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Permanent link: https//:doi.org/10.4095/313023

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Recommended citation

Galloway, B.J., 2018. Geological and geochemical data from the Canadian Arctic Islands. Part XVII: detrital zircon geochronology and stratigraphic interpretations for upper Paleozoic strata of the Sverdrup Basin; Geological Survey of Canada, Open File 8473, 1 .zip file. https//:doi.org/10.4095/313023

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Geological and geochemical data from the Canadian Arctic Islands. Part XVII: detrital zircon geochronology and stratigraphic interpretations for upper Paleozoic strata of the Sverdrup Basin

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INTRODUCTION

This publication reports on detrital zircon geochronology and stratigraphic interpretations of upper Paleozoic strata from the Sverdrup Basin of the Canadian Arctic Islands. The study was undertaken to investigate stratigraphic relationships along the NW margin of the Sverdrup Basin. The data is presented in spreadsheet form as well as plotted on stratigraphic columns for Arctic Islands wells that contain the detrital zircon geochronological samples.

The Sverdrup Basin is a major sedimentary basin located within the Canadian Arctic Islands. The basin contains upper Paleozoic to lower Cenozoic strata with a net cumulative thickness up to 13 km. The upper Paleozoic portion can be up to 5 km thick. It contains 20 formations deposited over approximately 95 million years and is composed of a shelf to deep basin sequence (Embry and Beauchamp, 2008).

MATERIAL, METHODS AND SOURCES

Detrital zircon geochronology was completed at the University of Calgary's Centre for Pure and Applied Tectonics and Thermochronology (CPATT) using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). Samples were provided by Suncor Energy Inc. and were collected by Bradley Galloway. All of the samples are contained within 5 hydrocarbon exploration wells along the NW margin of the Sverdrup Basin. These wells are Satellite F-68; Isachsen J-37; Pollux G-60; Brock I-20. Samples were obtained over ranges due to the small amount of cuttings material available and the relatively large amount required to complete the analysis. Stratigraphic analysis of the samples has also been conducted on the samples including two additional samples within the Brock C-50 well from Anfinson et al., 2016. Stratigraphic columns for 4 of the 5 wells (Isachsen J-37; Pollux G-60; Brock I-20; Brock C-50) has been provided to display the interpreted stratigraphic relationship for each sample. These columns and interpretations are part of an ongoing study by Bradley Galloway. The stratigraphic affinity for the samples in the Satellite F-68 well have been determined from Beauchamp et al. (2001).

Samples were prepared and analyzed by CPATT using the High-N approach of Matthews and Guest (2017). Isotopic signal intensities were measured using an Agilent 7700 quadrupole mass spectrometer coupled to a Resonetics Resochron™ 193nm laser ablation system. Samples were ablated in a Laurin-Technic M-50 dual volume ablation cell. U-Pb isotopic measurements were made on up to 300 grains for each sample using a sample-standard bracketing approach. Eighteen measurements of zircon reference material FC-1 (Paces and Miller, 1993) was used to calibrate the isotopic ratios and eight measurements of each of four validation reference materials with ages between 28.2 and 2679 Ma were used to validate the results and to assess uncertainties. Data reduction was performed in the commercially available Iolite (V2.5) data reduction software (Paton et al., 2010)

using the VisualAge data reduction scheme (Petrus and Kamber, 2012) and a custom Excel VBA™ macro (ARS4.0) was used to assess uncertainties (see Matthews and Guest 2016 for description of its function). Data were filtered using the probability of concordance of the measurement from the Concordia Age algorithm available in Isoplot (Ludwig 1998, 2012). Measurements with <5% probability of concordance were filtered from the dataset. Data are presented in probability density plots with 206Pb/238U dates used for grains yielding dates <1550 Ma and 207Pb/206Pb dates for grains yielding dates >1550 Ma (Spencer et al., 2016).

RESULTS

The detrital zircon geochronology results have been provided as a spreadsheet including the raw data and accepted ages after data reduction. The formation and approximate ages of each samples can be seen on the provided well columns labelled figures 1-4. Table 1 also contains the sample numbers, interpreted ages and formations, and sample locations. Figure 5 contains a normalized probability density plot for each new detrital zircon sample after data processing and a composite of the new samples.

Table 1: Results (Samples 561220 and 561222 are from Anfinson et al., 2016; Age and formations for samples 6 and 7 were obtained from Beauchamp et al., 2001)

Sample #	Age and Formation	Well Name	UWI	Depth in well (m)
1	Kungurian - Sabine Bay	Isachsen J-37	300J377920105000	3100-3121
2	Kungurian - Sabine Bay	Pollux G-60	300G607910104300	2792-2819
3	Kungurian - Sabine Bay	Brock I-20	300I207800114300	1960-2045
4	Roadian - Assistance	Brock I-20	300I207800114300	1737-1765
5	Roadian - Assistance	Pollux G-60	300G607910104300	2713-2743
6	Wordian - Trold Fiord	Satellite F-68	300F687720116300	2405-2432
7	Wordian - Trold Fiord	Satellite F-68	300F687720116300	1859-1881
561220	Kungurian - Sabine Bay	Isachsen J-37	300J377920105000	3184-3192
561222	Roadian - Assistance	Brock C-50	300C507750114000	2268-2272

ACKNOWLEDGEMENTS

I thank Dr. Benoit Beauchamp for his assistance with Sverdrup Basin upper Paleozoic sections and knowledge; Richard Fontaine and William Dwyer of the NEB Core and Sample Repository at GSC-Calgary for their help in the sampling process; Suncor Energy Inc. for access to the original well cuttings; Dr. William Matthews of the CPATT Laboratory at the University of Calgary; and Dr. Keith Dewing for his valued opinions, time, and expertise.

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APPENDIX

Arctic Well Column Figures

Figure	Well Name	UWI
1	Brock C-50	300C507750114000
2	Brock I-20	300I207800114300
3	Isachsen J-37	300J377920105000
4	Pollux G-60	300G607910104300