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Low-grade Neoproterozoic metamorphic rocks in eastern Wilkes Land inferred from marine sediments

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Marine sediments proximal to the East Antarctic Ice Sheet (EAIS) provide new clues into the cryptic sub-ice geology of the northern Wilkes Subglacial Basin region in East Antarctica. Here we analyse samples derived from IODP (Integrated Oceanic Drilling Program) expedition 318 and specifically drill site U1359, the easternmost of the six boreholes drilled. Previous investigations assigned potential sediment source regions to three contrasting geological provinces: the Cambrian-Ordovician Ross Orogen, the Archean to Mesoproterozoic Terre Adelie Craton, and the Beacon Supergroup and Ferrar Large Igneous Province that has been inferred to underlie at least parts of the northern Wilkes Subglacial Basin.

Using heavy mineral and sedimentological data we show that the inland sediment source area also includes a previously unrecognised metamorphosed subglacial terrain. The high grade part of this terrain contains inferred upper amphibolite to granulite facies rocks that are comparable in terms of metamorphic grade to Archean to Paleoproterozoic rocks exposed in the Terre Adelie Craton and in the formerly adjacent Gawler Craton in South Australia.

Chemical geochronology of texturally constrained subhedral monazite in biotite-muscovite schist provides a unimodal age of 799+13 Ma for the low-grade schists. Rocks of this age are not exposed in the Terre Adelie Craton nor recognised in scant outcrops along the George V Coast. We propose that these unexposed low grade Neoproterozoic schists may be related to the broadly coeval Adelaide Rift Complex and the Centralian Superbasin in Australia. Neoproterozoic basin formation in interior East Antarctica may have heralded the breakup of the Rodinia supercontinent like in Australia. These inferred Neoproterozoic metasedimentary source rocks in the Wilkes Subglacial Basin provide additional geological information to re-assess the controversial extent of EAIS fluctuations in Late Miocene and Pliocene times.