Extremely high Th/U in metamorphic zircon: in-situ dating of the Labwor Hills granulites

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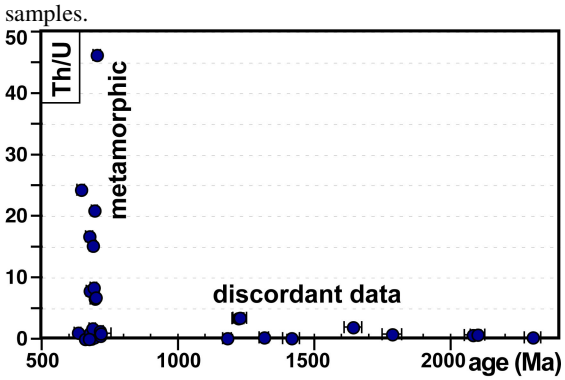
Sapphirine-bearing granulites of the Labwor Hills, Uganda preserve evidence of UHT metamorphism and retrograde, near-isobaric cooling. Chemical U-Th-Pb dating of monazite yields consistent ages from grains in peak metamorphic minerals and in quartz-feldspar leuco-somes, evidence for the very high resistance of monazite to diffusion resetting even under UHT conditions. Zircon is also dated within textural context of different meta-morphic assemblages. Inherited zircon have ages to 2.2 Ga, and show variable degrees of Pb-loss, probably in respon-se to metamictization during an extended low-temperature, detrital history. Metamorphic grains have very high Th contents (>1000ppm) and extremely high Th/U. This is consistent with fluid–related Th leaching from monazite observed in these samples.



Th/U in zircon from the Labwor Hills granulites

Thus, classifying zircon as 'metamorphic' solely based on low Th/U and regarding zircon with higher Th/U as magmatic, as seen in published articles on detrital grains from sediments, can lead to gross misinterpretations of detrital input and source region geology. Low or high Th/U metamorphic zircon may be found, depending on the growth process involved. Unchanged Th/U compared to magmatic protolith grains is interpreted to reflect closed system behaviour, lower Th/U can indicate competition with high Th minerals (monazite, allanite etc.) or growth from low-Th fluids, higher Th/U is also observed and interpreted as open system behaviour, resulting from breakdown of high Th/U minerals (monazite). This is also observed in the granulites studied here. In summary, zircon grown during metamorphic events cannot be identified by low Th/U alone, but characteristic trace element signatures may point towards particular growth or modification processes.