Detrital rutile geochemistry and geochronology from metasediments of the Thomson Orogen, Australia

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The Thomson Orogen, a huge portion of central eastern Australia west of the coastal New England Orogen is poorly understood due to thick sedimentary cover and limited outcrop. Zircon detrital geochronology of low-grade metasedimentary rocks intersected by drilling and from sparse outcrops have revealed two signatures [1]: 1/ Syn-Petermann with maximum depositional age (MDA) of 626 Ma, and zircons of 1300-900 Ma interpreted to derive from the Musgrave Province and deposited during the Petermann Orogeny (570-530 Ma), and 2/ the widespread Pacific-Gondwana signature observed in Eastern Australia and Antartica with 600-560 Ma and 1300-900 Ma zircons and MDA of 495 Ma.

Zircons are robust minerals that can easily be recycled and may resist multiple igneous and metamorphic events. Consequently, detrital zircons can yield complex signatures that are not easily interpreted. Zircon is essentially an igneous mineral, whereas rutile is a metamorphic one and thus provides complementary information.

We analysed about 100 rutiles from each of seven metasediments. Six samples characterised by a Pacific-Gondwana zircon signature have rutile ages ranging from 510 to 550 Ma, and the remaining sample with a Syn-Petermann zircon signature has rutile ages around 480 Ma. For the latter sample, the rutile MDA is younger than that for zircon. In non-orogenic settings zircon ages can be significantly older than that of deposition; the zircon MDA may therefore be unreliable and rutile MDA might approach it better. A key finding is that rutiles form a broad single age population in a given sample unlike zircons. The rutile ages from this study are consistent with detrital rutile ages recently obtained from Carboniferous sediments of the New England Orogen, suggesting a reworking of Thomson metasediments in the adjacent Orogen. Rutile trace element composition, in particular Cr and Nb, indicate that most Thomsom rutile derive from metapelitic and/or felsic granulitic rocks. Another difference between the two detrital signatures is the low Zr-in-rutile temperature for the Syn-Petermann signature sample (450-650°C) as compared to the rutile from six rocks with the Pacific-Gondwana signature (650-850°C).

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