



## Bioavailability of zinc in marine systems through time

Two geomicrobiologists in our department are part of a research team that successfully challenged a long-accepted theory about the chemical composition of the ancient oceans. MSc student Leslie (Jamie) Robbins and Kurt Konhauser contributed to a study led by University of California Riverside researchers that examined whether eukaryotic evolution was delayed until the Neoproterozoic (between 1000 and 542 Ma) when zinc became readily available and primitive life was able to utilize it.

The research examined marine shale samples from North America, Africa, Australia, Asia and Europe and found consistently high levels of seawater zinc, on the same order of magnitude observed in modern oceans. These findings were in stark contrast to the long established belief that the presence of zinc in the early oceans was severely limited. Importantly, without zinc in the early oceans, eukaryotes could not have evolved as the metal is key for many eukaryotic enzymes.

In this new study, the researchers showed that zinc was in relatively high abundance, even in oceans as old as 3.9 billion years ago. It now appears that zinc utilization is the result of eukaryotic diversification, rather than one of the causes. Given the constant, near modern paleomarine Zn reservoir found here, it seems likely that the rapid rise in zinc metalloenzymes is due to the increasing need for regulatory and signaling enzymes in the nucleus accompanying eukaryotic diversification. Although, this work does not shift the timetable on eukaryotic evolution, it does provide an example of how marine and biological evolution can be decoupled.

Further, this study highlights both the need for and value in examining sedimentary based proxies for early marine conditions when considering ties between the oceans and evolution. Robbins says, “the next step will be to see if this is consistent with the other major proxy for the Precambrian oceans, the iron formations record.”

The research was published in the February issue of *Nature Geoscience*.