U–Pb geochronology and *P*–*T* constraints on moraine samples from the Windmill Islands, east Antarctica: Implications for the Proterozoic evolution of east Antarctica and Australia

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U–PB GEOCHRONOLOGY AND *P–T* CONSTRAINTS ON MORAINE SAMPLES FROM THE WINDMILL ISLANDS, EAST ANTARCTICA: IMPLICATIONS FOR THE PROTEROZOIC EVOLUTION OF EAST ANTARCTICA AND AUSTRALIA

RUNNING TITLE: CONSTRAINTS ON MORAINE SAMPLES FROM EAST ANTARCTICA

ABSTRACT

The interior of Wilkes Land in east Antarctica remains one of the least understood geological regions on earth, as it is completely covered by the East Antarctic Ice Sheet (EAIS). An under-utilised avenue to access the geology under the EAIS is to study glacial moraine samples. With the integration of recent geophysical data and high-resolution ice sheet drainage maps, the source region of glacial moraine samples from the Windmill Islands extends up to 200 km inland of the Windmill Islands. Similarities in magmatic and metamorphic U–Pb ages at c. 1360–1300 Ma and 1260–1125 Ma between the Windmill Islands and the moraine samples suggest a continuation of the Mesoproterozoic metamorphic terrane inland of the Windmill Islands. Calculated phase equilibria modelling constrain peak metamorphic conditions to ~800°C and 5 kbar for the c. 1260–1125 Ma event. Peak metamorphic assemblages are associated with high to ultrahigh thermal gradients and coeval magmatism. This combination implies that the glacial moraine samples are sourced from a terrane that records metamorphism in thin crust, suggesting a possible extensional setting for metamorphism. Similarities between geochronological data and peak metamorphic conditions confirm links between the Windmill Islands and the formerly contiguous Mesoproterozoic Albany–Fraser orogenic belt. However, in contrast to the Albany–Fraser Orogen, the presence of c. 1450–1400 and c. 1900 Ma detrital zircon ages suggests new links between the interior of Wilkes Land and southern Australian geology such as the Madura and Musgrave Provinces.

KEYWORDS

U–Pb geochronology, phase equilibria modelling, moraine sampling, subglacial geology, Proterozoic east Antarctica, Proterozoic southern Australia

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