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Aquatic Chemistry

An Introduction Emphasizing Chemical Equilibria in Natural Waters

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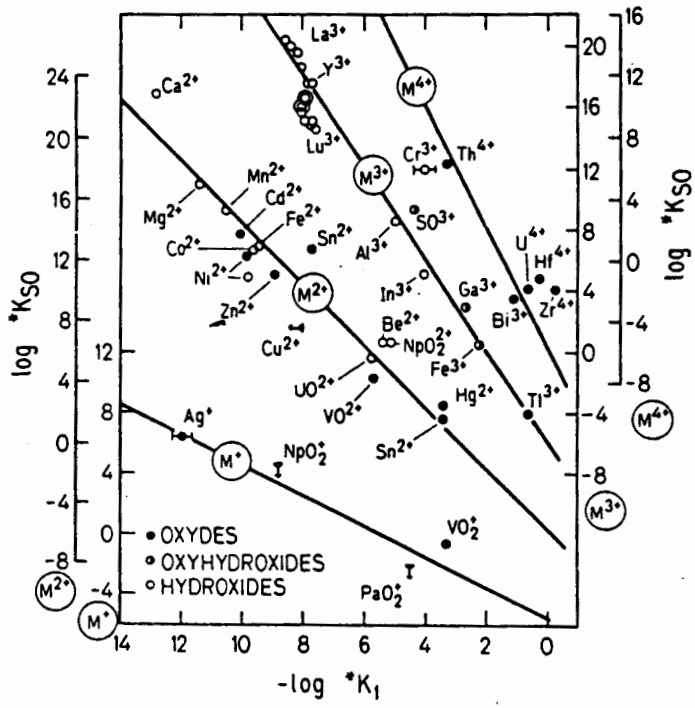

Figure 6.6 Correlation of the solubility product $*K_{so}$ with the first hydrolysis constant $*K_1$ for M^+, M^{2+}, M^{3+}, and M^{4+} cations. The lines have slopes of -1, -2, -3, and -4 (25°C). This relationship results because the equilibrium constant for the reaction $M(OH)_z(s) + (z-1)M^{z+} = zMOH^{(z-1)+}$, $K = (*K_1)^z K_{so}$, $K = \{MOH^{(z-1)+}\}^z/\{M^{z+}\}^{(z-1)}$, is often close to $10^{-5.6}$. This relatively low value reflects the general tendency of cations to precipitate shortly after hydrolysis begins unless $[M^z]$ is quite low. The strong tendency for solutions to supersaturate often allows hydrolysis to proceed much further in solution than would be expected from the value of K. (From Baes and Mesmer [6].)

6.4 METAL IONS AND LIGANDS

Considerable emphasis has been placed thus far on hydroxo complexes; this is amply justified by the ubiquitousness of OH^- in water and by the strong affinity of many metal ions for OH^-. But other proton acceptors can serve as electron pair donors and thus coordinate with metal ions. There is no single generally valid correlation between the stability of proton complexes (reciprocal of protolysis constant) and the stability of metal complexes, but some weak bases such as ClO_4^- and NO_3^- have very little tendency to form metal complexes.

Classification of Metal Ions and Ligands

Inorganic and organic ligands contain the following possible donor atoms in the fourth, fifth, sixth, and seventh vertical column of the periodic table:

C	N	O	F
	P	S	Cl
	As	Se	Br
		Te	I