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Decoding the tectonic evolution of Wilson Metamorphic Complex (WMC), northern Victoria Land (NVL), Antarctica

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The Terra Nova Intrusive Complex (TNIC) of northern Victoria Land (NVL), Antarctica, resulted from widespread magmatism during the Early Paleozoic Ross Orogeny, is composed of northern Browning Intrusive Unit (BUI), Campbell Intrusive Unit (CIU) and southern Wilson Metamorphic Complex (WMC). A significant component of intensely deformed mylonitic paragneiss and quartzofeldspathic orthogneiss could provide a better understanding of the tectonic evolution in the northern TNIC of northern Victoria Land (NVL), Antarctica. We conducted microstructural and petrological investigations including monazite geochronology on eight migmatitic/biotite gneisses around Gerlache Inlet. The samples are characterized by the alternation of quartzo-feldspathic leucosome and melanosome containing a combination of biotite + muscovite + plagioclase + K-feldspar + quartz + ilmenite ± cordierite ± magnetite with monazite and zircon as accessory phases making up the main assemblage. Mylonitic texture of the deformed gneiss is marked by the presence of quartz ribbons, fine-grained feldspars and elongated mica aggregates oriented along the foliation. Grain size and fabric strength analyses based on EBSD data combined with field evidence indicate that strain localization occurred at the boundary between biotite schist and migmatitic gneiss in WMC. Phase equilibria modelling along with Ti-in-quartz geothermometry estimated from the cordierite-spinel bearing mylonitic paragneiss implies deformation conditions of 630–700 °C and 6–7 kbar. Monazite chemistry of mylonitic gneisses in the shear zone exhibit three prominent domains: Domain-I characterized by c.520 Ma with relatively lower total REE concentrations; Domain-II by c.482 Ma with relatively higher REE concentrations; Domain-III by c. 420 Ma with REE enrichment. Monazites from the undeformed migmatitic gneisses also display similar ages of 520-500 Ma and 485 Ma, corresponding to Domain-I and Domain-II, respectively, in mylonitic gneisses. These results suggest the occurrence of regional metamorphism due to intrusive granite emplacement during the Early Cambrian-Early Ordovician Ross-Delamerian Orogeny and the reactivation of the shear zone in response to ~NE-SE-directed shortening. This study, therefore, reveals the presence of the Gerlache Inlet Shear Zone in WMC based on structural and petrological investigations and contributes to a deeper understanding of tectonic evolutions of NVL, Antarctica.