Geophysical Research Abstracts, Vol. 8, 02063, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02063

TerraneChron applications in the crustal evolution studies: Australian ancient and young terranes

E. A. Belousova (1), Suzanne Y. O'Reilly (1) and W. L. Griffin (1,2)

(1) GEMOC National Key Centre, Department of Earth and Planetary Sciences, Macquarie University, NSW, 2109, Australia, (2) CSIRO Exploration and Mining, North Ryde, NSW 2113

(ebelouso@els.mq.edu.au / Fax +61-2-9850-8943 / Phone: +61-2-9850-6126)

TerraneChron is GEMOC's unique methodology for terrane evaluation and studies of crustal genesis. Using laser ablation ICP-MS technology, the U-Pb age, Hf isotopic composition and trace element composition are determined in individual sand-sized zircon grains. The U-Pb dating provides the history of the zircon; the Hf isotopic data provide information on the source of the parent magma, specifically if it is from old reworked crust or from young mantle; the trace elements provide information about the composition of the parent rock. The combination of age, composition and magma sources for a large number of grains yields an "Event Signature" that gives a fingerprint of crustal evolution in the terrane. The *TerraneChron* methodology typically is applied to zircons in drainage samples collected from a defined catchment. That approach enables "remote-sensing" mapping on a range of scales (10-1000 km^2) and in terrains ranging from mountainous to alluvial plains.

The *TerraneChron* approach has been used to define the relative contribution of juvenile sources and recycled crust to the continental crust as a function of time, in Archean, Proterozoic and Phanerozoic terrains in Australia (e.g. Yilgarn Craton, Mount Isa Inlier, Gawler Craton, Eastern Australia Phanerozoic Belts). Low $^{176}Hf/^{177}Hf$ in young zircons, which implies remelting of older crust, provides clear evidence for the widespread existence of ancient deep crust, not presently exposed and not recognised in previous studies, even in such intensively studied areas as Mt Isa. These studies also help to constrain the role of mantle inputs during the Proterozoic rejuvenation of Archean terrains, of which the Gawler Craton of southern Australia is

an example. The data accumulated thus far indicate that the volume of crust generated during Archean time is much larger than commonly accepted estimates. Detailed *in-situ* analysis of Hf isotopes in zircons from Eastern Australian granitoids documents can also track mixing between magmas derived from different sources and provides new insights into the processes of magma generation.

The comparison of large volumes of data on the ages and Hf isotope compositions of zircons can be simplified by reducing the data to curves that illustrate the relative importance of juvenile and ancient sources in each time slice. This ‘Event Signature” curve provides a graphical summary of the crustal evolution of a terrane, that can be compared with similar signatures from other terranes to evaluate broad similarities and differences in crustal history. In Australia, this approach helps to define the relationships between different crustal blocks through time, providing new insights for tectonic reconstructions. The same methodology can be applied to the problem of continent-scale reconstructions and correlations.