Crustal History and Metallogenic fertility: Terrane-scale assessment with detrital zircons

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TerraneChron™ is GEMOC's methodology for studying the crustal evolution of individual exploration areas, using the integrated *in situ* analysis of zircon grains collected from sediments in modern drainages. *U-Pb analyses* by LAM-ICPMS provide rapid and cost-effective age determinations with precision comparable to the ion microprobe. *Hf-isotope analyses* by LAM-MC (multicollector)-ICPMS characterise the source(s) of the magmatic parent rock to each zircon. They tell whether the relevant tectonic event involved the input of mantle-derived magmas ("juvenile" source), the reworking of pre-existing crust, or a combination of these processes. *Trace element data* (EMP, LAM-ICPMS) identify the composition of the host magma for each grain zircon. The combination of age data with information on the composition and sources of the magmas yields the "Event Signature", a graphical fingerprint of the crustal evolution of the area sampled by the drainage. These Event Signatures allow rapid comparison between individual terranes, and comparisons between metallogenically fertile and barren terranes can help to identify the processes responsible for large-scale mineral endowment. The Event Signatures for the different crustal blocks in eastern Australia suggest that base metal enrichment in the Broken Hill and Mt Isa blocks reflects a long crustal prehistory with both reworking and juvenile input, ending with a single short episode of juvenile magmatism (1650 Ma) connected with mineralisation. The Georgetown Inlier shares much of its prehistory with the Mt Isa block, but was not affected by the 1650 Ma juvenile event and lacks significant base-metal deposits. Other examples (Archean Au, Gawler Craton IOCG) will be discussed.