Voluminous low-temperature melting of metasedimentary crust

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There is ongoing debate about the role of fluids in crustal melting. In the Proterozoic Aileron Province in central Australia there is approximately 35Kkm^2 of granite comprising just under 50% of the outcropping geology. The granites are several km thick, mostly aluminous and contain abundant inherited zircons similar in age to detrital zircons in the Aileron Province metasedimentary rocks. Both these characteristics point to metasedimentary dominated source regions. Compared with average metasedimentary subsolidus compositions in the Aileron Province the granites are Y-HREE enriched suggesting little garnet production in the source regions. Zircon saturation thermometry provides a maximum temperature of 780°C and for this maxima, mineral equilibria modelling indicates that melting must have occurred at pressures less than 0.6GPa to preclude source region garnet formation. Therefore based on plausible geothermal gradients the melting window was less than ~10km thick. At temperatures less than 780°C, modelling shows that fluid-absent melting is unable to generate sufficient melt to explain the regional geology. Instead external fluid is required. We note a small subset of the Aileron Province granites contain typical calc-alkaline compositions with depleted Y-HREE's suggesting they may have formed in a subduction setting. We speculate that metasedimentary rocks in the arc and near arc region received arc-derived fluids that promoted melting.

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