ROOTEDNESS AND THE DEVONIAN PHOSPHORUS CYCLE

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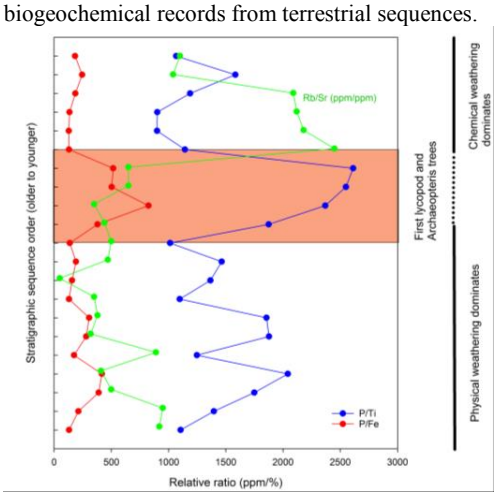
The evolutionary advancement of fully developed root structures by land plants in the later Devonian revolutionized the Earth's surface, constituting the emergence of the first Critical Zone. This biological innovation within the terrestrial biosphere initiated a pseudo-modern process of soil formation dynamics, and in turn significantly impacted nutrient and carbon cycling within the global oceans. In an effort to constraint this impact, we have been examining lacustrine sequences that span several intervals of terrestrial ecosystem evolution and extinction during the Devonian. We find compelling evidence of the impact on the terrestrial phosphorus cycle, and are working to launch a full study of biogeochemical records from terrestrial sequences.



Pilot data from the Upper Caithness Formation in the Mid Devonian. The maxima in P/Ti indicates net loss of P during root development and soil formation (i.e., net release of P, likely from the mineral P phase), and enrichment into the lake system. The P/Fe peak is more moderate, consistent with the rapid formation of the occluded pool and net retention of P on the landscape in that pool. Note that the P loss is only transient as soil stabilizes. The peak in Rb/Sr is reflects an increase in the extent of chemical weathering. The delayed peak, compared to P/Ti, is expected, as the initial P loss occurs as the landscape transitioned from physical weathering dominant to chemical weathering dominant.