## Solubility of biominerals: estimate of hydrated surface energy of hydrozincite.

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The apparent solubility of hydrozincite  $[Zn_5(CO_3)_2(OH)_6]$ was measured in samples of different nature, including natural abiotic ("geologic"), synthetic (abiotic), and natural biominerals. A systematic increase in the solubility is recorded from geologic sample to synthetic analogues and biomineral samples. Sample structural data were obtained by using SEM, TEM, synchrotron radiation X-rays powder diffraction (SR-XRPD), and Zn K-edge X-rays absorption spectroscopy (EXAFS). Main results are that solubility of hydrozincite increases crystal size is nanometric and decreases from geologic to synthetic and biologic samples. Zn-O interatomic distances slightly decrease with the crystal size and cell volume increases inversely with crystal size.

The effects on solubility of particle size and of cell volume increase were calculated by classical thermodynamic equations. In this way, the surface energy of hydrated hydrozincite was estimated to increase by at least one order of magnitude from (abiotic) geologic to biologic sample. The effect of cell volume variation on apparent solubility is deemed negligible, being of the same order of magnitude of the error in solubility measurements.

Finally, the different solubility of investigated samples is most likely ascribed to crystal size and hydrated surface energy.