Natural Resources Canada | Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 9149

U-Pb detrital zircon data from lower Cretaceous strata near the Mackenzie Mountain front, Northwest Territories

T. Hadlari and L.M. Heaman

2025

Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 9149

U-Pb detrital zircon data from lower Cretaceous strata near the Mackenzie Mountain front, Northwest Territories

T. Hadlari[1] and L.M. Heaman[2]

[1]Natural Resources Canada, Geological Survey of Canada, 3303-33rd Street N.W., Calgary, Alberta T2L 2A7
[2]Earth and Atmospheric Sciences, University of Alberta, 11223 Saskatchewan Drive, N.W., Edmonton, Alberta T6G 2E3

2025

Recommended citation
Hadlari, T. and Heaman, L.M., 2025. U-Pb detrital zircon data from lower Cretaceous strata near the Mackenzie Mountain front, Northwest Territories; Geological Survey of Canada, Open File 9149, 1 .zip file. https://doi.org/10.4095/pssp20ap8e

Publications in this series have not been edited; they are released as submitted by the author.

ISSN 2816-7155
ISBN 978-0-660-75634-9
Catalogue No. M183-2/9149E-PDF
https://doi.org/10.4095/pssp20ap8e

Abstract

Three sandstone samples were collected from lower Cretaceous strata in the northern Mackenzie Valley region. The sampled stratigraphy includes: the Tukweye Member of the Martin House Formation, which is an incised valley deposit at the base of the Cretaceous succession; marine facies of the Martin House Formation, a widespread transgressive sandstone above the sub-Cretaceous unconformity; and the Sans Sault Member of the Arctic Red Formation, which is a marine sandstone at the top of the lower Cretaceous (Albian) succession. These samples were analysed at the University of Alberta for U-Pb detrital zircon isotopic age dating. The analytical results are presented here and the full provenance interpretation will be presented in a subsequent publication.

Introduction

This work was part of the Geomapping for Energy and Minerals (GEM) program at the Geological Survey of Canada. The U-Pb detrital zircon data presented here are part of a regional study of the Cretaceous stratigraphy of the northern Mackenzie Valley near the front of the Mackenzie Mountains (Fig. 1). The geological framework derived from the project is outlined in Hadlari et al. (2014) and the full interpretation of the data are in Davison et al. (2024). The Martin House Formation is a transgressive sandstone interval generally less than 20 m thick that is very widespread and nearly ubiquitously overlies the sub-Cretaceous unconformity in the study area (Fig. 2). In some areas are fluvial facies that are interpreted as incised valley deposits that are very locally preserved below the sheets of marine sandstone. Above the Martin House Formation is a succession of marine shale forming the Arctic Red Formation, near the top of which are shallow marine sandstones of the Sans Sault Member.

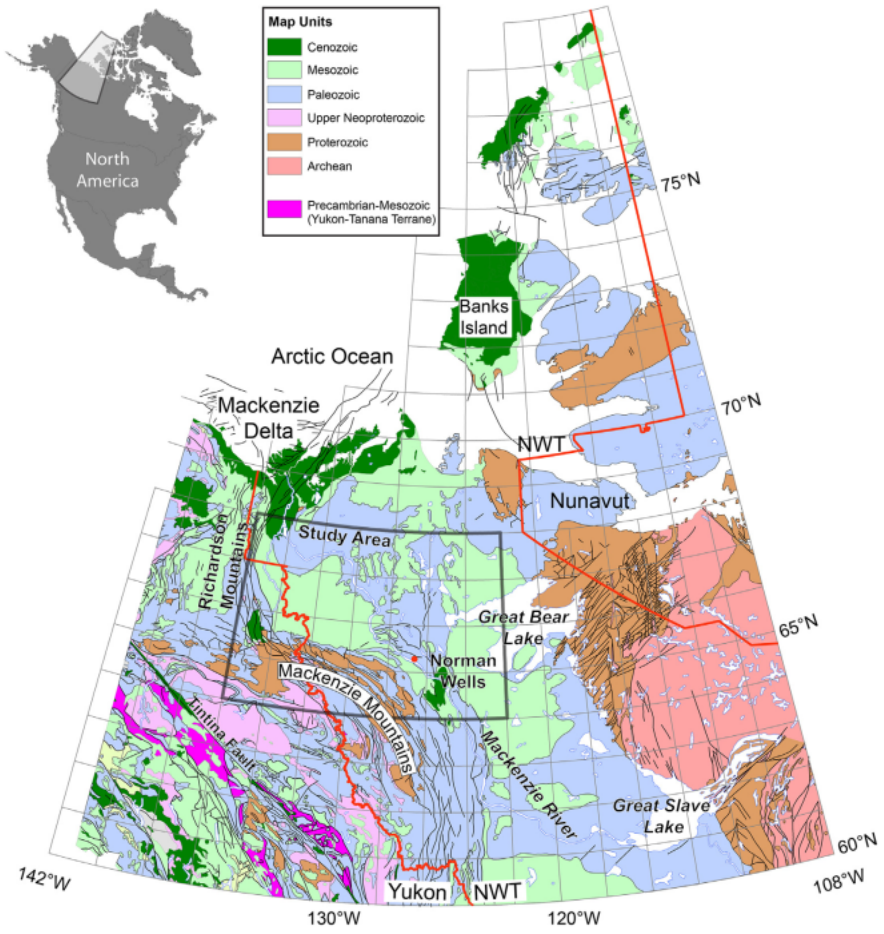

Figure 1: Geology of the Mackenzie Mountains and northern Mackenzie Valley area, showing the present study area (from Hadlari et al., 2014).

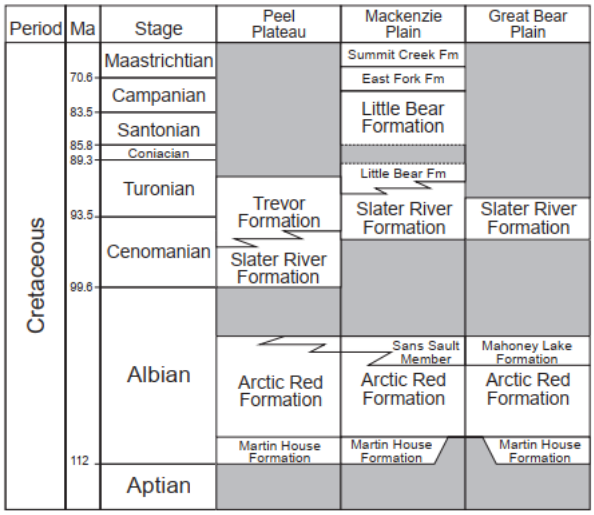

Figure 2: Cretaceous stratigraphy of the study area (from Hadlari et al., 2014).

Methods

Detrital zircon grains were isolated using standard mineral separation techniques (e.g., Simonetti et al., 2005). All samples yielded euhedral to anhedral, colourless to pink or yellow, well-rounded zircons. Grains selected for analysis were free of fractures, inclusions, and any other apparent alteration effects. U-Pb zircon analyses for samples 09-TH-01 and 11-HSB-300-B1 were conducted using laser ablation multi-collector inductively coupled plasma mass spectrometry techniques (LA-MC-ICP-MS) at the Radiogenic Isotope Facility at the University of Alberta using analytical procedures outlined by Simonetti et al. (2005). Individual analyses involved ablation of zircons using a 40 μm laser beam diameter for 30 second intervals. Analytical sessions included ablation of zircon reference materials after every 12 unknown grains to correct for instrumental drift. Reference zircons used for analyses at the University of Alberta to monitor age accuracy included LH-94-15 (Simonetti et al., 2005), OG1 (Stern et al., 2009), and GJ-1 (Jackson et al., 2004) and were in good agreement with their accepted published dates (Data Table). All results were corrected for common Pb using an initial Pb composition reported by Stacey and Kramers (1975). Detrital zircon ages considered for geologic interpretations employed $^{206}Pb/^{238}U$ ratios in cases where ages <1000 Ma and $^{207}Pb/^{206}Pb$ ratios for cases where ages were >1000 Ma. All ages used have a probability of concordance >5% (cf. Ludwig, 1998).

Results

Sample numbers and formations of the sandstone samples are:

Sample 09-TH-01: Martin House Formation; fluvial (Tukweye Member); 65.3536°N, 129.8922°W

Sample 11-HSB-300-B1: Arctic Red Formation; shallow marine (Sans Sault Member); 65.148°N, 127.828°W

Sample 11-HSB-305-A1: Martin House Formation; shallow marine; 67.2648°N, 129.8856°W

U-Pb data are included in this report as an Excel file.

References

Davison, J.E.A, Daniels, B.G., Hubbard, S.M., Heaman, L.M., and Hadlari, T., 2024. Anatomy and provenance of a typical transgressive sandstone: the Lower Cretaceous Martin House Formation, Northern Canada. Bulletin of Canadian Energy Geoscience, 71, p. 1–40. doi: https://doi.org/10.35767/gscpgbull.71.1.01

Hadlari, T., MacLean, B.C., Galloway, J.M., Sweet, A.R., White, J.M., Thomson, D., Gabites, J., and Schroder-Adams, C.J., 2014. The flexural margin, the foredeep, and the orogenic margin of a northern Cordilleran foreland basin: Cretaceous tectonostratigraphy and detrital zircon provenance, northwestern Canada. Marine and Petroleum Geology, v. 57, p. 173-186.

Jackson, S.E., Pearson, N.J., Griffin, W.L. and Belousova, E.A. 2004. The application of laser ablation-inductively coupled plasma-mass spectrometry to in situ U-Pb zircon geochronology. Chemical Geology, v. 211, p. 47-69.

Ludwig, K.R., 1998. On the treatment of concordant uranium-lead ages. Geochimica et Cosmochimica Acta, v. 62, p. 665-676.

Simonetti, A., Heaman, L.M., Hartlaub, R.P., Creaser, R.A., McHattie, T.G. and Böhm, C. 2005. U–Pb zircon dating by laser ablation–MC–ICP–MS using new multiple ion counting Faraday collector array. Journal of Analytical Atomic Spectrometry, v. 20, 677–686.

Stacey, J.S. and Kramers, J.D. 1975. Approximation of terrestrial lead isotope evolution by a two-stage model. Earth and Planetary Science Letters, v. 26, p. 207-221.

Stern, R.A., Bodorkos, S., Kamo, S.L., Hickman, A.H. and Corfu, F. 2009. Measurement of SIMS instrumental mass fractionation of Pb isotopes during zircon dating. Geostandards and Geoanalytical Research, v. 33, p. 145-168.