Zircon-Garnet REE distribution: events and processes in high grade terrains.

N.M. KELLY, S.L. HARLEY AND R.W. HINTON

[1] School of GeoSciences, University of Edinburgh, Kings Buildings, Edinburgh, EH9 3JW, United Kingdom; Nigel.Kelly@ed.ac.uk

Addressing the problem of relating U-Pb zircon ages to processes and hence geological events is central to understanding orogensis and crustal evolution. In multiply-deformed and polymetamorphosed high-grade terrains this problem is compounded by the highly variable response of zircon to metamorphism, with the geological meaning of resulting zircon age data commonly ambiguous. Therefore, reliable interpretation of zircon age data must be founded upon detailed textural analysis coupled with independent chemical criteria for constraining the processes that have affected or controlled zircon behaviour. One approach is to compare trace and rare earth element (REE) signatures from zircon and co-existing metamorphic minerals (e.g. garnet) with known equilibrium partitioning data.

To address this problem, an empirical study is underway to establish equilibrium REE distribution signatures for garnet-zircon from leucosomes and migmatites collected from a number of high-grade terrains with contrasting *P-T* histories. Preliminary results are consistent with those established for garnet-bearing UHT leucosomes from the Napier Complex [1], with D_{HREE}(zir/grt) values close to, or just less than unity, demonstrating a tendency for the HREE to be subtly partitioned into garnet over zircon.

The comparative study has shown that over a large range in absolute REE abundances in both garnet and zircon, the proposed equilibrium D_{REE} values hold. As such, the character of REE signatures in both zircon and garnet provide powerful tools to not only place age constraints on equilibrium metamorphic assemblages in high-grade rocks, but also establish the presence of disequilibrium associations. This provides a more robust means to assess the timing of, and processes controlling, growth and/or modification of zircon in other metamorphic environments. The results also indicate that the compositions of zircon and garnet are sensitive to fluctuations in coexisting melt compositions and therefore to the timing of individual mineral growth relative to melt evolution. Garnet-zircon REE distribution behaviour is therefore a key to not only date partial melting, but also to assess the effects of melt generation, migration, drainage and recharge in migmatites.

References

[1] Harley S.L. Kinny P.D., Snape I., Black L.P. (2001) AGSO Geosci. Aust. Rec. **2001/37**, 511-513.