

GEOCHRONOLOGY AND SEDIMENT PROVENANCE OF THE MESOPROTEROZOIC BELT-PURCELL SUPERGROUP OF MONTANA, USA AND ALBERTA, CANADA

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ABSTRACT

The Mesoproterozoic Belt-Purcell basin contains a 5-15 km thick succession of principally clastic deposits exposed in the vicinity of Glacier National Park in Montana, USA and Castle Provincial Park in Alberta, Canada. Previous work has explored plate tectonic configurations for the Columbia supercontinent in which Laurentia was joined with Antarctica, Australia, or Siberia. However, the depositional chronology and provenance of the Belt-Purcell Supergroup remain unresolved, necessitating a comprehensive reevaluation of the sediment routing history for individual stratigraphic units. To address these issues, we performed detrital zircon LA-ICP-MS U-Pb geochronological analyses on 27 samples collected from the Lewis thrust salient to calculate the maximum depositional ages and produce age distributions for incorporation in an inverse Monte Carlo unmixing model to determine the relative contributions of sediment source regions. Geochronological results suggest a Mesoproterozoic depositional age ranging from ca. 1492.6 ± 6.75 to 1384.5 ± 11.06 Ma ($YC1\sigma$) and exhibit the following Archean and Proterozoic age groups. From lower to upper stratigraphic levels, the Lower Belt to Ravalli Group contains Orosirian (1920-1800 Ma) and Archean (3500-2500 Ma) zircon, the upper Grinnell Formation records the introduction of Calymmian (1600-1340 Ma) and Statherian (1800-1600 Ma) ages, followed by the Missoula Group with almost exclusively Statherian grains. Results from a cross-correlation unmixing model indicate the Lower Belt to Ravalli Group was dominated by sediment signatures from the Sask, Churchill, and Makkovik cratons to the northeast, whereas the upper Grinnell Formation experienced a shift to the Yavapai-Mojave and Mojave crustal provinces to the south. The limited presence of non-North American zircon grains, potentially contained in the Helena and Sheppard Formations, will help constrain probable reconstructions of the Columbia supercontinent.

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