

Supplementary materials

River water quality of the Selenga-Baikal basin: part I – spatio-temporal patterns of dissolved and suspended metals

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Received: 22 June 2020; Accepted: 25 July 2020; Published: date

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Table S1. Overview of the most recent water quality studies in the Selenga River catchment

Reference	No of samp. points	No of samp. campaigns	River	Measured parameter	Date of measurement
[93]	76	3	Selenga, Tuul, Khangal, Orkhon, Kharaa,	Dissolved As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn	2007 - 2009
[102]		1	Selenga	Ca ²⁺ , K ⁺ , Mg ²⁺ , Na ⁺ Cl ⁻ , HCO ₃ ⁻ , SO ₄ ²⁻ TP, P _{inorg} , TN, TOC, NO ₃ ⁻ -N, NH ₄ PAH, total coliforms, enterococci	2010
[94,95]	52	1-2	Tuul, Orkhon, Kharaa, Selenga, Dzhida	As, Cd, Mn, Pb, Zn, orthophosphate-P	2010, 2011, 2012
[89]	31	3	Kharaa	Suspended Ag, Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Sn, Sr, Ti, Tl, U, V, W, and Zn	2009, 2010, 2011
[96]	28	2	Selenga, Tuul, Khangal, Orkhon, Kharaa	pH, EC, DO Dissolved Na, K, Ca, Mg, Si, Cl, NO, F,Fe,Li,Al,Cr,Mn,Cu,Zn, As,Se,Sr,Cd, Ba, Pb,Hg,	2005-2006
Moscow State University field campaigns (this study)					
July-August 2011	56 (95 samples)	6	Selenga, Tuul, Orkhon, Kharaa, Dzhida, Modonkul, Chikoy, Hilok, Uda, et al.	Ca ²⁺ , K ⁺ , Mg ²⁺ , Na ⁺ Cl ⁻ , HCO ₃ ⁻ , SO ₄ ²⁻ pH, DOC, POC dissolved and suspended Be, B, Al, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Mo, Cd, Sb, Sn, W, Pb, Th, U SPM concentrations (g/m ³), SL(t/day), SPM in certain classes	2011-2016
June 2012	55 (114)				
September 2013	35 (110)				
August 2014	53 (83)				
March 2015	22 (34)				
June 2016	30 (39)				

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Table S2. pH, Total Dissolved Solids (TDS) and Suspended Sediments Concentrations (SSC) in the Selenga River basin

	pH	TDS (mg\ L)	SSC (g/m ³)
Mean	8.3	120	61
Median	8.3	115	19
Standard Deviation	0.5	52	194
Minimum	6.8	0.6	0.7
Maximum	10.5	526	2384

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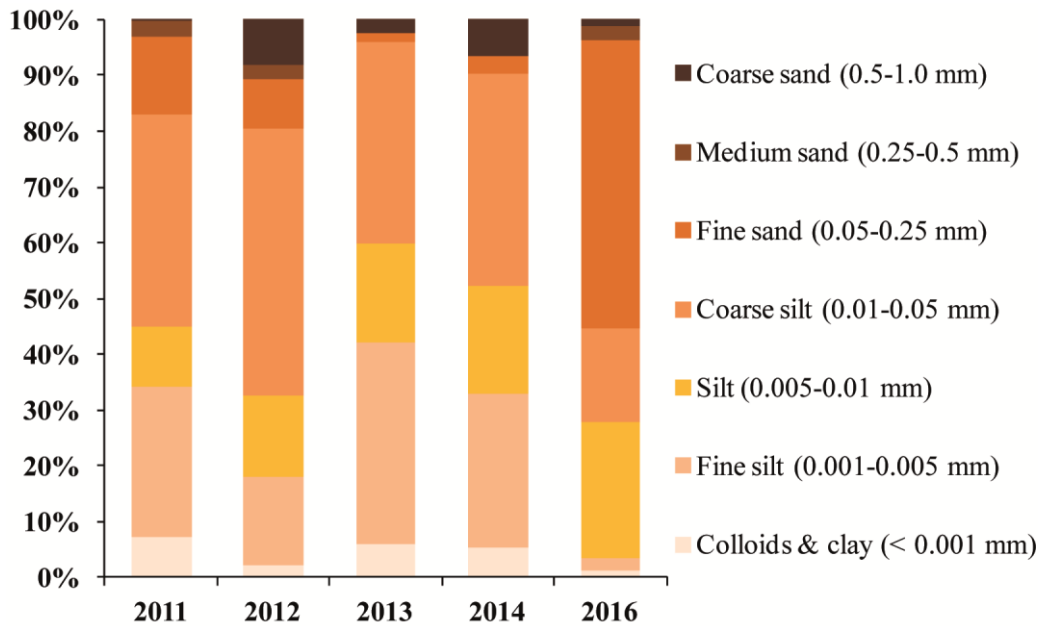


Figure S1. Granulometric composition of suspended sediments in the Selenga River basin

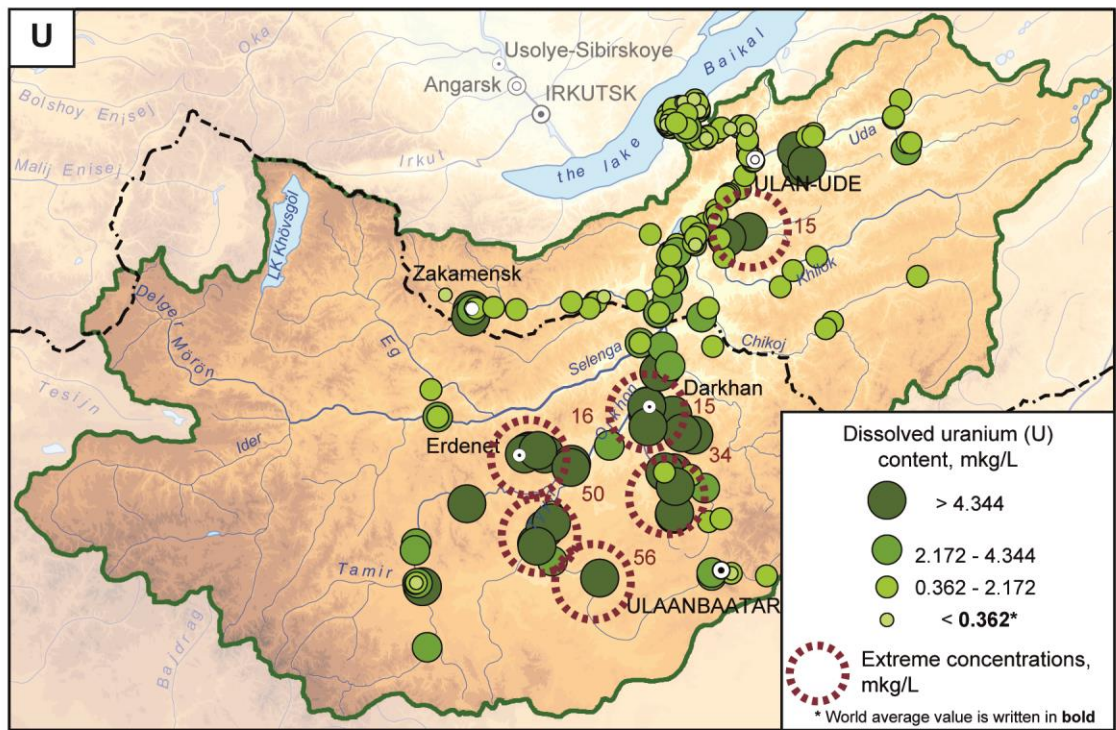


Figure S2. Dissolved U in river waters of the Selenga basin

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Table S3. PCA results. Factor loadings of dissolved metals concentrations in the Selenga River basin

Parameter	Factor 1	Factor 2	Factor 3	Factor 4
Fe	0,90			0,22
Bi	0,90			0,32
Pb	0,89			0,33
Sb	0,84			0,27
V	0,72	0,34		
B		0,94		
As		0,91	0,27	
U		0,82		
Ni	0,43	0,77		0,27
Mo			0,99	
Sn			0,98	
W		0,20	0,95	
Cd	0,33		0,31	0,83
Co	0,51			0,81
Cu	0,50			0,79
Zn	0,11			0,69
Cr		0,38		
Mn		0,19		0,37
% of total variance	35	19	15	8
Eigenvalue	6.3	3.5	2.7	1.4
Potential origin	Crustal	Mongolia - metallogenic zones	Mining (Tuul, Orkhon, Dzhida basins)	Urban

Bold red font corresponds to loadings ≥ 0.7 (strong connection), bold italic black font signifies loadings ≥ 0.5 (moderate connection), and in plain italic are values ≥ 0.3 (weak connection). Empty cells corresponds to loading values < 0.1

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57 Table S4. PCA results. Factor loadings of suspended metals concentrations in the Selenga River basin

Parameter	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
V	0,93				
Cr	0,89				
Ni	0,83				
Fe	0,82		0,13		
Co	0,76			0,18	0,27
Mn	0,67			0,43	0,33
Zn	0,10	0,88	0,15	0,15	
Cd		0,88	0,20	0,15	
U	0,11	0,87			
Cu		0,85	0,16		
Pb		0,18	0,96		
Bi		0,16	0,97		
Sn	0,13			0,76	
Sb		0,26	0,18	0,64	
W	0,31	0,19		0,57	0,39
Mo		0,14	<i>0,40</i>	<i>0,35</i>	
B					0,85
As	0,18				
% of total variance	28	19	10	8	6
Eigenvalue	5.0	3.4	1.7	1.4	1.0
Potential origin	Crustal	Urban	Crustal + mining	Mining (Tuul, Orkhon, Dzhida basins)	Mongolia - metallogenic zones

58 **Bold red font corresponds to loadings ≥ 0.7 (strong connection), bold italic black font signifies loadings $\geq$**
59 ***0.5* (moderate connection), and in plain italic are values ≥ 0.3 (weak connection). Empty cells corresponds**
60 **to loading values < 0.1**

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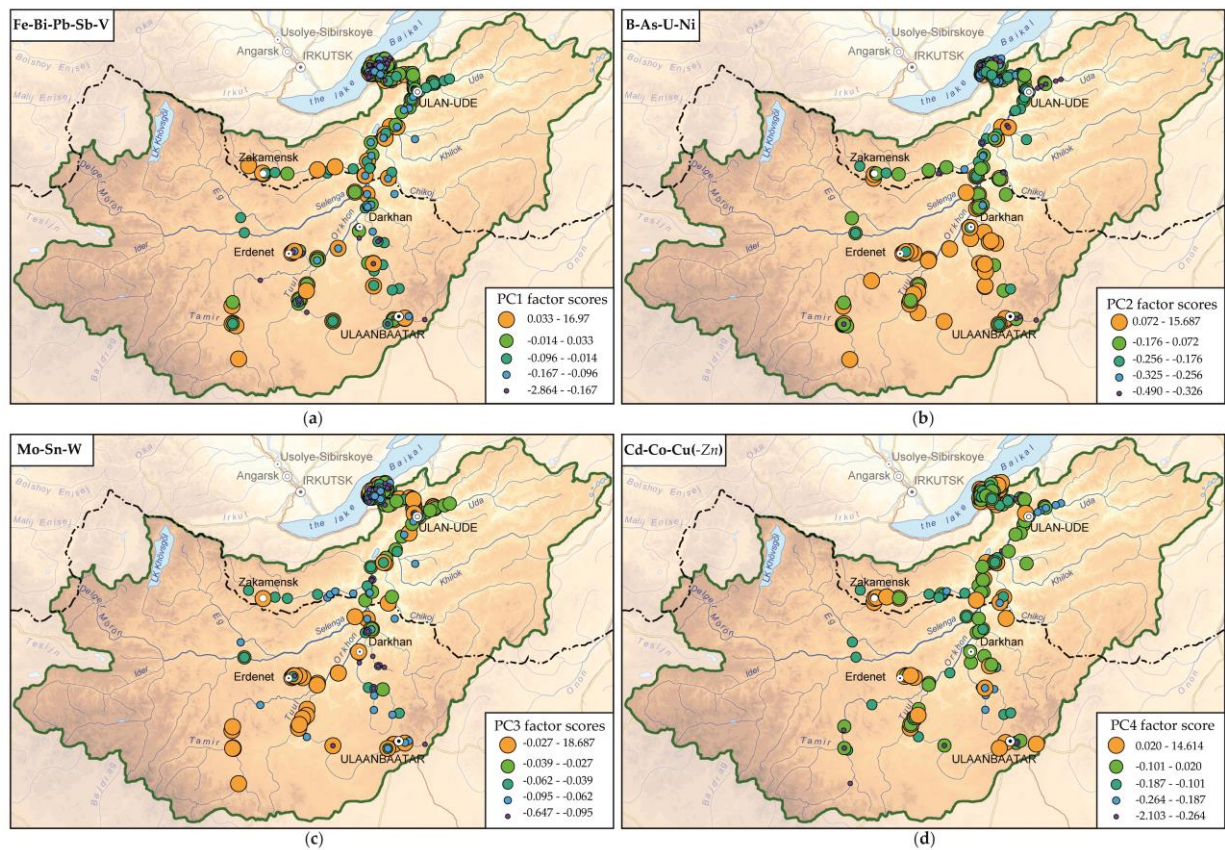


Figure 3. PCA results for dissolved metals. Distribution of factor score values for Factor 1 (a), Factor 2 (b), Factor 3 (c), and Factor 4 (d). In parentheses in italics are the elements with moderate connection.

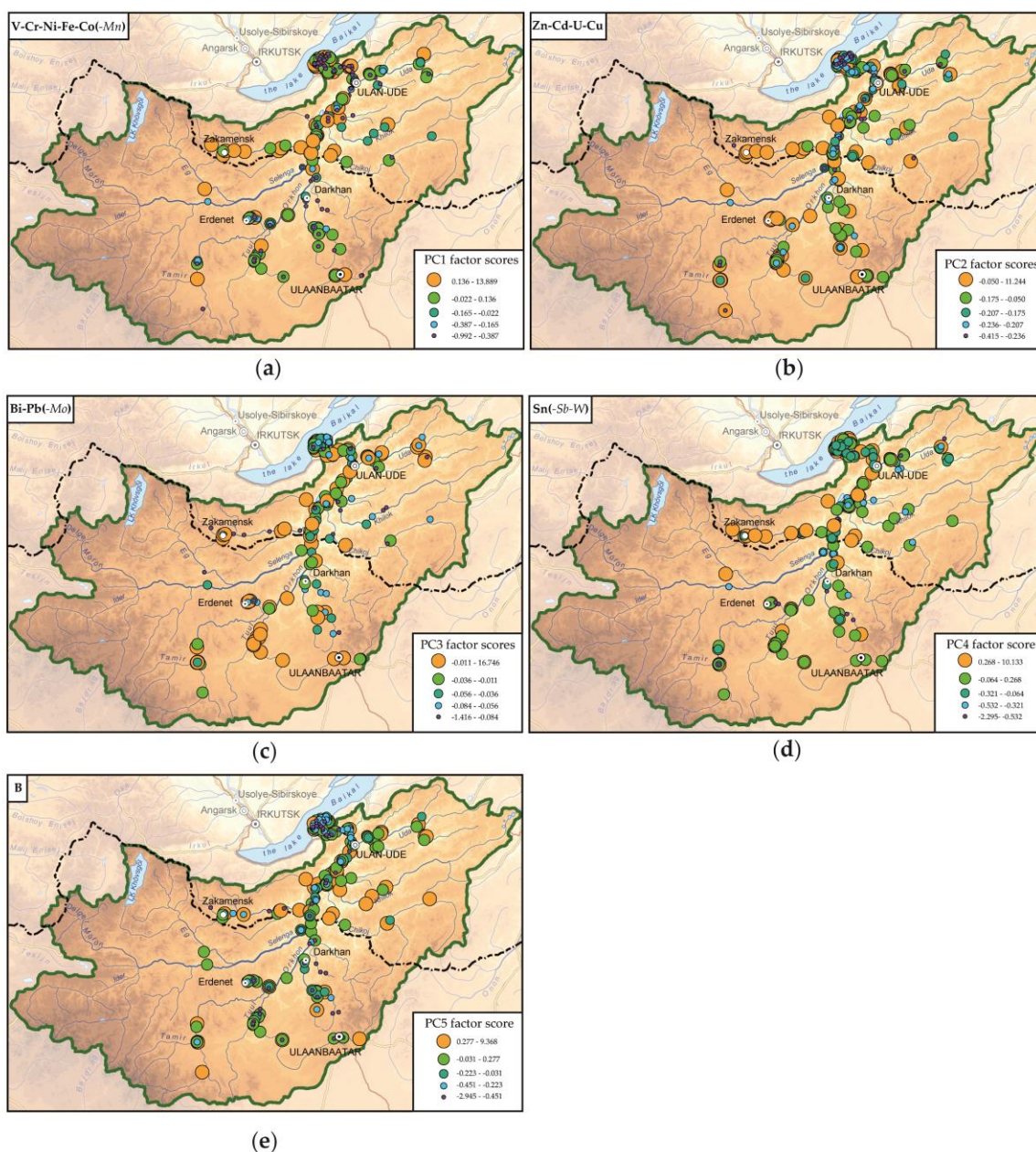
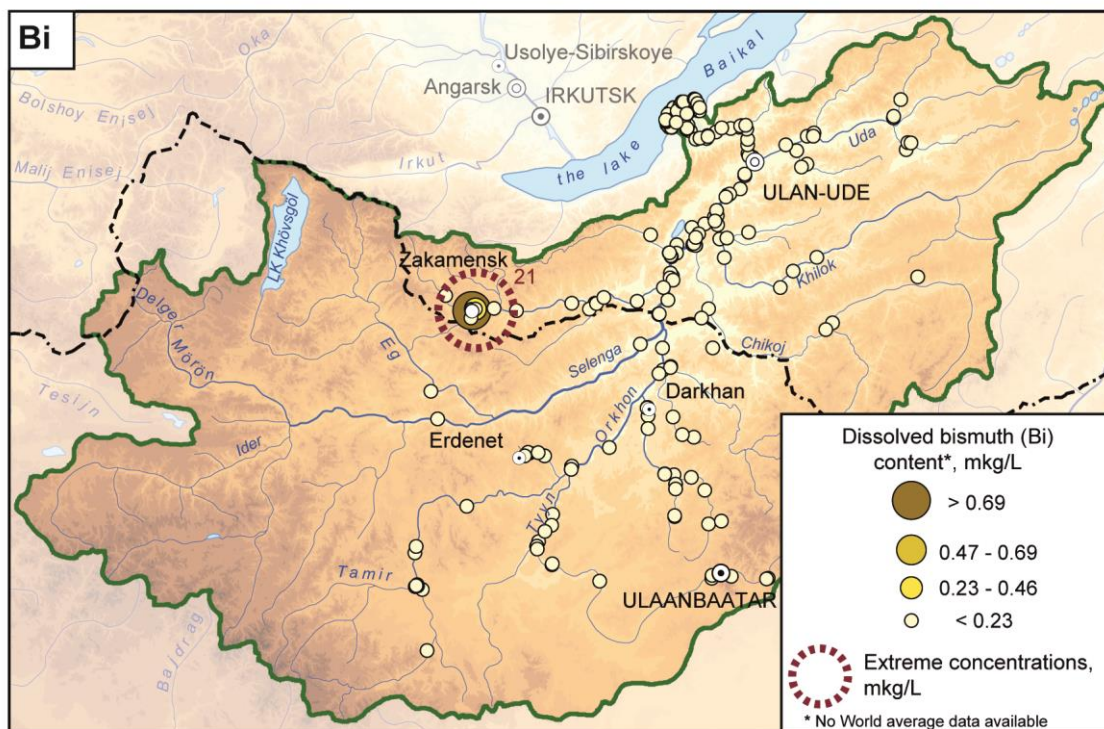
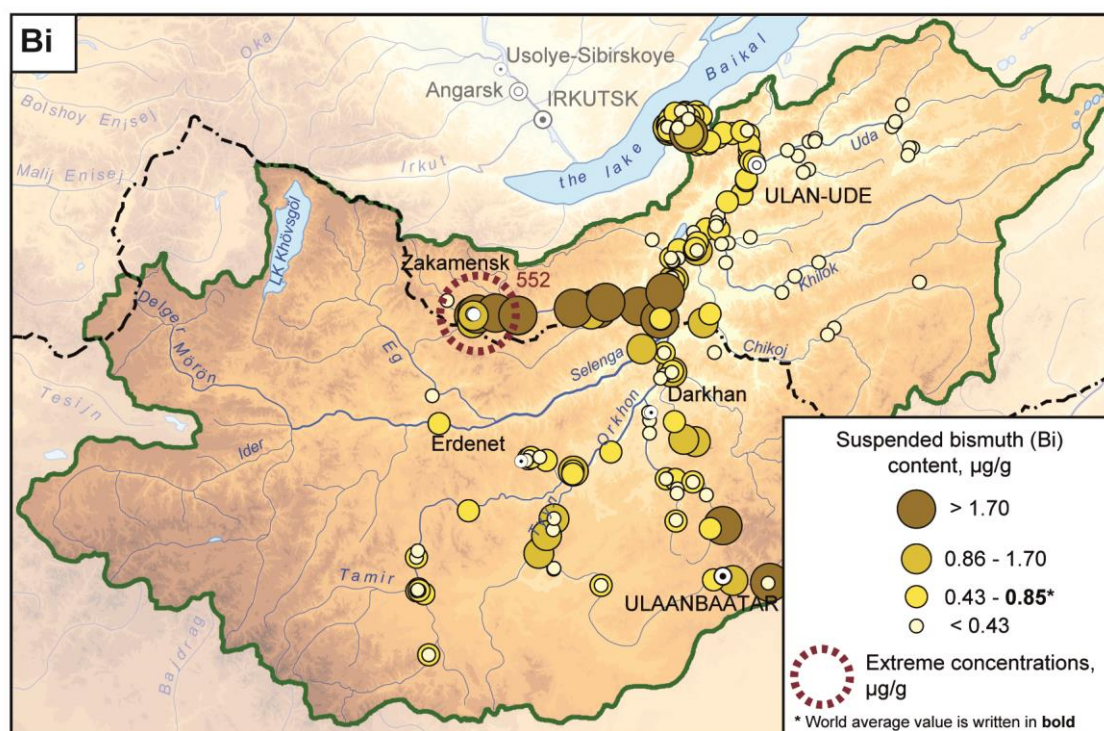


Figure S4. PCA results for suspended metals. Distribution of factor score values for Factor 1 (a), Factor 2 (b), Factor 3 (c), Factor 4 (d), and Factor 5 (e). In parentheses in *italics* are the elements with moderate connection.



(a)



(b)

Figure S5. Dissolved (a) and suspended (b) Bi in river waters of the Selenga basin

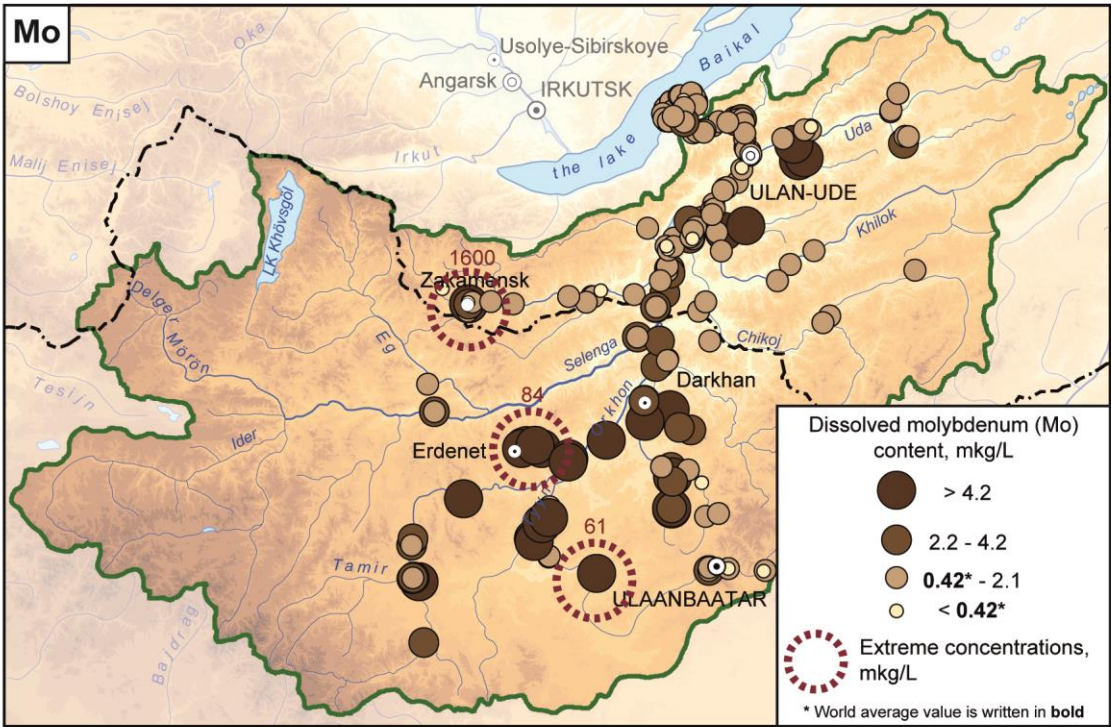
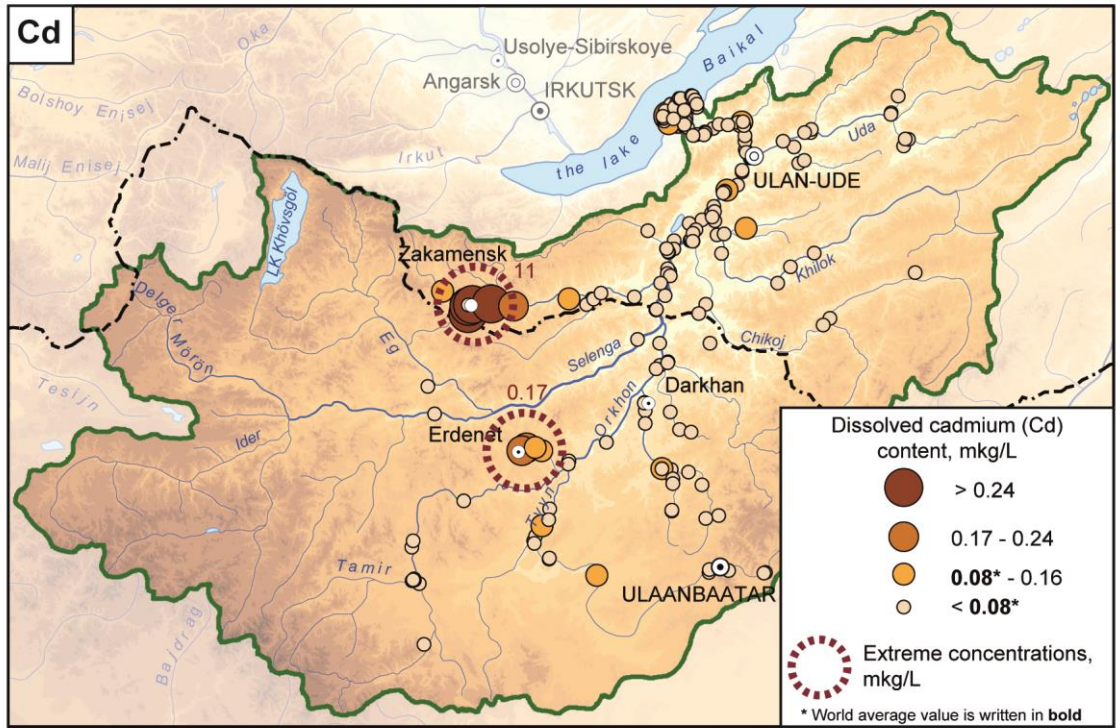
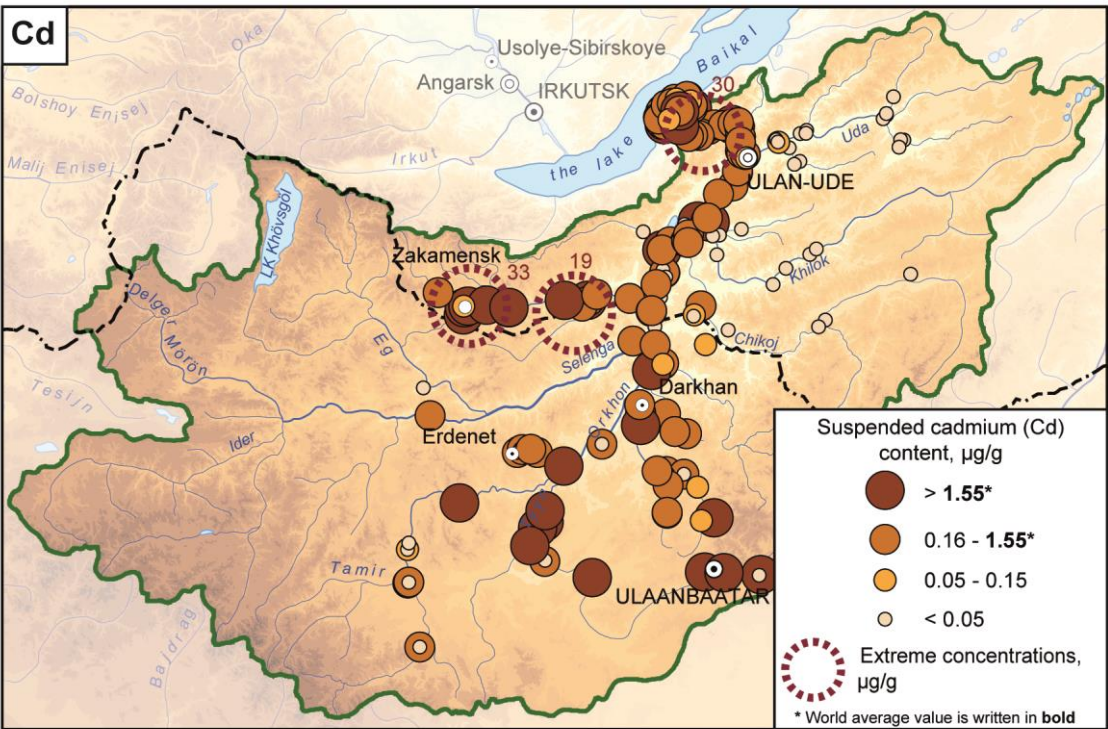


Figure S6. Dissolved Mo in river waters of the Selenga basin



(a)



(b)

Figure S7. Dissolved (a) and suspended (b) Cd in river waters of the Selenga basin

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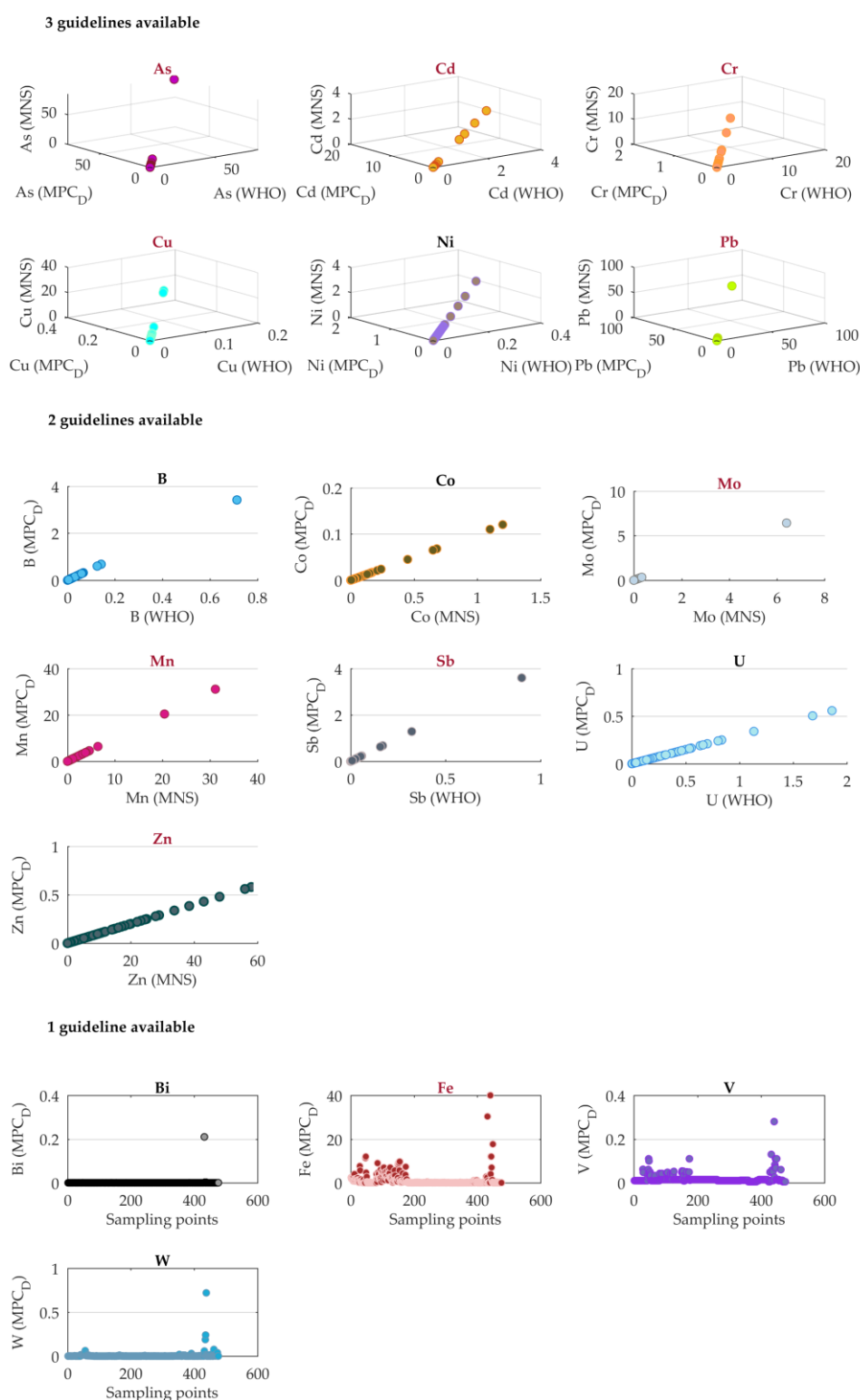


Figure S8. Concentration factors (CF) for dissolved metals relative to WHO guidelines (WHO), Mongolian national standard (MNS), Russian guidelines for drinking water (MPCD) if any.

Dark red title indicate metals with $CF > 3$. Number of axis (1-3) depends on availability of standards.

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