Mineral-Supported Water Films

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Hydrophilic minerals exposed to air moisture stabilise nanometer- to micrometer-thick water films (Fig. 1) of various degrees of organisation. These films host chemical reactions of great importance to numerous biogeochemical and atmospheric processes, including gas exchange, mineralogical transformations, and photocatalysis.

This keynote presentation will cover molecular, mesoscopic and thermodynamic aspects on formation mechanisms and stabilities of mineral-supported water films. These concepts will be chiefly presented in the light of (sum frequency generation) vibration spectroscopy, nanoscale imaging and molecular modelling investigations currently pursued by our research group.

Molecular aspects of water film formation will be discussed in terms of crystallographic and particle shape controls on water binding and condensation mechanisms. Focus on minerals of contrasting structures, crystal habits and organic coatings will highlight the various loadings, interfacial structures, and hydrogen bond populations that can be acquired by water films. Condensable water loadings will, additionally, be related to mineral particle size, and much less to mineralogy [1]. This dependence will be explained in terms of the curvature of the air/water interfacial portion of water films, and will be supported further using nanoscale imaging and molecular modelling.

Examples of processes to be highlighted in this presentation include gas dissolution, mineralogical transformations and ice formation. These processes — which can all take place within the confines of mineral-supported water films — are intimately tied to vadose zone geochemistry, as well as to cloud formation and ice nucleation processes in the atmosphere.

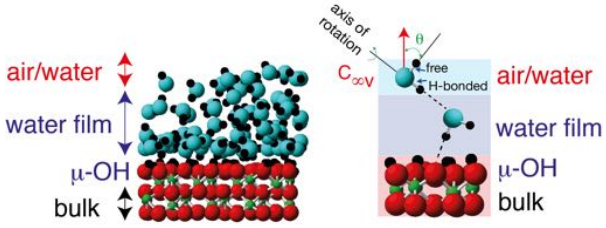

Figure 1. Schematic molecular representation of water films at hydroxylated mineral surfaces.

[1] Yeşilbaş, M. and Boily, J.-F. (2016), *Scientific Reports*. **6**, 32136.