

## **Electronic Supplementary Material**

**ESM – 1: Ground and aerial photos of lake stage development in Western Siberia.**

**ESM – 2: Element concentration in various filtrates and dialysates.**

**ESM – 3: Correlations between element concentrations in  $< 0.45 \mu\text{m}$  fraction.**

**ESM – 4: Filtration and dialysis pattern of various samples**

**ESM –5: Cartoon of three types of trace element association with organo-mineral colloids and their evolution during bacterioplankton consumption of the organic matter.**

**ESM – 1: Photos of lake stage development in Western Siberia**

**First, a crack in lichen coverage on the surface of frozen mound**



**2<sup>nd</sup> step, the palsa depression is being filled by thawed water**



**Fresh thermokarst depression: dwarf shrubs submerged into water**



**The border of small thermokarst lake; some dwarf shrubs are still alive  
(photo of S.N. Kirpotin)**



**Third stage of cyclic succession of permafrost degradation: round thermokarst lake** (photo S.N. Kirpotin)



**Khasyrey: drained lake**  
(4th stage of cyclic succession - photo S.N. Kirpotin)



## Khasyrey: drained lake



(photo S.N. Kirpotin)

**ESM – 2: Trace element concentration in various filtrates and dialysates (µg/L)**

	U-1 5µm	U-1 0.45µm	U-1 10kDa	U-1 1kDa	U-2 0.45 µm
<b>DOC</b>	<b>11.5</b>	<b>10.6</b>	<b>4.42</b>	<b>3.58</b>	<b>10.66</b>
<b>Na</b>	531	529.1	425.6	342.6	528.5
<b>Mg</b>	353.9	352.3	184.7	122.1	365.1
<b>Al</b>	137.8	69.25	35.22	21.69	84.43
<b>Si</b>	281	277	270	275	285
<b>K</b>	183.2	180.4	170.4	130.6	185.2
<b>Ca</b>	546.1	536.9	280.5	194.2	576.9
<b>Ti</b>	3.588	0.6084	0.2255	0.08955	0.6408
<b>V</b>	0.5099	0.1754	0.1729	0.17234	0.2415
<b>Cr</b>	0.388	0.2829	0.2235	0.1453	0.3091
<b>Mn</b>	47.9	47.64	25.24	17.1	49.14
<b>Fe</b>	388.6	227	35.63	25.67	224.4
<b>Co</b>	0.725	0.7205	0.3971	0.2412	0.7926
<b>Ni</b>	0.8067	0.7148	0.4059	0.2435	0.8822
<b>Cu</b>	0.5335	0.4223	0.3869	0.2058	0.3996
<b>Zn</b>	6.633	6.143	5.242	4.357	16.36
<b>Ga</b>	0.02405	0.005712	0.002482	0.001219	0.006561
<b>Ge</b>	0.003726	0.001372	0.003356	0.002542	0.0007896
<b>As</b>	0.7112	0.7305	0.71637	0.6346	0.5078
<b>Rb</b>	0.5628	0.482	0.359	0.2834	0.5116
<b>Sr</b>	5.535	5.519	2.909	1.956	5.834
<b>Y</b>	0.06964	0.04143	0.01475	0.007513	0.06003
<b>Zr</b>	0.2035	0.08659	0.0191	0.01391	0.1018
<b>Mo</b>	0.04259	0.04257	0.03519	0.03364	0.01992
<b>Cd</b>	0.01422	0.01378	0.014073	0.008017	0.02309
<b>Sb</b>	0.05653	0.0494	0.047324	0.04674	0.05553
<b>Cs</b>	0.006681	0.00164	0.001967	0.001013	0.001391
<b>Ba</b>	2.28	1.703	1.104	1.079	4.436
<b>La</b>	0.07396	0.03308	0.01504	0.004139	0.04951
<b>Ce</b>	0.1923	0.09071	0.0322	0.01195	0.1281
<b>Pr</b>	0.01823	0.01173	0.004832	0.001427	0.01503
<b>Nd</b>	0.0838	0.04667	0.01669	0.007916	0.06115
<b>Sm</b>	0.01647	0.01356	0.003707	0.001617	0.01502
<b>Eu</b>	0.004066	0.002889	0.001607	0.0004809	0.00422
<b>Gd</b>	0.02094	0.01159	0.004879	0.003519	0.0159
<b>Th</b>	0.002799	0.001704	0.000411	0.0002092	0.001922
<b>Dy</b>	0.01423	0.007772	0.0031	0.0006583	0.01366
<b>Ho</b>	0.003538	0.001956	0.0008754	0.0003287	0.002082
<b>Er</b>	0.007973	0.00506	0.001841	0.0007676	0.00711
<b>Tm</b>	0.0008841	0.0003062	0.0004091	< d.l.	0.0007221
<b>Yb</b>	0.007879	0.005497	0.001359	0.001011	0.004964
<b>Lu</b>	0.001288	0.0006651	0.0002946	0.0001032	0.0007939
<b>Hf</b>	0.009866	0.003801	0.0003229	0.0001488	0.002454
<b>Pb</b>	0.154	0.098888	0.09482	0.03727	0.2235
<b>Bi</b>	0.004257	0.002016	0.001056	0.0003424	0.003815
<b>Th</b>	0.02408	0.008678	0.0006394	< d.l.	0.006771
<b>U</b>	0.01034	0.006007	0.004623	0.002419	0.006372

<b>U-2 10kDa</b>	<b>U-2 1kDa</b>	<b>U-3 5µm</b>	<b>U-3 0.45 µm</b>	<b>U-3 10kDa</b>	<b>U-3 1kDa</b>
<b>4.68</b>	<b>3.67</b>	<b>14.89</b>	<b>13.97</b>	<b>4.436</b>	<b>3.104</b>
458.1	1139	478.9	467	463	370
211.3	422.1	382.5	374.3	208.2	164.6
31.88	69.25	193.5	128.7	28.01	16.82
277	232	634	641	612	605
225.9	480.9	54.98	36.83	29.5	21.2
386.4	652.1	773.5	773	448.8	331
0.12	0.2001	4.242	1.62	0.1268	0.09685
0.1569	0.5936	0.753	0.3614	0.1085	0.0949
0.1556	0.5572	0.8135	0.7306	0.2291	0.147
28.8	61.16	46.99	46.89	23.68	18.88
67.85	68.82	1347	767.8	32.53	14.6
0.4462	0.9826	1.055	1.024	0.4408	0.3556
0.4475	0.8781	1.852	1.661	0.6749	0.486
0.3445	0.4719	0.794	0.76558	0.7427	0.4869
15.33	12.84	6.984	7.507	6.0	5.1
0.002659	0.004599	0.02952	0.01002	0.001724	0.002047
0.002874	0.02232	0.005759	0.002047	0.001544	0.003591
0.7974	2.466	1.342	1.169	0.8649	0.7743
0.4376	0.9463	0.257	0.24397	0.2342	0.22552
3.656	3.716	7.264	7.046	3.916	2.987
0.01283	0.009984	0.3061	0.2544	0.02517	0.01207
0.01712	0.0623	0.477	0.3745	0.03022	0.01411
0.012701	0.01131	0.02023	0.01368	0.013404	0.0131
0.02469	0.02732	0.01496	0.01646	0.013121	0.012328
0.06896	0.2217	0.04042	0.0372	0.06535	0.03883
0.001884	0.005135	0.005321	0.001097	0.002102	0.001224
2.848	3.805	4.684	4.072	2.211	1.594
0.007882	0.003285	0.2382	0.1784	0.0134	0.005658
0.02099	0.007686	0.6426	0.4888	0.03889	0.01774
0.003067	0.001569	0.07705	0.05897	0.005386	0.002288
0.01272	0.006283	0.3301	0.2508	0.02651	0.01257
0.001489	0.003992	0.06925	0.05784	0.00632	0.001937
0.001206	0.001227	0.01637	0.01655	0.001164	0.0004854
0.003151	0.002866	0.08079	0.06593	0.007093	0.002483
0.0005077	0.0002275	0.01132	0.008668	0.0007543	0.0002265
0.001795	0.003386	0.05977	0.0481	0.004438	0.002403
0.0004793	0.0005476	0.01217	0.009941	0.001119	0.0003715
0.001168	0.002696	0.03614	0.03332	0.003244	0.001067
9.26E-05	0.0005005	0.005586	0.004	0.0001964	0.0001677
0.001245	0.0008663	0.03193	0.02986	0.002849	0.001956
0.000338	0.0003712	0.005811	0.004285	0.0004854	0.0002781
0.001644	0.0006473	0.01647	0.01088	0.000458	0.0006833
0.04811	0.0916	0.2161	0.1388	0.04677	0.02386
0.003265	< d.l.	0.005141	0.001717	0.02021	0.0001084
< d.l.	0.002014	0.05724	0.03896	0.00102	0.0005463
0.003265	0.005283	0.018	0.01341	0.002349	0.001297

U-4 5µm	U-4 0.45µm	U-4 10kDa	U-4 1kDa	U-5 5µm
<b>32.1</b>	<b>29.8</b>	<b>9.35</b>	<b>8.06</b>	<b>79.9</b>
215.5	207.6	158.5	113.4	186.3
145.8	144.2	58.82	40.35	892.5
135	108.3	34.33	22.96	366.5
132	126	122	128	1710
9.942	16.03	N.D.	N.D.	1052
360.6	357.6	162.6	114.9	2055
1.626	0.8341	0.152	0.117	6.209
0.2465	0.1712	0.2138	0.2157	1.254
0.4594	0.3769	0.2903	0.326	1.915
14.21	14.77	5.145	3.579	405.9
677.9	525.8	66.91	44.07	4775
0.3907	0.3768	0.124	0.07019	2.231
0.7599	0.9809	0.2682	0.1694	3.455
0.2882	0.2444	0.20511	0.2007	1.906
2.776	2.95	2.4192	3.725	38.01
0.0235	0.01339	0.004914	0.002988	0.06999
0.001759	0.0012	0.0007	<d.l.	0.0052
0.7309	0.6743	0.5256	0.4579	4.711
0.05629	0.04881	0.05103	0.02679	3.585
2.106	2.084	0.9698	0.568	14.96
0.06473	0.04061	0.003928	0.002169	0.2478
0.1797	0.1356	0.01653	0.01075	1.236
0.009566	0.007708	0.0162	0.002431	0.05152
0.02189	0.02644	0.02285	0.008245	0.1866
0.03315	0.03544	0.03583	0.02824	0.072
0.002701	0.001389	0.001088	0.0007516	0.03267
2.82	2.95	0.8598	0.6071	18.17
0.03483	0.0247	0.006428	0.002723	0.1421
0.1162	0.07178	0.006049	0.003791	0.403
0.01379	0.009163	0.0008399	0.0006463	0.04814
0.05883	0.03931	0.004232	0.003018	0.214
0.01548	0.01212	<d.l.	0.0002857	0.04604
0.004195	0.002188	0.0004111	<d.l.	0.01367
0.01553	0.01175	0.001422	0.0008275	0.04894
0.001785	0.00159	1.58E-05	<d.l.	0.008334
0.01442	0.01044	0.0009632	0.0004524	0.04404
0.002882	0.001898	0.0001258	7.58E-05	0.009518
0.00846	0.006334	0.0003513	0.000291	0.02999
0.0007875	0.0007852	<d.l.	<d.l.	0.004572
0.006954	0.003753	0.0005497	0.0001205	0.0261
0.001208	0.0006912	0.0001219	-7.21E-06	0.003989
0.005486	0.005317	0.0016	0.0006921	0.04266
0.209	0.193	0.07292	0.03138	1.605
0.003978	0.00187	0.002908	0.0005626	0.02487
0.01663	0.01082	0.0001108	-0.0001573	0.139
0.005852	0.00441	0.0005757	0.0005049	0.01664

U-5 0.45µm	U-5 10kDa	U-5 1kDa	U-6 5µm	U-6 0.45µm
75.9	18.0	12.1	127.4	118.6
176	123.8	118.7	1437	1432
819.9	334.4	262.1	2136	2004
300.3	71.65	47.07	1163	937
1660	1650	1620	689	681
987.6	617.6	632.1	1099	1082
1875	827.8	613.3	6836	6343
3.953	0.7864	0.5771	35	24
0.7779	0.6484	0.6285	7.32	5.57
1.689	0.6795	0.5745	6.47	6.47
374.1	133.1	108.7	413	386
3430	651.3	450.5	15254	13444
2.008	0.6807	0.5217	8.1867	7.4851
3.088	1.03	0.7307	15.8450	14.6893
1.412	0.5566	0.4421	7.8601	5.9149
35.68	17.06	13.21	16.1862	15.2655
0.05785	0.01513	0.009782	0.2105	0.1599
0.0045	0.0026	0.0017	0.0616	0.053
4.216	3.542	3.579	29.1947	26.5413
3.384	2.091	1.878	3.4474	3.4433
13.59	5.626	4.154	49.3183	45.3315
0.1996	0.0214	0.009748	1.7030	1.4867
1.09	0.1522	0.07378	4.7190	4.2708
0.04516	0.0418	0.04168	0.2145	0.1428
0.1504	0.1351	0.05814	0.1220	0.1182
0.06621	0.04737	0.04292	0.1720	0.1703
0.02895	0.01807	0.01523	0.0325	0.0245
15.62	5.471	4.098	31.0551	28.9205
0.1158	0.01175	0.00429	1.5559	1.1749
0.3179	0.03052	0.01394	3.7392	3.0243
0.04008	0.004421	0.001648	0.4425	0.3494
0.1759	0.01934	0.009261	1.7804	1.4113
0.03792	0.003401	0.002982	0.3652	0.3646
0.01074	0.00259	0.0009035	0.1033	0.0851
0.0444	0.006272	0.002547	0.4451	0.3828
0.0067	0.0006641	0.0002041	0.0581	0.0473
0.03986	0.00398	0.001028	0.3243	0.3007
0.008227	0.0009593	0.000464	0.0652	0.0563
0.02304	0.002829	0.001643	0.1878	0.1579
0.003703	0.0001448	0.0003203	0.0282	0.0257
0.02874	0.003648	0.001381	0.1723	0.1641
0.00458	0.0004403	0.000189	0.0278	0.0263
0.03935	0.007548	0.002453	0.1393	0.1139
2.926	0.1634	0.0994	3.7457	3.6631
0.0145	0.005504	0.009865	0.0505	0.0437
0.1085	0.007793	0.002769	0.5090	0.4677
0.01502	0.001981	0.001263	0.1141	0.1026

<b>U-6 10kDa</b>	<b>U-6 1kDa</b>	<b>U-7 5µm</b>	<b>U-7 0.45µm</b>	<b>U-8 5µm</b>	<b>U-9 0.45µm</b>
<b>34.1</b>	<b>25.3</b>	<b>10.4</b>	<b>10.5</b>	<b>21.9</b>	<b>33.93</b>
898.5	754.5	537.1	582.7	536.8	318
967.2	701.2	350.1	364.2	356.3	95.01
135.7	88.53	130.2	71.21	152	142.5
651	646	296	291	577	759
434.5	468.3	185.2	173	182.2	72.14
2839	2317	541	547.6	612.9	247.5
1.8	1.6	3.203	0.4177	4.454	2.142
1.31	1.16	0.4908	0.1276	0.6134	0.7075
1.12	0.81	0.3579	0.2782	0.4516	0.4284
167	121	49.23	52.95	47.53	12.17
1458	1333	387.2	186.1	432.8	465.8
2.584	1.871	0.808	0.8273	0.7637	0.1195
4.164	3.053	0.821	0.8132	0.9628	0.8332
0.9451	0.7175	0.5148	0.4395	1.679	0.5983
14.14	13.14	7.988	8.449	18.21	3.317
0.0193	0.01546	0.02132	0.00577	0.02711	0.03053
0.035	0.033	0.005	0.005	0.005	0.001
14.73	14.73	0.5724	0.5548	0.6071	0.7609
1.554	1.505	0.5231	0.4255	0.5383	0.4177
19.43	14.96	5.683	5.556	5.934	2.113
0.1585	0.08815	0.07003	0.0336	0.0745	0.04659
0.2794	0.1784	0.167	0.09729	0.234	0.2016
0.006346	0.02758	0.04922	0.02104	0.04579	0.01214
0.032	0.03963	0.01444	0.01419	0.01578	0.009435
0.08498	0.08348	0.0537	0.05008	0.06184	0.02526
0.01296	0.01252	0.005956	0.001213	0.006938	0.01825
10.1	7.847	2.13	2.556	2.761	1.852
0.07269	0.03664	0.0756	0.02475	0.07261	0.04007
0.2308	0.1343	0.1948	0.06756	0.1862	0.1006
0.0322	0.01939	0.02403	0.008744	0.0199	0.01163
0.1555	0.1063	0.08842	0.0392	0.08059	0.04876
0.03704	0.02831	0.01968	0.009184	0.01957	0.01067
0.009548	0.006251	0.004627	0.002266	0.004665	0.002359
0.04495	0.02354	0.02161	0.0112	0.01629	0.01262
0.004666	0.002494	0.003341	0.001144	0.002749	0.0009272
0.02792	0.01688	0.01716	0.009285	0.01869	0.009319
0.006656	0.003644	0.003117	0.001333	0.002685	0.00182
0.0207	0.01336	0.008044	0.003356	0.007757	0.004528
0.002918	0.001847	0.000865	0.0003945	0.001103	0.0007661
0.02438	0.01106	0.00779	0.003873	0.007966	0.003943
0.003846	0.002971	0.001087	0.000951	0.00102	0.0006954
0.01168	0.006719	0.005571	0.004121	0.009429	0.005437
0.1007	0.05239	0.8954	0.1591	9.986	0.7127
0.003838	0.001711	0.003971	0.0005425	0.005754	0.004778
0.01429	0.008535	0.01879	0.008844	0.02485	0.01914
0.01786	0.009481	0.009086	0.006079	0.009925	0.005836

U-9 10kDa	U-9 3.5kDa	U-9 1 kDa	U-10 0.45µm	U-11 0.5m	U-11 1.25m
<b>6.38</b>	<b>7.01</b>	<b>5.517</b>	<b>31.32</b>	<b>10.2</b>	<b>10.2</b>
160.8	277	138.5	324.1	350.2	354.3
18.44	24.86	12.43	99.7	287.2	288
9.727	12.538	6.269	152.4	63.34	64.53
707	711.000	738.900	464	205	189
42.49	69.06	34.53	109.9	135.4	132.9
86.95	89.44	44.72	278.1	421.3	433.5
0.07554	0.13678	0.06839	2.272	0.3765	0.4085
0.7698	1.386	0.693	0.5825	0.1899	0.1884
0.08884	0.12862	0.06431	0.4783	0.3102	0.2969
1.999	2.396	1.198	15.22	23.02	23.93
6.71	6.926	3.463	487.2	99.59	102.9
< d.l.	-0.03176	-0.01588	0.1812	0.4678	0.4823
0.2001	0.2268	0.1134	0.6969	1.085	1.01
0.2474	0.2662	0.1331	2.536	0.6579	1.581
2.567	2.166	2.083	7.199	7.072	6.8985
0.001873	0.003194	0.001597	0.03115	0.002217	0.004606
0.001	0.001	0.001	0.001	0.002	0.002
0.5329	0.93	0.465	0.8357	0.6189	0.6082
0.1846	0.3026	0.1513	0.4475	0.169	0.173
0.6749	0.5804	0.2902	2.306	3.314	3.331
0.001745	0.0012306	0.0006153	0.04913	0.065	0.06564
0.00676	0.01019	0.005095	0.2038	0.1849	0.1595
0.02365	0.05452	0.02726	0.04287	0.01703	0.04948
0.007301	0.002942	0.001471	0.01629	0.005784	0.007564
0.03196	0.06004	0.03002	0.04555	0.04141	0.04521
0.006188	0.013576	0.006788	0.01672	0.0004157	0.0001819
0.2769	0.3322	0.1661	2.366	1.791	1.792
0.001527	0.005682	0.002841	0.0493	0.05088	0.04503
0.001944	0.0016922	0.0008461	0.1166	0.1313	0.1361
0.0003	0.0002872	0.0001436	0.0131	0.01601	0.01586
0.0002207	0.000901	0.0004505	0.05079	0.07477	0.06345
0.0003011	#VALEUR!	<d.l.	0.009883	0.01718	0.01575
5.90E-05	3.20E-05	1.60E-05	0.003595	0.003544	0.004004
0.0004257	#VALEUR!	<d.l.	0.01253	0.01546	0.016
<d.l.	2.01E-05	1.01E-05	0.001784	0.002544	0.002126
<d.l.	0.000261	0.0001305	0.00957	0.01601	0.01662
1.96E-05	1.40E-04	6.98E-05	0.002231	0.002187	0.002385
0.0002917	#VALEUR!	<d.l.	0.00468	0.008025	0.008284
<d.l.	#VALEUR!	<d.l.	0.0008327	0.000878	0.001135
3.54E-06	2.04E-06	1.02E-06	0.00449	0.008134	0.008635
2.42E-05	<d.l.	<d.l.	0.0007728	0.001298	0.001195
0.0004309	0.0011832	0.0005916	0.009008	0.005157	0.006045
0.02076	0.02348	0.01174	0.7335	0.1014	0.3457
0.01292	0.000358	0.000179	0.003406	0.0005104	0.0007138
0.0002369	0.0005716	0.0002858	0.0176	0.0176	0.01482
0.0007415	0.0010778	0.0005389	0.007117	0.009507	0.009607

<b>U-11 surface</b>	<b>U-12 5µm</b>	<b>U-12 0.45µm</b>	<b>U-12 10kDa</b>	<b>U-12 3.5kDa</b>
<b>10.3</b>	<b>41.94</b>	<b>11.57</b>	<b>4.116</b>	<b>2.87</b>
374.6	660.6	660.5	436.6	420
293	356.3	334.1	155	130.3
63.35	203.1	78.55	13.69	10.39
193	188	182.8	194	181
148.4	176	155.5	109.5	102.7
407	548.9	513.9	300	218.9
0.38879	6.118	0.4579	0.336	0.01019
0.2093	0.9311	0.2437	0.23978	0.23546
0.3835	1.058	0.4305	0.2137	0.174
24.82	26.03	25.86	11.55	9.532
104.8	439	107.6	4.267	2.68
0.4804	0.3806	0.3163	0.08994	0.05478
1.143	48.52	0.8008	0.7078	0.1953
0.8067	0.829	0.7329	0.4202	0.2151
5.258	4.946	5.59	5.153	3.208
0.004115	0.03042	0.003245	0.001544	0.001169
0.000	0.002	0.000	<d.l.	<d.l.
0.7147	0.7984	0.75	0.5601	0.5888
0.1882	0.307	0.1832	0.1422	0.1396
3.361	4.548	4.451	2.322	1.973
0.07728	0.1194	0.07521	0.008763	0.005652
0.2176	0.3201	0.2053	0.01551	0.008469
0.0143	0.02317	0.01765	0.0162023	0.015804
0.008341	0.01055	0.009237	0.007843	0.008232
0.04725	0.0732	0.07768	0.069657	0.071047
0.0006535	0.007233	0.0004849	0.0001756	0.00014068
2.071	3.78	2.838	1.215	0.9565
0.06075	0.1145	0.05513	0.006185	0.003021
0.1614	0.2723	0.1476	0.01427	0.009021
0.0194	0.06145	0.01818	0.002241	0.001439
0.09158	0.1431	0.08476	0.01198	0.004893
0.02344	0.03234	0.01558	0.002405	0.001043
0.004398	0.007094	0.004421	0.0003102	0.0001475
0.02416	0.03673	0.02019	0.001699	0.002809
0.002878	0.003991	0.002985	0.0005094	0.0001109
0.01745	0.02925	0.0158	0.002098	0.0003437
0.003046	0.006352	0.003158	0.0005826	0.0003212
0.009849	0.01523	0.009894	0.00203	0.000858
0.001285	0.002034	0.001318	0.0001127	0.0001793
0.00828	0.01339	0.009724	0.001584	0.0008465
0.001377	0.002317	0.001666	0.0001201	0.000253
0.006797	0.01091	0.008021	-0.000159	0.0002354
0.1124	0.1807	0.09529	0.0374	0.01523
0.0003596	0.004263	0.0007687	0.0002415	0.0009086
0.01639	0.027	0.01748	0.0002026	0.0001978
0.008801	0.01203	0.00723	0.002481	0.001064

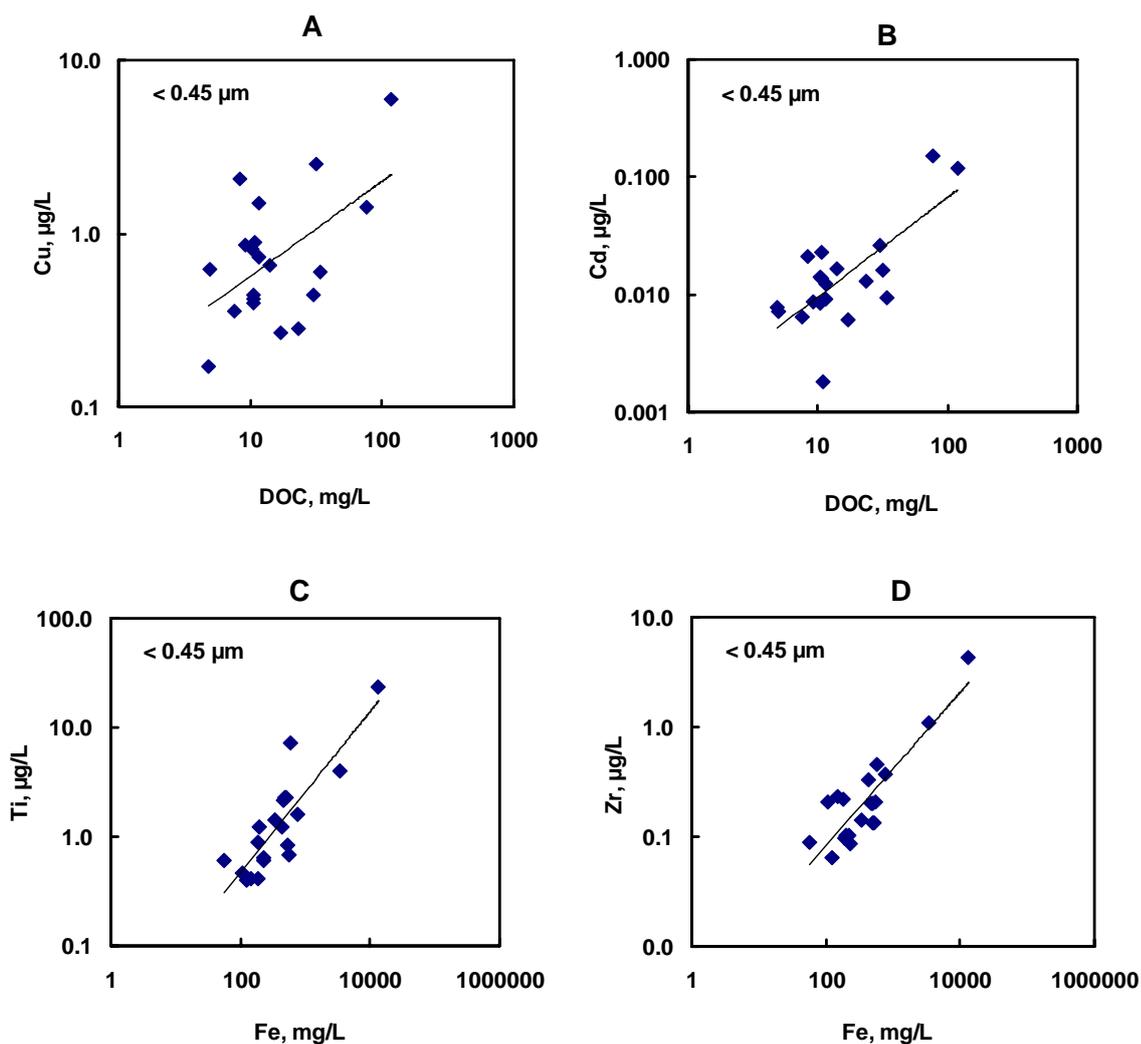
U-13 1.25 m	U-13 1.5 m	U-13 5µm	U-13 0.45µm	U-13 10kDa
<b>8.82</b>	<b>9.19</b>	<b>10.94</b>	<b>7.58</b>	<b>1.9</b>
181.9	181.9	160.9	147	137.1
289.6	281.2	298.2	301.9	120.4
41.68	37.55	66.31	47.3	4.338
230	206	215	221	206
54.78	355.7	14.58	11.35	28.32
356.9	397.8	386.9	361.7	154.4
0.2082	0.2707	1.195	0.398	0.02954
0.1067	0.2064	0.2288	0.1252	0.0558
0.1614	0.1698	0.2149	0.1494	0.06683
5.895	11.34	6.69	6.6802	2.503
87.12	98.63	280	92.7	1.425
0.04871	0.1622	0.1009	0.10043	0.01052
0.6258	0.5778	0.7185	0.6333	0.166
0.4564	0.425	0.389	0.3562	0.3336
7.812	9.848	7.37	6.022	3.341
0.001695	0.001986	0.006923	0.002377	8.07E-05
<d.l.	<d.l.	<d.l.	0.000	0.000
0.4557	0.4979	0.4658	0.466779	0.3116
0.05041	0.2432	0.05668	0.03825	0.04824
2.897	3.134	2.957	2.946	1.276
0.0294	0.02967	0.05554	0.03472	0.0009649
0.0596	0.06811	0.0907	0.06553	0.001482
0.006311	0.03358	0.005961	0.003657	0.002536
0.01082	0.01331	0.02207	0.006354	0.01285
0.0344	0.05518	0.052223	0.024341	0.02429
0.0004596	0.001355	0.0006329	0.0005057	0.0002639
1.089	1.047	1.229	1.08	0.4405
0.02388	0.02414	0.0459	0.02813	0.001894
0.06016	0.06022	0.1194	0.074	0.001705
0.007384	0.008356	0.01392	0.009228	0.0001766
0.03407	0.0373	0.0704	0.03396	0.00119
0.007106	0.005658	0.01284	0.009159	0.0003801
0.001448	0.001519	0.004043	0.002139	4.51E-05
0.008231	0.008138	0.01671	0.009324	0.0004437
0.001234	0.001102	0.002055	0.001214	6.49E-05
0.005715	0.006616	0.01097	0.005696	<d.l.
0.001081	0.001231	0.002252	0.00133	0.0001559
0.0039	0.003737	0.006152	0.003467	<d.l.
0.0003978	0.00061	0.0006609	0.0005338	<d.l.
0.004246	0.002896	0.004938	0.003679	<d.l.
0.0003831	0.0005123	0.0008391	0.0004795	<d.l.
0.001915	0.001119	0.00313	0.001329	0.0008068
0.08553	0.12752	0.08389	0.1002	0.02
0.0000665	0.000545	0.002094	2.55E-06	0.0003218
0.00549	0.004867	0.01214	0.007699	7.75E-05
0.00426	0.004333	0.005179	0.0042663	0.0004358

U-13 3.5kDa	U-13 3.5kDa in-situ	U-14 0.45µm	U-15 0.45µm	U-16 0.45 µm
1.59	2.48	4.91	8.41	11.62
98.47	109.7	230.6	492	397.5
104.8	125.7	136.3	362.9	374.6
3.175	4.607	43.49	239.4	119.1
210	222	122	114	38
12.91	23.76	49.4	264.7	216.6
138.1	166.1	336.5	1050	809.3
0.01853	0.01722	0.6098	7.161	1.241
0.05229	0.0743	0.2162	1.497	0.4209
0.01983	0.05649	0.1791	0.6641	0.5086
2.213	2.1305	9.054	18.18	52.17
1.013	1.378	56.96	584.7	437.6
0.004142	<d.l.	0.06441	0.3525	0.6703
0.1437	0.1745	0.6675	2.095	1.613
0.30672	0.2278	0.6194	2.056	1.495
3.213	4.659	2.398	6.316	6.467
0.0002296	0.0001686	0.004468	0.04573	0.009094
0.000	<d.l.	0.001	0.006	0.001
0.2804	0.3153	0.2761	0.8703	0.9398
0.02866	0.04601	0.09576	0.332	0.3194
1.17	1.337	2.434	6.713	5.614
0.0006074	0.001546	0.05813	0.482	0.2436
0.000222	0.002969	0.08952	0.455	0.3277
0.0025058	0.03902	0.01163	0.01113	0.06946
0.01123	0.00403	0.007257	0.02102	0.0123
0.01614	0.02612	0.04268	0.07326	0.0422
0.0001478	<d.l.	0.001255	0.01045	0.001068
0.3825	0.4322	1.84	4.4	3.604
0.0006109	0.002316	0.04569	0.3821	0.1849
0.0008634	0.002167	0.1216	0.9815	0.4975
1.83E-04	0.0003291	0.01601	0.1209	0.05872
0.0006192	0.001752	0.06779	0.5073	0.2575
0.0003395	0.0003312	0.01804	0.1106	0.05934
0.0001091	0.0002053	0.003479	0.02533	0.01325
0.0001632	0.0000876	0.01658	0.1189	0.06219
8.34E-05	5.33E-05	0.001631	0.0166	0.008589
<d.l.	0.0005416	0.01262	0.1031	0.04761
<d.l.	6.27E-05	0.002584	0.02011	0.009463
<d.l.	0.0003219	0.0076	0.05611	0.02602
-9.31E-05	1.58E-05	0.00114	0.008018	0.004048
0.0002122	<d.l.	0.006779	0.05153	0.02592
<d.l.	4.19E-05	0.001188	0.008157	0.004463
0.0004631	<d.l.	0.002698	0.01429	0.01146
0.01216	0.01068	0.05404	0.6502	0.142
0.0003106	<d.l.	<d.l.	0.004415	0.00149
0.0001229	<d.l.	0.01308	0.07851	0.04368
0.000234	0.0004799	0.007728	0.04055	0.01465

U-17 0.45µm	U-18 0.45 µm	U-19 0.45 µm	U-20 0.45 µm	U-21 0.45µm	U-21 10 kDa	U-21 3.5 kDa
10.87	17.09	4.86	9.11	23.44	7.13	6.03
8271	74.32	1306	703.2	449.4	491.4	166.1
1857	546.2	476.6	481.3	160.2	98.15	41
77.56	122.4	41.15	50.23	157.1	45.81	24.28
451	150	35	948	2350	2120	2150
386.4	20.91	185	133.3	9.315	105	10.46
2883	1534	1096	1045	457.3	311.9	134.2
2.277	0.6787	1.245	0.4097	1.412	0.8166	0.3463
0.9091	0.2502	0.1119	0.1209	0.2478	0.9676	0.3498
0.2431	0.4813	0.3887	0.3881	0.4004	0.5411	0.1481
19.85	8.738	77.03	49.26	16.87	9.123	3.472
508.6	560.5	197	147	339	15.89	15.62
0.2703	0.2309	0.755	0.6871	0.3992	0.1956	0.03175
1.044	1.936	1.008	1.911	0.8231	0.4702	0.2107
0.8866	0.2699	0.1712	0.856	0.2816	0.6474	0.3901
24.28	5.465	5.984	5.811	6.778	3.9001	3.287
0.0147	0.008918	0.01159	0.00708	0.0138	0.004602	0.001033
0.006	0.001	0.013	0.005	0.003	0.018	<d.l.
1.806	0.9404	0.5942	0.7002	0.5317	0.9652	0.3182
0.287	0.06388	0.2631	0.3415	0.02449	0.03873	0.0173
19.79	10.31	9.948	7.894	4.007	3.098	1.232
0.1644	0.1308	0.1121	0.2369	0.07967	0.001474	0.001705
0.1325	0.206	0.1031	0.2295	0.1407	0.02715	0.01088
0.07512	0.01001	0.009603	0.01327	0.001493	0.1222	0.01651
0.001793	0.00618	0.007847	0.008726	0.01281	0.03084	0.01313
0.03487	0.01934	0.0181	0.02927	0.02091	0.04955	0.0197
0.003947	0.0003172	0.0007281	0.0005583	0.0001222	0.002889	<d.l.
3.941	2.031	3.822	2.46	3.914	2.977	1.224
0.1757	0.08221	0.06279	0.1422	0.0618	0.0006366	0.001743
0.3712	0.2194	0.1814	0.3799	0.1475	0.001212	0.003387
0.04571	0.02756	0.02166	0.04724	0.01828	0.0002269	0.0003745
0.1962	0.1152	0.09669	0.2132	0.07476	0.0009252	0.002071
0.04094	0.02173	0.01928	0.04856	0.01358	0.0005385	<d.l.
0.01028	0.00719	0.005186	0.01304	0.004	0.0007152	0.0001832
0.04366	0.03367	0.02182	0.06006	0.01588	<d.l.	0.001312
0.005191	0.003654	0.003663	0.006874	0.002655	<d.l.	<d.l.
0.03336	0.02238	0.01957	0.04284	0.01478	0.0009518	0.0003594
0.00612	0.004586	0.003556	0.008551	0.002681	9.09E-05	9.63E-06
0.01807	0.01435	0.01214	0.02423	0.007887	0.0004237	0.0001447
0.001795	0.001947	0.001435	0.004002	0.0007513	0.000229	-8.92E-05
0.01625	0.0147	0.01222	0.02387	0.007462	0.0004801	0.0002487
0.002033	0.002507	0.002254	0.004084	0.0006008	8.79E-05	4.83E-05
0.005161	0.005818	0.003517	0.006415	0.004786	<d.l.	<d.l.
0.135	0.1333	0.03842	0.03695	0.29	0.07497	0.02236
0.001431	0.001843	0.0002531	0.0003514	0.002015	0.001275	0.0001269
0.0249	0.01728	0.01235	0.025	0.01215	0.0001681	5.95E-05
0.01593	0.002635	0.004114	0.01119	0.004649	0.001775	0.0008385

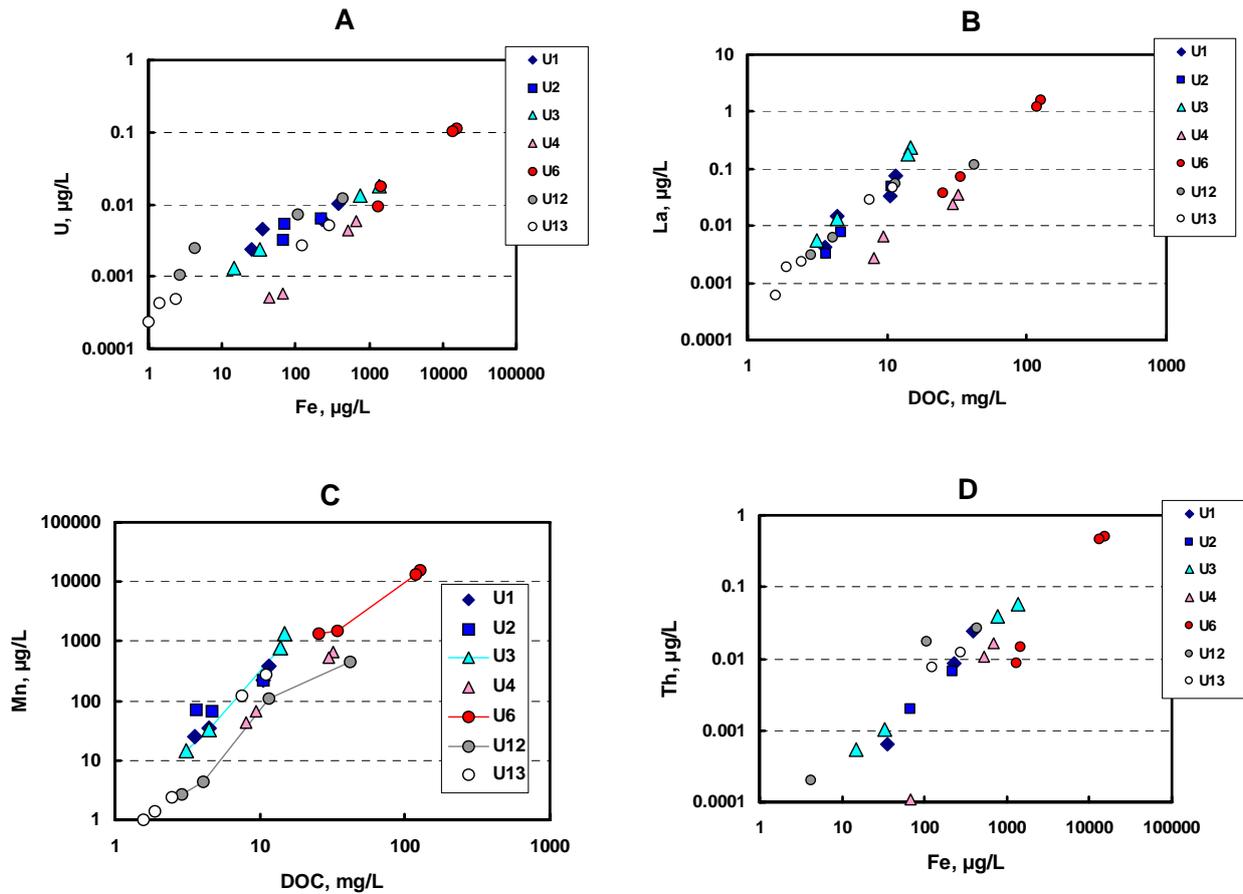
<b>µg/L</b>	<b>U 11* March</b>	<b>U 12* March</b>	<b>U 13* March</b>
<b>Na</b>	152	656.2	234.6
<b>Mg</b>	30.18	118.7	36.23
<b>Al</b>	3.256	14.04	3.515
<b>Si</b>	100	110	80
<b>P</b>	4.181	14.85	4.492
<b>K</b>	361	1058	359.2
<b>Ca</b>	93.43	729.9	163.3
<b>Ti</b>	0.02811	0.1213	0.05096
<b>V</b>	0.02026	0.1537	0.0746
<b>Cr</b>	0.06004	0.4837	0.062
<b>Mn</b>	1.381	6.625	2.372
<b>Fe</b>	5.421	22.08	6.281
<b>Co</b>	0.00657	0.07951	0.01173
<b>Ni</b>	0.2806	1.777	0.3562
<b>Cu</b>	0.9626	5.385	0.9848
<b>Zn</b>	Cntd	Cntd	Cntd
<b>Ga</b>	0.001476	0.002361	0.001573
<b>Ge</b>	0.000246	0.002718	0.0002482
<b>As</b>	0.01985	0.133	0.0239
<b>Rb</b>	0.2187	0.6297	0.234
<b>Sr</b>	0.2769	1.999	0.5024
<b>Y</b>	0.002356	0.02012	0.002319
<b>Zr</b>	0.002544	0.08166	0.00271
<b>Mo</b>	0.011	0.05277	0.01005
<b>Sb</b>	0.03584	0.2553	0.04444
<b>Cs</b>	0.0002435	0.001903	0.000742
<b>Ba</b>	0.6661	7.33	1.09
<b>La</b>	1.608	2.366	1.914
<b>Ce</b>	0.004049	0.02164	0.004997
<b>Pr</b>	0.0005642	0.002624	0.0006037
<b>Nd</b>	0.003011	0.01474	0.002913
<b>Sm</b>	0.0006634	0.002631	< d.l.
<b>Eu</b>	0.0005487	0.001962	0.0002779
<b>Gd</b>	0.00057	0.00642	0.0008039
<b>Th</b>	7.18E-05	0.0006654	< d.l.
<b>Dy</b>	0.0002509	0.004821	< d.l.
<b>Ho</b>	3.71E-05	0.0008712	< d.l.
<b>Er</b>	0.0002053	0.002645	< d.l.
<b>Tm</b>	0.0001921	0.0007892	< d.l.
<b>Yb</b>	0.0006768	0.002467	0.0003876
<b>Lu</b>	< d.l.	0.0003608	7.29E-05
<b>Hf</b>	0.0001519	0.001793	< d.l.
<b>W</b>	0.01357	0.06766	0.1739
<b>Pb</b>	0.01138	0.06639	0.01564
<b>Bi</b>	0.0001018	0.0003825	0.00011
<b>Th</b>	0.0003122	0.004671	6.74E-05
<b>U</b>	0.0005604	0.003345	0.0005602

### ESM – 3 Correlations between element concentrations in < 0.45 $\mu\text{m}$ fraction



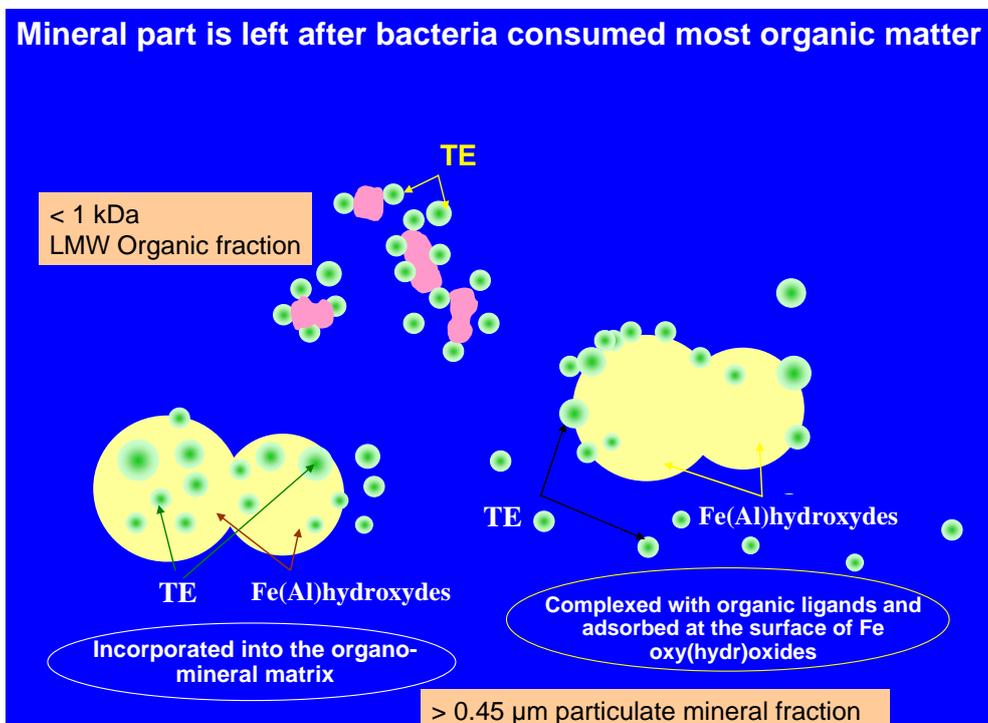
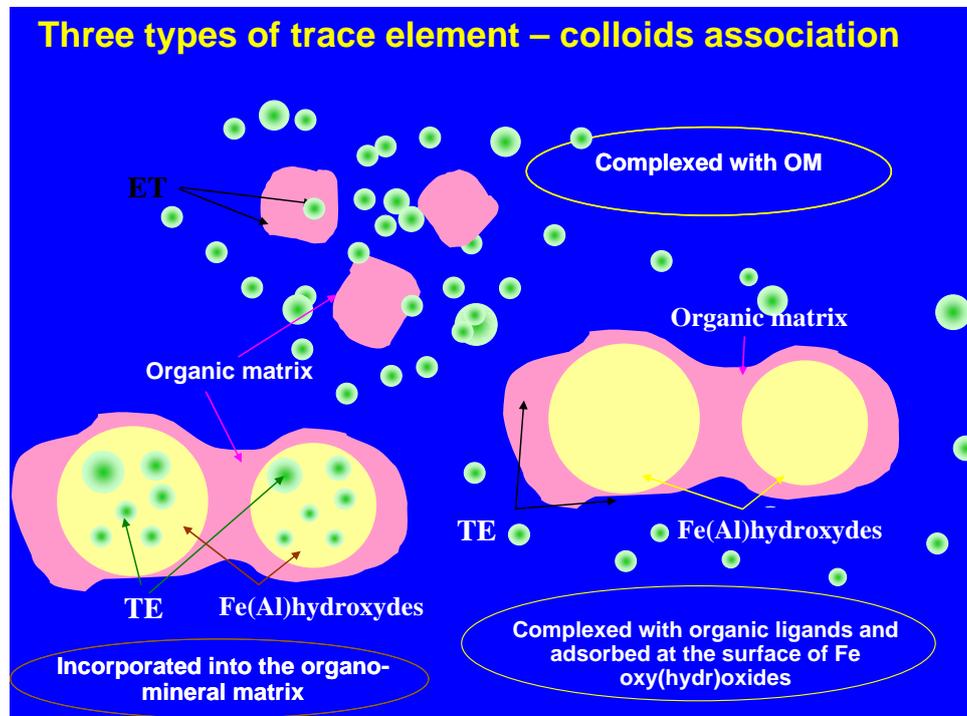
**Fig. ESM-3.** Concentration of Cu (A), Cd (B), Ti (C) and Zr (D) as a function of Fe in < 0.45  $\mu\text{m}$  fraction of various lakes and ponds. There is a clear trend of concentration decrease following the lake stage evolution, from peat abrasion, young lakes and ponds to mature lakes and khasyreys.

### ESM -4 Filtration and dialysis pattern of various samples



**Fig. ESM-4.** Correlation between U and Fe (A), La and DOC (B), Mn and DOC (C) and Th and Fe (D) in filtrates and dialysates of various samples shown by different symbols. In each series, the first (highest) point corresponds to filtration through 5 or 0.45 µm and the lowest point represents dialysis through 1 kDa.

**ESM – 5: Three types of trace element association with organo-mineral colloids and their evolution during bacterioplankton consumption of the organic matter.**



Adapted from: Vasyukova E. (2009) The chemical weathering of rocks and migration of elements in the boreal zone (North-West Russia). Ph.D. thesis, Universite' Toulouse III – Paul Sabatier, France.