Trace Metal Parameter Data

Table 2. Conditional stability constants for metals in seawater (Millero, 2001b)

Metal	[M]	[L]	log K_c
Cu(II)	1–10 nM	2–60 nM	8.5
Zn(II)	0.1–2 nM	1.2 nM	12
Cd(II)	2–800 pM	100 pM	12
Pb(II)	17–49 pM	200–500 pM	11
Ni(II)	1.7–4.3 nM	2–4 nM	17–19
Co(II)	10–103 pM	9–83 pM	11–16
Fe(III)	0.2–8 nM	0.4–13 nM	19–23

Table 2 Compilation of selected conditional stability constants and ligand concentrations of natural organic ligands for cobalt, nickel, copper, and zinc

Location	Values measured			Method, competing ligand[a,b]	Reference
	Metal concentration	Ligand concentration	$\log K'_{(Metal)-L}$		
Cobalt	**pM**	**pM**			
Antarctic polar front	10–120	15–50	–	CSV, nioxime	(Ellwood et al. 2005)
Costa Rica upwelling dome	57–12[c] 45–93[d]	50	$\geq$16.8	CSV, DMG	(Saito et al. 2005)
East equatorial Pacific	27–315[e]	–	–	CSV, DMG	(Saito et al. 2004)
Atlantic Ocean, Sargasso Sea	17–73[d] 20 ± 10[e,f] 19–133[c]	–	–	CSV, DMG	(Saito & Moffett 2002)
Sargasso Sea	19–73[d]	9–83	16.3 ± 0.9	CSV, DMG	(Saito & Moffett 2001b)
Northeast Atlantic Ocean	25–103[c]	22–60	15.6–16.1	CSV, nioxime	(Ellwood & van den Berg 2001)
Nickel	**nM**	**nM**			
Costa Rica upwelling dome	3.0 ± 0.3[f]	–	–	CSV, DMG	(Saito et al. 2005)
Coastal Britain	–	2–4	17.3–18.7	CSV, DMG	(van den Berg & Nimmo 1987)
Copper	**nM**	**nM**			
Subarctic northwest Pacific	3–4	3.7–5 (1500–2500 m)	12.7–14.1	CSV, salicylaldoxime, and benzoylacetone	(Moffett & Dupont 2007)
Estuarine waters	9–23[g]	L_1 = 10–33 L_2 = 14–300	L_1 = 14.8 – 15.8 L_2 = 13–13.5	CSV, salicylaldoxime	(Laglera & van den Berg 2003)
North Pacific	0.58–1.88[d]	L_1 = 1.5–3 L_2 = 5–10	L_1 = 11.6 L_2 = 8.6	DPASV	(Coale & Bruland 1990)
Zinc	**nM**	**nM**			
Northeastern Atlantic Ocean	0.3–2.0	0.4–2.5	10.0–10.5	CSV, PDC	(Ellwood & van den Berg 2000)
Central North Pacific	0.1–3.0[d]	1.2	11.0	DPASV	(Bruland 1989)

Distributive Characteristics of Dissolved Trace Metals

- Oxyanions and big, standalone ions with one valence electron (like Cs^+ and Rb^+) tend to exist in small oceanic concentrations.
- Metals with greatest variation in oceanic concentration seem to be greatly related to biological processes (iron, zinc, cadmium ex.)

Types of Trace Metal Distributions:

1) Conservative Distributions: Trace metal retains relative concentration for long periods of time.
2) Nutrient-dependent distributions: metals that are involved in nutrient cycles and whose concentrations also depend on concentrations of other nutrients; includes zinc, cadmium, and (surprisingly) silver (and co.).
3) Scavenged-type distribution: scavenged very often; high concentrations near source (e.g. aluminum).

Some like iron and copper have hybrid distributions (where iron follows a nutrient-dependent and scavenged-type distribution).

Mixed distributions (where different forms of the metal undergo different distributions) also exist with elements like germanium.

Inputs:

Metal inputs from rivers are a thing, but measuring input from river sources is difficult because metals tend to get “stuck” before flowing into the ocean.

Atmospheric input of metals is also recorded, though for metals like iron it is not the fundamental input.

Hydrothermal vents are said to be sinks of major metals, but sources for trace metals.

--- the above is from Bruland 2003