

# GB481

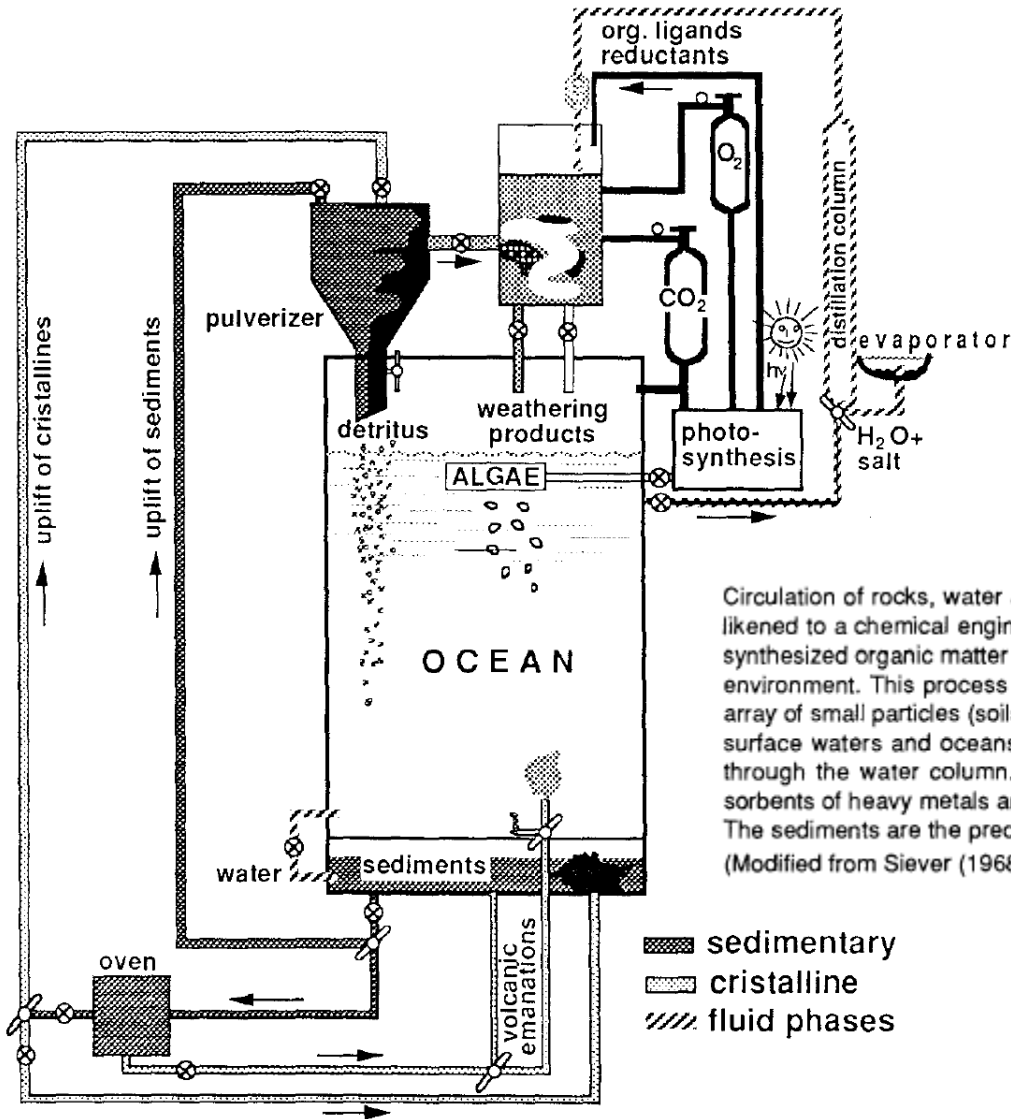
# Geochemie minerálních povrchů

Josef Zeman

Stumm W. (1992): Chemistry of the solid-water interface: processes at the mineral-water and particle-water interface in natural systems. John Wiley & Sons, Inc. 428 str.




Pashley R. M., Marilyn E. Karaman M. E. (2004): Applied colloid and surface chemistry. John Wiley & Sons Ltd. 188 str.

# Úvod



Circulation of rocks, water and biota. Steady state model for the earth's surface geochemical system likened to a chemical engineering plant. The interaction of water with rocks in the presence of photosynthesized organic matter continuously produces reactive material of high surface area in the surface environment. This process provides nutrient supply to the biosphere and, along with biota, forms the array of small particles (soils). Weathering imparts solutes to the water and erosion brings particles into surface waters and oceans. A large flux of settling detrital and biogenic particles continuously runs through the water column. The steady state conveyor belt of settling particles which are efficient sorbents of heavy metals and other trace elements regulates their concentrations in the water column. The sediments are the predominant sink of trace elements.

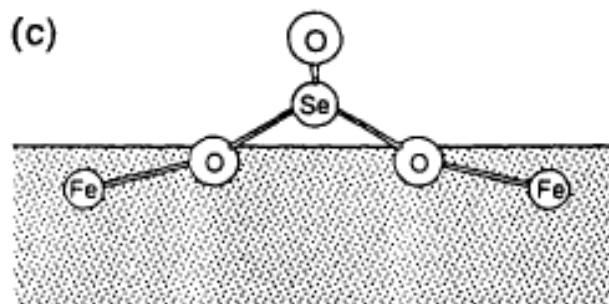
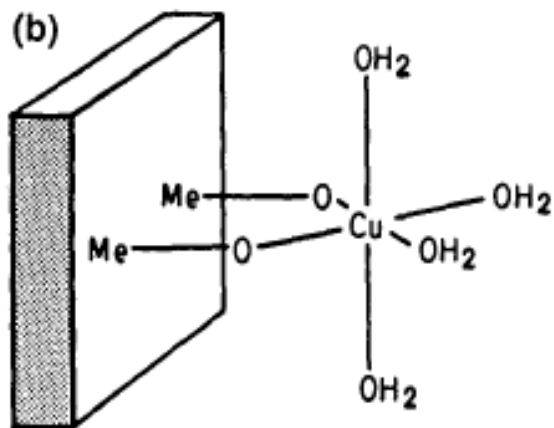
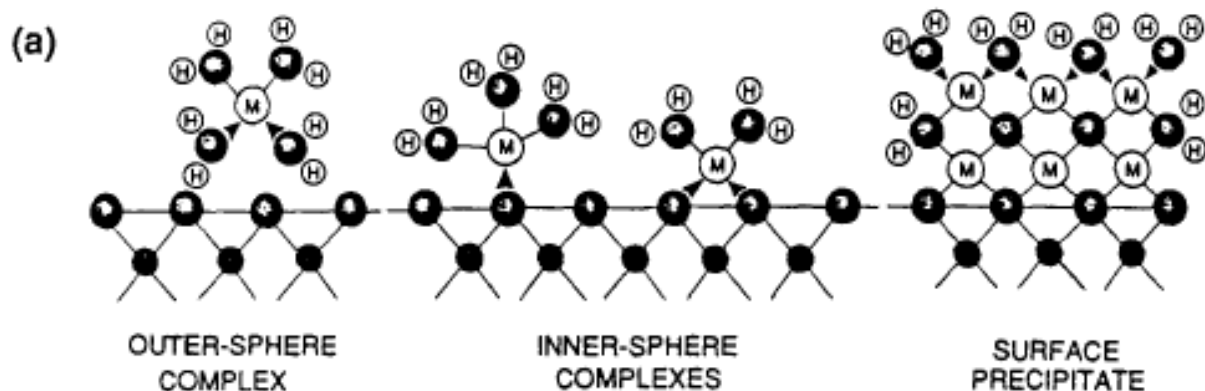
(Modified from Siever (1968))

-  sedimentary
-  crystalline
-  fluid phases

# Procesy

- minerál-voda
- částice-voda
- organismy-voda
- adsorpce ovlivňuje
  - distribuci látek mezi vodou a pevnou fází
  - elektrostatické vlastnosti povrch suspendovaných látek a koloidů
  - reaktivitu povrchů

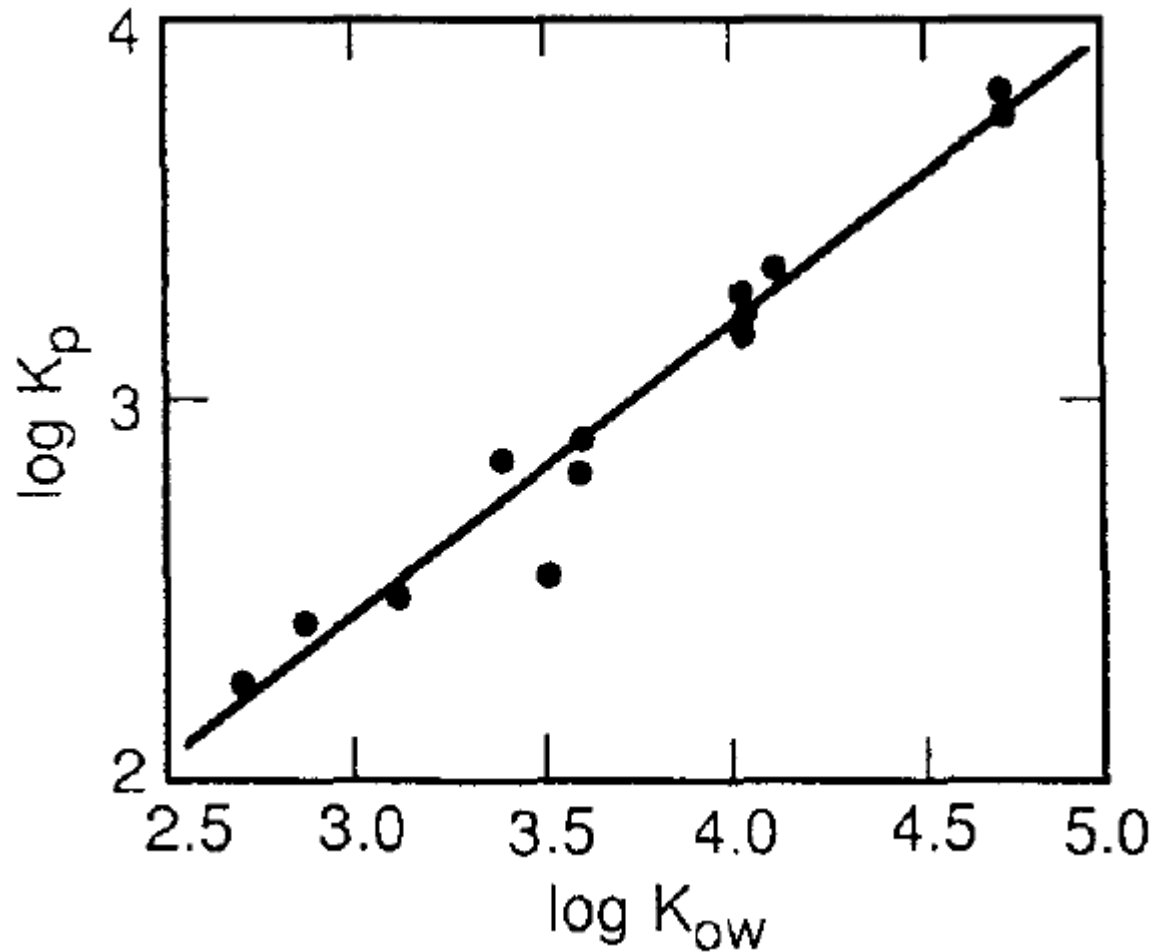
# Povrchová koordinace



Structural arrangements in surface complexes at an oxide surface.

- Definition of possible sorption complexes at the solid/water interface, which is represented by the horizontal line. The solid substrate is below the line and the solution is above the line. The circles labeled M represent sorbed metal atoms in various types of sorption complexes. The larger shaded spheres in the solid substrate and surrounding the metal in the solution phase are oxygens. The smaller dark spheres in the solid substrate are metal ions, as are the spheres labeled M in the sorption complexes and surface precipitate. (From Brown, 1990)
- Surface complex of Cu(II) on  $\delta$ - $\text{Al}_2\text{O}_3$  (structure inferred from EPR measurements). (From Motschi, 1987)
- Proposed structure for  $\text{SeO}_3^{2-}$  coordinated with Fe atoms of goethite based on Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy. (From Hayes, Roe, Brown, Hodgson, Leckie, and Parks, 1981)

# Hydrofobní efekt



Partition constant for the distribution of various aromatic substances (mono-, di-, tri-, and tetramethyl, and chlorobenzenes) between water and an aquifer material (0.15 % organic carbon) as a function of the octanol-water partition coefficient,  $K_{ow}$ . The values of  $\log K_p$  have been adjusted to be correct for a sorbent of 100 % organic carbon.  $K_{ow}$  is defined for the partition of a substance A between octanol water:  $K_{ow} = [A_{oct}]/[A(aq)]$ .  
(Modified from Westall, 1987)

# Koloidy

- 1 nm – 1  $\mu\text{m}$
- obvykle více než  $10^6$  částic/cm<sup>3</sup>
- stabilita
- koagulace
- modelování vzniku povrchových komplexů

# Struktura povrchu a povrchová reaktivita

- rozpouštění (zvětrávání) minerálů
- vznik pevné fáze (nukleace, srážení, růst krystalů, biomineralizace)
- redox procesy na mezifázi pevná látka-voda
- katalýza
- polovodiče
- heterogenní fotochemické procesy

# Vazby mezi pevnými a rozpuštěnými látkami

- strukturní uspořádání povrchových komplexů
- geometrie koordinační povrchové vrstvy
- elektronová struktura vazeb mezi pevnou látkou a rozpuštěnými složkami