Beyond the zircon bar code: Geochronology, thermochronology and isotope composition of detrital monazite and apatite

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Modern alluvium was collected from a major river (the French-Broad) in the SE USA. The majority of the watershed consists of bedrock of Ordovician, Devonian, and Permian ages corresponding to the Taconic, Acadian and Alleghanian orogenies, respectively. Only about 12% of the watershed drains ~ 1Ga bedrock, associated with the Grenville orogen, yet the majority of detrital zircon in the alluvium is ~ 1Ga reflecting a clear bias in the areal extent of exposed rock. In contrast, the age frequency of detrital monazite more accurately reflects the areal distribution of exposed bedrock and thus is a more robust tool for sedimentary provenance compared to zircon. The Nd isotopic composition of detrital monazite grains provides further insight into provenance as many grains with similar ages (e.g. Ordovician) have distinct clusters of Nd isotopic composition. These gains could not otherwise be distinguished based on age alone.

Detrital apatite and zircon were separated from Modern sediment in arroyos within granitic inselbergs in SE California, and compared to grains extracted from granitic bedrock. Detrital zircon ages overlap those of the bedrock but have different age frequencies, again demonstrating a bias. Detrital apatite was a more faithful recorder of provenance as Sr isotopic composition and (U-Th)/He dates of detrital and bedrock apatite significantly overlap.