Towards quantitative reconstructions of element cycles for weathering and carbon cycle tracers across the Cenozoic

ROBIN VAN DER PLOEG[1*], KARLINE SOETAERT[2], STEVEN M. BOHATY[3], JACK J. MIDDELBURG[1], APPY SLUIJS[1]

[1] Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, The Netherlands (*correspondence: r.vanderploeg@uu.nl)

[2] Department of Ecosystems Studies, Royal Netherlands Institute for Sea Research (NIOZ), Yerseke, The Netherlands

[3] Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton, UK

Earth's climate is ultimately regulated by the chemical weathering of silicate rocks, which exchanges carbon between the atmosphere, oceans and sedimentary rock record. This phenomenon has been studied for various intervals of the geological past by using isotope ratios of elements in seawater that are sensitive to shifts in weathering fluxes or compositions. However, silicate weathering reconstructions remain difficult because oceanic element and isotope budgets are generally not resolved through time. Here, we have modeled the oceanic element cycles of several common weathering and carbon cycle tracers (Sr, Os, Li, and C) based on existing datasets, in order to reconstruct changes in element residence times through time. Our initial results demonstrate that seawater element inventories are more dynamic than previously thought and that element residence times may have varied by a factor of two or more over the Cenozoic. This implies that steady state assumptions are only valid on multi-million year timescales and that changes in residence times should be considered when selecting the most appropriate tracer to study carbon cycle perturbations in the past.