LA-ICP-MS URANIUM-LEAD DETRITAL ZIRCON DATA FROM METAMORPHIC AND SEDIMENTARY ROCKS FROM THE YUKON-TANANA UPLAND, ALASKA

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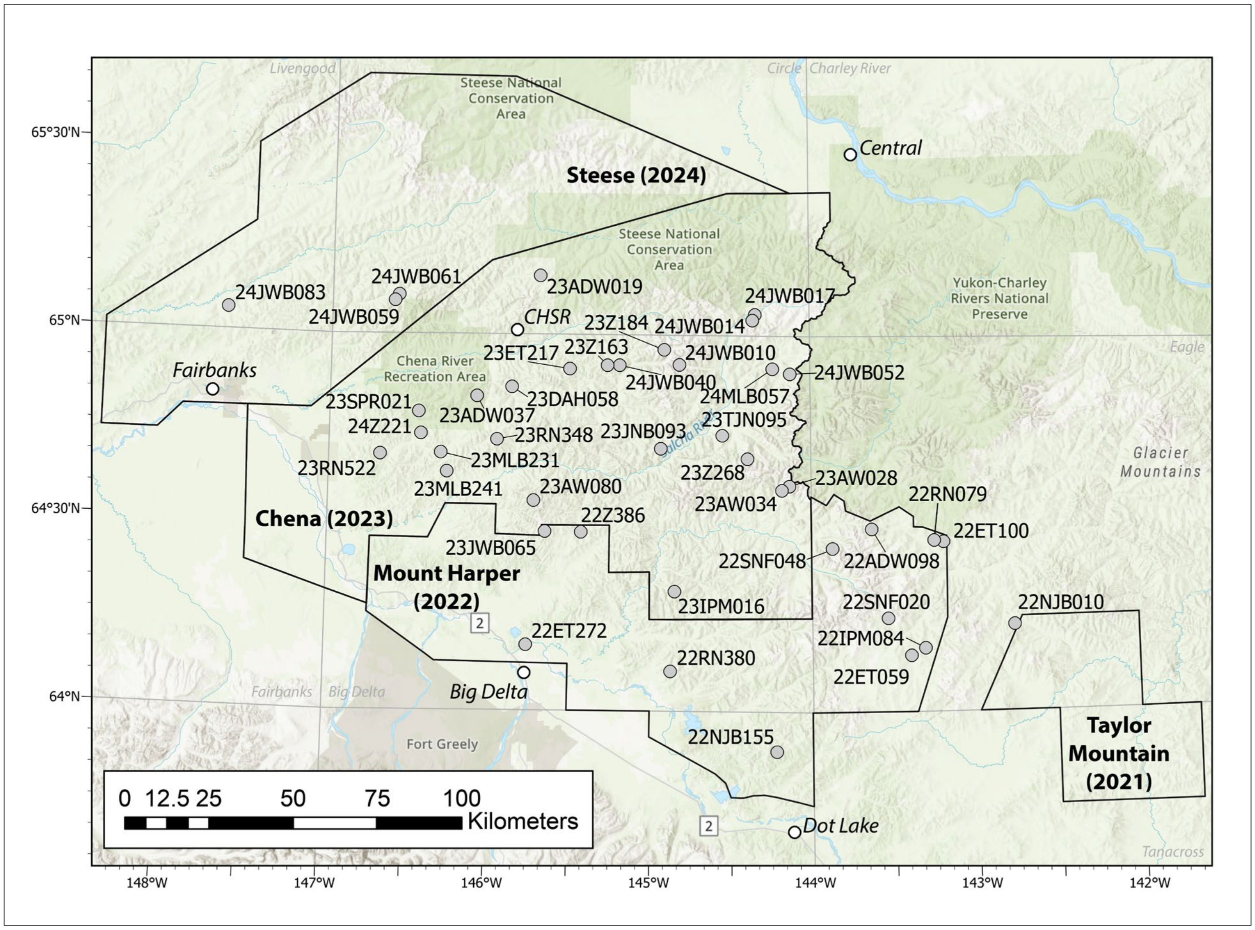
Raw Data File 2026-13



Location map of samples selected for uranium-lead geochronologic analysis. The black polygons represent Earth MRI project areas and are labeled with the project name and award year. CHSR is the location of Chena Hot Springs Resort. Light gray lines and text show the 1:250,000 quadrangle boundaries and name.

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2026
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Suggested citation:
Buchanan, J.W., Barrera, M.L., Gavel, M.M., Truskowski, C.M., Wildland, A.D., Moshrefzadeh, J.A., and Regan, S.P., 2026, LA-ICP-MS uranium-lead detrital zircon data from metamorphic and sedimentary rocks from the Yukon-Tanana Upland, Alaska: Alaska Division of Geological & Geophysical Surveys Raw Data File 2026-13, 5 p. https://doi.org/10.14509/32080

LA-ICP-MS URANIUM-LEAD DETRITAL ZIRCON DATA FROM METAMORPHIC AND SEDIMENTARY ROCKS FROM THE YUKON-TANANA UPLAND, ALASKA

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INTRODUCTION

This dataset contains uranium-lead (U-Pb) geochronologic data from single zircon spots analyzed by laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). U-Pb isotopic zircon data were collected from 42 metamorphic and sedimentary rock samples. Division of Geological & Geophysical Survey (DGGS) geologists collected the samples during the 2022, 2023, and 2024 field seasons, in support of the United States Geological Survey's Earth Mapping Resources Initiative (USGS Earth MRI). This report contains samples from the Steese, Chena, and Mount Harper (2024, 2023, and 2022, respectively) geologic mapping projects within the Livengood, Circle, Charley River, Fairbanks, Big Delta, and Eagle quadrangles. These Earth MRI projects are part of a broader effort to modernize geologic mapping of the nation's surface and subsurface with a focus on collecting data in areas of potential critical mineral resources. The USGS selected the Yukon–Tanana Upland (YTU) as the most likely area for new potential mineral resources in Alaska, and it has been the primary focus area of the DGGS Mineral Resources Section since 2019. Geologic mapping was completed across the roughly 34,500 km² area with new helicopter- and vehicle-supported fieldwork and the compilation of existing DGGS, USGS, industry, and academic datasets. The goal of this geochronologic dataset is to delineate the depositional timeframe and provenance of metamorphic and sedimentary rock packages and, where possible, to define the timing of metamorphism, thereby supporting future geologic mapping and elucidating the tectonic history of the YTU. Data are available on the DGGS website at https://doi.org/10.14509/32080.

DATA PRODUCTS

- Sample data summary table, which includes the sample lithology, map unit assemblage, sample description, and location coordinates
- Zircon grain data, which contains all isotopic ratios and ages for each analyzed zircon spot
- Accompanying data dictionaries for both tables

METHODS

Sample Collection

DGGS geologists collected 5-10 kg of whole-rock samples from selected stations with limited or no alteration, minimal weathering, and negligible retrograde metamorphism. Sample station coordinates were recorded using GPS-enabled tablets running ESRI Field Maps, with an accuracy of approximately 10 m. All location data are reported in latitude and longitude using the NAD83 datum.

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Sample Preparation

To generate single-grain zircon data, DGGS geologists worked at the Arizona LaserChron Center (ALC) at the University of Arizona under the direction of laboratory staff. Whole-rock samples were sent to the ALC, where they were cleaned and processed through a jaw crusher and roller mill. Zircon grains were isolated using magnetic separation and gravimetric separation with methylene iodide (MI). “Soft” minerals, those that are highly damaged, fractured, altered, or are otherwise less resistant, were removed using a Wig-L-Bug amalgamator, if necessary. Pyrite and apatite were removed by acid wash before hand-picking of zircon grains, if necessary. Heavy mineral grains (~2,500) from a portion of the isolated mineral separate for each sample were poured onto double-sided tape and then mounted into 1-inch-diameter epoxy pucks, with one sample per puck.

Analytical Method

Back-scatter electron (BSE), cathodoluminescence (CL), and transmitted light images were collected for each sample. Some zircon grains were analyzed in multiple areas to investigate complex internal textural variations (e.g., convoluted zoning, inherited cores, etc.) revealed by CL and/or BSE imaging. In the zircon grain data table, the *analysis_number* field follows the pattern, sample name-grain number-zircon morphology (core, mantle, or rim) to indicate the area analyzed (e.g., 25JWB128-3 core). In cases of one analysis on a single grain, only the sample number and grain number are included in the *analysis_number* field. LA-ICP-MS data were collected with an Element2 HR mass spectrometer. Zircon were targeted and ablated with a Teledyne/Photon Machines Analyte G2 excimer laser equipped with HelEx. Three hundred and fifteen zircon spots were analyzed for most samples using 15 to 20-µm-diameter zircon spots, except those with fewer zircon grains recovered during separation.

Before isotopic data collection, spots were cleaned using rapid-burst laser shots with 40-µm-diameter spot sizes to remove surface contamination. The ablated material was passed through helium to the plasma source. Isotopes measured for U-Th-Pb geochronology included: ^{204}Pb, ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th, ^{235}U, and ^{238}U. Standards FC-1 (Paces and Miller, 1993), SL-2 (Gehrels and others, 2008), and R33 (Black and others, 2004) were analyzed between unknowns using standard sample bracketing to monitor instrument drift over the entire session by checking for shifts in age of reference material relative to their known values as defined by isotope dilution thermal ionization mass spectrometry (ID-TIMS).

All analysis procedures followed the techniques documented by Gehrels and others (2008), Gehrels and Pecha (2014), Pullen and others (2018), and Sundell and others (2021). Isotopic data were reduced at ALC using the MATLAB-based program AgeCalcML (Sundell and others, 2021). Raw data were corrected for common Pb by the methods of Stacey and Kramers (1975) and Mattinson (1987). Raw data had backgrounds removed and isobaric interference accounted for. Preliminary isotopic ratios for $^{206}Pb/^{238}U$, $^{206}Pb/^{207}Pb$, and $^{208}Pb/^{232}Th$ were compared to accepted values of reference materials to determine fractionation factors for each ratio. Internal uncertainties were propagated using the methods of Gehrels and others (2008) and Gehrels and Pecha (2014).

ACKNOWLEDGMENTS

The authors thank the University of Arizona LaserChron Center staff for their contributions to data collection, technical discussions, and other support. The analytical work was funded by the U.S. Geological Survey's Earth Mapping Resources Initiative (Earth MRI) under cooperative agreements G22AC00288, G23AC00372, and G24AC00323 and by the State of Alaska. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.

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