

講演会のお知らせ

「東ユーラシア・環日本海域国際環境セミナー」

日時：2017年2月15日（水） 10:00-11:00

場所：金沢大学角間キャンパス 自然科学本館 102 講義室

講演題目： Mineral Growth and Dissolution: effects of solution chemistry and microbial activities（鉱物の成長と溶解：溶液化学組成と微生物活動の影響）

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対象：一般、学生

使用言語：英語

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Mineral Growth and Dissolution: *effects of solution chemistry and microbial activities*

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Natural process of mineral formation and dissolution at near-surface conditions are subject to various effects ranging from that of aqueous speciation to biological participation. As such complications arise when mineralization and weathering are concerned in lab settings. Two case studies, one is solution chemistry effect on crystallization and the other microbially mediated dissolution, will be discussed in this presentation to highlight the complexity.

For mineralization, the classical approach states that the net growth rate of mono-molecular layers (ie, step velocity) is determined by the difference between fluxes of species attaching to and detaching from kinks along step edges. Such treatment leads to the development of the widely accepted understanding that step velocity depends solely on solution supersaturation. Yet, literature data from numerous cases argued strongly against this supposition. In this study, we conducted a series of in situ AFM experiments to interrogate the effect of solution chemistry parameters on step kinetics using calcite as a model system. We found step kinetics were strong affected by solution pH, ionic strength SI, and the $[Ca^{2+}]/[CO_3^{2-}]$ ratio, and the impact differs in different cleavage directions. These observations suggest that, although supersaturation is the driving force for aqueous phase crystallization, solution chemistry plays critical roles in controlling the actual growth rate and needs to be taken into consideration in kinetic studies of crystallization.

For bio-weathering, complications are often associated with cell-mineral interfacial reactions because cells often change their physiology once becoming surface-bound and also because biomechanical forces needs to be evaluated in the case of fungal dissolution. In this study we examined lizardite $[Mg_3Si_2O_5(OH)_4]$ dissolution by a native fungal strain in bulk media and at interface through determining the total metal release in culture, the pH local to surface-bound cells, and the material composition and structure beneath cell-colonized surfaces. We found that (1) cellular dissolution proceeds by a mechanism fundamentally different from that at the mineral-water interface, (2) only attached cells release siderophores, and (3) biomechanical forces of hyphal growth are indispensable for fungal weathering and strong enough to breach the mineral lattice. These results strongly suggest that fungal cell-promoted interfacial dissolution may have been significantly underestimated in the current understanding of microbial geochemistry.