REFINING THE DATING PROCESS: RARE EARTH ELEMENT ANALYSIS OF ZIRCON

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The difficulty in accurately determining the timing of zircon growth, during metamorphism and relative to individual metamorphic events in polymetamorphosed rocks, can result in ambiguous interpretation of any resulting U/Pb ages. However, REE analysis combined with detailed image analysis can place better constraints on age data. In this study, three samples previously dated by Harley and Black (1997) were selected for detailed image and REE analysis. A garnet-absent charnockite from Proclamation Island contains magmatic zircon grains c.2990 Ma in age that have REE patterns typical of magmatic zircon. Low CL, c.2850 Ma mantles and rims on these grains are slightly depleted in MREE relative to magmatic zircon grains. High CL rims (yet to be dated) exhibit larger depletions in MREE compared with low CL zircon rims, and minor depletions in HREE. Altered zircon cores with ages of <2850 Ma have similar REE patterns to high CL zircon rims. A garnet-orthopyroxene-bearing granodioritic orthogneiss from Dallwitz Nunatak has c.2990 Ma magmatic zircons that retain steep REE patterns. Low CL rims on these grains have weak planar banding, and are depleted in MREE and slightly enriched in HREE relative to the magmatic zircon. These rims have ages that scatter between 2900 and 2700 Ma, with a dominant cluster at c.2840 Ma. High- to moderate CL c.2490 Ma rims have planar growth banding and sector zoning. These rims are depleted in M-HREE and have "flat" REE patterns that are similar to those from garnet and orthopyroxene in the same sample. A third sample, garnet-bearing paragneiss from Zircon Point, contains inherited magmatic zircons that have ages between 2850 and 2970 Ma, and typical magmatic REE patterns. Altered magmatic grains, ages of which scattered between 2850 and 2600 Ma, have depleted M-HREE patterns that are slightly positively sloping. Low-moderate CL grains, low CL outer rims, and mod-high CL rims, also depleted in M-HREE but all have slightly negatively sloping patterns, similar to garnet in the same sample. Each of these zircon...
rim types vary in REE concentration, with the oldest (c.2575 Ma) low-moderate CL grains highest in REE and high CL rims (c.2490 Ma) lowest. REE patterns from the Napier Complex zircons suggest metamorphic growth and alteration of zircon grains in the Proclamation Island sample in 2 distinct metamorphic events that had similar effects on the REE. The Dallwitz Nunatak zircon grains suggest metamorphism at c.2850 Ma in an event that did not produce garnet, whereas the c.2490 Ma rims grew in the presence of garnet and therefore give an approximate age of the garnet-orthopyroxene-bearing fabric in this rock. Alteration of inherited magmatic zircon grains in the Zircon Point paragneiss occurred in the presence of garnet and probably during the same event that produced metamorphic grains and rims. Differing REE concentration between these generations of metamorphic zircon suggests they grew at subtly different stages in this metamorphic event in communication with a varying REE reservoir largely controlled by the presence of garnet.