Secondary U-phosphates - possible links to Quaternary pluvial periods in SE Australia

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Weathering-related minerals amenable to radiometric dating may be used to establish chronologies of weathering. These relate to climate and the history of water in the landscape [1,2]. Here we present U-Th ages for secondary U-phosphates from the weathering zone of a 370 Ma granite (southern Murray Basin, SE Australia), obtained using MC-ICPMS [3]. Data for 18 samples indicate apparent ages from 115 to >550 ka, with initial $\delta^{234}U$ from 8 to 118 ‰. The significance of these ages depends on mineral growth mechanisms and crystal preservation. For example, it is unclear at present if the micro-crystal clusters represesent discrete growth phases, mixtures of growth phases, or a growth phase that is long relative to the absolute age. Possible U loss/gain during repeated groundwater residence also needs to be evaluated. Present work thus focusses on age reproducibility and SEM imaging of microcrystallites, to detect growth discontinuities or resorption surfaces.

Pending the results of this work, comparison of the available data with the global climate record [4] suggests a weak correlation of our apparent ages with periods of wet paleoclimate (interglacials), as expected if the growth of these weathering products relates to enhanced groundwater activity during humid (pluvial) periods. However, almost 40% of the ages nominally correlate with glacial periods and thus drier climate, weakening evidence for a link between pluvials and U-phosphate growth. More data are needed to establish clearly what controls secondary phosphate growth in this setting. For example, enhanced groundwater activity may be related to short-lived wet periods (interstadials), or to long-range recharge (old groundwater unrelated to ambient climate). Once this is clear, U-Th and U-Pb dating of secondary U phosphates may become a useful tool for improving existing (imprecise) chronologies of Quaternary pluvials in Australia.

References

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