LA-ICP-MS URANIUM-LEAD GEOCHRONOLOGIC DATA FOR ZIRCON FROM IGNEOUS AND META-IGNEOUS ROCKS IN THE CHENA AND MOUNT HARPER PROJECT AREAS, CIRCLE, BIG DELTA, AND EAGLE QUADRANGLES, ALASKA

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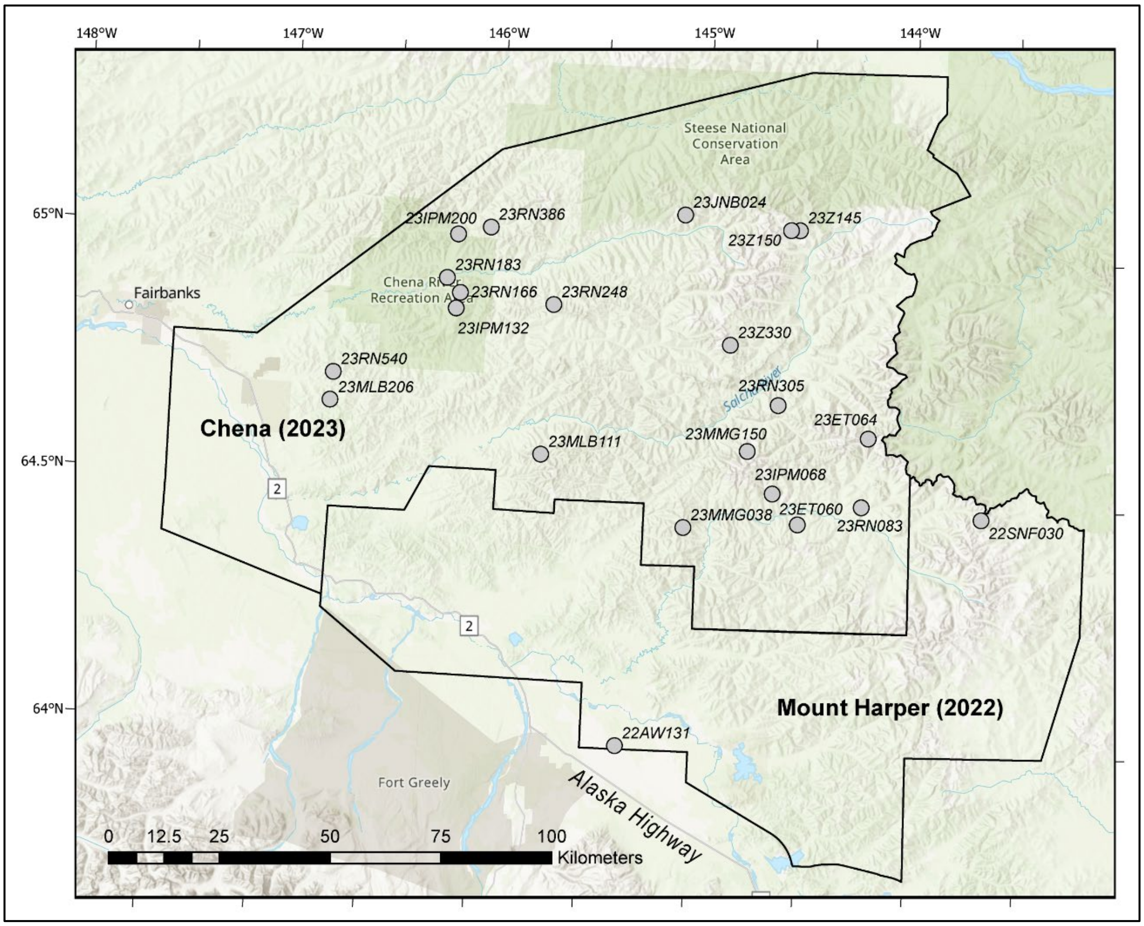
Raw Data File 2025-14



Location map of igneous samples selected for uranium-lead geochronologic analysis within the project areas. The polygons outlined in black represent Earth MRI project areas and are labeled with corresponding project names.

This report has not been reviewed for technical content or for conformity to the editorial standards of DGGS.

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LA-ICP-MS URANIUM-LEAD GEOCHRONOLOGIC DATA FOR ZIRCON FROM IGNEOUS AND META-IGNEOUS ROCKS IN THE CHENA AND MOUNT HARPER PROJECT AREAS, CIRCLE, BIG DELTA, AND EAGLE QUADRANGLES, ALASKA

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INTRODUCTION

This dataset contains uranium-lead (U-Pb) geochronologic data from single zircon spots, analyzed using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Alaska Division of Geological & Geophysical Surveys (DGGS) staff collected zircon data from 22 samples of igneous and meta-igneous rocks primarily collected during the 2023 field season in support of the Earth Mapping Resources Initiative (Earth MRI) Chena project. Two of these samples were analyzed to support geologic interpretation in the Mount Harper (2022) project area. The goal of this dataset is to delineate the age of igneous activity to support geologic mapping efforts, tectonic interpretations, and characterization of mineralization in the Yukon-Tanana Uplands, Alaska.

Crystallization age data are organized in the age summary data table with our interpreted crystallization ages, sample location information, and sample descriptions. The zircon grain data table contains isotopic and elemental data for each zircon spot analyzed. Both tables have accompanying data dictionaries. Data are available on the DGGS website at https://doi.org/10.14509/31553.

METHODS

This report includes single-grain zircon data generated by DGGS geologists at the Arizona LaserChron Center (ALC) at the University of Arizona, with direction from laboratory staff. Whole-rock samples were sent to the ALC where they were cleaned and processed through a jaw crusher and roller mill. Zircon 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. Approximately 60 zircon grains were selected from each isolated mineral separate to mount in 1-inch-diameter epoxy pucks. Back-scatter electron, cathodoluminescence (CL), and transmitted light images were collected. Some zircon grains were analyzed in multiple areas to investigate complex internal textural variations (e.g., convoluted zoning, inherited cores) revealed by CL imaging.

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. Thirty-five 20-µm-diameter zircon spots were analyzed for each sample. Before the analysis, spots are cleaned using rapid-burst laser shots with 40-µm-diameter spot sizes to remove surface contamination. The ablated material is passed through helium to the plasma source.

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Isotopes measured 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. All analysis procedures follow 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 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 are propagated using the methods of Gehrels and others (2008) and Gehrels and Pecha (2014).

Calculation Of Crystallization Ages

The crystallization age summary table contains weighted mean ages and accompanying statistics for all 22 samples analyzed. Weighted mean ages and mean squared weighted deviations were calculated with IsoplotR version 6.5 using the methods described by Vermeesch (2018). Mean ages were calculated using the $^{206}Pb/^{238}U$ age and reported in millions of years with analytical errors at the two standard deviations level. The summary table gives the number of ages used in each mean (n) and the total number of accepted analyses (N_total). The weighted mean age represents the time of igneous crystallization. Older inherited grains were not included in the mean age. The zircon grain data table includes isotopic ratios, lab-calculated ages, and elemental data for all lab-accepted spot analyses. The lab will choose to reject individual spot analyses based on variations in the intensity of the “signal” coming into the mass spectrometer, high common Pb, reverse discordance, and incorrect isotopic offsets. The zircon grain data table contains a column to indicate if the single zircon spot age was used in the weighted mean calculation.

Inherited older zircon grains were recorded in most samples, and inherited populations were a large percentage of the zircon in samples 23IPM132, 22SNF030, 23IPM068, and 23MMG038. While we are confident in the calculated igneous crystallization ages for these four samples, a more robust crystallization age population would have been preferable.

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