Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17663

Significance of glauconite formation for elemental sequestration in marine settings

ANDRE BALDERMANN[1], DR. STEFAN LÖHR, PHD[2] AND JURAJ FARKAS[3]

[1]Institute of Applied Geosciences, Graz University of Technology
[2]University of Adelaide
[3]University of Adelaide, Earth Sciences

Presenting Author: baldermann@tugraz.at

Reverse weathering reactions produce a suite of authigenic clay minerals on the ocean floor, which potentially record the biogeochemical evolution of seawater and the earth system through time and space. The ferruginous 2:1 phyllosilicate glauconite [$(K,Na)(Fe,Al,Mg)_2(Si,Al)_4O_{10}(OH)_2$] is a widespread and directly datable mineral in marine sediments, occurring from the Precambrian to present, which is thought to evolve through the alteration of Fe(III)-smectite to glauconite during early diagenesis. As glauconite matures, key elements and related stable metal isotopes (K, Fe, Mg, Si, etc.) are sequestered directly from seawater and the adjacent marine sediments, potentially offering a window to detangle the chemical and isotope signature of seawater throughout earth's history, if element sequestration rates and associated metal isotope fractionation effects during glauconite formation can be quantified. Here, we present element sequestration rates by glauconite formation in shallow marine settings (0-200 m) from the Triassic to the Holocene, with recognition of the spatiotemporal variability in glauconite abundance, chemical composition, bulk sedimentation rate and paleo-shelf area. We find that glauconite authigenesis had a substantial impact on the marine element cycles, in particular during 'greenhouse' periods with sea level highstand, with an average elemental burial of ~0.05 Tmol Mg and Al yr^{-1}, ~0.07 Tmol K yr^{-1}, ~0.12 Tmol Fe yr^{-1} and ~0.32 Tmol Si yr^{-1} (Baldermann et al., 2022). Unravelling the metal isotope signatures recorded in pristine glauconite grains may be key for better understanding and quantification of past and present geochemical cycling in marine sediments.

Baldermann, A., Banerjee, S., Czuppon, G., Dietzel, M., Farkaš, J., Löhr, S., Moser, U., Scheiblhofer, E., Wright, N.M., Zack, T., 2022. Impact of green clay authigenesis on element sequestration in marine settings. Nature Communications, 13, 1527, doi: 10.1038/s41467-022-29223-6.