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# Quaternary glacial cycles in East Antarctica trigger changes in silicate weathering

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Authigenic lead (Pb) isotopes derived from Fe-Mn crusts or sediment grain coatings in marine sediment cores are expected to reflect the Pb isotope composition of seawater at the time of precipitation. As the seawater composition is influenced by the dissolved flux of Pb from the continents, such Pb isotope records could potentially reveal past changes in regional silicate weathering fluxes over glacial cycle timescales. However, authigenic Pb isotope records are difficult to interpret. Compositions can be affected by the preferential dissolution or retention of different minerals during weathering, provenance changes, or water mass mixing.

To aid in identifying the controls on Pb release, we conducted laboratory experiments investigating major and minor element release and Pb isotope systematics during the progressive chemical weathering of silicate rocks over a range of grain sizes. Progressive radiogenic Pb enrichment in the weathering solutions dominates the isotopic behaviour for $^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ ratios, with thorogenic retention $^{208}Pb/^{204}Pb$ ratios under more enhanced weathering conditions. A grain-size dependence is observed in early weathering, where larger grain sizes (> 350 μm) preferentially release more radiogenic Pb compared to smaller grain sizes (< 100 μm). Under enhanced weathering conditions, smaller grains release more radiogenic Pb compared to larger grains.

We then apply these findings to help interpret a new authigenic and detrital Pb isotope record from East Antarctic marine sediment core U1361 spanning marine isotope stages 11 to 1 (~425 ka to the present day). The Pb isotope records are also compared to a new detrital Li isotope record and previously published authigenic and detrital Nd isotope records to investigate changes in Antarctic silicate weathering processes and fluxes through glacial-interglacial cycles. We observe a strong coupling between $^{208}Pb/^{206}Pb$ and the Nd isotope record in both the authigenic and detrital phases, with glacials characterised by lower εNd and elevated $^{208}Pb/^{206}Pb$. This is indictive of glacial-interglacial provenance shifts, with authigenic Pb isotopes further modulated by oceanographic changes and continental run off.