}
Sp 4-17	pyrite (Boom Clay)	BCW	10	8.2	0.506	—	0.506	2.87×10^{-7}	0.473	9.043	9.516	18.81	7.92×10^{-8}
Sp 4-18	pyrite (Boom Clay)	BCW	10	8.1	0.518	—	0.518	2.87×10^{-7}	0.262	8.983	9.245	17.85	8.25×10^{-8}

§: mixed layer